Configuring Control Plane Policing

Restrictions for Control Plane Policing

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 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).

- 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 the policer in a class-map disables all queues that belong to that class-map. See *Table: System-Defined Values for CoPP* for information about which CPU queues belong to each class-map.

- We recommend not disabling the policer for a system-defined class map, that is, do not configure **no police rate** *rate* **pps** command. Doing so affects the overall system health in case of high traffic towards the CPU. Further, even if you disable the policer rate for a system-defined class map, the systems automatically reverts to the default policer rate after system bootup in order to protect the system bring-up process.

- 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.

- A protocol with a large number of CPU-bound packets may impact other protocols in the same class, as some of these protocols share the same policer. For example, Address Resolution Protocol (ARP) shares 4000 hardware policers with an array of host protocols like Telnet, Internet Control Message Protocol (ICMP), SSH, FTP, and SNMP in the system-cpp-police-forus class. If there is an ARP poisoning or an ICMP attack, hardware policers start throttling any incoming traffic that exceeds 4000 packets per second to protect the CPU and the overall integrity of the system. As a result, ARP and ICMP host protocols are dropped, along with any other host protocols that share the same class.

- The creation of user-defined class-maps is not supported.

Information About Control Plane Policing

This chapter describes how CoPP works on your device and how to configure it.

Overview of Control Plane Policing

The CoPP feature improves security on your device by protecting the CPU from unnecessary traffic and denial of service (DoS) attacks. It can also protect control traffic 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 Control Plane Policing

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 eighteen 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 **system-cpp-policy** policy map is a system-default policy map, and normally, you do not have to expressly save it to the startup configuration of the device. But, a *failed* bulk synchronization with a standby device can result in the configuration being erased from the startup configuration. In case this happens, you have to manually save the **system-cpp-policy** policy map to the startup configuration. Use the **show running-config** privileged EXEC command to verify that it has been saved:

```
policy-map system-cpp-policy
```

The following table (System-Defined Values for CoPP) 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. This is followed by another table (CPU Queues and Associated Features), which lists features associated with each CPU queue.

Table 1: System-Defined Values for CoPP

Class Maps Names	Policer Index (Policer No.)	CPU queues (Queue No.)
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)
system-cpp-police-l2- control	WK_CPP_POLICE_L2_CONTROL(1)	WK_CPU_Q_L2_CONTROL(1)
system-cpp-police-routing-control	WK_CPP_POLICE_ROUTING_CONTROL(2)	WK_CPU_Q_ROUTING_CONTROL(4)
		WK_CPU_Q_LOW_LATENCY (27)
system-cpp-police-punt-webauth	WK_CPP_POLICE_PUNT_WEBAUTH(7)	WK_CPU_Q_PUNT_WEBAUTH(22)
system-cpp-police- topology-control	WK_CPP_POLICE_TOPOLOGY_CONTROL(8)	WK_CPU_Q_TOPOLOGY_CONTROL(15)
system-cpp-police- multicast	WK_CPP_POLICE_MULTICAST(9)	WK_CPU_Q_TRANSIT_TRAFFIC(18)
		WK_CPU_Q_MCAST_DATA(30)
system-cpp-police-sys- data	WK_CPP_POLICE_SYS_DATA(10)	WK_CPU_Q_OPENFLOW (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)
system-cpp-police-dot1x-auth	WK_CPP_POLICE_DOT1X(11)	WK_CPU_Q_DOT1X_AUTH(0)
system-cpp-police- protocol-snooping	WK_CPP_POLICE_PR(12)	WK_CPU_Q_PROTO_SNOOPING(16)

Class Maps Names	Policer Index (Policer No.)	CPU queues (Queue No.)
system-cpp-police-dhcp-snooping	WK_CPP_DHCP_SNOOPING(6)	WK_CPU_Q_DHCP_SNOOPING(17)
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)
system-cpp-police-forus	WK_CPP_POLICE_FORUS(14)	WK_CPU_Q_FORUS_ADDR_RESOLUTION(5) WK_CPU_Q_FORUS_TRAFFIC(2)
system-cpp-police- multicast-end-station	WK_CPP_POLICE_MULTICAST_SNOOPING(15)	WK_CPU_Q_MCAST_END_STATION_SERVICE(20)
system-cpp-default	WK_CPP_POLICE_DEFAULT_POLICER(16)	WK_CPU_Q_INTER_FED_TRAFFIC(7) WK_CPU_Q_EWLC_CONTROL(9) WK_CPU_Q_EWLC_DATA(10)
system-cpp-police-stackwise-virt-control	WK_CPP_STACKWISE_VIRTUAL_CONTROL(5)	WK_CPU_Q_STACKWISE_VIRTUAL_CONTROL(29)
system-cpp-police-l2lvx-control	WK_CPP_L2_LVX_CONT_PACK(4)	WK_CPU_Q_L2_LVX_CONT_PACK(8)
system-cpp-police-high-rate-app	WK_CPP_HIGH_RATE_APP(18)	WK_CPU_Q_HIGH_RATE_APP(23)
system-cpp-police-system-critical	WK_CPP_SYSTEM_CRITICAL(3)	WK_CPU_Q_SYSTEM_CRITICAL(25)

