

Modular QoS Command Reference for Cisco 8000 Series Routers

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Preface

This preface contains these sections:

- Changes to This Document, on page vii
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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
June 2025	Republished with documentation updates for Release 25.2.1 features.
January 2022	Republished with documentation updates for Release 7.3.3 features.
June 2021	Republished with documentation updates for Release 7.3.16 features.
February 2021	Republished for Release 7.3.1.
October 2020	Republished for Release 7.2.12.
August 2020	Republished with documentation updates for Release 7.0.14 features.
March 2020	Initial release of this document.

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Congestion Avoidance Commands

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

Syntax Description

ratio *ratio-value*	Specifies the relative share or weight of remaining bandwidth, based on a bandwidth ratio value. Range is 1 to 63 for main interfaces, and 1 to 255 for subinterfaces.
percent *percentage*	Specifies the share of available remaining bandwidth as a percentage. Range is 1 to 100.

Command Default

No bandwidth is specified.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 26.3.1	The command was enhanced to support the **percent** keyword for configuring percentage-based sharing of remaining bandwidth on supported Cisco 8000 Series routers.
Release 7.0.12	This command was introduced.

Usage Guidelines

Bandwidth, bandwidth remaining, and shaping commands can be configured together in the same class.

Note The **bandwidth remaining** command is supported only in the egress direction.

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

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

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.

Within a policy map, the **bandwidth remaining ratio** and **bandwidth remaining percent** configurations are mutually exclusive. Configure only one remaining-bandwidth method in a policy map. In two-level queuing policies, the parent policy performs only traffic shaping, so mixing ratio and percent across parent and child policies is not a valid use case.

For subinterface bandwidth distribution, you can configure a parent policy map with **bandwidth remaining percent** to distribute remaining bandwidth across subinterfaces. You cannot modify the parent-class **bandwidth remaining percent** value in place when it is configured for a subinterface. To change the value, detach the service policy, update the configuration, and then reapply the service policy. If you try to modify the value in place, the router displays this error: `!!% Unsupported class-action: In Place modification of parent BRR not supported for sub-interfaces: InPlace Modify Error:`

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 ratio 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 ratio 80
RP/0/RP0/CPU0:router(config-pmap-c)#exit
RP/0/RP0/CPU0:router(config-pmap)#exit
```

This example shows how to configure remaining bandwidth by percentage for class-based queuing:

```
router(config)#policy-map policymap_1_1_0
router(config-pmap)#class classmap_1_1_1_0
router(config-pmap-c)#bandwidth remaining percent 10
router(config-pmap-c)#exit
router(config-pmap)#class classmap_1_6_1_0
router(config-pmap-c)#bandwidth remaining percent 5
router(config-pmap-c)#exit
router(config-pmap)#class classmap_1_7_1_0
router(config-pmap-c)#priority level 1
router(config-pmap-c)#exit
router(config-pmap)#end-policy-map
```

clear controller npu qos high-water-marks

To clear traffic class queue occupancy and delay high water marks data, use the **clear controller npu qos high-water-marks** command in XR EXEC mode.

clear controller npu qos high-water-marks [**monotonic** | **periodic**] **interface** *type* [**traffic-class** *number*] [**location** *ID*]

Syntax Description

monotonic	(Optional) Clears the monotonic high water marks. Monotonic high water marks are cleared if neither the monotonic or periodic keyword is used.
periodic	(Optional) Clears the periodic high water marks.
interface *type*	Interface type and number. Specify an interface to clear high water marks for a single interface. Use the **all** keyword to clear high water marks for all interfaces.
traffic-class *number*	(Optional) Specify a traffic class number to clear high water marks for a single traffic class. High water marks are cleared for all traffic classes by default.
location *ID*	(Optional) Node ID.Specify a node id to clear high water marks for a single location. Use the **all** keyword to clear high water marks for all locations. All locations are cleared by default.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 24.2.11	This command was introduced.

Usage Guidelines

The **clear controller npu qos high-water-marks** command form clears monotonic high water marks for all traffic classes on all interfaces. This is equivalent to the **clear controller npu qos high-water-marks monotonic** form of the command.

Use the **interface**, **traffic-class** and **location** keywords to limit the scope of the *clear* operation.

Use the **periodic** keyword to clear the periodic high water marks instead of the monotonic high water marks.

Example

This command clears monotonic high water marks data for all traffic classes and all interfaces:

```
Router# clear controller npu qos high-water-marks interface all
```

This command clears monotonic high water marks data for traffic class 6 on interface fourHundredGigE 0/0/0/10:

```
Router# clear controller npu qos high-water-marks interface fourHundredGigE 0/0/0/10
traffic-class 6
```

This command clears monotonic high water marks data for all traffic classes and all interfaces:

```
Router# clear controller npu qos high-water-marks monotonic interface all
```

This command clears periodic high water marks data for all traffic classes on all interfaces on location 0/0/CPU0:

```
Router# clear controller npu qos high-water-marks periodic interface all location 0/0/CPU0
```

This command clears periodic high water marks data for traffic class 3 on interface FH0/0/0/21:

```
Router# clear controller npu qos high-water-marks periodic interface FH0/0/0/21 traffic-class
 3
```

clear controller priority-flow-control statistics

To clear priority flow control statistics on an interface on a per-port or a per-traffic-class, per-port basis, use the **clear controller priority-flow-control statistics** command in XR EXEC mode.

clear controllers *interface-type interfacepath-id* **priority-flow-control statistics traffic-class** *tc*

Syntax Description

traffic class *tc*	—Traffic class to be cleared

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.0.11	This command was introduced.

Usage Guidelines

None

Example

This example shows a sample for the **clear controllers priority-flow-control statistics** command to clear statistics for traffic class 3:

```
Router#clear controller FourHundredGigE0/0/0/0 priority-flow-control statistics traffic-class
 3
```

clear controller priority-flow-control watchdog statistics

To clear priority flow control watchdog statistics on an interface on a per-port or a per-traffic-class, per-port basis, use **clear controller priority-flow-control watchdog-stats** command in XR EXEC mode.

clear controllers *interface-type interfacepath-id* **priority-flow-control watchdog-stats traffic-class** *tc*

Syntax Description

traffic class *tc*	—Traffic class to be cleared

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.0.11	This command was introduced.

Usage Guidelines

None

Example

This example shows how to clear priority flow control watchdog statistics for traffic class 3 on a FourHundredGigE 0/0/0/0 interface.

```
Router#clear controller FourHundredGigE 0/0/0/0 priority-flow-control watchdog-stats
traffic-class 3
```

hw-module profile npu memory buffer-extended bandwidth-congestion-detection enable

To enable the ability to detect High Bandwidth Memory (HBM) congestion when you configure PFC in the buffer-extended mode, use the **hw-module profile npu memory buffer-extended bandwidth-congestion-detection enable** command in the XR Config mode.

To disable this feature, use the **no** form of this command.

hw-module profile npu memory buffer-extended location *lc*
bandwidth-congestion-detection enable

Syntax Description

location *lc*	—Line card location

Command Default

This feature is disabled by default.

Command Modes

XR Config mode

Command History

Release	Modification
Release 7.5.3	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
qos	read, write

The following example shows how to enable the detection of HBM congestion when packets are egressing from an interface.

```
Router#config
Router(config)#hw-module profile npu buffer-extended location 0/6/CPU0
bandwidth-congestion-detection enable
Router(config)#commit
Router(config)#exit
```

hw-module profile npu memory buffer-extended bandwidth-congestion-protect enable

To enable triggering of global pause frames (X-off) whenever there's HBM congestion in the buffer-extended mode, use the **hw-module profile npu memory buffer-extended bandwidth-congestion-protect enable** command in the XR Config mode.

To disable this feature, use the **no** form of this command.

hw-module profile npu memory buffer-extended location *lc* **bandwidth-congestion-protect enable**

Syntax Description

location *lc* —Line card location	

Command Default

This feature is disabled by default.

Command Modes

XR Config mode

Command History

Release	Modification
Release 7.5.4	This command was introduced.

Usage Guidelines

Configuring the **hw-module profile npu memory buffer-extended bandwidth-congestion-protect enable** command for line cards where you've configured headroom values exceeding 6144000 bytes could result in a commit error or the feature not being enabled.

You must reload the line card for the **hw-module profile npu memory buffer-extended bandwidth-congestion-protect enable** command to take effect.

Task ID

Task ID	Operation
qos	read, write

The following example shows how to enable the triggering of global pause frames (X-off) whenever there's HBM congestion.

```
Router#config
Router(config)#hw-module profile npu buffer-extended location 0/1/CPU0
bandwidth-congestion-protect enable
Router(config)#commit
```

hw-module profile priority-flow-control

To configure PFC threshold values, use the **hw-module profile priority-flow-control** command in XR Config mode. You can configure the values either in the **buffer-internal** mode or the **buffer-extended** mode. To return to the system defaults, use the **no** form of this command.

To disable this feature, use the no form of this command.

hw-module profile priority-flow-control location *lc* [**buffer-extended traffic-class** *value* { **max-non-pfc-voqs** | **hbm-buffers percentage** *value unit* } { **pause-threshold** *value unit* } [**headroom** *value unit*] | **buffer-internal traffic-class** *value* **pause-threshold** *value unit* **headroom** *value unit* [**ecn** *value unit* | **max-threshold** *value unit* | **probability-percentage** *value unit*]]

For 88-LC0-36FH-M line cards:

hw-module profile priority-flow-control location <*lc*> [**buffer-extended traffic-class** *value* **pause-threshold** *value unit* [**headroom** *value unit*]]

Syntax Description

location	<*lc*> —Line card location
buffer-extended	**traffic-class** — value from 0 through 7 Sets PFC threshold values for long-reach PFC deployments. You can configure the following parameters using the **buffer-extended** option: *pause-threshold* — pause-threshold for traffic class in ms or us and in KB or MB for 88-LC0-36FH-M line cards. For 88-LC0-36FH-M line cards, also configure: *headroom* —headroom for traffic class in KB or MB **max-non-pfc-tcs** – specifies the maximum number of non-Priority Flow Control (PFC) Virtual Output Queues (VOQs) that can utilize the allocated High Bandwidth Memory (HBM) buffers. **hbm-buffers-percentage** – specifies the percentage of the total High Bandwidth Memory (HBM) buffers that non-Priority Flow Control (PFC) traffic classes, typically lossy traffic, can utilize.

buffer-internal	**traffic-class** — value from 0 through 7 Sets PFC threshold values for short-reach PFC deployments. You can configure the following parameters using the **buffer-internal** option: **traffic-class** — value from 0 through 7 **pause-threshold** — pause-threshold for traffic class in bytes **headroom** — headroom for traffic class in bytes **ecn** — Explicit Congestion Notification (ECN) threshold in bytes From Release 7.3.6 **max threshold**— ECN maximum threshold value in bytes **probability-percentage** — mark probability in percent

Command Default

No default behavior or values.

Command Modes

XR Config

Command History

Release	Modification
Release 7.0.11	This command was introduced.
Release 7.3.1	This command isn’t supported.
Release 7.3.15	This command is supported.
Release 7.3.16	The default PFC configuration functionality that autodetects PFC threshold values and configures them for the buffer-internal and buffer-extended modes, was introduced.
Release 7.3.6	The options to configure ECN maximum threshold value and mark probability were added.
Release 25.3.1	Keywords **max-non-pfc-voqs** and **hbm-buffers percentage***value unit* were added.

Usage Guidelines

- If you add a new traffic class and configure PFC threshold values for the first time on that traffic class, you must reload the line card.
- If you want to use the functionality to autodetect the PFC threshold values (using the default PFC configuration), delete the existing PFC configuration and then run the requisite command. You needn't reload the line card.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how to configure the PFC threshold values using the buffer-internal mode.

```
RP/0/RP0/CPU0:router(config)#hw-module profile priority-flow-control location 0/1/CPU0
RP/0/RP0/CPU0:router(config-pfc-loc)#buffer-internal traffic-class 3 pause-threshold 403200
 bytes headroom 441600 bytes ecn 224640 bytes
RP/0/RP0/CPU0:router(config-pfc-loc)#buffer-internal traffic-class 4 pause-threshold 403200
 bytes headroom 441600 bytes ecn 224640 bytes

RP/0/RP0/CPU0:router(config-pfc-loc)#commit
```

This example shows how to configure the PFC threshold values using the buffer-extended mode.

```
RP/0/RP0/CPU0:router(config)#hw-module profile priority-flow-control location 0/6/0/1
RP/0/RP0/CPU0:router(config-pfc-loc)#buffer-extended traffic-class 3 pause-threshold 10 ms
RP/0/RP0/CPU0:router(config-pfc-loc)#buffer-extended traffic-class 4 pause-threshold 10 ms
RP/0/RP0/CPU0:router(config-pfc-loc)#commit
```

The default PFC configuration autodetects PFC threshold values and configures them for the buffer-internal and buffer-extended modes.

Configure the traffic class values for the buffer-internal and buffer-extended modes in the **hw-module profile priority-flow-control** command. Depending on the line card, the functionality configures the default threshold values.

For example, for buffer-internal mode on a line card, configure:

```
RP/0/RP0/CPU0:router(config)#hw-module profile priority-flow-control location 0/0/CPU0
RP/0/RP0/CPU0:router(config-pfc-loc)#buffer-internal traffic-class 3
RP/0/RP0/CPU0:router(config-pfc-loc)#buffer-internal traffic-class 4
RP/0/RP0/CPU0:router(config-pfc-loc)#exit
RP/0/RP0/CPU0:router(config-pfc-loc)#commit
```

For buffer-extended mode on a line card, configure:

```
RP/0/RP0/CPU0:router(config)#hw-module profile priority-flow-control location 0/2/CPU0
RP/0/RP0/CPU0:router(config-pfc-loc)#buffer-extended traffic-class 2
RP/0/RP0/CPU0:router(config-pfc-loc)#buffer-extended traffic-class 1
RP/0/RP0/CPU0:router(config-pfc-loc)#exit
RP/0/RP0/CPU0:router(config-pfc-loc)#commit
```

The following example shows how to configure PFC in buffer-internal mode with custom values for all parameters including **max-threshold** and **probability-percentage**.

```
Router(config)#hw-module profile priority-flow-control location 0/6/01
Router(config-pfc-loc)#buffer-internal traffic-class 3 pause-threshold 1574400 bytes headroom
 1651200 bytes ecn 629760 bytes max-threshold 1416960  bytes probability-percentage 50
Router(config-pfc-loc)#buffer-internal traffic-class 4 pause-threshold 1574400 bytes headroom
 1651200 bytes ecn 629760 bytes max-threshold 1416960  bytes probability-percentage 50
Router(config-pfc-loc)#commit
```

This example show to configure buffer-extended hybrid mode:

```
Router# configure
Router(config)# hw-module profile priority-flow-control location 0/0/CPU0
Router(config-pfc-profile)# buffer-extended traffic-class 3
Router(config-pfc-profile)# buffer-extended traffic-class 4
Router(config-pfc-profile# buffer-extended non-pfc-tcs hbm-buffers-percentage 60
Router(config-pfc-profile# !
Router(config-pfc-profile# end
Router(config)# commit
```

hw-module profile qos high-water-marks

To enable traffic class queue high water marks monitoring for all egress interfaces, configure the **hw-module profile qos high-water-marks** command in XR configuration mode. To disable the feature, use the **no** form of the command.

hw-module profile qos high-water-marks

Syntax Description

This command has no keywords or arguments.

Command Default

Traffic class queue high water marks monitoring is disabled.

Command Modes

XR config mode (config)

Command History

Release	Modification
Release 24.2.11	This command was introduced.

Usage Guidelines

Perform a manual reload of the chassis or all line cards after enabling or disabling this feature.

Example

This example shows how to enable traffic class queue high water marks monitoring for all egress interfaces:

```
Router(config)# hw-module profile qos high-water-marks

A manual reload of the chassis or all line cards is required to enable/disable Traffic Class
 High Water Marks Monitoring

Router(config)# commit
```

hw-module profile qos voq-mode

To configure the VOQ mode value or the fair VOQ mode value, use the hw-module profile qos voq-mode command in XR Config mode. To disable this mode, use the no form of the command. You can configure the normal VOQ mode value from 8 (default value) to 4 or conversely from 4 to 8.

hw-module profile qos voq-mode [**4** | **8** | **fair-4** | **fair-8**]

Syntax Description

4	Indicates the normal VOQ mode to configure to 4.
8	Indicates the normal VOQ mode to configure to 8.
fair-4	Indicates the fair VOQ mode to configure to fair-4.
fair-8	Indicates the fair VOQ mode to configure to fair-8.

Command Default

The default normal VOQ mode value is 8.

Command Modes

XR Config mode

Command History

Release	Modification
Release 7.0.12	This command was introduced.
Release 7.3.3	The option to configure fair VOQ mode was introduced.

Usage Guidelines

The default normal VOQ mode value is 8. To change the value to 4, you must:

1. Configure **hw-module profile qos voq-mode** *4* and commit.
2. Remove the queuing service-policy from all interfaces including main interface, subinterface, and bundle.
3. Run **reload location all** to reload all nodes on your router.

Note Because this mode supports a maximum of four VOQs, egress policy matches only on queues 7, 6, 5, and 0.

After you commit the *hw-module* configuration, you **must** reload the chassis immediately before proceeding with any other operation. Else, existing configurations on the chassis may be affected, leading to unexpected behavior.

Task ID

Task ID	Operation
qos	read, write

The following example shows how to enable VOQ mode value 4 on the router.

