



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*]
no bandwidth remaining [**ratio** *ratio-value*]

Syntax Description

ratio *ratio-value* Specifies the amount of guaranteed bandwidth, based on a bandwidth ratio value. Range is 1 to 63 for main interfaces, and 1 to 255 for subinterfaces.

Command Default

No bandwidth is specified.

Command Modes

Policy map class configuration

Command History

| Release | Modification |
|----------------|------------------------------|
| 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.

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
```

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 <i>type</i> | 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 <i>number</i> | (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 <i>ID</i> | (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 <i>tc</i> —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 <i>tc</i> —Traffic class to be cleared | | | | |
|---------------------------|--|---------|--------------|----------------|------------------------------|
| Command Modes | XR EXEC mode | | | | |
| Command History | <table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 7.0.11</td> <td>This command was introduced.</td> </tr> </tbody> </table> | Release | Modification | Release 7.0.11 | This command was introduced. |
| 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 <i>lc</i> —Line card location | | | | |
|---------------------------|---|---------|--------------|---------------|------------------------------|
| Command Default | This feature is disabled by default. | | | | |
| Command Modes | XR Config mode | | | | |
| Command History | <table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 7.5.3</td> <td>This command was introduced.</td> </tr> </tbody> </table> | Release | Modification | Release 7.5.3 | This command was introduced. |
| Release | Modification | | | | |
| Release 7.5.3 | This command was introduced. | | | | |
| Usage Guidelines | No specific guidelines impact the use of this command. | | | | |
| Task ID | <table border="1"> <thead> <tr> <th>Task ID</th> <th>Operation</th> </tr> </thead> <tbody> <tr> <td>qos</td> <td>read, write</td> </tr> </tbody> </table> | Task ID | Operation | qos | read, write |
| 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 memory 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* **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

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. |

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
```

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 | |
|----------------------|--|
| <i>value</i> | Maximum threshold for tail drop in bytes. Range is from 1 to 4294967295. |
| <i>unit</i> | (Optional) Units for the queue limit value. Values can be: <ul style="list-style-type: none"> • bytes —bytes • kbytes —kilobytes • mbytes —megabytes • ms —milliseconds • packets —packets (default) • us —microseconds <p>Note When the specified <i>units</i> is packets, packets are assumed to be 256 bytes in size.</p> |
| <i>percent</i> | (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. |
| <i>discard-class</i> | (Optional) Allows you to configure dual queue limit thresholds for high priority and low priority. This option was introduced in Release 7.0.12. |
| <i>value</i> | <ul style="list-style-type: none"> • 0 —higher priority flow • 1 —lower priority flow <p>(Optional) Units for the queue limit value. Values can be:</p> <ul style="list-style-type: none"> • 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 | Modification |
|----------------|---|
| 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. |
| | <i>policy-map</i> | Name of a service policy map (created using the policy-map command) to be attached. |
| Command Default | No service policy is specified. | |
| Command Modes | Interface configuration. | |
| Command History | Release | Modification |
| | Release 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 | <p>The service-policy (policy-map class) command creates hierarchical service policies in policy-map class configuration mode.</p> <p>This command is different from the service-policy (interface) command used in interface configuration mode.</p> <p>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.</p> <p>The service-policy (policy-map class) command has this restriction:</p> <ul style="list-style-type: none"> 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 <i>percentage</i> | Specifies the interface bandwidth in percentage. Values can be from 1 to 100. |
| <i>rate</i> | Average shaping rate in the specified units. Values can be from 1 to 4294967295. |
| <i>units</i> | (Optional) Units for the bandwidth. Values can be: <ul style="list-style-type: none"> • bps—bits per second (default) • gbps—gigabits per second • kbps—kilobits per second • mbps—megabits per second |
| per-thousand <i>value</i> | Specifies shape rate as parts per thousand of the available bandwidth. |
| per-million <i>value</i> | Specifies shape rate as parts per million of the available bandwidth. |

Command Default *units*: bps

Command Modes Policy map class configuration

| Command History | Release | Modification |
|-----------------|----------------|------------------------------|
| | Release 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, **shape average** can be configured only as a percentage.

The **priority** and **shape average** commands can be configured together in the same class.

| Task ID | Task | 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
```

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

| Command Modes | |
|---------------|--------------|
| | XR EXEC mode |

| Command History | Release | Modification |
|-----------------|-----------------|---|
| | Release 7.5.5 | The show controllers all priority-flow-control statistics location all command form was added to display PFC statistics for all interfaces. |
| | Release 24.2.11 | |
| | | 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 | <p>For the show controllers priority-flow-control watchdog-stats command output, separate counters were added for total dropped packets and dropped packets.</p> <p>For the show controllers priority-flow-control statistics command, an additional counter for PFC Tx pause frames per traffic class was added.</p> |
| Release 7.0.11 | <p>The show controllers priority-flow-control statistics and show controllers priority-flow-control watchdog-stats command forms were introduced.</p> |

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

