Quality of Service Commands

This module lists quality of service (QoS) commands in alphabetical order. For detailed information about QoS concepts, configuration tasks, and examples, see the *Modular Quality of Service Configuration Guide for Cisco NCS 6000 Series Routers Modular Quality of Service Configuration Guide for Cisco NCS 6000 Series Routers*.

- bandwidth (QoS), page 3
- bandwidth remaining, page 7
- class (policy-map), page 9
- class-map, page 11
- clear qos counters interface, page 14
- conform-action, page 16
- end-class-map, page 19
- end-policy-map, page 20
- exceed-action, page 21
- match access-group, page 24
- match cos, page 26
- match dscp, page 28
- match mpls experimental topmost, page 32
- match precedence, page 34
- match qos-group, page 37
- match vlan, page 39
- police rate, page 41
- policy-map, page 44
- priority (QoS), page 46
- queue-limit, page 48
- random-detect, page 50

- random-detect discard-class, page 53
- random-detect dscp, page 55
- random-detect exp, page 57
- random-detect precedence, page 59
- service-policy (interface), page 61
- service-policy (policy map class), page 63
- set cos, page 65
- set discard-class, page 67
- set dscp, page 69
- set mpls experimental, page 71
- set precedence, page 73
- set qos-group, page 75
- shape average, page 77
- show policy-map interface, page 79
- show policy-map targets, page 84
- show qos interface , page 86
- violate-action, page 90

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.
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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

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

Note The bandwidth value takes into account the Layer 2 encapsulation that is applied to traffic leaving the interface. For , the encapsulation is considered to be 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.

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.

- 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.

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

```
policy-map sub_int_hqos
 class class-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

This 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/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth percent 50
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# class class2
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth percent 10
```

Related Commands

Command	Description
class (policy-map), on page 9	Specifies the name of the class whose policy you want to create or change.
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
queue-limit, on page 48	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 59	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence.
show policy-map interface, on page 79	Displays policy configuration information for all classes configured for all service policies on the specified interface.
show qos interface , on page 86	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.

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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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. 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. 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.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how the remaining bandwidth is shared by classes class1 and class2 in a 20:80 ratio.

```
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth remaining percent 20
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# class class2
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth remaining percent 80
```

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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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/RP0/CPU0:router(config)# policy-map pm1
RP/0/RP0/CPU0:router(config-pmap)# end-policy-map
RP/0/RP0/CPU0:router(config)# end
!
RP/0/RP0/CPU0:router# show running-config
!
policy-map pm1
 class class-default
 !
 end-policy-map
!
```

Task ID

Task ID	Operations
qos	read, write

Examples

This 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/RP0/CPU0:router(config)# class-map class1
RP/0/RP0/CPU0:router(config-cmap)# match precedence 3
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:routerconfig-pmap-c)# shape average percent 30
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# class class-default
RP/0/RP0/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 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	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 XR Config 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

XR Config

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

These commands can be used in a class map:

- **match access-group**
- **match [not] cos**

- **match destination-address**
- **match [not] discard-class**
- **match [not] dscp**
- **match [not] mpls experimental topmost**
- **match [not] precedence**
- **match precedence**
- **match [not] protocol**
- **match [not] qos-group**
- **match source-address**
- **match vlan** *vlan-id*

Task ID

Task ID	Operations
qos	read, write

Examples

This 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/RP0/CPU0:router(config)# class-map class101
RP/0/RP0/CPU0:router(config-cmap)# match access-group ipv4 101
```

Related Commands

Command	Description
class (policy-map), on page 9	Specifies the name of the class whose policy you want to create or change.
match access-group, on page 24	Identifies a specified access control list (ACL) number as the match criteria for a class map.
match cos, on page 26	Identifies specified class of service (CoS) values as a match criteria in a class map.
match destination-address	Identifies a specific destination MAC address explicitly as a match criterion in a class map.
match discard-class	Identifies specific discard class values as a match criteria for a class map.
match dscp, on page 28	Identifies specific IP differentiated services code point (DSCP) values as match criteria for a class map.
match mpls experimental topmost, on page 32	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 34	Identifies IP precedence values as match criteria.

