



Configuring Control Plane Policing

- [Finding Feature Information, on page 1](#)
- [Restrictions for CoPP, on page 1](#)
- [Information About Control Plane Policing, on page 2](#)
- [How to Configure CoPP, on page 5](#)
- [Examples for Configuring CoPP, on page 9](#)
- [Monitoring CoPP, on page 12](#)
- [Additional References for CoPP, on page 13](#)
- [Feature History and Information For CoPP, on page 14](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

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, 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. Further, the **police rate** can be configured only in packets per second (pps).

- One or more CPU queues are part of each class-map. Where multiple CPU queues belong to one class-map, changing the policer rate of a class-map affects all CPU queues that belong to that class-map. Similarly, disabling a class-map disables all queues that belong to that class-map. See [Table 1: System-Defined Values for CoPP, on page 3](#) for information about which CPU queues belong to each class-map.

Related Topics

- [Enabling a CPU Queue or Changing the Policer Rate, on page 5](#)
- [Disabling a CPU Queue, on page 7](#)
- [Setting the Default Policer Rates for All CPU Queues, on page 8](#)
- [User-Configurable Aspects of CoPP, on page 4](#)

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 by protecting the CPU from unnecessary traffic, or DoS traffic, and by prioritizing control plane and management 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:

- It looks for policy-map **system-cpp-policy**. If it does not detect this policy-map, it creates and installs it on the control-plane.
- It 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.

- Once the policy is installed, sixteen (out of the thirty-two) CPU queues are enabled by default with their respective default rate. The CPU queues enabled by default and their default rates are indicated in [Table 1: System-Defined Values for CoPP, on page 3](#).

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.)	CPU Queues Enabled by Default?	Default Policer Rate—in packets per second (pps)
system-cpp-police-data	WK_CPP_POLICE_DATA(0)	WK_CPU_Q_ICMP_GEN(3) WK_CPU_Q_BROADCAST(12)	Yes	200
system-cpp-police-l2-control	WK_CPP_POLICE_L2_CONTROL(1)	WK_CPU_Q_L2_CONTROL(1)	No	500
system-cpp-police-routing-control	WK_CPP_POLICE_ROUTING_CONTROL(2)	WK_CPU_Q_ROUTING_CONTROL(4)	Yes	500
system-cpp-police-control-low-priority	WK_CPP_POLICE_CONTROL_LOW_PRIORITY(3)	WK_CPU_Q_ICMP_REDIRECT(6) WK_CPU_Q_GENERAL_PUNT(25)	No	500
system-cpp-police-wireless-priority1	WK_CPP_POLICE_WIRELESS_PRIORITY_1(4)	WK_CPU_Q_WIRELESS_PRIORITY_1(8)	No	1000
system-cpp-police-wireless-priority2	WK_CPP_POLICE_WIRELESS_PRIORITY_2(5)	WK_CPU_Q_WIRELESS_PRIORITY_2(9)	No	1000
system-cpp-police-wireless-priority3-4-5	WK_CPP_POLICE_WIRELESS_PRIORITY_3(6)	WK_CPU_Q_WIRELESS_PRIORITY_3(10) WK_CPU_Q_WIRELESS_PRIORITY_4(11) WK_CPU_Q_WIRELESS_PRIORITY_5(7)	No	1000
system-cpp-police-punt-webauth	WK_CPP_POLICE_PUNT_WEBAUTH(7)	WK_CPU_Q_PUNT_WEBAUTH(22)	No	1000
system-cpp-police-topology-control	WK_CPP_POLICE_TOPOLOGY_CONTROL(8)	WK_CPU_Q_TOPOLOGY_CONTROL(15)	No	13000
system-cpp-police-multicast	WK_CPP_POLICE_MULTICAST(9)	WK_CPU_Q_TRANSIT_TRAFFIC(18) WK_CPU_Q_MCAST_DATA(30)	Yes	500