```

show controllers

```

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 <i>type</i> | | Displays the name of the IEEE 802.3 interfaces. For <i>type</i> , you can specify a specific interface or use all to specify all interfaces. |
| usage <i>instancenumber</i> | | Displays information for the specific device instance number selected. |
| usage <i>instanceall</i> | | 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 Usage | Buff-int Max WM | Buff-ext Usage | Buff-ext Max WM | Min |
|---|--------|-------------------|--------------------|-------------------|--------------------|--------|
| Buff-int-free WM | | | | | | Min WM |
| Wed 2023-08-30 23:47:40.918 UTC 293394 | 0 | 1518 | 6668 | 17154 | 17656 | 982846 |
| Wed 2023-08-30 23:47:41.918 UTC 293685 | 0 | 1227 | 5631 | 16010 | 16427 | 983990 |
| Wed 2023-08-30 23:47:42.919 UTC 293514 | 0 | 1398 | 8295 | 15041 | 15734 | 984959 |
| Wed 2023-08-30 23:47:43.919 UTC 293147 | 0 | 1765 | 8892 | 14744 | 15678 | 985256 |
| Wed 2023-08-30 23:47:41.011 UTC 284532 | 1 | 10380 | 12419 | 37532 | 38165 | 962468 |
| Wed 2023-08-30 23:47:42.011 UTC 284449 | 1 | 10463 | 11977 | 37315 | 38326 | 962685 |
| Wed 2023-08-30 23:47:43.013 UTC 285767 | 1 | 9145 | 12604 | 37714 | 38242 | 962286 |
| Wed 2023-08-30 23:47:44.013 UTC 283916 | 1 | 10996 | 13272 | 37429 | 38051 | 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 Usage | Buff-int Max WM | Buff-ext Usage | Buff-ext 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 | int-WM | 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 <i>type</i> | | Interface type and number. For the <i>type</i> 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 <i>ID</i> | | Displays the source queue buffer usage information in the packet memory space. |
| location <i>ID</i> | | Specifies the node location. For <i>ID</i> , you can specify a specific node in the <i>rack/slot/module</i> 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 |

show controllers npu packet-memory interface

```

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

```

show controllers npu packet-memory interface

```

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 <i>number</i>] | (Optional) Displays per-interval high water marks from recent periodic data collection intervals. | Use the last <i>number</i> keyword-argument combination to view a specific number of collection intervals. The maximum number of intervals (6) are displayed by default. |
| interface <i>type</i> | 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 <i>number</i> | (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 <i>ID</i> | (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 % | <p>The maximum queue occupancy experienced by this traffic class as a percentage of the total queue size.</p> <p>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.</p> |
| Max Occupancy kilobytes | <p>The maximum queue occupancy experienced by this traffic class in kilobytes.</p> <p>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.</p> |
| 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 | <p>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.</p> <p>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.</p> <p>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.</p> <p>Use the show controllers npu voq-usage command to see which other ports share a virtual output queue with the identified source system port.</p> |

| Field | Description |
|--------------------------------------|--|
| Timestamp (monotonic only) | <p>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.</p> <p>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.</p> <p>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.</p> |

Table 3: Queue Delay fields

| Field | Description |
|--|--|
| Max Queue Delay ns | The maximum delay experienced by this traffic class in nanoseconds. |
| Queue Occupancy % | <p>The queue occupancy as a percentage of the total queue size at the time the maximum queue delay high water mark occurred.</p> <p>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.</p> |
| Queue Occupancy kilobytes | <p>The queue occupancy in kilobytes at the time the maximum queue delay high water mark occurred.</p> <p>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.</p> |
| Src Sys Port Slot/NPU/Slc/Gid | <p>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.</p> <p>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.</p> <p>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.</p> <p>Use the show controllers npu voq-usage command to see which other ports share a virtual output queue with the identified source system port.</p> |

| Field | Description |
|-----------------------------------|--|
| Timestamp (monotonic only) | <p>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.</p> <p>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.</p> <p>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.</p> |

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     114112   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 Delay High Water Marks                               Queue Occupancy High Water Marks

Queue Occupancy   Src Sys Port                               Max Occupancy   Queue   Src Sys Port   Max
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:

show controllers npu qos high-water-marks

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 Delay High Water Marks
Queue Occupancy High Water Marks

Max Queue Occupancy      Src Sys Port      Max Occupancy  Queue      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

----- 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

----- Delay High Water Marks ----- ] [
----- Occupancy 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 Delay High Water Marks
Queue Occupancy 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 | 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 | | |
|--------------------|--------------------|--|
| | <i>number</i> | 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 <i>ID</i> , 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 <i>lc</i> —Line card location | | | | |
|---------------------------|---|---------|--------------|---------------|------------------------------|
| Command Default | No default behavior or values | | | | |
| Command Modes | XR EXEC mode | | | | |
| Command History | <table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 7.5.4</td> <td>This command was introduced.</td> </tr> </tbody> </table> | Release | Modification | Release 7.5.4 | This command was introduced. |
| 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 |

| If you... | Configured field displays... | Applied field displays... | Action field displays... |
|---|--|--|--------------------------|
| 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 |
| 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
```

show hw-module bandwidth-congestion-protect