```
RP/0/RP0/CPU0:router#config
RP/0/RP0/CPU0:router(config)#hw-module profile
RP/0/RP0/CPU0:router(config)#hw-module profile qos
RP/0/RP0/CPU0:router(config)#hw-module profile voq-mode 4
RP/0/RP0/CPU0:router(config)#commit
RP/0/RP0/CPU0:router#reload location all
```

The following example shows how to configure fair-4 VOQ mode:

```
RP/0/RP0/CPU0:router#config
RP/0/RP0/CPU0:router(config)#hw-module profile
RP/0/RP0/CPU0:router(config)#hw-module profile qos
RP/0/RP0/CPU0:router(config)#hw-module profile voq-mode fair-4
RP/0/RP0/CPU0:router(config)#commit
RP/0/RP0/CPU0:router#reload location all
```

hw-module voq-watchdog cardshut disable

To prevent the line cards from being shut down upon detecting stuck VOQs, use the **hw-module voq-watchdog cardshut disable** command in the XR Config mode.

hw-module voq-watchdog cardshut disable

Syntax Description

This command has no arguments or keywords.

Command Default

This feature is enabled by default.

Command Modes

XR Config mode

Command History

Release	Modification
Release 24.2.11	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
qos	read, write

The following example shows how to disable the shutdown action on the line card upon detecting stuck VOQs.

```
Router#config
Router(config)#hw-module voq-watchdog cardshut disable
Router(config)#commit
```

hw-module voq-watchdog feature enable

To enable the Virtual Output Queue (VOQ) watchdog feature, use the **hw-module voq-watchdog feature enable** command in the XR Config mode.

To disable this feature, use the **no** form of this command.

hw-module voq-watchdog feature enable

Syntax Description

This command has no arguments or keywords.

Command Default

This feature is disabled by default.

Command Modes

XR Config mode

Command History

Release	Modification
Release 24.2.11	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
qos	read, write

The following example shows how to enable the VOQ watchdog feature on your router.

```
Router#config
Router(config)#hw-module voq-watchdog feature enable
Router(config)#commit
Router(config)#exit
```

queue-limit

To specify or modify the maximum number of packets the queue can hold for a class policy configured in a policy map for each port, 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*] | *percent <1-100>* | *discard-class value <0-1> 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 • **kbytes** —kilobytes • **mbytes** —megabytes • **ms** —milliseconds • **packets** —packets (default) • **us** —microseconds **Note** When the specified *units* is packets, packets are assumed to be 256 bytes in size.
percent	(Optional) Allows you to specify queue limit thresholds as a percentage of the total buffer limit for each port. This makes your provisioning model simpler and makes it easier for you to adjust the queue burst limit, irrespective of the queue's service rate.
discard-class	(Optional) Allows you to configure dual queue limit thresholds for high priority and low priority. This option was introduced in Release 7.0.12. value • **0** —higher priority flow • **1** —lower priority flow (Optional) Units for the queue limit value. Values can be: • **bytes** —bytes • **kbytes** —kilobytes • **mbytes** —megabytes • **ms** —milliseconds • **packets** —packets (default) • **us** —microseconds

Command Default

The default value is 6 milliseconds for all queues including the high-priority queues.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

When configuring the **queue-limit** command, you must configure one of the following commands: **priority**, **shape average**, **bandwidth** or **bandwidth remaining**, except for the default class. The default value is 6 milliseconds for all queues including the high-priority queues.

The **queue-limit** command is supported only in the egress direction.

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 a virtual output queue is full, until congestion is eliminated.

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

Queue Limit Default Values

These default values are used when **queue-limit** is not configured in the class.

If QoS is configured and random-detect is configured when the **queue-limit** is configured in time units, the guaranteed service rate (for the non-priority class) or the interface rate (for the priority class) is used to compute the queue-limit.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how to configure two queue limits, one for higher priority and the other for lower priority.:

```
RP/0/RP0/CPU0:router(config)#policy-map egress_pol_dql
RP/0/RP0/CPU0:router(config-pmap)# class tc7
RP/0/RP0/CPU0:router(config-pmap-c)#priority level 1
RP/0/RP0/CPU0:router(config-pmap-c)#queue-limit ?
<1-4294967295>  Max Threshold for tail drop
  discard-class   Discard Class based QLIMIT (upto 8 values)
  percent         Configure queue limit value in percentage

RP/0/RP0/CPU0:router(config-pmap-c)#queue-limit discard-class ?
<0-1>  Discard Class  value
RP/0/RP0/CPU0:router(config-pmap-c)#queue-limit discard-class 0 100 ?
bytes    Bytes
  kbytes   Kilobytes
  mbytes   Megabytes
  ms       Milliseconds
```

```
  packets  Packets (default)
  us       Microseconds
  <cr>
RP/0/RP0/CPU0:router(config-pmap-c)#queue-limit discard-class 0 100 mbytes
RP/0/RP0/CPU0:router(config-pmap-c)#queue-limit discard-class 1 50 mbytes
RP/0/RP0/CPU0:router(config-pmap-c)#commit
RP/0/RP0/CPU0:router(config-pmap-c)#end
```

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 [[[**min-threshold** *value*] [**max-threshold** *value*] **probability** *percentage probability value*]] [**discard-class** *value*]

no random-detect

Syntax Description

min-threshold *value*	Minimum threshold in number of packets. The value range of this argument is from 0 through 1073741823 in packets. **Note** On your router, the threshold numbers are converted into units of bytes (minimum: 6144, maximum: 390070272) and enforced.
max-threshold *value*	Maximum threshold in number of packets. The value range of this argument is from the value of the *min-threshold* argument through 1073741823. When the queue length exceeds the maximum threshold, RED drops all packets with the specified discard class value. **Note** On your router, the threshold numbers are converted into units of bytes (minimum: 6144, maximum: 390070272) and enforced.
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
probability *percentage probability value*	Configure WRED mark probability in percent. The value range of this argument is from 1 through 100.
discard-class *value*	Discard-class based RED (up to 2 values, which is 0 and 1).

Command Default

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

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.
Release 7.3.16	The functionality to configure WRED mark probability in percent was introduced.

Usage Guidelines

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.

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 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
```

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*
no service-policy {**input** | **output**} *policy-map*

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.

Command Default

No service policy is specified.

Command Modes

Interface configuration.

Command History

Release	Modification
Release 7.0.12	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 policy2 applied to HundredGigE 0/0/0/0.

```
RP/0/RP0/CPU0:router(config)# class-map class2
RP/0/RP0/CPU0:router(config)# match precedence ipv4 2
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-map class2
RP/0/RP0/CPU0:router(config-pmap-c)# set precedence 3
RP/0/RP0/CPU0:router(config-pmap)# exit

RP/0/RP0/CPU0:router(config)# HundredGigE 0/0/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input policy2
```

This example shows policy map policy 1 applied to Bundle-Ether interface.

```
RP/0/RP0/CPU0:router(config)# interface Bundle-Ether1
RP/0/RP0/CPU0:router(config-if)# service-policy input policy1
RP/0/RP0/CPU0:router(config-if)# exit
```

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 7.0.12	This command was introduced.

Usage Guidelines

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 this restriction:

- The **priority** command can be used only in the child policy.

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 level 1
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
```

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 *percentage*	Specifies the interface bandwidth in percentage. Values can be from 1 to 100.
rate	Specifies the average shaping rate as an absolute value. Use this argument with the optional *units* argument in the **shape average** *rate units* form of the command. Values can be from 1 to 4294967295.
units	Specifies the average shaping rate as an absolute value. Use this argument with the optional *units* argument in the **shape average** *rate units* form of the command. Values can be from 1 to 4294967295. • **bps**—bits per second (default) • **gbps**—gigabits per second • **kbps**—kilobits per second • **mbps**—megabits per second
per-thousand *value*	Specifies shape rate as parts per thousand of the available bandwidth.
per-million *value*	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 26.3.1	The command was enhanced to support absolute rate values on supported bundle interfaces.
Release 7.0.12	This command was introduced.

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 on unsupported releases or routers, **shape average** can be configured only as a percentage.

Starting with Cisco IOS XR Release 26.3.1, you can configure the **shape average** command with absolute units on supported bundle main interfaces and bundle subinterfaces on supported Cisco 8000 Series platforms.

For bundle shapers configured with an absolute value, the configured shaper rate is replicated on each bundle member interface. The configured value is not a single aggregate bundle-wide shaper rate.

For bundle shapers configured with an absolute value, the configured shaper rate must be less than or equal to the bandwidth of each bundle member interface. If you add a lower-bandwidth member to a bundle that already has an absolute-value shaper policy, member policy replication for that member can remain incomplete when the configured shaper rate is greater than that member bandwidth. The **show bundle** command can display this warning: `MQC: Shape bandwidth rate is greater than the parent reference bandwidth.`

If in-place policy modification fails after bundle member changes, remove the egress service policy from the bundle interface, update the shaper rate to a value supported by the current bundle member bandwidth, and apply the egress service policy again.

The **priority** and **shape average** commands can 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 parent shaper rate milliseconds:

```
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 100000 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 100000 kbps
```

This example shows how to configure an absolute shaper rate on a bundle interface in the output direction:

```
Router(config)# policy-map bundle_abs_shape
Router(config-pmap)# class bundle_tc1
Router(config-pmap-c)# shape average 500 mbps
Router(config-pmap-c)# exit
Router(config-pmap)# end-policy-map
Router(config)# interface Bundle-Ether30
Router(config-if)# service-policy output bundle_abs_shape
```

show controllers

To view Priority Flow Control (PFC) statistics, including PFC watchdog statistics, use the **show controllers** command in the XR EXEC mode.

show controllers { *interface* **priority-flow-control** [**statistics** | **watchdog-stats**] | **all priority-flow-control** { **statistics** | **watchdog-stats** } **location all** }

Syntax Description

interface	Displays statistics for an interface.
all	Displays statistics for all interfaces.
priority-flow-control	Specifies PFC mechanism.
statistics	Displays PFC statistics for an interface or all interfaces. (Optional) For a specific interface.
watchdog-stats	Displays PFC watchdog statistics for an interface or all interfaces. (Optional) For a specific interface.
location all	Displays PFC statistics for all nodes.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.5.5 Release 24.2.11	The **show controllers all priority-flow-control statistics location all** command form was added to display PFC statistics for all interfaces. The **show controllers all priority-flow-control watchdog-stats location all** command form was added to display PFC watchdog statistics for all interfaces.

Release	Modification
Release 7.5.4	For the **show controllers priority-flow-control watchdog-stats** command output, separate counters were added for total dropped packets and dropped packets. For the **show controllers priority-flow-control statistics**command, an additional counter for PFC Tx pause frames per traffic class was added.
Release 7.0.11	The **show controllers priority-flow-control statistics** and **show controllers priority-flow-control watchdog-stats** command forms were introduced.

Usage Guidelines

- From Release 7.5.5 (and Release 24.2.11), you can view the PFC and PFC Watchdog statistics for all interfaces using the **show controllers all priority-flow-control statistics location all** and **show controllers all priority-flow-control watchdog-stats location all** commands, respectively.
- Running the **clear controller priority-flow-control watchdog-stats** command also clears the counters for the corresponding interfaces that the **show controllers all priority-flow-control watchdog-stats location all** command displays.
- Running the **clear controller priority-flow-control statistics** command also clears the counters for the corresponding interfaces that the **show controllers all priority-flow-control statistics location all** command displays.
- You can view PFC statistics and PFC Watchdog statistics per interface using the **show controllers priority-flow-control statistics** and **show controllers priority-flow-control watchdog-stats** commands, respectively.
- Use the **clear controller priority-flow-control statistics**and **clear controller priority-flow-control watchdog-stats** commands to clear PFC statistics and PFC watchdog statistics counters, respectively.

This example shows a sample output of the **show controllers priority-flow-control statistics** command:

```
Router# show controllers hundredGigE 0/0/0/0 priority-flow-control statistics

Priority flow control information for interface HundredGigE0/0/0/0:
Priority Flow Control:
    Total Rx PFC Frames: 0
    Total Tx PFC Frames: 1764273
    Rx Data Frames Dropped: 0
    CoS  Status  Rx Frames
    ---  ------  ----------
      0    Off      0
      1    Off      0
      2    Off      0
      3    Off      0
      4    Off      0
```

```
      5    Off      0
      6    Off      0
      7    Off      0
```

This example shows the sample output with counters for PFC Tx frames per traffic class.

```
Router# show controllers hundredGigE 0/0/0/4  priority-flow-control statistics

Priority flow control information for interface HundredGigE0/0/0/4:
Priority Flow Control:
    Total Rx PFC Frames: 0
    Total Tx PFC Frames: 4832680
    Rx Data Frames Dropped: 1442056 (possible overflow)
    CoS  Status  Rx Frames   Tx Frames
    ---  ------  ----------  ----------
      0  on            0           0
      1  on            0           0
      2  on            0           0
      3  on            0      2416374
      4  on            0      2416306
      5  on            0           0
      6  on            0           0
      7  on            0           0
```

This example shows the sample output of **show controllers hundredGigE 0/0/0/0 priority-flow-control watchdog-stats** command:

```
Router# show controllers hundredGigE 0/0/0/0 priority-flow-control watchdog-stats

Priority flow control information for interface HundredGigE0/0/0/0:

Priority flow control watchdog statistics:
SAR: Auto restore and shutdown
------------------------------------------------------------------------------------------
Traffic Class            :       0        1        2        3        4        5        6
      7
------------------------------------------------------------------------------------------
Watchdog Events          :       0        0        0        0        0        0        0
      0
Shutdown Events          :       0        0        0        0        0        0        0
      0
Auto Restore Events      :       0        0        0        0        0        0        0
      0
SAR Events               :       0        0        0        0        0        0        0
      0
SAR Instantaneous Events :       0        0        0        0        0        0        0
      0
Total Dropped Packets    :       0        0        0        0        0        0        0
      0
```

From Release 7.5.4 onwards, the output includes separate counters for total dropped packets and dropped packets:

```
Router# show controllers hundredGigE 0/1/0/43 priority-flow-control watchdog-stats

Priority flow control information for interface HundredGigE0/1/0/43:

Priority flow control watchdog statistics:
SAR: Auto restore and shutdown
-\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\-
Traffic Class            :       0        1        2         3         4        5        6
```

```
        7
-------------------------------------------------------------------------------------------------------------
Watchdog Events           :       0        0        0         3         3        0        0
        0
Shutdown Events           :       0        0        0         3         3        0        0
        0
Auto Restore Events       :       0        0        0         3         3        0        0
        0
SAR Events                :       0        0        0      3510      3510        0        0
        0
SAR Instantaneous Events  :       0        0        0      1172      1172        0        0
        0
Total Dropped Packets     :       0        0        0 941505767 941488166        0        0
        0
Dropped Packets           :       0        0        0 314855466 314887161        0        0
        0
```

Disregard the SAR Events and SAR Instantaneous Events entries because those numbers have no bearing on your operations.

This example shows a sample output of the **show controllers all priority-flow-control statistics location all** command:

```
Router# show controllers all priority-flow-control statistics location all

   Interface                TC    Rx PFC  TxPFC  RxDropped

   FourHundredGigE0/0/0/0    0      0       0      NA
   FourHundredGigE0/0/0/0    7      0       0      NA
   FourHundredGigE0/0/0/0  all      0       0      0
   FourHundredGigE0/0/0/1    0      0       0      NA
   FourHundredGigE0/0/0/1    7      0       0      NA
   FourHundredGigE0/0/0/1  all      0       0      0
   FourHundredGigE0/0/0/2    0      0       0      NA
   FourHundredGigE0/0/0/2    7      0       0      NA
   FourHundredGigE0/0/0/2  all      0       0      0
   FourHundredGigE0/0/0/3    0      0       0      NA
```

This example shows the sample output of the **show controllers all priority-flow-control watchdog-stats location all** command:

```
Router# show controllers all priority-flow-control watchdog-stats location all

Interface               TC  Watchdog  Shutdown Auto Restore  SAR     SAR Instantaneous
Total Dropped   Dropped
                            Events    Events   Events        Events  Events

FourHundredGigE0/0/0/0   0   0         0        0             0       0
0               0
FourHundredGigE0/0/0/0   7   0         0        0             0       0
0               0
FourHundredGigE0/0/0/1   0   0         0        0             0       0
0               0
FourHundredGigE0/0/0/1   7   0         0        0             0       0
0               0
FourHundredGigE0/0/0/2   0   0         0        0             0       0
0               0
FourHundredGigE0/0/0/2   7   0         0        0             0       0
0               0
FourHundredGigE0/0/0/3   0   0         0        0             0       0
```

```
0               0
FourHundredGigE0/0/0/3   7   0          0         0              0        0
0               0
FourHundredGigE0/0/0/4   0   0          0         0              0        0
0               0
```

show controllers npu packet-memory

To display the High Bandwidth Memory (HBM) congestion state and the current current memory usage of Shared Memory System (SMS) and HBM, use the **show controllers npu packet-memory** command in the XR EXEC mode.

show controllers npu packet-memory [all | congestion | interface *type* **| usage {instance {** *number* **|** *all* **}| verbose}]**

Syntax Description

all	Displays all details, including memory usage and congestion .
congestion	Displays Open Forwarding Abstraction (OFA) hardware congestion.
interface *type*	Displays the name of the IEEE 802.3 interfaces. For *type*, you can specify a specific interface or use **all** to specify all interfaces.
usage instance*number*	Displays information for the specific device instance number selected.
usage instance*all*	Displays information for all device instances
verbose	Displays information details, including timestamp in milliseconds.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.5.5	Counters to view buffer availability for Shared Memory System (SMS) and High Bandwidth Memory (HBM) were added.
Release 7.5.3	This command was introduced.

Usage Guidelines

The **show controllers npu packet-memory** command is supported only when you:

- configure Priority Flow Control in the buffer-extended mode. (See **hw-module profile priority-flow-control**.)
- configure the **hw-module profile npu memory buffer-extended bandwidth-congestion-detection enable** command to detect HBM congestion.

For details on detecting HBM congestion, and detailed examples of **show controllers npu packet-memory**, see the *Modular QoS Configuration Guide for Cisco 8000 Series Routers*.

Task ID

Task ID	Operations
interface	read
cisco-support	read

From Release 7.5.5, you can also view details of the buffer available for SMS (**Buff-int-free Min WM**) and HBM (**Buff-ext-free Min WM**) when you run the **show controllers npu packet-memory usage instance all location all** command.