Command	Description
match protocol	Identifies a specific protocol as the match criterion for a class map.
match qos-group, on page 37	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 39	Identifies selected VLAN IDs 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 XR EXEC mode.

clear qos counters interface *type* [**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

XR EXEC

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

The MIB counters are not reset with this command.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how to clear output QoS counters attached to HundredGigE interface 0/1/0/0:

```
RP/0/RP0/CPU0:router# clear qos counters interface HundredGigE 0/1/0/0 output
```

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: • **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. • **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 1: IP DSCP Reserved Keywords, on page 29 for a list of valid values. • **dscp** [**tunnel**] *value* —Sets the differentiated services code point (DSCP) value and sends the packet. See Table 1: IP DSCP Reserved Keywords, on page 29 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 2: IP Precedence Values and Names, on page 35 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.
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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 41 command.

The **conform-action** command is used to set the DSCP, the precedence, or the discard class for IP packets, and experimental or discard class values for MPLS packets.

Task ID

Task ID	Operations
qos	read, write

Examples

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

```
RP/0/RP0/CPU0:router(config)# class-map class
RP/0/RP0/CPU0:router(config-cmap)# match mpls experimental topmost 0
RP/0/RP0/CPU0:router(config-cmap)# exit

RP/0/RP0/CPU0:router(config)# policy-map child
RP/0/RP0/CPU0:router(config-pmap)# class prec1
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 100000000 peak-rate 3125000 peak-burst
3125000
RP/0/RP0/CPU0:router(config-pmap-c-police)# conform-action set mpls experimental imp 1
RP/0/RP0/CPU0:router(config-pmap-c-police)# conform-action set qos-group 1
RP/0/RP0/CPU0:router(config-pmap-c-police)# exit
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if) service-policy input policy1
```

Related Commands

Command	Description
exceed-action, on page 21	Configures the action to take on packets that exceed the rate limit.
police rate, on page 41	Configures traffic policing and enters policy map police configuration mode.
policy-map, on page 44	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 79	Displays policy configuration information for all classes configured for all service policies on the specified interface.

Command	Description
violate-action, on page 90	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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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

This example shows how to end the class map configuration and exit class map configuration mode:

```
RP/0/RP0/CPU0:router(config)# class-map class101
RP/0/RP0/CPU0:router(config-cmap)# match access-group ipv4 101
RP/0/RP0/CPU0:router(config-cmap)# end-class-map
```

Related Commands

Command	Description
class-map, on page 11	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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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

This example shows how to end the policy map configuration and exit policy map configuration mode.

```
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# police 250
RP/0/RP0/CPU0:router(config-pmap-c)# set precedence 3
RP/0/RP0/CPU0:router(config-pmap)# end-policy-map
```

Related Commands

Command	Description
policy-map, on page 44	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: • **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. • **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 1: IP DSCP Reserved Keywords, on page 29 for a list of valid values. • **dscp** [**tunnel**] *value* —Sets the differentiated services code point (DSCP) value and sends the packet. See Table 1: IP DSCP Reserved Keywords, on page 29 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 2: IP Precedence Values and Names, on page 35 for a list of valid values. • **precedence** [**tunnel**] *precedence* —Sets the IP precedence and sends the packet. See Table 2: IP Precedence Values and Names, on page 35 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.
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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 41 command.

The **exceed-action** command can be used to set the DSCP, the precedence, or the discard class for IP packets, and experimental or discard-class values for MPLS packets.

Task ID

Task ID	Operations
qos	read, write

Examples

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

```
RP/0/RP0/CPU0:router(config)# class-map class1
RP/0/RP0/CPU0:router(config-cmap)# match mpls experimental topmost 0
RP/0/RP0/CPU0:router(config-cmap)# exit

RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 250 kbps burst 50
RP/0/RP0/CPU0:router(config-pmap-c-police)# exceed-action drop
RP/0/RP0/CPU0:router(config-pmap-c-police)# exit
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if) service-policy input policy1
```

Related Commands

Command	Description
conform-action, on page 16	Configures the action to take on packets that conform to the rate limit.
police rate, on page 41	Configures traffic policing and enters policy map police configuration mode.

Command	Description
policy-map, on page 44	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 79	Displays policy configuration information for all classes configured for all service policies on the specified interface.
violate-action, on page 90	Configures the action to take on packets that violate the rate limit.

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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

Access Control Entries with TCP fields such as, SYN, ACK and FIN in the corresponding ACL are not supported.

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

This 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/RP0/CPU0:router(config)# class-map map1
RP/0/RP0/CPU0:router(config-cmap)# match access-group ipv4 map1
RP/0/RP0/CPU0:router(config-cmap)# match access-group ipv6 map2
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.

