# Quality of Service

# bandwidth egress rate

To set the bandwidth limit on the outbound traffic on a port, use the **bandwidth egress** *rate* command in the interface configuration mode. To remove the configured bandwidth limit, use the **no** form of the command.

[no]bandwidth egress *target-rate* [ *target-burst-rate* ]

| Syntax Description | *target-rate* | Specifies the bandwidth limit in Kbps. |
| --- | --- | --- |
| | | The target rate must be a multiple of 64K and should range between 2048 and 2608832 Kbps: |
| | | It should be 2048 to 1024000 Kbps for a GE port, 2048 to 2608832 Kbps for a PON port, and 2048 to 10240000 for a 10GE port. |
| | *target-burst-rate* | Specifies the burst transmission rate. |
| | | Target burst rate (Kbps) must be a multiple of 64K |
| | | Values can range between 2048 through 2608832. |

| Command Default | None |
| --- | --- |

| Command Modes | Interface Configuration (config-if) |
| --- | --- |

### Example

```
Device#configure terminal
Device(config)#interface e1/1

Device(config-if-ethernet-1/1)#bandwidth egress 2048
```

# clear traffic-statistic

To remove the traffic statistics records, use the **clear traffic-statistic** command in the global configuration mode.

**clear traffic-statistic** { [ **all** | [ **ip-group** { **num** | **name** } [ **subitem** *subitem* ] ] [ **link-group** { **num** | **name** } [ **subitem** *subitem* ] ] ] }

| ip-group { **num** | **name** } | Specifies a standard or extended ACL. |
|---|---|
| **link-group** { **num** | **name** } | Specifies a Layer 2 ACL. |
| **subitem** *subitem* | Specifies the sub item in the ACL. |

**Command Modes**  Global Configuration (config)

**Command Default**  None

**Usage Guidelines**  Use the **clear traffic-statistic all** command to remove all traffic statistics records.

Use the **clear traffic-statistic ip-group** or **clear traffic-statistic link-group** command to remove the traffic statistics records that are generated for the specified access control list.

### Example

```
Device#configure terminal
Device(config)#clear traffic-statistic ip-group 3
```

# queue-scheduler cos-map

To map the 802.1p priorities to the hardware queue, use the **queue-scheduler cos-map** command in the global configuration mode. To restore the default queue scheduler settings, use the **no** form of the command.

[no ]queue-scheduler cos-map [*queue-class*] [*priority*]

| Syntax Description | *queue-class* | Specifies the hardware queue value which ranges from 0 through 7. |
|---|---|---|
| | *priority* | Specifies the 802.1p priority. The value ranges from 0 to 7. |

**Command Default**   Strict Priority scheduling is followed by default.

**Command Modes**   Global configuration (config)

**Usage Guidelines**   802.1p is used to classify the outgoing traffic at the egress port based on the 802.1p priority. For each message that enters the switch, the system maps the specific hardware queue priority according to the 802.1p priority of the message.

Changing the mapping relation between 802.1p priority and hardware queues changes the mapping relation between 802.1p priorities and output queues.

If two 802.1p priorities are mapped to the same hardware priority queue, messages of the two 802.1p priorities cannot be forwarded with 1:1 forwarding.

Use the **queue-scheduler cos-map** command to set the 802.1p mapping with hardware queue priority.

### Example

The following example shows how to map packets with priority 0 to queue 1:

```
Device#configure terminal
Device(config)#queue-scheduler cos-map 1 0
Config successfully.
```

# queue-scheduler strict-priority

To configure the strict priority queue scheduling algorithm on the queue scheduler, use the **queue-scheduler strict-priority** command in the global configuration mode. To restore the default queue scheduler settings, use the **no** form of the command.

```
[no ]queue-scheduler strict-priority
```

| | |
|---|---|
| **Command Default** | Strict Priority scheduling is followed by default. |
| **Command Modes** | Global configuration (config) |

**Usage Guidelines**    Strict-Priority Queuing is designed for critical business applications wherein the services are prioritized in order to reduce the latency of response when a congestion occurs. The priority queue classifies all messages into eight class: 7,6,5,4,3,2,1, and 0, in the order of priority. The group of critical services is put into the higher priority queue and non-critical business group is put into the lower priority queue. The higher priority queue is first emptied before the messages in the lower priority queue are sent. Messages in the group of non-critical business are transmitted in the idle gap of handling critical business data.