The following table lists the CPU queues and the feature(s) associated with each CPU queue.

Table 2: CPU Queues and Associated Features

CPU queues (Queue No.)	Feature(s)
WK_CPU_Q_DOT1X_AUTH(0)	IEEE 802.1x Port-Based Authentication

CPU queues (Queue No.)	Feature(s)
WK_CPU_Q_L2_CONTROL(1)	Dynamic Trunking Protocol (DTP) VLAN Trunking Protocol (VTP) Port Aggregation Protocol (PAgP) Client Information Signaling Protocol (CISP) Message session relay protocol Multiple VLAN Registration Protocol (MVRP) Metropolitan Mobile Network (MMN) Link Level Discovery Protocol (LLDP) UniDirectional Link Detection (UDLD) Link Aggregation Control Protocol (LACP) Cisco Discovery Protocol (CDP) Spanning Tree Protocol (STP)
WK_CPU_Q_FORUS_TRAFFIC(2)	Host such as Telnet,Pingv4 and Pingv6, and SNMP Keepalive / loopback detection Initiate-Internet Key Exchange (IKE) protocol (IPSec)
WK_CPU_Q_ICMP_GEN(3)	ICMP - destination unreachable ICMP-TTL expired

CPU queues (Queue No.)	Feature(s)
WK_CPU_Q_ROUTING_CONTROL(4)	Routing Information Protocol version 1 (RIPv1)
	RIPv2
	Interior Gateway Routing Protocol (IGRP)
	Border Gateway Protocol (BGP)
	PIM-UDP
	Virtual Router Redundancy Protocol (VRRP)
	Hot Standby Router Protocol version 1 (HSRPv1)
	HSRPv2
	Gateway Load Balancing Protocol (GLBP)
	Label Distribution Protocol (LDP)
	Web Cache Communication Protocol (WCCP)
	Routing Information Protocol next generation (RIPng)
	Open Shortest Path First (OSPF)
	Open Shortest Path First version 3(OSPFv3)
	Enhanced Interior Gateway Routing Protocol (EIGRP)
	Enhanced Interior Gateway Routing Protocol version 6 (EIGRPv6)
	DHCPv6
	Protocol Independent Multicast (PIM)
	Protocol Independent Multicast version 6 (PIMv6)
	Hot Standby Router Protocol next generation (HSRPng)
	IPv6 control
	Generic Routing Encapsulation (GRE) keepalive
	Network Address Translation (NAT) punt
	Intermediate System-to-Intermediate System (IS-IS)
WK_CPU_Q_FORUS_ADDR_RESOLUTION(5)	Address Resolution Protocol (ARP)
	IPv6 neighbor advertisement and neighbor solicitation
WK_CPU_Q_ICMP_REDIRECT(6)	Internet Control Message Protocol (ICMP) redirect