```
Router#show controller npu packet-memory usage instance all location all
HW memory Information For Location: 0/6/CPU0

-------------------------------------------------------------------------------------------------------------------
Timestamp(msec)                    | Device | Buff-int | Buff-int | Buff-ext | Buff-ext |
Buff-int-free | Buff-ext-free
                                                 Usage      Max WM   | Usage    | Max WM   | Min
 WM         | Min WM
-------------------------------------------------------------------------------------------------------------------
Wed 2023-08-30 23:47:40.918 UTC       0       1518       6668      17154      17656
293394          982846
Wed 2023-08-30 23:47:41.918 UTC       0       1227       5631      16010      16427
293685          983990
Wed 2023-08-30 23:47:42.919 UTC       0       1398       8295      15041      15734
293514          984959
Wed 2023-08-30 23:47:43.919 UTC       0       1765       8892      14744      15678
293147          985256
Wed 2023-08-30 23:47:41.011 UTC       1      10380      12419      37532      38165
284532          962468
Wed 2023-08-30 23:47:42.011 UTC       1      10463      11977      37315      38326
284449          962685
Wed 2023-08-30 23:47:43.013 UTC       1       9145      12604      37714      38242
285767          962286
Wed 2023-08-30 23:47:44.013 UTC       1      10996      13272      37429      38051
283916          962571
```

Run the **show controllers npu packet-memory usage verbose instance all location all** to view memory usage details in SMS and HBM.

```
RP/0/RP0/CPU0:Router#show controllers npu packet-memory usage verbose instance all location
 all

HW memory Information For Location: 0/RP0/CPU0

* Option 'verbose' formatted data is for internal consumption.
-----------------------------------------------------------------------
Timestamp(msec) | Device | Buff-int | Buff-int | Buff-ext | Buff-ext
                           Usage      Max WM   | Usage    | Max WM
-----------------------------------------------------------------------
   1663958881006       0       2455       2676        637        640
   1663958882007       0       2461       2703        635        640
   1663958883007       0       2364       2690        635        640
   1663958884007       0      71603      75325       3183      18336
   1663958885008       0       2458       2852       1275       1279
   1663958886008       0       2484       2827       1275       1279
```

Run the **show controllers npu packet-memory congestion verbose instance all location all** command to view congestion details in SMS and HBM.

```
Router#show controllers npu packet-memory congestion verbose instance all location all
HW memory Information For Location: 0/RP0/CPU0
```

```
* Option 'verbose' formatted data is for internal consumption.

Timestamp(msec) |      Event | Device | Slice |    VOQ |VOQ-buff| Evicted-buff | Buff-int
| Buff-int | Buff-int | Buff-ext | Buff-ext
                |      Type  |                          |int-WM  | int-WM       | UC-WM
| Usage    | Max WM   | Usage    | Max WM
-------------------------------------------------------------------------------------------
1663958550349          0         0        5      534     16011        63969        65451
    70410      70410      34405     34405
1663958551101          1         0        5      534         0            0          900
     2440       2440          0         0
1663958557354          0         0        5      534     16011        63984        65493
    70573      70573      34408     34408
1663958558354          1         0        5      534         0            0          915
     2455       2455          0         0
1663958564606          0         0        5      534     16011        64002        65520
    70081      70081      34532     34532
1663958565356          1         0        5      534         0            0          915
     2417       2417          0         0
```

show controllers npu packet-memory interface

To view source queue buffer usage information in the packet memory space and pause duration of traffic class queues on PFC buffer-extended mode-enabled routers, use the **show controllers npu packet-memory interface** command in the XR EXEC mode.

show controllers npu packet-memory interface *type* { { **rx-pause-percent** | **tx-pause-percent** } [**detail** | **five-minute** | **one-minute** | **verbose**] **location** *ID* | **sq-buffer-usage location** *ID* }

Syntax Description

interface *type*	Interface type and number. For the *type* argument, you can specify an interface and its number, or use the **all** keyword to view data for all interfaces. If you select **all**, only the last one-minute and five-minute average entries are displayed, and not all 120 records.
rx-pause-percent	Specifies the pause duration of the input queues on the receiving router.
tx-pause-percent	Specifies the pause duration of the output queues on the transmitting router.
detail	(Optional) Displays a maximum of 120 records, at a frequency of one record per 250-millisecond interval.
[**five-minute**|**one-minute**|**verbose**]	(Optional) Displays traffic class queue pause frame information for a 1-minute or 5-minute duration. If you don't specify the 1-minute or 5-minute options, 30 records are displayed for each traffic class at a frequency of one record per second. If you want to view the time stamp in a raw mode, choose **verbose**.
sq-buffer-usage *ID*	Displays the source queue buffer usage information in the packet memory space.
location *ID*	Specifies the node location. For *ID*, you can specify a specific node in the *rack/slot/module* notation or use **all** to specify all nodes.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 24.1.1	The **sq-buffer-usage** keyword was added to the **show controllers npu packet-memory interface** command form.

Release	Modification
Release 24.2.11	The **rx-pause-percent** and **tx-pause-percent** keywords were added to the **show controllers npu packet-memory interface** command form

Usage Guidelines

Displaying the source queue buffer usage in all ports at all locations is not supported.

When you use the **show controllers npu packet-memory interface** *type* {**rx-pause-percent**|**tx-pause-percent**} **location** *ID* command form, 30 records are displayed for each traffic class at a frequency of one record per second. You can append the **verbose** option to this command form to display time stamps in a raw mode.

Source Queue Buffer Usage

This example displays periodic information about the source queue buffer usage per port in the packet memory space

```
Router#show controllers npu packet-memory interface FourHundredGigE 0/0/0/23 sq-buffer-usage
 location 0/RP0/CPU0
Thu Feb  1 16:52:48.101 UTC

------------------------------------------------------------------------------
Node ID: 0/RP0/CPU0
Source Queue Buffer Usage Info for interface(s) FourHundredGigE0_0_0_23

Intf          Intf        TC      buffer-usage      congestion-state
name          handle
              (hex)
------------------------------------------------------------------------------
FH0/0/0/23   0x0f0001c8     3              0                 NO
FH0/0/0/23   0x0f0001c8     6              0                 NO
```

This example displays periodic information about source queue buffer usage in all ports in the packet memory space.

```
RP/0/RP0/CPU0:ios#show controllers npu packet-memory interface all sq-buffer-usage location
 0/RP0/CPU0
Thu Feb  1 17:04:40.472 UTC

------------------------------------------------------------------------------
Node ID: 0/RP0/CPU0
Source Queue Buffer Usage Info for interface(s) all

Intf          Intf        TC      buffer-usage      congestion-state
name          handle
              (hex)
------------------------------------------------------------------------------
Hu0/0/0/0    0x0f000130     3              0                 NO
Hu0/0/0/0    0x0f000130     6              0                 NO
Hu0/0/0/35   0x0f000138     3              0                 NO
Hu0/0/0/35   0x0f000138     6              0                 NO
Hu0/0/0/34   0x0f000140     3              0                 NO
Hu0/0/0/34   0x0f000140     6              0                 NO
Hu0/0/0/33   0x0f000148     3              0                 NO
Hu0/0/0/33   0x0f000148     6              0                 NO
Hu0/0/0/32   0x0f000150     3              0                 NO
Hu0/0/0/32   0x0f000150     6              0                 NO
Hu0/0/0/31   0x0f000158     3              0                 NO
Hu0/0/0/31   0x0f000158     6              0                 NO
Hu0/0/0/30   0x0f000160     3              0                 NO
Hu0/0/0/30   0x0f000160     6              0                 NO
```

```
Hu0/0/0/29    0x0f000168     3              0                NO
Hu0/0/0/29    0x0f000168     6              0                NO
Hu0/0/0/28    0x0f000170     3              0                NO
Hu0/0/0/28    0x0f000170     6              0                NO
Hu0/0/0/27    0x0f000178     3              0                NO
Hu0/0/0/27    0x0f000178     6              0                NO
Hu0/0/0/26    0x0f000180     3              0                NO
Hu0/0/0/26    0x0f000180     6              0                NO
Hu0/0/0/25    0x0f000188     3              0                NO
Hu0/0/0/25    0x0f000188     6              0                NO
Hu0/0/0/24    0x0f000190     3              0                NO
Hu0/0/0/24    0x0f000190     6              0                NO
Hu0/0/0/20    0x0f000198     3              0                NO
Hu0/0/0/20    0x0f000198     6              0                NO
Hu0/0/0/19    0x0f0001a0     3              0                NO
Hu0/0/0/19    0x0f0001a0     6              0                NO
Hu0/0/0/15    0x0f0001a8     3              0                NO
Hu0/0/0/15    0x0f0001a8     6              0                NO
Hu0/0/0/8     0x0f0001b0     3              0                NO
Hu0/0/0/8     0x0f0001b0     6              0                NO
Hu0/0/0/1     0x0f0001b8     3              0                NO
Hu0/0/0/1     0x0f0001b8     6              0                NO
FH0/0/0/2     0x0f0001c0     3              0                NO
```

Displaying the source queue buffer usage in all ports at all locations is not supported.

This example throws the 'Operation not supported' error in an attempt to display source queue buffer usage information for all ports at all locations.

```
RP/0/RP0/CPU0:ios#show controllers npu packet-memory interface all sq-buffer-usage location
 all
Thu Feb  1 17:13:35.010 UTC
Operation not supported on this location: all
```

Pause Duration

Traffic Class Queue Pause Duration Examples:

In the following examples, input queue and output queue samples are provided for each example:

Example 1: Average Pause Duration in the Last Minute

Input Queue on R3: Displays the average pause duration of input queues on node 0/6/CPU0 interfaces for the last one-minute duration. Traffic for the traffic class 2 queue on interfaces FH0/6/0/21 and FH0/6/0/23 is paused for more than 50% of the time.

```
R3# show controllers npu packet-memory interface all tx-pause-percent one-minute location
0/6/CPU0

------------------------------------------------------------------------
Node ID: 0/6/CPU0
Source Queue Pause Percentage Info for interface(s) all
Intf               TC          Pause-Percentage
name
------------------------------------------------------------------------
  FH0/6/0/10       2           0.00000
  FH0/6/0/11       2           0.00000
  FH0/6/0/13       2           0.00000
  FH0/6/0/14       2           0.00000
  FH0/6/0/15       2           0.00000
  FH0/6/0/16       2           0.00000
  FH0/6/0/18       2           0.00000
```

```
  FH0/6/0/21       2          53.01604
  FH0/6/0/22       2           0.00000
  FH0/6/0/23       2          53.13991
```

Output Queue on R2: Displays the average pause duration of output queues on node 0/6/CPU0 interfaces for the last one-minute duration. Traffic for the traffic class 2 queue on interfaces FH0/6/0/21 and FH0/6/0/23 is paused for more than 50% of the time.

```
R2# show controllers npu packet-memory interface all rx-pause-percent one-minute location
0/6/CPU0
------------------------------------------------------------------------------
Node ID: 0/6/CPU0
Out Queue Pause Percentage Info for interface(s) all
Intf               TC          Pause-Percentage
name
------------------------------------------------------------------------------
  FH0/6/0/10       2           0.00000
  FH0/6/0/11       2           0.00000
  FH0/6/0/13       2           0.00000
  FH0/6/0/14       2           0.00000
  FH0/6/0/15       2           0.00000
  FH0/6/0/16       2           0.00000
  FH0/6/0/18       2           0.00000
  FH0/6/0/21       2          53.01604
  FH0/6/0/22       2           0.00000
  FH0/6/0/23       2          53.13991
```

Example 2: Average Pause Duration for the Last Minute on One Interface

Input Queue on R3: Displays the average pause duration of input queues on node 0/6/CPU0 interface FourHundredGigE0_6_0_21 for the last one-minute duration. Traffic for the traffic class 2 queue on interface FourHundredGigE0_6_0_21 is paused for more than 50% of the time.

```
R3# show controllers npu packet-memory interface FH0/6/0/21 tx-pause-percent one-minute
location 0/6/CPU0
------------------------------------------------------------------------------
Node ID: 0/6/CPU0
Source Queue Pause Percentage Info for interface(s) FourHundredGigE0_6_0_21
Time                                TC      Pause-Percentage
------------------------------------------------------------------------------
Thu 2024-03-28 18:53:30.264 UTC       2       53.49027
```

Output Queue on R2: Displays the average pause duration of output queues on node 0/6/CPU0 interface FourHundredGigE0_6_0_21 for the last one-minute duration. Traffic for the traffic class 2 queue on interface FH0/6/0/21 is paused for more than 50% of the time.

```
R2# show controllers npu packet-memory interface FH0/6/0/21 rx-pause-percent one-minute
location 0/6/CPU0

Node ID: 0/6/CPU0
Out Queue Pause Percentage Info for interface(s) FourHundredGigE0_6_0_21
Time                                TC      Pause-Percentage
------------------------------------------------------------------------------
Thu 2024-03-28 18:53:30.264 UTC       2       53.49027
```

Example 3: Average Pause Duration for the Last 5 Minutes

Input Queue on R3: Displays the average pause duration of input queues on node 0/6/CPU0 interfaces for the last five minutes. Traffic for the traffic class 2 queue on interfaces FH0/6/0/21 and FH0/6/0/23 is paused for more than 50% of the time.

```
R3# show controllers npu packet-memory interface all  tx-pause-percent five-minute location
 0/6/CPU0
```

```
------------------------------------------------------------------------
Node ID: 0/6/CPU0
Source Queue Pause Percentage Info for interface(s) all
Intf               TC          Pause-Percentage
name
------------------------------------------------------------------------
  FH0/6/0/18       2            0.00000
  FH0/6/0/21       2           53.24746
  FH0/6/0/22       2            0.00000
  FH0/6/0/23       2           53.23203
  FH0/6/0/24       2            0.00000
  FH0/6/0/30       2            0.00000
  Hu0/6/0/17       2            0.00000
  Hu0/6/0/20       2            0.00000
```

Output Queue on R2: Displays the average pause duration of output queues on node 0/6/CPU0 interfaces for the last five minutes. Traffic for the traffic class 2 queue on interfaces FH0/6/0/21 and FH0/6/0/23 is paused for more than 50% of the time.

```
R2# show controllers npu packet-memory interface all rx-pause-percent five-minute location
 0/6/CPU0
------------------------------------------------------------------------
Node ID: 0/6/CPU0
Out Queue Pause Percentage Info for interface(s) all
Intf               TC          Pause-Percentage
name
------------------------------------------------------------------------
  FH0/6/0/10       2            0.00000
  FH0/6/0/11       2            0.00000
  FH0/6/0/13       2            0.00000
  FH0/6/0/14       2            0.00000
  FH0/6/0/15       2            0.00000
  FH0/6/0/16       2            0.00000
  FH0/6/0/18       2            0.00000
  FH0/6/0/21       2           53.01604
  FH0/6/0/22       2            0.00000
  FH0/6/0/23       2           53.13991
```

Example 4: Average Pause Duration for the Last 5 Minutes on One Interface

Input Queue on R3: Displays the average pause duration of input queues on interface FH0/6/0/21 on node 0/6/CPU0 for the last five minutes. Traffic for the traffic class 2 queue on interface FH0/6/0/21 is paused for more than 50% of the time.

```
R3# show controllers npu packet-memory interface FH0/6/0/21 tx-pause-percent five-minute
location 0/6/CPU0

------------------------------------------------------------------------
Node ID: 0/6/CPU0
Source Queue Pause Percentage Info for interface(s) FourHundredGigE0_6_0_21
Time                                TC      Pause-Percentage
------------------------------------------------------------------------
Thu 2024-03-28 18:53:00.242 UTC       2       53.31213
```

Output Queue on R2: Displays the average pause duration of output queues on interface FH0/6/0/21 on node 0/6/CPU0 for the last five minutes. Traffic for the traffic class 2 queue on interface FH0/6/0/21 is paused for more than 50% of the time.

```
R2# show controllers npu packet-memory interface FH0/6/0/21 rx-pause-percent five-minute
location 0/6/CPU0
------------------------------------------------------------------------
Node ID: 0/6/CPU0
Out Queue Pause Percentage Info for interface(s) FourHundredGigE0_6_0_21
```

```
Time                                    TC      Pause-Percentage
-------------------------------------------------------------------------
                                           2       53.31213
```

Example 5: Pause Duration for the Last 30 Seconds With a One-Second Interval

Input Queue on R3: Displays the pause duration of input queues on interface FH0/6/0/21. The traffic class 2 queue is paused for more than 50% of the time for the entire time duration.

```
R3# show controllers npu packet-memory interface FH0/6/0/21 tx-pause-percent location
0/6/CPU0
-------------------------------------------------------------------------
Node ID: 0/6/CPU0
Source Queue Pause Percentage Info for interface(s) FourHundredGigE0_6_0_21
Time                                    TC      Pause-Percentage
-------------------------------------------------------------------------
Thu 2024-03-28 18:53:31.265 UTC       2       53.57590
Thu 2024-03-28 18:53:32.266 UTC       2       54.04276
Thu 2024-03-28 18:53:33.267 UTC       2       53.99954
Thu 2024-03-28 18:53:34.268 UTC       2       53.38932
Thu 2024-03-28 18:53:35.269 UTC       2       54.52591
Thu 2024-03-28 18:53:36.270 UTC       2       54.27677
Thu 2024-03-28 18:53:37.271 UTC       2       52.78747
Thu 2024-03-28 18:53:38.271 UTC       2       53.42725
Thu 2024-03-28 18:53:39.271 UTC       2       53.34946
Thu 2024-03-28 18:53:40.272 UTC       2       53.06505
Thu 2024-03-28 18:53:41.272 UTC       2       53.50647
Thu 2024-03-28 18:53:42.272 UTC       2       53.49165
Thu 2024-03-28 18:53:43.272 UTC       2       52.52429
Thu 2024-03-28 18:53:44.272 UTC       2       53.44903
..
..
```

Output Queue on R2: Displays the pause duration of output queues on interface FH0/6/0/21. The traffic class 2 queue is paused for more than 50% of the time for the entire time duration.