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 [not] cos *cos-value* [*cos-value1 ... cos-value7*]

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

Syntax Description

not	(Optional) Negates the specified match result.
cos-value	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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 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.

Task ID

Task ID	Operations
qos	read, write

Examples

This 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 HundredGigE interface 0/7/0/0 .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/RP0/CPU0:router(config)# class-map cos146
RP/0/RP0/CPU0:router(config-cmap)# match cos 1 4 6
RP/0/RP0/CPU0:router(config-cmap)# exit

RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class cos146
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input policy1
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
match access-group, on page 24	Identifies a specified access control list (ACL) number as the match criteria for a class map.
match destination-address	Identifies a specific destination MAC address explicitly as a match criterion in a class map.
match cos, on page 26	Identifies specified class of service (CoS) values as a match criteria in a class map.
match discard-class	Identifies specific discard class values as a match criteria for a class map.
match dscp, on page 28	Identifies specific IP differentiated services code point (DSCP) values as match criteria for a class map.
match precedence, on page 34	Identifies IP precedence values as match criteria.
match protocol	Identifies a specific protocol as the match criterion for a class map.
match qos-group, on page 37	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 39	Identifies selected VLAN IDs as the match criteria for a class map.
policy-map, on page 44	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
set cos, on page 65	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

not	(Optional) Negates the specified match result.
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 1: IP DSCP Reserved Keywords, on page 29 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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

Table 1: 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
48	CS6

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

Task ID

Task ID	Operations
qos	read, write

Examples

This 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 HundredGigE 0/7/0/0for 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/RP0/CPU0:router(config)# class-map dscp14
RP/0/RP0/CPU0:router(config-cmap)# match dscp ipv4 14
RP/0/RP0/CPU0:router(config-cmap)# exit

RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class dscp14
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input policy1
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
set dscp, on page 69	Marks a packet by setting the IP differentiated services code point (DSCP) in the type of service (ToS) byte.
match cos, on page 26	Identifies specified class of service (CoS) values as a match criteria in a class map.
match discard-class	Identifies specific discard class values as a match criteria for a class map.
match dscp, on page 28	Identifies specific IP differentiated services code point (DSCP) values as match criteria for a class map.
match precedence, on page 34	Identifies IP precedence values as match criteria.

Command	Description
match protocol	Identifies a specific protocol as the match criterion for a class map.
match qos-group, on page 37	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 39	Identifies selected VLAN IDs as the match criteria for a class map.

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 [**not**] **mpls experimental topmost** *exp-value* [*exp-value1 ...exp-value7*]

no match [**not**] **mpls experimental topmost** *exp-value* [*exp-value1 ...exp-value7*]

Syntax Description

not	**not**
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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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

This 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 HundredGigE 0/7/0/0 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/RP0/CPU0:router(config)# class-map mplsmap1
RP/0/RP0/CPU0:router(config-cmap)# match mpls experimental topmost 1
RP/0/RP0/CPU0:router(config-cmap)# exit
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class mplsmap1
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input policy1
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
match dscp, on page 28	Identifies specific IP differentiated services code point (DSCP) values as match criteria for a class map.
policy-map, on page 44	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 71	Sets the experimental (EXP) value of the Multiprotocol Label Switching (MPLS) packet topmost or imposition labels.
show policy-map interface, on page 79	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 [**not**] **precedence** [**ipv4**| **ipv6**] *precedence-value* [*precedence-value1 ... precedence-value7*]

no match [**not**] **precedence** [**ipv4**| **ipv6**] *precedence-value* [*precedence-value1 ... precedence-value7*]

Syntax Description

not	(Optional) Negates the specified match result.
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 2: IP Precedence Values and Names, on page 35 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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

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

Table 2: 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

This 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 HundredGigE 0/7/0/0 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/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# class-map ipprec5
RP/0/RP0/CPU0:router(config-cmap)# match precedence ipv4 5
RP/0/RP0/CPU0:router(config-cmap)# exit
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class ipprec5
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/RP0/CPU0:router(config-pmap-c)# exit
```

```
RP/0/RP0/CPU0:router(config-pmap)# exit
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy  input policy1
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
set precedence, on page 73	Sets the precedence value in the IP header.
show policy-map interface, on page 79	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 [not] qos-group [*qos-group-id lower-limit*]

no match qos-group

Syntax Description

not	(Optional) Negates the specified match result.
qos-group-id	QoS group identifier that specifies the exact value from 0 to 511 or a range of values from 0 to 511.
lower-limit	Specifies the lower limit of QoS group that should be matched.

