



# Configure Control Plane Policing

This chapter describes how to configure Control Plane Policing on Cisco NX-OS devices.

- [About CoPP, on page 1](#)
- [Guidelines and Limitations for CoPP, on page 14](#)
- [Default Settings for CoPP, on page 18](#)
- [Configuring CoPP, on page 18](#)
- [Protocol ACL Filtering for Egress CoPP, on page 26](#)
- [Verifying the CoPP Configuration, on page 30](#)
- [Displaying the CoPP Configuration Status, on page 32](#)
- [Monitoring CoPP, on page 33](#)
- [Monitoring CoPP with SNMP, on page 33](#)
- [Clearing the CoPP Statistics, on page 34](#)
- [Configuration Examples for CoPP, on page 34](#)
- [Additional References for CoPP, on page 37](#)

## About CoPP

Control Plane Policing (CoPP) protects the control plane and separates it from the data plane, which ensures network stability, reachability, and packet delivery.

This feature allows a policy map to be applied to the control plane. This policy map looks like a normal QoS policy and is applied to all traffic entering the switch from a non-management port. A common attack vector for network devices is the denial-of-service (DoS) attack, where excessive traffic is directed at the device interfaces.

The Cisco NX-OS device provides CoPP to prevent DoS attacks from impacting performance. Such attacks, which can be perpetrated either inadvertently or maliciously, typically involve high rates of traffic destined to the supervisor module or CPU itself.

The supervisor module divides the traffic that it manages into three functional components or planes:

### Data plane

Handles all the data traffic. The basic functionality of a Cisco NX-OS device is to forward packets from one interface to another. The packets that are not meant for the switch itself are called the transit packets. These packets are handled by the data plane.

**Control plane**

Handles all routing protocol control traffic. These protocols, such as the Border Gateway Protocol (BGP) and the Open Shortest Path First (OSPF) Protocol, send control packets between devices. These packets are destined to router addresses and are called control plane packets.

**Management plane**

Runs the components meant for Cisco NX-OS device management purposes such as the command-line interface (CLI) and Simple Network Management Protocol (SNMP).

The supervisor module has both the management plane and control plane and is critical to the operation of the network. Any disruption or attacks to the supervisor module will result in serious network outages. For example, excessive traffic to the supervisor module could overload and slow down the performance of the entire Cisco NX-OS device. For example, a DoS attack on the supervisor module could generate IP traffic streams to the control plane at a very high rate, forcing the control plane to spend a large amount of time in handling these packets and preventing the control plane from processing genuine traffic.

Examples of DoS attacks include:

- Internet Control Message Protocol (ICMP) echo requests
- IP fragments
- TCP SYN flooding

These attacks can impact the device performance and have the following negative effects:

- Reduced service quality (such as poor voice, video, or critical applications traffic)
- High route processor or switch processor CPU utilization
- Route flaps due to loss of routing protocol updates or keepalives
- Unstable Layer 2 topology
- Slow or unresponsive interactive sessions with the CLI
- Processor resource exhaustion, such as the memory and buffers
- Indiscriminate drops of incoming packets

**Caution**

It is important to ensure that you protect the supervisor module from accidental or malicious attacks by configuring control plane protection.

## Control Plane Protection

To protect the control plane, the Cisco NX-OS device segregates different packets destined for the control plane into different classes. Once these classes are identified, the Cisco NX-OS device polices the packets, which ensures that the supervisor module is not overwhelmed.

### Control Plane Packet Types

Different types of packets can reach the control plane:

**Receive packets**

Packets that have the destination address of a router. The destination address can be a Layer 2 address (such as a router MAC address) or a Layer 3 address (such as the IP address of a router interface). These packets include router updates and keepalive messages. Multicast packets can also be in this category where packets are sent to multicast addresses that are used by a router.

**Exception packets**

Packets that need special handling by the supervisor module. For example, if a destination address is not present in the Forwarding Information Base (FIB) and results in a miss, the supervisor module sends an ICMP unreachable packet back to the sender. Another example is a packet with IP options set.

The following exceptions are possible from line cards only:

- match exception ip option
- match exception ipv6 option
- match exception ttl-failure

The following exceptions are possible from fabric modules only:

- match exception ipv6 icmp unreachable
- match exception ip icmp unreachable

The following exceptions are possible from line cards and fabric modules:

- match exception mtu-failure

**Redirected packets**

Packets that are redirected to the supervisor module.

**Glean packets**

If a Layer 2 MAC address for a destination IP address is not present in the FIB, the supervisor module receives the packet and sends an ARP request to the host.

All of these different packets could be maliciously used to attack the control plane and overwhelm the Cisco NX-OS device. CoPP classifies these packets to different classes and provides a mechanism to individually control the rate at which the supervisor module receives these packets.

## Classification for CoPP

For effective protection, the Cisco NX-OS device classifies the packets that reach the supervisor modules to allow you to apply different rate controlling policies based on the type of the packet. For example, you might want to be less strict with a protocol packet such as Hello messages but more strict with a packet that is sent to the supervisor module because the IP option is set. You configure packet classifications and rate controlling policies using class maps and policy maps.

## Egress CoPP

Beginning with Cisco NX-OS Release 10.2(3)F, egress CoPP is supported on the Nexus 93180YC-FX, Nexus 93240YC-FX2, Nexus 93360YC-FX2, Nexus 9336C-FX2, Nexus 9336C-FX2-E, Nexus 93180YC-FX3, N9K-C9316D-GX, N9K-C93600CD-GX, Nexus 9364C-GX, N9K-C9332D-GX2B CloudScale switches.

Egress CoPP can be applied on top of custom/default CoPP policy.

## Rate Controlling Mechanisms

Once the packets are classified, the Cisco NX-OS device has different mechanisms to control the rate at which packets arrive at the supervisor module. Two mechanisms control the rate of traffic to the supervisor module. One is called policing and the other is called rate limiting.

Using hardware policers, you can define separate actions for traffic that conforms to or violates certain conditions. The actions can transmit the packet, mark down the packet, or drop the packet.

You can configure the following parameters for policing:

**Committed information rate (CIR)**

Desired bandwidth, specified as a bit rate or a percentage of the link rate.

**Committed burst (BC)**

Size of a traffic burst that can exceed the CIR within a given unit of time and not impact scheduling

In addition, you can set separate actions such as transmit or drop for conform and violate traffic.

For more information on policing parameters, see the *Cisco Nexus 9000 Series NX-OS Quality of Service Configuration Guide*.

## Dynamic and Static CoPP ACLs

CoPP access control lists (ACLs) are classified as either dynamic or static. Cisco Nexus 9300 and 9500 Series switches use only dynamic CoPP ACLs.

Dynamic CoPP ACLs work only for Forwarding Information Base (FIB)-based supervisor redirected packets, and static CoPP ACLs work for ACL-based supervisor redirected packets. Dynamic CoPP ACLs are supported for myIP and link-local multicast traffic, and static CoPP ACLs are supported for all other types of traffic.

Static CoPP ACLs are identified by a substring. Any ACL that has one of these substrings is categorized as a static CoPP ACL.

- MAC-based static CoPP ACL substrings:
  - acl-mac-cdp-udld-vtp
  - acl-mac-cfsoe
  - acl-mac-dot1x
  - acl-mac-l2-tunnel
  - acl-mac-l3-isis
  - acl-mac-lacp
  - acl-mac-lldp
  - acl-mac-sdp-srp
  - acl-mac-stp
  - acl-mac-undesirable
- Protocol-based static CoPP ACL substrings:
  - acl-dhcp
  - acl-dhcp-relay-response
  - acl-dhcp6
  - acl-dhcp6-relay-response
  - acl-ptp

- Multicast-based static CoPP ACL substrings:
  - acl-igmp

For more information on static CoPP ACLs, see [Guidelines and Limitations for CoPP, on page 14](#).

## Default Policing Policies

When you bring up your Cisco NX-OS device for the first time, the Cisco NX-OS software installs the default copp-system-p-policy-strict policy to protect the supervisor module from DoS attacks. You can set the level of protection by choosing one of the following CoPP policy options from the initial setup utility:

- Strict—This policy is 1 rate and 2 color.
- Moderate—This policy is 1 rate and 2 color. The important class burst size is greater than the strict policy but less than the lenient policy.
- Lenient—This policy is 1 rate and 2 color. The important class burst size is greater than the moderate policy but less than the dense policy.
- Dense—This policy is 1 rate and 2 color. The policer CIR values are less than the strict policy.
- Skip—No control plane policy is applied. (Cisco does not recommend using the Skip option because it will impact the control plane of the network.)

If you do not select an option or choose not to execute the setup utility, the software applies strict policing. We recommend that you start with the strict policy and later modify the CoPP policies as required.



**Note** Strict policing is not applied by default when using POAP, so you must configure a CoPP policy.

The copp-system-p-policy policy has optimized values suitable for basic device operations. You must add specific class and access-control list (ACL) rules that meet your DoS protection requirements. The default CoPP policy does not change when you upgrade the software.



**Caution** Selecting the skip option and not subsequently configuring CoPP protection can leave your Cisco NX-OS device vulnerable to DoS attacks.