```
R2# show controllers npu packet-memory interface FH0/6/0/21 rx-pause-percent location
0/6/CPU0
-------------------------------------------------------------------------
Node ID: 0/6/CPU0
Out Queue Pause Percentage Info for interface(s) FourHundredGigE0_6_0_21
Time                                    TC      Pause-Percentage
-------------------------------------------------------------------------
Thu 2024-03-28 18:53:31.265 UTC       2       53.57590
Thu 2024-03-28 18:53:32.266 UTC       2       54.04276
Thu 2024-03-28 18:53:33.267 UTC       2       53.99954
Thu 2024-03-28 18:53:34.268 UTC       2       53.38932
Thu 2024-03-28 18:53:35.269 UTC       2       54.52591
Thu 2024-03-28 18:53:36.270 UTC       2       54.27677
Thu 2024-03-28 18:53:37.271 UTC       2       52.78747
Thu 2024-03-28 18:53:38.271 UTC       2       53.42725
Thu 2024-03-28 18:53:39.271 UTC       2       53.34946
Thu 2024-03-28 18:53:40.272 UTC       2       53.06505
Thu 2024-03-28 18:53:41.272 UTC       2       53.50647
Thu 2024-03-28 18:53:42.272 UTC       2       53.49165
Thu 2024-03-28 18:53:43.272 UTC       2       52.52429
Thu 2024-03-28 18:53:44.272 UTC       2       53.44903
..
..
```

Example 6: Pause Duration for the Last 30 Seconds With a 250 ms Interval

Input Queue on R3: Displays the pause duration of the input queues on interface FH0/6/0/21. The traffic class 2 queue is paused for more than 50% of the time.

```
R3# show controllers npu packet-memory interface FH0/6/0/21 tx-pause-percent detail location
 0/6/CPU0
------------------------------------------------------------------------------
This CLI will fetch large number of records.
Integration with automation scripts is not recommended
------------------------------------------------------------------------------
Node ID: 0/6/CPU0
Source Queue Pause Percentage Info for interface(s) FourHundredGigE0_6_0_21
Time                                    TC      Pause-Percentage
------------------------------------------------------------------------------
Thu 2024-03-28 18:53:30.514 UTC       2       52.22349
Thu 2024-03-28 18:53:30.764 UTC       2       53.67103
Thu 2024-03-28 18:53:31.014 UTC       2       53.63637
Thu 2024-03-28 18:53:31.265 UTC       2       54.77273
Thu 2024-03-28 18:53:31.515 UTC       2       53.72371
Thu 2024-03-28 18:53:31.765 UTC       2       54.29221
Thu 2024-03-28 18:53:32.015 UTC       2       53.04150
Thu 2024-03-28 18:53:32.266 UTC       2       55.11364
..
..
```

Output Queue on R2: Displays the pause duration of the output queues on interface FH0/6/0/21. The traffic class 2 queue is paused for more than 50% of the time.

```
R2# show controllers npu packet-memory interface FH0/6/0/21 rx-pause-percent detail location
 0/6/CPU0
------------------------------------------------------------------------------
This CLI will fetch large number of records.
Integration with automation scripts is not recommended
------------------------------------------------------------------------------
Node ID: 0/6/CPU0
Out Queue Pause Percentage Info for interface(s) FourHundredGigE0_6_0_21
Time                                    TC      Pause-Percentage
------------------------------------------------------------------------------
Thu 2024-03-28 18:53:30.514 UTC       2       52.22349
Thu 2024-03-28 18:53:30.764 UTC       2       53.67103
Thu 2024-03-28 18:53:31.014 UTC       2       53.63637
Thu 2024-03-28 18:53:31.265 UTC       2       54.77273
Thu 2024-03-28 18:53:31.515 UTC       2       53.72371
Thu 2024-03-28 18:53:31.765 UTC       2       54.29221
Thu 2024-03-28 18:53:32.015 UTC       2       53.04150
Thu 2024-03-28 18:53:32.266 UTC       2       55.11364
```

show controllers npu priority-flow-control

To display the current status and configured thresholds in a hardware module configuration, use **show controllers npu priority-flow-control** command in XR EXEC mode.

show controllers npu priority-flow-control <*loc*>

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.5.4	The output added values for ECN maximum threshold value and mark probability.
Release 7.0.11	This command was introduced.

Usage Guidelines

None

Example

This example shows sample output of `show controllers npu priority-flow-control loc 0/0/CPU0` command:

```
RP/0/RP1/CPU0:router#show controllers npu priority-flow-control loc 0/0/CPU0
Mon Oct 12 14:35:17.531 UTC

Location:    0/0/CPU0
PFC:          Enabled
TC    Pause-threshold    Resume-Threshold     Headroom
-------------------------------------------------------
3       403200 bytes        40320 bytes        441600 bytes
4       403200 bytes        40320 bytes        441600 bytes
RP/0/RP1/CPU0:router#
```

This example shows the sample output with custom values for all parameters including **max-threshold** and **probability-percentage**.

```
Router#show controllers npu priority-flow-control location all

Location:              0/6/CPU0
PFC:                    Enabled
PFC Mode:               buffer-internal
TC    Pause-threshold    Headroom       ECN            ECN-MAX         Prob-per
-------------------------------------------------------------------------------
3    1574400 bytes      1651200 bytes   629760 bytes   1416960 bytes   50
4    1574400 bytes      1651200 bytes   629760 bytes   1416960 bytes   50
```

show controllers npu qos high-water-marks

To view traffic class queue occupancy and delay high water marks for each traffic class on an egress interface, use the **show controllers npu qos high-water-marks** command in the XR EXEC mode.

show controllers npu qos high-water-marks [**monotonic** | **periodic** [**last** *number*]] **interface** *type* [**traffic-class** *number*] [**location** *ID*]

Syntax Description

monotonic	(Optional) Displays monotonically increasing high water marks since bootup or the last clear operation. Monotonic high water marks are displayed if neither the monotonic or periodic keyword is used.
periodic [**last** *number*]	(Optional) Displays per-interval high water marks from recent periodic data collection intervals. Use the **last** *number* keyword-argument combination to view a specific number of collection intervals. The maximum number of intervals (6) are displayed by default.
interface *type*	Interface type and number. Specify an interface to view high water marks for a single interface. Use the **all** keyword to view high water marks for all interfaces.
traffic-class *number*	(Optional) Specify a traffic class number to view high water marks for a single traffic class. High water marks are displayed for all traffic classes by default.
location*ID*	(Optional) Node ID. Specify a node id to view high water marks for a single location. Use the **all** keyword to view high water marks for all locations. Data for all locations is displayed by default.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 24.2.11	The command was introduced.

Field Description for the **show controllers npu qos high-water-marks** command:

Table 2: Common fields

Field	Description
Interval Start and **End** (**periodic** only)	The periodic collection interval number, and the start and end time of the interval.

Field	Description
TC_*Number* = (*Number* range is 0-7)	Indicates the traffic class for the high water marks data displayed on that line. For periodic output, TC_ *Number* is only displayed for the traffic class's first periodic interval.

Table 3: Queue Occupancy fields

Field	Description
Max Occupancy %	The maximum queue occupancy experienced by this traffic class as a percentage of the total queue size. Due to limited queue quantization thresholds provided by the NPU, the max occupancy percentage and max occupancy kilobytes value below are an estimate of the actual maximum queue occupancy.
Max Occupancy kilobytes	The maximum queue occupancy experienced by this traffic class in kilobytes. The kilobytes value is calculated with the assumption that all buffers are fully packed (i.e., all 384 bytes utilized in an SMS buffer). As a result, the displayed kilobytes value will be higher than the actual number of kilobytes queued in many cases.
Queue Delay ns	The delay in nanoseconds at the time the maximum queue occupancy high water mark occurred.
Src Sys Port **Slot/NPU/Slc/Gid**	The Slot, NPU, Slice and GID identify the virtual output queue on which the queue occupancy high water mark occurred. The GID is the global identifier of the source system port whose packet was dequeued when the maximum queue occupancy high water mark occurred. In most cases, all ports on each slice share a virtual output queue. Although the identified source system port sent the packet that was detected as the high water mark, other ports using the same virtual output queue may have also contributed to the burst of packets that caused the queue occupancy high water mark. **Note** When the fair-4 or fair-8 VOQ mode is configured, each source port has its own virtual output queue. When PFC buffer-internal mode is configured, each port shares a virtual output queue with other ports on the same slice interface group (IFG). There are two IFGs per slice. Use the **show controllers npu voq-usage** command to see which other ports share a virtual output queue with the identified source system port.

Field	Description
Timestamp (**monotonic** only)	The timestamp when the maximum queue occupancy high water mark was recorded. The timestamp corresponds to the time the high water mark information was read from the NPU, and not the timestamp when the high water mark was detected by the NPU. The NPU is queried for high water mark info every 30 seconds, so the timestamp indicates the end time of a 30-second timeframe that the high water mark occurred within. For example, a timestamp of 16:56:44 indicates that the high water mark was observed sometime between 16:56:14 and 16:56:44.

Table 4: Queue Delay fields

Field	Description
Max Queue Delay ns	The maximum delay experienced by this traffic class in nanoseconds.
Queue Occupancy %	The queue occupancy as a percentage of the total queue size at the time the maximum queue delay high water mark occurred. Due to limited queue quantization thresholds provided by the NPU, the occupancy percentage and occupancy kilobytes value below are an estimate of the actual maximum queue occupancy.
Queue Occupancy kilobytes	The queue occupancy in kilobytes at the time the maximum queue delay high water mark occurred. The kilobytes value is calculated with the assumption that all buffers are fully packed (i.e., all 384 bytes utilized in an SMS buffer). As a result, the displayed kilobytes value will be higher than the actual number of kilobytes queued in many cases.
Src Sys Port **Slot/NPU/Slc/Gid**	The Slot, NPU, Slice and GID identify the virtual output queue on which the queue delay high water mark occurred. The GID is the global identifier of the source system port whose packet was dequeued when the maximum delay high water mark occurred. In most cases, all ports on each slice share a virtual output queue. Although the identified source system port sent the packet that was detected as the high water mark, other ports using the same virtual output queue may have also contributed to the burst of packets that caused the maximum delay high water mark. **Note** When the fair-4 or fair-8 VOQ mode is configured, each source port has its own virtual output queue. When PFC buffer-internal mode is configured, each port shares a virtual output queue with other ports on the same slice interface group (IFG). There are two IFGs per slice. Use the **show controllers npu voq-usage** command to see which other ports share a virtual output queue with the identified source system port.

Field	Description
Timestamp (**monotonic** only)	The timestamp when the maximum delay high water mark was recorded. The timestamp corresponds to the time the high water mark information was read from the NPU, and not the timestamp when the high water mark was detected by the NPU. The NPU is queried for high water mark info every 30 seconds, so the timestamp indicates the end time of a 30-second timeframe that the high water mark occurred within. For example, a timestamp of 16:56:44 indicates that the high water mark was observed sometime between 16:56:14 and 16:56:44.

Example 1: Monotonic High Water Marks for All Traffic Classes

The following output displays monotonic high water marks data for all traffic classes on interface fourHundredGigE 0/0/0/11:

```
Router# show controllers npu qos high-water-marks interface fourHundredGigE 0/0/0/11

Interface Name        =   FH0/0/0/11
Interface Handle      =        0x1F8
System Port Gid       =           96
Asic Instance         =            0

       Queue Occupancy High Water Marks                                  Queue Delay High
Water Marks

       Max Occupancy    Queue     Src Sys Port                          Max Queue   Occupancy
     Src Sys Port
         %    kilobytes   Delay ns  Slot/NPU/Slc/Gid Timestamp           Delay ns    %
kilobytes  Slot/NPU/Slc/Gid Timestamp
-------------------------------------------------------------------------------------------

TC_0 =   6.00 30965     73728     0/0/2/40         04/08/23 08:39:35   102400     3.00
15482   0/0/1/44       04/05/23 12:22:05
TC_1 =   0.00 0         0         0/0/0/0          -                   0          0.00  0
      0/0/0/0        -
TC_2 =  25.00 129024    1114112   0/0/0/48         04/07/23 01:10:23   1179648    15.00
77414   0/0/0/48       04/07/23 21:40:53
TC_3 =  70.00 361267    8912896   0/1/1/56         04/02/23 08:41:44   8912896    70.00
361267  0/1/1/58       04/02/23 08:41:44
TC_4 =  40.00 206438    2228224   3/0/2/4          04/09/23 06:38:35   2359296    25.00
129024  3/0/2/5        04/04/23 18:30:56
TC_5 =   0.00 0         0         0/0/0/0          -                   0          0.00  0
      0/0/0/0        -
TC_6 =  78.00 599       6437184   3/1/0/24        04/10/23 16:35:00   8628192    64.00 492
     7/0/2/76       04/10/23 16:35:00
TC_7 =  25.00 129024    139264    3/0/0/14         04/06/23 08:39:41   155648     15.00
77414   0/2/2/66       04/08/23 08:39:41

[ -----------     Occupancy High Water Marks     ---------------    ]  [ --------------
Delay High Water Marks  -----------  ]
```

Example 2: Monotonic High Water Marks for a Single Traffic Class

The following output displays monotonically increasing high water marks data (since bootup or the last clear operation) for traffic class 5 on interface fourHundredGigE 0/0/0/2.

```
Router# show controllers npu qos high-water-marks monotonic interface fourHundredGigE 0/0/0/2
 traffic-class 5

Interface Name        =    FH0/0/0/2
Interface Handle      =    0xF000120
System Port Gid       =            6
Asic Instance         =            0

       Queue Occupancy High Water Marks                                    Queue Delay High
Water Marks

       Max Occupancy    Queue     Src Sys Port                          Max Queue  Occupancy
     Src Sys Port
         %     kilobytes  Delay ns  Slot/NPU/Slc/Gid Timestamp            Delay ns   %
kilobytes  Slot/NPU/Slc/Gid Timestamp
-------------------------------------------------------------------------------------------

TC_5 = 40.00 206438     6815744   3/0/0/15         11/11/23 17:43:30   1811939328  25.00
129024  7/1/2/89         11/27/23 11:21:26

[ -----------     Occupancy High Water Marks     ---------------    ]  [ --------------
Delay High Water Marks  ----------- ]
```

Example 3: Periodic High Water Marks for a Single Traffic Class

The following output displays high water marks data for the last three periodic collection intervals for traffic class 7 on interface fourHundredGigE 0/0/0//5.

```
Router# show controllers npu qos high-water-marks periodic last 3 interface fourHundredGigE
 0/0/0/5 traffic-class 7

Interface Name       =    FH0/0/0/5
Interface Handle     =    0xF000138
System Port Gid      =            9
Asic Instance        =            0


                                          Queue Occupancy High Water Marks
Queue Delay High Water Marks

                                         Max Occupancy   Queue    Src Sys Port      Max
 Queue  Occupancy       Src Sys Port
       Interval Start      End               %     kilobytes Delay ns Slot/NPU/Slc/Gid
Delay ns   %     kilobytes Slot/NPU/Slc/Gid
-------------------------------------------------------------------------------------------
TC_7 = 1 12/01/23 17:46:30 12/01/23 17:46:59 50.00 258048    34680274 7/1/2/91
34680274   50.00 258048    7/1/2/91
       2 12/01/23 17:45:58 12/01/23 17:46:30 60.00 309657    52296260 0/2/1/68
61348106   50.00 258048    7/1/2/91
       3 12/01/23 17:45:30 12/01/23 17:45:58 40.00 206438    15290430 0/2/1/68
15290430   40.00 206438    0/2/1/68

                                          [----- Occupancy High Water Marks ----- ]  [
------- Delay High Water Marks ------  ]
```

Example 4: Periodic High Water Marks for All Traffic Classes

The following output displays periodic high water marks data for the last three periodic collection intervals for all traffic classes on interface fourHundredGigE 0/0/0/5:

```
Router# show controllers npu qos high-water-marks periodic last 3 interface fourHundredGigE
 0/0/0/5

Interface Name       =    FH0/0/0/5
Interface Handle     =    0xF000138
System Port Gid      =            9
Asic Instance        =            0

                                                 Queue Occupancy High Water Marks
Queue Delay High Water Marks

                                                 Max Occupancy   Queue     Src Sys Port
Max Queue  Occupancy        Src Sys Port
       Interval Start      End                   %     kilobytes Delay ns  Slot/NPU/Slc/Gid
Delay ns   %      kilobytes Slot/NPU/Slc/Gid
-------------------------------------------------------------------------------------------
TC_0 = 1 12/01/23 17:46:30 12/01/23 17:46:59 60.00 309657    60405506  0/1/0/60
81234030   50.00  258048    0/1/0/59
       2 12/01/23 17:45:58 12/01/23 17:46:30 80.00 412876    104607820 0/2/2/65
104607820  80.00  412876    0/2/2/67
       3 12/01/23 17:45:30 12/01/23 17:45:58 15.00 77414     9089660   0/1/0/6
11204567   6.00   30965     0/2/2/67

TC_1 = 1 12/01/23 17:46:30 12/01/23 17:46:59 0.05  258       288       3/2/0/37
512        0.05   258       3/2/0/38
       2 12/01/23 17:45:58 12/01/23 17:46:30 0.05  258       288       3/2/0/39
258        0.05   258       3/2/0/37
       3 12/01/23 17:45:30 12/01/23 17:45:58 0.75  3870      512       3/2/0/39
768        0.50   2580      3/2/0/39

TC_2 = 1 12/01/23 17:46:30 12/01/23 17:46:59 50.00 258048    52046526  0/1/2/55
58048530   40.00  206438    0/1/2/55
       2 12/01/23 17:45:58 12/01/23 17:46:30 40.00 206438    24690240  0/1/2/54
24690240   40.00  206438    0/1/2/54
       3 12/01/23 17:45:30 12/01/23 17:45:58 15.00 77414     6034820   7/2/0/111
8075420    6.00   30965     0/1/2/55
                                                 [----- Occupancy High Water Marks -----  ]  [
------- Delay High Water Marks ------  ]
..
..
TC_7 = 1 12/01/23 17:46:30 12/01/23 17:46:59 50.00 258048    34680274  7/1/2/91
34680274   50.00  258048    7/1/2/91
       2 12/01/23 17:45:58 12/01/23 17:46:30 60.00 309657    52296260  0/2/1/68
61348106   50.00  258048    7/1/2/91
       3 12/01/23 17:45:30 12/01/23 17:45:58 40.00 206438    15290430  0/2/1/68
15290430   40.00  206438    0/2/1/68
                                                 [----- Occupancy High Water Marks -----  ]  [
------- Delay High Water Marks ------  ]
```

The following output displays periodic high water marks data for all traffic classes on interface fourHundredGigE 0/0/0/9:

