Cisco IOS XR Modular Quality of Service Command Reference for the Cisco XR 12000 Series Router, Release 4.1

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
        800 553-NETS (6387)
Fax: 408 527-0883

C O N T E N T S

Preface

This reference describes the Cisco IOS XR Quality of Service commands. The preface for *Cisco IOS XR Modular Quality of Service Command Reference for the Cisco XR 12000 Series Router* contains the following sections:

Changes To This Document

Table 1: Changes to This Document, on page vii lists the technical changes made to this document since it was first printed.

Table 1: Changes to This Document

Revision	Date	Change Summary
OL-24690-01	April, 2011	First issue of this document.

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Quality of Service Commands on the Cisco IOS XR Software

This module lists quality of service (QoS) commands in alphabetical order. For detailed information about QoS concepts, configuration tasks, and examples, see the *Cisco IOS XR Modular Quality of Service Configuration Guide for the Cisco XR 12000 Series Router*.

bandwidth (QoS)

To specify the minimum bandwidth allocated to a class belonging to a policy map, 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 {*rate* [*units*]| **percent** *percentage-value*}

no bandwidth {*rate* [*units*]| **percent** *percentage-value*}

Syntax Description

rate	Minimum bandwidth, in the units specified, to be assigned to the class. Range is from 1 to 4294967295. For 16 kbps granularity on 2.5 Gbps IP Services Engine (Engine 3) line cards, the maximum value is 1.05 gbps.
units	Specifies the units for the bandwidth. Values can be: • **bps**—bits per second • **gbps**—gigabits per second • **kbps**—kilobits per second (default) • **mbps**—megabits per second
percent *percentage-value*	Specifies the amount of guaranteed bandwidth, based on an absolute percentage of available bandwidth. Range is from 1 to 100.

Command Default   The default units is kbps.

Command Modes   Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.3.0	The ability to select the units for the bandwidth was added. The range of bandwidth values was changed from 8 to 4000000 to 1 to 4294967295.
Release 3.3.1	Minimum rate value changed from 128 kbps to 256 kbps.
Release 3.9.0	The granularity of the rates specified was changed to 8 kbps.

Usage Guidelines You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **bandwidth** command is used to specify the minimum guaranteed bandwidth allocated for traffic matching a particular class. Bandwidth may be defined as a specific value or may be set as a percentage of the interface bandwidth.

The actual bandwidth used is calculated in multiples of 8 kbps, the minimum bandwidth rate. The configured value is rounded down to a multiple of 8 kbps.

Line card Type	Ingress Granularity	Egress Granularity
2.5 Gbps IP Services Engine (Engine 3)**Exceptions: 1-Port OC-48c POS ISE 4-Port OC-12c POS ISE	16 kbps64 kbps64 kbps	16 kbps64 kbps64 kbps
10 Gbps IP Services Engine (Engine 5)	32 kbps	32 kbps
Multirate 10G IP Services Engines (Engine 5+)	32 kbps	8 kbps

If a percentage value is set, the accuracy that can be expected is 1 percent.

The **bandwidth** command can be used only within egress service policies. Use within an ingress policy is not supported.

Note The bandwidth value takes into account the Layer 2 encapsulation that is applied to traffic leaving the interface. For POS/SDH transmission, the encapsulation is considered to be 4 bytes. For Ethernet, the encapsulation is 14 bytes; whereas for IEEE 802.1Q, the encapsulation is 18 bytes. The actual bandwidth assigned to a class can be seen in the output of the **show qos interface** command.

Be careful when specifying bandwidth guarantees close to 100 percent, because the Layer 2 encapsulation considered does not include the entire Layer 2 header. This can lead to oversubscription, particularly in the case of small packet sizes.

For bundled interfaces, **bandwidth** can be configured only as a percentage.

A policy map can have a single bandwidth statement per class. Both percentage and actual value bandwidth configurations can be used within a policy map.

The **bandwidth** command does not specify how the bandwidth is to be shared. Instead it specifies how much bandwidth is guaranteed per class, by setting the number of tokens that are assigned to the token bucket of a particular class. For configured behavior to work correctly, you must ensure that the sum of the bandwidths plus any priority traffic is not greater than the bandwidth of the interface itself. If the interface is oversubscribed, unpredictable behavior results.

The bandwidth of the interface is set to be that of the physical interface, unless a hierarchical policy is defined that reduces the bandwidth available to the traffic. The following example shows a hierarchical policy being used to shape traffic to the specified value. The child policy then determines how the shaped bandwidth should be apportioned between the specified classes:

```
policy-map parent
  class match_all
  shape average 1000000
  bandwidth 1000000
    service-policy child

policy-map child
  class gold
    bandwidth percent 20
  class silver
    bandwidth percent 40
  class default
    bandwidth percent 40
```

Note   The **bandwidth** command is part of the parent policy. In this instance, the **bandwidth** command not only sets the minimum bandwidth for the class but also resets the reference point for the **bandwidth percent** statements in the child policy.

For main interface service policies:

- If bandwidth is configured in the parent class, parent minimum bandwidth is used as a reference for the child bandwidth percentages.

- If bandwidth is not configured in the parent class, the implicit minimum bandwidth, which is a portion of the total unallocated bandwidth allocated to the class based on the explicit or implicit bandwidth remaining, is used as a reference.
  Implicit bandwidth remaining is an equal share of unallocated bandwidth among all queuing classes without either bandwidth or bandwidth remaining actions.

For subinterface policies:

- If bandwidth is configured in the parent class, parent minimum bandwidth is used as a reference for child bandwidth percentages.

- If bandwidth remaining is configured in the parent class, *bandwidth-remaining-percent * interface-rate* is used as a reference.

- If bandwidth is not configured in the parent class, *shape rate* is used as a reference.

In the following example, the hierarchical policy is attached to the main interface, and the parent classes are a mix of bandwidth and shape only classes:

```
policy-map hqos
 class c1
   bandwidth percent 40
    service-policy child
 class c2
   shape average 500000000
    service-policy child
```

The reference for the child policy in class c2 is the implicit bandwidth of class c2 bounded by the shape rate of class c2. Therefore, the reference = (60 percent * interface bandwidth) / 3 bounded by 500000000 kbps.

In the following example, the hierarchical policy is a class-default only parent shape configured on subinterfaces:

```
policy-map sub_int_hqos
 class c1ass-default
   shape average 40
     service-policy child
```

The class-default parent shape rate is used as reference.

When the **percent** keyword is used with the **bandwidth** command, the bandwidth of the interface is defined as being the Layer 2 capacity excluding the Gigabit Ethernet or POS encapsulation but including the High-Level Data Link Control (HDLC) flags, frame check sequence (FCS), and so on. These have to be included because they are applied per packet, and the system cannot predict how many packets of a particular packet size are being sent out.

For example, the following policy is applied to an OC-192 interface:

```
policy-map oc-192
  class c1
  bandwidth percent 50
```

The resulting bandwidth reservation for class c1 is 4,792,320 kbps. This equates to 50 percent of the OC-192 bandwidth excluding the GE or POS overhead.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to guarantee 50 percent of the interface bandwidth to a class called class1 and 10 percent of the interface bandwidth to a class called class2:

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# bandwidth percent 50
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# class class2
RP/0/0/CPU0:router(config-pmap-c)# bandwidth percent 10
```

Related Commands

Command	Description
class (policy-map), on page 13	Specifies the name of the class whose policy you want to create or change.
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
queue-limit, on page 84	Specifies or modifies the maximum number of packets the queue can hold for a class policy configured in a policy map.
random-detect precedence, on page 98	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

Command	Description
show qos interface, on page 141	Displays QoS information for a specific interface.

bandwidth remaining

To specify how to allocate leftover bandwidth to various classes, use the **bandwidth remaining** command in policy map class configuration mode. To return to the system defaults, use the **no** form of this command.

bandwidth remaining percent *percentage-value*

no bandwidth remaining percent *percentage-value*

Syntax Description

percent *percentage-value*	Specifies the amount of guaranteed bandwidth, based on an absolute percentage of the available bandwidth. Range is from 1 to 100.

Command Default

No bandwidth is specified.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced.

Usage Guidelines

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **bandwidth remaining** command is used to set the Modified Deficit Round Robin (MDRR) weight for the particular class.

When applied within an egress service policy, the command is used to define how any unallocated bandwidth should be apportioned. It typically is used in conjunction with the **bandwidth** command. In such a combination, if the minimum bandwidth guarantees are met, the remaining bandwidth is shared in the ratio defined by the **bandwidth remaining** command in the class configuration in the policy map.

The available bandwidth is equally distributed among those queueing classes that do not have the remaining bandwidth explicitly configured.

Note On egress, the actual bandwidth of the interface is determined to be the Layer 2 capacity excluding the Layer 2 encapsulation, but including the HDLC flags, FCS, and so on. These have to be included because they are applied per packet, and the system cannot predict how many packets of a particular packet size are being sent out.

On egress, if the **bandwidth remaining** command is not present, then the bandwidth is shared equally among the configured queueing classes present in the policy-map. When attempting precise calculations of expected

MDRR behavior, you must bear in mind that because you are dealing with the bandwidth remaining on the link, you must convert the values to the bandwidth remaining percentages on the link, based upon the packet sizes of the traffic within the class. If the packet sizes are the same in all the classes, then the defined ratio is enforced precisely and predictably on the link.

The **bandwidth remaining** command is not supported on ingress.

Task ID

Task ID	Operations
qos	read, write

Examples

In the following example, a class called class1 is guaranteed 50 percent of the interface bandwidth and a class called class2 is guaranteed 10 percent of the interface bandwidth. The remaining bandwidth of 40 percent is shared by classes class1 and class2 in a 20:80 ratio: class class1 receives 20 percent of the 40 percent, and class class2 receives 80 percent of the 40 percent.

```
RP/0/0/CPU0:router(config)#policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# bandwidth percent 50
RP/0/0/CPU0:router(config-pmap-c)#bandwidth remaining percent 20
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)#class class2
RP/0/0/CPU0:router(config-pmap-c)# bandwidth percent 10
RP/0/0/CPU0:router(config-pmap-c)# bandwidth remaining percent 80
```

child-conform-aware

To prevent the parent policer from dropping any ingress traffic that conforms to the maximum rate specified in the child policer, use the **child-conform-aware** command in policy map police configuration mode. To remove this action from the policy map, use the **no** form of this command.

child-conform-aware

no child-conform-aware

Syntax Description   This command has no keywords or arguments.

Command Default   The **child-conform-aware** command is not configured.

Command Modes   Policy map police configuration

Command History

Release	Modification
Release 3.8.0	This command was introduced.

Usage Guidelines   You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

In hierarchical policing, traffic is policed first at the child policer level and then at the parent policer level. It is possible for traffic that conforms to the maximum rate specified by the child policer to be dropped by the parent policer.

In enhanced hierarchical ingress policing, the **child-conform-aware** command prevents the parent policer from dropping any ingress traffic that conforms to the maximum rate specified in the child policer.

Task ID

Task ID	Operations
qos	read, write

Examples   This example shows parent and child policy maps in which two classes are defined in the child policy. In class AF1, the exceed action is set to an action other than to drop traffic.

If the **child-conform-aware** command were not configured in the parent policy, the parent policer would drop traffic that matches the conform rate of the child policer but exceeds the conform rate of the parent policer.

The **child-conform-aware** command prevents the parent policer from dropping any ingress traffic that conforms to the maximum rate specified in the child policer.

```
RP/0/0/CPU0:router(config)# policy-map parent
RP/0/0/CPU0:router(config-pmap)# class class-default
RP/0/0/CPU0:router(config-pmap-c)# service-policy child
RP/0/0/CPU0:router(config-pmap-c)# police rate percent 50
RP/0/0/CPU0:router(config-pmap-c-police)# child-conform-aware
RP/0/0/CPU0:router(config-pmap-c-police)# conform-action transmit
RP/0/0/CPU0:router(config-pmap-c-police)# exceed-action drop

RP/0/0/CPU0:router(config)# policy-map child
RP/0/0/CPU0:router(config-pmap)# class EF
RP/0/0/CPU0:router(config-pmap-c)# police rate 1 mbps
RP/0/0/CPU0:router(config-pmap-c-police)# conform-action set mpls experimental imposition
4
RP/0/0/CPU0:router(config-pmap-c-police)# exceed-action drop
RP/0/0/CPU0:router(config-pmap-c-police)# exit
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# class AF1
RP/0/0/CPU0:router(config-pmap-c)# police rate percent 50
RP/0/0/CPU0:router(config-pmap-c-police)# conform-action set mpls experimental imposition
3
RP/0/0/CPU0:router(config-pmap-c-police)# conform-action set mpls experimental imposition
2
```

Related Commands

Command	Description
exceed-action, on page 28	Configures the action to take on packets that exceed the rate limit.
police rate, on page 76	Configures traffic policing and enters policy map police configuration mode.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

class (policy-map)

To specify the name of the class whose policy you want to create or change, use the **class** command in policy map configuration mode. To remove a class from the policy map, use the **no** form of this command.

class [**type qos**] {*class-name*| **class-default**}

no class [**type qos**] {*class-name*| **class-default**}

Syntax Description

type qos	(Optional) Specifies a quality-of-service (QoS) class.
class-name	Name of the class for which you want to configure or modify policy.
class-default	Configures the default class.

Command Default

No class is specified.

Type is QoS when not specified.

Command Modes

Policy map configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.6.0	The **type qos** keywords were added.

Usage Guidelines

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Policy Map Configuration Mode

Within a policy map, the **class (policy-map)** command can be used to specify the name of the class whose policy you want to create or change. The policy map must be identified first.

To identify the policy map (and enter the required policy map configuration mode), use the **policy-map** command before you use the **class (policy-map)** command. After you specify a policy map, you can configure the policy for new classes or modify the policy for any existing classes in that policy map.

Class Characteristics

The class name that you specify in the policy map ties the characteristics for that class—that is, its policy—to the class map and its match criteria, as configured using the **class-map** command.

The **class-default** keyword is used for configuring default classes. It is a reserved name and cannot be used with user-defined classes. It is always added to the policy map (type qos) even if the class is not configured. For example, the following configuration shows that the class has not been configured, but the running configuration shows 'class class-default'.

```
RP/0/0/CPU0:router(config)# policy-map pm1
RP/0/0/CPU0:router(config-pmap)# end-policy-map
RP/0/0/CPU0:router(config)# end
!
RP/0/0/CPU0:router# show running-config
!
policy-map pm1
 class class-default
 !
 end-policy-map
!
```

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to create a policy map called policy1, which is defined to shape class1 traffic at 30 percent and default class traffic at 20 percent.

```
RP/0/0/CPU0:router(config)# class-map class1
RP/0/0/CPU0:router(config-cmap)# match precedence ipv4 3
!
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:routerconfig-pmap-c)# shape average percent 30
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# class class-default
RP/0/0/CPU0:router(config-pmap-c)# shape average percent 20
```

The default class is used for packets that do not satisfy configured match criteria for class1. Class1 must be defined before it can be used in policy1, but the default class can be directly used in a policy map, as the system defines it implicitly.

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.

class-map

To define a traffic class and the associated rules that match packets to the class, use the **class-map** command in global configuration mode. To remove an existing class map from the router, use the **no** form of this command.

class-map [**type qos**] [**match-all**] [**match-any**] *class-map-name*

no class-map [**type qos**] [**match-all**] [**match-any**] *class-map-name*

Syntax Description

type qos	(Optional) Specifies a quality-of-service (QoS) class-map.
match-all	(Optional) Specifies a match on all of the match criteria.
match-any	(Optional) Specifies a match on any of the match criteria. This is the default.
class-map-name	Name of the class for the class map. The class name is used for the class map and to configure policy for the class in the policy map. The class name can be a maximum of 63 characters, must start with an alphanumeric character, and in addition to alphanumeric characters, can contain any of the following characters: . _ @ $ % +	# : ; - =

Command Default

Type is QoS when not specified.

Command Modes

Global configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.6.0	The **type qos** keywords were added.
Release 3.7.0	Support was added for the character '=' in the *class-map-name* argument. The argument accepts a maximum of 63 characters.

Usage Guidelines

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **class-map** command specifies the name of the class for which you want to create or modify class map match criteria. Use of this command enables class map configuration mode in which you can enter any **match** command to configure the match criteria for this class. Packets arriving on the interface are checked against the match criteria configured for a class map to determine if the packet belongs to that class.

The following commands can be used in a class map:

- match access-group
- **match atm**
- **match [not] cos**
- **match destination-address**
- match [not] discard-class
- **match [not] dscp**
- **match frame-relay dlci**
- **match [not] mpls experimental topmost**
- **match [not] precedence**
- **match precedence**
- **match [not] protocol**
- **match [not] qos-group**
- **match source-address**
- **match vlan**
- **match vpls**

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to specify class101 as the name of a class and defines a class map for this class. The packets that match the access list 101 are matched to class class101.

```
RP/0/0/CPU0:router(config)# class-map class101
RP/0/0/CPU0:router(config-cmap)# match access-group ipv4 101
```

Related Commands

Command	Description
class (policy-map), on page 13	Specifies the name of the class whose policy you want to create or change.
match access-group, on page 52	Identifies a specified access control list (ACL) number as the match criteria for a class map.
match atm, on page 54	Enables packet matching on the basis of the ATM operations, administration, and maintenance (OAM) or cell loss priority (CLP).
match cos, on page 56	Identifies specified class of service (CoS) values as a match criteria in a class map.

Command	Description
match dscp, on page 59	Identifies specific IP differentiated services code point (DSCP) values as match criteria for a class map.
match mpls experimental topmost, on page 67	Identifies specific three-bit experimental (EXP) field values in the topmost Multiprotocol Label Switching (MPLS) label as match criteria for a class map.
match precedence, on page 69	Identifies IP precedence values as match criteria.
match qos-group, on page 72	Identifies specific quality-of-service (QoS) group values as match criteria in a class map.
match source-address	Identifies a specific source MAC address as match criterion in a class map.
match vlan, on page 74	Identifies selected VLAN IDs as the match criteria for a class map.
match vpls	Identifies selected virtual private LAN service (VPLS) fields as the match criteria for a class map.

clear qos counters interface

To clear QoS counters for a specified interface, use the **clear qos counters interface** command in EXEC mode.

clear qos counters interface *type interface-path-id* [**input**| **output**]

Syntax Description

type	Interface type. For more information, use the question mark (?) online help function.

interface-path-id	Either a physical interface instance or a virtual interface instance as follows:
	
	• Physical interface instance. Naming notation is *rack/slot/module/port* and a slash between values is required as part of the notation.
	
	  ◦ *rack* : Chassis number of the rack.
	
	  ◦ *slot* : Physical slot number of the modular services card or line card.
	
	  ◦ *module* : Module number. A physical layer interface module (PLIM) is always 0.
	
	  ◦ *port* : Physical port number of the interface.
	
	  Note In references to a Management Ethernet interface located on a route processor card, the physical slot number is alphanumeric (RSP0RP0 or RP1) and the module is CPU0. Example: interface MgmtEth0/RSP0RP1/CPU0/0.
	
	• Virtual interface instance. Number range varies depending on interface type.
	
	For more information about the syntax for the router, use the question mark (?) online help function.

input	(Optional) Clears input QoS counters that are attached to the specified interface.
output	(Optional) Clears output QoS counters that are attached to the specified interface.

Command Default

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.9.0	The **interface** keyword was added.

Usage Guidelines To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **clear qos counters interface** command clears all input and output QoS counters that are attached to a specified interface, unless the **input** or **output** keyword is specified. If the **input** or **output** keyword is specified, only counters attached to the interface in a specified direction are cleared.

Task ID

Task ID	Operations
qos	read, write

Examples The following example shows how to clear QoS counters attached to Gigabit Ethernet interface 0/1/0/9:

```
RP/0/0/CPU0:router# clear qos counters interface gigabitethernet 0/1/0/9
```
The following example shows how to clear output QoS counters attached to POS interface 0/7/0/3:

```
RP/0/0/CPU0:router# clear qos counters interface pos 0/7/0/3 output
```

compress header ip

To enable IP header compression for a policy map class, use the **compress header ip** command in policy map class configuration mode. To disable header compression, use the **no** form of this command.

compress header ip

no compress header ip

Syntax Description   This command has no keywords or arguments.

Command Default   By default, IP header compression is disabled.

Command Modes   Policy map class configuration

Command History

Release	Modification
Release 4.0.0	This command was introduced.

Usage Guidelines   You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operations
qos	read, write

Examples   The following example shows how to enable IP header compression for a policy map class:

```
RP/0/0/CPU0:router(config)#class-map class1
RP/0/0/CPU0:router(config-cmap)# match access-group ipv4 customer1
RP/0/0/CPU0:router(config-cmap)# exit
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# compress header ip
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.