Class Maps Names	Policer Index (Policer No.)	CPU queues (Queue No.)	CPU Queues Enabled by Default?	Default Policer Rate—in packets per second (pps)
system-cpp-police-sys-data	WK_CPP_POLICE_SYS_DATA(10)	WK_CPU_Q_LEARNING_CACHE_OVH(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)	Yes	100
system-cpp-police-dot1x-auth	WK_CPP_POLICE_DOT1X(11)	WK_CPU_Q_DOT1X_AUTH(0)	No	1000
system-cpp-police-protocol-snooping	WK_CPP_POLICE_PR	WK_CPU_Q_PROTO_SNOOPING(16)	No	500
system-cpp-police-sw-forward	WK_CPP_POLICE_SW_FWD(13)	WK_CPU_Q_SW_FORWARDING_Q(14) WK_CPU_Q_SGT_CACHE_FULL(27) WK_CPU_Q_LOGGING(21)	Yes	1000
system-cpp-police-forus	WK_CPP_POLICE_FORUS(14)	WK_CPU_Q_FORUS_ADDR_RESOLUTION(5) WK_CPU_Q_FORUS_TRAFFIC(2)	No	1000
system-cpp-police-multicast-end-station	WK_CPP_POLICE_MULTICAST_SNOOPING(15)	WK_CPU_Q_MCAST_END_STATION_SERVICE(20)	Yes	2000
system-cpp-default	WK_CPP_POLICE_DEFAULT_POLICER	WK_CPU_Q_DHCP_SNOOPING WK_CPU_Q_SHOW_FORWARD	No	1000

User-Configurable Aspects of CoPP

You can perform these tasks to manage control plane traffic:

- Enable or disable CPU queues.

Enable 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 CPU queue, by removing the policer action under the corresponding class-map, within the **system-cpp-policy** policy-map.

- Change the policer rate, by configuring a policer rate action (in packets per second) under the corresponding class-map, within the **system-cpp-policy** policy-map.
- Set the CPU queues to their default values, by entering the **cpp system-default** command in global configuration mode.

Related Topics

[Enabling a CPU Queue or Changing the Policer Rate](#), on page 5

[Disabling a CPU Queue](#), on page 7

[Setting the Default Policer Rates for All CPU Queues](#), on page 8

[Restrictions for CoPP](#), on page 1

[Example: Enabling a CPU Queue or Changing the Policer Rate of a CPU Queue](#), on page 9

[Example: Disabling a CPU Queue](#), on page 10

[Example: Setting the Default Policer Rates for All CPU Queues](#), on page 11

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:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map-name*
4. **class** *class-name*
5. **service-policy input** *policy-name*
6. **police rate** *rate* **pps**
7. **end**
8. **show running-config** | **begin system-cpp-policy**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example:	Enters the global configuration mode.

	Command or Action	Purpose
	Device# <code>configure terminal</code>	
Step 3	policy-map <i>policy-map-name</i> Example: Device(config)# <code>policy-map system-cpp-policy</code> Device(config-pmap)#	Enters the policy map configuration mode.
Step 4	class <i>class-name</i> Example: Device(config-pmap)# <code>class system-cpp-police-protocol-snooping</code> Device(config-pmap-c)#	Enters the class action configuration mode. Enter the name of the class that corresponds to the CPU queue you want to enable. See Table 1: System-Defined Values for CoPP, on page 3
Step 5	service-policy input <i>policy-name</i> Example: Device(config)# <code>control-plane</code> Device(config-cp)# <code>service-policy input system-cpp-policy</code> Device(config-cp)#	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.
Step 6	police rate <i>rate</i> pps Example: Device(config-pmap-c)# <code>police rate 100 pps</code>	Specifies an upper limit on the number of incoming packets processed per second, for the specified traffic class. Note The rate you specify is applied to all CPU queues that belong to the class-map you have specified.
Step 7	end Example: Device(config-pmap-c)# <code>end</code>	Returns to the privileged EXEC mode.
Step 8	show running-config begin system-cpp-policy Example: Device# <code>show running-config begin system-cpp-policy</code>	Displays the rates configured for the various traffic types.