You can reassign the CoPP default policy by entering the setup utility again using the **setup** command from the CLI prompt or by using the **copp profile** command.

### Related Topics

[Changing or Reapplying the Default CoPP Policy](#), on page 24

## Default Class Maps

The copp-system-class-critical class has the following configuration:

```
class-map type control-plane match-any copp-system-p-class-critical
  match access-group name copp-system-p-acl-bgp
  match access-group name copp-system-p-acl-rip
  match access-group name copp-system-p-acl-vpc
  match access-group name copp-system-p-acl-bgp6
  match access-group name copp-system-p-acl-ospf
```

```

match access-group name copp-system-p-acl-rip6
match access-group name copp-system-p-acl-eigrp
match access-group name copp-system-p-acl-ospf6
match access-group name copp-system-p-acl-eigrp6
match access-group name copp-system-p-acl-auto-rp
match access-group name copp-system-p-acl-mac-l3-isis

```

The `copp-system-class-exception` class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-exception
  match exception ip option
  match exception ip icmp unreachable
  match exception ipv6 option
  match exception ipv6 icmp unreachable

```

The `copp-system-class-exception-diag` class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-exception-diag
  match exception ttl-failure
  match exception mtu-failure

```

The `copp-system-class-important` class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-important
  match access-group name copp-system-p-acl-hsrp
  match access-group name copp-system-p-acl-vrrp
  match access-group name copp-system-p-acl-hsrp6
  match access-group name copp-system-p-acl-vrrp6
  match access-group name copp-system-p-acl-mac-lldp

```

The `copp-system-class-l2-default` class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-l2-default
  match access-group name copp-system-p-acl-mac-undesirable

```

The `copp-system-class-l2-unpoliced` class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-l2-unpoliced
  match access-group name copp-system-p-acl-mac-stp
  match access-group name copp-system-p-acl-mac-lacp
  match access-group name copp-system-p-acl-mac-cfsoe
  match access-group name copp-system-p-acl-mac-sdp-srp
  match access-group name copp-system-p-acl-mac-l2-tunnel
  match access-group name copp-system-p-acl-mac-cdp-udld-vtp

```

The `copp-system-class-l3mc-data` class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-l3mc-data
  match exception multicast rpf-failure
  match exception multicast dest-miss

```

The `copp-system-class-l3uc-data` class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-l3uc-data
  match exception glean

```

The `copp-system-class-management` class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-management
  match access-group name copp-system-p-acl-ftp

```

```

match access-group name copp-system-p-acl-ntp
match access-group name copp-system-p-acl-ssh
match access-group name copp-system-p-acl-http
match access-group name copp-system-p-acl-ntp6
match access-group name copp-system-p-acl-sftp
match access-group name copp-system-p-acl-snmp
match access-group name copp-system-p-acl-ssh6
match access-group name copp-system-p-acl-tftp
match access-group name copp-system-p-acl-https
match access-group name copp-system-p-acl-snmp6
match access-group name copp-system-p-acl-tftp6
match access-group name copp-system-p-acl-radius
match access-group name copp-system-p-acl-tacacs
match access-group name copp-system-p-acl-telnet
match access-group name copp-system-p-acl-radius6
match access-group name copp-system-p-acl-tacacs6
match access-group name copp-system-p-acl-telnet6

```

The copp-system-class-monitoring class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-monitoring
  match access-group name copp-system-p-acl-icmp
  match access-group name copp-system-p-acl-icmp6
  match access-group name copp-system-p-acl-traceroute

```

The copp-system-class-multicast-host class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-multicast-host
  match access-group name copp-system-p-acl-mld

```

The copp-system-class-multicast-router class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-multicast-router
  match access-group name copp-system-p-acl-pim
  match access-group name copp-system-p-acl-msdp
  match access-group name copp-system-p-acl-pim6
  match access-group name copp-system-p-acl-pim-reg
  match access-group name copp-system-p-acl-pim6-reg
  match access-group name copp-system-p-acl-pim-mdt-join

```

The copp-system-class-nat-flow class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-nat-flow
  match exception nat-flow

```

The copp-system-class-ndp class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-ndp
  match access-group name copp-system-p-acl-ndp

```

The copp-system-class-normal class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-normal
  match access-group name copp-system-p-acl-mac-dot1x
  match protocol arp

```

The copp-system-class-normal-dhcp class has the following configuration:

```

class-map type control-plane match-any copp-system-p-class-normal-dhcp
  match access-group name copp-system-p-acl-dhcp

```

```
match access-group name copp-system-p-acl-dhcp6
```

The `copp-system-class-normal-dhcp-relay-response` class has the following configuration:

```
class-map type control-plane match-any copp-system-p-class-normal-dhcp-relay-response
  match access-group name copp-system-p-acl-dhcp-relay-response
  match access-group name copp-system-p-acl-dhcp6-relay-response
```

The `copp-system-class-normal-igmp` class has the following configuration:

```
class-map type control-plane match-any copp-system-p-class-normal-igmp
  match access-group name copp-system-p-acl-igmp
```

The `copp-system-class-redirect` class has the following configuration:

```
class-map type control-plane match-any copp-system-p-class-redirect
  match access-group name copp-system-p-acl-ptp
```

The `copp-system-class-undesirable` class has the following configuration:

```
class-map type control-plane match-any copp-system-p-class-undesirable
  match access-group name copp-system-p-acl-undesirable
  match exception multicast sg-rpf-failure
```

The `copp-system-class-fcoe` class has the following configuration:

```
class-map type control-plane match-any copp-system-p-class-fcoe
  match access-group name copp-system-p-acl-mac-fcoe
```

## Strict Default CoPP Policy

On Cisco Nexus 9300 and 9500 Series switches, the strict CoPP policy has the following configuration:

```
policy-map type control-plane copp-system-p-policy-strict
  class copp-system-p-class-l3uc-data
    set cos 1
    police cir 250 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-critical
    set cos 7
    police cir 19000 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-important
    set cos 6
    police cir 3000 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-multicast-router
    set cos 6
    police cir 3000 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-management
    set cos 2
    police cir 3000 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-multicast-host
    set cos 1
    police cir 2000 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-l3mc-data
    set cos 1
    police cir 3000 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-normal
    set cos 1
    police cir 1500 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-ndp
    set cos 6
    police cir 1500 pps bc 32 packets conform transmit violate drop
```

```

class copp-system-p-class-normal-dhcp
  set cos 1
  police cir 300 pps bc 32 packets conform transmit violate drop
class copp-system-p-class-normal-dhcp-relay-response
  set cos 1
  police cir 400 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-normal-igmp
  set cos 3
  police cir 6000 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-redirect
  set cos 1
  police cir 1500 pps bc 32 packets conform transmit violate drop
class copp-system-p-class-exception
  set cos 1
  police cir 50 pps bc 32 packets conform transmit violate drop
class copp-system-p-class-exception-diag
  set cos 1
  police cir 50 pps bc 32 packets conform transmit violate drop
class copp-system-p-class-monitoring
  set cos 1
  police cir 300 pps bc 128 packets conform transmit violate drop
class copp-system-p-class-l2-unpoliced
  set cos 7
  police cir 20000 pps bc 8192 packets conform transmit violate drop
class copp-system-p-class-undesirable
  set cos 0
  police cir 15 pps bc 32 packets conform transmit violate drop
class copp-system-p-class-fcoe
  set cos 6
  police cir 1500 pps bc 128 packets conform transmit violate drop
class copp-system-p-class-nat-flow
  set cos 7
  police cir 100 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-l2-default
  set cos 0
  police cir 50 pps bc 32 packets conform transmit violate drop
class class-default
  set cos 0
  police cir 50 pps bc 32 packets conform transmit violate drop

```

## Moderate Default CoPP Policy

On Cisco Nexus 9300 and 9500 Series switches, the moderate CoPP policy has the following configuration:

```

policy-map type control-plane copp-system-p-policy-moderate
  class copp-system-p-class-l3uc-data
    set cos 1
    police cir 250 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-critical
    set cos 7
    police cir 19000 pps bc 192 packets conform transmit violate drop
  class copp-system-p-class-important
    set cos 6
    police cir 3000 pps bc 192 packets conform transmit violate drop
  class copp-system-p-class-multicast-router
    set cos 6
    police cir 3000 pps bc 192 packets conform transmit violate drop
  class copp-system-p-class-management
    set cos 2
    police cir 3000 pps bc 48 packets conform transmit violate drop
  class copp-system-p-class-multicast-host
    set cos 1
    police cir 2000 pps bc 192 packets conform transmit violate drop