Command	Description
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy (interface), on page 101	Attachs a policy map to an input interface or output interface to be used as the service policy for that interface.

conform-action

To configure the action to take on packets that conform to the rate limit, use the **conform-action** command in policy map police configuration mode. To remove a conform action from the policy-map, use the **no** form of this command.

conform-action [**drop**| **set** *options*| **transmit**]

no conform-action [**drop**| **set** *options*| **transmit**]

Syntax Description

drop	(Optional) Drops the packet.
set *options*	(Optional) Configures the specified packet properties. Replace *options* with one of the following keywords or keyword arguments:

- **atm-clp value** —Sets the cell loss priority (CLP) bit.

- **cos value** —Sets the class of service value. Range is 0 to7.

- **cos** [**inner**]*value* —Sets the class of service value. Range is 0 to 7.

- dei—Sets the drop eligible indicator (DEI). Can be 0 or 1.

- **discard-class** *value* —Sets the discard class value. Range is 0 to 7.

- **dscp** *value* —Sets the differentiated services code point (DSCP) value and sends the packet. See Table 2: IP DSCP Reserved Keywords, on page 60 for a list of valid values.

- **dscp** [**tunnel**] *value* —Sets the differentiated services code point (DSCP) value and sends the packet. See Table 2: IP DSCP Reserved Keywords, on page 60 for a list of valid values. With the **tunnel** keyword, the DSCP is set in the outer header.

- **mpls experimental** {**topmost**|**imposition**} *value* —Sets the experimental (EXP) value of the Multiprotocol Label Switching (MPLS) packet topmost label or imposed label. Range is 0 to 7.

- **precedence** *precedence* —Sets the IP precedence and sends the packet See Table 2 for a list of valid values.

- **precedence** [**tunnel**] *precedence* —Sets the IP precedence and sends the packet. See Table 3: IP Precedence Values and Names, on page 70 for a list of valid values. With the **tunnel** keyword, the precedence is set in the outer header.

- **qos-group** *value* —Sets the QoS group value.

- **srp-priority** *value* —Sets the Spatial Reuse Protocol (SRP) priority. Range is 0 to 7.

transmit	(Optional) Transmits the packets.

Command Default   By default, if no action is configured on a packet that conforms to the rate limit, the packet is transmitted.

Command Modes   Policy map police configuration

Command History

Release	Modification
Release 3.4.0	This command was introduced.
Release 3.4.1	The **set qos-group** keyword was added.
Release 3.7.0	Multi-action policer set action for the **conform-action** command was added.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

For more information regarding the traffic policing feature, see the police rate, on page 76 command.

The **conform-action** command can be used to set values for MPLS packets in the ingress direction. The values can be set in the following combinations:

- experimental, qos-group, and discard class values, or

- experimental and qos-group values, or

- experimental and discard class values

> **Note**   The multi-action policer sets cannot be used for IP packets.

- Ingress and egress
- Layer 2 subinterfaces
- Layer 2 main interfaces
- Layer 3 main interfaces

Task ID

Task ID	Operations
qos	read, write

Examples   In the following example for MPLS, traffic policing is configured to set the MPLS experimental bit for packets that conform to the rate limit:

```
RP/0/0/CPU0:router(config)# class-map class
```

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```
RP/0/0/CPU0:router(config-cmap)# match mpls experimental topmost 0
RP/0/0/CPU0:router(config-cmap)# exit

RP/0/0/CPU0:router(config)# policy-map child
RP/0/0/CPU0:router(config-pmap)# class prec1
RP/0/0/CPU0:router(config-pmap-c)# police rate 100000000 peak-rate 3125000 peak-burst 3125000

RP/0/0/CPU0:router(config-pmap-c-police)# conform-action set mpls experimental imp 1
RP/0/0/CPU0:router(config-pmap-c-police)# conform-action set qos-group 1
RP/0/0/CPU0:router(config-pmap-c-police)# exit
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit

RP/0/0/CPU0:router(config)# interface gigabitethernet 0/1/0/9
RP/0/0/CPU0:router(config-if) service-policy input policy1
```

Related Commands

Command	Description
child-conform-aware, on page 11	Prevents the parent policer from dropping any ingress traffic that conforms to the maximum rate specified in the child policer.
conform-color	(Used for SIP 700 cards only.) Configures preclassification of ingress Layer 2 Frame Relay packets that have been previously marked as *not* discard eligible on an upstream node. These previously-marked packets are analyzed and preclassified by the color-aware policer on the ingress interface as part of the 2-rate 3-color (2R3C) traffic policing feature.
exceed-action, on page 28	Configures the action to take on packets that exceed the rate limit.
police rate, on page 76	Configures traffic policing and enters policy map police configuration mode.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.
violate-action, on page 150	Configures the action to take on packets that violate the rate limit.

end-class-map

To end the configuration of match criteria for the class and to exit class map configuration mode, use the **end-class-map** command in class map configuration mode.

end-class-map

Syntax Description   This command has no keywords or arguments.

Command Default   No default behavior or values

Command Modes   Class map configuration

Command History

Release	Modification
Release 3.6.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operations
qos	read, write

Examples   The following example shows how to end the class map configuration and exit class map configuration mode:

```
RP/0/0/CPU0:router(config)# class-map class101
RP/0/0/CPU0:router(config-cmap)# match access-group ipv4 101
RP/0/0/CPU0:router(config-cmap)# end-class-map
RP/0/0/CPU0:router(config)#
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.

end-policy-map

To end the configuration of a policy map and to exit policy map configuration mode, use the **end-policy-map** command in policy map configuration mode.

end-policy-map

Syntax Description This command has no keywords or arguments.

Command Default No default behavior or values

Command Modes Policy map configuration

Command History

Release	Modification
Release 3.6.0	This command was introduced.

Usage Guidelines To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operations
qos	read, write

Examples The following example shows how to end the policy map configuration and exit policy map configuration mode.

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# police
 cir

 250
RP/0/0/CPU0:router(config-pmap-c)# set precedence 3
RP/0/0/CPU0:router(config-pmap)# end-policy-map
RP/0/0/CPU0:router(config)#
```

Related Commands

Command	Description
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.

exceed-action

To configure the action to take on packets that exceed the rate limit, use the **exceed-action** command in policy map police configuration mode. To remove an exceed action from the policy-map, use the **no** form of this command.

exceed-action [**drop**| **set** *options*| **transmit**]

no exceed-action [**drop**| **set** *options*| **transmit**]

Syntax Description

drop	(Optional) Drops the packet.
set *options*	Configures the specified packet properties. Replace *options* with one of the following keywords or keyword arguments:

> • **atm-clp** *value* —Sets the cell loss priority (CLP) bit.
>
> • **cos [inner]** *value* —Sets the class of service value. Range is 0 to 7.
>
> • **cos** *value* —Sets the class of service value. Range is 0 to 7.
>
> • **dei** —Sets the drop eligible indicator (DEI). Can be 0 or 1.
>
> • **discard-class** *value* —Sets the discard class value. Range is 0 to 7.
>
> • **dscp** *value* —Sets the differentiated services code point (DSCP) value and sends the packet. See Table 2: IP DSCP Reserved Keywords, on page 60 for a list of valid values.
>
> • **dscp** [**tunnel**] *value* —Sets the differentiated services code point (DSCP) value and sends the packet. See Table 2: IP DSCP Reserved Keywords, on page 60 for a list of valid values. With the **tunnel** keyword, the DSCP is set in the outer header.
>
> • **fr-de** *value* —Sets the Frame Relay discard eligible (DE) bit on the Frame Relay frame then transmits that packet. In congested environments, frames with the DE bit set to 1 are discarded before frames with the DE bit set to 0. The frame relay DE bit has only one bit and has only two settings, 0 or 1. The default DE bit setting is 0.
>
> • **mpls experimental** {**topmost** | **imposition**} *value* —Sets the experimental (EXP) value of the Multiprotocol Label Switching (MPLS) packet topmost label or imposed label. Range is 0 to 7.
>
> • **precedence** *precedence* —Sets the IP precedence and sends the packet. See Table 3: IP Precedence Values and Names, on page 70 for a list of valid values.
>
> • **precedence** [**tunnel**] *precedence* —Sets the IP precedence and sends the packet. See Table 3: IP Precedence Values and Names, on page 70 for a list of valid values. With the **tunnel** keyword, the precedence is set in the outer header.
>
> • **qos-group** *value* —Sets the QoS group value.
>
> • **qos-group** *value* —Sets the QoS group value. Range is 0 to 63.
>
> • **srp-priority** *value* —Sets the Spatial Reuse Protocol (SRP) priority. Range is 0 to 7

transmit	(Optional) Transmits the packets.

Command Default By default, if no action is configured on a packet that exceeds the rate limit, the packet is dropped.

Command Modes Policy map police configuration

Command History

Release	Modification
Release 3.4.0	This command was introduced.
Release 3.4.1	The **set qos-group** keyword was added.
Release 3.7.0	Multi-action policer set action for the **exceed-action** command was supported.

Usage Guidelines To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

For more information regarding the traffic policing feature, see the police rate, on page 76 command.

The **exceed-action** command can be used to set values for MPLS packets in the following combinations:

- experimental, qos-group, and discard class values, or

- experimental and qos-group values, or

- experimental and discard class values

Note The multi-action policer sets cannot be used for IP packets.

- Ingress and egress
- Layer 2 subinterfaces
- Layer 2 main interfaces
- Layer 3 main interfaces

Task ID

Task ID	Operations
qos	read, write

Examples   In the following example for MPLS, traffic policing is configured to drop traffic that exceeds the rate limit:

```
RP/0/0/CPU0:router(config)# class-map class1
RP/0/0/CPU0:router(config-cmap)# match mpls experimental topmost 0
RP/0/0/CPU0:router(config-cmap)# exit

RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# police rate 250 kbps burst 50
RP/0/0/CPU0:router(config-pmap-c-police)# exceed-action drop
RP/0/0/CPU0:router(config-pmap-c-police)# exit
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit

RP/0/0/CPU0:router(config)# interface pos 0/5/0/0
RP/0/0/CPU0:router(config-if) service-policy input policy1
```

Related Commands

Command	Description
conform-action, on page 22	Configures the action to take on packets that conform to the rate limit.
exceed-color	(Used for SIP 700 cards only.) Configures preclassification of ingress Layer 2 Frame Relay packets that have been previously marked as discard eligible on an upstream node. These previously-marked packets are analyzed and preclassified by the color-aware policer on the ingress interface as part of the 2-rate 3-color (2R3C) traffic policing feature.
police rate, on page 76	Configures traffic policing and enters policy map police configuration mode.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.
violate-action, on page 150	Configures the action to take on packets that violate the rate limit.

hw-module mrq-polling

To configure the threshold values for polling of MRQ counters, use the **hw-module mrq-polling** command in global configuration mode. To revert to the default threshold values for MRQ polling, use the **no** form of this command.

hw-module mrq-polling {**max-threshold**| **min-threshold**} *threshold value* **location** *node-id*

no hw-module mrq-polling {**max-threshold**| **min-threshold**} *threshold value* **location** *node-id*

Syntax Description

max-threshold	Configures the maximum threshold value for the polling of MRQ counters.
min-threshold	Configures the minimum threshold value for the polling of MRQ counters.
threshold value	Threshold value. For Multirate 10G IP Services Engines (Engine 5+) line cards, range is 1 to 16384. For 2.5 Gbps IP Services Engine (Engine 3) line cards, range is 1 to 2048.
location	Configures threshold values for MRQ polling, for a designated node.
node-id	Location of node to be configured. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default   The default minimum threshold is 25 percent of the available MRQ counters, 4096 for Engine 5+ line cards, 512 for Engine 3 line cards. The default maximum threshold is 75 percent of the available MRQ counters, 12288 for Engine 5+ line cards, 1536 for Engine 3 line cards.

Command Modes   Global configuration mode

Command History

Release	Modification
Release 4.0.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

This command is supported on 2.5 Gbps IP Services Engine (Engine 3) line cards and Multirate 10G IP Services Engines (Engine 5+) line cards.

The maximum threshold value should always exceed the minimum threshold value. Attempting to commit a configuration with threshold values which do not meet this criteria will result in an error.

Task ID

Task ID	Operation
drivers	read, write
root-lr	read, write

Examples

The following example demonstrates how to configure the maximum threshold value for MRQ polling as 2000, at location 0/2/CPU0:

```
RP/0/0/CPU0:router# configure terminal
Wed Aug 11 01:21:51.378 UTC
RP/0/0/CPU0:router(config)#
RP/0/0/CPU0:router(config)# hw-module mrq-polling max-threshold 2000 location 0/2/CPU0
RP/0/0/CPU0:router(config)# commit
RP/0/0/CPU0:router : config[65809]: %MGBL-CONFIG-6-DB_COMMIT : Configuration committed by
user 'root'. Use 'show configuration commit changes 1000000015' to view the changes.
RP/0/0/CPU0:router(config)#
```

The following example demonstrates how to configure the default maximum threshold value for MRQ polling, at location 0/2/CPU0:

```
RP/0/0/CPU0:router# configure terminal
Wed Aug 11 01:21:51.378 UTC
RP/0/0/CPU0:router(config)#
RP/0/0/CPU0:router(config)# no hw-module mrq-polling max-threshold 2000 location 0/2/CPU0
RP/0/0/CPU0:router(config)# commit
RP/0/0/CPU0:router : config[65809]: %MGBL-CONFIG-6-DB_COMMIT : Configuration committed by
user 'root'. Use 'show configuration commit changes 1000000016' to view the changes.
RP/0/0/CPU0:router(config)#
```

hw-module qos acc-l2-with-additional

To account Layer 2 with additional bytes, use the **hw-module qos acc-l2-with-additional** command in global configuration mode. To account Layer 2 without additional bytes, use the **no** form of this command.

hw-module qos acc-l2-with-additional *number of bytes* **location** *node-id*

no hw-module qos acc-l2-with-additional *number of bytes* **location** *node-id*

Syntax Description

number of bytes	Number of additional bytes to be used for Layer 2 accounting.
location	Configures additional Layer 2 bytes for the designated node.
node-id	Location of node to be configured. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default

No additional bytes are used in Layer 2 accounting.

Command Modes

Global configuration mode

Command History

Release	Modification
Release 4.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

This command is supported on 10 Gbps IP Services Engine (Engine 5) line cards and Multirate 10G IP Services Engines (Engine 5+) line cards only.

Layer 2 accounting must be enabled on the location specified at *node-id*. The specified interface must not be configured using the **service-policy (interface)** command with the optional **account nolayer2** keyword, as this disables Layer 2 accounting of the specified interface and enables Layer 3 accounting only.

This command configures all interfaces on the specified node to account Layer 2 using the specfified number of additional bytes.

Task ID

Task ID	Operation
qos	read, write
root-lr	read, write

Examples   The following example demonstrates how to configure Layer 2 accounting to use an additional 4 bytes, at location 0/2/CPU0:

```
RP/0/0/CPU0:router# configure terminal
RP/0/0/CPU0:router (config)# hw-module qos acc-l2-with-additional 4 location 0/2/CPU0
RP/0/0/CPU0:router (config)#
```

Related Commands

Command	Description
hw-module qos account layer2 encapsulation, on page 35	Configures Layer 2 encapsulation header lengths on a node.
service-policy (interface), on page 101	Attachs a policy map to an input interface or output interface to be used as the service policy for that interface.

hw-module qos account layer2 encapsulation

To configure Layer 2 encapsulation header lengths on a node, use the **hw-module qos account layer2 encapsulation** command in global configuration mode. To disable this functionality, use the **no** form of this command.

hw-module qos account layer2 encapsulation {**arpa**| **dot1q**| **length** *value*} **location** *node-id*

no hw-module qos account layer2 encapsulation {**arpa**| **dot1q**| **length** *value*} **location** *node-id*

Syntax Description

arpa	Specifies the ARPA encapsulation size (14 bytes).
dot1q	Specifies the EEE 802.1q encapsulation size (18 bytes).
length *value*	Specifies the Layer 2 encapsulation length in bytes. Range is 1-50.
location *node-id*	Enables Layer 2 encapsulation header lengths for the designated node. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default

No default behavior or values

Command Modes

Global configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The default packet size for QoS accounting on 2.5 Gbps IP Services Engine (Engine 3) line cards is Layer 3 packet size. This command allows you to specify Layer 2 packet size for QoS accounting and to specify its length, which allows service providers to limit the amount of traffic that is passed to particular users.

This command applies only to the 4-Port Gigabit Ethernet ISE line card. If enabled, this command applies to all interfaces on the 4-port Gigabit Ethernet ISE line card. Ingress QoS traffic uses the actual Layer 2 encapsulation size of each packet. For example, if packets come from a dot1q interface the encapsulation size is 18 bytes. If packets come from a QinQ interface, the encapsulation size is 22 bytes. Egress QoS traffic uses the encapusulation size specified in this command regardless of the egress interface type.

Task ID

Task ID	Operations
qos	read, write
root-lr	read, write

Examples

The following example shows how to configure Layer 2 encapsulation header lengths to 25 on 0/1/CPU0:

```
RP/0/0/CPU0:router# configure
RP/0/0/CPU0:router(config)# hw-module qos account layer2 encapsulation length 25 0/1/CPU0
```

Related Commands

Command	Description
hw-module qos multicast, on page 40	Enables multicast egress quality of service (QoS) on a node.
hw-module qos queue-auto-defrag disable location, on page 46	Disables automatic QoS queue defragmentation on a node.
show hw-module multicast qos, on page 128	Displays the multicast QoS group information.

hw-module qos acl-deny enable

To deny access control lists (ACL) on a node, use the **hw-module qos acl-deny enable** command in global configuration mode. To disable this functionality, use the **no** form of this command.

hw-module qos acl-deny enable [**location** *node-id*]

no hw-module qos acl-deny enable [**location** *node-id*]

Syntax Description

location *node-id*	Denies ACLs for the designated node. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default

By default, this feature is disabled.

Command Modes

Global configuration

Command History

Release	Modification
Release 3.6.0	This command was introduced on the Cisco XR 12000 Series Router.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

For the **hw-module qos acl-deny enable** command to run effectively, you must reload the line card (LC).

Task ID

Task ID	Operations
qos-ea	write

Examples

The following example shows how to configure an acl-deny function on location 0/1/CPU0:

```
RP/0/0/CPU0:router# configure
RP/0/0/CPU0:router(config)# hw-mod qos acl-deny enable location 0/1/CPU0
```

Related Commands

Command	Description
show qos acl-deny enable, on page 138	Displays the acl-deny information for a particular location.

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hw-module qos if-ref-bw

To enable the interface bandwidth as the Quality of Service (QoS) reference bandwidth, use the **hw-module qos if-ref-bw** command in global configuration mode. To revert to the default configuration, use the **no** form of this command.

hw-module qos if-ref-bw enable location *node-id*

no hw-module qos if-ref-bw enable location *node-id*

Syntax Description

enable	Enables interface bandwidth as the QoS reference bandwidth.
location	Configures node for which the QoS reference bandwidth is to be defined.
node-id	Node for which the QoS reference bandwidth is to be defined. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default

The class service rate is the default reference bandwidth.

Command Modes

Global configuration mode

Command History

Release	Modification
Release 4.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

New configuration will only take effect after a line card reload.

The QoS reference bandwidth is used for the conversion of time based values to equivalent packet based interpretation.

Task ID

Task ID	Operation
qos	read, write
root-lr	read, write

Examples   The following example shows how to enable the interface bandwidth as the QoS reference bandwidth, on location 0/3/cpu0:

```
RP/0/0/CPU0:router(config)# hw-module qos if-ref-bw enable location 0/3/cpu0
RP/0/0/CPU0:router(config)# commit
RP/0/0/CPU0:router:Aug 9 02:41:43.952 : qos_ea[238]: %QOS-QOSEA-6-INFO : QoSEA-Info: if-ref-bw
 config accepted, reload LC to take effect.
RP/0/0/CPU0:router:Aug 9 02:41:44.537 : config[65809]: %MGBL-CONFIG-6-DB_COMMIT :
Configuration committed by user 'root'. Use 'show configuration commit changes 1000000012'
 to view the changes.
RP/0/0/CPU0:router(config)#
```

The following example shows how to enable the class service rate as the QoS reference bandwidth, on location 0/3/cpu0:

```
RP/0/0/CPU0:router(config)# no hw-module qos if-ref-bw enable location 0/3/cpu0
RP/0/0/CPU0:router(config)# commit
RP/0/0/CPU0:router:Aug 9 02:41:58.168 : qos_ea[238]: %QOS-QOSEA-6-INFO : QoSEA-Info: if-ref-bw
 config accepted, reload LC to take effect.
RP/0/0/CPU0:router:Aug 9 02:41:58.669 : config[65809]: %MGBL-CONFIG-6-DB_COMMIT :
Configuration committed by user 'root'. Use 'show configuration commit changes 1000000013'
 to view the changes.
RP/0/0/CPU0:router(config)#
```

Related Commands

Command	Description
show qos if-ref-bw, on page 139	Displays the Quality of Service (QoS) reference bandwidth.

hw-module qos multicast

To enable multicast egress quality of service (QoS) on a node, use the **hw-module qos multicast** command in global configuration mode. To disable this functionality, use the **no** form of this command.

hw-module qos multicast [**location** *node-id*]

no hw-module qos multicast [**location** *node-id*]

Syntax Description

location *node-id*	Enables egress QoS for the designated node. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default

All multicast traffic is routed through the default queue.

Command Modes

Global configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	The **enable** keyword was deleted from the command syntax.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **hw-module qos multicast** command enables multicast QoS, which means that general, system wide QoS applies to multicast traffic as well.

Note The following commands apply to Cisco XR 12000 Series Router Engine 3 line cards only: **hw-module qos multicast** , **hw-module qos multicast priorityq** , and **show hw-module qos multicast** . For Engine 5 line cards, there is no requirement for a command to enable QoS. On Engine 5 line cards, multicast QoS behaves like unicast QoS (when a policy is attached to an interface).

If multicast QoS is disabled (which is the default value), all multicast traffic travels to the default queue. When multicast routes are configured with QoS enabled, there may be insufficient resources (PLU/TLU, MGIDs, and so on.) to support multicast QoS for all routes. In such cases, some multicast routes are unchanged and associated multicast traffic is routed to the default queue.

For complete information about QoS in Cisco IOS XR software, see the Cisco IOS XR Modular Quality of Service Configuration Guide.

Task ID

Task ID	Operations
qos	read, write
root-lr	read, write

Examples

The following example shows how to enable multicast QoS on location 0/1/CPU0:

```
RP/0/0/CPU0:router# configure
RP/0/0/CPU0:router(config)# hw-module qos multicast location 0/1/CPU0
```

Related Commands

Command	Description
show hw-module multicast qos, on page 128	Displays the multicast QoS group information.

hw-module qos multicast priorityq disable

To divert multicast traffic slated for the priority queue to the default queue, use the **hw-module qos multicast priorityq disable** command in global configuration mode. To disable this functionality, use the **no** form of this command.

hw-module qos multicast priorityq disable location *node-id*

no hw-module qos multicast priorityq disable location *node-id*

Syntax Description

location *node-id*	Assigns a QoS priority value for the designated node. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default

By default, all multicast traffic is routed to the priority queue (as defined by the QoS policy).

Command Modes

Global configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Note The following commands apply to Engine 3 line cards only: **hw-module qos multicast** , **hw-module qos multicast priorityq disable** , and **show hw-module qos multicast** . For Engine 5 line cards, there is no requirement for a command to enable QoS. On Engine 5 line cards, multicast QoS behaves like unicast QoS (when a policy is attached to an interface).

For complete information about QoS in Cisco IOS XR software, see the Cisco IOS XR Modular Quality of Service Configuration Guide.

Task ID

Task ID	Operations
qos	read, write
root-lr	read, write

Examples   The following example shows how to divert multicast traffic slated for the priority queue to the default queue on 0/1/CPU0:

```
RP/0/0/CPU0:router# hw-module qos multicast priorityq disable 0/1/CPU0
```

Related Commands

Command	Description
hw-module qos multicast, on page 40	Enables multicast egress quality of service (QoS) on a node.
show hw-module multicast qos, on page 128	Displays the multicast QoS group information.

hw-module qos pol-gran location

To override the default policer granularity, use the **hw-module qos pol-gran location** command in global configuration mode. To return to the default policer granularity, use the **no** form of this command.

hw-module qos pol-gran *granularity* **location** *interface-path-id*

no hw-module qos pol-gran *granularity* **location** *interface-path-id*

Syntax Description

granularity	Policer granularity in kbps. Valid values are from 8 kbps to 64 kbps.
interface-path-id	Physical location of the Shared Interface Processor (SIP). Naming notation is *rack/slot/module* and a slash between values is required as part of the notation. • *rack* —Chassis number of the rack. • *slot* —Physical slot number of the modular services card or line card. • *module* —Module number. A physical layer interface module (PLIM) is always 0.

Command Default

Default policer granularity values are:

• Cisco 12000 SIP-401—64 kbps

• Cisco 12000 SIP-501—64 kbps

• Cisco 12000 SIP-601—64 kbps

Command Modes

Global configuration

Command History

Release	Modification
Release 3.8.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The police rate you set should be a multiple of the policer granularity. For example, if the police rate is set to 72 kbps but the default policer granularity is 64 kbps, the effective police rate is 64 kbps. To get an actual police rate of 72 kbps, configure the policer granularity to 8 kbps. Because 72 is a multiple of 8, the police rate will be exactly 72 kbps.

Policer granularity values, whether default or configured, apply to the SIP and to all SPAs that are installed on the SIP.

Task ID

Task ID	Operations
qos	read, write
root-lr	read, write

Examples

The following example shows how to set the policer granularity to 8 on location 0/1/CPU0:

```
RP/0/0/CPU0:router# configure
RP/0/0/CPU0:router(config)# hw-module qos pol-gran 8 location 0/1/CPU0
```

Related Commands

Command	Description
show qos pol-gran location, on page 147	Displays policer granularity for a SPA Interface Processor.

hw-module qos queue-auto-defrag disable location

To disable automatic QoS queue defragmentation on a node, use the **hw-module qos queue-auto-defrag disable location** command in global configuration mode. To disable this functionality, use the **no** form of this command.

hw-module qos queue-auto-defrag disable location *node-id*

no hw-module qos queue-auto-defrag disable location *node-id*

Syntax Description

node-id	Specifies the node in the *rack/slot/module* notation.

Command Default

No default behavior or values

Command Modes

Global configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.5.0	The **enable** keyword was removed.
Release 3.9.0	Added usage guidelines to refer to the **hw-module queue-defrag location** command for information on manually defragmenting QoS queues.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

When policies are frequently added and removed in large-scale configurations, the line card might not have enough free contiguous QoS queues to accommodate a new policy—even though there are enough free queues on the line card. Defragmentation solves this problem by moving the minimum number of queues to make all occupied queues contiguous.

There is the potential for packet loss during QoS queue defragmentation. However, if you disable automatic defragmentation, you could get an error while trying to applying a policy map because there are not enough queues available on the line card.

To avoid packet loss during defragmentation or running out of available queues, schedule a maintenance window and manually defragment the QoS queues using the **hw-module queue-defrag location** command.

Task ID

Task ID	Operations
qos	read, write
root-lr	read, write

Examples

The following example shows how to disable automatic QoS queue defragmentation on location 0/1/CPU0. Automatic defragmentation is disabled for all interfaces on location 0/1/CPU0.

```
RP/0/0/CPU0:router# configure
RP/0/0/CPU0:router(config)# hw-module qos queue-auto-defrag disable location 0/1/CPU0
```

Related Commands

Command	Description
hw-module qos account layer2 encapsulation, on page 35	Configures Layer 2 encapsulation header lengths on a node.
hw-module qos multicast, on page 40	Enables multicast egress quality of service (QoS) on a node.
hw-module queue-defrag location, on page 48	Manually defragment the QoS queues on a node.
show hw-module multicast qos, on page 128	Displays the multicast QoS group information.

hw-module queue-defrag location

To manually defragment the QoS queues on a node, use the **hw-module queue-defrag location** command in EXEC mode.

hw-module queue-defrag location *node-id*

Syntax Description

node-id	Specifies the node in the *rack/slot/module* notation.

Command Default   No default behavior or values

Command Modes   EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

When policies are frequently added and removed in large-scale configurations, the line card might not have enough free contiguous QoS queues to accommodate a new policy—even though there are enough free queues on the line card. Defragmentation solves this problem by moving the minimum number of queues to make all occupied queues contiguous.

You can manually defragment the QoS queues on a node regardless of whether automatic defragmentation is enabled. If automatic defragmentation is disabled, you could get an error while trying to applying a policy map because there are not enough free contiguous queues available on the line card. In this case, use the **hw-module queue-defrag location** command to defragment the queues on the node.

To determine the number of occupied QoS queues and the level of fragmentation on a node, use the **show controllers egressq enaq location** command.

Task ID

Task ID	Operations
sysmgr	execute
root-lr	read

Examples   The following example shows how to manually defragment QoS queues on location 0/1/CPU0. QoS queues are defragmented for all the interfaces on location 0/1/CPU0.

```
RP/0/0/CPU0:router# hw-module queue-defrag location 0/1/CPU0
```

Related Commands

Command	Description
hw-module qos queue-auto-defrag disable location, on page 46	Disables automatic QoS queue defragmentation on a node.
show controllers egressq enaq location, on page 124	Displays information about QoS queue fragmentation on a node, use the show controllers egressq enaq location command in EXEC mode.

hw-module sanity

To configure sanity checking of ingress and egress queueing ASICs, use the **hw-module sanity** command in global configuration mode. To revert to the default sanity checking configuration, use the **no** form of this command.

hw-module sanity {**egressq**| **ingressq**} {**action** *action*| **threshold** *threshold-value*| **timer** *seconds*} **location** *node-id*

no hw-module sanity {**egressq**| **ingressq**} {**action** *action*| **threshold** *threshold-value*| **timer** *seconds*} **location** *node-id*

Syntax Description

egressq	Configures sanity checking of egress queueing ASIC.
ingressq	Configures sanity checking of ingress queuing ASIC.
action	Configures action performed when buffer has depleted completely.
action	Action to be performed when buffer has depleted completely. Valid values are • **recarve**—Recarve performed as recovery. • **none**—No action performed as recovery. • **reload**—Reload of line card performed as recovery.
threshold	Configures remaining buffer threshold value. Warning printed on the console when the remaining buffer threshold value is reached.
threshold-value	Buffer threshold value, as a percentage. Range: 1 to 100.
timer	Configures time lapse between successive sanity checks.
seconds	Time lapse between successive sanity checks, in seconds.
location	Configures sanity checking for a designated node.
node-id	Node for which sanity checking is to be configured. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default   Action: pcds. Threshold: 5. Timer: 60

Command Modes   Global configuration mode

Command History

Release	Modification
Release 4.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

This command is supported on 10 Gbps IP Services Engine (Engine 5) line cards and Multirate 10G IP Services Engines (Engine 5+) line cards only.

Use of the **no** form of this command, with the keyword **action** , configures the action as none. The default action, pcds, is equivalent to the user configurable action, none. When action is set as pcds or none, a warning is printed on the console when the buffer threshold value is reached, but no action is performed as recovery when the buffer has depleted completely.

Task ID

Task ID	Operation
drivers	read, write
root-lr	read, write

Examples

The following example shows how to configure sanity checking of the ingress queuing ASIC at 30 second intervals on location 0/2/CPU0, to print a warning on the console when the buffer has depleted to 7 percent and to perform a line card reload when the buffer has depleted completely.

```
RP/0/0/CPU0:router# configure terminal
RP/0/0/CPU0:router(config)# hw-module sanity ingressq timer 30 location 0/2/CPU0
RP/0/0/CPU0:router(config)# hw-module sanity ingressq action reload location 0/2/CPU0
RP/0/0/CPU0:router(config)# hw-module sanity ingressq threshold 7 location 0/2/CPU0
RP/0/0/CPU0:router(config)#
```

Related Commands

Command	Description
show controllers sanity, on page 126	Displays information about sanity checking of ingress and egress queueing ASICs.

match access-group

To identify a specified access control list (ACL) number as the match criteria for a class map, use the **match access-group** command in class map configuration mode. To remove ACL match criteria from a class map, use the **no** form of this command.

match access-group {**ipv4**| **ipv6**} *access-group-name*

no match access-group {**ipv4**| **ipv6**} *access-group-name*

Syntax Description

ipv4	Specifies the name of the IPv4 access group to be matched.
ipv6	Specifies the name of the IPv6 access group to be matched.
access-group-name	ACL whose contents are used as the match criteria against which packets are checked to determine if they belong to this class.

Command Default   By default, if neither IPv6 nor IPv4 is specified as the match criteria for a class map, IPv4 addressing is used.

Command Modes   Class map configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.2.2	Support for IPv6 ACLs with source port matching was added in MQC policy maps.
Release 3.3.0	No modification.
Release 3.3.1	Support for IPv4 ACLs with source port matching was added in MQC policy maps.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

For class-based features (such as marking, Modified Deficit Round Robin [MDRR], and policing), you define traffic classes based on match criteria, including ACLs and input interfaces. Packets satisfying the match criteria for a class constitute the traffic for that class.

The **match access-group** command specifies an ACL whose contents are used as the match criteria against which packets are checked to determine if they belong to the class specified by the class map.

To use the **match access-group** command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish. You can specify up to eight IPv4 and IPv6 ACLs in a match statement.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to specify a class map called map1 and configures map1 to be used as the match criteria for this class:

```
RP/0/0/CPU0:router(config)# class-map map1
RP/0/0/CPU0:router(config-cmap)# match access-group ipv4 map1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.

match atm

To enable packet matching on the basis of the ATM operations, administration, and maintenance (OAM) or cell loss priority (CLP), use the **match atm** command in class-map configuration mode. To disable packet matching, use the **no** form of this command.

match atm {**clp** [*clp-bit-value*]| **oam**}

no match atm {**clp** [*clp-bit-value*]| **oam**}

Syntax Description

clp	Configures the ATM CLP bit to be matched. Use either 0 or 1 for *clp-bit-value* .
clp-bit-value	(Optional) Value for the ATM CLP bit. Choose either 0 or 1 as the bit value. If you do not specify a bit value, the default value of 1 is used.
oam	Configures the ATM OAM to be matched.

Command Default   Packets are not matched on the basis of the ATM CLP or OAM.

Command Modes   Class map configuration

Command History

Release	Modification
Release 3.8.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **match atm** command is supported on policy maps that are attached to ATM main interfaces, ATM subinterfaces, or ATM permanent virtual circuits (PVCs). However, policy maps (containing the **match atm** command) that are attached to these types of ATM interfaces can be input policy maps only.

Task ID

Task ID	Operations
qos	read, write

Examples   The following example shows how to specify a class map called map1 and configures map1 to be used as the match criteria for this class:

```
RP/0/0/CPU0:router(config)#class-map map1
RP/0/0/CPU0:router(config-cmap)# match atm oam
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
match access-group, on page 52	Identifies a specified access control list (ACL) number as the match criteria for a class map.
match cos, on page 56	Identifies specified class of service (CoS) values as a match criteria in a class map.
match dscp, on page 59	Identifies specific IP differentiated services code point (DSCP) values as match criteria for a class map.
match mpls experimental topmost, on page 67	Identifies specific three-bit experimental (EXP) field values in the topmost Multiprotocol Label Switching (MPLS) label as match criteria for a class map.
match precedence, on page 69	Identifies IP precedence values as match criteria.
match qos-group, on page 72	Identifies specific quality-of-service (QoS) group values as match criteria in a class map.
match source-address	Identifies a specific source MAC address as match criterion in a class map.
match vlan, on page 74	Identifies selected VLAN IDs as the match criteria for a class map.

match cos

To identify specified class of service (CoS) values as a match criteria in a class map, use the **match cos** command in class map configuration mode. To remove a specified CoS class value from the matching criteria for a class map, use the **no** form of this command.

match cos *cos-value* [*cos-value1 ... cos-value7*]

no match cos *cos-value* [*cos-value1 ... cos-value7*]

Syntax Description

cos-value	Class-of-service identifier that specifies the exact value from 0 to 7. Up to eight CoS identifiers can be specified to match packets.

Command Default   No match criteria are specified.

Command Modes   Class map configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **match cos** command specifies a class of service that is used as the match criteria against which packets are checked to determine if they belong to the class specified by the class map.

To use the **match cos** command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish. If you specify more than one **match cos** command in a class map, the values of subsequent match statements are added to the first **match cos** command.

The **match cos** command is not supported on an output service policy attached to a Layer 3 interface (POS interface or routed VLAN subinterface).

The **match cos** command is supported on egress Layer 2 interfaces, Layer 2 subinterfaces, and Layer 3 physical interfaces. Layer 3 physical interfaces are supported, because it is possible for a Layer 3 interface to have underlying Layer 2 subinterfaces. This command is supported only on the ingress ethernet subinterface.

- Ingress and egress

- Layer 2 main interfaces and subinterfaces

- Layer 3 main interfaces

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to configure the service policy called policy1 and attach service policy policy1 to an interface. In this example, class map cos146 evaluates all packets entering Gigabit Ethernet subinterface 0/1/0/0.100 for class of service values of 1, 4, or 6. If the incoming packet has been marked with any of these CoS values, the packet is queued to the class queue with the bandwidth setting of 300 kbps.

```
RP/0/0/CPU0:router(config)# class-map cos146
RP/0/0/CPU0:router(config-cmap)# match cos 1 4 6
RP/0/0/CPU0:router(config-cmap)# exit

RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class cos146
RP/0/0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit

RP/0/0/CPU0:router(config)# interface

 gigabitethernet 0/1/0/0.100
RP/0/0/CPU0:router(config-if)# service-policy

 output
 policy1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
match access-group, on page 52	Identifies a specified access control list (ACL) number as the match criteria for a class map.
match atm, on page 54	Enables packet matching on the basis of the ATM operations, administration, and maintenance (OAM) or cell loss priority (CLP).
match dscp, on page 59	Identifies specific IP differentiated services code point (DSCP) values as match criteria for a class map.
match mpls experimental topmost, on page 67	Identifies specific three-bit experimental (EXP) field values in the topmost Multiprotocol Label Switching (MPLS) label as match criteria for a class map.
match precedence, on page 69	Identifies IP precedence values as match criteria.
match qos-group, on page 72	Identifies specific quality-of-service (QoS) group values as match criteria in a class map.
match source-address	Identifies a specific source MAC address as match criterion in a class map.
match vlan, on page 74	Identifies selected VLAN IDs as the match criteria for a class map.