Command Default

No match criteria are specified.

Command Modes

Class map configuration

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 30, and 31. Only one of the eight values is needed to yield a match (OR operation).

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

This example shows a service policy called policy1 attached to an interface. In this example, class map qosgroup5 will evaluate all packets leaving HundredGigE 0/7/0/0 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/RP0/CPU0:router(config)# class-map qosgroup5
RP/0/RP0/CPU0:router(config-cmap)# match qos-group 5
RP/0/RP0/CPU0:router(config-cmap)# exit
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class qosgroup5
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input policy1
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	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 67	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 75	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. **Note** The router supports up to eight values or ranges on a single match statement, and up to 300 values or ranges specified on up to eight match statements.

Command Default

No match criteria are specified.

Command Modes

Class map configuration

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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

This 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 HundredGigE 0/7/0/0 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/RP0/CPU0:router(config)# class-map vlan1
RP/0/RP0/CPU0:router(config-cmap)# match vlan 1234 1698 3000-4000
RP/0/RP0/CPU0:router(config-cmap)# exit
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class vlan1
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth 300
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input policy1
```

Related Commands

Command	Description
class-map, on page 11	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* | **per-thousand** *value* | **per-million** *value*} [**burst** *burst-size* [*burst-units*]] [**peak-rate** {*value* [*units*]| **percent** *percentage*}] [**peak-burst** *peak-burst* [*burst-units*]]

no police rate {*value* [*units*]| **percent** *percentage* | **per-thousand** *value* | **per-million** *value*} [**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.
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.
per-thousand *value*	Specifies the committed information rate in per thousand of the link bandwidth.
per-million *value*	Specifies the committed information rate in per million of the link bandwidth.
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*. The 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 5.0.0	This command was introduced.

Usage Guidelines

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

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.

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.

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
 !
```

For more information, see the "Committed Bursts and Excess Bursts" section in the *Modular Quality of Service Configuration Guide for Cisco NCS 6000 Series Routers*Modular Quality of Service Configuration Guide for Cisco NCS 6000 Series Routers.

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 HundredGigE interface 0/1/0/0:

```
RP/0/RP0/CPU0:router(config)# class-map class1
RP/0/RP0/CPU0:router(config-cmap)# match mpls experimental topmost 0
RP/0/RP0/CPU0:router(config-cmap)# exit

RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 250 kbps burst 50
RP/0/RP0/CPU0:router(config-pmap-c-police)#conform-action set mpls experimental topmost 4
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if) service-policy input policy1
```

Related Commands

Command	Description
policy-map, on page 44	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 79	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 XR Config 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

XR Config

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 1024 classes in one policy map, no policy map can contain more than 1024 class policies. The maximum number of 1024 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

These 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/RP0/CPU0:router(config)# class-map class1
RP/0/RP0/CPU0:router(config-cmap)# match access-group ipv4 136

RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 250

RP/0/RP0/CPU0:router(config-pmap-c)# exit

RP/0/RP0/CPU0:router(config-pmap)# class class-default
RP/0/RP0/CPU0:router(config-pmap-c)# queue-limit 1000000 bytes
```

Related Commands

Command	Description
class (policy-map), on page 9	Specifies the name of the class whose policy you want to create or change.
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.

priority (QoS)

To assign priority to a traffic class based on the amount of available bandwidth within a traffic policy, 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 multiple levels of priority to a traffic class. Value can be 1 or 2. Default level is 1. Level 1 traffic has higher priority.

Command Default

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 .

Task ID

Task ID	Operations
qos	read, write

Examples

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

```
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1


RP/0/RP0/CPU0:router(config-pmap-c)# priority level 1
(config-pmap-c)#police rate percent 20
```

Related Commands

Command	Description
bandwidth (QoS), on page 3	Specifies the minimum bandwidth allocated to a class belonging to a policy map.
policy-map, on page 44	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 79	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*]

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: • **bytes —**bytes • **ms —**milliseconds • **packets —**packets (default) • **us —**microseconds **Note** When the specified *units* is packets, packets are assumed to be 256 bytes in size.

Command Default

100 milliseconds: maximum threshold for tail drop

10 milliseconds: maximum threshold for high-priority queues

Maximum threshold units are in packets.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

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)

This 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

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