```

```

class copp-system-p-class-l3mc-data
  set cos 1
  police cir 3000 pps bc 32 packets conform transmit violate drop
class copp-system-p-class-normal
  set cos 1
  police cir 1500 pps bc 48 packets conform transmit violate drop
class copp-system-p-class-ndp
  set cos 6
  police cir 1500 pps bc 48 packets conform transmit violate drop
class copp-system-p-class-normal-dhcp
  set cos 1
  police cir 300 pps bc 48 packets conform transmit violate drop
class copp-system-p-class-normal-dhcp-relay-response
  set cos 1
  police cir 400 pps bc 96 packets conform transmit violate drop
class copp-system-p-class-normal-igmp
  set cos 3
  police cir 6000 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-redirect
  set cos 1
  police cir 1500 pps bc 48 packets conform transmit violate drop
class copp-system-p-class-exception
  set cos 1
  police cir 50 pps bc 48 packets conform transmit violate drop
class copp-system-p-class-exception-diag
  set cos 1
  police cir 50 pps bc 48 packets conform transmit violate drop
class copp-system-p-class-monitoring
  set cos 1
  police cir 300 pps bc 192 packets conform transmit violate drop
class copp-system-p-class-l2-unpoliced
  set cos 7
  police cir 20000 pps bc 8192 packets conform transmit violate drop
class copp-system-p-class-undesirable
  set cos 0
  police cir 15 pps bc 48 packets conform transmit violate drop
class copp-system-p-class-fcoe
  set cos 6
  police cir 1500 pps bc 192 packets conform transmit violate drop
class copp-system-p-class-nat-flow
  set cos 7
  police cir 100 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-l2-default
  set cos 0
  police cir 50 pps bc 48 packets conform transmit violate drop
class class-default
  set cos 0
  police cir 50 pps bc 48 packets conform transmit violate drop

```

## Lenient Default CoPP Policy

On Cisco Nexus 9300 and 9500 Series switches, the lenient CoPP policy has the following configuration:

```

policy-map type control-plane copp-system-p-policy-lenient
  class copp-system-p-class-l3uc-data
    set cos 1
    police cir 250 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-critical
    set cos 7
    police cir 19000 pps bc 256 packets conform transmit violate drop
  class copp-system-p-class-important
    set cos 6
    police cir 3000 pps bc 256 packets conform transmit violate drop

```

```

class copp-system-p-class-multicast-router
  set cos 6
  police cir 3000 pps bc 256 packets conform transmit violate drop
class copp-system-p-class-management
  set cos 2
  police cir 3000 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-multicast-host
  set cos 1
  police cir 2000 pps bc 256 packets conform transmit violate drop
class copp-system-p-class-l3mc-data
  set cos 1
  police cir 3000 pps bc 32 packets conform transmit violate drop
class copp-system-p-class-normal
  set cos 1
  police cir 1500 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-ndp
  set cos 6
  police cir 1500 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-normal-dhcp
  set cos 1
  police cir 300 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-normal-dhcp-relay-response
  set cos 1
  police cir 400 pps bc 128 packets conform transmit violate drop
class copp-system-p-class-normal-igmp
  set cos 3
  police cir 6000 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-redirect
  set cos 1
  police cir 1500 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-exception
  set cos 1
  police cir 50 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-exception-diag
  set cos 1
  police cir 50 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-monitoring
  set cos 1
  police cir 300 pps bc 256 packets conform transmit violate drop
class copp-system-p-class-l2-unpoliced
  set cos 7
  police cir 20000 pps bc 8192 packets conform transmit violate drop
class copp-system-p-class-undesirable
  set cos 0
  police cir 15 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-fcoe
  set cos 6
  police cir 1500 pps bc 256 packets conform transmit violate drop
class copp-system-p-class-nat-flow
  set cos 7
  police cir 100 pps bc 64 packets conform transmit violate drop
class copp-system-p-class-l2-default
  set cos 0
  police cir 50 pps bc 64 packets conform transmit violate drop
class class-default
  set cos 0
  police cir 50 pps bc 64 packets conform transmit violate drop

```

## Dense Default CoPP Policy

On Cisco Nexus 9300 and 9500 Series switches, the dense CoPP policy has the following configuration:

```

policy-map type control-plane copp-system-p-policy-dense
  class copp-system-p-class-l3uc-data
    set cos 1
    police cir 250 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-critical
    set cos 7
    police cir 2500 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-important
    set cos 6
    police cir 1200 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-multicast-router
    set cos 6
    police cir 1200 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-management
    set cos 2
    police cir 1200 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-multicast-host
    set cos 2
    police cir 1000 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-l3mc-data
    set cos 1
    police cir 1200 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-normal
    set cos 1
    police cir 750 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-ndp
    set cos 1
    police cir 750 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-normal-dhcp
    set cos 1
    police cir 150 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-normal-dhcp-relay-response
    set cos 1
    police cir 200 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-normal-igmp
    set cos 3
    police cir 2500 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-redirect
    set cos 1
    police cir 1500 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-exception
    set cos 1
    police cir 50 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-exception-diag
    set cos 1
    police cir 50 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-monitoring
    set cos 1
    police cir 50 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-l2-unpoliced
    set cos 7
    police cir 20000 pps bc 8192 packets conform transmit violate drop
  class copp-system-p-class-undesirable
    set cos 0
    police cir 15 pps bc 32 packets conform transmit violate drop
  class copp-system-p-class-fcoe
    set cos 6
    police cir 750 pps bc 128 packets conform transmit violate drop
  class copp-system-p-class-l2-default
    set cos 0
    police cir 25 pps bc 32 packets conform transmit violate drop
  class class-default
    set cos 0

```

```
police cir 25 pps bc 32 packets conform transmit violate drop
```

### Packets Per Second Credit Limit

The aggregate packets per second (PPS) for a given policy (sum of PPS of each class part of the policy) is capped by an upper PPS Credit Limit (PCL). If an increase in PPS of a given class causes a PCL exceed, the configuration is rejected. To increase the desired PPS, the additional PPS beyond PCL should be decreased from other class(es).

## Modular QoS Command-Line Interface

CoPP uses the Modular Quality of Service Command-Line Interface (MQC). MQC is a CLI structure that allows you to define a traffic class, create a traffic policy (policy map), and attach the traffic policy to an interface. The traffic policy contains the CoPP feature that will be applied to the traffic class.

### Procedure

- 
- Step 1** Define a traffic class using the **class-map** command. A traffic class is used to classify traffic.
- This example shows how to create a new class-map called copp-sample-class:
- ```
class-map type control-plane copp-sample-class
```
- Step 2** Create a traffic policy using the **policy-map** command. A traffic policy (policy map) contains a traffic class and one or more CoPP features that will be applied to the traffic class. The CoPP features in the traffic policy determine how to treat the classified traffic.
- Step 3** Attach the traffic policy (policy map) to the control plane using the **control-plane** and **service-policy** commands.

This example shows how to attach the policy map to the control plane:

```
control-plane
service-policy input copp-system-policy
```

### Note

The copp-system-policy is always configured and applied. There is no need to use this command explicitly.

---

## CoPP and the Management Interface

The Cisco NX-OS device supports only hardware-based CoPP, which does not support the management interface (mgmt0). The out-of-band mgmt0 interface connects directly to the CPU and does not pass through the in-band traffic hardware where CoPP is implemented.

On the mgmt0 interface, ACLs can be configured to give or deny access to a particular type of traffic.

### Related Topics

[Configure IP ACLs](#)

[Configuring MAC ACLs](#)

# Guidelines and Limitations for CoPP

CoPP has the following configuration guidelines and limitations:

- We recommend that you use the strict default CoPP policy initially and then later modify the CoPP policies that are based on the data center and application requirements.
- First-generation Cisco Nexus 9000 Series switches (non -FX/FX2), do not support source-based CoPP. This limitation does not exist for cloud scale ASIC-based Cisco Nexus switches.
- The **match-all** option is not supported in CoPP class-map and it always defaults to the **match-any** option.
- Customizing CoPP is an ongoing process. CoPP must be configured according to the protocols and features that are used in your specific environment and the supervisor features that are required by the server environment. As these protocols and features change, CoPP must be modified.
- We recommend that you continuously monitor CoPP. If drops occur, determine if CoPP dropped traffic unintentionally or in response to a malfunction or attack. In either event, analyze the situation and evaluate the need to modify the CoPP policies.
- All the traffic that you do not specify in the other class maps is put into the last class, the default class. Monitor the drops in this class and investigate if these drops are based on traffic that you do not want or the result of a feature that was not configured and you need to add.
- All broadcast traffic is sent through CoPP logic in order to determine which packets (for example, ARP and DHCP) must be redirected through an access control list (ACL) to the router processor. Broadcast traffic that does not need to be redirected is matched against the CoPP logic, and both conforming and violated packets are counted in the hardware but not sent to the CPU. Broadcast traffic that must be sent to the CPU and broadcast traffic that does not need to be sent to the CPU must be separated into different classes.
- After you have configured CoPP, delete anything that is not being used, such as old class maps and unused routing protocols.
- You must ensure that the CoPP policy does not filter critical traffic such as routing protocols or interactive access to the device. Filtering this traffic could prevent remote access to the Cisco NX-OS device and require a console connection.
- The Cisco NX-OS software does not support egress CoPP or silent mode. CoPP is supported only on ingress (you cannot use the **service-policy output copp** command to the control plane interface).
- You can use the access control entry (ACE) hit counters in the hardware only for ACL logic. Use the software ACE hit counters and the **show access-lists** and **show policy-map type control-plane** commands to evaluate CPU traffic.
- The Cisco NX-OS device hardware performs CoPP on a per-forwarding-engine basis. CoPP does not support distributed policing. Therefore, you should choose rates so that the aggregate traffic does not overwhelm the supervisor module.
- If multiple flows map to the same class, individual flow statistics will not be available.
- If you upgrade from a Cisco NX-OS release that supports the CoPP feature to a Cisco NX-OS release that supports the CoPP feature with other classes for new protocols, you must either run the setup utility using the **setup** command or use the **copp profile** command for the new CoPP classes to be available.