Related Topics

[User-Configurable Aspects of CoPP, on page 4](#)

[Restrictions for CoPP, on page 1](#)

[Example: Enabling a CPU Queue or Changing the Policer Rate of a CPU Queue, on page 9](#)

[Example: Disabling a CPU Queue, on page 10](#)

[Example: Setting the Default Policer Rates for All CPU Queues, on page 11](#)

Disabling a CPU Queue

Follow these steps to disable a CPU queue:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map-name*
4. **class** *class-name*
5. **no police rate** *rate* **pps**
6. **end**
7. **show running-config** | **begin system-cpp-policy**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters the global configuration mode.
Step 3	policy-map <i>policy-map-name</i> Example: Device(config)# policy-map system-cpp-policy Device(config-pmap)#	Enters the policy map configuration mode.
Step 4	class <i>class-name</i> Example: Device(config-pmap)# class system-cpp-police-protocol-snooping Device(config-pmap-c)#	Enters the class action configuration mode. Enter the name of the class that corresponds to the CPU queue you want to disable. See Table 1: System-Defined Values for CoPP, on page 3
Step 5	no police rate <i>rate</i> pps Example: Device(config-pmap-c)# no police rate 100 pps	Disables incoming packet processing for the specified traffic class. Note This disables all CPU queues that belong to the class-map you have specified.

	Command or Action	Purpose
Step 6	end Example: Device(config-pmap-c)# end	Returns to the privileged EXEC mode.
Step 7	show running-config begin system-cpp-policy Example: Device# show running-config begin system-cpp-policy	Displays the rates configured for the various traffic types.

Related Topics

[User-Configurable Aspects of CoPP](#), on page 4

[Restrictions for CoPP](#), on page 1

[Example: Enabling a CPU Queue or Changing the Policer Rate of a CPU Queue](#), on page 9

[Example: Disabling a CPU Queue](#), on page 10

[Example: Setting the Default Policer Rates for All CPU Queues](#), on page 11

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:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cpp system-default**
4. **end**
5. **show platform hardware fed switch *switch-number* qos que stat internal cpu policer**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters the global configuration mode.

	Command or Action	Purpose
Step 3	cpp system-default Example: <pre>Device(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.
Step 4	end Example: <pre>Device(config)# end</pre>	Returns to the privileged EXEC mode.
Step 5	show platform hardware fed switch <i>switch-number</i> qos que stat internal cpu policer Example: <pre>Device# show platform hardware fed switch 1 qos que stat internal cpu policer</pre>	Displays the rates configured for the various traffic types.

Related Topics

[User-Configurable Aspects of CoPP](#), on page 4

[Restrictions for CoPP](#), on page 1

[Example: Enabling a CPU Queue or Changing the Policer Rate of a CPU Queue](#), on page 9

[Example: Disabling a CPU Queue](#), on page 10

[Example: Setting the Default Policer Rates for All CPU Queues](#), on page 11

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 **100 pps**.

```
Device> enable
Device# configure terminal
Device(config)# policy-map system-cpp-policy
Device(config-pmap)# class system-cpp-police-protocol-snooping
Device(config-pmap-c)# police rate 100 pps
Device(config-pmap-c)# end
```

```
Device# show running-config | begin system-cpp-policy

policy-map system-cpp-policy
```

```

class system-cpp-police-data
  police rate 200 pps
class system-cpp-police-sys-data
  police rate 100 pps
class system-cpp-police-sw-forward
  police rate 1000 pps
class system-cpp-police-multicast
  police rate 500 pps
class system-cpp-police-multicast-end-station
  police rate 2000 pps
class system-cpp-police-punt-webauth
class system-cpp-police-l2-control
class system-cpp-police-routing-control
  police rate 500 pps
class system-cpp-police-control-low-priority
class system-cpp-police-wireless-priority1
class system-cpp-police-wireless-priority2
class system-cpp-police-wireless-priority3-4-5
class system-cpp-police-topology-control
class system-cpp-police-dot1x-auth
class system-cpp-police-protocol-snooping
  police rate 100 pps
class system-cpp-police-forus
class system-cpp-default