```
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# queue-limit 1000000
```

Related Commands

Command	Description
class (policy-map), on page 9	Specifies the name of the class whose policy you want to create or change.
policy-map, on page 44	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 86	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 {**cos** *value*| **default**| **discard-class** *value*| **dscp** *value*| **exp** *value*| **precedence** *value*| *min-threshold* [*units*] *max-threshold* [*units*]}

no random-detect

Syntax Description

cos *value*	COS-based WRED.
default	Enables RED with default minimum and maximum thresholds.
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 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: • **bytes—**bytes • **gbytes—**gigabytes • **kbytes—**kilobytes • **mbytes —**megabytes • **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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 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.

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—30ms 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

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

```
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# random-detect 1000000 2000000
```

Related Commands

Command	Description
random-detect precedence, on page 59	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence.
show policy-map interface, on page 79	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: • **bytes—**bytes • **gbytes—**gigabytes • **kbytes—**kilobytes • **mbytes —**megabytes • **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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

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

This 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/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# random-detect discard-class 3 1000000 2000000
```

Related Commands

Command	Description
class (policy-map), on page 9	Specifies the name of the class whose policy you want to create or change.
policy-map, on page 44	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 59	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence.
show policy-map interface, on page 79	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 1: IP DSCP Reserved Keywords, on page 29 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: • **bytes**—bytes • **gbytes**—gigabytes • **kbytes**—kilobytes • **mbytes** —megabytes • **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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

Reserved keywords can be specified instead of numeric values. See Table 1: IP DSCP Reserved Keywords, on page 29 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

This 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/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# random-detect dscp AF11 1000000 2000000
```

Related Commands

Command	Description
class (policy-map), on page 9	Specifies the name of the class whose policy you want to create or change.
policy-map, on page 44	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 59	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence.
show policy-map interface, on page 79	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: • **bytes—**bytes • **gbytes—**gigabytes • **kbytes—**kilobytes • **mbytes —**megabytes • **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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

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

This 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/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# random-detect exp 4 1000000 20000
```

Related Commands

Command	Description
class (policy-map), on page 9	Specifies the name of the class whose policy you want to create or change.
policy-map, on page 44	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 55	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a specific differentiated services code point (DSCP) value.
random-detect precedence, on page 59	Configures the Weighted Random Early Detection (WRED) thresholds for packets with a particular IP precedence.
show policy-map interface, on page 79	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 2: IP Precedence Values and Names, on page 35 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: • **bytes—**bytes • **gbytes—**gigabytes • **kbytes—**kilobytes • **mbytes —**megabytes • **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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

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

This 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/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)#random-detect precedence 3 1000000 2000000
```

Related Commands

Command	Description
bandwidth (QoS), on page 3	Specifies the minimum bandwidth allocated to a class belonging to a policy map.
class (policy-map), on page 9	Specifies the name of the class whose policy you want to create or change.
policy-map, on page 44	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 55	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 79	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**{**layer1**| **nolayer**}

no service-policy {**input**| **output**} *policy-map* **account**{**layer1**| **nolayer**}

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 layer1	(Optional) Turns on Layer 1 QoS accounting.
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 3.6.0	The command was supported in Layer 2 transport configuration mode.
Release 4.3.0	The command was supported in dynamic template configuration mode in BNG.
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

Task ID

Task ID	Operations
qos	read, write

Examples

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

```
RP/0/RP0/CPU0:router(config)# class-map class1
RP/0/RP0/CPU0:router(config-cmap)# match precedence ipv4 1
RP/0/RP0/CPU0:router(config-cmap)# exit
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# set precedence 2
RP/0/RP0/CPU0:router(config-pmap)# exit
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy output policy1
```

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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 these restrictions:

- The **priority** command can be used in either the parent or the child policy, but not both policies simultaneously.

Task ID

Task ID	Operations
qos	read, write

Examples

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

```
RP/0/RP0/CPU0:router(config)# policy-map child
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# priority
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit
RP/0/RP0/CPU0:router(config)# policy-map parent
RP/0/RP0/CPU0:router(config-pmap)# class class-default
RP/0/RP0/CPU0:router(config-pmap-c)# shape average 10000000
RP/0/RP0/CPU0:router(config-pmap-c)# service-policy child
```

Related Commands

Command	Description
bandwidth (QoS), on page 3	Specifies the minimum bandwidth allocated to a class belonging to a policy map.
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
priority (QoS), on page 46	Assigns a priority to a class of traffic belonging to a policy map.
service-policy (interface), on page 61	Attaches 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 [inner] cos-value

no set cos [inner] cos-value

Syntax Description

inner	(Optional) Specifies the inner CoS in, for example, a QinQ configuration.
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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

The **set cos inner** command is supported on:

- Egress only: conditional and unconditional marking
- Layer 2 main interfaces and subinterfaces
- Layer 3 main interfaces

Task ID

Task ID	Operations
qos	read, write

Examples

In this 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 HundredGigE subinterface 0/1/0/0.3 VLAN.

