



# Configuring Control Plane Policing

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## Restrictions for CoPP

Restrictions for control plane policing (CoPP) include the following:

- Only ingress CoPP is supported. The **system-cpp-policy** policy-map is available on the control plane interface, and only in the ingress direction.
- Only the **system-cpp-policy** policy-map can be installed on the control plane interface.
- The **system-cpp-policy** policy-map and the seventeen system-defined classes cannot be modified or deleted.
- Only the **police** action is allowed under the **system-cpp-policy** policy-map. The police rate for system-defined classes must be configured only in packets per second (pps); for user-defined class maps this must be configured only in bits per second (bps).
- When setting the policer rate, note that a clock frequency limitation causes differences in the `default rate` and the `set rate` values displayed for some classes (even if you set the default rate for all classes). See the *User-Configurable Aspects of CoPP* and *Example: Setting the Default Policer Rates for All CPU Queues* topics in this chapter for more information.
- Removing the policer rate configuration, disables CoPP on all affected queues.
- The **show run** command does not display information about classes configured under `system-cpp policy`, when they are left at default values. Use the **show policy-map system-cpp-policy** or the **show policy-map control-plane** commands instead.

You can continue use the **show run** command to display information about custom policies.

# Information About Control Plane Policing

This chapter describes how control plane policing (CoPP) works on your device and how to configure it.

## CoPP Overview

The CoPP feature improves security on your device protecting the CPU from unnecessary traffic and DoS attacks. It can also protect control and management traffic from traffic drops caused by high volumes of other, lower priority traffic.

Your device is typically segmented into three planes of operation, each with its own objective:

- The data plane, to forward data packets.
- The control plane, to route data correctly.
- The management plane, to manage network elements.

You can use CoPP to protect most of the CPU-bound traffic and ensure routing stability, reachability, and packet delivery. Most importantly, you can use CoPP to protect the CPU from a DoS attack.

CoPP uses the modular QoS command-line interface (MQC) and CPU queues to achieve these objectives. Different types of control plane traffic are grouped together based on certain criteria, and assigned to a CPU queue. You can manage these CPU queues by configuring dedicated policers in hardware. For example, you can modify the policer rate for certain CPU queues (traffic-type), or you can disable the policer for a certain type of traffic.

Although the policers are configured in hardware, CoPP does not affect CPU performance or the performance of the data plane. But since it limits the number of packets going to CPU, the CPU load is controlled. This means that services waiting for packets from hardware may see a more controlled rate of incoming packets (the rate being user-configurable).

## System-Defined Aspects of CoPP

When you power-up the device for the first time, the system automatically performs the following tasks:

- Looks for policy-map **system-cpp-policy**. If not found, the system creates and installs it on the control-plane.
- Creates seventeen class-maps under **system-cpp-policy**.

The next time you power-up the device, the system detects the policy and class maps that have already been created.

- Enables all CPU queues by default, with their respective default rate. The default rates are indicated in the table System-Defined Values for CoPP.

The following table lists the class-maps that the system creates when you load the device. It lists the policer that corresponds to each class-map and one or more CPU queues that are grouped under each class-map. There is a one-to-one mapping of class-maps to policers; and one or more CPU queues map to a class-map.