- Before you downgrade from a Cisco NX-OS release that supports the CoPP feature to an earlier Cisco NX-OS release that supports the CoPP feature, you should verify compatibility using the **show incompatibility nxos bootflash:filename** command. If an incompatibility exists, disable any features that are incompatible with the downgrade image before downgrading the software.
- You cannot disable CoPP. If you attempt to disable it, packets are rate limited at 50 packets per seconds.
- Skip CoPP policy option has been removed from the Cisco NX-OS initial setup utility because using it can impact the control plane of the network.
- The following guidelines and limitations apply to static CoPP ACLs:
  - Static CoPP ACLs can be remapped to a different CoPP class.
  - Access control entries (ACEs) cannot be modified or removed for static CoPP ACLs.
  - If a CoPP ACL has a static ACL substring, it maps to that type of traffic. For example, if the ACL includes the `acl-mac-stp` substring, STP traffic classifies to the class map for that ACL.
  - Static CoPP ACLs take priority over dynamic CoPP ACLs, regardless of their position in the CoPP policy, the order in which they are configured, and how they appear in the output of the **show policy-map type control-plane** command.
  - You must have static CoPP ACLs in the CoPP policy. Otherwise, the CoPP policy is rejected.
- Beginning with Cisco Nexus Release 9.2(2), Cisco Nexus 9300-FX Series switches and Cisco Nexus 9500 platform switches support protocol ACL filtering. In this release, IPv6 ACL is not supported.
- Beginning with Cisco NX-OS Release 9.2(3), IPv6 ACL is supported for dynamic CoPP on the Cisco Nexus 9300-FX Series switches, and Cisco Nexus 9500 platform switches.
- The protocol ACL filtering for egress CoPP has the following limitations:
  - Once the egress CoPP ACL is defined, you cannot add or remove an existing rule. This is applicable for all class-maps and policy-maps attached to the egress CoPP ACLs.
  - You cannot override the existing egress CoPP with a new policy. You must remove the existing egress CoPP before you add a new policy.
  - The deny action is not applicable.
  - Every entry is programmed in TCAM and uses a different TCAM space if two MAC or IP ACLs with the same entries are created and bound to either the same or a different class-map.
  - The maximum TCAM carving supported for the egress CoPP is 128 entries (24 entries are reserved and the remaining 104 entries are for egress CoPP, which are all double wide), which can be any of 52 (IPv4, mac, Ipv6) entries.
  - Policer can be used to drop the traffic completely, with cir and burst as 0.
  - SNMP MIB is not supported.
- When a packet meets multiple exception conditions, CoPP matches the packet based on the order in which the CoPP ACLs are configured and matches it only against a single class. This is an expected CoPP behavior.

Beginning with Cisco NX-OS Release 9.3(4), the UC FIB MISS exception is counted against the CoPP class (`copp-system-p-class-exception`). Therefore, if a packet has both, the TTL (accounted user class

copp-system-p-class-exception-diag) and the UC FIB MISS exceptions, it is accounted against the UC FIB MISS exception. This behavior occurs because the order of the CoPP classes where the copp-system-p-class-exception class has an order higher than the copp-system-p-class-exception-diag class. For NX-OS releases earlier to NX-OS Release 9.3(4), the UC FIB MISS exception was not explicitly handled by the CoPP rules.

- CoPP processing comprises of 2 stages: In the first stage, the actual packet size is reused in each class policy, however when the packet enters the second stage, an internal header of 44 bytes is added. This causes an alteration in the conform or violation policies of all the CoPP classes. This limitation is applicable to Cisco Nexus 9300-FX, Nexus 9300-FX2, and 9300-GX platform switches.
- Beginning with Cisco NX-OS Release 10.1(2), CoPP is supported on the Cisco Nexus X9624D-R2 line cards and 9508-FM-R2 switches.
- Beginning with Cisco NX-OS Release 10.1(2), CoPP is supported on the Cisco Nexus 9364D-GX2A and 9332D-GX2B switches.
- Cloudscale IPv6 link-local BGP support requires carving > 512 ing-sup TCAM region (this requires a reload to take effect).
- Beginning with Cisco NX-OS Release 10.3(1)F, CoPP ACL is supported on Cisco Nexus 9808 switches.
  - Beginning with Cisco NX-OS Release 10.4(1)F, CoPP ACL is supported on Cisco Nexus X98900CD-A and X9836DM-A line cards with Cisco Nexus 9808 switches.
- Beginning with Cisco NX-OS Release 10.4(1)F, CoPP ACL is supported on Cisco Nexus 9804 switches, and Cisco Nexus X98900CD-A and X9836DM-A line cards.
- Cisco Nexus 9808/9804 switches have the following limitations for SUP CoPP ACL support:
  - Policer rate is in multiples of 161 PPS at Stage-1.
  - There is no shaper in Stage 0.
  - Stage-2 output is at LC/Module level, and Stage-3 output is at SUP/CPU level.
  - Fabrics/FMs are not involved in in-band path.
  - CoPP policy for Stage-1, Stage-2, and Stage-3 are in PPS.
  - CoPP Stage3 stats gets reset to zero after system switchover.
  - Only policer rate changes are supported in Custom CoPP.
- To avoid traffic loss during traffic impact, configure the CoPP class normal CIR value to 2200 kbps on Cisco Nexus 9300 GX/FX/FX2/FX3, 9504-FM-G, and 9508-FM-G switches and X9716D-GX line cards.
- Beginning with Cisco NX-OS Release 10.3(2)F, source IP based filtering in CoPP is supported on Cisco Nexus 9504 and 9508 modular chassis with R/RX line cards.




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**Note** For IPv6, source IP based filtering is supported up to 24b MSB.

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- Beginning with Cisco NX-OS Release 10.4(1)F, CoPP ACL is supported on the Cisco Nexus 9332D-H2R switches.

- Beginning with Cisco NX-OS Release 10.4(2)F, CoPP ACL is supported on the Cisco Nexus 93400LD-H1, and 93108TC-FX3 switches.
- Beginning with Cisco Nexus Release 10.4(3)F, CoPP ACL is supported on the Cisco Nexus 9364C-H1 switches.
- On Cisco Nexus 9336C-SE1 switches, zero CIR is not supported under custom CoPP or hardware rate-limiter. When a user configures zero CIR, it is set to the minimum possible value in the hardware.

### **CoPP guidelines and limitations for Cisco Nexus 9364E-SG2 switches**

- Beginning with Cisco NX-OS Release 10.5(3)F, on the Cisco Nexus 9364E-SG2-Q and 9364E-SG2-O switches, Custom CoPP is supported. Below are the functionalities and limitations:
  - You can modify the policer rates for the copy of inbuilt classes.
  - You can create fully user-defined CoPP classes with user-defined match criteria and policer rates.
  - You can configure policer rates in packets per second (PPS) only.
  - User-defined MAC access lists and source MAC addresses (SMACs) are not supported within Custom CoPP. However, MAC ACLs with well-known destination MAC addresses (DMACs) from the default profile are supported.
  - At least one IPv4 ACL must be present in the Custom CoPP configuration.
  - All Bridge Protocol Data Units (BPDUs) are mapped to a single policer; therefore, distinct policing configurations for protocols such as Cisco Discovery Protocol (CDP), Link Layer Discovery Protocol (LLDP), and Spanning Tree Protocol (STP) are not supported.
  - You can create up to 28 class maps in a CoPP policy.
  - Custom CoPP scale limit (unidimensional) - Maximum number of TCAM entries :
    - IPv4 - 360
    - IPv6 – 180
  - CoPP Consistency checker is not supported for Custom CoPP.
  - Only a single burst value of 126 packets is supported.
  - Destination IP match does not support IPv4 or IPv6 link-local multicast addresses.
  - IPv4 and IPv6 ACLs of link-local multicast entries like OSPF, RIP, EIGRP, and AUTO-RP should be added within the same CoPP class. Similarly, IPv4 and IPv6 ACLs for HSRP and VRRP must also be in the same CoPP class as in the default CoPP profile. Additionally, the ACL name for link-local multicast entries should include the string from the default CoPP policy, such as "acl-ospf" or "acl-eigrp".

### **Guidelines and limitations for CoPP on Cisco Nexus 9336C-SE1 switches**

- Policer rates are specified in packets per second (PPS).
- Destination IP-based access-list matching is not supported in Custom CoPP.
- User-defined MAC access lists are not supported; only built-in MAC ACLs can be used.

- A maximum of 28 class maps can be configured under a Custom CoPP policy.
- Custom CoPP supports maximum 360 IPv4 (uni-dimensional) and 180 IPv6 (uni-dimensional) TCAM entries.
- The CoPP Consistency Checker is not supported for Custom CoPP.
- Zero Committed Information Rate (CIR) is not supported. If zero CIR is configured, the hardware sets it to the minimum possible value.

