



Modular QoS Command Reference for Cisco NCS 5000 Series Routers

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Preface

This preface contains these sections:

- [Changes to This Document, on page v](#)
- [Communications, Services, and Additional Information, on page vi](#)

Changes to This Document

This table lists the technical changes made to this document since it was first released.

Table 1: Changes to This Document

Date	Summary
December 2015	Initial release of this document.
July 2016	Republished with documentation updates for Cisco IOS XR Release 6.0.2 features.
November 2016	Republished with documentation updates for Cisco IOS XR Release 6.1.x features
May 2017	Republished with documentation updates for Cisco IOS XR Release 6.1.31 features
March 2018	Republished for Release 6.3.2.
April 2019	Republished for Release 6.6.2
May 2019	Republished with documentation updates for Release 6.6.25 features
December 2019	Republished with documentation updates for Release 6.6.3 features
January 2020	Republished with documentation updates for Release 7.1.1 features
July 2021	Republished for Release 7.4.1.

Date	Summary
January 2022	Republished with documentation updates for Release 7.3.3.

Communications, Services, and Additional Information

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QoS Classification Commands

This chapter describes the commands used for QoS packet classification.

- [class \(policy-map\)](#), on page 2
- [class-map](#), on page 4
- [conform-action](#), on page 6
- [end-class-map](#), on page 8
- [end-policy-map](#), on page 9
- [exceed-action](#), on page 10
- [match access-group](#), on page 12
- [match cos](#), on page 14
- [match dscp](#), on page 16
- [match mpls experimental topmost](#), on page 19
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- [set dscp](#), on page 29
- [set qos-group](#), on page 30
- [show qos summary](#) , on page 32

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.
<i>class-name</i>	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 6.0	This command was introduced.

Usage Guidelines

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.

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 Single-Rate Two-Color (SR2C) in color-blind mode for conform and exceed actions are supported in ingress direction.



Note

It is mandatory to configure all the 8 qos-group classes (including class-default) for the egress policies in the Cisco NCS 5000 Series Routers.

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 pml
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 pml
  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 policy-in which is defined to policer 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-cmap)# exit

RP/0/RP0/CPU0:router(config)# policy-map policy-in
RP/0/RP0/CPU0:router(config-pmap)# class class1...
RP/0/RP0/CPU0:router(config-pmap-c)# police rate percent 30
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)# class class-default
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 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.

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 [traffic | qos]] [match-all] [match-any] class-map-name
no class-map [type [traffic | qos]] [match-all] [match-any] class-map-name
```

Syntax Description

type qos	(Optional) Specifies a quality-of-service (QoS) class-map.
traffic	(Optional) Specifies traffic type 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.
<i>class-map-name</i>	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 mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

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.



Note

It is mandatory to configure all the 8 qos-group classes (including class-default) for the egress policies in Cisco NCS 5001 and Cisco NCS 5002 Routers. One class-map can match only one qos-group.

These commands can be used in a class map match criteria for the ingress direction:

- **match access-group**
- **match [not] cos**
- **match [not] dscp**
- **match [not] mpls experimental topmost**
- **match [not] precedence**
- **match precedence**
- **match [not] protocol**

The command used in a class map match criteria for the egress direction:

- **match [not] qos-group**

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows how to specify class1 as the name of a class and defines a class map for this class. The packets that match the access list 1 are matched to class class1.

```
RP/0/RP0/CPU0:router(config)# class-map class1  
RP/0/RP0/CPU0:router(config-cmap)# match access-group ipv4 1
```

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 <i>options</i>	(Optional) Configures the specified packet properties. Replace <i>options</i> with one of the following keywords or keyword arguments: <ul style="list-style-type: none"> • cos <i>value</i> —Sets the class of service value. Range is 0 to 7. • dscp <i>value</i> —Sets the differentiated services code point (DSCP) value and sends the packet. Range is 0 to 63. • qos-group <i>value</i> —Sets the QoS group value. Range is 1 to 7.
transmit	(Optional) Transmits the packets.

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

Command Modes Policy map police configuration

Command History	Release	Modification
	Release 6.0	This command was introduced.

Usage Guidelines For more information regarding the traffic policing feature, see the [police rate, on page 38](#) command. At least two set of actions for each policer action can be configured by using the **conform-action** command.

Task ID	Task ID	Operations
	qos	read, write

Examples

In this example of MPLS, traffic policing is configured to set DSCP bits for packets that conform to the rate limit:

```
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 policy-in
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 100 mbps burst 2 kbytes
```

```
RP/0/RP0/CPU0:router(config-pmap-c-police)# conform-action set dscp 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 TenGigE 0/1/0/9
RP/0/RP0/CPU0:router(config-if) service-policy input policy-in
```

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 6.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

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 class1
RP/0/RP0/CPU0:router (config-cmap) # match access-group ipv4 1
RP/0/RP0/CPU0:router (config-cmap) # end-class-map
```

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 6.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

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 rate 250
...
...
RP/0/RP0/CPU0:router(config-pmap)# class class7
...
...
RP/0/RP0/CPU0:router(config-pmap)# end-policy-map
```

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 <i>options</i>	Configures the specified packet properties. Replace <i>options</i> with one of the following keywords or keyword arguments: <ul style="list-style-type: none"> • cos <i>value</i> —Sets the class of service value. Range is 0 to 7. • dscp <i>value</i> —Sets the differentiated services code point (DSCP) value and sends the packet. Range is 0 to 63. • qos-group <i>value</i> —Sets the QoS group value. Range is 1 to 7.
transmit	(Optional) Transmits the packets.

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

Command Modes Policy map police configuration

Command History	Release	Modification
	Release 6.0	This command was introduced.

Usage Guidelines For more information regarding the traffic policing feature, see the [police rate, on page 38](#) command. At least two set of actions for each policer action can be configured by using the **exceed-action** command.

Task ID	Task ID	Operations
	qos	read, write

Examples

In this example for MPLS, traffic policing is configured to drop traffic for interface TenGigE 0/7/0/0 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 TenGigE 0/7/0/0  
RP/0/RP0/CPU0:router(config-if) service-policy input policy1
```

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.

