Configuring QoS Policing

This chapter contains the following sections:

Information About Policing

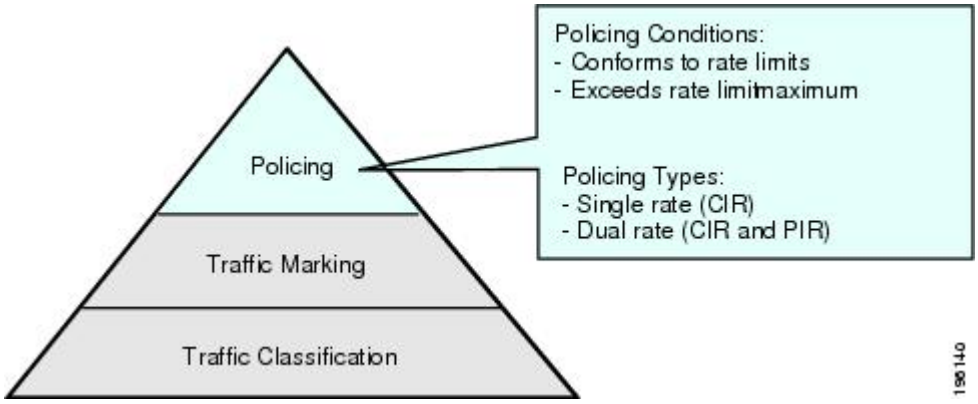
Policing is the monitoring of the data rates for a particular class of traffic. When the data rate exceeds user-configured values, marking or dropping of packets occurs immediately. Policing does not buffer the traffic, so transmission delay is not affected. When traffic exceeds the data rate, you instruct the system to either drop the packets or mark QoS fields in them. You can define single-rate, dual-rate, and color-aware policers.

Single-rate policers monitor the committed information rate (CIR) of traffic. Dual-rate policers monitor both the CIR and peak information rate (PIR) of traffic. In addition, the system monitors associated burst sizes. Three colors or conditions are determined by the policer for each packet depending on the data rate parameters supplied: conform (green), exceed (yellow), or violate (red).

You can configure only one action for each condition. For example, you might police for traffic in a class to conform to the data rate of 256,000 bits per second, with up to 200 millisecond bursts. The system would apply the conform action to traffic that falls within this rate, and it would apply the violate action to traffic that exceeds this rate.

Color-aware policers assume that traffic has been previously marked with a color. This information is then used in the actions taken by this type of policer. For more information about policies, see RFC 2697, RFC 2698, and RFC4115.

Figure 1: Policing Condition and Types



The following table lists the conditions that trigger actions by the policer depending on the defined data rate.

Table 1: Policer Actions for Exceed or Violate

Condition	Color	Description	Policer Action[1]
Conform	Green	The packet traffic data rate is within the defined boundaries.	The policer either transmits these packets as is or changes the value in the header (DSCP, precedence, or CoS) and then transmits these packets.
Exceed	Yellow	The packet traffic data rate exceeds the defined boundary.	The policer can drop or mark down these packets.
Violate	Red	The packet traffic data rate violates the defined boundaries.	The policer can drop or mark down these packets.

1 Only one policer action is allowed per condition.

Prerequisites for Policing

- You are logged on to the CLI in EXEC mode.

Guidelines and Limitations for QoS Policing

Each module polices independently, which might affect a policer that is applied to traffic distributed across more than one module, such as in the case of a port channel interface.

Configuring Ingress and Egress Policing

You can apply the policing instructions in a QoS policy map to ingress or egress packets by attaching that QoS policy map to an interface or port profile. To select ingress or egress, you specify either the **input** or **output** keyword in the **service-policy** command. For an example of how to use the **service-policy** command, see Creating Ingress and Egress Policies.

Configuring Policing

Police Command and Policer Types

Police Command Arguments

The type of policer that is created by the Cisco Nexus 1000V is based on a combination of the **police** command arguments listed in the following table.

Note Specify the identical value for **pir** and **cir** to configure 1-rate, 3-color policing.

Argument	Description
cir	Committed information rate (**cir**), or desired bandwidth, specified as a bit rate or a percentage of the link rate. Although a value for **cir** is required, the argument itself is optional. The range of values is from 1 to 80000000000; the range of mathematically significant policing values is 250 kbps to 80 Gbps.
percent	Rate as a percentage of the interface rate. The range of values is from 1 to 100%.
bc	Indication of how much the **cir** can be exceeded, either as a bit rate or an amount of time at **cir**. The default is 200 milliseconds of traffic at the configured rate. The default data rate units are bytes, and the Gigabit per second (gbps) rate is not supported for this parameter.
pir	Peak information rate (**pir**), which is specified as a PIR bit rate or a percentage of the link rate. There is no default. The range of values is from 1 to 80000000000; the range of mathematically significant policing values is from 250 kbps to 80 Gbps. The range of percentage values is from 1 to 100%.