Table 1: System-Defined Values for CoPP

Class Maps Names	Policer Index (Policer No.)	CPU queues (Queue No.)	Default Policer Rate (pps)
system-cpp- police-data	WK_CPP_POLICE_DATA(0)	WK_CPU_Q_ICMP_GEN(3) WK_CPU_Q_BROADCAST(12) WK_CPU_Q_ICMP_REDIRECT (6)	600 600 600
system-cpp-police-l2- control	WK_CPP_POLICE_L2_ CONTROL(1)	WK_CPU_Q_L2_CONTROL(1)	2000
system-cpp-police-routing-control	WK_CPP_POLICE_ROUTING_CONTROL(0)	WK_CPU_Q_ROUTING_CONTROL(4) WK_CPU_Q_LOW_LATENCY (27)	5400 5400
system-cpp-police-control-low-priority	WK_CPP_POLICE_CO NTROL_LOW_PRI(3)	WK_CPU_Q_GENERAL_PUNT(25)	200
system-cpp-police-punt-webauth	WK_CPP_POLICE_PU NT_WEBAUTH(7)	WK_CPU_Q_PUNT_WEBAUTH(22)	1000
system-cpp-police- topology-control	WK_CPP_POLICE_TOPOLOGY_CONTROL(8)	WK_CPU_Q_TOPOLOGY_CONTROL(15)	13000
system-cpp-police- multicast	WK_CPP_POLICE_MULTICAST(9)	WK_CPU_Q_TRANSIT_TRAFFIC(18) WK_CPU_Q_MCAST_DATA(30)	500 500
system-cpp-police-sys- data	WK_CPP_POLICE_SYS _DATA (10)	WK_CPU_Q_LEARNING_CACHE_OVFL(13) WK_CPU_Q_CRYPTO_CONTROL(23) WK_CPU_Q_EXCEPTION(24) WK_CPU_Q_EGR_EXCEPTION(28) WK_CPU_Q_NFL_SAMPLED_DATA(26) WK_CPU_Q_GOLD_PKT(31) WK_CPU_Q_RPF_FAILED(19)	100 100 200 100 100 100 100
system-cpp-police-dot1x-auth	WK_CPP_POLICE_DOT1X(11)	WK_CPU_Q_DOT1X_AUTH(0)	1000
system-cpp-police- protocol-snooping	WK_CPP_POLICE_PR	WK_CPU_Q_PROTO_SNOOPING(16)	2000
system-cpp-police-sw-forward	WK_CPP_POLICE_SW_FWD (13)	WK_CPU_Q_SW_FORWARDING_Q(14) WK_CPU_Q_LOGGING(21) WK_CPU_Q_L2_LVX_DATA_PACK (11)	1000 1000 1000

Class Maps Names	Policer Index (Policer No.)	CPU queues (Queue No.)	Default Policer Rate (pps)
system-cpp-police-forus	WK_CPP_POLICE_FORUS(14)	WK_CPU_Q_FORUS_ADDR_RESOLUTION(5) WK_CPU_Q_FORUS_TRAFFIC(2)	1000 1000
system-cpp-police-multicast-end-station	WK_CPP_POLICE_MCAST_END_STATION(6)	WK_CPU_Q_MCAST_END_STATION_SERVICE(20)	2000
<b>system-cpp-default</b>	WK_CPP_POLICY_DEFAULT(15)	WK_CPU_Q_DHCP_SNOOPING(17) WK_CPU_Q_UNUSED (7) WK_CPU_Q_EWLC_CONTROL(9) WK_CPU_Q_EWLC_DATA(10)	1000 1000 1000 1000
system-cpp-police-stackwise-vit-control	WK_CPP_POLICY_STACKWISE_VIRTUAL_CTRL(16)	WK_CPU_Q_STACKWISE_VIRTUAL_CTRL(29)	8000
system-cpp-police-l2lvx-control	WK_CPP_L2_LVX_CONT_PACK	WK_CPU_Q_L2_LVX_CONT_PACK(8)	1000

When you upgrade or downgrade the software version on your device, note the following:

- When upgrading from one software release to another:

The upgrade could be from one Cisco IOS XE 16.x.x release to another Cisco IOS XE 16.x.x release:

- If the device did not have a `system-cpp-policy` policy map before upgrade, then on upgrade, a default policy is created.
- If the device had a `system-cpp-policy` policy map before upgrade, then on upgrade, the policy is not re-generated. Enter the **cpp system-default** command in global configuration mode to get the default policy working.




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**Note** We recommend that you to enter the **cpp system-default** command after any major upgrade to get the latest, default policer rates.