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.
	<i>access-group-name</i>	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 6.0	This command was introduced.

Usage Guidelines

For class-based features (such as marking 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.

The **match access-group** command is supported only in the ingress direction.

The match criteria which is not supported on **match access-group** is match on ttl.

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.

QoS classification based on the packet length or TTL (time to live) field in the IPv4 and IPv6 headers is not supported.

When an ACL list is used within a class-map, the deny action of the ACL is ignored and the traffic is classified based on the specified ACL match parameters.

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
```

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

Syntax Description	not (Optional) Negates the specified match result.				
	<i>cos-value</i> 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	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 6.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 6.0	This command was introduced.
Release	Modification				
Release 6.0	This command was introduced.				

Usage Guidelines

The **match cos** command is supported only in the ingress direction.

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.

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows how to configure the service policy called policy-in and attach service policy policy-in to an interface TenGigE 0/7/0/0. In this example, class map cos146 evaluates all packets of service values of 1, 4, or 6. If the incoming packet has been marked with any of these CoS values, the traffic is policed at 300 mbps.

```
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 policy-in
RP/0/RP0/CPU0:router(config-pmap)# class cos146
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 300 mbps
```

```
RP/0/RP0/CPU0:router(config-pmap-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 TenGigE 0/7/0/0  
RP/0/RP0/CPU0:router(config-if)# service-policy input policy-in
```

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 [not] dscp [ipv4|ipv6] dscp-value [dscp-value1 ... dscp-value7] |[min-value - max-value]
no match [not] dscp [ipv4|ipv6] dscp-value [dscp-value1 ... dscp-value7] |[min-value -
max-value]
```

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 - 63. Up to eight IP DSCP values can be specified to match packets. Reserved keywords can be specified instead of numeric values. [Table 2: IP DSCP Reserved Keywords, on page 17](#) describes the reserved keywords.

min-value Lower limit of DSCP range to match. Value range is 0 - 63.

max-value Upper limit of DSCP range to match. Value range is 0 - 63.

Command Default

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

Command Modes

Class map configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **match dscp** command is supported only in the ingress direction. The minimum value is 0 and maximum value is 63. The maximum allowed entries: 64.

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

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 policies in policy map class configuration mode.

Table 2: IP DSCP Reserved Keywords

DSCP Value	Reserved Keyword
0	default
10	AF11
12	AF12
14	AF13
18	AF21
20	AF22
22	AF23
26	AF31
28	AF32
30	AF33
34	AF41
36	AF42
38	AF43
46	EF
8	CS1
16	CS2
24	CS3
32	CS4
40	CS5
48	CS6
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 policy-in and attach service policy policy-in to an interface TenGigE 0/7/0/0. In this example, class map dscp14 evaluates all packets entering for an IP DSCP value of 14. If the incoming packet has been marked with the IP DSCP value of 14, the traffic is policed at 300 mbps.

```
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 policy-in
RP/0/RP0/CPU0:router(config-pmap)# class dscp14
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 300 mbps
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 TenGigE 0/7/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input policy-in
```


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
	<i>exp-value</i>	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 6.0	This command was introduced.

Usage Guidelines The **match mpls experimental topmost** command is supported only in the ingress direction. The minimum value is 0 and maximum value is 7. The maximum allowed entries: 8.

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 policy-in and attach service policy policy-in to an interface. In this example, class map mplsmap1 evaluates all packets entering TenGigabit Ethernet interface 0/1/0/9 for an MPLS experimental value of 1. If the incoming packet has been marked with the MPLS experimental value of 1, the traffic is policed at 300 mbps.

```
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 policy-in
RP/0/RP0/CPU0:router(config-pmap)# class mplsmap1
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 300 mbps
RP/0/RP0/CPU0:router(config-pmap-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 TenGigabitEthernet 0/1/0/9
RP/0/RP0/CPU0:router(config-if)# service-policy input policy-in
```

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. Reserved keywords can be specified instead of numeric values. [Table 3: IP Precedence Values and Names, on page 22](#) 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 6.0	This command was introduced.

Usage Guidelines

The **match precedence** command is supported only in the ingress direction. The minimum value is 0 and maximum value is 7. The maximum allowed entries: 8.

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, the new values are added to the existing statement.

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 3: IP Precedence Values and Names

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

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows how to configure the service policy called policy-in and attach service policy policy-in to an interface. In this example, class map ipprec5 evaluates all packets entering TenGigabit Ethernet interface 0/1/0/9 for a precedence value of 5. If the incoming packet has been marked with the precedence value of 5, the traffic is policed at 300 mbps.

```
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 policy-in
RP/0/RP0/CPU0:router(config-pmap)# class ipprec5
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 300 mbps
RP/0/RP0/CPU0:router(config-pmap-c-police)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# interface TenGigabitEthernet 0/1/0/9
RP/0/RP0/CPU0:router(config-if)# service-policy input policy-in
```

match protocol

To identify a specific protocol as the match criterion for a class map, use the **match protocol** command in class map configuration mode. To remove protocol-based match criteria from a class map, use the **no** form of this command.

```
match [not] protocol protocol-value [protocol-value1 . . . protocol-value7] |[min-value - max-value]
no match [not] protocol protocol-value [protocol-value1 . . . protocol-value7] |[ min-value -
max-value]
```

Syntax Description

not (Optional) Negates the specified match result.

protocol-value A protocol identifier. A single value for *protocol-value* (any combination of numbers and names) can be matched in one match statement.

min-value Lower limit of protocol range to match. Minimum value is 0.

max-value Upper limit of protocol range to match. Maximum value is 255.