## Default Settings for CoPP

This table lists the default settings for CoPP parameters.

**Table 1: Default CoPP Parameters Settings**

| Parameters         | Default                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------|
| Default policy     | Strict                                                                                                         |
| Default policy     | 9 policy entries<br><b>Note</b><br>The maximum number of supported policies with associated class maps is 128. |
| Scale factor value | 1.00                                                                                                           |

## Configuring CoPP

This section describes how to configure CoPP.

### Configuring a Control Plane Class Map

You must configure control plane class maps for control plane policies.

You can classify traffic by matching packets based on existing ACLs. The permit and deny ACL keywords are ignored in the matching.

You can configure policies for IP version 4 (IPv4) and IP version 6 (IPv6) packets.

#### Before you begin

Ensure that you have configured the IP ACLs if you want to use ACE hit counters in the class maps.

## Procedure

|               | Command or Action                                                                                                                                                                      | Purpose                                                                                                                                                                                                                                                                                      |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b><br>switch# configure terminal<br>switch(config)#                                                                                      | Enters global configuration mode.                                                                                                                                                                                                                                                            |
| <b>Step 2</b> | <b>class-map type control-plane [match-all   match-any] class-map-name</b><br><br><b>Example:</b><br>switch(config)# class-map type<br>control-plane ClassMapA<br>switch(config-cmap)# | Specifies a control plane class map and enters class map configuration mode. The default class matching is match-any. The name can be a maximum of 64 characters long and is case sensitive.<br><br><b>Note</b><br>You cannot use class-default, match-all, or match-any as class map names. |
| <b>Step 3</b> | (Optional) <b>match access-group name access-list-name</b><br><br><b>Example:</b><br>switch(config-cmap)# match access-group<br>name MyAccessList                                      | Specifies matching for an IP ACL.<br><br><b>Note</b><br>The permit and deny ACL keywords are ignored in the CoPP matching.                                                                                                                                                                   |
| <b>Step 4</b> | (Optional) <b>match exception {ip   ipv6} icmp redirect</b><br><br><b>Example:</b><br>switch(config-cmap)# match exception ip<br>icmp redirect                                         | Specifies matching for IPv4 or IPv6 ICMP redirect exception packets.                                                                                                                                                                                                                         |
| <b>Step 5</b> | (Optional) <b>match exception {ip   ipv6} icmp unreachable</b><br><br><b>Example:</b><br>switch(config-cmap)# match exception ip<br>icmp unreachable                                   | Specifies matching for IPv4 or IPv6 ICMP unreachable exception packets.                                                                                                                                                                                                                      |
| <b>Step 6</b> | (Optional) <b>match exception {ip   ipv6} option</b><br><br><b>Example:</b><br>switch(config-cmap)# match exception ip<br>option                                                       | Specifies matching for IPv4 or IPv6 option exception packets.                                                                                                                                                                                                                                |
| <b>Step 7</b> | <b>match protocol arp</b><br><br><b>Example:</b><br>switch(config-cmap)# match protocol arp                                                                                            | Specifies matching for IP Address Resolution Protocol (ARP) and Reverse Address Resolution Protocol (RARP) packets.                                                                                                                                                                          |
| <b>Step 8</b> | <b>exit</b><br><br><b>Example:</b>                                                                                                                                                     | Exits class map configuration mode.                                                                                                                                                                                                                                                          |

|                | Command or Action                                                                                                                                                      | Purpose                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
|                | <pre>switch(config-cmap)# exit switch(config)#</pre>                                                                                                                   |                                                                |
| <b>Step 9</b>  | <p>(Optional) <b>show class-map type control-plane</b> <i>[class-map-name]</i></p> <p><b>Example:</b></p> <pre>switch(config)# show class-map type control-plane</pre> | Displays the control plane class map configuration.            |
| <b>Step 10</b> | <p>(Optional) <b>copy running-config startup-config</b></p> <p><b>Example:</b></p> <pre>switch(config)# copy running-config startup-config</pre>                       | Copies the running configuration to the startup configuration. |

## Configuring a Control Plane Policy Map

You must configure a policy map for CoPP, which includes policing parameters. If you do not configure a policer for a class, the following default is configured:

- 50 packets per second (pps) with a burst of 32 packets (for Cisco Nexus 9300 and 9500 Series switches)
- 150 kilobits per second (kbps) with a burst of 32,000 bytes

### Before you begin

Ensure that you have configured a control plane class map.

### Procedure

|               | Command or Action                                                                                                                                                                 | Purpose                                                                                                                                                       |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>switch# configure terminal switch(config)#</pre>                                                                     | Enters global configuration mode.                                                                                                                             |
| <b>Step 2</b> | <p><b>policy-map type control-plane</b> <i>policy-map-name</i></p> <p><b>Example:</b></p> <pre>switch(config)# policy-map type control-plane ClassMapA switch(config-pmap)#</pre> | Specifies a control plane policy map and enters policy map configuration mode. The policy map name can have a maximum of 64 characters and is case sensitive. |
| <b>Step 3</b> | <p><b>class</b> {<i>class-map-name</i> [<b>insert-before</b> <i>class-map-name2</i>]   <b>class-default</b>}</p> <p><b>Example:</b></p>                                           | Specifies a control plane class map name or the class default and enters control plane class configuration mode.                                              |

|               | Command or Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | <pre>switch(config-pmap)# class ClassMapA switch(config-pmap-c)#</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                         | The class-default class map is always at the end of the class map list for a policy map.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Step 4</b> | <p>Enter one of the following commands:</p> <ul style="list-style-type: none"> <li>• <b>police</b> [cir] {cir-rate [rate-type]}</li> <li>• <b>police</b> [cir] {cir-rate [rate-type]} [bc] burst-size [burst-size-type]</li> <li>• <b>police</b> [cir] {cir-rate [rate-type]} conform transmit [violate drop]</li> </ul> <p><b>Example:</b></p> <pre>switch(config-pmap-c)# police cir 52000 bc 1000 packets</pre> <p><b>Example:</b></p> <pre>switch(config-pmap-c)# police cir 3400 kbps bc 200 kbytes</pre> | <p>Specifies the committed information rate (CIR). The rate range is as follows:</p> <ul style="list-style-type: none"> <li>• 01 to 268435456 pps (for Cisco Nexus 9300 and 9500 Series switches)</li> <li>• 0 to 80000000000 bps/gbps/kbps/mbps</li> </ul> <p><b>Note</b><br/>The CIR rate range starts with 0. In previous releases, the CIR rate range starts with 1. A value of 0 drops the packet.</p> <p>The committed burst (BC) range is as follows:</p> <ul style="list-style-type: none"> <li>• 1 to 1073741 packets (for Cisco Nexus 9300 and 9500 Series switches)</li> <li>• 1 to 512000000 bytes/kbytes/mbytes</li> </ul> <p>The <b>conform transmit</b> action transmits the packet.</p> <p><b>Note</b><br/>You can specify the BC and conform action for the same CIR.</p> |
| <b>Step 5</b> | <p>(Optional) <b>logging drop threshold</b> [drop-count [level syslog-level]]</p> <p><b>Example:</b></p> <pre>switch(config-pmap-c)# logging drop threshold 100</pre>                                                                                                                                                                                                                                                                                                                                          | Specifies the threshold value for dropped packets and generates a syslog if the drop count exceeds the configured threshold. The range for the <i>drop-count</i> argument is from 1 to 8000000000 bytes. The range for the <i>syslog-level</i> argument is from 1 to 7, and the default level is 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Step 6</b> | <p>(Optional) <b>set cos</b> cos-value</p> <p><b>Example:</b></p> <pre>switch(config-pmap-c)# set cos 1</pre>                                                                                                                                                                                                                                                                                                                                                                                                  | Specifies the 802.1Q class of service (CoS) value. The range is from 0 to 7. The default value is 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Step 7</b> | <p><b>exit</b></p> <p><b>Example:</b></p> <pre>switch(config-pmap-c)# exit switch(config-pmap)#</pre>                                                                                                                                                                                                                                                                                                                                                                                                          | Exits policy map class configuration mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Step 8</b> | <p><b>exit</b></p> <p><b>Example:</b></p> <pre>switch(config-pmap)# exit switch(config)#</pre>                                                                                                                                                                                                                                                                                                                                                                                                                 | Exits policy map configuration mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|                | Command or Action                                                                                                                                                           | Purpose                                                        |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| <b>Step 9</b>  | (Optional) <b>show policy-map type control-plane [expand] [name class-map-name]</b><br><br><b>Example:</b><br><pre>switch(config)# show policy-map type control-plane</pre> | Displays the control plane policy map configuration.           |
| <b>Step 10</b> | (Optional) <b>copy running-config startup-config</b><br><br><b>Example:</b><br><pre>switch(config)# copy running-config startup-config</pre>                                | Copies the running configuration to the startup configuration. |

**Related Topics**

[Configuring a Control Plane Class Map](#), on page 18

## Configuring the Control Plane Service Policy

You can configure one or more policy maps for the CoPP service policy.



