

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 1: 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 2: 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 3: 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
```