Command Default

No default behavior or values

Command Modes

Class map configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **match protocol** command is supported only in ingress direction.

Definitions of traffic classes are based on match criteria, including protocols, access control lists (ACLs), input interfaces, QoS labels, and experimental (EXP) field values. Packets satisfying the match criteria for a class constitute the traffic for that class.

The **match protocol** command specifies the name of a protocol to be used as the match criteria against which packets are checked to determine if they belong to the class specified by the class map. Available protocol names are listed in the table that follows.

The *protocol-value* argument supports a range of protocol numbers. After you identify the class, you may use the **match protocol** command to configure its match criteria.

Table 4: Protocol Names and Descriptions

Name	Description
icmp	Internet Control Message Protocol
igmp	Internet Gateway Message Protocol
ospf	Open Shortest Path First, Routing Protocol
pim	Protocol Independent Multicast

Name	Description
tcp	Transport Control Protocol
udp	User Datagram Protocol

Task ID

Task ID	Operations
qos	read, write

Examples

In this example, all TCP packets belong to class class 1:

```
RP/0/RP0/CPU0:router(config)# class-map class 1
RP/0/RP0/CPU0:router(config-cmap)# match protocol tcp
```

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-value 1 . . . qos-group-value7]
no match [not] qos-group
```

Syntax Description	not (Optional) Negates the specified match result.				
	<i>qos-group-value</i> QoS group value identifier that specifies the exact value from 1 to 7 or a range of values from 1 to 7. Up to eight values can be entered in one match statement.				
Command Default	No match criteria are specified.				
Command Modes	Class map configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 6.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 6.0	This command was introduced.
Release	Modification				
Release 6.0	This command was introduced.				

Usage Guidelines

The **match qos-group** command is supported only in the egress direction. The egress default class will implicitly match qos-group 0. The minimum value is 1 and maximum value is 7. The maximum allowed entries: 7.

The **match qos-group** command sets the match criteria for examining QoS groups marked on the packet. One class map can match only one qos-group value from 1 to 7. The qos-group values 1 to 7 maps to queue 1 to 7 on the egress port. Queue 0 is reserved for class-default.

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 to be used locally and the router to give differing levels of service based on the group identifier.



Note The egress policy should contain 7 match qos-group classes and a class-default to map to 8 data-traffic queues for the egress port.

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows a service policy called policy-out attached to an TenGigabit Ethernet interface 0/1/0/9 . In this example, class map qosgroup5 will evaluate all packets leaving TenGigabit Ethernet interface 0/1/0/9 for a QoS group value of 5. If the packet has been marked with the QoS group value of 5, the traffic shaping is at 1 gbps.

```
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 policy-out
RP/0/RP0/CPU0:router(config-pmap)# class qosgroup5
RP/0/RP0/CPU0:router(config-pmap-c)# shape average 1 gbps
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# interface TenGigabitEthernet 0/1/0/9
RP/0/RP0/CPU0:router(config-if)# service-policy output policy-out
```

The above example is for egress, the user has to configure all the 8 classes.

service-policy

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
no service-policy input | output policy-map
```

Syntax Description	input	output
	Attaches the specified policy map to the input interface.	Attaches the specified policy map to the output interface.
	<i>policy-map</i> Name of a service policy map (created using the policy-map command) to be attached.	

Command Default No service policy is specified.

Command Modes Interface configuration.

Command History	Release	Modification
	Release 6.0	This command was introduced.

Usage Guidelines 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 policy-in applied to Bundle-Ether interfaces 1 and 2.

```
RP/0/RP0/CPU0:router(config)#interface Bundle-Ether 1
RP/0/RP0/CPU0:router(config-if)#service-policy input policy-in
RP/0/RP0/CPU0:router(config-if)#exit

RP/0/RP0/CPU0:router(config)# interface Bundle-Ether 2
RP/0/RP0/CPU0:router(config-if)# service-policy output policy-out
```

set cos (outer)

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

```
set cos cos-value
no set cos cos-value
```

Syntax Description

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

Command Default

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

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

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.

The **set cos** command is supported only in the ingress direction. Both conditional and unconditional outer COS marking is supported.

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 TenGigE interface 0/1/0/9

```
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 TenGigE 0/1/0/9
RP/0/RP0/CPU0:router (config-if)# service-policy input cos-set
```

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 dscp-value
no set dscp dscp-value
```

Syntax Description	<i>dscp-value</i> Number from 0 to 63 that sets the DSCP value. Reserved keywords can be specified instead of numeric values. Table 2: IP DSCP Reserved Keywords, on page 17 describes the reserved keywords.	
Command Default	No default behavior or values	
Command Modes	Policy map class configuration	
Command History	Release	Modification
	Release 6.0	This command was introduced.
Usage Guidelines	<p>After the DSCP bit is set, other quality-of-service (QoS) services can then operate on the bit settings. The set dscp is supported only in the ingress direction.</p> <p>Both conditional and unconditional dscp marking is supported.</p> <p>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.</p>	
Task ID	Task ID	Operations
	qos	read, write
Examples	<p>In this example, the DSCP ToS byte is set to 6 in the policy map called policy-in. All packets that satisfy the match criteria of class1 are marked with the DSCP value of 6. The network configuration determines how packets are marked.</p> <pre>RP/0/RP0/CPU0:router (config)# policy-map policy-in RP/0/RP0/CPU0:router (config-pmap)# class class1... RP/0/RP0/CPU0:router (config-pmap-c)# set dscp 6</pre>	

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 1 to 7, to be marked on the packet.

Command Default

No group ID is specified.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **set qos-group** command is supported only in the ingress direction.

The **set qos-group** is used to group incoming traffic and then to classify and remark packets on the egress interface

The **set qos-group** action overrides the default marking section.

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 policy-in
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 TenGigE 0/1/0/9
RP/0/RP0/CPU0:router(config-if)# service-policy input policy-in
```