**Note** When you try to change the CoPP policy and apply a custom CoPP policy, it is configured in the hardware as non-atomic, and the following system message appears:

```
This operation can cause disruption of control traffic. Proceed (y/n)? [no] y
2013 Nov 13 23:16:46 switch %ACLQOS-SLOT24-5-ACLQOS_NON_ATOMIC: Non atomic ACL/QoS policy
update done for CoPP
2013 Nov 13 23:16:46 switch %ACLQOS-SLOT23-5-ACLQOS_NON_ATOMIC: Non atomic ACL/QoS policy
update done for CoPP
2013 Nov 13 23:16:46 switch %ACLQOS-SLOT21-5-ACLQOS_NON_ATOMIC: Non atomic ACL/QoS policy
update done for CoPP
2013 Nov 13 23:16:46 switch %ACLQOS-SLOT25-5-ACLQOS_NON_ATOMIC: Non atomic ACL/QoS policy
update done for CoPP
2013 Nov 13 23:16:46 switch %ACLQOS-SLOT26-5-ACLQOS_NON_ATOMIC: Non atomic ACL/QoS policy
update done for CoPP
2013 Nov 13 23:16:46 switch %ACLQOS-SLOT22-5-ACLQOS_NON_ATOMIC: Non atomic ACL/QoS policy
update done for CoPP
2013 Nov 13 23:16:46 switch %ACLQOS-SLOT4-5-ACLQOS_NON_ATOMIC: Non atomic ACL/QoS policy
update done for CoPP
```

**Before you begin**

Ensure that you have configured a control plane policy map.

## Procedure

|               | Command or Action                                                                                                                               | Purpose                                                                                                                                                                                                                                          |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b><br><pre>switch# configure terminal switch(config)#</pre>                                       | Enters global configuration mode.                                                                                                                                                                                                                |
| <b>Step 2</b> | <b>control-plane</b><br><br><b>Example:</b><br><pre>switch(config)# control-plane switch(config-cp)#</pre>                                      | Enters control plane configuration mode.                                                                                                                                                                                                         |
| <b>Step 3</b> | <b>[no] service-policy input <i>policy-map-name</i></b><br><br><b>Example:</b><br><pre>switch(config-cp)# service-policy input PolicyMapA</pre> | <p>Specifies a policy map for the input traffic. Repeat this step if you have more than one policy map.</p> <p>You cannot disable CoPP. If you enter the <b>no</b> form of this command, packets are rate limited at 50 packets per seconds.</p> |
| <b>Step 4</b> | <b>exit</b><br><br><b>Example:</b><br><pre>switch(config-cp)# exit switch(config)#</pre>                                                        | Exits control plane configuration mode.                                                                                                                                                                                                          |
| <b>Step 5</b> | <b>(Optional) show running-config copp [all]</b><br><br><b>Example:</b><br><pre>switch(config)# show running-config copp</pre>                  | Displays the CoPP configuration.                                                                                                                                                                                                                 |
| <b>Step 6</b> | <b>(Optional) copy running-config startup-config</b><br><br><b>Example:</b><br><pre>switch(config)# copy running-config startup-config</pre>    | Copies the running configuration to the startup configuration.                                                                                                                                                                                   |

### Related Topics

[Configuring a Control Plane Policy Map](#), on page 20

## Configuring the CoPP Scale Factor Per Line Card

You can configure the CoPP scale factor per line card.

The scale factor configuration is used to scale the policer rate of the applied CoPP policy for a particular line card. The accepted value is from 0.10 to 2.00. You can increase or reduce the policer rate for a particular line card without changing the current CoPP policy. The changes are effective immediately, so you do not need to reapply the CoPP policy.

## Procedure

|               | Command or Action                                                                                                                                         | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b><br><pre>switch# configure terminal switch(config)#</pre>                                                 | Enters global configuration mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Step 2</b> | <b>control-plane</b><br><br><b>Example:</b><br><pre>switch(config)# control-plane switch(config-cp)#</pre>                                                | Enters control plane configuration mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Step 3</b> | <b>scale-factor value module<br/>multiple-module-range</b><br><br><b>Example:</b><br><pre>switch(config-cp)# scale-factor 1.10 module 1-2</pre>           | <p>Configures the policer rate per line card. The allowed scale factor value is from 0.10 to 2.00. When the scale factor value is configured, the policing values are multiplied by the corresponding scale factor value of the module, and it is programmed in the particular module.</p> <p>To revert to the default scale factor value of 1.00, use the <b>no scale-factor value module multiple-module-range</b> command, or explicitly set the default scale factor value to 1.00 using the <b>scale-factor 1 module multiple-module-range</b> command.</p> |
| <b>Step 4</b> | <b>(Optional) show policy-map interface control-plane</b><br><br><b>Example:</b><br><pre>switch(config-cp)# show policy-map interface control-plane</pre> | Displays the applied scale factor values when a CoPP policy is applied.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Step 5</b> | <b>(Optional) copy running-config startup-config</b><br><br><b>Example:</b><br><pre>switch(config)# copy running-config startup-config</pre>              | Copies the running configuration to the startup configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## Changing or Reapplying the Default CoPP Policy

You can change to a different default CoPP policy, or you can reapply the same default CoPP policy.

**Procedure**

|               | Command or Action                                                                                                              | Purpose                                                                                                                                                                                           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>[no] copp profile [strict   moderate   lenient   dense]</b><br><br><b>Example:</b><br>switch(config)# copp profile moderate | Applies the CoPP best practice policy.<br><br>You cannot disable CoPP. If you enter the <b>no</b> form of this command, packets are rate limited at 50 packets per seconds.                       |
| <b>Step 2</b> | (Optional) <b>show copp status</b><br><br><b>Example:</b><br>switch(config)# show copp status                                  | Displays the CoPP status, including the last configuration operation and its status. This command also enables you to verify that the CoPP best practice policy is attached to the control plane. |
| <b>Step 3</b> | (Optional) <b>show running-config copp</b><br><br><b>Example:</b><br>switch(config)# show running-config copp                  | Displays the CoPP configuration in the running configuration.                                                                                                                                     |

**Related Topics**

[Changing or Reapplying the Default CoPP Policy Using the Setup Utility](#), on page 36

## Copying the CoPP Best Practice Policy

The CoPP best practice policy is read-only. If you want to modify its configuration, you must copy it.

**Procedure**

|               | Command or Action                                                                                                                                             | Purpose                                                                                                                                                                                   |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>copp copy profile {strict   moderate   lenient   dense} {prefix   suffix} string</b><br><br><b>Example:</b><br>switch# copp copy profile strict prefix abc | Creates a copy of the CoPP best practice policy.<br><br>CoPP renames all class maps and policy maps with the specified prefix or suffix.                                                  |
| <b>Step 2</b> | (Optional) <b>show copp status</b><br><br><b>Example:</b><br>switch# show copp status                                                                         | Displays the CoPP status, including the last configuration operation and its status. This command also enables you to verify that the copied policy is not attached to the control plane. |
| <b>Step 3</b> | (Optional) <b>show running-config copp</b><br><br><b>Example:</b><br>switch# show running-config copp                                                         | Displays the CoPP configuration in the running configuration, including the copied policy configuration.                                                                                  |

# Protocol ACL Filtering for Egress CoPP

The protocol ACL filtering for egress CoPP enables the NX-OS switch to filter all traffic to control plane based on the host MAC, IPv4, and IPv6 address.

## Configuring ARP ACL Filtering for Egress CoPP

You can configure MAC ACL filtering at egress CoPP.

### Before you begin

Ensure that you have configured a control plane policy map.

### Procedure

|               | Command or Action                                                                                                                                             | Purpose                                                                                                                                                                              |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b><br><pre>switch# configure terminal switch(config)#</pre>                                                     | Enters global configuration mode.                                                                                                                                                    |
| <b>Step 2</b> | <b>[no] hardware access-list tcam region erg-copp size</b><br><br><b>Example:</b><br><pre>switch(config)# hardware access-list tcam region erg-copp 128</pre> | Configures the size of the CoPP TCAM region.                                                                                                                                         |
| <b>Step 3</b> | <b>copy running-config startup-config</b><br><br><b>Example:</b><br><pre>switch(config)# copy running-config startup-config</pre>                             | Copies the running configuration to the startup configuration.                                                                                                                       |
| <b>Step 4</b> | <b>reload</b><br><br><b>Example:</b><br><pre>switch(config)# reload</pre>                                                                                     | Reloads the device.<br><br><b>Note</b><br>The new size values are effective only after you enter <b>copy running-config startup-config + reload</b> or reload all line card modules. |
| <b>Step 5</b> | <b>configure terminal</b><br><br><b>Example:</b><br><pre>switch# configure terminal switch(config)#</pre>                                                     | Enters global configuration mode.                                                                                                                                                    |
| <b>Step 6</b> | <b>mac access-list mac-foo-1</b><br><br><b>Example:</b>                                                                                                       |                                                                                                                                                                                      |