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- When downgrading from one software release to another:

The downgrade could be from one Cisco IOS XE 16.x.x release to another Cisco IOS XE 16.x.x release:

- The `system-cpp-policy` policy map is retained on the device, but not installed on the control plane. You can delete the policy.
- If you downgrade to an earlier release and then upgrade to a later release:
  - If you delete the policy after downgrading to an earlier Cisco IOS XE 16.x.x and then upgrade to a Cisco IOS XE 16.x.x release, the policy is generated with defaults
  - If you do not delete the policy after downgrade to an earlier Cisco IOS XE 16.x.x release, then on upgrade to a later Cisco IOS XE 16.x.x release, the policy is not regenerated.

Enter the **cpp system-default** command in global configuration mode to get the default policy working.

## User-Configurable Aspects of CoPP

You can perform these tasks to manage control plane traffic:



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**Note** All `system-cpp-policy` configurations must be saved so they are retained after reboot.

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### Enable or Disable a Policer for CPU Queues

Enable a policer for a CPU queue, by configuring a policer action (in packets per second) under the corresponding class-map, within the `system-cpp-policy` policy-map.

Disable a policer for CPU queue, by removing the policer action under the corresponding class-map, within the `system-cpp-policy` policy-map.



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**Note** If a default policer is already present, carefully consider and control its removal; otherwise the system may see a CPU hog or other anomalies, such as control packet drops.

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### Change the Policer Rate

You can do this by configuring a policer rate action (in packets per second), under the corresponding class-map, within the `system-cpp-policy` policy-map.

When setting a policer rate, note that the rate you set is automatically converted to the nearest multiple of 200. For instance, if you set the policer rate of a CPU queue 100 pps, the system changes it to 200; or if set the policer rate to 650, the system changes it to 600. See *Example: Setting the Default Policer Rates for All CPU Queues* in this chapter, for sample output that displays this behavior.

### Set Policer Rates to Default

Set the policer for CPU queues to their default values, by entering the **cpp system-default** command in global configuration mode.

### Create User-Defined Class Maps

If a given traffic class does not have a designated class map, and you want to protect this traffic, you can create specific class maps (with filters) for such traffic packets and add these user-defined class maps to `system-cpp-policy`.

While `system-cpp-policy` is applied in the ingress direction, the forwarding engine driver (FED) changes policers on user-defined class maps to the egress. The filters and the policers in all user-defined classes must therefore be applied as egress classifications and actions, respectively. The policy map itself is unaffected by this change in the direction.

When you add a user-defined class map to `system-cpp-policy`, the system automatically installs it on all 32 CPU queues (in addition to the control plane), resulting in 33 instances of the policy. You can see this by entering the command in privileged EXEC mode.

The police rate on these class maps is controlled by the Active Queue Management (AQM) policer. AQM provides buffering control of traffic flows prior to queuing a packet into the transmit queue of a port, ensuring that certain flows do not hog the switch packet memory. If the AQM policer feature is enabled, any user-defined police rates exceeding the AQM policer limits are disregarded.

User defined class maps have normal QoS or ACL classification filters.

## How to Configure CoPP

### Enabling a CPU Queue or Changing the Policer Rate

The procedure to enable a CPU queue and change the policer rate of a CPU queue is the same. Follow these steps:

#### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> <pre>&gt; enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> <pre># configure terminal</pre>	Enters global configuration mode.
<b>Step 3</b>	<b>policy-map <i>policy-map-name</i></b> <b>Example:</b> <pre>(config)# policy-map system-cpp-policy (config-pmap)#</pre>	Enters the policy map configuration mode.
<b>Step 4</b>	<b>class <i>class-name</i></b> <b>Example:</b> <pre>(config-pmap)# class system-cpp-police-protocol-snooping (config-pmap-c)#</pre>	Enters the class action configuration mode. Enter the name of the class that corresponds to the CPU queue you want to enable. See table <i>System-Defined Values for CoPP</i> .