```
Router# show controllers npu qos high-water-marks periodic interface fourHundredGigE 0/0/0/9

Interface Name       =    FH0/0/0/9
Interface Handle     =    0xF000158
System Port Gid      =           13
Asic Instance        =            0

                                                 Queue Occupancy High Water Marks
Queue Delay High Water Marks

                                                 Max Occupancy   Queue     Src Sys Port
```

```
Max Queue  Occupancy        Src Sys Port
       Interval Start      End              %     kilobytes Delay ns  Slot/NPU/Slc/Gid
Delay ns   %      kilobytes Slot/NPU/Slc/Gid
-------------------------------------------------------------------------------------

TC_0 = 1 12/01/23 17:45:58 12/01/23 17:46:30  6.00 30965     256       7/0/1/83
272        3.00   15482     7/0/1/83
       2 12/01/23 17:45:30 12/01/23 17:45:58 25.00 129024    16777216  3/1/1/21
17825792   25.00  129024    7/0/1/83
       3 12/01/23 17:44:58 12/01/23 17:45:30 60.00 309657    268435456 7/2/2/103
285212672  50.00  361267    7/2/2/103
       4 12/01/23 17:44:31 12/01/23 17:44:58 15.00 77414     1048576   7/0/1/83
1114112    15.00  77414     7/0/1/83
       5 12/01/23 17:43:59 12/01/23 17:44:31 15.00 77414     1068942   3/1/1/21
8912896    15.00  77414     3/1/1/21
       6 12/01/23 17:43:30 12/01/23 17:43:59 15.00 77414     6553602   0/1/1/59
6963204    15.00  77414     0/1/1/59

TC_1 = 1 12/01/23 17:45:58 12/01/23 17:46:30 25.00 129024    1114112   7/1/2/88
2228224    15.00 77414       7/1/2/88
       2 12/01/23 17:45:30 12/01/23 17:45:58 60.00 309657    301989888 0/1/1/59
318767104  50.00 258048      0/1/1/59
       3 12/01/23 17:44:58 12/01/23 17:45:30 60.00 309657    188743688 7/1/2/88
188743688  60.00 309657      7/1/2/88
       4 12/01/23 17:44:31 12/01/23 17:44:58 25.00 129024    11796480  7/2/2/103
12451840   25.00 129024      7/1/2/88
       5 12/01/23 17:43:59 12/01/23 17:44:31 15.00 77414     9089660   0/1/1/59
11023450    6.00 30965       0/1/1/59
       6 12/01/23 17:43:30 12/01/23 17:43:59  6.00 30965     7372802   0/1/1/59
7782440     6.00 30965       7/1/2/88

TC_2 = 1 12/01/23 17:45:58 12/01/23 17:46:30  0.05 258       256       3/2/1/35
288         0.05 258         3/2/1/35
       2 12/01/23 17:45:30 12/01/23 17:45:58  0.25 1290      256       0/0/0/49
272         0.05 258         0/0/0/49
       3 12/01/23 17:44:58 12/01/23 17:45:30  0.75 3870      304       3/2/1/35
2202        0.50 2580        0/0/0/49
       4 12/01/23 17:44:31 12/01/23 17:44:58  0.75 3870      512       0/0/0/49
2506        0.50 2580        3/2/1/35
       5 12/01/23 17:43:59 12/01/23 17:44:31  3.00 15482     10412     3/2/1/35
10412       3.00 15482       3/2/1/35
       6 12/01/23 17:43:30 12/01/23 17:43:59  3.00 15482     8192      0/0/0/50
10406       1.00 5160        0/0/0/48

                                              [--- Occupancy High Water Marks ---- ]  [
---- Delay High Water Marks ---- ]
..

TC_7 = 1 12/01/23 17:45:58 12/01/23 17:46:30  6.00 30965     6578904   7/1/2/88
6578904     6.00 30965       7/1/2/88
       2 12/01/23 17:45:30 12/01/23 17:45:58 15.00 77414     5033164   3/0/2/6
5200936     15.00 77414      7/1/2/88
       3 12/01/23 17:44:58 12/01/23 17:45:30 50.00 258048    31457280  3/0/2/7
32505856    40.00 206438     3/0/2/6
       4 12/01/23 17:44:31 12/01/23 17:44:58 40.00 206438    19660800  7/1/2/90
20316160    40.00 206438     7/1/2/90
       5 12/01/23 17:43:59 12/01/23 17:44:31 15.00 77414     4560450   3/0/2/6
6004508     15.00 77414      3/0/2/6
       6 12/01/23 17:43:30 12/01/23 17:43:59 25.00 129024    6122880   7/1/2/88
7226976     15.00 77414      3/0/2/8

                                             [----- Occupancy High Water Marks ----]  [
------- Delay High Water Marks ------ ]
```

show controllers npu voq in-extended-memory instance

To view the VOQs that are evicted to the HBM and the VOQs' HBM buffer usage details, use the **show controllers npu voq in-extended-memory instance** command in the XR EXEC mode.

show controllers npu voq in-extended-memory instance { *number* | **all** } [**latest**] **location** *ID*

Syntax Description

number	Displays information for the specified device instance.
all	Displays information for all device instances.
latest	(Optional) Specifies that almost-instantaneous information be retrieved and displayed.
location *ID*	Displays information for the specified node. For *ID*, specify a node in the rack/slot/module notation (0/0/CPU0, 0/RP0/CPU0 and so on) or use **all** to specify all nodes.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 24.2.11	This command was introduced.

Usage Guidelines

Important Caveat:

Do not use the **show controllers npu voq in-extended-memory instance** command in an automation script.

Other pointers:

- If the PFC buffer-extended mode is enabled on a device, the associated VOQs are evicted to the HBM on priority. The remaining VOQs are retained in the Shared Memory Switch (SMS).
- If PFC buffer-internal mode is enabled on a device, the associated VOQs are retained in the SMS and the remaining VOQs are evicted to the HBM.
- If PFC isn't enabled on a device, VOQs are evicted to the HBM based on the VOQs' age and buffer usage.
- With this feature, you can view up to 4000 records for these interfaces:
  - 400G and 100G (PFC buffer-internal and PFC buffer-extended modes)
  - 40G (PFC buffer-internal mode)

Examples

Output pointers for the **show controllers npu voq in-extended-memory instance** command:

- **Egress Interface**–The egress interface of the virtual output queue.
- **VOQ_Base**–Base VOQ ID
- **TC**–Traffic Class number

- **Slice**–Source slice number
- **Buff_Usage and In_Bytes**–Buffer usage in blocks and in bytes

Example 1: The following output displays VOQs that are evicted to the HBM for node 0/6/cpu0 and all instances. In this case, VOQs from device instance **Device 1** are evicted to the HBM.

```
Router# show controllers npu voq in-extended-memory instance all location 0/6/CPU0

* Use this CLI with caution.
* This should not be integrated with any automation scripts.

Total Entries  0  | Slot 6   | Device  0  | Percent in Evict Voq Buff(s) 0.000000

--------------------------------------------------------------------------------
Egress Interface  | VOQ_Base  | TC  | Slice  |  Buff_Usage |  In_Bytes     |

Total Entries  2  | Slot 6   | Device  1  | Percent in Evict Voq Buff(s) 0.004883

--------------------------------------------------------------------------------
Egress Interface  | VOQ_Base  | TC  | Slice  |  Buff_Usage  |  In_Bytes  |
--------------------------------------------------------------------------------
    FH0/6/0/0           28672       2     0         14722          87837459
    FH0/6/0/3           28728       2     0         1049           6335369

Total Entries  0  | Slot 6   | Device  2  | Percent in Evict Voq Buff(s) 0.000000

--------------------------------------------------------------------------------
   Egress Interface  | VOQ_Base  | TC  | Slice  |  Buff_Usage  |  In_Bytes  |
```

Example 2: The following output displays VOQs that are evicted to the HBM for node 0/6/cpu0 and all instances. In this case, the virtual output queue from device instance **Device 0** is evicted to the HBM.

```
Router# show controllers npu voq in-extended-memory instance all location 0/6/CPU0

* Use this CLI with caution.
* This should not be integrated with any automation scripts.

Total Entries  1  | Slot 6   | Device  0  | Percent in Evict Voq Buff(s) 0.002441

--------------------------------------------------------------------------------
Egress Interface  | VOQ_Base  | TC  | Slice  |  Buff_Usage |  In_Bytes     |
--------------------------------------------------------------------------------
    FH0/6/0/22          28776       6     1         7140           46969050

Total Entries  0  | Slot 6   | Device  1  | Percent in Evict Voq Buff(s) 0.000000

--------------------------------------------------------------------------------
Egress Interface  | VOQ_Base  | TC  | Slice  |  Buff_Usage  |  In_Bytes  |

Total Entries  0  | Slot 6   | Device  2  | Percent in Evict Voq Buff(s) 0.000000

--------------------------------------------------------------------------------
   Egress Interface  | VOQ_Base  | TC  | Slice  |  Buff_Usage  |  In_Bytes  |
```

show hw-module bandwidth-congestion-protect

To view the current status of global pause frames (X-off) in case of High Bandwidth Memory (HBM) congestion, use the **show hw-module bandwidth-congestion-protect** command in XR EXEC mode.

show hw-module bandwidth-congestion-protect location *lc*

Syntax Description

location *lc*	—Line card location

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.5.4	This command was introduced.

Usage Guidelines

- Use this command to view the status of the global pause frame (X-off) configuration after you configure the **hw-module profile npu memory buffer-extended bandwidth-congestion-protect enable** command.
- The table lists the various possibilities for the command output based on your activity.

If you...	Configured field displays…	Applied field displays…	Action field displays…
Configure the **hw-module profile npu memory buffer-extended** command	**Yes**	**No**	**Reload**
Use the **no** form of the **hw-module profile npu memory buffer-extended** command after configuring it, but before reloading the line card	**No**	**No**	**N/A**
Configure the **hw-module profile npu memory buffer-extended** command for a supported variant and reload the line card	**Yes**	**Yes, Active** **Note** **Yes** indicates that the configuration is programmed to the hardware, **Active** indicates that the global X-off functionality is active on the hardware.	**N/A**

If you...	Configured field displays…	Applied field displays…	Action field displays…
Use the **no** form of the **hw-module profile npu memory buffer-extended** command when it is active, and commit the **no** form but don't reload the line card	**No** **Note** At this stage, the output displays the user action and not the hardware status.	**No** **Note** At this stage, the output displays the user action and not the hardware status.	**Reload**
Reload the line card after committing the **no** form of the **hw-module profile npu memory buffer-extended** command	**No** **Note** At this stage, the output displays the hardware status.	**No** **Note** At this stage, the output displays the hardware status.	**N/A**

Task ID

Task ID	Operation
qos	read, write

Example

This example shows how to view the current status of global pause frames (X-off) in case of High Bandwidth Memory (HBM) congestion using the **show hw-module bandwidth-congestion-protect location 0/1/CPU0** command:

```
RP/0/RP1/CPU0:router#show hw-module bandwidth-congestion-protect location 0/1/CPU0

Location   Configured     Applied          Action
--------------------------------------------------------------------------------

0/1/CPU0     Yes             No               Reload
```



Congestion Management Commands

- clear qos counters interface, on page 58
- conform-action, on page 59
- decapsulate gue, on page 61
- exceed-action, on page 62
- nve, on page 64
- police rate, on page 65
- policy-map, on page 69
- priority (QoS), on page 71
- show policy-map interface, on page 72
- show policy-map targets, on page 78
- show qos inconsistency, on page 80
- show qos interface , on page 82
- violate-action, on page 90
- random-detect ecn, on page 92

clear qos counters interface

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

clear qos counters interface {*type* | **all**} [**input** | **output**]

Syntax Description

type	Interface type. For more information, use the question mark (?) online help function.
all	Specifies all interfaces.
input	(Optional) Clears input QoS counters that are attached to the specified interface.
output	(Optional) Clears output QoS counters that are attached to the specified interface.

Command Default

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

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.

Note The **clear qos counters interface** command when executed on satellite may lead to unexpected behavior for QoS offload.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how to clear QoS counters attached to GigabitEthernet interface 0/0/0/0:

```
RP/0/RP0/CPU0:router# clear qos counters interface GigabitEthernet 0/0/0/0
```

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

Syntax Description

drop	(Optional) Drops the packet.
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 7.0.12	This command was introduced.

Usage Guidelines

For more information regarding the traffic policing feature, see the police rate, on page 65 command.

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
RP/0/RP0/CPU0:router(config-pmap-c-police)# conform-action set mpls experimental imposition
 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 0/0/0/0
RP/0/RP0/CPU0:router(config-if) service-policy input policy1
```

In this example, the police rate (Committed Information Rate) is set to 5. Conforming traffic is marked with a discard-class value of 0; traffic that exceeds the police rate is marked with a discard-class value of 1.

```
RP/0/RP0/CPU0:router(config)# policy-map 1ad-mark-dei
RP/0/RP0/CPU0:router(config-pmap)# class c1
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 5
RP/0/RP0/CPU0:router(config-pmap-c-police)# conform-action set discard-class 0
RP/0/RP0/CPU0:router(config-pmap-c-police)# exceed-action set discard-class 1
RP/0/RP0/CPU0:router(config-pmap-c-police)# end-policy-map
```

decapsulate gue

To enable decapsulation of the Generic UDP Encapsulation (GUE) packets, use the **decapsulate gue** command in policy map class configuration mode. To remove a previously configured GUE decapsulation for a class, use the **no** form of this command.

decapsulate gue *version*
no decapsulate gue *version*

Syntax Description

version	Specifies the variant number that can indicate the version of the GUE protocol. Supports variant 1 only.

Command Default

No default action.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

Supports Generic UDP Decapsulation for variant 1 only. This command is supported only in Cisco NCS 5500 Series Routers.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how to configure decapsulation of the GUE packets:

```
Router# configure
Router(config)# policy-map type pbr gue-decap
Router(config-pmap)# class type traffic gue-class
Router(config-pmap-c)# decapsulate gue
```

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** *value* —Sets the class of service value. Range is 0 to 7. • **dei** —Sets the drop eligible indicator (DEI). Can be 0 or 1. • **discard-class** *value* —Sets the discard class value. Range is 0 to 7. • **dscp** *value* —Sets the differentiated services code point (DSCP) value and sends the packet. See match dscp, on page 105 for a list of valid values. • **dscp** [**tunnel**] *value* —Sets the differentiated services code point (DSCP) value and sends the packet. See match dscp, on page 105 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 match precedence, on page 110 for a list of valid values. • **precedence** [**tunnel**] *precedence* —Sets the IP precedence and sends the packet. See match precedence, on page 110 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. 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 7.0.12	This command was introduced.

Usage Guidelines

For more information regarding the traffic policing feature, see the police rate, on page 65 command.

The **set cos** action in policy maps is supported on 802.1ad packets for:

- Egress
- Layer 3 subinterfaces

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 pos 0/5/0/0
RP/0/RP0/CPU0:router(config-if) service-policy input policy1
```

In this example, the police rate is set to 5 Mbps. Conforming traffic is marked with a DEI value of 0; traffic that exceeds the police rate is marked with a DEI value of 1.

```
RP/0/RP0/CPU0:router(config)# policy-map 1ad-mark-dei
RP/0/RP0/CPU0:router(config-pmap)# class c1
RP/0/RP0/CPU0:router(config-pmap-c)# police rate 5 mbps
RP/0/RP0/CPU0:router(config-pmap-c-police)# conform-action set dei 0
RP/0/RP0/CPU0:router(config-pmap-c-police)# exceed-action set dei 1
RP/0/RP0/CPU0:router(config-pmap-c-police)# end-policy-map
```

nve

To configure network virtualization encapsulation and enter nve configuration mode, use the **nve** command in XR Config mode.

nve

This command has no keywords or arguments.

Command Default

None

Command Modes

XR Config

Command History

Release	Modification
Release 7.10.1	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
interface	read, write

In this example, VXLAN ingress traffic policing is configured at a rate of 4000000 kbps.