Examples

This example sets the **qos-group** value to 5:

```
RP/0/RP0/CPU0:router(config)# policy-map policy-in  
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
```

show qos summary

To view the QoS summary, use the **show qos summary** command in XR EXEC mode.

```
show qos summary police interface type instance | location node-location | policy policy-name
interface type instance | location node-location | queue interface type instance | location node-location
input | output [ location node-location ]
```

Syntax Description		
police		Show policer interface statistics.
policy <i>policy-name</i>		String to identify the policy.
queue		Show queue statistics.
interface <i>type instance</i>		Interface type and instance. For more information, use the question mark (?) online help function .
location <i>node-location</i>		Identifies fully qualified location specification.
input		Shows the specified policy map to the input interface.
output		Shows the specified policy map to the output interface.

Command Default None

Command Modes XR EXEC mode

Command History	Release	Modification
	Release 6.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task	Operations
	qos	read, write

Examples

This example shows the results of the qos summary queue of interface TEnGigE 0/0/0/9:

```
RP/0/RP0/CPU0:router# show qos summary queue interface TEnGigE 0/0/0/9 output
Wed Nov 25 12:13:21.769 UTC
```

Legend:

=====

1. Queue ID is displayed in HEX.
2. A '*' against Queue ID means class does not own the queue.
3. Length, Transmit and Drop are the queue statistics.

```
Policy:Class                               QueueID           Length    Transmit    Drop    Idle_ts
```

```

TenGigE0/0/0/9
qos
 :qos1          51          0          0          0
00:00:00
qos
 :qos2          52          0          0          0
00:00:00
qos
 :qos3          53          0          0          0
00:00:00
qos
 :qos4          54          0          0          0
00:00:00
qos
 :qos5          55          0          0          0
00:00:00
qos
 :qos6          56          0          0          0
00:00:00
qos
 :qos7          57          0          0          0
00:00:00
qos
 :class-default 50          0          0          0
00:00:00

```

This example shows policer interface statistics of interface TenGigE 0/0/0/5 :

```

RP/0/RP0/CPU0:router# show qos summary police interface TenGigE 0/0/0/5 input
Wed Nov 25 12:10:06.521 UTC
Legend:
=====
1. Policer ID is displayed in HEX.
2. A '*' against the counter means the action is drop.
3. Conform displays match counter for non-policer leaf.

Policy:Class          PoliceID    Conform    Exceed    Violate
TenGigE0/0/0/5
policer
 :class-default      106        1456      1657*     0*
RP/0/RP0/CPU0:ios#
RP/0/RP0/CPU0:ios#show run policy-map policer
Wed Nov 25 12:10:20.603 UTC
policy-map policer
 class class-default
  police rate 1 gbps burst 200 kbytes
  !
  !
end-policy-map
!
```

show qos summary



Congestion Management Commands

This chapter describes the commands used to manage congestion.

- [bandwidth remaining](#), on page 36
- [police rate](#), on page 38
- [policy-map](#), on page 41
- [priority \(QoS\)](#), on page 43
- [shape average](#), on page 44
- [show policy-map interface](#), on page 46
- [show policy-map targets](#), on page 51
- [show qos-ea interface](#), on page 53
- [show qos interface](#) , on page 56

bandwidth remaining

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

bandwidth remaining [**percent** *percentage-value* | **ratio** *ratio-value*]
no bandwidth remaining [**percent** *percentage-value* | **ratio** *ratio-value*]

Syntax Description

percent <i>percentage-value</i>	Specifies the amount of guaranteed bandwidth, based on an absolute percentage of the available bandwidth. Range is from 1 to 100.
ratio <i>ratio-value</i>	Specifies the amount of guaranteed bandwidth, based on a bandwidth ratio value. Range is 1 to 127.

Command Default

No bandwidth is specified.

Command Modes

Policy map class configuration

Command History

Release	Modification
---------	--------------

Release 6.0	This command was introduced.
-------------	------------------------------

Usage Guidelines

The **bandwidth remaining** command is used to proportionally allocate bandwidth to the particular classes, but there is no reserved bandwidth capacity.

The bandwidth remaining ratio or percentage directly translates to weights of the egress queue.

The bandwidth remaining ratio and bandwidth remaining percentage cannot be configured together.



Note

The egress policies must have eight class maps including the default. This command is supported only in the egress direction.

Task ID

Task ID	Operations
---------	------------

qos	read, write
-----	----------------

Examples

This example shows the remaining bandwidth for the all classes on egress policy:

```
RP/0/RP0/CPU0:router show run policy-map qos
Wed Nov 25 12:13:33.250 UTC
policy-map qos
  class qos1
    bandwidth remaining ratio 20
!
```

```
class qos2
  bandwidth remaining ratio 10
!
class qos3
  bandwidth remaining ratio 10
!
class qos4
  bandwidth remaining ratio 30
!
class qos5
  bandwidth remaining ratio 10
!
class qos6
  bandwidth remaining ratio 10
!
class qos7
  bandwidth remaining ratio 10
!
class class-default
  bandwidth remaining ratio 5
!
end-policy-map
```

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.

no police rate *value* [*units*] | **percent** *percentage* | **per-thousand** *value* | **per-million** *value* [**burst** *burst-size* [*burst-units*]]