### Example

```
Device#configure terminal
Device(config)#queue-scheduler strict-priority
```

# queue-scheduler sp-wrr

To configure strict priority and weighted round robin (WRR) queue scheduling algorithm on the queue scheduler, use the **queue-scheduler sp-wrr** command in the global configuration mode. To restore the default queue scheduler settings, use the **no** form of the command.

```
[no ]queue-scheduler sp-wrr {w1| w2| w3| w4| w5| w6| w7| w8}
```

| | |
|---|---|
| **Syntax Description** | |
| *wx* | Specifies the weight of the queue represented by x. |
| where x can be 1, 2, 3, 4, 5, 6, 7,8 | For example, w1 represents the weight of the first queue. w2 represents the weight of the second queue. |

**Command Default**　　Strict Priority scheduling is followed by default.

**Command Modes**　　Global configuration (config)

**Usage Guidelines**　　Strict-Priority and WRR queue scheduling combines the algorithms of strict-priority and Weighted round robin scheduling. If the weight of the queue is set to 0, the queue follows the Strict-Priority queuing algorithm to send messages. A non-zero value of the weight puts the queue to the WRR scheduling mechanism.

### Example

```
Device#configure terminal
Device(config)#queue-scheduler sp-wrr 1 2 3 4 5 6 7 8
```

# queue-scheduler wrr

To configure the weighted round robin (WRR) queue scheduling algorithm on the queue scheduler, use the **queue-scheduler wrr** command in the global configuration mode. To restore the default queue scheduler settings, use the **no** form of the command.

```
[no ]queue-scheduler wrr{ w1| w2| w3| w4| w5| w6| w7| w8}
```

**Syntax Description**

| | |
|---|---|
| *wx* | Specifies the weight of the queue represented by x. |
| where x can be 1, 2, 3, 4, 5, 6, 7,8 | For example, w1 represents the weight of the first queue. w2 represents the weight of the second queue. |

**Command Default**

Strict Priority scheduling is followed by default.

**Command Modes**

Global configuration (config)

**Usage Guidelines**

Weighted Round Robin (WRR) queue scheduling divides each port into eight output queues: 7, 6, 5, 4, 3, 2, 1, and 0, in the that order of priority, with 7 being the highest priority. All the queues are scheduled by turns and each queue gets a certain service time. Each queue of WRR can be configured with weighted values of w7, w6, w5, w4, w3, w2, w1, or w0. The weighted value represents the weight of the resource.

An advantage of WRR queuing is that although multiple queues are scheduled by polling, each queue is not assigned a fixed time slot. If a queue is empty, it immediately switches to the next queue schedule. So, the bandwidth and resources of that queue can be fully utilized

**Example**

```
Device#configure terminal
Device(config)#queue-scheduler wrr 1 2 3 4 5 6 7 8
```

# queue-scheduler dscp-map

To configure the strict priority queue scheduling algorithm on the queue scheduler, use the **queue-scheduler dscp-map** command in the global configuration mode. To restore the default queue scheduler settings, use the **no** form of the command.

```
[no ]queue-scheduler dscp-map [dscp-value] [priority]
```

| Syntax Description | *dscp-value* | Specifies the DSCP value whioch ranges from 0 through 63. |
| --- | --- | --- |
| | *priority* | Specifies the 802.1p priority. The value ranges from 0 to 7. |

**Command Default**   Strict Priority scheduling is followed by default.

**Command Modes**   Global configuration (config)

**Usage Guidelines**   DSCP mapping is disable by default. To enable DSCP mapping use the **queue-scheduler dscp-map** command.