```
RP/0/RP0/CPU0:router(config)# nve
RP/0/RP0/CPU0:router(config-nve)# overlay-encap vxlan
RP/0/RP0/CPU0:router(config-vxlan)# vrf vrf1
RP/0/RP0/CPU0:router(config-nve-vxlan-vrf)# policer-rate 4000000 kbps
RP/0/RP0/CPU0:router(config-nve-vxlan-vrf)# commit
```

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

Syntax Description

value	Specifies the committed information rate (CIR) as an absolute value. Range is from 1 to 4294967295.
units	(Optional) Specifies the unit for the absolute CIR or PIR value. Units 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.
peak-rate *value*	(Optional) Specifies the peak information rate (PIR) as an absolute value in the specified *units*.

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 26.3.1	The command was enhanced to support absolute rate values on supported bundle interfaces. The command was also enhanced to support parent policer configuration for two-level hierarchical ingress policing.
Release 7.0.12	This command was introduced.

Usage Guidelines

Policer conditional set discard-class is supported.

Policing can be applied only in the ingress direction.

For bundle interfaces on unsupported releases or platforms, configure QoS policers with percentage-based values.

Starting with Cisco IOS XR Release 26.3.1, you can configure the **police rate** command with absolute units on supported bundle main interfaces and bundle subinterfaces on supported Cisco 8000 Series routers. This support applies to the documented bundle QoS scope. Bundle aggregate mode is not supported on bundle interfaces, regardless of whether the policer uses absolute values or percentage-based values.

For bundle policers configured with an absolute value, the configured policer rate is applied per logical hardware unit. On A100, K100, and P100-based Cisco 8000 routers, the logical hardware unit is a slice. On Q200-based Cisco 8000 routers, the logical hardware unit is an interface group.

If all bundle members are in the same slice or interface group, the configured policer rate is shared by the members in that logical hardware unit. If bundle members are spread across slices or interface groups, each participating logical hardware unit can enforce the configured rate independently. The effective aggregate policing behavior can therefore be higher than the single configured value.

For bundle policers configured with an absolute value, the configured policer rate must be less than or equal to the bandwidth of the bundle member interfaces.

You can configure a one-rate, three-color (1R3C) parent policer by using **police rate** *value units*. You can configure a two-rate, three-color (2R3C) parent policer by using **police rate** *value units* **peak-rate** *value units*.

Use two-level hierarchical ingress policing when you need to enforce an aggregate ingress rate while preserving child policers for individual traffic classes under that aggregate. Configure the parent committed information rate (CIR) greater than or equal to the sum of the child CIRs when you want child-conform-aware behavior.

Two-level hierarchical ingress policing is supported for ingress QoS policies on supported physical main interfaces and subinterfaces, and on supported bundle main interfaces and bundle subinterfaces.

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

- For a one-level policy, the **percent** keyword specifies the committed information rate (CIR), or the peak information rate (PIR) when used with **peak-rate percent**, as a percentage of the link rate. For example, the command **police rate percent 35** configures the CIR as 35 percent of the link rate.
- For a two-level policy, the **percent** keyword uses different reference rates for parent and child policers. For a parent policer, the reference rate is the interface bandwidth, or the sum of member-interface bandwidths for bundle interfaces. For child policers, the reference rate is the parent committed information rate (CIR) when the parent policer is one-rate, and the parent peak information rate (PIR) when the parent policer is two-rate.



Note Configured values take into account the Layer 2 encapsulation applied to traffic. This applies to ingress policing. For Ethernet transmission, the encapsulation is considered to be 14 bytes, whereas for IEEE 802.1Q, the encapsulation is 18 bytes.

Task ID

Task ID	Operations
qos	read, write

In this example for MPLS, traffic policing is configured with average rate at 1600 kbps for packets received on 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 1600 kbps
RP/0/RP0/CPU0:router(config-pmap-c)# exit
RP/0/RP0/CPU0:router(config-pmap)# exit

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

This example shows how to configure an absolute policer rate on a bundle interface in the input direction:

```
Router(config)#class-map match-all bundle_prec3
Router(config-cmap)#match precedence ipv4 3
Router(config-cmap)#exit
Router(config)#policy-map bundle_abs_police
Router(config-pmap)#class bundle_prec3
Router(config-pmap-c)#police rate 30 mbps peak-rate 50 mbps
Router(config-pmap-c)#exit
Router(config-pmap)#end-policy-map
Router(config)#interface Bundle-Ether10
Router(config-if)#service-policy input bundle_abs_police
```

This example shows how to configure a 2R3C parent policer for two-level hierarchical ingress policing. The child policy map is attached under the parent **class-default** class, and the parent policer enforces an aggregate 16 Gbps CIR and 20 Gbps PIR:

```
Router(config)# policy-map IN_4_CHILD_TEST
Router(config-pmap)# class IN_CMAP_DSCP_56
Router(config-pmap-c)# police rate 1 gbps
Router(config-pmap-c)# exit
Router(config-pmap)# class IN_CMAP_DSCP_48
Router(config-pmap-c)# police rate 2 gbps
Router(config-pmap-c)# exit
Router(config-pmap)# class IN_CMAP_DSCP_40
Router(config-pmap-c)# police rate 6 gbps peak-rate 20 gbps
Router(config-pmap-c-police)# exceed-action transmit
Router(config-pmap-c-police)# exit
Router(config-pmap-c)# exit
Router(config-pmap)# class class-default
Router(config-pmap-c)# police rate 7 gbps peak-rate 20 gbps
Router(config-pmap-c-police)# exceed-action transmit
Router(config-pmap-c-police)# exit
Router(config-pmap-c)# exit
Router(config-pmap)# end-policy-map
Router(config)# policy-map IN_PARENT_4_CHILD_TEST
Router(config-pmap)# class class-default
Router(config-pmap-c)# service-policy IN_4_CHILD_TEST
Router(config-pmap-c)# police rate 16 gbps peak-rate 20 gbps
Router(config-pmap-c-police)# exceed-action transmit
```

```
Router(config-pmap-c-police)# exit
Router(config-pmap-c)# exit
Router(config-pmap)# end-policy-map
Router(config)# interface HundredGigE0/0/0/3
Router(config-if)# service-policy input IN_PARENT_4_CHILD_TEST
```

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*

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

Syntax Description

type	(Optional) Specifies type of the service policy.
qos	(Optional) Specifies a quality-of-service (QoS) policy map.
pbr	(Optional) Specifies a policy-based routing (PBR) 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 mode

Command History

Release	Modification
Release 7.0.12	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.

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.

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

The number of classes per policy-map supported in the egress direction is 8 and ingress direction is 32.

For egress classification, in order to see statistics on all 8 CoSQs, you are recommended to configure all 8 classes including class-default.

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)# set precedence 3
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 *priority-level*	Sets multiple levels of priority to a traffic class. Level 1 through 7. Default level is 1. Level 1 traffic has higher priority.

Command Default

No default action.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 7.0.12	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. The **priority** command is supported only in the egress direction. To limit the priority traffic use the **shape average** command.

Classification policy determines traffic class and traffic class maps to priority.

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
```

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

interface type	Interface type. For more information, use the question mark (?) online help function.
all	Specifies all interfaces.
interface-path-id	Physical interface or virtual 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 26.3.1	The command output was enhanced to display parent policer statistics and child policer statistics.
Release 7.0.12	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.

Starting with Cisco IOS XR Release 26.3.1 , use the **show policy-map interface** *interface-path-id* **input** command to verify parent and child policer statistics for two-level hierarchical ingress policing. The parent class statistics show aggregate parent policer behavior. Child policy class statistics show per-class child policer behavior.

For child classes in a two-level hierarchical ingress policing policy on Cisco 8000 Series routers, the **Policed and dropped(parent policer)** field is not supported and always displays **0/0**.

Child policer statistics can be inaccurate in specific scenarios because of parent policing behavior. The configured policer behavior and throughput are as expected, but review parent policer statistics and child policer statistics together when you verify policy behavior. For details, see *Guidelines and restrictions for two-level hierarchical ingress policing* in the *Modular QoS Configuration Guide for Cisco 8000 Series Routers*.

For routers that support two-level hierarchical policing, when a one-rate three-color (1R3C) or two-rate three-color (2R3C) policer is configured with **exceed-action** drop, the **show policy-map interface** output provides conform and exceed statistics only. The violate statistics display as zero, and all non-conforming packets are counted as exceed packets. In this case, the statistics appear similar to a one-rate two-color (1R2C) policer configured with **exceed-action** drop.

Task ID

Task ID	Operations
qos	read

Examples

This sample output shows how to display policy statistics information for all classes on the **interface hundredGigE 0/6/0/18** that are in the input direction:

```
RP/0/RP0/CPU0:router# show policy-map interface hundredGigE 0/6/0/18 input

Mon Nov 30 17:10:29.065 UTC

HundredGigE0/6/0/18 input: 32-classmaps

Class exp-classifier-af1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :              53186/54090162             3769
    Transmitted         :              53186/54090162             3769
    Total Dropped       :                   0/0                   0
Class exp-classifier-af2
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :              54279/55201743             7483
    Transmitted         :              54279/55201743             7483
    Total Dropped       :                   0/0                   0
Class exp-classifier-af3
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :              56710/57674070             7898
    Transmitted         :              56710/57674070             7898
    Total Dropped       :                   0/0                   0
Class exp-classifier-af4
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :             110405/112281885           11584
    Transmitted         :             110405/112281885           11584
    Total Dropped       :                   0/0                   0
Class exp-classifier-be1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :              52753/53649801             3756
    Transmitted         :              52753/53649801             3756
    Total Dropped       :                   0/0                   0
Class inet4-classifier-af1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :           38796901/14695393569          1580677
    Transmitted         :           38796901/14695393569          1580677
    Total Dropped       :                   0/0                   0
Class inet4-classifier-af2
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :           38850080/14715510334          1589124
```

```
    Transmitted         :            38850080/14715510334          1589124
    Total Dropped       :                   0/0                    0
Class inet4-classifier-af3
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :            38757080/14679867944          1580632
    Transmitted         :            38757080/14679867944          1580632
    Total Dropped       :                   0/0                    0
Class inet4-classifier-af4
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :            77228177/29251757855          3137985
    Transmitted         :            77228177/29251757855          3137985
    Total Dropped       :                   0/0                    0
Class inet4-classifier-be1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :            38921394/14742645566          1588557
    Transmitted         :            38921394/14742645566          1588557
    Total Dropped       :                   0/0                    0
Class inet4-classifier-nc1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :            77088116/29199136824          3144053
    Transmitted         :            77088116/29199136824          3144053
    Total Dropped       :                   0/0                    0
Class inet6-classifier-af1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :            21953707/22326920019          1237979
    Transmitted         :            21953707/22326920019          1237979
    Total Dropped       :                   0/0                    0
Class inet6-classifier-af2
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :            21701336/22070258712          1208262
    Transmitted         :            21701336/22070258712          1208262
    Total Dropped       :                   0/0                    0
Class inet6-classifier-af3
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :            21715705/22084871985          1210060
    Transmitted         :            21715705/22084871985          1210060
    Total Dropped       :                   0/0                    0
Class inet6-classifier-af4
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :            43418446/44156559582          2413245
    Transmitted         :            43418446/44156559582          2413245
    Total Dropped       :                   0/0                    0
Class inet6-classifier-be1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :            21958845/22332119845          1236894
    Transmitted         :            21958845/22332119845          1236894
    Total Dropped       :                   0/0                    0
Class inet6-classifier-nc1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :            43428930/44167221810          2415137
    Transmitted         :            43428930/44167221810          2415137
    Total Dropped       :                   0/0                    0
Class inet-classifier-ipv6-af1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                   0/0                    0
    Transmitted         :                   0/0                    0
    Total Dropped       :                   0/0                    0
Class inet-classifier-ipv6-af2
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                   0/0                    0
    Transmitted         :                   0/0                    0
    Total Dropped       :                   0/0                    0
Class inet-classifier-ipv6-af3
  Classification statistics          (packets/bytes)     (rate - kbps)
```

```
    Matched             :                  0/0                    0
    Transmitted         :                  0/0                    0
    Total Dropped       :                  0/0                    0
Class inet-classifier-ipv6-af4
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                  0/0                    0
    Transmitted         :                  0/0                    0
    Total Dropped       :                  0/0                    0
Class inet-classifier-ipv6-af5
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                  0/0                    0
    Transmitted         :                  0/0                    0
    Total Dropped       :                  0/0                    0
Class inet-classifier-ipv6-af6
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                  0/0                    0
    Transmitted         :                  0/0                    0
    Total Dropped       :                  0/0                    0
Class inet-management-classifier-af4
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                  0/0                    0
    Transmitted         :                  0/0                    0
    Total Dropped       :                  0/0                    0
Class exp-classifier-nc1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :             57115/58085955             7953
    Transmitted         :             57115/58085955             7953
    Total Dropped       :                  0/0                    0
  Policing statistics                (packets/bytes)     (rate - kbps)
    Policed(conform)    :             57115/58085955             7953
    Policed(exceed)     :                  0/0                    0
    Policed(violate)    :                  0/0                    0
    Policed and dropped :                  0/0
Class class-default
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :                  0/0                    0
    Transmitted         :                  0/0                    0
    Total Dropped       :                  0/0                    0
```

Starting with Cisco IOS XR Release 26.3.1 , this sample output shows policy statistics for a two-level hierarchical ingress policing policy:

```
Router#<userinput>show policy-map interface HundredGigE0/0/0/3 input</userinput>

HundredGigE0/0/0/3 input: IN_PARENT_4_CHILD_TEST

Class class-default
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :          6036378230/6036378230000        98038979
    Transmitted         :          1218109401/1218109401000        19768818
    Total Dropped       :          4818268829/4818268829000        78270161
  Policing statistics                (packets/bytes)     (rate - kbps)
    Policed(conform)    :           973485880/973485880000         15798604
    Policed(exceed)     :           244623521/244623521000         3970214
    Policed(violate)    :          4818268829/4818268829000        78270161
    Policed and dropped :          4818268829/4818268829000

  Policy IN_4_CHILD_TEST Class IN_CMAP_DSCP_56
    Classification statistics          (packets/bytes)     (rate - kbps)
      Matched             :          1509094690/1509094690000        24509737
      Transmitted         :            60817814/60817814000          987093
      Total Dropped       :          1448276876/1448276876000        23522644
    Policing statistics                (packets/bytes)     (rate - kbps)
      Policed(conform)    :            60817814/60817814000          987093
```

```
    Policed(exceed)     :          1448276876/1448276876000        23522644
    Policed(violate)    :                   0/0                    0
    Policed and dropped :          1448276876/1448276876000
    Policed and dropped(parent policer)  : 0/0

  Policy IN_4_CHILD_TEST Class IN_CMAP_DSCP_48
    Classification statistics          (packets/bytes)     (rate - kbps)
      Matched             :          1509094800/1509094800000        24509747
      Transmitted         :           121696005/121696005000         1975211
      Total Dropped       :          1387398795/1387398795000        22534536
    Policing statistics                (packets/bytes)     (rate - kbps)
      Policed(conform)    :           121696005/121696005000         1975211
      Policed(exceed)     :          1387398795/1387398795000        22534536
      Policed(violate)    :                   0/0                    0
      Policed and dropped :          1387398795/1387398795000
      Policed and dropped(parent policer)  : 0/0

  Policy IN_4_CHILD_TEST Class IN_CMAP_DSCP_40
    Classification statistics          (packets/bytes)     (rate - kbps)
      Matched             :          1509094905/1509094905000        24509746
      Transmitted         :          1509094905/1509094905000        24509746
      Total Dropped       :                   0/0                    0
    Policing statistics                (packets/bytes)     (rate - kbps)
      Policed(conform)    :           365170865/365170865000         5926650
      Policed(exceed)     :          1143924040/1143924040000        18583096
      Policed(violate)    :                   0/0                    0
      Policed and dropped :                   0/0
      Policed and dropped(parent policer)  : 0/0

  Policy IN_4_CHILD_TEST Class class-default
    Classification statistics          (packets/bytes)     (rate - kbps)
      Matched             :          1509095016/1509095016000        24509742
      Transmitted         :          1509095016/1509095016000        24509742
      Total Dropped       :                   0/0                    0
    Policing statistics                (packets/bytes)     (rate - kbps)
      Policed(conform)    :           425801627/425801627000         6909638
      Policed(exceed)     :          1083293389/1083293389000        17600104
      Policed(violate)    :                   0/0                    0
      Policed and dropped :                   0/0
      Policed and dropped(parent policer)  : 0/0
```

This sample output shows how to display policy statistics information for all classes on the **interface hundredGigE 0/6/0/0** that are in the output direction:

```
RP/0/RP0/CPU0:router# show policy-map interface hundredGigE 0/6/0/0 output

Wed Dec  9 16:18:10.179 UTC
HundredGigE0/6/0/0 output: test-pol-out

Class tc2
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :          3080542734/394309469952         4808049
    Transmitted         :          3080542734/394309469952         4808049
    Total Dropped       :                   0/0                    0
  Queueing statistics
    Queue ID                             : 1026
    Taildropped(packets/bytes)           : 0/0
Class tc1
  Classification statistics          (packets/bytes)     (rate - kbps)
    Matched             :          1562482674/199997782272         2883014
    Transmitted         :          1434402692/183603544576         2646687
    Total Dropped       :           128079982/16394237696          236327
  Queueing statistics
```

```
    Queue ID                               : 1025
    Taildropped(packets/bytes)             : 128079982/16394237696

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                               : 1024
    Taildropped(packets/bytes)             : 0/0
Policy Bag Stats time: 1557231345776  [Local Time: 05/07/19 12:15:45.776]
```

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 mode

Command History

Release	Modification
Release 7.0.12	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.