	Command or Action	Purpose
<b>Step 5</b>	<b>police rate</b> <i>rate</i> <b>pps</b> <b>Example:</b> <pre>(config-pmap-c) # police rate 100 pps (config-pmap-c-police) #</pre>	Specifies an upper limit on the number of incoming packets processed per second, for the specified traffic class. <b>Note</b> The rate you specify is applied to all CPU queues that belong to the class-map you have specified.
<b>Step 6</b>	<b>exit</b> <b>Example:</b> <pre>(config-pmap-c-police) # exit (config-pmap-c) # exit (config-pmap) # exit (config) #</pre>	Returns to the global configuration mode.
<b>Step 7</b>	<b>control-plane</b> <b>Example:</b> <pre>(config) # control-plane (config-cp) #</pre>	Enters the control plane (config-cp) configuration mode
<b>Step 8</b>	<b>service-policy input</b> <i>policy-name</i> <b>Example:</b> <pre>(config) # control-plane (config-cp) # service-policy input system-cpp-policy (config-cp) #</pre>	Installs system-cpp-policy in FED. This command is required for you to see the FED policy. Not configuring this command will lead to an error.
<b>Step 9</b>	<b>end</b> <b>Example:</b> <pre>(config-cp) # end</pre>	Returns to the privileged EXEC mode.
<b>Step 10</b>	<b>show policy-map control-plane</b> <b>Example:</b> <pre># show policy-map control-plane</pre>	Displays all the classes configured under <code>system-cpp policy</code> , the rates configured for the various traffic types, and statistics

## Disabling a CPU Queue

Follow these steps to disable a CPU queue:

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>	Enables privileged EXEC mode.

	Command or Action	Purpose
	<b>Example:</b> <pre>&gt; enable</pre>	<ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> <pre># configure terminal</pre>	Enters global configuration mode.
<b>Step 3</b>	<b>policy-map <i>policy-map-name</i></b> <b>Example:</b> <pre>(config)# policy-map system-cpp-policy (config-pmap)#</pre>	Enters the policy map configuration mode.
<b>Step 4</b>	<b>class <i>class-name</i></b> <b>Example:</b> <pre>(config-pmap)# class system-cpp-police-protocol-snooping (config-pmap-c)#</pre>	Enters the class action configuration mode. Enter the name of the class that corresponds to the CPU queue you want to disable. See the table, <i>System-Defined Values for CoPP</i> .
<b>Step 5</b>	<b>no police rate <i>rate</i> pps</b> <b>Example:</b> <pre>(config-pmap-c)# no police rate 100 pps</pre>	Disables incoming packet processing for the specified traffic class. <b>Note</b> This disables all CPU queues that belong to the class-map you have specified.
<b>Step 6</b>	<b>end</b> <b>Example:</b> <pre>(config-pmap-c)# end</pre>	Returns to the privileged EXEC mode.
<b>Step 7</b>	<b>show policy-map control-plane</b> <b>Example:</b> <pre># show policy-map control-plane</pre>	Displays all the classes configured under <code>system-cpp policy</code> and the rates configured for the various traffic types and statistics.

## Setting the Default Policer Rates for All CPU Queues

Follow these steps to set the policer rates for all CPU queues to their default rates:

**Procedure**

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> <pre>&gt; enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> <pre># configure terminal</pre>	Enters global configuration mode.
<b>Step 3</b>	<b>cpp system-default</b> <b>Example:</b> <pre>(config)# cpp system-default Defaulting CPP : Policer rate for all classes will be set to their defaults</pre>	Sets the policer rates for all the classes to the default rate.
<b>Step 4</b>	<b>end</b> <b>Example:</b> <pre>(config)# end</pre>	Returns to the privileged EXEC mode.
<b>Step 5</b>	<b>show platform hardware fed { active   standby } qos queue stats internal cpu policer</b> <b>Example:</b> <pre># show platform hardware fed active qos queue stats internal cpu policer</pre>	Displays device-specific internal queue information.