Syntax Description					
<i>value</i>	Committed information rate (CIR). Range is from 1 to 4294967295.				
<i>units</i>	(Optional) Unit of measurement for the CIR. Values can be: <ul style="list-style-type: none"> • bps —bits per second (default) • gbps —gigabits per second • kbps —kilobits per second • mbps —megabits per second • pps —packets per second 				
percent <i>percentage</i>	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 <i>value</i>	Specifies the committed information rate in per thousand of the link bandwidth.				
per-million <i>value</i>	Specifies the committed information rate in per million of the link bandwidth.				
burst <i>burst-size</i>	(Optional) Specifies the burst size (in the specified <i>burst-units</i>). Range is from 1 to 4294967295.				
<i>burst-units</i>	(Optional) Unit of measurement for the burst values. Values can be: <ul style="list-style-type: none"> • bytes —bytes (default) • gbytes —gigabytes • kbytes —kilobytes • mbytes —megabytes • ms —milliseconds • us —microseconds • packets —packets 				
Command Default	No restrictions on the flow of data are applied to any interface.				
Command Modes	Policy map class configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 6.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 6.0	This command was introduced.
Release	Modification				
Release 6.0	This command was introduced.				
Usage Guidelines	<p>The police rate can set the DSCP, the outer cos and qos -group for IP packets.</p> <p>Policing can be applied only in ingress direction.</p>				

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.



Note Configured values take into account the Layer 2 encapsulation applied to traffic. This applies to ingress policing.

If the burst value is not configured, it is automatically set to 100 msec-worth of the CIR value. For example, if a CIR value of 1,000,000 kbps is entered, the burst value is calculated to be 12,500,000 bytes.

When you define policers, for optimum performance use these formulas to calculate the burst values:

Committed Burst (Bc) = CIR bps * (1 byte / 8 bits) * 100 ms

For example, if CIR = 2,000,000 bps, the calculated burst value is 2,000,000 bps * (1/8) * 100 ms *(1/1000) = 25000 bytes.

For more information, see the Committed Bursts and Excess Bursts section in the *Modular QoS Configuration Guide for Cisco NCS 5000 Series Routers*.

Task ID	Task ID	Operations
	qos	read, write

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 TenGigE interface 0/1/0/9:

```
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 qos-group 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 TenGigE 0/1/0/9
RP/0/RP0/CPU0:router(config-if) service-policy input policy1
```

In this example, traffic policing is configured with an average rate of 200 pps, and a normal burst size of 50 packets, for all packets in class-map class1, leaving TenGigE interface 0/1/0/9:

```
RP/0/RP0/CPU0:router(config)# policy-map pps-1r2c
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 200 pps burst 50 packets
```

```
RP/0/RP0/CPU0:router(config-pmap-c)# exit  
RP/0/RP0/CPU0:router(config-pmap)# exit  
  
RP/0/RP0/CPU0:router(config)# interface TenGigE 0/1/0/9  
RP/0/RP0/CPU0:router(config-if) service-policy input policy1
```

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 type of the service policy.
	qos	(Optional) Specifies a quality-of-service (QoS) policy map.
	<i>policy-name</i>	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 mode

Command History	Release	Modification
	Release 6.0	This command was introduced.

Usage Guidelines 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.

For egress classification, you must configure all 8 classes including class-default.

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 2048 classes in one policy map, no policy map can contain more than 2048 class policies. The maximum number of 2048 classes per policy includes the implicit default class. The maximum number of policy maps supported is 2048.

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 policy-in 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 policy-in
RP/0/RP0/CPU0:router(config-pmap)# class class1...
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 250 mbps
RP/0/RP0/CPU0:router(config-pmap-c-police)# exit
RP/0/RP0/CPU0:router(config-pmap-c)# exit
```


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 <i>priority-level</i> (Optional) Sets priority level to a traffic class. Only Level 1 is supported.
---------------------------	--

Command Default	No default action.
------------------------	--------------------

Command Modes	Policy map class configuration
----------------------	--------------------------------

Command History	Release	Modification
	Release 6.0	This command was introduced.

Usage Guidelines	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.
-------------------------	--

Egress queuing actions supports priority-level 1 for one of the eight class-maps. Policer is not supported in the egress direction, so the priority queue can take all the egress port bandwidth starving other queues. If priority traffic has to be policed, user can police it in the ingress direction where policer is supported.

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 queueing for the policy map named policy-out :

```
RP/0/RP0/CPU0:router(config)# policy-map policy-out
RP/0/RP0/CPU0:router(config-pmap)# class class1...
RP/0/RP0/CPU0:router(config-pmap-c)# priority level 1
```

The egress policy-out should have all the eight classes.

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] | | per-thousand value | | per-million value
no shape average
```

Syntax Description

percent <i>percentage</i>	Specifies the interface bandwidth in percentage. Values can be from 1 to 100.
<i>rate</i>	Average shaping rate in the specified units. Values can be from 1 to 4294967295.
<i>units</i>	(Optional) Units for the bandwidth. Values can be: <ul style="list-style-type: none"> • bps—bits per second (default) • gbps—gigabits per second • kbps—kilobits per second • mbps—megabits per second
per-thousand <i>value</i>	Specifies shape rate as parts per thousand of the available bandwidth.
per-million <i>value</i>	Specifies shape rate as parts per million of the available bandwidth.

Command Default

units: **bps**

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 6.0	This command was introduced.
Release 6.6.25	Added absolute rate units for shaper on bundle and link aggregation (LAG) interfaces.

Usage Guidelines

The **shape average** command is supported only in the egress direction.

When you use the **shape average** command, egress shaping is done at the Layer 1 level and includes the Layer 1 header in the rate calculation. 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. For bundled interfaces, **shape average** can be configured only as a percentage.

The **priority** and **shape average** commands must not be configured together in the same class.