```

<output truncated>

Related Topics

- [Enabling a CPU Queue or Changing the Policer Rate](#), on page 5
- [Disabling a CPU Queue](#), on page 7
- [Setting the Default Policer Rates for All CPU Queues](#), on page 8
- [User-Configurable Aspects of CoPP](#), on page 4

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.

```

Device> enable
Device# configure terminal
Device(config)# policy-map system-cpp-policy
Device(config-pmap)# class system-cpp-police-protocol-snooping
Device(config-pmap-c)# no police rate 100 pps
Device(config-pmap-c)# end

```

```

Device# show running-config | begin system-cpp-policy

```

```

policy-map system-cpp-policy
class system-cpp-police-data
  police rate 200 pps
class system-cpp-police-sys-data
  police rate 100 pps
class system-cpp-police-sw-forward
  police rate 1000 pps
class system-cpp-police-multicast
  police rate 500 pps
class system-cpp-police-multicast-end-station
  police rate 2000 pps
class system-cpp-police-punt-webauth

```

```

class system-cpp-police-l2-control
class system-cpp-police-routing-control
  police rate 500 pps
class system-cpp-police-control-low-priority
class system-cpp-police-wireless-priority1
class system-cpp-police-wireless-priority2
class system-cpp-police-wireless-priority3-4-5
class system-cpp-police-topology-control
class system-cpp-police-dot1x-auth
class system-cpp-police-protocol-snooping
class system-cpp-police-forus
class system-cpp-default

```

<output truncated>

Related Topics

[Enabling a CPU Queue or Changing the Policer Rate](#), on page 5

[Disabling a CPU Queue](#), on page 7

[Setting the Default Policer Rates for All CPU Queues](#), on page 8

[User-Configurable Aspects of CoPP](#), on page 4

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:

```

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

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

```

QId	PlcIdx	Queue Name	Enabled	(default) Rate	(set) Rate	Drop
0	11	DOT1X Auth	No	1000	1000	0
1	1	L2 Control	No	500	500	0
2	14	Forus traffic	No	1000	1000	0
3	0	ICMP GEN	Yes	200	200	0
4	2	Routing Control	Yes	1800	1800	0
5	14	Forus Address resolution	No	1000	1000	0
6	3	ICMP Redirect	No	500	500	0
7	6	WLESS PRI-5	No	1000	1000	0
8	4	WLESS PRI-1	No	1000	1000	0
9	5	WLESS PRI-2	No	1000	1000	0
10	6	WLESS PRI-3	No	1000	1000	0
11	6	WLESS PRI-4	No	1000	1000	0
12	0	BROADCAST	Yes	200	200	0
13	10	Learning cache ovfl	Yes	100	100	0
14	13	Sw forwarding	Yes	1000	1000	0
15	8	Topology Control	No	13000	13000	0
16	12	Proto Snooping	No	500	500	0
17	16	DHCP Snooping	No	1000	1000	0
18	9	Transit Traffic	Yes	500	500	0
19	10	RPF Failed	Yes	100	100	0
20	15	MCAST END STATION	Yes	2000	2000	0
21	13	LOGGING	Yes	1000	1000	0
22	7	Punt Webauth	No	1000	1000	0