## Creating A User-Defined Class Map

Follow these steps to create user-defined class maps in system-cpp-policy and set the policer rates in bps

**Procedure**

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> <pre>&gt; enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>

	Command or Action	Purpose
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> <pre># configure terminal</pre>	Enters global configuration mode.
<b>Step 3</b>	<b>class-map</b> <i>class-map-name</i> <b>Example:</b> <pre>(config)# class-map example_class (config-cmap)#</pre>	Specify the class map you want to create. Enters the class map configuration mode.
<b>Step 4</b>	<b>exit</b> <b>Example:</b> <pre>Device(config-cmap)# exit Device(config)#</pre>	Exits the class map configuration mode.
<b>Step 5</b>	<b>policy-map</b> <i>policy-map-name</i> <b>Example:</b> <pre>Device(config)# policy-map system-cpp-policy Device(config-pmap)#</pre>	Enter the policy map name. Enters the policy map configuration mode.
<b>Step 6</b>	<b>class-map</b> <i>class-map-name</i> <b>Example:</b> <pre>Device(config-pmap)# class example_class Device(config-pmap-c)#</pre>	Enters the class action configuration mode. Enter the name of the class.
<b>Step 7</b>	<b>[no] police rate</b> <i>target_bit_rate</i> <b>Example:</b> <pre>Device(config-pmap-c)# police 90000</pre>	Specifies the bit rate per second, enter a value between 8000 and 10000000000.  <b>Note</b> The police rate for user-defined class-maps must not exceed 10000 pps worth of traffic.
<b>Step 8</b>	<b>end</b> <b>Example:</b> <pre>Device(config-pmap-c-police)# end Device#</pre>	Returns to the privileged EXEC mode.
<b>Step 9</b>	<b>show policy-map control-plane</b> <b>Example:</b> <pre>Device# show policy-map control-plane</pre>	Displays all the classes configured under <code>system-cpp policy</code> , including the user-defined class maps, and the rates configured.

# Examples for Configuring CoPP

## Example: Enabling a CPU Queue or Changing the Policer Rate of a CPU Queue

This example shows how to enable a CPU queue or to change the policer rate of a CPU queue. Here the **class system-cpp-police-protocol-snooping** CPU queue is enabled with the policer rate of 2000 pps.

```
> enable
# configure terminal
(config)# policy-map system-cpp-policy
(config-pmap)# class system-cpp-police-protocol-snooping
(config-pmap-c)# police rate 2000 pps
(config-pmap-c-police)# end

# show policy-map control-plane
Control Plane

Service-policy input: system-cpp-policy

<output truncated>

Class-map: system-cpp-police-dot1x-auth (match-any)
  0 packets, 0 bytes
  5 minute offered rate 0000 bps, drop rate 0000 bps
  Match: none
  police:
    rate 1000 pps, burst 244 packets
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      drop

Class-map: system-cpp-police-protocol-snooping (match-any)
  0 packets, 0 bytes
  5 minute offered rate 0000 bps, drop rate 0000 bps
  Match: none
  police:
    rate 2000 pps, burst 488 packets
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      drop

<output truncated>

Class-map: class-default (match-any)
  0 packets, 0 bytes
  5 minute offered rate 0000 bps, drop rate 0000 bps
  Match: any
```

## Example: Disabling a CPU Queue

This example shows how to disable a CPU queue. Here the `class system-cpp-police-protocol-snooping` CPU queue is disabled.

## Example: Setting the Default Policer Rates for All CPU Queues

This example shows how to set the policer rates for all CPU queues to their default and then verify the setting.