Task ID	Task ID	Operations
	qos	read, write

Examples

This example sets traffic shaping to 50 percent of the :
port bandwidth:

```
RP/0/RP0/CPU0:router(config)# policy-map policy-out
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 100000 kbps:

```
RP/0/RP0/CPU0:router(config)# policy-map policy-out
RP/0/RP0/CPU0:router(config-pmap)# class class1...
RP/0/RP0/CPU0:router(config-pmap-c)# shape average 100000 kbps
```

This example shows how to set traffic shaping to 100000 kbps and peak burst for egress shaping to 1000:

```
RP/0/RP0/CPU0:router(config)# policy-map policy-out
RP/0/RP0/CPU0:router(config-pmap)# class class1...
RP/0/RP0/CPU0:router(config-pmap-c)# shape average 100000 kbps 1000
```

show policy-map interface

To display policy information and statistics 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** *interface type* | **all** *interface-path-id*] [**input** | **output**]

Syntax Description		
<i>interface type</i>		Interface type. For more information, use the question mark (?) online help function.
all		Specifies all interfaces.
<i>interface-path-id</i>		Physical interface or bundle interface.
	Note	Use the show interfaces command to see a list of all interfaces currently configured on the router.
		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 None

Command Modes XR EXEC mode

Command History	Release	Modification
	Release 6.0	This command was introduced.

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

The **show policy-map interface** command displays the statistics for shared and referred classes separately. To determine the policer action, an aggregate of the shared policer statistics should be collected.

The per-class statistics for a shaper action do not reflect the Layer 1 header and the overhead bytes (if any configured) even though the shaper includes them in the rate calculation.

Task ID	Task ID	Operations
	qos	read

Examples

This sample output shows how to display policy statistics information for all classes on the **interface TenGigE0/1/0/0 nv** that are in the output direction:

```
RP/0/RP0/CPU0:router# show policy-map interface TenGigE0/1/0/0 nv
Wed Nov 18 12:38:46.372 UTC
TenGigE0/0/0/0 output: egress_policy_shaper1

Class group_1
  Classification statistics          (packets/bytes)    (rate - kbps)
  Matched                          : 720175703/46091244992    0
  Transmitted                       : 720175703/46091244992    0
  Total Dropped                     : 0/0                    0
  Queueing statistics
  Queue ID                          : 9
  High watermark                    : N/A
  Inst-queue-len (cells)            : 0
  Avg-queue-len                     : N/A
  Taildropped (packets/bytes)       : 0/0
  Queue (conform)                   : 720175703/46091244992    0
  RED random drops (packets/bytes)  : 0/0

Class group_2
  Classification statistics          (packets/bytes)    (rate - kbps)
  Matched                          : 720169263/46090832832    0
  Transmitted                       : 720153475/46089822400    0
  Total Dropped                     : 15788/1010432          0
  Queueing statistics
  Queue ID                          : 10
  High watermark                    : N/A
  Inst-queue-len (cells)            : 0
  Avg-queue-len                     : N/A
  Taildropped (packets/bytes)       : 15788/1010432
  Queue (conform)                   : 720153475/46089822400    0
  RED random drops (packets/bytes)  : 0/0

Class group_3
  Classification statistics          (packets/bytes)    (rate - kbps)
  Matched                          : 720175701/46091244864    0
  Transmitted                       : 720175701/46091244864    0
  Total Dropped                     : 0/0                    0
  Queueing statistics
  Queue ID                          : 11
  High watermark                    : N/A
  Inst-queue-len (cells)            : 0
  Avg-queue-len                     : N/A
  Taildropped (packets/bytes)       : 0/0
  Queue (conform)                   : 720175701/46091244864    0
  RED random drops (packets/bytes)  : 0/0

Class group_4
  Classification statistics          (packets/bytes)    (rate - kbps)
  Matched                          : 720175701/46091244864    0
  Transmitted                       : 720175701/46091244864    0
  Total Dropped                     : 0/0                    0
  Queueing statistics
  Queue ID                          : 12
  High watermark                    : N/A
  Inst-queue-len (cells)            : 2
  Avg-queue-len                     : N/A
  Taildropped (packets/bytes)       : 0/0
```

show policy-map interface

```

Queue(conform)      :          720175701/46091244864      0
RED random drops (packets/bytes) : 0/0

Class group_5
Classification statistics      (packets/bytes)      (rate - kbps)
  Matched      :          720169263/46090832832      0
  Transmitted  :          720152985/46089791040      0
  Total Dropped :          16278/1041792      0
Queueing statistics
  Queue ID      : 13
  High watermark : N/A
  Inst-queue-len (cells) : 1
  Avg-queue-len : N/A
  Taildropped (packets/bytes) : 16278/1041792
  Queue(conform) :          720152985/46089791040      0
  RED random drops (packets/bytes) : 0/0

Class group_6
Classification statistics      (packets/bytes)      (rate - kbps)
  Matched      :          720169439/46090844096      0
  Transmitted  :          720155056/46089923584      0
  Total Dropped :          14383/920512      0
Queueing statistics
  Queue ID      : 14
  High watermark : N/A
  Inst-queue-len (cells) : 6438
  Avg-queue-len : N/A
  Taildropped (packets/bytes) : 14383/920512
  Queue(conform) :          720155056/46089923584      0
  RED random drops (packets/bytes) : 0/0

Class group_7
Classification statistics      (packets/bytes)      (rate - kbps)
  Matched      :          720175701/46091244864      0
  Transmitted  :          720175701/46091244864      0
  Total Dropped :          0/0      0
Queueing statistics
  Queue ID      : 15
  High watermark : N/A
  Inst-queue-len (cells) : 2
  Avg-queue-len : N/A
  Taildropped (packets/bytes) : 0/0
  Queue(conform) :          720175701/46091244864      0
  RED random drops (packets/bytes) : 0/0