```
RP/0/RP0/CPU0:router(config)# policy-map cos-set
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# set cos 1
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# class class2
RP/0/RP0/CPU0:router(config-pmap-c)# set cos 2
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/1/0/0.3
RP/0/RP0/CPU0:router(config-subif)# service-policy output cos-set
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	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 61	Attaches 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 default behavior or values

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 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 has only local significance on a node.

Task ID

Task ID	Operations
qos	read, write

Examples

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

```
RP/0/RP0/CPU0:router(config)# class-map cust1
RP/0/RP0/CPU0:router(config-cmap)# match mpls experimental topmost 1
RP/0/RP0/CPU0:router(config-cmap)# exit
RP/0/RP0/CPU0:router(config)# policy-map policy2
RP/0/RP0/CPU0:router(config-pmap)# class cust1
RP/0/RP0/CPU0:router(config-pmap-c)# set discard-class 5
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/1/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input policy2
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	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 61	Attaches 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 for IPsec tunnels.
dscp-value	Number from 0 to 63 that sets the DSCP value. Reserved keywords can be specified instead of numeric values. Table 1: IP DSCP Reserved Keywords, on page 29 describes the reserved keywords.

Command Default

No default behavior or values

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

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 1: IP DSCP Reserved Keywords, on page 29 describes the reserved keywords.

Task ID

Task ID	Operations
qos	read, write

Examples

In this 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/RP0/CPU0:router (config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# set dscp 8
```

Related Commands

Command	Description
policy-map, on page 44	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 61	Attaches a policy map to an input interface or output interface to be used as the service policy for that interface.
set precedence, on page 73	Sets the precedence value in the IP header.
show policy-map interface, on page 79	Displays policy configuration information for all classes configured for all service policies on the specified interface.

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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 queuing 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

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

```
RP/0/RP0/CPU0:router(config)# class-map class1
RP/0/RP0/CPU0:router(config-cmap)# match access-group ipv4 acl101
RP/0/RP0/CPU0:router(config-cmap)# exit

RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# set mpls experimental 5
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/1/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy output policy1
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	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 61	Attaches 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 2: IP Precedence Values and Names, on page 35 describes the reserved keywords.

Command Default

No default behavior or values

Command Modes

Policy map class configuration

Command History

Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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.

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

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

```
RP/0/RP0/CPU0:router(config)# class-map class1
RP/0/RP0/CPU0:router(config-cmap)# match access-group ipv4 customer1
RP/0/RP0/CPU0:router(config-cmap)# exit

RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# set precedence 5
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# interface POS 0/1/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy output policy1
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
policy-map, on page 44	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 61	Attaches 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 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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

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

```
RP/0/RP0/CPU0:router(config)# class-map class1
RP/0/RP0/CPU0:router(config-cmap)# match mpls experimental topmost 1
RP/0/RP0/CPU0:router(config-cmap)# exit
```

```
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# set qos-group 5
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/1/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input policy1
```

Related Commands

Command	Description
class-map, on page 11	Defines a traffic class and the associated rules that match packets to the class.
match dscp, on page 28	Identifies specific IP differentiated services code point (DSCP) values as match criteria for a class map.
policy-map, on page 44	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 61	Attaches 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

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.
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 5.0.0	This command was introduced.

Usage Guidelines

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

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.

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

This example sets traffic shaping to 50 percent of the parent shaper rate:

```
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# shape average percent 50
```

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

```
RP/0/RP0/CPU0:router(config)# policy-map policy1
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# shape average 5000000 kbps
```

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 XR EXEC mode.

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

Syntax Description

interface 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. 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.