|                | Command or Action                                                                                                                                                                                                                                                                                                                                                                                | Purpose                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | switch# mac access-list mac-foo-1<br>switch(config-mac-acl)#                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                  |
| <b>Step 7</b>  | <b>class-map type control-plane [match-all   match-any] class-map-name</b><br><br><b>Example:</b><br>switch(config)# class-map type<br>control-plane match-any c-map2<br>switch(config-cmap)#                                                                                                                                                                                                    | Specifies a control plane class map and enters class map configuration mode. The default class matching is match-any. The name can be a maximum of 64 characters long and is case-sensitive.                     |
| <b>Step 8</b>  | (Optional) <b>match access-group name access-list-name</b><br><br><b>Example:</b><br>switch(config-cmap)# match access-group<br>name IP-foo-1                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                  |
| <b>Step 9</b>  | <b>policy-map type control-plane policy-map-name</b><br><br><b>Example:</b><br>switch(config)# policy-map type<br>control-plane ClassMapA<br>switch(config-pmap)#                                                                                                                                                                                                                                | Specifies a control plane policy map and enters policy map configuration mode. The policy map name can have a maximum of 64 characters and is case-sensitive.                                                    |
| <b>Step 10</b> | <b>class {class-map-name [insert-before class-map-name2]   class-default}</b><br><br><b>Example:</b><br>switch(config-pmap)# class ClassMap2<br>switch(config-pmap-c)#                                                                                                                                                                                                                           | Specifies a control plane class map name or the class default and enters control plane class configuration mode.<br><br>The class-default class map is always at the end of the class map list for a policy map. |
| <b>Step 11</b> | Enter one of the following commands: <ul style="list-style-type: none"> <li>• <b>police [cir] {cir-rate [rate-type]}</b></li> <li>• <b>police [cir] {cir-rate [rate-type]} [bc] burst-size [burst-size-type]</b></li> <li>• <b>police [cir] {cir-rate [rate-type]}} conform transmit [violate drop]</b></li> </ul> <b>Example:</b><br>switch(config-pmap-c)# police cir 52000<br>bc 1000 packets | Specifies the committed information rate (CIR). The rate range is as follows:<br><br>The committed burst (BC) range is as follows:                                                                               |
| <b>Step 12</b> | <b>control-plane Dynamic mode</b><br><br><b>Example:</b><br>switch(config)# control-plane dynamic<br>switch(config-cp-dyn)#                                                                                                                                                                                                                                                                      | Enters the control plane dynamic configuration mode.                                                                                                                                                             |
| <b>Step 13</b> | <b>service-policy-dynamic input policy-map-name</b><br><br><b>Example:</b>                                                                                                                                                                                                                                                                                                                       | Specifies a policy map for the input traffic.                                                                                                                                                                    |

|  | Command or Action                                                 | Purpose |
|--|-------------------------------------------------------------------|---------|
|  | switch(config-cp-dyn)#<br>service-policy-dynamic input PolicyMap1 |         |

## Configuring IP ACL Filtering for Egress CoPP

You can configure IP ACL filtering at egress CoPP.

### Before you begin

Ensure that you have configured a control plane policy map.

### Procedure

|               | Command or Action                                                                                                                                     | Purpose                                                                                                                                                                              |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b><br>switch# configure terminal<br>switch(config)#                                                     | Enters global configuration mode.                                                                                                                                                    |
| <b>Step 2</b> | <b>[no] hardware access-list tcam region erg-copp size</b><br><br><b>Example:</b><br>switch(config)# hardware access-list<br>tcam region erg-copp 128 | Configures the size of the egress CoPP TCAM region.                                                                                                                                  |
| <b>Step 3</b> | <b>copy running-config startup-config</b><br><br><b>Example:</b><br>switch(config)# copy running-config<br>startup-config                             | Copies the running configuration to the startup configuration.                                                                                                                       |
| <b>Step 4</b> | <b>reload</b><br><br><b>Example:</b><br>switch(config)# reload                                                                                        | Reloads the device.<br><br><b>Note</b><br>The new size values are effective only after you enter <b>copy running-config startup-config + reload</b> or reload all line card modules. |
| <b>Step 5</b> | <b>configure terminal</b><br><br><b>Example:</b><br>switch# configure terminal<br>switch(config)#                                                     | Enters global configuration mode.                                                                                                                                                    |
| <b>Step 6</b> | <b>ip access-list IP-foo-1</b><br><br><b>Example:</b><br>switch# ip access-list mac-foo-1<br>switch(config-acl)#                                      |                                                                                                                                                                                      |

|                | Command or Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Purpose                                                                                                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 7</b>  | <b>permit tcp access-list IP-foo-1 eq bgp</b><br><b>Example:</b><br><pre>switch(config-acl)# 10 permit tcp 10.1.1.1/32 10.1.1.2/32 eq bgp</pre>                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                         |
| <b>Step 8</b>  | <b>class-map type control-plane [match-all   match-any] class-map-name</b><br><b>Example:</b><br><pre>switch(config)# class-map type control-plane match-any c-map2 switch(config-cmap)#</pre>                                                                                                                                                                                                                                                                                                          | Specifies a control plane class map and enters class map configuration mode. The default class matching is match-any. The name can be a maximum of 64 characters long and is case sensitive.                            |
| <b>Step 9</b>  | <b>match access-group name access-list-name</b><br><b>Example:</b><br><pre>switch(config-cmap)# match access-group name IP-foo-1</pre>                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |
| <b>Step 10</b> | <b>policy-map type control-plane policy-map-name</b><br><b>Example:</b><br><pre>switch(config)# policy-map type control-plane ClassMapA switch(config-pmap)#</pre>                                                                                                                                                                                                                                                                                                                                      | Specifies a control plane policy map and enters policy map configuration mode. The policy map name can have a maximum of 64 characters and is case sensitive.                                                           |
| <b>Step 11</b> | <b>class {class-map-name [insert-before class-map-name2]   class-default}</b><br><b>Example:</b><br><pre>switch(config-pmap)# class ClassMap2 switch(config-pmap-c)#</pre>                                                                                                                                                                                                                                                                                                                              | <p>Specifies a control plane class map name or the class default and enters control plane class configuration mode.</p> <p>The class-default class map is always at the end of the class map list for a policy map.</p> |
| <b>Step 12</b> | <p>Enter one of the following commands:</p> <ul style="list-style-type: none"> <li>• <b>police [cir] {cir-rate [rate-type]}</b></li> <li>• <b>police [cir] {cir-rate [rate-type]} [bc] burst-size [burst-size-type]</b></li> <li>• <b>police [cir] {cir-rate [rate-type]]} conform transmit [violate drop]</b></li> </ul> <b>Example:</b><br><pre>switch(config-pmap-c)# police cir 52000 bc 1000 packets</pre> <b>Example:</b><br><pre>switch(config-pmap-c)# police cir 3400 kbps bc 200 kbytes</pre> | <p>Specifies the committed information rate (CIR). The rate range is as follows:</p> <p>The committed burst (BC) range is as follows:</p>                                                                               |
| <b>Step 13</b> | <b>control-plane Dynamic mode</b><br><b>Example:</b><br><pre>switch(config)# control-plane dynamic switch(config-cp-dyn)#</pre>                                                                                                                                                                                                                                                                                                                                                                         | Enters the control plane dynamic configuration mode.                                                                                                                                                                    |

|                | Command or Action                                                                                                                                                  | Purpose                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>Step 14</b> | <b>service-policy-dynamic input</b><br><i>policy-map-name</i><br><br><b>Example:</b><br><pre>switch(config-cp-dyn) # service-policy-dynamic input PolicyMap1</pre> | Specifies a policy map for the input traffic.<br>END |

## Verifying the CoPP Configuration

To display CoPP configuration information, perform one of the following tasks:

| Command                                                                                            | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>show policy-map type control-plane</b> [ <b>expand</b> ] [ <b>name</b> <i>policy-map-name</i> ] | Displays the control plane policy map with associated class maps and CIR and BC values.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>show policy-map interface control-plane</b>                                                     | <p>Displays the policy values with associated class maps and drops per policy or class map. It also displays the scale factor values when a CoPP policy is applied. When the scale factor value is the default (1.00), it is not displayed.</p> <p><b>Note</b><br/>The scale factor changes the CIR and BC values internally on each module, but the display shows the configured CIR and BC values only. The actual applied value on a module is the scale factor multiplied by the configured value.</p> |
| <b>show class-map type control-plane</b> [ <i>class-map-name</i> ]                                 | Displays the control plane class map configuration, including the ACLs that are bound to this class map.                                                                                                                                                                                                                                                                                                                                                                                                   |

| Command                                                                                                                                              | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>show copp diff profile {strict   moderate   lenient   dense} [prior-ver] profile {strict   moderate   lenient   dense} show copp diff profile</b> | <p>Displays the difference between two CoPP best practice policies.</p> <p>When you do not include the prior-ver option, this command displays the difference between two currently applied default CoPP best practice policies (such as the currently applied strict and currently applied moderate policies).</p> <p>When you include the prior-ver option, this command displays the difference between a currently applied default CoPP best practice policy and a previously applied default CoPP best practice policy (such as the currently applied strict and the previously applied lenient policies).</p> |
| <b>show copp profile {strict   moderate   lenient   dense}</b>                                                                                       | Displays the details of the CoPP best practice policy, along with the classes and policer values.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>show running-config aclmgr [all]</b>                                                                                                              | Displays the user-configured access control lists (ACLs) in the running configuration. The <b>all</b> option displays both the default (CoPP-configured) and user-configured ACLs in the running configuration.                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>show running-config copp [all]</b>                                                                                                                | Displays the CoPP configuration in the running configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>show startup-config aclmgr [all]</b>                                                                                                              | Displays the user-configured access control lists (ACLs) in the startup configuration. The <b>all</b> option displays both the default (CoPP-configured) and user-configured ACLs in the startup configuration.                                                                                                                                                                                                                                                                                                                                                                                                     |

# Displaying the CoPP Configuration Status

## Procedure

|               | Command or Action               | Purpose                                                 |
|---------------|---------------------------------|---------------------------------------------------------|
| <b>Step 1</b> | switch# <b>show copp status</b> | Displays the configuration status for the CoPP feature. |

## Example

This example shows how to display the CoPP configuration status:

```
switch# show copp status
```

## CoPP Consistency Checker

Beginning with Cisco NX-OS Release 10.5(2)F, CoPP consistency checker is introduced to ensure the consistency of all SUP related ACLs across the Software, HAL, and Hardware layers. This feature is supported on Cisco Nexus 9300-FX3/GX/GX2/HX, Nexus 9808, and Nexus 9804 series switches.