### Note

For some CPU queues, the `default rate` and the `set rate` values will not be the same, even if you set the default rate for all classes. This is because the set rate is rounded off to the nearest multiple of 200. This behavior is controlled by the clock speed of your device. In the sample output below, the default and set rate values for `DHCP Snooping` and `NFL SAMPLED DATA` display this difference.

```
> enable
# configure terminal
(config)# cpp system-default
Defaulting CPP : Policer rate for all classes will be set to their defaults
(config)# end

show platform hardware fed switch 1 qos queue stats internal cpu policer

CPU Queue Statistics
=====
```

QId	PlcIdx	Queue Name	Enabled	(default) Rate	(set) Rate	Queue Drop (Bytes)	Queue Drop (Frames)
0	11	DOT1X Auth	Yes	1000	1000	0	0
1	1	L2 Control	Yes	2000	2000	0	0
2	14	Forus traffic	Yes	1000	1000	0	0
3	0	ICMP GEN	Yes	600	600	0	0
4	2	Routing Control	Yes	5400	5400	0	0
5	14	Forus Address resolution	Yes	1000	1000	0	0
6	0	ICMP Redirect	Yes	600	600	0	0
7	16	Unused	Yes	1000	1000	0	0
8	4	L2 LVX Cont Pack	Yes	1000	1000	0	0
9	16	EWLC Control	Yes	1000	1000	0	0
10	16	EWLC Data	Yes	1000	1000	0	0
11	13	L2 LVX Data Pack	Yes	1000	1000	0	0
12	0	BROADCAST	Yes	600	600	0	0
13	10	Learning cache ovfl	Yes	100	200	0	0
14	13	Sw forwarding	Yes	1000	1000	0	0

15	8	Topology Control	Yes	13000	13000	0	0
16	12	Proto Snooping	Yes	2000	2000	0	0
17	16	DHCP Snooping	Yes	1000	1000	0	0
18	9	Transit Traffic	Yes	500	400	0	0
19	10	RPF Failed	Yes	100	200	0	0
20	15	MCAST END STATION	Yes	2000	2000	0	0
21	13	LOGGING	Yes	1000	1000	0	0
22	7	Punt Webauth	Yes	1000	1000	0	0
23	10	Crypto Control	Yes	100	200	0	0
24	10	Exception	Yes	100	200	0	0
25	3	General Punt	Yes	200	200	0	0
26	10	NFL SAMPLED DATA	Yes	100	200	0	0
27	2	Low Latency	Yes	5400	5400	0	0
28	10	EGR Exception	Yes	100	200	0	0
29	5	Stackwise Virtual Control	Yes	8000	8000	0	0
30	9	MCAST Data	Yes	500	400	0	0
31	10	Gold Pkt	Yes	100	200	0	0

\* NOTE: CPU queue policer rates are configured to the closest hardware supported value

CPU Queue Policer Statistics

```
=====
```

Policer Index	Policer Accept Bytes	Policer Accept Frames	Policer Drop Bytes	Policer Drop Frames
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0

CPP Classes to queue map

```
=====
```

```

PlcIdx CPP Class                               : Queues
-----
0      system-cpp-police-data                  : ICMP GEN/BROADCAST/ICMP Redirect/
10     system-cpp-police-sys-data              : Learning cache ovfl/Crypto
Control/Exception/EGR Exception/NFL SAMPLED DATA/Gold Pkt/RPF Failed/
13     system-cpp-police-sw-forward            : Sw forwarding/LOGGING/L2 LVX Data Pack/
9      system-cpp-police-multicast             : Transit Traffic/MCAST Data/
15     system-cpp-police-multicast-end-station : MCAST END STATION /
7      system-cpp-police-punt-webauth          : Punt Webauth/
1      system-cpp-police-l2-control            : L2 Control/
5      system-cpp-police-stackwise-virt-control : Stackwise Virtual Control/
2      system-cpp-police-routing-control        : Routing Control/Low Latency/
3      system-cpp-police-control-low-priority  : General Punt/
4      system-cpp-police-l2lvx-control         : L2 LVX Cont Pack/
8      system-cpp-police-topology-control      : Topology Control/
11     system-cpp-police-dot1x-auth            : DOT1X Auth/
12     system-cpp-police-protocol-snooping     : Proto Snooping/
14     system-cpp-police-forus                 : Forus Address resolution/Forus traffic/
5      system-cpp-police-stackwise-virt-control : Stackwise Virtual Control/
16     system-cpp-default                      : DHCP Snooping/Unused/EWLC Control/EWLC

```

## Example: Creating a User-Defined Class Map

This example shows how to create a user-defined class map, apply it to `system-cpp-policy` and display information about where the policy is applied.