Command Default

No default behavior or values

Command Modes

XR EXEC

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 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/RP0/CPU0:router# show policy-map interface TenGigE 0/4/0/0/7 output

Thu Sep  5 10:01:58.535 UTC

TenGigE0/4/0/0/7 output: egress-8q

Class prec-1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                  0/0                  0
    Transmitted         :                  0/0                  0
    Total Dropped       :                  0/0                  0
  Queueing statistics
    Queue ID                              : 50
    High watermark  (bytes)/(ms)          : 1256996/100
    Inst-queue-len  (bytes)/(ms)          : 1256996/100
    Avg-queue-len   (bytes)/(ms)          : 1249924/99
    Taildropped(packets/bytes)            : 0/0
Class prec-2
  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
    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
Class prec-3
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                  0/0                  0
    Transmitted         :                  0/0                  0
    Total Dropped       :                  0/0                  0
  Queueing statistics
    Queue ID                              : 54
    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
Class prec-5
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                  0/0                  0
    Transmitted         :                  0/0                  0
    Total Dropped       :                  0/0                  0
  Queueing statistics
    Queue ID                              : 55
    High watermark  (bytes)/(ms)          : 383712/30
    Inst-queue-len  (bytes)/(ms)          : 383712/30
    Avg-queue-len   (bytes)/(ms)          : 368071/29
```

```
    Taildropped(packets/bytes)           : 0/0
    RED random drops(packets/bytes)      : 0/0
    RED maxthreshold drops(packets/bytes): 0/0

    RED profile (default)
    RED Transmitted (packets/bytes)      : 0/0
    RED random drops(packets/bytes)      : 0/0
    RED maxthreshold drops(packets/bytes): 0/0
Class prec-6
  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                           : 58
    High watermark  (bytes)/(ms)       : 192/0
    Inst-queue-len  (bytes)/(ms)       : 0/0
    Avg-queue-len   (bytes)/(ms)       : 0/0
    Taildropped(packets/bytes)         : 0/0
Class prec-7
  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                           : 59
    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
Class prec-0
  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                           : 62
    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                           : 62
    High watermark  (bytes)/(ms)       : 1254960/100
    Inst-queue-len  (bytes)/(ms)       : 1249980/99
    Avg-queue-len   (bytes)/(ms)       : 1249980/99
    Taildropped(packets/bytes)         : 0/0
```

This table describes the significant fields shown in the display.

Table 3: 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.
Queuing 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.
Sent full header	Number of packets sent with a full header.
Saved	Number of bytes saved.
Sent	Number of bytes sent.

Field	Description
Efficiency improvement factor	Ratio of the packet's original full size to the packet's compressed size.

show policy-map targets

To display information about the interfaces on which policy maps are applied, use the **show policy-map targets** command in XR EXEC mode.

show policy-map targets [**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 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

XR EXEC

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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/RP0/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 79	Displays policy configuration information for all classes configured for all service policies on the specified interface.

show qos interface

To display QoS information for a specific interface, use the **show qos interface** command in the XR EXEC mode.

show qos interface *type interface-path-id* {**input**| **output**} [**host-link** *interface-path-id*| **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.
host-link	Specifies the host-link.

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

XR EXEC

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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

This is the sample output shows the L2VPN QoS information on TenGigE 0/4/0/0/7 interface:

```
RP/0/RP0/CPU0:routershow qos interface TenGigE 0/4/0/0/7 output
Thu Sep  5 10:02:14.217 UTC
NOTE:- Configured values are displayed within parentheses
Interface TenGigE0/4/0/0/7 ifh 0x2000048  -- output policy
NPU Id:       0
Total number of classes:       8
Interface Bandwidth:           10000000 kbps
Accounting Type:               Layer2 (Include Layer 2 encapsulation and above)
------------------------------------------------
Level1 Class                              =   prec-1
Schedule entry ID                         =   0x32 (0x10001)
Egressq Queue ID                          =   50 (LP queue)
Queue Max. BW.                            =   100000 kbps (1 %)
Queue Min. BW.                            =   0 kbps (default)
Weight                                    =   25 (BWR not configured)
Guaranteed service rate                   =   100000 kbps
TailDrop Threshold                        =   1250000 bytes / 100 ms (default)
Policer not configured for this class
WRED not configured for this class
```

```
Level1 Class (HP2)                        =   prec-2
Schedule entry ID                         =   0x33 (0x10002)
Egressq Queue ID                          =   51 (HP2 queue)
Guaranteed service rate                   =   10000000 kbps
TailDrop Threshold                        =   12500000 bytes / 10 ms (default)

Policer Bucket Id                         =   0x9000100095103
Policer committed rate                    =   99968 kbps (1 %)
Policer conform burst                     =   124928 bytes (default)
Policer conform action                    =   Just TX
Policer exceed action                     =   DROP PKT
WRED not configured for this class