Class class-default
Classification statistics      (packets/bytes)      (rate - kbps)
  Matched      :          720175701/46091244864      0
  Transmitted  :          720175584/46091237376      0
  Total Dropped :          117/7488      0
Queueing statistics
  Queue ID      : 8
  High watermark : N/A
  Inst-queue-len (cells) : 0
  Avg-queue-len : N/A
  Taildropped (packets/bytes) : 117/7488
  Queue(conform) :          720175701/46091244864      0
  RED random drops (packets/bytes) : 0/0

```



Note In the **show policy-map interface** command output, displayed police rate and actual police rate for an interface varies.

This table describes the significant fields shown in the display.

Table 5: 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.
Efficiency improvement factor	Ratio of the packet's original full size to the packet's compressed size.
Queue (conform)	Number of packets or bytes that conformed to the queue rate for this class.

Field	Description
Queue (exceed)	Number of packets or bytes that exceeded the queue rate for this class.

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 <i>node-id</i>	(Optional) Displays information about the interfaces on which policy maps are applied for the specified location. The <i>node-id</i> argument is entered in the <i>rack/slot/module</i> notation.
pmap-name <i>name</i>	(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 mode

Command History	Release	Modification
	Release 6.0	This command was introduced.

Usage Guidelines For a short period of time while a QoS policy is being modified, there might not be any policy in effect on the interfaces in which the modified policy is used. For this reason, 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.

When an unsupported policy-map is offloaded, a warning message stating 'policy is not offloaded' is shown. But the **show policy-map targets** command shows the unsupported policy-map entry for an interface.

Task ID	Task ID	Operations
	qos	read

Examples

In this example, the TenGigabit Ethernet interface 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

Wed Nov 18 12:39:08.829 UTC
1) Policymap: egress_policy_shaper1    Type: qos
   Targets (applied as main policy):
     TenGigE0/0/0/0 output
     TenGigE0/0/0/8 output
```

show policy-map targets

```
Total targets: 2
```

```
Targets (applied as child policy):
```

```
Total targets: 0
```

show qos-ea interface

To display internal programming information for an interface, use the **show qos-ea interface** command in XR EXEC mode.

```
show qos-ea interface type interface-path-id { input | output } detail interface-type
interface-path-id [location interface-path-id]
```

Syntax Description	
<i>type</i>	Interface type. The range is from 1 to 32768.
<i>interface-path-id</i>	Physical interface or bundle interface. Note Use the show interfaces command to see a list of all interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
input	Refers to policy applied in ingress direction.
output	Refers to policy applied egress direction.
detail	Displays detailed output.
location	(Optional) Specifies the location of the node.

Command Default None.

Command Modes XR EXEC mode

Command History	Release	Modification
	Release 6.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task ID	Operation
	qos	read

Examples

This is the sample output which shows the QoS information on a TenGigabit Ethernet interface:

```
RP/0/RP0/CPU0:router # show qos-ea interface tenGigE 0/0/0/0 output
Wed Nov 18 12:36:36.130 UTC
Interface: TenGigE0_0_0_0 output policy: egress_policy_shaper1
Total number of classes: 8
Total number of UBRL classes: 0
```

show qos-ea interface

```

Total number of CAC classes: 0
-----
Policy name: egress_policy_shaper1
Hierarchical depth 1
Interface type TenGigE
Interface rate 10000000 kbps
Port Shaper rate 0 kbps
Interface handle 0x08000038
ul_ifh 0x00000000, ul_id 0x00000080
uidb index 0x0006
qos_ifh 0x108000800006
Local port 0, NP 0
Policy map id 0x0000, format 0, uidb index 0x0006
-----
Index 0 Level 0 Class name group_1 service_id 0x0 Policy name egress_policy_shaper1
Node flags: LEAF Q_LEAF
Stats flags: Queuing enabled
Node Config:
WFQ: BW/Sum of BW/Excess ratio: 0kbps/0kbps/20
Queue limit 250000 Guarantee 0
Node Result: Class-based stats:Stat ID 0xCC000009
Queue: Q-ID 0x00000009 Stat ID(Commit/Excess/Drop): 0xF0000009/0x00000000/0xF8000009
-----
Index 1 Level 0 Class name group_2 service_id 0x0 Policy name egress_policy_shaper1
Node flags: LEAF Q_LEAF
Stats flags: Queuing enabled
Node Config:
WFQ: BW/Sum of BW/Excess ratio: 0kbps/0kbps/2
Queue limit 25000 Guarantee 0
Node Result: Class-based stats:Stat ID 0xCC00000A
Queue: Q-ID 0x0000000a Stat ID(Commit/Excess/Drop): 0xF000000A/0x00000000/0xF800000A
-----
Index 2 Level 0 Class name group_3 service_id 0x0 Policy name egress_policy_shaper1
Node flags: LEAF Q_LEAF
Stats flags: Queuing enabled
Node Config:
WFQ: BW/Sum of BW/Excess ratio: 0kbps/0kbps/12
Queue limit 150000 Guarantee 0
Node Result: Class-based stats:Stat ID 0xCC00000B
Queue: Q-ID 0x0000000b Stat ID(Commit/Excess/Drop): 0xF000000B/0x00000000/0xF800000B
-----
Index 3 Level 0 Class name group_4 service_id 0x0 Policy name egress_policy_shaper1
Node flags: LEAF Q_LEAF
Stats flags: Queuing enabled
Node Config:
WFQ: BW/Sum of BW/Excess ratio: 0kbps/0kbps/30
Queue limit 375000 Guarantee 0
Node Result: Class-based stats:Stat ID 0xCC00000C
Queue: Q-ID 0x0000000c Stat ID(Commit/Excess/Drop): 0xF000000C/0x00000000/0xF800000C
-----
Index 4 Level 0 Class name group_5 service_id 0x0 Policy name egress_policy_shaper1
Node flags: LEAF Q_LEAF
Stats flags: Queuing enabled
Node Config:
WFQ: BW/Sum of BW/Excess ratio: 0kbps/0kbps/2
Queue limit 25000 Guarantee 0
Node Result: Class-based stats:Stat ID 0xCC00000D
Queue: Q-ID 0x0000000d Stat ID(Commit/Excess/Drop): 0xF000000D/0x00000000/0xF800000D
-----
Index 5 Level 0 Class name group_6 service_id 0x0 Policy name egress_policy_shaper1
Node flags: LEAF Q_LEAF
Stats flags: Queuing enabled
Node Config:
WFQ: BW/Sum of BW/Excess ratio: 0kbps/0kbps/2