Command	Description
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
set cos, on page 107	Sets the Layer 2 class of service (CoS) value of an outgoing packet.

match dscp

To identify specific IP differentiated services code point (DSCP) values as match criteria for a class map, use the **match dscp** command in class map configuration mode. To remove a DSCP value from a class map, use the **no** form of this command.

match dscp [**ipv4**| **ipv6**] *dscp-value* [*dscp-value1 ... dscp-value7*]

no match dscp [**ipv4**| **ipv6**] *dscp-value* [*dscp-value1 ... dscp-value7*]

Syntax Description

ipv4	(Optional) Specifies the IPv4 DSCP value.
ipv6	(Optional) Specifies the IPv6 DSCP value.
dscp-value	IP DSCP value identifier that specifies the exact value or a range of values. Range is 0 to 63. Up to eight IP DSCP values can be specified to match packets. Reserved keywords can be specified instead of numeric values. Table 2: IP DSCP Reserved Keywords, on page 60 describes the reserved keywords.

Command Default

Matching on both IP Version 4 (IPv4) and IPv6 packets is the default.

Command Modes

Class map configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.3.0	The **ipv6** and **ipv4** keywords were added.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **match dscp** command specifies a DSCP value that is used as the match criteria against which packets are checked to determine if they belong to the class specified by the class map.

To use the **match dscp** command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish. If you specify more than one **match dscp** command in a class map, only the last command entered applies.

The **match dscp** command examines the higher-order six bits in the type of service (ToS) byte of the IP header. Only one of the eight values is needed to yield a match (OR operation).

The command supports only eight IP DSCP values. If you try to configure more match statements after all the eight values are matched, the statements get rejected.

The IP DSCP value is used as a matching criterion only. The value has no mathematical significance. For instance, the IP DSCP value 2 is not greater than 1. The value simply indicates that a packet marked with the IP DSCP value of 2 should be treated differently than a packet marked with an IP DSCP value of 1. The treatment of these marked packets is defined by the user through the setting of QoS policies in policy map class configuration mode.

The reserved keywords listed in the following table can be specified instead of numeric values.

Table 2: IP DSCP Reserved Keywords

DSCP Value	Reserved Keyword
0	default
10	AF11
12	AF12
14	AF13
18	AF21
20	AF22
22	AF23
26	AF31
28	AF32
30	AF33
34	AF41
36	AF42
38	AF43
46	EF
8	CS1
16	CS2
24	CS3
32	CS4
40	CS5

DSCP Value	Reserved Keyword
48	CS6
56	CS7
ipv4	ipv4 dscp
ipv6	ipv6 dscp

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to configure the service policy called policy1 and attach service policy policy1 to an interface. In this example, class map dscp14 evaluates all packets entering Packet-over-SONET/SDH (POS) interface 0/1/0/0 for an IP DSCP value of 14. If the incoming packet has been marked with the IP DSCP value of 14, the packet is queued to the class queue with the bandwidth setting of 300 kbps.

```
RP/0/0/CPU0:router(config)# class-map dscp14
RP/0/0/CPU0:router(config-cmap)# match dscp ipv4 14
RP/0/0/CPU0:router(config-cmap)# exit

RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class dscp14
RP/0/0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit

RP/0/0/CPU0:router(config)# interface pos 0/1/0/0
RP/0/0/CPU0:router(config-if)# service-policy output policy1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
set dscp, on page 111	Marks a packet by setting the IP differentiated services code point (DSCP) in the type of service (ToS) byte.
match atm, on page 54	Enables packet matching on the basis of the ATM operations, administration, and maintenance (OAM) or cell loss priority (CLP).
match cos, on page 56	Identifies specified class of service (CoS) values as a match criteria in a class map.
match precedence, on page 69	Identifies IP precedence values as match criteria.

Command	Description
match qos-group, on page 72	Identifies specific quality-of-service (QoS) group values as match criteria in a class map.
match source-address	Identifies a specific source MAC address as match criterion in a class map.
match vlan, on page 74	Identifies selected VLAN IDs as the match criteria for a class map.
set dscp, on page 111	Marks a packet by setting the IP differentiated services code point (DSCP) in the type of service (ToS) byte.

match fr-de

To match packets on the basis of the Frame Relay discard eligibility (DE) bit setting, use the **match fr-de** command in class-map configuration mode. To remove the match criterion, use the **no** form of this command.

match fr-de *fr-de-bit-value*

no match fr-de *fr-de-bit-value*

Syntax Description

not	(Optional) Negates the specified match result.
fr-de-bit-value	Specifies the Frame Relay DE bit. Value can be 0 or 1.

Command Default

Packets are not matched on the basis of the Frame Relay DE bit setting.

Command Modes

Class map configuration

Command History

Release	Modification
Release 3.8.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

This match criterion can be used under a subinterface (L2 PVC) using the **service-policy** command, and it is supported in the ingress direction only. This match criterion can also be used in hierarchical policy maps.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to create a class called match-fr-de and match packets on the basis of the Frame Relay DE bit setting. Packets match Frame Relay DE bit 1.

```
RP/0/0/CPU0:router(config)# class-map match-fr-d
RP/0/0/CPU0:router(config-cmap)# match fr-de 1
RP/0/0/CPU0:routerrouter(config-cmap)# end
```

Related Commands

Command	Description
set fr-de, on page 113	Changes the discard eligible (DE) bit setting in the address field of a Frame Relay frame to 1 for all traffic leaving an interface.

match frame-relay dlci

To specify a Frame Relay packet data-link connection identifier (DLCI) number or number range as a match criterion in a class map, use the **match frame-relay dlci** command in class map configuration mode. To remove a previously specified DLCI number as a match criterion, use the **no** form of this command.

match frame-relay dlci [*Dlci*| *StartDlci-EndDlci*]

no match frame-relay dlci [*Dlci*| *StartDlci-EndDlci*]

Syntax Description

Dlci	A DLCI number associated with the packet. Range is from 16 to 1007.
StartDlci-EndDlci	A DLCI number range from 16 to 1007. Numbers are separated by a hyphen.

Command Default   No DLCI number is specified.

Command Modes   Class map configuration

Command History

Release	Modification
Release 3.4.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The match criterion for the **match frame-relay dlci** command can be used only on hierarchical policy maps.

Task ID

Task ID	Operations
qos	read, write

Examples   The following example shows how to create the fr-dlci class map, and specify the Frame Relay DLCI number range 100-200 as a match criterion. Packets with DLCIs matching this criterion are placed in fr-dlci. In this example, class map fr-dlci evaluates all packets entering Packet-over-SONET/SDH (POS) interface 0/1/0/0.1

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for DLCIs in the range from 100 through 200. If the incoming packet has been marked with the DLCI in the range from 100 through 200, the packet is queued to the class queue with the bandwidth setting of 300 kbps.

```
RP/0/0/CPU0:router(config)# class-map fr-dlci
RP/0/0/CPU0:router(config-cmap)# match frame-relay dlci 100-200
RP/0/0/CPU0:router(config-cmap)# end
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class fr-dlci
RP/0/0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit

RP/0/0/CPU0:router(config)# interface pos 0/1/0/0.1
RP/0/0/CPU0:router(config)# service-policy output policy1

RP/0/0/CPU0:router(config)# interface pos 0/1/0/0.1 point-to-point pvc 16
RP/0/0/CPU0:router(config-subif)# pvc 16
RP/0/0/CPU0:router(config-fr-vc)# service-policy output policy1
```

Related Commands

match mpls experimental topmost

To identify specific three-bit experimental (EXP) field values in the topmost Multiprotocol Label Switching (MPLS) label as match criteria for a class map, use the **match mpls experimental topmost** command in class map configuration mode. To remove experimental field values from the class map match criteria, use the **no** form of the command.

match mpls experimental topmost *exp-value* [*exp-value1 ...exp-value7*]

no match mpls experimental topmost *exp-value* [*exp-value1 ...exp-value7*]

Syntax Description

exp-value	Experimental value that specifies the exact value from 0 to 7. Up to eight experimental values can be specified to match MPLS headers.

Command Default   No default behavior or values

Command Modes   Class map configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.3.0	The **not** keyword was added.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **match mpls experimental topmost** command is used by the class map to identify MPLS experimental values matching on a packet.

To use the **match mpls experimental topmost** command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish. If you specify more than one **match mpls experimental topmost** command in a class map, the new values are added to the existing match statement.

This command examines the three experimental bits contained in the topmost label of an MPLS packet. Up to eight experimental values can be matched in one match statement. For example, **match mpls experimental topmost 2 4 5 7** returns matches for experimental values of 2, 4, 5, and 7. Only one of the four values is needed to yield a match (OR operation).

The experimental values are used as a matching criterion only. The value has no mathematical significance. For instance, the experimental value 2 is not greater than 1. The value indicates that a packet marked with the experimental value of 2 should be treated differently than a packet marked with the EXP value of 1. The

treatment of these different packets is defined by the user through the setting of QoS policies in policy map class configuration mode.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to configure the service policy called policy1 and attach service policy policy1 to an interface. In this example, class map mplsmap1 evaluates all packets entering GigabitEthernet interface 0/1/0/9 for an MPLS experimental value of 1. If the incoming packet has been marked with the MPLS experimental value of 1, the packet is queued to the class queue with the bandwidth setting of 300 kbps.

```
RP/0/0/CPU0:router(config)# class-map mplsmap1
RP/0/0/CPU0:router(config-cmap)# match mpls experimental topmost 1
RP/0/0/CPU0:router(config-cmap)# exit
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class mplsmap1
RP/0/0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit
RP/0/0/CPU0:router(config)# interface gigabitethernet 0/1/0/9
RP/0/0/CPU0:router(config-if)# service-policy input output policy1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
match dscp, on page 59	Identifies specific IP differentiated services code point (DSCP) values as match criteria for a class map.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
set mpls experimental, on page 115	
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

match precedence

To identify IP precedence values as match criteria, use the **match precedence** command in class map configuration mode. To remove precedence values from a class map, use the **no** form of this command.

match precedence [**ipv4**| **ipv6**] *precedence-value* [*precedence-value1 ... precedence-value7*]

no match precedence [**ipv4**| **ipv6**] *precedence-value* [*precedence-value1 ... precedence-value7*]

Syntax Description

ipv4	(Optional) Specifies the IPv4 precedence value.
ipv6	(Optional) Specifies the IPv6 precedence value.
precedence-value	An IP precedence value identifier that specifies the exact value. Range is from 0 to 7. Reserved keywords can be specified instead of numeric values. Table 3: IP Precedence Values and Names, on page 70 describes the reserved keywords.
	Up to eight precedence values can be matched in one match statement.

Command Default   Matching on both IP Version 4 (IPv4) and IPv6 packets is the default.

Command Modes   Class map configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **match precedence** command specifies a precedence value that is used as the match criteria against which packets are checked to determine if they belong to the class specified by the class map.

To use the **match precedence** command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish. If you specify more than one **match precedence** command in a class map, only the last command entered applies.

The **match precedence** command examines the higher-order three bits in the type of service (ToS) byte of the IP header. Up to eight precedence values can be matched in one match statement. For example, **match precedence ipv4 0 1 2 3 4 5 6 7** returns matches for IP precedence values of 0, 1, 2, 3, 4, 5, 6, and 7. Only one of the eight values is needed to yield a match (OR operation).

The precedence values are used as a matching criterion only. The value has no mathematical significance. For instance, the precedence value 2 is not greater than 1. The value simply indicates that a packet marked

with the precedence value of 2 is different than a packet marked with the precedence value of 1. The treatment of these different packets is defined by the user through the setting of QoS policies in policy map class configuration mode.

The following table lists the IP precedence value number and associated name in descending order of importance.

Table 3: IP Precedence Values and Names

Value	Name
0	routine
1	priority
2	immediate
3	flash
4	flash-override
5	critical
6	internet
7	network
ipv4	ipv4 precedence
ipv6	ipv6 precedence

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to configure the service policy called policy1 and attach service policy policy1 to an interface. In this example, class map ipprec5 evaluates all packets entering GigabitEthernet interface 0/1/0/9 for a precedence value of 5. If the incoming packet has been marked with the precedence value of 5, the packet is queued to the class queue with the bandwidth setting 300 kbps.

```
RP/0/0/CPU0:router# configure
RP/0/0/CPU0:router(config)# class-map ipprec5
RP/0/0/CPU0:router(config-cmap)# match precedence ipv4 5
RP/0/0/CPU0:router(config-cmap)# exit
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class ipprec5
RP/0/0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit
RP/0/0/CPU0:router(config)# interface gigabitethernet 0/1/0/9
```

```
RP/0/0/CPU0:router(config-if)# service-policy output policy1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
set precedence, on page 117	Sets the precedence value in the IP header.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

match qos-group

To identify specific quality-of-service (QoS) group values as match criteria in a class map, use the **match qos-group** command in class map configuration mode. To remove a specific QoS group value from the matching criteria for a class map, use the **no** form of this command.

match qos-group [*qos-group-value 1 ... qos-group-value7*]

no match qos-group

Syntax Description

qos-group-value	QoS group value identifier that specifies the exact value from 0 to 31 or a range of values from 0 to 31. Up to eight values can be entered in one match statement.

Command Default   No match criteria are specified.

Command Modes   Class map configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	The *qos-group-value* argument was deleted from the **no match** command.
Release 3.7.0	Up to eight values or ranges on a single match statement, and up to 32 values or ranges specified on up to eight match statements for *qos-group-value*, were supported.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **match qos-group** command sets the match criteria for examining QoS groups marked on the packet. Up to eight QoS group values can be matched in one match statement. For example, **match qos-group 4 9 11 15 16 21 30 31** returns matches for QoS group values of 4, 9, 11, 15, 16, 21, 30, and 31. Only one of the eight values is needed to yield a match (OR operation).

The **match qos-group** command is used on the ingress match to support QoS Policy Propagation using BGP (QPPB). To use this command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish. If you specify more than one **match qos-group** command in a class map, the subsequent match statements are added to the first **match qos-group** command.

The QoS group value is used as a matching criterion only. The value has no mathematical significance. For instance, the QoS group value 2 is not greater than 1. The value simply indicates that a packet marked with

the QoS group value of 2 should be treated differently than a packet marked with a QoS group value of 1. The treatment of these different packets is defined using the **service-policy** command in policy map class configuration mode.

The QoS group setting is limited in scope to the local router. Typically, the QoS group is set on the local router and is used in conjunction with WRED or MDRR to give differing levels of service based on the group identifier.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows a service policy called policy1 attached to an interface. In this example, class map qosgroup5 will evaluate all packets leaving GigabitEthernet 0/1/0/9 for a QoS group value of 5. If the packet has been marked with the QoS group value of 5, the packet is queued to the class queue with the bandwidth setting 300 kbps.

```
RP/0/0/CPU0:router(config)# class-map qosgroup5
RP/0/0/CPU0:router(config-cmap)# match qos-group 5
RP/0/0/CPU0:router(config-cmap)# exit
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class qosgroup5
RP/0/0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit
RP/0/0/CPU0:router(config)# interface gigabitethernet 0/1/0/9
RP/0/0/CPU0:router(config-if)# service-policy output policy1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
set discard-class, on page 109	Sets the discard class and Quality of Service (QoS) group identifiers on IP Version 4 (IPv4) or Multiprotocol Label Switching (MPLS) packets.
set qos-group, on page 119	Sets the quality of service (QoS) group identifiers on packets.

match vlan

To identify selected VLAN IDs as the match criteria for a class map, use the **match vlan** command in class map configuration mode. To remove VLAN ID match criteria from a class map, use the **no** form of this command.

match vlan *vlanid* [*vlanid1 ... vlanid7*]

no match vlan *vlanid* [*vlanid1 ... vlanid7*]

Syntax Description

vlanid	VLAN identifier that specifies the exact value from 1 to 4094 or a range of values from 1 to 4094. Up to eight values can be specified in a match statement.

Command Default No match criteria are specified.

Command Modes Class map configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	Changed the range value from 0 to 8096. to 1 to 4094.

Usage Guidelines To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **match vlan** command specifies a VLAN ID that is used as the match criteria against which packets are checked to determine if they belong to the class specified by the class map.

To use the **match vlan** command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish. If you specify more than one **match vlan** command in a class map, up to eight values of the subsequent match statements are added to the first **match vlan** command, exceeding which, the statement is rejected.

Task ID

Task ID	Operations
qos	read, write

Examples　　The following example shows how to configure the service policy called policy1 and attach service policy policy1 to an interface. In this example, class map vlan1 evaluates all packets entering Gigabit Ethernet interface 0/1/0/0 for VLAN IDs of 1234, 1698, and all the VLAN IDs in the range 3000 to 4000. If the incoming packet has been marked with any of these VLAN IDs, the packet is queued to the class queue with the bandwidth setting of 300 kbps.

```
RP/0/0/CPU0:router(config)# class-map vlan1
RP/0/0/CPU0:router(config-cmap)# match vlan 1234 1698 3000-4000
RP/0/0/CPU0:router(config-cmap)# exit
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class vlan1
RP/0/0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit
RP/0/0/CPU0:router(config)# interface gigabitethernet 0/1/0/0
RP/0/0/CPU0:router(config-if)# service-policy output policy1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.

police rate

To configure traffic policing and enter policy map police configuration mode, use the **police rate** command in policy map class configuration mode. To remove traffic policing from the configuration, use the **no** form of this command.

police rate {*value* [*units*]| **percent** *percentage*} [**burst** *burst-size* [*burst-units*]] [**peak-rate** {*value* [*units*]| **percent** *percentage*}] [**peak-burst** *peak-burst* [*burst-units*]]

no police rate {*value* [*units*]| **percent** *percentage*} [**burst** *burst-size* [*burst-units*]] [**peak-rate** {*value* [*units*]| **percent** *percentage*}] [**peak-burst** *peak-burst* [*burst-units*]]

Syntax Description

value	Committed information rate (CIR). Range is from 1 to 4294967295. For 8 kbps granularity the maximum value is 2.1 gbps, for 16 kbps granularity the maximum value is 4.2gbps, and for 32kbps granularity the maximum value is 8.4gbps.
units	(Optional) Unit of measurement for the CIR. Values can be: • **bps** —bits per second (default) • **gbps** —gigabits per second • **kbps** —kilobits per second • **mbps** —megabits per second
percent *percentage*	Specifies the police rate as a percentage of the CIR. Range is from 1 to 100. See the Usage Guidelines for information on how to use this keyword.
burst *burst-size*	(Optional) Specifies the burst size (in the specified *burst-units*). Range is from 1 to 4294967295.
burst-units	(Optional) Unit of measurement for the burst values. Values can be: • **bytes** —bytes (default) • **gbytes** —gigabytes • **kbytes** —kilobytes • **mbytes** —megabytes • **ms** —milliseconds • **us** —microseconds
peak-rate *value*	(Optional) Specifies the Peak Information Rate (PIR) in the specified *units* . Range is from 1 to 4294967295.
peak-burst *peak-burst*	(Optional) Specifies the peak burst size in the specified *burst-units* . Range is from 1 to 4294967295.

Command Default   No restrictions on the flow of data are applied to any interface.

Command Modes   Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced without the **pir** and **violate-action** keywords.
Release 3.3.0	The command name was changed from **police cir** to **police rate** .
	The keywords **bc** , **be** , and **pir** were changed to **burst** , **peak-burst** , and **peak-rate** , respectively.
	The *units* argument was added.
	The default units for the rate, peak rate, and burst rate changed from kbps to bps.
	The keywords **mpls experimental imposition** were added to the *action* argument.
Release 3.4.0	This command now enters policy-map police configuration mode.
	The **conform-action** , **exceed-action** and **violate-action** keywords changed into commands within the policy-map police configuration mode.
	The **cos** and **transmit** keywords were added to the *action* argument. The **atm-clp** keyword was added.
Release 3.6.0	The **packets** burst value option was removed.
Release 3.7.0	Hierarchical ingress policing was supported.
Release 3.9.0	The granularity of the police rate specified changed to 8 kbps.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The traffic policing feature works with a single-token bucket algorithm.

The **police rate** can set the DSCP, the precedence, or the discard class for IP packets, and experimental and discard-class values for MPLS packets.

For bundled interfaces, traffic policing can be configured only as a percentage.

Policing can be applied in both ingress and egress directions.

The parameters set by the action keywords are rounded by the hardware. To check the actual values programmed in the hardware use the **show qos interface** command.

For **police rate** commands, interpret the **percent** keyword in this way:

- For a one-level policy, the **percent** keyword specifies the CIR as a percentage of the link rate. For example, the command **police rate percent 35** configures the CIR as 35% of the link rate.

- For a two-level policy, in the parent policy, the **percent** keyword specifies the parent CIR as a percentage of the link rate. In the child policy, the percent keyword specifies the child CIR as a percentage of the maximum policing or shaping rate of the parent. If traffic policing or shaping is not configured on the parent, the parent inherits the interface policing or shaping rate.

Note Configured values take into account the Layer 2 encapsulation applied to traffic. This applies to both ingress and egress policing. For POS/SDH transmission, the encapsulation is considered to be 4 bytes. For Ethernet, the encapsulation is 14 bytes; whereas for 802.1Q, the encapsulation is 18 bytes.

If the burst value is not specifically configured, it is automatically set to equate to 250 msec-worth of the CIR value. For example, if a CIR value of 1000000 kbps is entered, the burst value is calculated to be 32000000 bytes. However, the maximum burst value supported is 16777215 bytes.

Hierarchical policing is also supported. In such a configuration, both parent and child policies have class-maps containing policing statements, as in this example:

```
!
policy-map child
 class gold
  police rate percent 50
  conform-action set precedence immediate
  exceed-action drop
 !
!
policy-map parent
 class match_all
  police rate 10000 kbps burst 15000
  exceed-action drop
  service-policy child
 !
```

The router supports hierarchical ingress policing, which consists of a two-level hierarchical policy-map. The two levels are:

- Parent level: Consists of a class-default or match-vlan class (in nCmD model) only and has policing with only transmit/drop actions.

- Child level: Consists of a flat policy that can be configured with any action other than the queuing action. This level does not contain configurations that require a continuous bit support.

You can police the ingress interface while applying different classification submodels on the ingress interfaces. The order of the actions within the hierarchical policy-map is from child to parent as specified by the Modular Quality of Service command-line interface (MQC). This is with the exception of the queuing action (shape), which is executed after any police/set actions. If a police action is configured in a child policy, the child police action is executed before the parent police action.

The police action is invoked with only transmit/drop actions under the conform-action and exceed-action options specified for class-default traffic.

This example explains a hierarchical policer configuration:

```
!
policy-map parent
 class class-default

service-policy child
```

```
police rate percent 50
conform-action transmit
exceed-action drop

!
```

Task ID

Task ID	Operations
qos	read, write

Examples

In this example for MPLS, traffic policing is configured with the average rate at 250 kbps, and the normal burst size at 50 bytes for all packets leaving GigabitEthernet interface 0/1/0/9:

```
RP/0/0/CPU0:router(config)# class-map class1
RP/0/0/CPU0:router(config-cmap)# match mpls experimental topmost 0
RP/0/0/CPU0:router(config-cmap)# exit

RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# police rate 250 kbps burst 50
RP/0/0/CPU0:router(config-pmap-c-police)#conform-action set mpls experimental topmost 4
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit

RP/0/0/CPU0:router(config)# interface gigabitethernet 0/1/0/9
RP/0/0/CPU0:router(config-if) service-policy input policy1
```

Related Commands

Command	Description
child-conform-aware, on page 11	Prevents the parent policer from dropping any ingress traffic that conforms to the maximum rate specified in the child policer.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

policy-map

To create or modify a policy map that can be attached to one or more interfaces to specify a service policy, use the **policy-map** command in global configuration mode. To delete a policy map, use the **no** form of this command.

policy-map [**type qos**] *policy-name*

no policy-map [**type qos**] *policy-name*

Syntax Description

type qos	(Optional) Specifies a quality-of-service (QoS) policy map.
policy-name	Name of the policy map.

Command Default

A policy map does not exist until one is configured. Because a policy map is applied to an interface, no restrictions on the flow of data are applied to any interface until a policy map is created.

Type is QoS when not specified.

Command Modes

Global configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.3.0	Maximum number of classes permitted per policy map was increased to 32.
Release 3.6.0	The **type qos** keywords were added.
	Maximum number of classes permitted per policy map was increased to 512.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Use the **policy-map** command to specify the name of the policy map to be created, added to, or modified before you can configure policies for classes whose match criteria are defined in a class map. Entering the **policy-map** command enables policy map configuration mode in which you can configure or modify the class policies for that policy map.

You can configure class policies in a policy map only if the classes have match criteria defined for them. Use the **class-map** and **match** commands to configure the match criteria for a class. Because you can configure

a maximum of 512 classes in one policy map, no policy map can contain more than 512 class policies. The maximum number of 512 classes per policy includes the implicit default class and its child policies.

A single policy map can be attached to multiple interfaces concurrently.

Task ID

Task ID	Operations
qos	read, write

Examples

The following examples show how to create a policy map called policy1 and configures two class policies included in that policy map. The policy map is defined to contain policy specification for class1 and the default class (called class-default) to which packets that do not satisfy configured match criteria are directed. Class1 specifies policy for traffic that matches access control list 136.

```
RP/0/0/CPU0:router(config)# class-map class1
RP/0/0/CPU0:router(config-cmap)# match access-group ipv4 136

RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# police cir 250
RP/0/0/CPU0:router(config-pmap-c)# set precedence 3
RP/0/0/CPU0:router(config-pmap-c)# exit

RP/0/0/CPU0:router(config-pmap)# class class-default
RP/0/0/CPU0:router(config-pmap-c)# queue-limit 1000000 bytes
```

Related Commands

Command	Description
class (policy-map), on page 13	Specifies the name of the class whose policy you want to create or change.
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.

priority (QoS)

To assign a 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 [**level** *priority-level*]

no priority

Syntax Description

level *priority-level*	(Optional) Sets the class priority level value. Value can be 1. Default level is 1. Level 1 traffic has higher priority.

Command Default

If a priority action is not configured in a class, traffic in that class is not serviced with strict priority.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.9.0	The **level** keyword was added.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **priority** command configures low-latency queueing (LLQ), providing strict priority queueing (PQ). Strict PQ allows delay-sensitive data such as voice to be dequeued and sent before packets in other queues are dequeued. When a class is marked as high priority using the **priority** command, we recommend that you configure a policer to limit the priority traffic. This policer ensures that the priority traffic does not starve all other traffic on the line card, which protects low-priority traffic from starvation. Use the **police rate** to explicitly configure the policer.

The **priority** command sets up classes based on a variety of criteria (not just User Datagram Protocol [UDP] ports) and assigns a priority to them.

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, but only when the priority class has the policer limit configured .

There cannot be a WRED action along with a priority configuration in the same class. Only one class under a policy map can have a priority action configured.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to configure priority queuing for the policy map named policy1:

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1

RP/0/0/CPU0:router(config-pmap-c)# priority level 1
```

Related Commands

Command	Description
bandwidth (QoS), on page 4	Specifies the minimum bandwidth allocated to a class belonging to a policy map.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

queue-limit

To specify or modify the maximum number of packets the queue can hold for a class policy configured in a policy map, use the **queue-limit** command in policy map class configuration mode. To remove the queue packet limit from a class, use the **no** form of this command.

queue-limit {*value* [*unit*]| **atm-clp** *atm-value atm-unit tail-value* [*tail-unit*]}

no queue-limit

Syntax Description

value	Maximum threshold for tail drop in bytes. Range is from 1 to 4294967295.
unit	(Optional) Units for the queue limit value. Values can be: • **cells** —cells (ATM subinterfaces only) • **ms** —milliseconds • **packets** —packets (default) • **us** —microseconds **Note** When the specified *units* is packets, packets are assumed to be 256 bytes in size.
atm-clp	Specifies an ATM cell loss priority (CLP)-based queue limit.
atm-value	Maximum threshold for the ATM CLP value. Range is from 1 to 4294967295.
atm-unit	ATM CLP unit. Values can be: • **cells** —cells • **ms** —milliseconds • **us** —microseconds
tail-value	Maximum threshold for tail drop. Range is from 1 to 4294967295.
tail-unit	(Optional) Tail drop unit. Values can be: • **cells** —cells • **ms** —milliseconds • **packets** —packets (default) • **us** —microseconds

Command Default   100 milliseconds: maximum threshold for tail drop

10 milliseconds: maximum threshold for high-priority queues

Maximum threshold units are in packets.

Note The default queue limit is 200 ms. Default queue limits are calculated considering 200 ms of data and assuming an average packet size of 256 bytes.

Command Modes Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.3.0	Command name changed from **queue-limit** **bytes** to **queue-limit** .
	Command order modified to place value before units.
	The *units* argument was added.
	Default units was changed from bytes to packets.
Release 3.6.0	The *value* range of 1 to 1000000000 has changed to 1 to 4294967295.
	The **cells** *unit* keyword and argument were added.
	The default threshold for tail drop changed from 200 milliseconds to 100 milliseconds.
Release 3.8.0	The **atm-clp** keyword was added for supporting the virtual circuit (VC) queuing on the segmentation and reassembly (SAR) in the egress direction.
	Two discard threshold settings, CLP1 and CLP0+1, were supported using an extension to the queue-limit modular QoS CLI (MQC) configuration.

Usage Guidelines To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Packets satisfying the match criteria for a class accumulate in the queue reserved for the class until they are serviced by the scheduling mechanism. The **queue-limit** command defines the maximum threshold for a class. When that threshold is reached, enqueued packets to the class queue result in tail drop (packet drop). Tail drop is a congestion avoidance technique that drops packets when an output queue is full, until congestion is eliminated.

Use the **show qos interface** command to display the queue limit and other policer values.

Queue Limit Default Values

The following default values are used when **queue-limit** is not configured in the class:

• If QoS is not configured:

Cisco IOS XR Modular Quality of Service Command Reference for the Cisco XR 12000 Series Router, Release 4.1

- The queue limit is 16384 packets for the class default and priority queues when no actions are configured.

- If QoS is configured and Weighted Random Early Detection (WRED) is not configured:

  - Queue limit is 200 ms at the guaranteed service rate of the queue for non-priority queues.

  - When priority is configured with policing with an exceed action of DROP: queue limit = (rate_kpbs) * 200 / 8, where rate_kbps = (Police Be + Police Bc) * 8 / 1000, and Bc is conformed police rate, Be is exceeded police rate

  - When priority configured with policing with an exceed action other than DROP: queue limit = (rate_kpbs) * 200 / 8, where rate_kbps = police rate.

  - When priority configured without policing: queue limit = (rate_kpbs) * 200 / 8, where rate_kbps = interface rate / 2 for flat policies, and rate_kbps = parent shape rate / 2 for hierarchicalpolicies.

- If QoS is configured and WRED is configured:

  - Queue limit is two times the WRED maximum threshold. The maximum threshold is an explicitly configured value.

  - If more than one WRED profile is configured in the class, the maximum threshold is the maximum for all profiles.

  - When the **queue-limit** is configured in time units, the guaranteed service rate is used to compute the queue limit.

When the queue limit is configured in time units, the guaranteed service rate of the class is used to calculate the queue limit in bytes. For example: time_unit in ms * *guaranteed_service_rate in kbps / 8* is equivalent to queue-limit in bytes.

The following restrictions apply to queue limits:

- The maximum queue limit is 262143 bytes.

- Only time-based units are allowed on bundle targets.

Guaranteed Service Rate

The guaranteed service rate is defined as the service rate of the queue when all queues are backlogged and derived as:

minimum_bandwidth + (bandwidth_remaining_percent * unallocated_bandwidth)

The following example shows the guaranteed service rate calculation:

```
policy-map sample_policy
  class c1
    bandwidth percent 30
    bandwidth remaining percent 40
  class c2
    bandwidth percent 20
  class class-default
```

guaranteed service rate of c1 = 30 percent LR + (40 percent * 50 percent * LR)

guaranteed service rate of c2 = 20 percent LR + (30 percent * 50 percent * LR)

guaranteed service rate of class-default = 30 percent * 50 percent * LR

- Where LR is line rate of the target on which service policy "sample_policy" is attached.

- 50 percent is unallocated bandwidth.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to set the queue limit for a class to 1000000 packets for policy map policy1:

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# queue-limit 1000000
```

Related Commands

Command	Description
class (policy-map), on page 13	Specifies the name of the class whose policy you want to create or change.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show qos interface, on page 141	Displays QoS information for a specific interface.

random-detect

To enable random early detection (RED), use the **random-detect** command in policy map class configuration mode. To remove RED, use the **no** form of this command.

random-detect {**discard-class** *value*| **dscp** *value*| **exp** *value*| **precedence** *value*| *min-threshold* [*units*] *max-threshold* [*units*]}

no random-detect [**discard-class** *value*| **dscp** *value*| **exp** *value*| **precedence** *value*| *min-threshold* [*units*] *max-threshold* [*units*]]

Syntax Description

discard-class *value*	Discard-class based WRED.
dscp *value*	DSCP-based WRED.
exp *value*	MPLS Experimental-based WRED.
precedence *value*	Precedence-based WRED. Values can be: • 0 or routine • 1 or priority • 2 or immediate • 3 or flash • 4 or flash-override • 5 or critical • 6 or internet • 7 or network
min-threshold	Minimum threshold in number of packets. The value range of this argument is from 0 to 1073741823 in bytes.
max-threshold	Maximum threshold the units specified. The value range of this argument is from the value of the *min-threshold* argument or 23, whichever is larger, to 1073741823. When the average queue length exceeds the maximum threshold, RED drops all packets with the specified discard class value.
units	(Optional) Units for the threshold values. Values can be: • **cells**—cells (ATM subinterfaces only) • **ms** —milliseconds • **packets** —packets (default) • **us** —microseconds

Command Default   Default unit for *max-threshold* and *min-threshold* is **packets** .

Command Modes   Policy map class configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.6.0	The **cells** *unit* was added.
	The **default** keyword was removed.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The RED congestion avoidance technique takes advantage of the congestion control mechanism of TCP. By randomly dropping packets before periods of high congestion, RED tells the packet source to decrease its transmission rate. Assuming the packet source is using TCP, it decreases its transmission rate until all the packets reach their destination, indicating that the congestion is cleared. You can use RED as a way to cause TCP to slow transmission of packets. TCP not only pauses, but it also restarts quickly and adapts its transmission rate to the rate that the network can support.

RED distributes losses in time and maintains normally low queue depth while absorbing traffic bursts. When enabled on an interface, RED begins dropping packets when congestion occurs at a rate you select during configuration.

When time units are used, the guaranteed service rate is used to compute thresholds.

The default values for RED are calculated as follows:

default min_threshold = 0.03 * B

default max_threshold = 0.1 * B

where B is the bandwidth for the queue. When all the queues are congested, the bandwidth for the queue is equal to the guaranteed service rate of the queue.

The mark probability is always set to 1.

When the value of the *units* argument is packets, packets are assumed to be 256 bytes in size.

For the **random-detect** command to take effect, you must configure the **shape average** , **bandwidth (QoS)** , or **bandwidth remaining** commands in the user-defined policy map class. This dependency is not applicable to the class default for the policy map class.

Weighted Random Early Detection

The following restrictions apply to Weighted Random Early Detection (WRED):

- For thresholds in time units, the guaranteed service rate is used to calculate the thresholds in bytes.

- Default RED minimum threshold—30 ms at the guaranteed service rate.

• Default RED maximum threshold—100 ms as the guaranteed service rate.

For bundles, queue limit and WRED thresholds are supported in time units only.

> **Note** RED is enabled when you configure any of the supported **random-detect** commands.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to enable RED using a minimum threshold value of 1000000 and a maximum threshold value of 2000000:

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# random-detect 1000000 2000000
```

Related Commands

Command	Description
random-detect precedence, on page 98	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

random-detect discard-class

To configure the Weighted Random Early Detection (WRED) thresholds for packets with a specific discard class value, use the **random-detect discard-class** command in policy map class configuration mode. To return the thresholds to the default for the discard class, use the **no** form of this command.

random-detect discard-class *discard-value min-threshold* [*units*] *max-threshold* [*units*]

no random-detect discard-class *discard-value min-threshold* [*units*] *max-threshold* [*units*]

Syntax Description

discard-value	Discard class value. Valid values are from 0 to 7. Up to eight values can be entered separated by commas.
min-threshold	Minimum threshold in number of packets. The value range of this argument is from 0 to 1073741823 in bytes.
max-threshold	Maximum threshold in number of packets. The value range of this argument is from the value of the *min-threshold* argument to 1073741823. When the average queue length exceeds the maximum threshold, WRED drops all packets with the specified discard class value.
units	(Optional) Units for the threshold values. Values can be: • **cells**—cells • **ms**—milliseconds • **packets**—packets (default) • **us**—microseconds

Command Default

Default unit for *max-threshold* and *min-threshold* is **packets** .

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	The *units* argument was added to allow specifying the units of the thresholds. The *discard-value min-threshold max-threshold* arguments were deleted form the **no random-detect discard-class** command.

Release	Modification
Release 3.6.0	The *discard-value* argument can accept up to eight values separated by commas.
	The **cells** *unit* was added.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

For the **random-detect discard-class** command to take effect, you must configure the **shape average**, **bandwidth (QoS)**, or **bandwidth remaining** commands in the user-defined policy map class. This dependency is not applicable to the class default for the policy map class.

WRED is a congestion avoidance mechanism that slows traffic by randomly dropping packets when congestion exists. WRED is most useful with protocols like TCP that respond to dropped packets by decreasing the transmission rate.

When you configure the **random-detect discard-class** command on an interface, packets are given preferential treatment based on the discard class of the packet.

When the value of the *units* argument is packets, packets are assumed to be 256 bytes in size.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to set the discard class values for discard class 3 to a minimum byte threshold of 1000000 and a maximum byte threshold of 2000000:

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# random-detect discard-class 3 1000000 2000000
```

Related Commands

Command	Description
class (policy-map), on page 13	Specifies the name of the class whose policy you want to create or change.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
random-detect precedence, on page 98	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

random-detect dscp

To configure the Weighted Random Early Detection (WRED) thresholds for packets with a specific differentiated services code point (DSCP) value, use the **random-detect dscp** command in policy map class configuration mode. To return the thresholds to the default for the DSCP value, use the **no** form of this command.

random-detect dscp *dscp-value min-threshold* [*units*] *max-threshold* [*units*]

no random-detect dscp *dscp-value min-threshold* [*units*] *max-threshold* [*units*]

Syntax Description

dscp-value	DSCP value. Up to eight *dscp-values* (any combination of numbers, ranges, and reserved keywords) can be used separated by commas. The following arguments are supported: • Number from 0 to 63 that sets the DSCP value. • Range of DSCP values. Range is from 0 to 63. • Reserved keywords can be specified instead of numeric values. Table 2: IP DSCP Reserved Keywords, on page 60 describes the reserved keywords.
min-threshold	Minimum threshold in number of packets. The value range of this argument is from 0 to 1073741823. When the average queue length reaches the minimum threshold, WRED randomly drops some packets with the specified DSCP value.
max-threshold	Maximum threshold in number of packets. The value range of this argument is from the value of the *min-threshold* argument to 1073741823. When the average queue length exceeds the maximum threshold, WRED drops all packets with the specified DSCP value.
units	(Optional) Units for the threshold values. Values can be: • **cells**—cells • **ms**—milliseconds • **packets**—packets (default) • **us**—microseconds

Command Default

Match packets with default DSCP (000000).

Default unit for *max-threshold* and *min-threshold* is **packets**.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.4.0	The *units* argument was added to allow specifying the units of the thresholds.
	The *dscp-value min-threshold max-threshold* arguments were deleted from the **no random-detect dscp** command.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

WRED is a congestion avoidance mechanism that slows traffic by randomly dropping packets when congestion exists. WRED is most useful with protocols like TCP that respond to dropped packets by decreasing the transmission rate.

For the **random-detect dscp** command to take effect, you must configure the **shape average**, **bandwidth (QoS)**, or **bandwidth remaining** commands in the user-defined policy map class. This dependency is not applicable to the class default for the policy map class.

Reserved keywords can be specified instead of numeric values. See Table 2: IP DSCP Reserved Keywords, on page 60 for the list of keywords.

When the value of the *units* argument is packets, packets are assumed to be 256 bytes in size.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows that for packets with DSCP AF11, the WRED minimum threshold is 1,000,000 bytes and the maximum threshold is 2,000,000 bytes:

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# random-detect dscp AF11 1000000 2000000
```

Related Commands

Command	Description
class (policy-map), on page 13	Specifies the name of the class whose policy you want to create or change.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
random-detect precedence, on page 98	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence.