Level1 Class                              =   prec-3
Schedule entry ID                         =   0x36 (0x10003)
Egressq Queue ID                          =   54 (LP queue)
Queue Max. BW.                            =   100000 kbps (1 %)
Queue Min. BW.                            =   100000 kbps (1 %)
Weight                                    =   25 (BWR not configured)
Guaranteed service rate                   =   100000 kbps
TailDrop Threshold                        =   13750 bytes / 1 ms (1100 us)
Policer not configured for this class
WRED not configured for this class

Level1 Class                              =   prec-5
Schedule entry ID                         =   0x37 (0x10004)
Egressq Queue ID                          =   55 (LP queue)
Queue Max. BW.                            =   100000 kbps (1 %)
Queue Min. BW.                            =   0 kbps (default)
Weight                                    =   25 (BWR not configured)
Guaranteed service rate                   =   100000 kbps
TailDrop Threshold                        =   1250000 bytes / 100 ms (default)
Policer not configured for this class

WRED table handle                         =   0x0

RED profile
WRED Min. Threshold                       =   249856 bytes (20 ms)
WRED Max. Threshold                       =   374784 bytes (30 ms)
WRED First Segment                        =   1334
WRED Segment Size                         =   11

Level1 Class (HP1)                        =   prec-6
Schedule entry ID                         =   0x3a (0x10005)
Egressq Queue ID                          =   58 (HP1 queue)
Guaranteed service rate                   =   10000000 kbps
TailDrop Threshold                        =   12500000 bytes / 10 ms (default)

Policer Bucket Id                         =   0x90001000a5103
Policer committed rate                    =   99968 kbps (1 %)
Policer conform burst                     =   124928 bytes (default)
Policer conform action                    =   Just TX
Policer exceed action                     =   DROP PKT
WRED not configured for this class

Level1 Class (HP1)                        =   prec-7
Schedule entry ID                         =   0x3b (0x10006)
Egressq Queue ID                          =   59 (HP1 queue)
Guaranteed service rate                   =   10000000 kbps
TailDrop Threshold                        =   12500000 bytes / 10 ms (default)

Policer Bucket Id                         =   0x90001000b5103
Policer committed rate                    =   99968 kbps (1 %)
Policer conform burst                     =   124928 bytes (default)
Policer conform action                    =   Just TX
Policer exceed action                     =   DROP PKT
WRED not configured for this class

Level1 Class                              =   prec-0
Egressq Queue ID                          =   62 (Default LP queue)

Policer Bucket Id                         =   0x90001000c5103
```

```
Policer committed rate                  =   99968 kbps (1 %)
Policer conform burst                   =   1245184 bytes (default)
Policer conform action                  =   Just TX
Policer exceed action                   =   DROP PKT
WRED not configured for this class

Level1 Class                            =   class-default
Schedule entry ID                       =   0x3e (0x10008)
Egressq Queue ID                        =   62 (Default LP queue)
Queue Max. BW.                          =   100000 kbps (1 %)
Queue Min. BW.                          =   0 kbps (default)
Weight                                  =   25 (BWR not configured)
Guaranteed service rate                 =   100000 kbps
TailDrop Threshold                      =   1250000 bytes / 100 ms (default)
Policer not configured for this class
WRED not configured for this class
```

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**| **set** *options*| **transmit**}

no violate-action {**drop**| **set** *options*| **transmit**}

Syntax Description

drop	Drops the packet.
transmit	Transmits the packets.

Command Default

No default behavior or values

Command Modes

Policy map police configuration

Command History

Release	Modification
Release 5.0.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the 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 41 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 this example for MPLS, traffic policing is configured to drop packets that violate the rate limit:

```
RP/0/RP0/CPU0:router(config)# class-map class1
RP/0/RP0/CPU0:router(config-cmap)# match mpls experimental topmost 0
RP/0/RP0/CPU0:router(config-cmap)# exit
RP/0/RP0/CPU0:router(config)# policy-map policy1
```

```
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 250 kbps burst 50
RP/0/RP0/CPU0:router(config-pmap-c-police)# violate-action drop
RP/0/RP0/CPU0:router(config-pmap-c-police)# exit
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/1/0/0
RP/0/RP0/CPU0:router(config-if) service-policy input policy1
```

Related Commands

Command	Description
conform-action, on page 16	Configures the action to take on packets that conform to the rate limit.
exceed-action, on page 21	Configures the action to take on packets that exceed the rate limit.
police rate, on page 41	Configures traffic policing and enters policy map police configuration mode.
policy-map, on page 44	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 79	Displays policy configuration information for all classes configured for all service policies on the specified interface.