A user-defined class map is applied to `system-cpp-policy`, which means that any control traffic matching the user-defined class map `class-cpp-user` is subject to the aggregate policer, under the user-defined class map. Statistics for the user defined traffic class are reported in Bytes.

```

Device> enable
Device# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Device(config)# class-map match-any class-cpp-user
Device(config-cmap)# match dscp cs1
Device(config-cmap)# exit
Device(config)# policy-map system-cpp-policy
Device(config-pmap)# class class-cpp-user
Device(config-pmap-c)# police rate 2m bps
Device(config-pmap-c-police)# end

Device# show policy-map control-plane
<output truncated>
Class-map: class-cpp-user (match-any)
  0 packets, 0 bytes
  5 minute offered rate 0000 bps, drop rate 0000 bps
Match: dscp cs1 (8)
police:
  rate 2000000 bps, burst 62500 bytes
  conformed 0 bytes; actions:
    transmit
  exceeded 0 bytes; actions:
    drop
  conformed 0000 bps, exceeded 0000 bps
<output truncated>

```

When you add a user-defined class map to `system-cpp-policy`, the system automatically installs it on all 32 CPU queues, in addition to the control plane (resulting in 33 instances of the policy).

Note how the direction is display as egress (OUT), even though `system-cpp-policy` is applied in the ingress

```
Device# show platform software fed switch active qos policy target status
```

```
TCG status summary:
```

```

Loc Interface                IIF-ID                Dir State: (cfg,opr) Policy
-----
?:255 Control Plane         0x00000001000001     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-0           0x0000000100000d     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-1           0x0000000100000e     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-2           0x0000000100000f     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-3           0x00000001000010     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-4           0x00000001000011     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-5           0x00000001000012     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-6           0x00000001000013     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-7           0x00000001000014     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-8           0x00000001000015     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-9           0x00000001000016     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-10          0x00000001000017     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-11          0x00000001000018     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-12          0x00000001000019     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-13          0x0000000100001a     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-14          0x0000000100001b     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-15          0x0000000100001c     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-16          0x0000000100001d     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-17          0x0000000100001e     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-18          0x0000000100001f     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-19          0x00000001000020     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-20          0x00000001000021     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-21          0x00000001000022     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-22          0x00000001000023     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-23          0x00000001000024     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-24          0x00000001000025     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-25          0x00000001000026     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-26          0x00000001000027     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-27          0x00000001000028     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-28          0x00000001000029     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-29          0x0000000100002a     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-30          0x0000000100002b     OUT VALID,SET_INHW  system-cpp-policy
?:0 CoPP-Queue-31          0x0000000100002c     OUT VALID,SET_INHW  system-cpp-policy

```

## Monitoring CoPP

Use these commands to display policer settings, such as, traffic types and policer rates (user-configured and default rates) for CPU queues:

Command	Purpose
<b>show policy-map control-plane</b>	Displays the rates configured for the various traffic types
<b>show policy-map system-cpp-policy</b>	Displays all the classes configured under system-cpp policy, and policer rates

## Feature History and Information For CoPP

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Feature	Release	Feature Information
Control Plane Policing (CoPP) or CPP	Cisco IOS XE Everest 16.6.1	This feature was introduced.
Change in the system behavior for policer rates that are set.	Cisco IOS XE Everest 16.6.4	For some CPU queues, the default rate and the set rate values will not be the same, even if you set the default rate for all classes. This because the set rate is rounded off to the nearest multiple of 200.