Argument	Description
be	Indication of how much the **pir** can be exceeded, either as a bit rate or an amount of time at **pir**. When the **bc** value is not specified, the default is 200 milliseconds of traffic at the configured rate. The default data rate units are bytes, and the Gigabit per second (gbps) rate is not supported for this parameter. **Note** You must specify a value for **pir** before the device displays this argument.
conform	Single action to take if the traffic data rate is within bounds. The basic actions are transmit or one of the **set** commands listed in the table. The default is transmit.
exceed	Single action to take if the traffic data rate exceeds the specified boundaries. The basic actions are drop or markdown. The default is drop.
violate	Single action to take if the traffic data rate violates the configured rate values. The basic actions are drop or markdown. The default is drop.

Policer Types and Actions

Although all the Police Command arguments are optional, you must specify a value for **cir**. In the following table, **cir** indicates the value but not necessarily the keyword itself. The combination of these arguments and the resulting policer types and actions are described.

Police Arguments Present	Policer Type	Policer Action
cir, but not **pir**, **be**, or **violate**	1-rate, 2-color	**≤ cir**, then **conform**; otherwise **violate**
cir and **pir**	1-rate, 3-color	**≤ cir**, **conform**; **≤ pir**, **exceed**; else **violate** **Note** You must specify identical values for **cir** and **pir**.
cir and **pir**	2-rate, 3-color	**≤ cir**, then **conform**; **≤ pir**, then **exceed**; otherwise **violate**

Policer Action

You can take the actions listed in the following table when the packet exceeds the parameters or violates the parameters.

Table 2: Policer Action for Exceed or Violate

Action	Description
drop	Drops the packet. This action is available only when the packet exceeds or violates the parameters.
set dscp dscp table {*cir-markdown-map* | *pir-markdown-map*}	Sets the specified fields from a table map and transmits the packet. For more information on the system-defined, or default table maps, see Configuring QoS Marking Policies. This action is available only when the packet exceeds the parameters (use the *cir-markdown-map*) or violates the parameters (use the *pir-markdown-map*).

Table 3: Policer Action for Conform

Action	Description
transmit	Transmits the packet. This action is available only when the packet conforms to the parameters.
set-prec-transmit	Sets the IP precedence field to a specified value and transmits the packet. This action is available only when the packet conforms to the parameters.
set-dscp-transmit	Sets the DSCP field to a specified value and transmits the packet. This action is available only when the packet conforms to the parameters.
set-cos-transmit	Sets the CoS field to a specified value and transmits the packet. This action is available only when the packet conforms to the parameters.
set-qos-transmit	Sets the QoS group internal label to a specified value and transmits the packet. This action can be used only in input policies and is available only when the packet conforms to the parameters.
set-discard-class-transmit	Sets the discard-class internal label to a specified value and transmits the packet. This action can be used only in ingress policies and is available only when the packet conforms to the parameters.

Police Command Data Rates

The policer can only drop or mark down packets that exceed or violate the specified parameters. For more information about marking down packets, see Configuring QoS Marking Policies.

The **police** command uses the data rates listed in the following table.

Table 4: Data Rates for the police Command

Rate	Description
bps	Bits per second (default)
kbps	1000 bits per seconds
mbps	1,000,000 bits per second
gbps	1,000,000,000 bits per second

Police Command Burst Sizes

The **police** command uses the burst sizes in the following table.

Speed	Description
bytes	bytes
kbytes	1000 bytes
mbytes	1,000,000 bytes
ms	milliseconds
us	microseconds

Configuring Markdown Policing

Markdown policing is the setting of a QoS field in a packet when traffic exceeds or violates the policed data rates. You can configure markdown policing by using the **set** commands.

Note You must specify the identical value for **pir** and **cir** to configure 1-rate, 3-color policing.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **policy-map** [**type qos**] [**match-first**] *policy-map-name*	Places you into policy map QoS configuration mode for the specified policy map and configures the map name in the running configuration. The *policy-map-name* argument is a unique alphabetic string that can be up to 40 case-sensitive characters long, including hyphen (-) and underscore (_) characters. The map name must be unique across class-maps and policy-maps. For example, you cannot have a class-map and a policy-map with the same name of HR_Map.
Step 3	switch(config-pmap-qos)# **class** [**type qos**] {*class_map_name* |**class-default**}	Creates a reference to *class-map-name* and enters policy-map class QoS configuration mode for the specified class map. By default, the class is added to the end of the policy map. Changes are saved in the running configuration. Use the **class-default** keyword to select all traffic that is not currently matched by classes in the policy map. The *class_map_name* argument is a unique alphabetic string that can be up to 40 case-sensitive characters long, including hyphen (-) and underscore (_) characters. The map name must be unique across class-maps and policy-maps. For example, you cannot have a class-map and a policy-map with the same name of HR_Map.
Step 4	switch(config-pamp-c-qos)# **police** [**cir**] {*committed-rate* [*data-rate*] | **percent** *cir-link-percent*} [**bc** *committed-burst-rate* [*link-speed*]][**pir**] {*peak-rate* [*data-rate*] | **percent** *cir-link-percent*} [**be** *peak-burst-rate* [*link-speed*]] [**conform** {**transmit** | **set-prec-transmit** | **set-dscp-transmit** | **set-cos-transmit** | **set-qos-transmit** | **set-discard-class-transmit**} [**exceed** {**drop** | **set dscp dscp table** {*cir-markdown-map*}} [**violate** {**drop** | **set dscp dscp table** {*pir-markdown-map*}}]	Polices **cir** in bits or as a percentage of the link rate. The **conform** action is taken if the data rate is **≤cir**. If **be** and **pir** are not specified, all other traffic takes the **violate** action. If **be** or **violate** are specified, the exceed action is taken if the data rate **≤ pir**. The actions are described in Information About Policing, on page 1. The data rates and link speeds are described in Police Command Data Rates, on page 6 and Police Command Burst Sizes, on page 6. **Note** The default value of 200 ms is taken for bc and be, if bc and be are configured in ms/us. This limitation does not apply if bc and be are in bps.
Step 5	switch(config-pamp-c-qos)# **show policy-map** [**type qos**] [*policy-map-name*]	(Optional) Displays information about all configured policy maps or a selected policy map of type QoS.