Command	Description
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

random-detect exp

To configure the Weighted Random Early Detection (WRED) thresholds for packets marked with a specific MPLS experimental (EXP) bit value, use the **random-detect exp** command in policy map class configuration mode. To return the value to the default, use the **no** form of this command.

random-detect exp *exp-value min-threshold* [*units*] *max-threshold* [*units*]

no random-detect exp *exp-value min-threshold* [*units*] *max-threshold* [*units*]

Syntax Description

exp-value	MPLS experimental value. Valid values are from 0 to 7. Up to eight values can be entered separated by commas.
min-threshold	Minimum threshold in number of packets. The value range of this argument is from 0 to 1073741823 in bytes.
max-threshold	Maximum threshold in units specified. The value range of this argument is from the value of the *min-threshold* argument to 1073741823. When the average queue length exceeds the maximum threshold, WRED drops all packets with the specified experimental value.
units	(Optional) Units for the threshold values. Values can be: • **cells**—cells • **ms**—milliseconds • **packets**—packets (default) • **us**—microseconds

Command Default Default unit for *max-threshold* and *min-threshold* is **packets** .

Command Modes Policy map class configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	The *exp-value min-threshold max-threshold* arguments were deleted form the **no random-detect exp** command.
Release 3.6.0	The *exp-value* argument can accept up to eight values separated by commas.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

For the **random-detect exp** command to take effect, you must configure the **shape average** , **bandwidth (QoS)** , or **bandwidth remaining** commands in the user-defined policy map class. This dependency is not applicable to the class default for the policy map class.

WRED is a congestion avoidance mechanism that slows traffic by randomly dropping packets when congestion exists. WRED is most useful with protocols like TCP that respond to dropped packets by decreasing the transmission rate.

When the value of the *units* argument is packets, packets are assumed to be 256 bytes in size.

Task ID

Task ID	Operations
qos	read, write

Examples   The following example shows that for Multiprotocol Label Switching (MPLS) packets with an EXP field value of 4, the WRED minimum threshold is 1,000,000 bytes and the maximum threshold is 2,000,000 bytes:

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# random-detect exp 4 1000000 20000
```

Related Commands

Command	Description
class (policy-map), on page 13	Specifies the name of the class whose policy you want to create or change.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
random-detect dscp, on page 93	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a specific differentiated services code point (DSCP) value.
random-detect precedence, on page 98	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

random-detect precedence

To configure the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence, use the **random-detect precedence** command in policy map class configuration mode. To return the thresholds to the default for the precedence, use the **no** form of this command.

random-detect precedence *precedence-value min-threshold* [*units*] *max-threshold* [*units*]

no random-detect precedence *precedence-value min-threshold* [*units*] *max-threshold* [*units*]

Syntax Description

precedence-value	An IP precedence value identifier that specifies the exact value. Range is from 0 to 7. Reserved keywords can be specified instead of numeric values. Table 3: IP Precedence Values and Names, on page 70 describes the reserved keywords. Up to eight values or reserved keywords can be entered separated by commas.
min-threshold	Minimum threshold in number of packets. Range is from 0 to 1073741823 in bytes.
max-threshold	Maximum threshold in the units specified. Range is from the value of the *min-threshold* argument to 1073741823. When the average queue length exceeds the maximum threshold, WRED drops all packets with the specified precedence value.
units	(Optional) Units for the threshold values. Values can be: • **cells**—cells • **ms**—milliseconds • **packets**—packets (default) • **us**—microseconds

Command Default

Default unit for *max-threshold* and *min-threshold* is **packets**.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.3.0	The *units* argument was added to allow specifying the units of the thresholds.
Release 3.4.0	The *precedence-value min-threshold max-threshold* arguments were deleted from the **no random-detect precedence** command.

Release	Modification
Release 3.6.0	The *precedence-value* argument can accept up to eight values or reserved keywords separated by commas.
	The **cells** *unit* keword and argument were added.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

For the **random-detect precedence** command to take effect, you must configure the **shape average**, **bandwidth (QoS)**, or **bandwidth remaining** commands in the user-defined policy map class. This dependency is not applicable to the class default for the policy map class.

WRED is a congestion avoidance mechanism that slows traffic by randomly dropping packets when congestion exists. WRED is most useful with protocols like TCP that respond to dropped packets by decreasing the transmission rate.

When you configure the **random-detect** command on an interface, packets are given preferential treatment based on the IP precedence of the packet. Use the **random-detect precedence** command to adjust the treatment for different precedences.

When the value of the *units* argument is packets, packets are assumed to be 256 bytes in size.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows that for packets with precedence 3, the WRED minimum threshold is 1,000,000 bytes and maximum threshold is 2,000,000 bytes:

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)#random-detect precedence 3 1000000 2000000
```

Related Commands

Command	Description
bandwidth (QoS), on page 4	Specifies the minimum bandwidth allocated to a class belonging to a policy map.
class (policy-map), on page 13	Specifies the name of the class whose policy you want to create or change.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.

Command	Description
random-detect dscp, on page 93	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a specific differentiated services code point (DSCP) value.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

service-policy (interface)

To attach a policy map to an input interface or output interface to be used as the service policy for that interface, use the **service-policy** command in the appropriate configuration mode. To remove a service policy from an input or output interface, use the **no** form of the command.

service-policy {**input**| **output**} *policy-map* [**account nolayer2**]

no service-policy {**input**| **output**} *policy-map* [**account nolayer2**]

Syntax Description

input	Attaches the specified policy map to the input interface.
output	Attaches the specified policy map to the output interface.
policy-map	Name of a service policy map (created using the **policy-map** command) to be attached.
account nolayer2	(Optional) Turns off layer 2 QoS-specific accounting and enables Layer 3 QoS accounting.

Command Default

No service policy is specified.

Command Modes

Interface configuration

Layer 2 transport configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.4.0	The **pre-decrypt**, **post-decrypt**, and **pre-encrypt** keywords were added for IPSec.
Release 3.5.0	The **pre-decrypt**, **post-decrypt**, and **pre-encrypt** keywords were removed.
Release 3.6.0	The command was supported in Layer 2 transport configuration mode.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

You can attach a single policy map to one or more interfaces to specify the service policy for those interfaces. The class policies composing the policy map are then applied to packets that satisfy the class map match criteria for the class. To apply a new policy to an interface, you must remove the previous policy. A new policy cannot replace an existing policy.

The default packet size for QoS accounting on 10 Gbps IP Services Engine (Engine 5) and Multirate 10G IP Services Engines (Engine 5+) line cards is Layer 2 packet size. The **account nolayer2** option allows you to specify a Layer 3 packet size for QoS accounting. This option is enabled in a policy map and applies to a specific interface. It does not apply to any other interface on the line card or to any other line card on the router.

Less traffic passes through the network using Layer 2 packet size than using Layer 3 packet size. The **account nolayer2** option allows service providers to tailor the amount of traffic that is passed to particular users, and to use QoS accounting based on Layer 3 packet size.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows policy map policy1 applied to Packet-over-SONET/SDH (POS) interface 0/2/0/0:

```
RP/0/0/CPU0:router(config)# class-map class1
RP/0/0/CPU0:router(config-cmap)# match precedence ipv4 1
RP/0/0/CPU0:router(config-cmap)# exit
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# set precedence 2
RP/0/0/CPU0:router(config-pmap)# exit
RP/0/0/CPU0:router(config)# interface pos 0/2/0/0
RP/0/0/CPU0:router(config-if)# service-policy output policy1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy (policy map class), on page 103	Uses a service policy as a QoS policy within a policy map.

service-policy (policy map class)

To use a service policy as a QoS policy within a policy map (called a *hierarchical service policy*), use the **service-policy** command in policy map class configuration mode. To disable a particular service policy as a QoS policy within a policy map, use the **no** form of this command.

service-policy [**type qos**] *policy-map-name*

no service-policy [**type qos**] *policy-map-name*

Syntax Description

type qos	(Optional) Specifies a QoS service policy.
policy-map-name	Name of the predefined policy map to be used as a QoS policy. The name can be a maximum of 40 alphanumeric characters.

Command Default

No service policy is specified.

Type is QoS when not specified.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.6.0	The **type qos** keywords were added.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **service-policy (policy-map class)** command creates hierarchical service policies in policy-map class configuration mode.

This command is different from the **service-policy (interface)** command used in interface configuration mode.

The child policy is the previously defined service policy that is being associated with the class default of the parent policy-map. The new service policy using the preexisting service policy is the parent policy.

The **service-policy (policy-map class)** command has the following restrictions:

- The **priority** command cannot be used in the parent policy; it can only be used in the child policy.

- The **bandwidth** command cannot be used in the parent policy.

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Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to create a hierarchical service policy in the service policy called parent:

```
RP/0/0/CPU0:router(config)# policy-map child
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# priority
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit
RP/0/0/CPU0:router(config)# policy-map parent
RP/0/0/CPU0:router(config-pmap)# class class-default
RP/0/0/CPU0:router(config-pmap-c)# shape average 10000000
RP/0/0/CPU0:router(config-pmap-c)# service-policy child
```

Related Commands

Command	Description
bandwidth (QoS), on page 4	Specifies the minimum bandwidth allocated to a class belonging to a policy map.
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
priority (QoS), on page 82	Assigns a priority to a class of traffic belonging to a policy map.
service-policy (interface), on page 101	Attachs a policy map to an input interface or output interface to be used as the service policy for that interface.

set atm-clp

To set the cell loss priority (CLP) bit when a policy map is configured, use the **set atm-clp** command in policy map class configuration mode. To remove a specific CLP bit setting, use the **no** form of this command.

set atm-clp

no set atm-clp

Syntax Description   This command has no keywords or arguments.

Command Default   The CLP bit is automatically set to 0 when Cisco routers convert IP packets into ATM cells for transmission through Multiprotocol Label Switching (MPLS)-aware ATM networks.

Command Modes   Policy map class configuration

Command History

Release	Modification
Release 3.4.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **set atm-clp** command sets the CLP bit within the packet. After the CLP bit is set, other QoS services such as Modified Deficit Round Robin (MDRR) and Weighted Random Early Detection (WRED) can operate on the bit settings.

A policy map containing the **set atm-clp** command can be attached as an output policy only. The **set atm-clp** command does not support packets that originate from the router.

Task ID

Task ID	Operations
qos	read, write

Examples   The following example illustrates setting the CLP bit using the **set atm-clp** command in the policy map:

```
RP/0/0/CPU0:router(config)# class-map c1
RP/0/0/CPU0:router(config-cmap)# match precedence ipv4 0 1
RP/0/0/CPU0:router(config-cmap)# exit

RP/0/0/CPU0:router(config)# policy-map atm-clp-set
RP/0/0/CPU0:router(config-pmap)# class c1
```

```
RP/0/0/CPU0:router(config-pmap-c)# set atm-clp
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit

RP/0/0/CPU0:router(config)# interface atm 0/2/0/0.1
RP/0/0/CPU0:router(config-subif)# pvc 10/100
RP/0/0/CPU0:router(config-atm-vc)# service-policy output atm-clp-set
RP/0/0/CPU0:router(config-atm-vc)# end
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy (interface), on page 101	Attachs a policy map to an input interface or output interface to be used as the service policy for that interface.

set cos

To set the Layer 2 class of service (CoS) value of an outgoing packet, use the **set cos** command in policy map class configuration mode. To remove a specific CoS value setting, use the **no** form of this command.

set cos cos-value

no set cos cos-value

Syntax Description		
cos-value	Specific IEEE 802.1Q CoS value from 0 to 7.	

Command Default No Layer 2 CoS value of an outgoing packet is set.

Command Modes Policy map class configuration

Command History	**Release**	**Modification**
	Release 3.3.0	This command was introduced.

Usage Guidelines To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Use the **set cos** command to mark a packet that is being sent to a switch. Switches can leverage Layer 2 header information, including a CoS value marking.

For Layer 3, the **set cos** command can be used only in service policies that are attached in the output direction of an interface. Packets entering an interface cannot be set with a CoS value.

Task ID	**Task ID**	**Operations**
	qos	read, write

Examples In the following example, the policy map called cos-set is created to assign different CoS values for different service classes, and then is attached to the output Gigabit Ethernet VLAN subinterface 0/1/0/9.100.

```
RP/0/0/CPU0:router(config)# policy-map cos-set
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# set cos 1
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# class class2
```

```
RP/0/0/CPU0:router(config-pmap-c)# set cos 2
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit
RP/0/0/CPU0:router(config)# interface gigabitethernet 0/1/0/9.100
RP/0/0/CPU0:router(config-if)# service-policy output cos-set
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy (interface), on page 101	Attachs a policy map to an input interface or output interface to be used as the service policy for that interface.

set discard-class

To set the discard class and Quality of Service (QoS) group identifiers on IP Version 4 (IPv4) or Multiprotocol Label Switching (MPLS) packets, use the **set discard-class** command in policy map class configuration mode. To leave the discard-class values unchanged, use the **no** form of this command.

set discard-class *discard-class-value*

no set discard-class *discard-class-value*

Syntax Description

discard-class-value	Discard class ID. An integer from 0 to 7, to be marked on the packet.

Command Default
No group ID is specified.

Command Modes
Policy map class configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines
To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **set discard-class** command associates a discard class ID with a packet. After the discard class and QoS group IDs are set, other QoS services such as Modified Deficit Round Robin (MDRR) and Weighted Random Early Detection (WRED) can operate on the bit settings.

Discard-class indicates the discard portion of the per hop behavior (PHB). The **set discard-class** command is typically used in Pipe mode. Discard-class is required when the input PHB marking is used to classify packets on the output interface.

The discard-class values can be used to specify the type of traffic that is dropped when there is congestion.

Note   Marking of the discard class and the QoS group has only local significance on a node.

Task ID

Task ID	Operations
qos	read, write

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Examples   The following example shows how to set the discard class value to 5 for packets that match the MPLS experimental bits 1:

```
RP/0/0/CPU0:router(config)# class-map cust1
RP/0/0/CPU0:router(config-cmap)# match mpls experimental topmost 1
RP/0/0/CPU0:router(config-cmap)# exit
RP/0/0/CPU0:router(config)# policy-map policy2
RP/0/0/CPU0:router(config-pmap)# class cust1
RP/0/0/CPU0:router(config-pmap-c)# set discard-class 5
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit
RP/0/0/CPU0:router(config)# interface gigabitethernet 0/1/0/9
RP/0/0/CPU0:router(config-if)# service-policy input policy2
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy (interface), on page 101	Attachs a policy map to an input interface or output interface to be used as the service policy for that interface.

set dscp

To mark a packet by setting the IP differentiated services code point (DSCP) in the type of service (ToS) byte, use the **set dscp** command in policy-map class configuration mode. To remove a previously set DSCP value, use the **no** form of this command.

set dscp [tunnel] *dscp-value*

no set dscp [tunnel] *dscp-value*

Syntax Description

tunnel	(Optional) Sets the DSCP on the outer IP header. This command is available for IPSec in the egress direction.
dscp-value	Number from 0 to 63 that sets the DSCP value. Reserved keywords can be specified instead of numeric values. Table 2: IP DSCP Reserved Keywords, on page 60 describes the reserved keywords.

Command Default

No default behavior or values

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.8.0	The **tunnel** keyword is supported for QoS in a Multicast Virtual Private Network (mVPN) enabled network that requires both conditional and unconditional marking of DSCP bits on the tunnel header.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

After the DSCP bit is set, other quality-of-service (QoS) services can then operate on the bit settings.

Conditional marking marks the DSCP values on the tunnel header as a policer action. Unconditional marking marks the DSCP tunnel as a policy action. Both conditional and unconditional markings are supported only in the ingress direction.

The network gives priority (or some type of expedited handling) to marked traffic. Typically, you set the DSCP value at the edge of the network (or administrative domain); data then is queued based on the DSCP value. Modified Deficit Round Robin (MDRR) can speed up handling for high DSCP traffic at congestion points. Weighted Random Early Detection (WRED) ensures that high DSCP traffic has lower loss rates than other traffic during times of congestion.

Reserved keywords can be specified instead of numeric values. Table 2: IP DSCP Reserved Keywords, on page 60 describes the reserved keywords.

Task ID

Task ID	Operations
qos	read, write

Examples

In the following example, the DSCP ToS byte is set to 8 in the policy map called policy1. All packets that satisfy the match criteria of class1 are marked with the DSCP value of 8. The network configuration determines how packets are marked.

```
RP/0/0/CPU0:router (config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# set dscp 8
```

Related Commands

Command	Description
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy (interface), on page 101	Attachs a policy map to an input interface or output interface to be used as the service policy for that interface.
set precedence, on page 117	Sets the precedence value in the IP header.
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

set fr-de

To change the discard eligible (DE) bit setting in the address field of a Frame Relay frame to 1 for all traffic leaving an interface, use the **set fr-de** command in policy map configuration mode. To remove the DE bit setting, use the **no** form of this command.

set fr-de [*fr-de-bit-value*]

no set fr-de [*fr-de-bit-value*]

Syntax Description

not	(Optional) Negates the specified match result.
fr-de-bit-value	(Optional) Specifies the Frame Relay DE bit. Value can be 0 or 1. Value can be 1.

Command Default

The default value is 0.

Command Modes

Policy map configuration

Command History

Release	Modification
Release 3.8.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

To disable this command in a traffic policy, use the **no set fr-de** command in policy map configuration mode of the traffic policy.

If the DE bit is already set to 1, no changes are made to the frame.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to set the DE bit using the **set fr-de** command in the traffic policy. The router sets the DE bit of outbound packets belonging to the ip-precedence class.

```
RP/0/0/CPU0:router(config)# class-map ip-precedence
```

```
RP/0/0/CPU0:router(config-cmap)# match precedence 0 1
RP/0/0/CPU0:router(config-cmap)# exit
RP/0/0/CPU0:router(config)# policy-map set-de
RP/0/0/CPU0:router(config-pmap)# class ip-precedence
RP/0/0/CPU0:router(config-pmap-c)# set fr-de 1
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit
RP/0/0/CPU0:router(config)# interface serial 1/0/0
RP/0/0/CPU0:router(config-if)# no ip address
RP/0/0/CPU0:router(config-if)# encapsulation frame-relay
RP/0/0/CPU0:router(config-if)# interface serial 1/0/0.1
RP/0/0/CPU0:router(config-subif)# ip address 10.1.1.1 255.255.255.252
RP/0/0/CPU0:router(config-subif)# no ip directed-broadcast
RP/0/0/CPU0:router(config-subif)# service-policy output set-de
```

Related Commands

Command	Description
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.

set mpls experimental

To set the experimental (EXP) value of the Multiprotocol Label Switching (MPLS) packet topmost or imposition labels, use the **set mpls experimental** command in policy map configuration mode. To leave the EXP value unchanged, use the **no** form of this command.

set mpls experimental {**imposition**| **topmost**} *exp-value*

no set mpls experimental {**imposition**| **topmost**} *exp-value*

Syntax Description

imposition	Specifies to set the EXP value of the imposition label.
topmost	Specifies to set the EXP value of the topmost label.
exp-value	Value of the MPLS packet label. Range is 0 to 7.