CPU queues (Queue No.)	Feature(s)
WK_CPU_Q_INTER_FED_TRAFFIC(7)	Layer 2 bridge domain inject for internal communication.
WK_CPU_Q_L2_LVX_CONT_PACK(8)	Exchange ID (XID) packet
WK_CPU_Q_EWLC_CONTROL(9)	Embedded Wirelss Controller (eWLC) [Control and Provisioning of Wireless Access Points (CAPWAP) (UDP 5246)]
WK_CPU_Q_EWLC_DATA(10)	eWLC data packet (CAPWAP DATA, UDP 5247)
WK_CPU_Q_L2_LVX_DATA_PACK(11)	Unknown unicast packet punted for map request.
WK_CPU_Q_BROADCAST(12)	All types of broadcast
WK_CPU_Q_OPENFLOW(13)	Learning cache overflow (Layer 2 + Layer 3)
WK_CPU_Q_CONTROLLER_PUNT(14)	Data - access control list (ACL) Full Data - IPv4 options Data - IPv6 hop-by-hop Data - out-of-resources / catch all Data - Reverse Path Forwarding (RPF) incomplete Glean packet
WK_CPU_Q_TOPOLOGY_CONTROL(15)	Spanning Tree Protocol (STP) Resilient Ethernet Protocol (REP) Shared Spanning Tree Protocol (SSTP)
WK_CPU_Q_PROTO_SNOOPING(16)	Address Resolution Protocol (ARP) snooping for Dynamic ARP Inspection (DAI)
WK_CPU_Q_DHCP_SNOOPING(17)	DHCP snooping
WK_CPU_Q_TRANSIT_TRAFFIC(18)	This is used for packets punted by NAT, which need to be handled in the software path.
WK_CPU_Q_RPF_FAILED(19)	Data – mRPF (multicast RPF) failed
WK_CPU_Q_MCAST_END_STATION_SERVICE(20)	Internet Group Management Protocol (IGMP) / Multicast Listener Discovery (MLD) control
WK_CPU_Q_LOGGING(21)	Access control list (ACL) logging
WK_CPU_Q_PUNT_WEBAUTH(22)	Web Authentication

CPU queues (Queue No.)	Feature(s)
WK_CPU_Q_HIGH_RATE_APP(23)	Wired Application Visibility and Control (WDAVC) traffic
	Network-Based Application Recognition (NBAR) traffic
WK_CPU_Q_EXCEPTION(24)	IKE indication
	IP learning violation
	IP port security violation
	IP Static address violation
	IPv6 scope check
	Remote Copy Protocol (RCP) exception
	Unicast RPF fail
WK_CPU_Q_SYSTEM_CRITICAL(25)	Media Signaling/ Wireless Proxy ARP
WK_CPU_Q_NFL_SAMPLED_DATA(26)	Netflow sampled data and Media Services Proxy (MSP)
WK_CPU_Q_LOW_LATENCY(27)	Bidirectional Forwarding Detection (BFD), Precision Time Protocol (PTP)
WK_CPU_Q_EGR_EXCEPTION(28)	Egress resolution exception
WK_CPU_Q_STACKWISE_VIRTUAL_CONTROL(29)	Front side stacking protocols, namely SVL
WK_CPU_Q_MCAST_DATA(30)	Data - (S,G) creation
	Data - local joins
	Data - PIM Registration
	Data - SPT switchover
	Data - Multicast
WK_CPU_Q_GOLD_PKT(31)	Gold

User-Configurable Aspects of Control Plane Policing

You can perform these tasks to manage control plane traffic:

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

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.

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.

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.

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.

Upgrading or Downgrading the Software Version

Software Version Upgrades and CoPP

When you upgrade the software version on your device, the system checks and make the necessary updates as required for CoPP (For instance, it checks for the `system-cpp-policy` policy map and creates it if missing). You may also have to complete certain tasks before or after the upgrade activity. This is to ensure that any configuration updates are reflected correctly and CoPP continues to work as expected. Depending on the method you use to upgrade the software, upgrade-related tasks may be optional or recommended in some scenarios, and mandatory in others.

The system actions and user actions for an upgrade, are described here. Also included, are any release-specfic caveats.

System Actions for an Upgrade

When you upgrade the software version on your device, the system performs these actions. This applies to all upgrade methods:

- If the device did not have a `system-cpp-policy` policy map before upgrade, then on upgrade, the system creates a default policy map.

- If the device had a `system-cpp-policy` policy map before upgrade, then on upgrade, the system does not re-generate the policy.

User Actions for an Upgrade

User actions for an upgrade – depending on upgrade method:

Upgrade Method	Condition	Action Time and Action	Purpose
Regular[1]	None	**After upgrade (required)** Enter the **cpp system-default** command in global configuration mode	To get the latest, default policer rates.
In-Service Software Upgrade (ISSU)[2]	If there are user-defined classes in the existing software version or If there are system-defined classes in the existing software version that are deprecated in a later release (for example: system-cpp-police-control-low-priority).	**Before and after upgrade (required)** Enter the **cpp system-default** command in global configuration mode	Enter the command before upgrade, to ensure that any required system configuration is updated, ensuring smooth ISSU operation. Enter the command after upgrade for the latest, default policer rates.