DSCP allows 64 priority values whereas 802.1p (hardware queue) allows only eight priority values. By default, the following is the mapping between DSCP and 802.1p:

| DSCP | 802.1p |
| --- | --- |
| 0-7 | 0 |
| 8-15 | 1 |
| 16-23 | 2 |
| 24-31 | 3 |
| 32-39 | 4 |
| 40-47 | 5 |
| 48055 | 6 |
| 56-63 | 7 |

**Example**

The following example shoes how to map DSCP 56 to 802.1p priority 6:

```
Device#configure terminal
Device(config)#queue-scheduler dscp-map

Device(config)#queue-scheduler dscp-map 56 6
```

# rate-limit

To set the traffic rate limit in inbound or outbound direction, use the **rate-limit** command in the global configuration mode. To remove the rate limit, use the **no** form of the command.

[**no**]**rate-limit** {**input** | **output**} {[**ip-group** {**num** | **name**} [**subitem** *subitem*] ] [**link-group** {**num** | **name**} [**subitem** *subitem*] ] }*target-rate*

| input | Specifies the rate limit in inbound direction. |
|---|---|
| output | Specifies the rate limit in outbound direction. |
| ip-group {num \| name} | Specifies a standard or extended ACL. |
| link-group {num \| name} | Specifies a Layer 2 ACL. |
| subitem *subitem* | Specifies the sub item in the ACL. |
| *target-rate* | Specifies target rate which is the traffic rate limit in Kbps. Target rate should be a multiple of 64, and can range from 64 to 1048512. |

**Command Modes**  Global Configuration (config)

**Command Default**  None

**Usage Guidelines**  Use the **rate-limit input** command to limit the traffic rate in the inbound direction.

Use the **rate-limit output** command to limit the traffic rate in the outbound direction.

Use this command to monitor the rate of traffic that enters a device. If the traffic exceeds a certain threshold, you can define policies to take suitable measures.

### Example

The following example sets the inbound traffic rate limit to 100 Kbps:

```
Device#configure terminal
Device(config)#rate-limit input ip-group 3 100
```

# show bandwidth egress

To display the rate limit and the burst rate that are set for the egress interface, use the **show bandwidth egress** command in privileged or global configuration mode.

```
show bandwidth egress[ interface {ethernet | gpon }port-num]
```

**Command Default**    None

**Command Modes**    Privileged (#)

Global Configuration (config)

**Example**

The following is a sample output of the **show bandwidth** command.

```
Device(config)#show bandwidth egress
g0/1: bandwidth egress
  limit rate:  / Kbps     burst:   / Kbps

g0/2: bandwidth egress
  limit rate:  / Kbps     burst:   / Kbps

g0/3: bandwidth egress
  limit rate:  / Kbps     burst:   / Kbps
 ....
 ...
e2/2: bandwidth egress
  limit rate:  / Kbps     burst:   / Kbps
```

**Related Commands**

| Command | Description |
|---|---|
| **bandwidth egress rate** | Sets the bandwidth limit on the outbound traffic on a port. |

# show qos-info all

To display the parameters that are set for Quality of Service (QoS), use the **show qos-info** command in privileged or global configuration mode.

```
show qos-info {all| traffic-copy-to-cpu | mirrored-to | traffic-priority
| traffic-redirect | traffic-statistic| statistic }
```

**Command Default**    None

**Command Modes**    Privileged (#)

Global Configuration (config)

**Usage Guidelines**    Use the **show qos-info all** command to display all the configured QoS parameters.

Use the **show qos-info statistic** command to display all the statistics for QoS parameters.

Use the **show qos-info traffic-copy-to-cpu** command to display the parameter settings for copying messages to the CPU.

Use the **show qos-info mirrored-to** command to display the parameter settings for traffic mirroring.

Use the **show qos-info traffic-priority** command to display the parameter settings for traffic priority.

Use the **show qos-info traffic-redirect** command to display the parameter settings for message redirection.