**Note** Beginning with Cisco NX-OS Release 10.5(3)F, the **show consistency-checker copp extended module** command is deprecated. For more information on the CoPP consistency checker, see the **Consistency Checker Commands** section of *Cisco Nexus 9000 Series NX-OS Troubleshooting Guide, Release 10.5(x)*.

## Procedure

|               | Command or Action                                                                               | Purpose                                                                                                                                                                                    |
|---------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | switch# <b>show consistency-checker copp extended module &lt;module_no&gt; [brief   detail]</b> | Performs CoPP consistency check.<br><br><b>brief</b> – shows consistency checker structured output in brief.<br><br><b>detail</b> - shows consistency checker structured output in detail. |

# Monitoring CoPP

## Procedure

|               | Command or Action                                      | Purpose                                                                                                                                                                                                                                               |
|---------------|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | switch# <b>show policy-map interface control-plane</b> | Displays packet-level statistics for all classes that are part of the applied CoPP policy.<br><br>Statistics are specified in terms of OutPackets (packets admitted to the control plane) and DropPackets (packets dropped because of rate limiting). |

## Example

This example shows how to monitor CoPP:

```
switch# show policy-map interface control-plane
Control Plane

Service-policy input: copp-system-p-policy-strict

class-map copp-system-p-class-critical (match-any)
set cos 7
police cir 19000 pps , bc 128 packets
module 4 :
    transmitted 373977 packets;
    dropped 0 packets;
```

# Monitoring CoPP with SNMP

Beginning with Cisco Nexus Release 9.2(3), CoPP supports the Cisco class-based QoS MIB (cbQoS MIB). All CoPP elements can now be monitored (but not modified) using SNMP. This feature applies only to policies and their subelements (such as classes, match rules, and set actions) that are attached to the control plane. Elements of policies that are not in service on the control plane are not visible through SNMP.

The following cbQoS MIB tables are supported:

- ccbQosServicePolicy
- cbQosInterfacePolicy
- cbQosObjects
- cbQosPolicyMapCfg
- cbQosClassMapCfg
- cbQosMatchStmtCfg
- cbQosPoliceCfg

- cbQosSetCfg



**Note** SNMP MIB is not supported for Dynamic CoPP.

## Clearing the CoPP Statistics

### Procedure

|               | Command or Action                                                 | Purpose                                                                                                                                                                                                                                                                                                                                        |
|---------------|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | (Optional) switch# <b>show policy-map interface control-plane</b> | Displays the currently applied CoPP policy and per-class statistics.                                                                                                                                                                                                                                                                           |
| <b>Step 2</b> | switch# <b>clear copp statistics</b>                              | <p>Clears the CoPP statistics.</p> <p><b>Note</b><br/>On Cisco Nexus 9800 Series switches with N9K-X9836DM-A and N9K-X98900CD-A line cards, N9K-C9232E-B1, 9364E-SG2, and N9324C-SE1U switches, the <b>clear copp statistics</b> command clears the CoPP statistics for all the policers except the <b>hardware rate-limiter</b> policers.</p> |

### Example

This example shows how to clear the CoPP statistics for your installation:

```
switch# show policy-map interface control-plane
switch# clear copp statistics
```

## Configuration Examples for CoPP

This section includes example CoPP configurations.

### CoPP Configuration Example

The following example shows how to configure CoPP using IP ACLs and MAC ACLs:

```
configure terminal
ip access-list copp-system-p-acl-igmp
permit igmp any 10.0.0.0/24

ip access-list copp-system-p-acl-msdp
permit tcp any any eq 639
```

```
mac access-list copp-system-p-acl-arp
permit any any 0x0806

ip access-list copp-system-p-acl-tacas
permit udp any any eq 49

ip access-list copp-system-p-acl-ntp
permit udp any 10.0.1.1/23 eq 123

ip access-list copp-system-p-acl-icmp
permit icmp any any

class-map type control-plane match-any copp-system-p-class-critical
match access-group name copp-system-p-acl-igmp
match access-group name copp-system-p-acl-msdp

class-map type control-plane match-any copp-system-p-class-normal
match access-group name copp-system-p-acl-icmp
match exception ip icmp redirect
match exception ip icmp unreachable
match exception ip option

policy-map type control-plane copp-system-p-policy

class copp-system-p-class-critical
police cir 19000 pps bc 128 packets conform transmit violate drop

class copp-system-p-class-important
police cir 500 pps bc 128 packets conform transmit violate drop

class copp-system-p-class-normal
police cir 300 pps bc 32 packets conform transmit violate drop

class class-default
police cir 50 pps bc 32 packets conform transmit violate drop

control-plane
service-policy input copp-system-p-policy
```

#### Create CoPP class and associate ACL:

```
class-map type control-plane copp-arp-class
match access-group name copp-arp-acl
```

#### Add the class to the CoPP policy:

```
policy-map type control-plane copp-system-policy
class copp-arp-class
police pps 500
```

#### The following example shows to customize COPP limit:

```
copp copy profile strict suffix CUSTOMIZED-COPP
policy-map type control-plane copp-policy-strict-CUSTOMIZED-COPP
class copp-class-redirect-CUSTOMIZED-COPP
police cir 1500 mbps bc 125 mbytes conform transmit violate drop
control-plane
service-policy input copp-policy-strict-CUSTOMIZED-COPP
```

## Changing or Reapplying the Default CoPP Policy Using the Setup Utility

The following example shows how to change or reapply the default CoPP policy using the setup utility.

```
switch# setup

----- Basic System Configuration Dialog -----

This setup utility will guide you through the basic configuration of
the system. Setup configures only enough connectivity for management
of the system.

*Note: setup is mainly used for configuring the system initially,
when no configuration is present. So setup always assumes system
defaults and not the current system configuration values.

Press Enter at anytime to skip a dialog. Use ctrl-c at anytime
to skip the remaining dialogs.

Would you like to enter the basic configuration dialog (yes/no): yes

Do you want to enforce secure password standard (yes/no) [y]: <CR>

Create another login account (yes/no) [n]: n

Configure read-only SNMP community string (yes/no) [n]: n

Configure read-write SNMP community string (yes/no) [n]: n

Enter the switch name : <CR>

Enable license grace period? (yes/no) [n]: n

Continue with Out-of-band (mgmt0) management configuration? (yes/no) [y]: n

Configure the default gateway? (yes/no) [y]: n

Configure advanced IP options? (yes/no) [n]: <CR>

Enable the telnet service? (yes/no) [n]: y

Enable the ssh service? (yes/no) [y]: <CR>

Type of ssh key you would like to generate (dsa/rsa) : <CR>

Configure the ntp server? (yes/no) [n]: n

Configure default interface layer (L3/L2) [L3]: <CR>

Configure default switchport interface state (shut/noshut) [shut]: <CR>

Configure best practices CoPP profile (strict/moderate/lenient/dense/skip) [strict]:
strict

The following configuration will be applied:
password strength-check
no license grace-period
no telnet server enable
no system default switchport
system default switchport shutdown
```

```
policy-map type control-plane copp-system-p-policy

Would you like to edit the configuration? (yes/no) [n]: <CR>

Use this configuration and save it? (yes/no) [y]: y

switch#
```

## Changing CoPP Policy limit

The following examples shows to change CoPP limit to set PTP state stable across PTP interfaces.

```
copp copy profile strict suffix CUSTOMIZED-COPP
policy-map type control-plane copp-policy-strict-CUSTOMIZED-COPP
class copp-class-redirect-CUSTOMIZED-COPP
police cir 1500 mbps bc 125 mbytes conform transmit violate drop
control-plane
service-policy input copp-policy-strict-CUSTOMIZED-COPP
```

## Additional References for CoPP

This section provides additional information related to implementing CoPP.

### Related Documents

| Related Topic | Document Title                     |
|---------------|------------------------------------|
| Licensing     | <i>Cisco NX-OS Licensing Guide</i> |

### Standards

| Standards | Title                         |
|-----------|-------------------------------|
| RFC 2698  | A Two Rate Three Color Marker |