Task ID

Task ID	Operations
qos	read

Examples

In this example, the TenGigabit Ethernet interface 4/0/10/0 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

Wed Dec  2 22:35:13.993 UTC
1) Policymap: test-qlimit    Type: qos
     Targets (applied as main policy):
       TenGigE0/4/0/10/0 output
       TenGigE0/6/0/30/1 output
     Total targets: 2

     Targets (applied as child policy):
     Total targets: 0
```

```
2) Policymap: test-priority    Type: qos
     Targets (applied as main policy):
       HundredGigE0/6/0/35 output
       HundredGigE0/6/0/34 output
       HundredGigE0/6/0/33 output
       HundredGigE0/6/0/32 output
       HundredGigE0/6/0/31 output
       HundredGigE0/6/0/29 output
       HundredGigE0/6/0/28 output
       HundredGigE0/6/0/27 output
       HundredGigE0/6/0/25 output
       HundredGigE0/6/0/24 output
       HundredGigE0/6/0/23 output
       HundredGigE0/6/0/22 output
       HundredGigE0/6/0/21 output
       HundredGigE0/6/0/20 output
       HundredGigE0/6/0/19 output
       HundredGigE0/6/0/1 output
       HundredGigE0/6/0/3 output
       HundredGigE0/6/0/4 output
       HundredGigE0/6/0/5 output
       HundredGigE0/6/0/6 output
       HundredGigE0/6/0/7 output
       HundredGigE0/6/0/8 output
       HundredGigE0/6/0/9 output
       HundredGigE0/6/0/10 output
       HundredGigE0/6/0/11 output
       HundredGigE0/6/0/13 output
       HundredGigE0/6/0/14 output
       HundredGigE0/6/0/15 output
       HundredGigE0/6/0/16 output
       HundredGigE0/6/0/17 output
     Total targets: 30

     Targets (applied as child policy):
     Total targets: 0
```

show qos inconsistency

To display inconsistency information for the QoS policy on an interface, use the **show qos inconsistency** command in XR EXEC mode.

show qos inconsistency { **detail** *warning-type* { **file** *filename* | **location** *node-id* } | **summary** { **file** *filename* | **location** *node-id* } }

Syntax Description

detail	Displays interface and policy name details of the inconsistency.
warning-type	Selects the warning types to display: • 0—All warning types • 1—ANCP - No shaper at top policy map • 2—ANCP - Multiple classes at top policy map • 3—ANCP - Downstream rate less than shaper rate • 4—ANCP - Downstream rate more than port speed • 5—ANCP - Policy resolution failure • 6—ANCP - Traffic manager program failure • 7—Port speed - Policy resolution failure • 8—Port speed - Traffic manager program failure • 9—Bundle member addition failure • 10—Interface state not matching system configuration
file *filename*	Specify a file name, such as disk0:tmp.log or bootflash:.
location *node-id*	Displays detailed QoS information for the designated node. The *node-id* argument is entered in the rack/slot/module notation.
summary	Displays summary counts of QoS inconsistency warnings.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 3.7.2	This command was introduced.
Release 4.3.0	The command was supported in dynamic template configuration mode in BNG.

Task ID

Task ID	Operations
qos	read

Examples

This example provides detail about QoS policy inconsistency, for all warning types:

```
RP/0/RP0/CPU0:router# show qos inconsistency detail 0 location 0/7/CPU0

Interface Lists with QoS Inconsistency Warning:
=======================================================

                     Node 0/7/CPU0
-------------------------------------------------------

Interfaces with QoS Inconsistency:  ANCP - No Shaper at top policymap
=========================================================================
Interface                  Direction  Policy Name             SPI Name
-------------------------------------------------------------------------
GigabitEthernet0/7/0/1.5     output    parent-none

Interfaces with QoS Inconsistency:  ANCP - Downstream Rate less than Shaper Rate
=========================================================================
Interface                  Direction  Policy Name             SPI Name
-------------------------------------------------------------------------
GigabitEthernet0/7/0/1       output    parent                   SPI1
GigabitEthernet0/7/0/1.2     output    parent
GigabitEthernet0/7/0/1       output    normal-policy-name      normal-spi-name
```

This example displays summary counts of inconsistency warnings:

```
RP/0/RP0/CPU0:router#
RP/0/RP0/CPU0:router# show qos inconsistency summary location 0/7/CPU0

Summary Counts of QoS Inconsistency Warnings:
=======================================================


                     Node 0/7/CPU0

   Inconsistency Warning Type                Count
-------------------------------------------------------
ANCP - No Shaper at top policymap:              1
ANCP - Downstream Rate less than Shaper Rate:    4
```

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

interface-name	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	Displays the specified policy map to the input interface.
output	Displays the specified policy map to the output interface.
location *node-id*	(Optional) Displays detailed QoS information for the designated node. The *node-id* argument is entered in the rack/slot/module notation.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 26.3.1	The command output was enhanced to display configured bandwidth remaining percent values in the **Inverse Weight / Weight** field for supported egress class-based queuing policies. The command output was also enhanced to display Level 1 parent policer and Level 2 child policer configuration for two-level hierarchical ingress policing.

Release	Modification
Release 25.2.1	The accuracy of the displayed values for Queue Max. BW and guaranteed service rates for the main interface was enhanced to reflect the actual hardware-programmed values from the NPU, rather than the configured values.
Release 7.0.12	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.

Starting with Cisco IOS XR Release 26.3.1 , use the **show qos interface** *interface-name* **input** command to verify the programmed parent and child policer configuration for two-level hierarchical ingress policing. The parent policer appears as **Level1 Class = class-default**. The child policers appear as indented **Level2 Class** entries under the parent class.

For a 1R3C parent policer, the parent Level1 class output displays the committed rate and does not display a peak rate. For a 2R3C parent policer, the parent Level1 class output displays both the committed rate and the peak rate.

Starting with Cisco IOS XR Release 26.3.1, use the **show qos interface** *interface-name* **output** command to verify configured bandwidth remaining percent values for supported egress class-based queuing policies. The configured percentage appears in parentheses in the **Inverse Weight / Weight** field. You do not need to calculate the internal inverse-weight value to verify the configured percentage.

For classes configured with **bandwidth remaining percent**, the command output displays a low-priority queue and the configured percentage in parentheses. Priority classes appear as priority queues, such as **HP1 queue**, and do not display a bandwidth remaining percent value. Classes without bandwidth remaining configuration can display **BWR not configured**.

Task ID

Task ID	Operations
qos	read

Examples

This sample output shows the QoS information on a **interface hundredGigE 0/6/0/18** that are in the input direction:

```
RP/0/RP0/CPU0:router# show qos interface hundredGigE 0/6/0/18 input

Wed Dec  2 22:34:20.241 UTC
NOTE:- Configured values are displayed within parentheses
Interface HundredGigE0/6/0/18 ifh 0x3000210  -- input policy
NPU Id:                        3
Total number of classes:       28
Interface Bandwidth:           100000000 kbps
```

```
Accounting Type:               Layer1 (Include Layer 1 encapsulation and above)
------------------------------------------------------------------------------
Level1 Class                             =   exp-classifier-af1
New topmost exp                          =   7


Policer not configured for this class

Level1 Class                             =   exp-classifier-af2
New topmost exp                          =   6

Policer not configured for this class

Level1 Class                             =   exp-classifier-af3
New topmost exp                          =   5

Policer not configured for this class

Level1 Class                             =   exp-classifier-af4
New topmost exp                          =   3

Policer not configured for this class

Level1 Class                             =   exp-classifier-be1
New topmost exp                          =   4

Policer not configured for this class

Level1 Class                             =   inet4-classifier-af1
New qos group                            =   1


Policer not configured for this class

Level1 Class                             =   inet4-classifier-af2
New qos group                            =   2

Policer not configured for this class

Level1 Class                             =   inet4-classifier-af3
New qos group                            =   3

Policer not configured for this class

Level1 Class                             =   inet4-classifier-af4
New qos group                            =   4

Policer not configured for this class

Level1 Class                             =   inet4-classifier-be1
New qos group                            =   5

Policer not configured for this class

Level1 Class                             =   inet4-classifier-nc1
New qos group                            =   6


Policer not configured for this class

Level1 Class                             =   inet6-classifier-af1
New qos group                            =   1
```

```
Policer not configured for this class

Level1 Class                            =   inet6-classifier-af2
New qos group                           =   2

Policer not configured for this class

Level1 Class                            =   inet6-classifier-af3
New qos group                           =   3


Policer not configured for this class

Level1 Class                            =   inet6-classifier-af4
New qos group                           =   4

Policer not configured for this class

Level1 Class                            =   inet6-classifier-be1
New qos group                           =   5

Policer not configured for this class

Level1 Class                            =   inet6-classifier-nc1
New qos group                           =   6

Policer not configured for this class

Level1 Class                            =   inet-classifier-ipv6-af1
New qos group                           =   1

Policer not configured for this class

Level1 Class                            =   inet-classifier-ipv6-af2
New qos group                           =   2


Policer not configured for this class

Level1 Class                            =   inet-classifier-ipv6-af3
New qos group                           =   3

Policer not configured for this class

Level1 Class                            =   inet-classifier-ipv6-af4
New qos group                           =   4


Policer not configured for this class

Level1 Class                            =   inet-classifier-ipv6-af5
New qos group                           =   5

Policer not configured for this class

Level1 Class                            =   inet-classifier-ipv6-af6
New qos group                           =   6

Policer not configured for this class

Level1 Class                            =   inet-management-classifier-af4
New qos group                           =   7

Policer not configured for this class
```

```
Level1 Class                              =   exp-classifier-nc1
New qos group                             =   6
New topmost exp                           =   2

Policer not configured for this class

Level1 Class                              =   inet-management-classifier-nc1
New prec                                  =   6
New qos group                             =   5

Policer not configured for this class

Level1 Class                              =   inet6-management-classifier-nc1
New qos group                             =   4


Policer not configured for this class

Level1 Class                              =   class-default

Policer not configured for this class
```

This is the sample output shows the QoS information on an `interface hundredGigE 0/0/0/30` that are in the output direction:

```
RP/0/RP0/CPU0:ios#
RP/0/RP0/CPU0:ios#show qos interface hundredGigE 0/0/0/30 output
NOTE:- Configured values are displayed within parentheses
Interface HundredGigE0/0/0/30 ifh 0xf000210  -- output policy
NPU Id:                        0
Total number of classes:       2
Interface Bandwidth:           100000000 kbps
Policy Name:                   egress_pol_dql
VOQ Base:                      464
Accounting Type:               Layer1 (Include Layer 1 encapsulation and above)
VOQ Mode:                      8
Shared Counter Mode:           1
------------------------------------------------------------------------------
Level1 Class (HP1)                        =   tc7
Egressq Queue ID                          =   471 (HP1 queue)
Queue Max. BW.                            =   no max (default)
Discard Class 1 Threshold                 =   25165824 bytes / 2 ms (50 mbytes)
Discard Class 0 Threshold                 =   75497472 bytes / 5 ms (100 mbytes)
WRED not configured for this class

Level1 Class                              =   class-default
Egressq Queue ID                          =   464 (Default LP queue)
Queue Max. BW.                            =   no max (default)
Inverse Weight / Weight                   =   1 / (1)
TailDrop Threshold                        =   749568 bytes / 6 ms (default)
WRED not configured for this class
```

Starting IOS XR Release 25.2.1, you can view accurate guaranteed service rates and Queue Max. BW for the main interface, which reflects the actual hardware-programmed values from the NPU, rather than the configured values.

```
router# show qos interface HundredGigE 0/0/0/30 output
Thu Sep  5 10:02:14.217 UTC
NOTE:- Configured values are displayed within parentheses
Interface HundredGigE0/0/0/30 ifh 0xf000210  -- output policy
NPU Id:                        0
Total number of classes:       8
Interface Bandwidth:           100000000 kbps
```

```
Policy Name:                    egress_pol_dql
VOQ Base:                       464
Accounting Type:                Layer1 (Include Layer 1 encapsulation and above)
VOQ Mode:                       8
Shared Counter Mode:            1
------------------------------------------------
Level1 Class                                =   class-default
Queue Max. BW.                              =   62019301 kbps (62 %)
Inverse Weight / Weight                     =   0 / (BWR not configured)

   Level2 Class (HP1)                           =   tc7
   Egressq Queue ID                             =   839 (HP1 queue)
   Queue Max. BW.                               =   10806250 kbps (11 gbits/sec)
   Guaranteed service rate                      =   10806250 kbps
   TailDrop Threshold                           =   8245248 bytes / 6 ms (default)
   WRED not configured for this class

   Level2 Class (HP2)                           =   tc6
   Egressq Queue ID                             =   838 (HP2 queue)
   Queue Max. BW.                               =   21612500 kbps (22 gbits/sec)
   Guaranteed service rate                      =   21612500 kbps
   TailDrop Threshold                           =   16496640 bytes / 6 ms (default)
   WRED not configured for this class

   Level2 Class                                 =   tc5
   Egressq Queue ID                             =   837 (LP queue)
   Queue Max. BW.                               =   54599999 kbps (55 gbits/sec)
   Inverse Weight / Weight                      =   1 / (63)
   Guaranteed service rate                      =   14227913 kbps
   TailDrop Threshold                           =   9578496 bytes / 6 ms (default)
   WRED not configured for this class

   Level2 Class                                 =   tc4
   Egressq Queue ID                             =   836 (LP queue)
   Queue Max. BW.                               =   no max (default)
   Inverse Weight / Weight                      =   2 / (40)
   Guaranteed service rate                      =   7113956 kbps
   TailDrop Threshold                           =   6082560 bytes / 6 ms (default)
   WRED not configured for this class

   Level2 Class                                 =   tc3
   Egressq Queue ID                             =   835 (LP queue)
   Queue Max. BW.                               =   no max (default)
   Inverse Weight / Weight                      =   3 / (25)
   Guaranteed service rate                      =   4742637 kbps
   TailDrop Threshold                           =   3796992 bytes / 6 ms (default)
   WRED not configured for this class

   Level2 Class                                 =   tc2
   Egressq Queue ID                             =   834 (LP queue)
   Queue Max. BW.                               =   no max (default)
   Inverse Weight / Weight                      =   5 / (12)
   Guaranteed service rate                      =   2845582 kbps
   TailDrop Threshold                           =   1824768 bytes / 6 ms (default)
   WRED not configured for this class

   Level2 Class                                 =   tc1
   Egressq Queue ID                             =   833 (LP queue)
   Queue Max. BW.                               =   no max (default)
   Inverse Weight / Weight                      =   32 / (2)
   Guaranteed service rate                      =   444622 kbps
   TailDrop Threshold                           =   614400 bytes / 12 ms (default)
   WRED not configured for this class
```

```
   Level2 Class                              =   class-default
   Egressq Queue ID                          =   832 (Default LP queue)
   Queue Max. BW.                            =   no max (default)
   Inverse Weight / Weight                   =   63 / (1)
   Guaranteed service rate                   =   225839 kbps
   TailDrop Threshold                        =   614400 bytes / 24 ms (default)
   WRED not configured for this class
```

Starting with Cisco IOS XR Release 26.3.1, this example shows the output for an egress policy that uses bandwidth remaining percent:

```
router# show qos interface HundredGigE0/0/0/4/0 output
NOTE:- Configured values are displayed within parentheses
Interface HundredGigE0/0/0/4/0 ifh 0x78000408  -- output policy
NPU Id:                        0
Total number of classes:       8
Interface Bandwidth:           100000000 kbps
Policy Name:                   policymap_1_1_0
VOQ Base:                      928
Accounting Type:               Layer1 (Include Layer 1 encapsulation and above)
VOQ Mode:                      8
Shared Counter Mode:           1
------------------------------------------------------------------------------
Level1 Class                              =   classmap_1_1_1_0
Egressq Queue ID                          =   929 (LP queue)
Queue Max. BW.                            =   no max (default)
Inverse Weight / Weight                   =   5 / (10%)
TailDrop Threshold                        =   608256 bytes / 5 ms (default)
WRED not configured for this class

Level1 Class                              =   classmap_1_6_1_0
Egressq Queue ID                          =   934 (LP queue)
Queue Max. BW.                            =   no max (default)
Inverse Weight / Weight                   =   9 / (5%)
TailDrop Threshold                        =   608256 bytes / 5 ms (default)
WRED not configured for this class

Level1 Class (HP1)                        =   classmap_1_7_1_0
Egressq Queue ID                          =   935 (HP1 queue)
Queue Max. BW.                            =   no max (default)
TailDrop Threshold                        =   59996160 bytes / 5 ms (default)
WRED not configured for this class

Level1 Class                              =   class-default
Egressq Queue ID                          =   928 (Default LP queue)
Queue Max. BW.                            =   no max (default)
Inverse Weight / Weight                   =   1 / (BWR not configured)
TailDrop Threshold                        =   608256 bytes / 5 ms (default)
WRED not configured for this class
```

Starting with Cisco IOS XR Release 26.3.1, this example shows the output for an input policy that uses two-level hierarchical ingress policing:

```
Router# show qos interface HundredGigE0/0/0/3 input
NOTE:- Configured values are displayed within parentheses
Interface HundredGigE0/0/0/3 ifh 0x780001b0  -- input policy
NPU Id:                        0
Total number of classes:       5
Interface Bandwidth:           100000000 kbps
Policy Name:                   IN_PARENT_4_CHILD_TEST
Accounting Type:               Layer1 (Include Layer 1 encapsulation and above)
------------------------------------------------------------------------------
Level1 Class                              =   class-default
Policer committed rate                    =   16000000 kbps (16 gbits/sec)
Policer peak rate                         =   20000000 kbps (20 gbits/sec)
```

```
Policer conform burst                    =   4096000 bytes (default)
Policer exceed burst                     =   4096000 bytes (default)
Policer conform action                   =   Just TX
Policer exceed action                    =   Just TX
Policer violate action                   =   DROP PKT

   Level2 Class                             =   IN_CMAP_DSCP_56
   New traffic class                        =   7
   Policer committed rate                   =   1000000 kbps (1 gbits/sec)
   Policer conform burst                    =   1024000 bytes (default)
   Policer conform action                   =   Just TX
   Policer exceed action                    =   DROP PKT

   Level2 Class                             =   IN_CMAP_DSCP_48
   New traffic class                        =   6
   Policer committed rate                   =   2000000 kbps (2 gbits/sec)
   Policer conform burst                    =   1024000 bytes (default)
   Policer conform action                   =   Just TX
   Policer exceed action                    =   DROP PKT

   Level2 Class                             =   IN_CMAP_DSCP_40
   New traffic class                        =   5
   Policer committed rate                   =   6000000 kbps (6 gbits/sec)
   Policer peak rate                        =   20000000 kbps (20 gbits/sec)
   Policer conform burst                    =   1024000 bytes (default)
   Policer exceed burst                     =   2048000 bytes (default)
   Policer conform action                   =   Just TX
   Policer exceed action                    =   Just TX
   Policer violate action                   =   DROP PKT

   Level2 Class                             =   class-default
   Policer committed rate                   =   7000000 kbps (7 gbits/sec)
   Policer peak rate                        =   20000000 kbps (20 gbits/sec)
   Policer conform burst                    =   1024000 bytes (default)
   Policer exceed burst                     =   2048000 bytes (default)
   Policer conform action                   =   Just TX
   Policer exceed action                    =   Just TX
   Policer violate action                   =   DROP PKT
```

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.
set *options*	Configures the specified packet properties. Replace *options* with one of the following keywords or keyword arguments: • **discard-class** *value* —Sets the discard class value. Range is 0 to 1.
transmit	Transmits the packets.

Command Default

No default behavior or values

Command Modes

Policy map police configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

For more information regarding the traffic policing feature refer to the police rate, on page 65 command.

The **violate-action** command can set the discard class values for IP packets and 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
```

random-detect ecn

To enable ECN-based (Explicit Congestion Notification) random-detect, use the **random-detect ecn** command in policy-map configuration mode. To remove random-detect, use the **no** form of the command.

random-detect ecn
no random-detect ecn

Syntax Description

This command has no keywords or arguments.