**Example**

```
Device#show qos-info all
mirrored-to(max 3 dest port):
traffic-priority:
traffic-redirect:
traffic-statistic:
traffic-copy-to-cpu:
```

Here is a sample ouput for the **show qos-info statistic** command:

```
Device#show qos-info statistic
mirrored-to:
total mirrored-to rules        : 0 rules

traffic-priority:
total traffic-priority rules   : 0 rules

traffic-redirect:
total traffic-redirect rules   : 0 rules

traffic-statistic:
total traffic-statistic rules  : 0 rules

traffic-copy-to-cpu:
total traffic-copy-to-cpu rules : 0 rules

total mirrored-to rules        : 0 rules
total traffic-priority rules   : 0 rules
```

```
total traffic-redirect rules     : 0 rules
total traffic-statistic rules    : 0 rules
total traffic-copy-to-cpu rules : 0 rules
total qos-info rules             : 0 rules
```

**Related Commands**

| Command | Description |
|---|---|
| **traffic-copy-to-cpu** | Copies all packets to the CPU. |
| **traffic-statistic** | Configures the system to collect the traffic statistics |
| **traffic-redirect** | Redirects the traffic to a specified interface or to the CPU. |

# show qos-interface

To display all the policies set for Quality of Service (QoS) on the interface, use the **show qos-interface** command in privileged or global configuration mode.

```
show qos-interface {all| rate-limit | statistic
```

**Command Default**
None

**Command Modes**
Privileged (#)

Global Configuration (config)

**Usage Guidelines**
Use the **show qos-interface all** command to display all the QoS parameters for the interface.

Use the **show qos-interface rate-limit** command to display the rate limit parameters for the interface.

Use the **show qos-interface statistic** command to display the statistics of rate limit for all interfaces.

### Example

The following is a sample output of the **show qos-interface all** command:

```
Device#show qos-interface all
total qos-interface rules : 0 rules
```

The following is a sample output of the **show qos-interface rate-limit** command:

```
Device#show qos-interface rate-limit
total rate-limit rules : 0 rules
```

The following is a sample output of the **show qos-interface statistic** command:

```
Device#show qos-interface satistic
total qos-interface rules : 0 rules
```

# show queue-scheduler

To display information about the queue scheduler, use the **show queue-scheduler** command in privileged or global configuration mode.

```
show queue-scheduler [ cos-map | dscp-map ]
```

| | |
|---|---|
| **Syntax Description** | |

| | |
|---|---|
| **cos-map** | Specifies the 802.1p and hardware queue mapping. |
| **dscp-map** | Specifies the DSCP and 802.1p value mapping. |

**Command Default** None

**Command Modes** Privileged (#)

Global Configuration (config)

**Usage Guidelines** Use the **show queue-scheduler** command to display information about the queue scheduler parameters.

Use the **show queue-scheduler cos-map** command to display information about the mapping between 802.1p and hardware.

Use the **show queue-scheduler dscp-map** command to display information about the mapping between 802.1p values and DSCP.

### Examples

Following are sample outputs for the **show queue-scheduler** commands.

```
Device#show queue-scheduler
Queue scheduler status : enable
Queue scheduler mode   : SP (Strict Priority)


Device#show queue-scheduler cos-map
Information about map of cos:
802.1P Priority  Queue of class
------------------------------
0                0
1                1
2                2
3                3
4                4
5                5
6                6
7                7

Device#show queue-scheduler dscp-map
dscp-pri has been disabled.
```

**Related Commands**

| Command | Description |
|---|---|
| **queue-scheduler wrr** | Configures the weighted round robin scheduling mode. |

| Command | Description |
|---|---|
| **queue-scheduler strict-priority** | Configures the strict priority scheduling mode. |
| **queue-scheduler dscp-map** | Maps DSCP values to hardware priority values. |
| **queue-scheduler cos-map** | Maps 802.1p values to hardware queue map. |