```

```
Queue limit 25000 Guarantee 0
Node Result: Class-based stats:Stat ID 0xCC00000E
Queue: Q-ID 0x0000000e Stat ID(Commit/Excess/Drop): 0xF000000E/0x00000000/0xF800000E
-----
Index 6 Level 0 Class name group_7 service_id 0x0 Policy name egress_policy_shaper1
Node flags: LEAF Q_LEAF
Stats flags: Queuing enabled
Node Config:
WFQ: BW/Sum of BW/Excess ratio: 0kbps/0kbps/26
Queue limit 325000 Guarantee 0
Node Result: Class-based stats:Stat ID 0xCC00000F
Queue: Q-ID 0x0000000f Stat ID(Commit/Excess/Drop): 0xF000000F/0x00000000/0xF800000F
-----
Index 7 Level 0 Class name class-default service_id 0x0 Policy name egress_policy_shaper1

Node flags: LEAF Q_LEAF DEFAULT DEFAULT-ALL
Stats flags: Queuing enabled
Node Config:
WFQ: BW/Sum of BW/Excess ratio: 0kbps/0kbps/6
Queue limit 75000 Guarantee 0
Node Result: Class-based stats:Stat ID 0xCC000008
Queue: Q-ID 0x00000008 Stat ID(Commit/Excess/Drop): 0xF0000008/0x00000000/0xF8000008
```

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 *interface-name* **input** | **output**[**location** *node-id*]

Syntax Description		
<i>interface-name</i>		Interface name. For more information about the syntax for the router, use the question mark (?) online help function.
	Note	Use the show interfaces command to see a list of all interfaces currently configured on the router.
input		Attaches the specified policy map to the input interface.
output		Attaches the specified policy map to the output interface.
location <i>node-id</i>		(Optional) Displays detailed QoS information for the designated node. The <i>node-id</i> argument is entered in the rack/slot/module notation.

Command Default No default behavior or values

Command Modes XR EXEC mode

Command History	Release	Modification
	Release 6.0	This command was introduced.

Usage Guidelines 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 QoS information on a TenGigE interface:

```
RP/0/RP0/CPU0:router# show qos interface tenGigE 0/0/0/0 output
```

```
Wed Nov 18 12:40:49.404 UTC
```

```

Interface: TenGigE0_0_0 output
Bandwidth configured: 10000000 kbps Bandwidth programed: 10000000 kbps
ANCP user configured: 0 kbps ANCP programed in HW: 0 kbps
Port Shaper programed in HW: 0 kbps
Policy: egress_policy_shaper1 Total number of classes: 8
-----
Level: 0 Policy: egress_policy_shaper1 Class: group_1
QueueID: 9 (Priority Normal)
Committed Weight: 0 Excess Weight: 20
Bandwidth: 0 kbps, BW sum for Level 0: 0 kbps, Excess Ratio: 20
-----
Level: 0 Policy: egress_policy_shaper1 Class: group_2
QueueID: 10 (Priority Normal)
Committed Weight: 0 Excess Weight: 2
Bandwidth: 0 kbps, BW sum for Level 0: 0 kbps, Excess Ratio: 2
-----
Level: 0 Policy: egress_policy_shaper1 Class: group_3
QueueID: 11 (Priority Normal)
Committed Weight: 0 Excess Weight: 12
Bandwidth: 0 kbps, BW sum for Level 0: 0 kbps, Excess Ratio: 12
-----
Level: 0 Policy: egress_policy_shaper1 Class: group_4
QueueID: 12 (Priority Normal)
Committed Weight: 0 Excess Weight: 30
Bandwidth: 0 kbps, BW sum for Level 0: 0 kbps, Excess Ratio: 30
-----
Level: 0 Policy: egress_policy_shaper1 Class: group_5
QueueID: 13 (Priority Normal)
Committed Weight: 0 Excess Weight: 2
Bandwidth: 0 kbps, BW sum for Level 0: 0 kbps, Excess Ratio: 2
-----
Level: 0 Policy: egress_policy_shaper1 Class: group_6
QueueID: 14 (Priority Normal)
Committed Weight: 0 Excess Weight: 2
Bandwidth: 0 kbps, BW sum for Level 0: 0 kbps, Excess Ratio: 2
-----
Level: 0 Policy: egress_policy_shaper1 Class: group_7
QueueID: 15 (Priority Normal)
Committed Weight: 0 Excess Weight: 26
Bandwidth: 0 kbps, BW sum for Level 0: 0 kbps, Excess Ratio: 26
-----
Level: 0 Policy: egress_policy_shaper1 Class: class-default
QueueID: 8 (Priority Normal)
Committed Weight: 0 Excess Weight: 6
Bandwidth: 0 kbps, BW sum for Level 0: 0 kbps, Excess Ratio: 6

```

This table describes the significant fields shown in the display.

Table 6: show QoS interface Field Descriptions

Field	Description
Level 0 class	Level 0 class identifier in hexadecimal format.
Level 1 class	Level 1 class identifier in hexadecimal format.
class name	Name that was assigned to this class with the class command.
Conform	Number of conform packets transmitted.

Field	Description
Burst	Configured burst size, expressed in bytes, gigabytes (GB), kilobytes (KB), megabytes (MB), milliseconds (ms), or microseconds (us).
Queue ID	Queue identifier.
Weight	Bandwidth weight.