Command Default   No MPLS experimental value is set

Command Modes   Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.3.0	Added the **imposition** keyword and changed overall command name from **set mpls experimental topmost** to **set mpls experimental**.
Release 3.4.0	Added the range for the *exp-value* argument.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

After the MPLS experimental bits are set, other QoS services such as Modified Deficit Round Robin (MDRR) and Weighted Random Early Detection (WRED) then operate on the bit settings.

The network gives priority (or some type of expedited handling) to the marked traffic through the application of MDRR or WRED at points downstream in the network. Typically, the MPLS experimental value is set at the edge of the network (or administrative domain) and queueing is acted on it thereafter. MDRR can speed up handling for high-priority traffic at congestion points. WRED ensures that high-priority traffic has lower loss rates than other traffic during times of congestion.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to set the MPLS experimental to 5 for packets that match access list 101:

```
RP/0/0/CPU0:router(config)# class-map class1
RP/0/0/CPU0:router(config-cmap)# match access-group ipv4 acl101
RP/0/0/CPU0:router(config-cmap)# exit

RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# set mpls experimental  imposition 5
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit

RP/0/0/CPU0:router(config)# interface  gigabitithernet 0/3/0/2
RP/0/0/CPU0:router(config-if)# service-policy  input policy1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy (interface), on page 101	Attachs a policy map to an input interface or output interface to be used as the service policy for that interface.

set precedence

To set the precedence value in the IP header, use the **set precedence** command in policy map class configuration mode. To leave the precedence value unchanged, use the **no** form of this command.

set precedence [tunnel] *value*

no set precedence [tunnel] *value*

Syntax Description

tunnel	(Optional) Sets the IP precedence on the outer IP header. This command is available on Layer 3 interfaces in the ingress direction.
value	Number or name that sets the precedence bits in the IP header. Range is from 0 to 7. Reserved keywords can be specified instead of numeric values. Table 3: IP Precedence Values and Names, on page 70 describes the reserved keywords.

Command Default

Marking is not configured.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.8.0	The **tunnel** keyword is supported for QoS in a Multicast Virtual Private Network (mVPN) enabled network that requires both conditional and unconditional marking of precedence bits on the tunnel header.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Precedence can be set using a number or corresponding name. After IP Precedence bits are set, other QoS services such as Modified Deficit Round Robin (MDRR) and Weighted Random Early Detection (WRED) then operate on the bit settings.

Conditional marking marks the precedence values on the tunnel header as a policer action. Unconditional marking marks the precedence tunnel as a policy action. Both conditional and unconditional markings are supported only in an ingress direction. The **tunnel** keyword is available on Layer 3 interfaces in the ingress direction.

The network gives priority (or some type of expedited handling) to the marked traffic through the application of MDRR or WRED at points downstream in the network. IP precedence can be set at the edge of the network (or administrative domain) and have queueing act on it thereafter. MDRR can speed handling for

high-precedence traffic at congestion points. WRED ensures that high-precedence traffic has lower loss rates than other traffic during times of congestion.

The mapping from keywords such as 0 (routine) and 1 (priority) to a precedence value is useful only in some instances. That is, the use of the precedence bit is evolving. You can define the meaning of a precedence value by enabling other features that use the value. In the case of high-end Internet QoS, IP precedences can be used to establish classes of service that do not necessarily correspond numerically to better or worse handling in the network.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example shows how to set the IP precedence to 5 (critical) for packets that match the access control list named customer1:

```
RP/0/0/CPU0:router(config)# class-map class1
RP/0/0/CPU0:router(config-cmap)# match access-group ipv4 customer1
RP/0/0/CPU0:router(config-cmap)# exit

RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# set precedence 5
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit

RP/0/0/CPU0:router(config)# interface gigabitethernet 0/1/0/9
RP/0/0/CPU0:router(config-if)# service-policy output policy1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy (interface), on page 101	Attachs a policy map to an input interface or output interface to be used as the service policy for that interface.

set qos-group

To set the quality of service (QoS) group identifiers on packets, use the **set qos-group** command in policy map class configuration mode. To leave the QoS group values unchanged, use the **no** form of this command.

set qos-group qos-group-value

no set qos-group qos-group-value

Syntax Description

qos-group-value	QoS group ID. An integer from 0 to 31, to be marked on the packet.

Command Default

No group ID is specified.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **set qos-group** command associates a QoS group ID with a packet. After the QoS group ID is set, other QoS services, such as Modified Deficit Round Robin (MDRR) and Weighted Random Early Detection (WRED), can operate on the QoS group setting.

The QoS group setting is limited in scope to the local router. Typically, the QoS group is set on the local router and used in conjunction with WRED or MDRR to give differing levels of service based on the group identifier.

Task ID

Task ID	Operations
qos	read, write

Examples

The following example sets the QoS group to 5 for packets that match the MPLS experimental bit 1:

```
RP/0/0/CPU0:router(config)# class-map class1
RP/0/0/CPU0:router(config-cmap)# match mpls experimental topmost 1
RP/0/0/CPU0:router(config-cmap)# exit
```

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# set qos-group 5
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit

RP/0/0/CPU0:router(config)# interface pos 0/7/0/0
RP/0/0/CPU0:router(config-if)# service-policy input policy1
```

Related Commands

Command	Description
class-map, on page 15	Defines a traffic class and the associated rules that match packets to the class.
match dscp, on page 59	Identifies specific IP differentiated services code point (DSCP) values as match criteria for a class map.
policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy (interface), on page 101	Attachs a policy map to an input interface or output interface to be used as the service policy for that interface.

shape average

To shape traffic to the indicated bit rate according to the algorithm specified, use the **shape average** command in policy map class configuration mode. To remove traffic shaping, use the **no** form of this command.

shape average {**percent** *percentage*| *rate* [*units*]}

no shape average {**percent** *percentage*| *rate* [*units*]}

Syntax Description

percent *percentage*	Specifies the interface bandwidth in percentage. Values can be from 1 to 100.
rate	Average shaping rate in the specified units. Values can be from 1 to 4294967295. For 16 kbps granularity on 2.5 Gbps IP Services Engine (Engine 3) line cards, the maximum shape rate is 1.05 gbps.
units	(Optional) Units for the bandwidth. Values can be: • **bps**—bits per second (default) • **gbps**—gigabits per second • **kbps**—kilobits per second • **mbps**—megabits per second

Command Default   *units*: **bps**

Command Modes   Policy map class configuration

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.3.0	The *units* and *burst-units* arguments were added.
Release 3.3.1	Minimum rate value changed from 128 kbps to 256 kbps.
Release 3.4.0	The *burst-size* option was removed.
Release 3.9.0	The granularity of the rates specified was changed from 64 kbps to 8 kbps.

Cisco IOS XR Modular Quality of Service Command Reference for the Cisco XR 12000 Series Router, Release 4.1

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

When you use the **shape average** command, egress shaping is done at the Layer 2 level and includes the Layer 2 header in the rate calculation. Ingress shaping is done at the Layer 3 level and does not include the Layer 2 header in the rate calculation. Shaping is performed in multiples of 256 kbps, the minimum shaping rate.

When using this command, egress and ingress shaping is performed in multiples of 8 kbps on the Layer 3 level.

Line card Type	Ingress Granularity	Egress Granularity
2.5 Gbps IP Services Engine (Engine 3)**Exceptions: 1-Port OC-48c POS ISE 4-Port OC-12c POS ISE	16 kbps64 kbps64 kbps	16 kbps64 kbps64 kbps
10 Gbps IP Services Engine (Engine 5)	32 kbps	32 kbps
Multirate 10G IP Services Engines (Engine 5+)	32 kbps	8 kbps

For **shape average** commands in the child policy, the reference used for percentage parameters is relative to the maximum rate of the parent. If shaping or policing is not configured on the parent, then the parent inherits the interface rate.

For bundled interfaces, **shape average** can be configured only as a percentage.

If you have both shape and bandwidth configured for a class, ensure that the shape percent value is always greater than the percent value for bandwidth.

Task ID

Task ID	Operations
qos	read, write

Examples   The following example sets traffic shaping to 50 milliseconds:

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# shape average percent 50
```

The following example shows how to set traffic shaping to 5,000,000 kbps:

```
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
```

```
RP/0/0/CPU0:router(config-pmap-c)# shape average 5000000 kbps
```

show controllers egressq enaq location

To display information about QoS queue fragmentation on a node, use the **show controllers egressq enaq location** command in EXEC mode.

show controllers egressq enaq location *node-id*

Syntax Description

node-id	Specifies the node in the *rack/slot/module* notation.

Command Default

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

When policies are frequently added and removed in large-scale configurations, the line card might not have enough free contiguous QoS queues to accommodate a new policy—even though there are enough free queues on the line card. Use this command to determine the number of occupied (used/enabled) QoS queues on a node and to see where the fragments are.

QoS queues are automatically defragmented unless the **hw-module qos queue-auto-defrag disable location** command is configured. You can manually defragment QoS queues using the **hw-module queue-defrag location** command.

Task ID

Task ID	Operations
interface	read
drivers	read

Examples

The following example displays information about QoS queue fragmentation on location 0/1/CPU0. There are 12 enabled (occupied/used) QoS queues on the node. Between queue number 7 and queue number 12, there is a gap; this is a fragment of four unoccupied queues.

There are 4096 QoS queues on 2.5 Gbps IP Services Engine (Engine 3) line cards and 8192 QoS queues on 10 Gbps IP Services Engine (Engine 5) line cards. For the purpose of this example, if there were 16 total queues on this line card and a new policy needed five free contiguous queues, the system would display an error because there are only four free contiguous queues.

```
RP/0/0/CPU0:router# show controllers egressq enaq location 0/1/CPU0

Wed Oct  7 21:57:34.531 eastern
Total enabled queues:12
Total allocated ports:5

Queue#  Head    Tail    Length  Threshold    Type    Red avg Port/Slot
                        pkts    index


================================================================================

0       0       0       0       63           oq      0       0
1       0       0       0       63           oq      0       0
2       0       0       0       63           oq      0       1
3       0       0       0       63           oq      0       1
4       0       0       0       63           oq      0       2
5       0       0       0       63           oq      0       2
6       0       0       0       63           oq      0       3
7       0       0       0       63           oq      0       3
12      0       0       0       63           oq      0       5
13      0       0       0       1            oq      0       5
14      0       0       0       63           oq      0       5
15      0       0       0       63           oq      0       5
```

The following example displays information for the same node after it has been defragmented.

```
RP/0/0/CPU0:router# show controllers egressq enaq location 0/1/CPU0

Wed Oct  7 22:04:45.420 eastern
Total enabled queues:12
Total allocated ports:5

Queue#  Head    Tail    Length  Threshold    Type    Red avg Port/Slot
                        pkts    index


================================================================================

0       0       0       0       63           oq      0       0
1       0       0       0       63           oq      0       0
2       0       0       0       63           oq      0       1
3       0       0       0       63           oq      0       1
4       0       0       0       63           oq      0       2
5       0       0       0       63           oq      0       2
6       0       0       0       63           oq      0       3
7       0       0       0       63           oq      0       3
8       0       0       0       63           oq      0       5
9       0       0       0       1            oq      0       5
10      0       0       0       63           oq      0       5
11      0       0       0       63           oq      0       5
```

Related Commands

Command	Description
hw-module qos queue-auto-defrag disable location, on page 46	Disables automatic QoS queue defragmentation on a node.
hw-module queue-defrag location, on page 48	Manually defragment the QoS queues on a node.

show controllers sanity

To display information about sanity checking of ingress and egress queueing ASICs, use the **show controllers sanity** command in EXEC mode.

show controllers {**egressq**| **ingressq**} **sanity location** *node-id*

Syntax Description

egressq	Displays egress queueing ASIC sanity configuration.
ingressq	Dsiplays ingress queuing ASIC sanity configuration.
location	Displays sanity checking configuration for a designated node.
node-id	Node for which sanity checking information is to be displayed. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default No default behavior or values

Command Modes EXEC

Command History

Release	Modification
Release 4.0.0	This command was introduced.

Usage Guidelines To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

This command is supported on 10 Gbps IP Services Engine (Engine 5) line cards and Multirate 10G IP Services Engines (Engine 5+) line cards only.

Task ID

Task ID	Operation
sonet-sdh OR	read
dwdm OR	read
interface	read
drivers	read

Examples   The following example demonstrates how to display information on the sanity checking of the ingress queueing ASIC on location 0/2/CPU0:

```
RP/0/0/CPU0:router# show controllers ingressq sanity location 0/2/CPU0

Wait Timer:                 60
Buffer Threshold:           5
Sanity Action Set:          Recarve
```
The following table describes the significant fields shown in the display.

Table 4: show controllers sanity Field Descriptions

Field	Description
Wait Timer	Indicates the time lapse, in seconds, between successive sanity checks.
Buffer Threshold	Indicates the remaining buffer threshold value, as a percentage. A warning will be printed on the console when the buffer threshold value is reached.
Sanity Action Set	Indicates the action to be performed when the buffer has depleted completely. • **recarve**—Recarve performed as recovery. • **none**—No action performed as recovery. • **reload**—Reload of line card performed as recovery. • **pcds**—(Default) No action performed as recovery. Equivalent to the user configurable action, none.

Related Commands

Command	Description
hw-module sanity, on page 50	Configures sanity checking of ingress and egress queueing ASICs.

show hw-module multicast qos

To display the multicast QoS group information, use the **show hw-module multicast qos** command in EXEC mode.

show hw-module multicast qos [**group-info** [*port*] **location** *node-id*| **queue-info** [*type instance*] **location** *node-id*| **wred location** *node-id*]

Syntax Description

group-info	(Optional) Displays multicast QoS group information.
port	(Optional) Port number. Range is from 0 to 15.
location *node-id*	(Optional) Specifies multicast QoS group information for a designated node. The *node-id* argument is entered in the *rack/slot/module* notation.
queue-info	(Optional) Displays multicast QoS group queue information.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
instance	(Optional) Either a physical interface instance or a virtual interface instance:

- Physical interface instance. Naming notation is *rack/slot/module/port* and a slash between values is required as part of the notation.
  - *rack*: Chassis number of the rack.
  - *slot*: Physical slot number of the line card.
  - *module*: Module number. A physical layer interface module (PLIM) is always 0.
  - *port*: Physical port number of the interface.

  Note   In references to a Management Ethernet interface located on a Route Processor card, the physical slot number is alphanumeric (RP0 or RP1) and the module is CPU0. Example: interface MgmtEth0/RP1/CPU0/0.

- Virtual interface instance. Number range varies depending on interface type.

  For more information about the syntax for the router, use the question mark (?) online help function.

wred	(Optional) Displays multicast QoS Weighted Random Early Detection (WRED) information.

Command Default

No default behavior or values

Command Modes   EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	Command syntax was changed from **show hw-module qos multicast** to **show hw-module multicast qos**.
Release 3.6.0	The **wred** keyword was added.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

If you do not enter a *node-id* argument, all configured interfaces are displayed.

Task ID

Task ID	Operations
multicast	read

Examples   The following sample output shows how to display QoS information about for Packet-over-SONET/SDH (POS) interface 0/7/0/3:

```
RP/0/0/CPU0:router# show hw-module multicast qos

POS 0/7/0/3 output: p1
Class c1
Matched         (packets/bytes) : 0/0
Marked (packets/bytes) : 0/0
```

The following table describes the significant fields shown in the display.

Table 5: show hw-module multicast qos Field Descriptions

Field	Description
POS 0/7/0/3 output: p1	POS output interface for policy p1.
Matched (packets/bytes): 0/0	Class c1 of policy p1 displays no matched packets and bytes.
Marked (packets/bytes): 0/0	Class c1 of policy p1 displays no marked packets and bytes.

Field	Description
Matched (packets/bytes): 10/1320	Class c2 of policy p1 displays 10 matched packets and 1320 matched bytes.

Related Commands

Command	Description
hw-module qos multicast, on page 40	Enables multicast egress quality of service (QoS) on a node.

show policy-map interface

To display policy configuration information for all classes configured for all service policies on the specified interface, use the **show policy-map interface** command in EXEC mode.

show policy-map interface *type interface-path-id* [**input**| **output** [**member** *type interface-path-id*]]

Syntax Description

type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface instance. Naming notation is *rack/slot/module/port* and a slash between values is required as part of the notation. • *rack*—Chassis number of the rack. • *slot*—Physical slot number of the line card. • *module*—Module number. A physical layer interface module (PLIM) is always 0. • *port*—Physical port number of the interface. **Note** In references to a Management Ethernet interface located on a route processor card, the physical slot number is alphanumeric (RP0 or RP1) and the module is CPU0. Example: interface MgmtEth0/RP1/CPU0/0. For more information about the syntax for the router, use the question mark (?) online help function.
input	(Optional) Displays per class statistics on inbound traffic for the specified policy map and interface.
output	(Optional) Displays per class statistics on outbound traffic for the specified policy map and interface.
member	(Optional) Specifies the bundle member's interface.

Command Default   No default behavior or values

Command Modes   EXEC

Command History

Release	Modification
Release 3.2	This command was introduced.
Release 3.3.0	The **combined**, **hw**, and **sw** keywords were added.

Release	Modification
Release 3.4.0	The **combined**, **hw**, and **sw** keywords were deleted.
	The **pre-decrypt**, **post-decrypt**, **pre-encrypt**, and **post-encrypt** keywords were added.
Release 3.4.1	The **combined**, **hw**, and **sw** keywords were added.
Release 3.5.0	The **show policy-map interface** command output was updated to show when a policy is suspended on a multilink or T3 interface.
	The **pre-decrypt**, **post-decrypt**, **post-encrypt**, and **pre-decrypt** keywords were removed.
Release 3.6.0	The **combined**, **hw**, and **sw** keywords were removed.
	The **member** *type interface-path-id* keyword and arguments were added.
Release 3.9.0	The **show policy-map interface** command output was updated to show IPHC statistics.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **show policy-map interface** command displays the statistics for classes in the service policy attached to an interface.