23	10	Crypto Control	Yes	100	100	0
24	10	Exception	Yes	100	100	0
25	3	General Punt	No	500	500	0
26	10	NFL SAMPLED DATA	Yes	100	100	0
27	2	SGT Cache Full	Yes	1800	1800	0
28	10	EGR Exception	Yes	100	100	0
29	16	Show frwd	No	1000	1000	0
30	9	MCAST Data	Yes	500	500	0
31	10	Gold Pkt	Yes	100	100	0

Related Topics

[Enabling a CPU Queue or Changing the Policer Rate](#), on page 5

[Disabling a CPU Queue](#), on page 7

[Setting the Default Policer Rates for All CPU Queues](#), on page 8

[User-Configurable Aspects of CoPP](#), on page 4

Monitoring CoPP

Follow these steps to display policer settings, such as, traffic types and policer rates (user-configured and default rates) for CPU queues.

SUMMARY STEPS

1. `enable`
2. `show platform hardware fed switch switch-number qos que stat internal cpu policer`

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><code>enable</code></p> <p>Example:</p> <p>Device> <code>enable</code></p>	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	<code>show platform hardware fed switch <i>switch-number</i> qos que stat internal cpu policer</code>	Displays the rates configured for the various traffic types.

Example

```
Device> enable
Device# show platform hardware fed switch 3 qos queue stats internal cpu policer
              (default) (set)
QId PlcIdx  Queue Name           Enabled  Rate   Rate   Drop
-----
0    11     DOT1X Auth           No       1000  1000   0
1     1     L2 Control           No       500   500    0
2    14     Forus traffic        No       1000  1000   0
3     0     ICMP GEN             Yes      200   200    0
4     2     Routing Control      Yes     1800  1800   0
```

5	14	Forus Address resolution	No	1000	1000	0
6	3	ICMP Redirect	No	500	500	0
7	6	WLESS PRI-5	No	1000	1000	0
8	4	WLESS PRI-1	No	1000	1000	0
9	5	WLESS PRI-2	No	1000	1000	0
10	6	WLESS PRI-3	No	1000	1000	0
11	6	WLESS PRI-4	No	1000	1000	0
12	0	BROADCAST	Yes	200	200	0
13	10	Learning cache ovfl	Yes	100	100	0
14	13	Sw forwarding	Yes	1000	1000	0
15	8	Topology Control	No	13000	13000	0
16	12	Proto Snooping	No	500	500	0
17	16	DHCP Snooping	No	1000	1000	0
18	9	Transit Traffic	Yes	500	500	0
19	10	RPF Failed	Yes	100	100	0
20	15	MCAST END STATION	Yes	2000	2000	0
21	13	LOGGING	Yes	1000	1000	0
22	7	Punt Webauth	No	1000	1000	0
23	10	Crypto Control	Yes	100	100	0
24	10	Exception	Yes	100	100	0
25	3	General Punt	No	500	500	0
26	10	NFL SAMPLED DATA	Yes	100	100	0
27	2	SGT Cache Full	Yes	1800	1800	0
28	10	EGR Exception	Yes	100	100	0
29	16	Show frwd	No	1000	1000	0
30	9	MCAST Data	Yes	500	500	0
31	10	Gold Pkt	Yes	100	100	0

Additional References for CoPP

Related Documents

Related Topic	Document Title
MQC QoS Commands, and CoPP show commands	Command Reference, Cisco IOS XE Denali 16.1.x (Catalyst 3850 Switches)

Error Message Decoder

Description	Link
To help you research and resolve system error messages in this release, use the Error Message Decoder tool.	https://www.cisco.com/cgi-bin/Support/Errordecoder/index.cgi

Standards and RFCs

Standard/RFC	Title
None	—

MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/support

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 Name	Releases	Feature Information
Control Plane Policing (CoPP) or CPP	Cisco IOS XE 3.2SE	This feature was introduced.
CLI configuration for CoPP	Cisco IOS XE Denali 16.1.2	This feature was made user-configurable. CLI configuration options to enable and disable CPU queues, to change the policer rate, and to set policer rates to default.