[1] Refers to a software upgrade method that involves a reload of the switch. Can be install or bundle mode.

[2] ISSU is supported only from one extended maintenance release to another. For more information, see In-Service Software Upgrade (ISSU).

Software Version Downgrades and CoPP

The system actions and user actions for a downgrade, are described here.

System Actions for a Downgrade

When you downgrade the software version on your device, the system performs these actions. This applies to all downgrade methods:

- The system retains the system-cpp-policy policy map on the device, and installs it on the control plane.

User Actions for a Downgrade

User actions for a downgrade:

Upgrade Method	Condition	Action Time and Action	Purpose
Regular[3]	None	No action required	Not applicable
In-Service Software Upgrade (ISSU)[4]	None	No action required	Not applicable

[3] Refers to a software upgrade method that involves a reload of the switch. Can be install or bundle mode.

[4] ISSU downgrades are not supported.

If you downgrade the software version and then upgrade, the system action and user actions that apply are the same as those mentioned for upgrades.

How to Configure CoPP

Enabling a CPU Queue and 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**
Step 1	**enable** **Example:** Device> **enable**	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Device# **configure terminal**	Enters global configuration mode.
Step 3	**policy-map** *policy-map-name* **Example:** Device(config)# **policy-map system-cpp-policy** Device(config-pmap)#	Enters the policy map configuration mode.
Step 4	**class** *class-name* **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 enable. See table *System-Defined Values for CoPP*.
Step 5	**police rate** *rate* **pps** **Example:** Device(config-pmap-c)# **police rate 100 pps** Device(config-pmap-c-police)#	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 6	exit **Example:** Device(config-pmap-c-police)# **exit** Device(config-pmap-c)# **exit**	Returns to the global configuration mode.

	Command or Action	Purpose
	Device(config-pmap)# **exit** Device(config)#	
Step 7	**control-plane** **Example:** Device(config)# **control-plane** Device(config-cp)#	Enters the control plane (config-cp) configuration mode
Step 8	**service-policy input** *policy-name* **Example:** Device(config)# **control-plane** Device(config-cp)#**service-policy input system-cpp-policy** 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 9	**end** **Example:** Device(config-cp)# **end**	Returns to the privileged EXEC mode.
Step 10	**show policy-map control-plane** **Example:** Device# **show policy-map control-plane**	Displays all the classes configured under system-cpp policy, 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
Step 1	**enable** **Example:** Device> **enable**	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Device# **configure terminal**	Enters global configuration mode.
Step 3	**policy-map** *policy-map-name* **Example:** Device(config)# **policy-map**	Enters the policy map configuration mode.

	Command or Action	**Purpose**
	`system-cpp-policy` `Device(config-pmap)#`	

Step 4	**class** *class-name*
	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 the table, *System-Defined Values for CoPP*.

Step 5	**no police rate** *rate* **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.

Step 6	**end** **Example:** `Device(config-pmap-c)# end`	Returns to the privileged EXEC mode.
Step 7	**show policy-map control-plane** **Example:** `Device# show policy-map control-plane`	Displays all the classes configured under `system-cpp policy` 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**
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**cpp system-default** **Example:**	Sets the policer rates for all the classes to the default rate.

Command or Action	Purpose
Device(config)# **cpp system-default** Defaulting CPP : Policer rate for all classes will be set to their defaults	
Step 4	**end** **Example:** Device(config)# **end**	Returns to the privileged EXEC mode.

Configuration Examples for Control Plane Policing

Example: Enabling and 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**.

```
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 2000 pps
Device(config-pmap-c-police)# end


Device# 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.

```
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>
```

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

CPU Queue Statistics
===============================================================================================

                                              (default) (set)    Queue        Queue
QId PlcIdx  Queue Name           Enabled      Rate      Rate     Drop(Bytes)  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          4000      4000     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     4000      4000     0            0

6   0       ICMP Redirect        Yes          600       600      0            0

7   16      Inter FED Traffic    Yes          2000      2000     0            0

8   4       L2 LVX Cont Pack     Yes          1000      1000     0            0

9   16      EWLC Control         Yes          2000      2000     0            0

10  16      EWLC Data            Yes          2000      2000     0            0

11  13      L2 LVX Data Pack     Yes          1000      1000     0            0

12  0       BROADCAST            Yes          600       600      0            0

13  10      Openflow             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  6       DHCP Snooping        Yes          500       400      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  18      High Rate App        Yes          13000     13000    0            0

24  10      Exception            Yes          100       200      0            0
```