Task ID

Task ID	Operations
qos	read

Examples

The following sample output shows how to display policy statistics information for all classes on the TenGigE interface 0/6/1/0 that are in the output and input direction:

```
RP/0/0/CPU0:router# show policy-map interface tengige 0/6/1/0

TenGigE0/6/1/0 input: policy1

Class class1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                 0/0                     0
    Transmitted         :                 0/0                     0
    Total Dropped       :                 0/0                     0
  Policing statistics                (packets/bytes)     (rate - kbps)
    Policed(conform)    :                 0/0                     0
    Policed(exceed)     :                 0/0                     0
    Policed(violate)    :                 0/0                     0
    Policed and dropped :                 0/0
  Queueing statistics
    Queue ID                             : 44
    Taildropped(packets/bytes)           : 0/0
```

```
Class class-default
  Classification statistics        (packets/bytes)      (rate - kbps)
    Matched            :               0/0                        0
    Transmitted        :               0/0                        0
    Total Dropped      :               0/0                        0
  Queueing statistics
    Queue ID                               : 44
    High watermark   (bytes)/(ms)          : 0/0
    Inst-queue-len   (bytes)/(ms)          : 0/0
    Avg-queue-len    (bytes)/(ms)          : 0/0
    Taildropped(packets/bytes)             : 0/0

TenGigE0/6/1/0 output: policy4

Class class1
  Classification statistics        (packets/bytes)      (rate - kbps)
    Matched            :               0/0                        0
    Transmitted        :               0/0                        0
    Total Dropped      :               0/0                        0
  Policing statistics              (packets/bytes)      (rate - kbps)
    Policed(conform)   :               0/0                        0
    Policed(exceed)    :               0/0                        0
    Policed(violate)   :               0/0                        0
    Policed and dropped :              0/0
  Queueing statistics
    Queue ID                               : 51
    Taildropped(packets/bytes)             : 0/0
Class class-default
  Classification statistics        (packets/bytes)      (rate - kbps)
  Classification statistics        (packets/bytes)      (rate - kbps)
    Matched            :               0/0                        0
    Transmitted        :               0/0                        0
    Total Dropped      :               0/0                        0
  Queueing statistics
    Queue ID                               : 51
    High watermark   (bytes)/(ms)          : 0/0
    Inst-queue-len   (bytes)/(ms)          : 0/0
    Avg-queue-len    (bytes)/(ms)          : 0/0
    Taildropped(packets/bytes)             : 0/0
```

The following sample output shows how to display policy statistics information for all classes on the Serial interface 0/0/3/0/3:0 that are in the output direction:

```
RP/0/0/CPU0:router# show policy-map interface Serial0/0/3/0/3:0 output

show policy-map int  Serial0/0/3/0/3:0  output
Mon May 18 22:06:14.698 UTC
Serial0/0/3/0/3:0 output: p1
Class class-default
  Classification statistics        (packets/bytes)      (rate - kbps)
    Matched            :               0/0                        0
    Transmitted        :               0/0                        0
    Total Dropped      :               0/0                        0
  Queueing statistics
    Queue ID                               : 0
    High watermark   (Unknown)             : 0
    Inst-queue-len   (packets)             : 0
    Avg-queue-len    (packets)             : 0
    Taildropped(packets/bytes)             : 0/0
  Compression Statistics
    Header ip rtp
    Sent Total       (packets)            : 880
    Sent Compressed  (packets)            : 877
    Sent full header (packets)            : 342
    Saved            (bytes)              : 31570
    Sent             (bytes)              : 24750
    Efficiency improvement factor         : 2.27
```

Note   In Classification Statistics, the total dropped packets are calculated based on the total number of policed-dropped packets and the queueing tail dropped packets. Currently, for ATM interfaces in the egress direction, the queueing tail dropped packets are not added to the classification total dropped packets.

The following table describes the significant fields shown in the display.

Table 6: show policy-map interface Field Descriptions

Field	Description
Classification statistics	
Matched	Number of packets or bytes that matched this class.
Transmitted	Number of packets or bytes transmitted for this class.
Total Dropped	Number of packets or bytes dropped for this class.
Policing statistics	
Policed(conform)	Number of packets or bytes that conformed to the police rate for this class.
Policed(exceed)	Number of packets or bytes that exceeded the police rate for this class.
Policed(violate)	Number of packets or bytes that violated the police rate for this class.
Policed and dropped	Number of packets or bytes dropped by the policer of this class.
Queueing statistics	
Queue ID	Queue number of the packet in this class.
High watermark (bytes)/(ms)	Maximum length of the queue.
Inst-queue-len (bytes)/(ms)	Instantaneous length of the queue.
Avg-queue-len (bytes)/(ms)	Average length of the queue.
Taildropped (bytes)	Number of bytes taildropped for this queue.
Compression Statistics	
Sent Total	Total number of packets sent.
Sent Compressed	Number of compressed packets sent.

Field	Description
Sent full header	Number of packets sent with a full header.
Saved	Number of bytes saved.
Sent	Number of bytes sent.
Efficiency improvement factor	Ratio of the packet's original full size to the packet's compressed size.

The following example shows sample output shows when a policy has been suspended on a multilink interface:

```
RP/0/0/CPU0:router# show policy-map interface Multilink 0/2/0/0/201 input

Multilink0/2/0/0/201 input: ps1 suspended by EA: No bandwidth
```

show policy-map targets

To display information about the interfaces on which policy maps are applied, use the **show policy-map targets** command in EXEC mode.

show policy-map targets [**location** *node-id*| **pmap-name** *name*| **type performance-traffic** [**location** *node-id*| **pmap-name** *name*]| **type qos** [**location** *node-id*| **pmap-name** *name*]]

Syntax Description

location *node-id*	(Optional) Displays information about the interfaces on which policy maps are applied for the specified location. The *node-id* argument is entered in the *rack/slot/module* notation.
pmap-name *name*	(Optional) Displays information about the interfaces on which the specified policy map is applied.
type performance-traffic	(Optional) Displays information about the interfaces on which Realtime Application Flow Monitoring policy maps are applied.
type qos	(Optional) Displays information about the interfaces on which QoS policy maps are applied. This is the default type.

Command Default   The default QoS policy type is QoS.

Command Modes   EXEC

Command History

Release	Modification
Release 3.8.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

For a short period of time while a QoS policy is being modified, no QoS policy is active on the interface. For these reasons, modify QoS policies that affect the fewest number of interfaces at a time. Use the **show policy-map targets** command to identify the number of interfaces that will be affected during policy map modification.

Task ID

Task ID	Operations
qos	read

Examples   In this example, the Gigabit Ethernet interface 0/1/0/0 has one policy map attached as a main policy. Outgoing traffic on this interface will be affected if the policy is modified:

```
RP/0/0/CPU0:router# show policy-map targets

Fri Jul 16 16:38:24.789 DST
1) Policymap: policy1    Type: qos
     Targets (applied as main policy):
       GigabitEthernet0/1/0/0 output
     Total targets: 1

     Targets (applied as child policy):
     Total targets: 0
```

Related Commands

Command	Description
show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

show qos acl-deny enable

To display the acl-deny information for a particular location, use the **show qos acl-deny enable** command in the root configuration mode. To disable this functionality, use the **no** form of this command.

show qos acl-deny enable [**location** *node-id*]

no show qos acl-deny enable [**location** *node-id*]

Syntax Description

location *node-id*	Displays the acl-deny function on a node. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default   No default behavior or values

Command Modes   Root configuration

Command History

Release	Modification
Release 3.6.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

This command displays the administration and operational states of the acl-deny function. The operational state dictates the current operational behavior while the administration state dictates the operational state after the next line card (LC) reload.

Task ID

Task ID	Operations
qos-ea	write

Examples   The following example shows how to display an acl-deny function on 0/0/CPU0:

```
RP/0/0/CPU0:router# F14-01
RP/0/0/CPU0:router# show qos acl-deny location 0/0/CPU0
```

show qos if-ref-bw

To display the Quality of Service (QoS) reference bandwidth, use the **show qos if-ref-bw** command in EXEC mode.

show qos if-ref-bw location *node-id*

Syntax Description

location	Configures node for which the QoS reference bandwidth is to be displayed.
node-id	Node for which the reference bandwidth is to be displayed. The *node-id* argument is entered in the *rack/slot/module* notation.

Command Default

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 4.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The QoS reference bandwidth is used for the conversion of time based values to equivalent packet based interpretation.

Task ID

Task ID	Operation
qos	read

Examples

The following example demonstrates how to display the QoS reference bandwidth on location 0/2/CPU0. In this example, the command output indicates that the interface reference bandwidth has been enabled as the QoS reference bandwidth:

```
RP/0/0/CPU0:router# show qos if-ref-bw location 0/2/CPU0

QOS reference BW configuration
Admin State:    Interface reference BW enable.
```

```
Oper State:      Interface reference BW enable.
```

The following table describes the significant fields shown in the display.

Table 7: show qos if-ref-bandwidth Field Descriptions

Field	Description
Admin State	Most recently configured QoS reference bandwidth
Oper State	QoS reference bandwidth currently applied to hardware

Related Commands

Command	Description
hw-module sanity, on page 50	Configures sanity checking of ingress and egress queueing ASICs.

show qos interface

To display QoS information for a specific interface, use the **show qos interface** command in EXEC mode.

show qos interface *type interface-path-id* {**input**| **output**} [**location** *node-id*]

Syntax Description	

type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Either a physical interface instance or a virtual interface instance as follows:
	• Physical interface instance. Naming notation is *rack/slot/module/port* and a slash between values is required as part of the notation.
	◦ *rack* : Chassis number of the rack.
	◦ *slot* : Physical slot number of the modular services card or line card.
	◦ *module* : Module number. A physical layer interface module (PLIM) is always 0.
	◦ *port* : Physical port number of the interface.
	Note In references to a Management Ethernet interface located on a route processor card, the physical slot number is alphanumeric (RSP0 RP0 or RP1) and the module is CPU0. Example: interface MgmtEth0/ RSP0 RP1 /CPU0/0.
	• Virtual interface instance. Number range varies depending on interface type.
	For more information about the syntax for the router, use the question mark (?) online help function.
input	Attaches the specified policy map to the input interface.
output	Attaches the specified policy map to the output interface.
location *node-id*	(Optional) Displays detailed QoS information for the designated node. The *node-id* argument is entered in the rack/slot/module notation.

Command Default No default behavior or values

Command Modes EXEC

Command History

Release	Modification
Release 3.2	This command was introduced.

Release	Modification
Release 3.4.0	The **pre-decrypt**, **post-decrypt**, **pre-encrypt**, and **post-encrypt** keywords were added for IPSec.
Release 3.5.0	The **show qos interface** command output was updated to show when a policy is suspended on a multilink or T3 interface.
	The **pre-decrypt**, **post-decrypt**, **post-encrypt**, and **pre-decrypt** keywords were removed.
Release 3.6.0	The command output now includes the following:
	• User-configured values are shown in parentheses.
	• Guaranteed service rate value.
	• Weight for each class.
Release 3.9.0	Updated to support three-level hierarchical policy maps.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **show qos interface** command displays configuration for all classes in the service policy that is attached to an interface.

Use this command to check the actual values programmed in the hardware from the action keywords in the **police rate** command.

Task ID

Task ID	Operations
qos	read

Examples

The following sample output shows the L2VPN QoS information on a GigabitEthernet interface:

```
RP/0/0/CPU0:router# show qos interface GigabitEthernet 0/2/0/0 output

NOTE:- Configured values are displayed within parentheses
Interface GigE0_2_0_0  --   output policy
Total number of classes:   3
--------------------------------------------------------
Level1 class                         =    c1
Egressq Queue ID                     =    25 (LP queue)
Queue belongs to Group               =    9
Queue Max. BW.                       =    999936 kbps (10 %)
Queue Min. BW.                       =    0 kbps (default)
Weight                               =    10 (BWR not configured)
Shaper burst                         =    31248 bytes
Guaranteed service rate              =    1000000 kbps
TailDrop Threshold                   =    12500000 bytes / 100 ms (default)
Policer not configured for this class
```

```
          WRED not configured for this class

          Level1 class                       =   c2
          Egressq Queue ID                   =   26 (LP queue)
          Queue belongs to Group             =   9
          Queue Max. BW.                     =   10000128 kbps (default)
          Queue Min. BW.                     =   2000128 kbps (20 %)
          Weight                             =   10 (BWR not configured)
          Guaranteed service rate            =   4666666 kbps
          TailDrop Threshold                 =   58333325 bytes / 100 ms (default)
          Policer not configured for this class
          WRED not configured for this class

          Level1 class                       =   class-default
          Egressq Queue ID                   =   9 (Group default LP queue)
          Queue belongs to Group             =   9
          Queue Max. BW.                     =   10000128 kbps (default)
          Queue Min. BW.                     =   0 kbps (default)
          Weight                             =   10 (BWR not configured)
          Guaranteed service rate            =   1000000 kbps
          TailDrop Threshold                 =   12500000 bytes / 100 ms (default)

          Policer slot #                     =   224
          Policer committed rate             =   1000000 kbps (10 %)
          Policer conform burst              =   2097120 bytes (default)
          Policer conform action             =   Just TX
          Policer exceed  action             =   DROP PKT
          WRED not configured for this class
```

The following table describes the significant fields shown in the display.

Table 8: show QoS interface Field Descriptions

Field	Description
LEVEL1 class	Level 1 class identifier in hexadecimal format.
class name	Name that was assigned to this class with the **class** command.
Queue ID	Queue identifier.
Queue Min. BW	Minimum bandwidth allowed on this queue.
Queue Max. BW	Maximum bandwidth allowed on this queue.
Queue Max. Burst	Maximum burst size allowed on this queue.
Weight	Weight assigned to the specified class. If no weight has been assigned, the **show policy-map interface** command output shows "No explicit weight assigned for this class."
Queue Limit	Configured queue limit.
Policer average	Average Committed Information Rate (CIR) in bits per second (bps), gigabits per second (gbps), kilobits per second (KBits), or megabits per second (mbps).

Field	Description
Policer conform burst	Configured burst size, expressed in bytes, gigabytes (GB), kilobytes (KB), megabytes (MB), milliseconds (ms), or microseconds (us).
Policer excess burst	Programmed burst size for conforming cells, expressed in bytes, gigabytes (GB), kilobytes (KB), megabytes (MB), milliseconds (ms), or microseconds (us).
Policer conform action	Policer conform action.
Policer exceed action	Policer exceed action.
Policer violate	Indicates whether the device supports excess burst size configuration. In the example, excess burst size configuration is supported for transmitted cells only.
Policer exceed action value	Policer exceed action value.
Policer violate action	Policer violate action.

The following example shows a sample display of three-level QoS policy configuration information on a GigabitEthernet interface.

```
RP/0/0/CPU0:router# show qos interface gigabitethernet 0/0/0/0 output

Interface GigabitEthernet0_0_0_0  --  Direction: output
Policy              :  3level-p
Total number of classes:  5
--------------------------------------------------
LEVEL1 class: classid   =   0x1
class name              =   class-default
Queue Max. BW.          =   20 mbits/sec (19968 kbps)

    LEVEL2 class: classid   =   0x2
    class name              =   prec1
    queue ID                =   6
    port ID                 =   0
    Queue Max. BW.          =   10 mbits/sec (9984 kbps)
    Queue Limit             =   1024 packets (1024 pkts)

        LEVEL3 class: classid   =   0x3
        class name              =   qosgrp2
        Policer average         = 3 mbits/sec (3008 kbps)
        Policer conform action  = Just TX
        Policer exceed action   = DROP PKT

        LEVEL3 class: classid   =   0x4
        class name              =   class-default
        Policer average         = 2 mbits/sec (2000 kbps)
        Policer conform action  = Just TX
        Policer exceed action   = DROP PKT

    LEVEL2 class: classid   =   0x5
    class name              =   class-default
    queue ID                =   7
    port ID                 =   0
```

```
        Weight                  =   1
        Queue Limit             =   1024 packets (1024 pkts)
```

The following table describes the significant fields shown in the display.

Table 9: show QoS interface Field Descriptions (three-level policy)

Field	Description
LEVEL1 class	Level 1 class identifier in hexadecimal format.
LEVEL2 class	Level 2 class identifier in hexadecimal format.
LEVEL3 class	Level 3 class identifier in hexadecimal format.
class name	Name that was assigned to this class with the **class** command.
Queue ID	Queue identifier.
Queue Min. BW	Minimum bandwidth allowed on this queue.
Queue Max. BW	Maximum bandwidth allowed on this queue.
Queue Max. Burst	Maximum burst size allowed on this queue.
Weight	Weight assigned to the specified class. If no weight has been assigned, the **show policy-map interface** command output shows "No explicit weight assigned for this class."
Queue Limit	Configured queue limit.
Policer average	Average Committed Information Rate (CIR) in bits per second (bps), gigabits per second (gbps), kilobits per second (KBits), or megabits per second (mbps).
Policer conform burst	Configured burst size, expressed in bytes, gigabytes (GB), kilobytes (KB), megabytes (MB), milliseconds (ms), or microseconds (us).
Policer excess burst	Programmed burst size for conforming cells, expressed in bytes, gigabytes (GB), kilobytes (KB), megabytes (MB), milliseconds (ms), or microseconds (us).
Policer conform action	Policer conform action.
Policer exceed action	Policer exceed action.

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Field	Description
Policer violate	Indicates whether the device supports excess burst size configuration. In the example, excess burst size configuration is supported for transmitted cells only.
Policer exceed action value	Policer exceed action value.
Policer violate action	Policer violate action.

show qos pol-gran location

To display policer granularity for a SPA Interface Processor, use the **show qos pol-gran location** command in EXEC mode.

show qos pol-gran location *interface-path-id*

Syntax Description

interface-path-id	Physical location of the Shared Interface Processor (SIP). Naming notation is *rack/slot/module* and a slash between values is required as part of the notation. • *rack*—Chassis number of the rack. • *slot*—Physical slot number of the modular services card or line card. • *module*—Module number. A physical layer interface module (PLIM) is always 0.

Command Default

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 3.8.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **show qos interface** command displays policer granularity for a SPA Interface Processor and all of its installed SPAs. Use this command to verify the policer granularity configured using the **hw-module qos pol-gran location** command.

Task ID

Task ID	Operations
qos	read

Examples

The following sample output shows the configured (8 kbps) and default (64 kbps) policer granularity for the SIP at location 0/1/CPU0:

```
RP/0/0/CPU0:router# show qos pol-gran location 0/1/CPU0

QoS Policer Granularity Rate
Admin Value:     8 kbps
Oper Value:      64 kbps
```

The following table describes the significant fields shown in the display.

Table 10: show QoS pol-gran location Field Descriptions

Field	Description
Admin Value	Policer granularity configured using the **hw-module qos pol-gran location** command.
Oper Value	Default policer granularity for this SIP.

Related Commands

Command	Description
hw-module qos pol-gran location, on page 44	Overrides the default policer granularity.

switch-fabric service-policy

To configure a service policy for the switch fabric, use the **switch-fabric service-policy** command in global configuration mode. To remove a specified service policy from the switch fabric, use the **no** form of this command.

switch-fabric service-policy *policy-map-name*

no switch-fabric service-policy *policy-map-name*

Syntax Description		
policy-map-name	Name of the predefined policy map to be used as a QoS policy. The name can be a maximum of 40 alphanumeric characters.	

Command Default   No service policy is specified.

Command Modes   Global configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operations
qos	read, write

Examples   The following example configures the service policy for policy map1.

```
RP/0/0/CPU0:router# configure
RP/0/0/CPU0:router(config)# switch-fabric service-policy map1
```

violate-action

To configure the action to take on packets that violate the rate limit, use the **violate-action** command in policy map police configuration mode. To remove a conform action from the policy-map, use the **no** form of this command.

violate-action drop

no violate-action drop

Syntax Description

drop	Drops the packet.

Command Default   No default behavior or values

Command Modes   Policy map police configuration

Command History

Release	Modification
Release 3.4.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes the proper task IDs. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

For more information regarding the traffic policing feature refer to the police rate, on page 76 command.

The **violate-action** command can set the DSCP, the precedence, or the discard class for IP packets, and experimental and discard-class values for MPLS packets.

Task ID

Task ID	Operations
qos	read, write

Examples   In the following example for MPLS, traffic policing is configured to drop packets that violate the rate limit:

```
RP/0/0/CPU0:router(config)# class-map class1
RP/0/0/CPU0:router(config-cmap)# match mpls experimental topmost 0
RP/0/0/CPU0:router(config-cmap)# exit
RP/0/0/CPU0:router(config)# policy-map policy1
RP/0/0/CPU0:router(config-pmap)# class class1
RP/0/0/CPU0:router(config-pmap-c)# police rate 250 kbps burst 50
```

```
RP/0/0/CPU0:router(config-pmap-c-police)# violate-action drop
RP/0/0/CPU0:router(config-pmap-c-police)# exit
RP/0/0/CPU0:router(config-pmap-c)# exit
RP/0/0/CPU0:router(config-pmap)# exit
RP/0/0/CPU0:router(config)# interface gigabitethernet 0/1/0/9
RP/0/0/CPU0:router(config-if) service-policy input policy1
```

Related Commands	Command	Description
	conform-action, on page 22	Configures the action to take on packets that conform to the rate limit.
	exceed-action, on page 28	Configures the action to take on packets that exceed the rate limit.
	police rate, on page 76	Configures traffic policing and enters policy map police configuration mode.
	policy-map, on page 80	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
	show policy-map interface, on page 131	Displays policy configuration information for all classes configured for all service policies on the specified interface.

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