Command Default

No default behavior or value.

Command Modes

Policy-map configuration mode.

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

None

Task ID

Task ID	Operation
qos	read, write

Example

This example shows how to use the **random-detect ecn**command:

```
RP/0/RP0/CPU0:router(config-pmap-c)#random-detect ecn
```



QoS Classification Commands

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- class-map, on page 95
- class (policy-map), on page 97
- end-class-map, on page 99
- end-policy-map, on page 100
- hw-module profile qos l2-mode, on page 101
- hw-module profile qos mode l3vpn-short-pipe, on page 102
- match access-group, on page 103
- match dscp, on page 105
- match mpls experimental topmost, on page 108
- match precedence, on page 110
- match qos-group, on page 112
- match mpls disposition class-map, on page 114
- set discard-class, on page 115
- set forward-class, on page 117
- set dscp, on page 118
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- set mpls experimental, on page 121
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- set qos-group, on page 124
- show qos-ea default-queue, on page 126

cef pbts class

To override the default behaviour of the policy based tunnel selection (PBTS), use the **cef pbts class** command in the global configuration mode.

cef pbts class any | *forward-class-value* **fallback-to** { *forward-class-value* | **any** | **drop** }

Syntax Description

forward-class-value	Set the forward-class. You can choose the forward-classs value from 0 to 7. The default value is 0 (zero).
any	Specify **any** forward-class.
fallback-to *forward-class-value*| **any** | **drop**	Specify to which forward-class it has to fall back during a tunnel failure. You can either choose the forward-class value from 0 to 7, any, or you can choose to drop the forward-class. When **any** class is specified, it takes precedence over other forward-class value (0 to 7) .

Command Default

No default behavior or values

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 7.5.3	This command was introduced.

Usage Guidelines

When TE tunnels associated with the forward-class goes down, traffic can be redirected to another forward-class, any forward-class or chosen to be dropped using fallback PBTS configuration. This configuration overrides the default behavior when PBTS enabled TE tunnel goes down. You can specify the sequence of preferred fallback classes to revert to when TE tunnel of main forward-class goes down.

When **cef pbts class any fallback-to any** is specified, then the lowest available forward-class in ascending order of 0 to 7 is chosen as fallback when paths to any class goes down.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how to enable fallback during a tunnel failure:

```
RP/0/RP0/CPU0:router(config)#  cef pbts class 0 fallback-to 1 2 3 5
```

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.
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 mode

Command History

Release	Modification
Release 7.0.12	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.

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

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

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
```

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 7.0.12	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 **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)# class-map p2
RP/0/RP0/CPU0:router(config-cmap)# match precedence 2
RP/0/RP0/CPU0:router(config-cmap)# end-class-map
RP/0/RP0/CPU0:router(config)# commit

RP/0/RP0/CPU0:router(config)# policy-map pm2
RP/0/RP0/CPU0:router(config-pmap)# class p2
RP/0/RP0/CPU0:router(config-pmap-c)# set precedence 3
RP/0/RP0/CPU0:router(config-pmap-c)# end-policy-map
RP/0/RP0/CPU0:router(config)# commit
RP/0/RP0/CPU0:router(config)# end
```

```
RP/0/RP0/CPU0:router# show run policy-map pm2
policy-map pm2
class p2
set precedence 3
!
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-cmap)#  exit

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.

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 7.0.12	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 7.0.12	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)# end-policy-map
```

hw-module profile qos l2-mode

To configure the header mode used for QoS classification on Layer 2 interfaces, use the **hw-module profile qos l2-mode** command in XR configuration mode. To remove the configuration and revert to the default behavior, use the **no** form of the command.

hw-module profile qos l2-mode [**L2** | **L3**]

Syntax Description

L2	Select L2 to classify ingress packets based on Layer 2 headers.
L3	Select L3 to classify ingress packets based on Differentiated Services Code Point (DSCP) in Layer 3 headers.

Command Default

No default behavior or values.

Command Modes

XR Config

Command History

Release	Modification
Release 7.5.1	This command was introduced.

Usage Guidelines

Perform a manual reload of the chassis or all line cards after changing this setting.

Task ID

Task ID	Operation
qos	read, write

Example

This example shows how to configure Layer 3 header-based QoS classification (DSCP) on Layer 2 interfaces:

```
Router(config)# hw-module profile qos l2-mode L3
Router(config)# commit
```

hw-module profile qos mode l3vpn-short-pipe

To enable the short-pipe mode, use the **hw-module profile qos mode l3vpn-short-pipe** command in the XR Config mode.

To disable this feature, use the **no** form of this command. Disabling the short-pipe mode changes the mode to pipe mode.

hw-module profile qos mode l3vpn-short-pipe

Syntax Description

This command has no arguments or keywords.

Command Default

Pipe mode is the default QoS tunneling mode.

Command Modes

XR Config mode

Command History

Release	Modification
Release 25.4.1	This command was introduced.

Usage Guidelines

- Pipe mode is the default QoS tunneling mode.
- Disabling short-pipe mode reverts the node to pipe mode.
- The router does not require a reload when you enable short-pipe mode.

Task ID

Task ID	Operation
qos	read, write

The following example shows how to enable the short-pipe mode on your router.

```
Router#config
Router(config)#hw-module profile qos mode l3vpn-short-pipe
Router(config)#commit
Router(config)#exit
```

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.
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 7.0.12	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 maximum allowed entries: 8

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 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 64 IP DSCP values can be specified to match packets. Reserved keywords can be specified instead of numeric values. Table 5: IP DSCP Reserved Keywords, on page 106 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 7.0.12	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 **match dscp** command examines the higher-order six bits in the type of service (ToS) byte of the IP header. If you specify more than one **match dscp** command in a class map, the new values are added to the existing statement.

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 5: 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 policy1 and attach service policy policy1 to an interface HundredGigE 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 packet is queued to the class queue with the bandwidth setting of 1000 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 policy1
RP/0/RP0/CPU0:router(config-pmap)# class dscp14
RP/0/RP0/CPU0:router(config-pmap-c)#bandwidth 1000 mbps
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
```

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 7.0.12	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 policy1 and attach service policy policy1 to an interface. In this example, class map mplsmap1 evaluates all packets entering HundredGigabit 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 packet is queued to the class queue with the bandwidth setting of 1000 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 policy1
RP/0/RP0/CPU0:router(config-pmap)# class mplsmap1
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth 1000 mbps
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 0/0/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input  policy1
```

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 6: IP Precedence Values and Names, on page 111 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 7.0.12	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 6: 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 HundredGigabit 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 packet is queued to the class queue with the bandwidth setting of 1000 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 policy1
RP/0/RP0/CPU0:router(config-pmap)# class ipprec5
RP/0/RP0/CPU0:router(config-pmap-c)# bandwidth 1000 mbps
RP/0/RP0/CPU0:router(config-pmap)# exit

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

match qos-group

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

match qos-group [*qos-group-value*]
no match qos-group

Syntax Description

qos-group-value	QoS group value identifier that specifies the exact value from 1 to 7. Range is not supported.

Command Default

No match criteria are specified.

Command Modes

Class map configuration

Command History

Release	Modification
Release 7.0.12	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 ingress on the local router to be used locally and the router to give differing levels of service based on the group identifier.

In the ingress policy-map, in order to designate the traffic class to a certain CoSQ other than CoSQ 0, the class-map needs to have an explicit set qos-group x statement, where 'x' is the CoSQ in the range of 0 to 7. The default COSQ is 0. In the egress policy-map, a class-map with a corresponding match qos-group x will allow further Quality of Service actions to be applied to the traffic class. For example,

```
class-map prec1
  match prec 1

policy-map test-ingress
  class prec1
    set qos-group 1
    police rate percent 50


class-map qg1
```

```
  match qos-group 1


policy-map test-egress
  class qg1
    shape average percent 70
```

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows a service policy called policy1 attached to an HundredGigabit Ethernet interface 0/1/0/9. In this example, class map qosgroup5 will evaluate all packets leaving HundredGigabit 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 packet is queued to the class queue with the bandwidth setting of 1000 mbps.

```
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 1000 mbps
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 0/0/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy output  policy1
```

match mpls disposition class-map

To classify MPLS-to-IP L3VPN decapsulation traffic using a referenced class map for short-pipe mode, use the **match mpls disposition class-map** command in class map configuration mode.

To remove the MPLS disposition classification match from the class map, use the **no** form of this command.

match mpls disposition class-map *class-map-name*

Syntax Description

class-map-name	Name of the class map that defines the match criteria for MPLS disposition classification.

Command Default

No MPLS disposition class map is associated with a class map.

Command Modes

Class map configuration

Command History

Release	Modification
Release 26.2.1	This command was introduced.

Usage Guidelines

- Use this command to indicate that a class map is used for short-pipe classification of MPLS-to-IP L3VPN decapsulation traffic.
- This command is not required on Q200 ASIC-based routers. However, you can configure it to distinguish a short-pipe policy from a non-short-pipe policy.
- The referenced class map can classify packets using the DSCP value in the inner IP header for MPLS-to-IP decapsulation traffic.

Task ID

Task ID	Operation
qos	read, write

Use the **match mpls disposition** *class-map* CLI command to configure MPLS disposition classification for short-pipe mode.

```
Router# config
Router(config)# class-map match-any MPLS-DISP-VOICE
Router(config-cmap)# match dscp ef
Router(config-cmap)# end-class-map
Router(config)# class-map match-any POST-MPLS-VOICE
Router(config-cmap)# match mpls disposition class-map MPLS-DISP-VOICE
Router(config-cmap)# end-class-map
Router(config)# policy-map pm
Router(config-pmap)# class POST-MPLS-VOICE
Router(config-pmap-c)# set qos-group 1
Router(config-pmap-c)# end-policy-map
Router(config)# commit
Router(config)# exit
```

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 0 to 1, to be marked on the packet.

Command Default

No default behavior or values

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

The **set discard-class** command associates a discard class ID with a packet. After the discard class is set, other QoS services such as Random Early Detection (random-detect) 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 **set discard-class** command is supported only in the ingress direction.Unconditional discard-class marking is supported.

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

Note

1. Marking of the discard class has only local significance on a node.
2. Discard class cannot be associated with a QoS profile in peering mode.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how to set the discard class value to 1 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 1
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 0/0/0/0
RP/0/RP0/CPU0:router(config-if)# service-policy input policy2
```

set forward-class

To associate the class-map with a forward-class, use the **set forward-class** command in policy-map class configuration mode. To remove a previously set forward-class, use the **no** form of this command.

set forward-class *forward-class-value*

Syntax Description

forward-class-value	Number from 1 to 7 that sets the forward-class value.

Command Default

No default behavior or values

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 7.5.3	This command was introduced.

Usage Guidelines

In policy based traffic selection (PBTS), 0 is the default forward-class. You cannot set forward-class 0 to the class-map.

Task ID

Task ID	Operations
qos	read, write

Examples

In this example, the class-map is associated with the forward-class 1:

```
RP/0/RP0/CPU0:router(config)#policy-map INGRESS-POLICY
RP/0/RP0/CPU0:router(config-pmap)#class AF42-Class
RP/0/RP0/CPU0:router(config-pmap-c)#set forward-class 1
```

set dscp

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

set dscp [**tunnel**] *dscp-value*
no set dscp [**tunnel**] *dscp-value*

Syntax Description

tunnel	(Optional) Sets the DSCP on the outer IP header. This command is available on Layer 3 interfaces in the ingress direction.
dscp-value	Number from 0 to 63 that sets the DSCP value. Reserved keywords can be specified instead of numeric values. Table 5: IP DSCP Reserved Keywords, on page 106 describes the reserved keywords.

Command Default

No default behavior or values

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

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.

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.

Task ID

Task ID	Operations
qos	read, write

Examples

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.

```
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
```

set ip encapsulation

To set traffic class imposition for SRv6 encapsulation, use the **set ip encapsulation** command in policy map class configuration mode.

set ip encapsulation class-of-service *cos-value*

Syntax Description

class-of-service	Specifies the class of service.
cos-value	Specifies the number that sets the SRv6 encapsulation in the IP header. The value ranges from 0 to 63.

Command Default

None

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 24.2.11	This command was introduced.

Usage Guidelines

- The **set ip encapsulation class-of-service** command is not allowed in egress QoS policies.
- The described behavior is applicable only in pipe mode. When in uniform mode or when propagate mode is active, regardless of QoS policy encapsulation settings, the class-of-service (CoS) from the inner header is always copied to the outer header.
- The **set qos-group** action cannot be used in conjunction with the **set ip encapsulation class-of-service** command.
- The IP encapsulation marking (**set ip encapsulation class-of-service**) and the MPLS experimental imposition marking (**set mpls experimental**) features are mutually exclusive. Both the configurations are not allowed at the same time.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how to set the traffic class imposition for SRv6 encapsulations.

```
RP/0/RP0/CPU0:router(config)# class-map match-any class1
RP/0/RP0/CPU0:router(config-pmap)# match protocol ipv4
RP/0/RP0/CPU0:router(config-pmap-c)# match access-group ipv4 10
RP/0/RP0/CPU0:router(config-cmap-c)# class class-default
RP/0/RP0/CPU0:router(config-cmap-c)# end-class-map
RP/0/RP0/CPU0:router(config)# policy-map SRv6
RP/0/RP0/CPU0:router(config-pmap)# class class1
RP/0/RP0/CPU0:router(config-pmap-c)# set ip encapsulation class-of-service 55
```

```
RP/0/RP0/CPU0:router(config-cmap-c)# class class-default
RP/0/RP0/CPU0:router(config-cmap-c)# end-policy-map
RP/0/RP0/CPU0:router(config)# interface HundredGigE 0/0/0/24
RP/0/RP0/CPU0:router(config-if)# service-policy input SRv6
```

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

Syntax Description

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 7.0.12	This command was introduced.

Usage Guidelines

After the MPLS experimental bits are set, other QoS services can then operate on the bit settings.

This command is supported only in ingress direction. Unconditional MPLS experimental marking is supported.

The network gives priority (or some type of expedited handling) to the marked traffic. Typically, the MPLS experimental value is set at the edge of the network (or administrative domain) and queuing is acted on it thereafter.

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 topmost 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
```

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.
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 6: IP Precedence Values and Names, on page 111 describes the reserved keywords.

Command Default

No default behavior or values

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

Precedence can be set using a number or corresponding name. After IP Precedence bits are set, other QoS services can then operate on the bit settings.

The **set precedence** command is supported only in the ingress direction. Unconditional precedence marking is supported.

The network gives priority (or some type of expedited handling) to the marked traffic. IP precedence can be set at the edge of the network (or administrative domain) and have queueing act on it thereafter.

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 HundredGigE 0/1/0/9
RP/0/RP0/CPU0:router(config-if)# service-policy input policy1
```

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. The *qos-group-value* is used to select a CoSQ and eventually to a VOQ

Command Default

No group ID is specified.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

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

The **set qos-group** will be used as internal priority to choose the queue on the egress port.

In the ingress policy-map, in order to designate the traffic class to a certain CoSQ other than CoSQ 0, the class-map needs to have an explicit set qos-group x statement, where 'x' is the CoSQ in the range of 0 to 7. The default COSQ is 0. In the egress policy-map, a class-map with a corresponding match qos-group x will allow further Quality of Service actions to be applied to the traffic class. For example,

```
class-map prec1
  match prec 1

policy-map test-ingress
  class prec1
    set qos-group 1
    police rate percent 50


class-map qg1
  match qos-group 1


policy-map test-egress
  class qg1
    shape average percent 70
```

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

show qos-ea default-queue

To display the queue statistics of aggregate shaper at the pin-down member level, use **show qos-ea default-queue** command in XR EXEC mode.

show qos-ea default-queue pw-ether *pw-ether-interface-number* **member interface** *pin-down-interface-type pin-down-interface-path-id* **output**

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 24.3.1	This command was introduced.

Usage Guidelines

You can configure a line card can to allow PWHE aggregate shaper policy to co-exist with subinterface policies. The PWHE aggregate shaper policy will only have a class-default with shape and bandwidth remaining actions.

The PWHE aggregate shaper policy can have:

- only shape action,
- only bandwidth remaining action, or
- shape and bandwidth remaining actions (recommended).

Example

This example shows a sample output of the **show qos-ea default-queue** command to verify that the aggregate shaper is enforced on the default traffic class **TC_0** for the egress traffic from the **PW-Ether1** main interface.

```
Router(config)#show qos-ea default-queue PW-Ether 1 member interface HundredGigE0/7/0/2
output

Interface Name        =          PE1
Interface Handle      =     1c000180
Location              =     0/7/CPU0
Asic Instance         =            0
VOQ Base              =        53312
Port Speed(kbps)      =    100000000
Local Port            =    etm_local
VOQ Mode              =            8
       ReceivedPkts    ReceivedBytes   DroppedPkts     DroppedBytes
-------------------------------------------------------------------
TC_0 = 150295879       150596322940    762151909       763676346056
TC_1 = 0               0               0               0
TC_2 = 0               0               0               0
TC_3 = 0               0               0               0
TC_4 = 0               0               0               0
TC_5 = 0               0               0               0
TC_6 = 0               0               0               0
```

```
TC_7 = 0                0               0               0
```



Hardware Module Commands

This module lists the hardware module commands for the Modular QoS configuration on the Cisco 8000 Series Routers.

For detailed information about the hardware module configuration tasks and examples, refer to the *Modular QoS Configuration Guide for Cisco 8000 Series Routers*.

- Hardware Module Commands, on page 130

Hardware Module Commands

Congestion Avoidance Commands

- hw-module profile npu memory buffer-extended bandwidth-congestion-detection enable
- hw-module profile npu memory buffer-extended bandwidth-congestion-protect enable
- hw-module profile priority-flow-control
- hw-module profile qos high-water-marks
- hw-module profile qos l2-mode, on page 101
- hw-module profile qos voq-mode
- hw-module voq-watchdog cardshut disable
- hw-module voq-watchdog feature enable



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