25	3	System Critical	Yes	1000	1000	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 OOB	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    Policer Accept    Policer Accept   Policer Drop  Policer Drop
 Index         Bytes             Frames          Bytes          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
18         0                 0                0             0

                  Second Level Policer Statistics
=======================================================================
20         52772252          688073           0             0
21         0                 0                0             0

Policer Index Mapping and Settings
-----------------------------------------------------------------------
level-2   :   level-1                        (default)   (set)
PlcIndex  :   PlcIndex                         rate       rate
-----------------------------------------------------------------------
20        :   1  2  8                         13000      13000
21        :   0  4  7  9 10 11 12 13 14 15    6000       6000
=======================================================================

                  Second Level Policer Config
=======================================================================
    level-1 level-2                           level-2
QId PlcIdx  PlcIdx   Queue Name               Enabled
-----------------------------------------------------------------------
0   11      21       DOT1X Auth               Yes
1   1       20       L2 Control               Yes
2   14      21       Forus traffic            Yes
```

```
3    0    21    ICMP GEN                      Yes
4    2    20    Routing Control               Yes
5    14   21    Forus Address resolution      Yes
6    0    21    ICMP Redirect                 Yes
7    16   -     Inter FED Traffic             No
8    4    21    L2 LVX Cont Pack              Yes
9    19   -     EWLC Control                  No
10   16   -     EWLC Data                     No
11   13   21    L2 LVX Data Pack              Yes
12   0    21    BROADCAST                     Yes
13   10   21    Openflow                      Yes
14   13   21    Sw forwarding                 Yes
15   8    20    Topology Control              Yes
16   12   21    Proto Snooping                Yes
17   6    -     DHCP Snooping                 No
18   13   21    Transit Traffic               Yes
19   10   21    RPF Failed                    Yes
20   15   21    MCAST END STATION             Yes
21   13   21    LOGGING                       Yes
22   7    21    Punt Webauth                  Yes
23   18   -     High Rate App                 No
24   10   21    Exception                     Yes
25   3    -     System Critical               No
26   10   21    NFL SAMPLED DATA              Yes
27   2    20    Low Latency                   Yes
28   10   21    EGR Exception                 Yes
29   5    -     Stackwise Virtual OOB         No
30   9    21    MCAST Data                    Yes
31   3    -     Gold Pkt                      No

                    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            : Openflow/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/
2     system-cpp-police-routing-control     : Routing Control/Low Latency/
3     system-cpp-police-system-critical     : System Critical/
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/
6     system-cpp-police-dhcp-snooping       : DHCP Snooping/
14    system-cpp-police-forus               : Forus Address resolution/Forus traffic/
5     system-cpp-police-stackwise-virt-control : Stackwise Virtual OOB/
16    system-cpp-default                    : Inter FED Traffic/ EWLC Data/
18    system-cpp-police-high-rate-app       : High Rate App/
19    system-cpp-police-ewlc-control        : EWLC Control/
20    system-cpp-police-ios-routing         : L2 Control/ Topology Control/ Routing
Control/ Low Latency/
21    system-cpp-police-ios-feature         : ICMP GEN/ BROADCAST/ ICMP Redirect/ L2
LVX Cont Pack/ Proto Snooping/ Punt Webauth/ MCAST Data/ Transit Traffic/ DOT1X Auth/ Sw
forwarding/ LOGGING/ L2 LVX Data Pack/ Forus traffic/ Forus Address resolution/ MCAST END
STATION / Openflow/ Exception/ EGR Exception/ NFL SAMPLED DATA/ RPF Failed/
```

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
show policy-map control-plane	Displays the rates configured for the various traffic types
show policy-map system-cpp-policy	Displays all the classes configured under system-cpp policy, and policer rates

Feature History for Control Plane Policing

This table provides release and related information for the features explained in this module.

These features are available in all the releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Gibraltar 16.10.1	Control Plane Policing (CoPP) or CPP	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. The feature provides CLI configuration options to enable and disable CPU queues, to change the policer rate, and set policer rates to default.
Cisco IOS XE Cupertino 17.7.1	Control Plane Policing (CoPP) or CPP	This feature was implemented on the Cisco Catalyst 9600 Series Supervisor 2 Module (C9600X-SUP-2).

Use the Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to https://cfnng.cisco.com.