	Command or Action	Purpose
Step 6	switch# **show table-map** [**table-map-name**]	(Optional) Displays information about the QoS table map.
Step 7	switch(config-pamp-c-qos)# **copy running-config startup-config**	(Optional) Displays information about all configured policy maps or a selected policy map of type QoS.

This example shows how to configure a 1-rate, 2-color policer that transmits if the data rate is within 200 milliseconds of traffic at 256000 bps and how to mark DSCP using the pir-markdown-map from the table map if the data rate is violated:

```
switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# policy-map pol1
switch(config-pmap-qos)# class class-default
switch(config-pmap-c-qos)# police cir 256000 bps conform transmit violate set dscp dscp
table pir-markdown-map
switch(config-pmap-c-qos)# show policy-map pol1


  Type qos policy-maps
  ====================

  policy-map type qos pol1
    class  class-default
      police cir 256000 bps bc 200 ms conform transmit violate set dscp dscp table
pir-markdown-map
switch(config-pmap-c-qos)# show table-map pir-markdown-map

  Table-map pir-markdown-map
    default copy
    from 10,12 to 14
    from 18,20 to 22
    from 26,28 to 30
    from 34,36 to 38

switch(config-pmap-c-qos)#
```

Verifying the Policing Configuration

Use the following command to verify the configuration:

Command	Description
show policy-map	Displays information about policy maps and policing.

Configuration Example for QoS Policing

This example shows a two- rate, three- color policer that sets the CoS to 4 if the data rate is within 300 kbps. It also shows how to mark down DSCP using the system-defined cir-markdown-map table map if the data

rate is within 750 kbps and how to mark down DSCP using the system-defined pir-markdown-map table map if the data rate is greater than 750 kbps:

```
switch(config)# policy-map ty qos 2rate3clr
switch(config-pmap-qos)# class  class1
switch(config-pmap-c-qos)# police cir 300 kbps pir 750 kbps conform
set-cos-transmit 4 exceed set dscp dscp table cir-markdown-map violate set dscp
dscp table pir-markdown-map
switch(config-pmap-c-qos)# show policy-map 2rate3clr
  Type qos policy-maps
  ====================

  policy-map type qos 2rate3clr
    class  class1
      police cir 300 kbps bc 200 ms pir 750 kbps be 200 ms conform set-cos-transmit 4
exceed set dscp dscp table cir-markdown-map violate set dscp dscp table pir-mar
kdown-map
```

This example shows a single-rate, two-color policer that transmits if the data rate is within 200 milliseconds of traffic at 600 kbps and drops packets otherwise:

```
switch(config)# policy-map ty qos 1rate2clr
switch(config-pmap-qos)# class  class2
switch(config-pmap-c-qos)# police cir 600 kbps conform transmit violate drop
switch(config-pmap-c-qos)# show policy-map 1rate2clr
  Type qos policy-maps
  ====================
  policy-map type qos 1rate2clr
    class  class2
      police cir 600 kbps bc 200 ms conform transmit violate drop
switch(config-pmap-c-qos)#
```

The following example shows how to configure a single-rate, three-color policer that polices traffic at 4,000,000 bits per second and allows normal or committed bursts of 200 kbytes and excess bursts of 400 kbytes. The policer transmits traffic that conforms to the policing rate, marks down the DSCP using the system-defined cir-markdown-map table map for traffic that exceeds the burst sizes, and drops traffic that violates the policing rate.

```
switch(config)# policy-map 1rate3clr
switch(config-pmap-qos)# class class1
switch(config-pmap-c-qos)# police cir 4 mbps bc 200 kbytes pir 4 mbps be 400 kbytes
conform transmit exceed set dscp dscp table cir-markdown-map violate drop
switch(config-pmap-c-qos)# show policy-map 1rate3clr

  Type qos policy-maps
  ====================

  policy-map type qos 1rate3clr
    class  class1
      police cir 4 mbps bc 200 kbytes pir 4 mbps be 400 kbytes conform transmit exceed set
 dscp dscp table cir-markdown-map violate drop
```

Feature History for QoS Policing

This section provides the QoS policing release history.

Feature Name	Release	Feature Information
QoS Policing	5.2(1)SM1(5.1)	This feature was introduced