# storm-control

To enable traffic storm control on an interface and to configure a threshold for the number of packets on the port, use the **storm-control** command in the interface configuration mode. To remove the storm control configuration on an interface, use the **no** form of the command.

```
[no]storm-control {broadcast | multicast | unicast } target-rate
```

| Syntax Description | | |
| --- | --- | --- |
| | **broadcast** | Specifies broadcast traffic for storm control. |
| | **multicast** | Specifies multicast traffic for storm control. |
| | **unicast** | Specifies unicast traffic for storm control. |
| | *target-rate* | Specifies a threshold limit for the number of packets on the port. |
| | | Value can range from 64 to 32000000 packets per second (pps) |
| | | Default value is 49984 pps |

**Command Default**  None

**Command Modes**  Interface Configuration (config-if)

### Example

```
Device#configure terminal
Device(config)#interface e1/1

Device(config-if-ethernet-1/1)#storm-control unicast 512
Device(config-if-ethernet-1/1)#storm-control multicast 256
Device(config-if-ethernet-1/1)#storm-control broadcast 128
```

# traffic-copy-to-cpu

To copy the packets that match an ACL to CPU, use the **traffic-copy-to-cpu** command in the global configuration mode. To remove the traffic copy configuration, use the **no** form of the command.

[**no**] **traffic-copy-to-cpu** { [**ip-group** {**num** | **name** } [**subitem** *subitem* ] ] [**link-group** {**num** | **name** } [**subitem** *subitem* ] ] }

| | |
|---|---|
| **ip-group** {**num** | **name** } | Specifies a standard or extended ACL. |
| **link-group** {**num** | **name** } | Specifies a Layer 2 ACL. |
| **subitem** *subitem* | Specifies the sub item in the ACL. |

**Command Modes**    Global Configuration (config)

**Command Default**    None

### Example

The following example shows how to copy packets that match the subitem number 2 of ACL numbered 3 to CPU:

```
Device#configure terminal
Device(config)#traffic-copy-to-cpu ip-group 3 subitem 2
```

# traffic-redirect

To redirect the messages sent to a port, use the **traffic-redirect** command in the global configuration mode. To remove the redirect configuration, use the **no** form of the command.

[**no**] **traffic-redirect** { [**ip-group** {**num** | **name** } [**subitem** *subitem* ] ] [**link-group** {**num** | **name** } [**subitem** *subitem* ] ] [**interface** *interface-num* | **cpu**] }

| ip-group {**num** | **name** } | Specifies a standard or extended ACL. |
|---|---|
| link-group {**num** | **name** } | Specifies a Layer 2 ACL. |
| subitem *subitem* | Specifies the sub item in the ACL. |
| interface *interface-num* | Specifies the interface to which the traffic is redirected. |
| cpu | Specifies that the traffic is redirected to the CPU. |

**Command Modes**    Global Configuration (config)

**Command Default**    None

**Usage Guidelines**    Use the **traffic-redirect** command to forward the traffic to an egress port or a CPU, using the specified access control list (ACL) sub items.

### Example

The following example shows how to redirect traffic to the ethernet 1/1 interface:

```
Device#configure terminal
Device(config)#traffic-redirect link-group link1 interface ethernet 1/1
```

# traffic-statistic

To configure a device to collect traffic statistics, use the **traffic-statistic** command in in global configuration mode. To remove the traffic statistic configuration, use the **no** form of the command.

[**no**]**traffic-statistic** { [**ip-group** {**num** | **name** } [**subitem** *subitem* ] ] [**link-group** {**num** | **name** } [**subitem** *subitem* ] ] }

| | |
|---|---|
| **ip-group** {**num** | **name** } | Specifies a standard or extended ACL. |
| **link-group** {**num** | **name** } | Specifies a Layer 2 ACL. |
| **subitem** *subitem* | Specifies the sub item in the ACL. |

**Command Modes**      Global Configuration (config)

**Command Default**      None

**Usage Guidelines**      Use this command to configure the device to collect traffic statistics. This command displays a cumulative value of the count of the number of packets that matched the ACL rule.

If you reconfigure traffic statistics, the previous information is lost.

### Example

```
Device#configure terminal
Device(config)#traffic-statistic ip-group 3
```