



# Configuring Control Plane Policing

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This chapter describes how to configure Control Plane Policing (CoPP) on a Cisco NX-OS device.

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## Information 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 destined to any of the IP addresses of the router or Layer 3 switch. 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. Attacks on the supervisor module can be of various types such as DoS that generates IP traffic streams to the control plane at a very high rate. These attacks force the control plane to spend a large amount of time in handling these packets and prevents the control plane from processing genuine traffic.

Examples of DoS attacks are as follows:

- 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



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**Caution**

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

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## Control Plane Protection

To protect the control plane, the Cisco NX-OS device segregates different packets destined to 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.

### Redirected packets

Packets that are redirected to the supervisor module. Features like Dynamic Host Configuration Protocol (DHCP) snooping or dynamic Address Resolution Protocol (ARP) inspection redirect some packets 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 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.

The following parameters can be used to classify a packet:

- Source IP address
- Destination IP address
- Source port

- Destination port
- Layer 4 protocol

## 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.

The policing rate is specified in terms of packets per second (PPS). Each classified flow can be policed individually by specifying a policing rate limit in PPS.

## CoPP Policy Templates

When you bring up your Cisco NX-OS device for the first time, the Cisco NX-OS software installs the default `copp-system-policy` to protect the supervisor module from DoS attacks. You can choose the CoPP policy template for your deployment scenario by specifying CoPP policy options from the initial setup utility:

- Default—Layer 2 and Layer 3 policy which provides a good balance of policing between switched and routed traffic bound to CPU.
- Layer 2—Layer 2 policy which gives more preference to the Layer 2 traffic (eg BPDU) bound to the CPU
- Layer 3—Layer 3 policy which gives more preference to the Layer 3 traffic (eg BGP, RIP, OSPF etc ) bound to the CPU

If you do not select an option or choose not to execute the setup utility, the Cisco NX-OS software applies the Default policing. Cisco recommends starting with the default policy and later modifying the CoPP policies as required.

The default `copp-system-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.

You can switch across default, Layer 2 and Layer 3 templates by entering the setup utility again using the `setup` command.

## Default CoPP Policy

This policy is applied to the switch by default. It has the classes with policer rates that should suit most network installations. You cannot modify this policy or the class maps associated with it. In addition, you cannot modify the class map configurations in this policy.

This policy has the following configuration:

```
policy-map type control-plane copp-system-policy
  class copp-s-selfIp
    police pps 500
  class copp-s-default
    police pps 400
  class copp-s-l2switched
    police pps 200
  class copp-s-ping
    police pps 100
```

```
class copp-s-l3destmiss
  police pps 100
class copp-s-glean
  police pps 500
class copp-s-l3mtufail
  police pps 100
class copp-s-ttl1
  police pps 100
class copp-s-ipmcmis
  police pps 400
class copp-s-l3slowpath
  police pps 100
class copp-s-dhcpreq
  police pps 300
class copp-s-dhcpresp
  police pps 300
class copp-s-dai
  police pps 300
class copp-s-igmp
  police pps 400
class copp-s-routingProto2
  police pps 1300
class copp-s-v6routingProto2
  police pps 1300
class copp-s-eigrp
  police pps 200
class copp-s-pimreg
  police pps 200
class copp-s-pimautorp
  police pps 200
class copp-s-routingProto1
  police pps 1000
class copp-s-arp
  police pps 200
class copp-s-ntp
  police pps 1000
class copp-s-bfd
  police pps 350
class copp-s-bpdu
  police pps 12000
class copp-icmp
  police pps 200
class copp-telnet
  police pps 500
class copp-ssh
  police pps 500
class copp-snmp
  police pps 500
class copp-ntp
  police pps 100
class copp-tacacsradius
  police pps 400
class copp-stftp
  police pps 300
```

## Layer 2 CoPP Policy

This policy has the following configuration:

```
policy-map type control-plane copp-system-policy
  class copp-s-selfIp
    police pps 500
  class copp-s-default
    police pps 400
  class copp-s-l2switched
    police pps 200
  class copp-s-ping
    police pps 100
  class copp-s-l3destmiss
    police pps 100
```

```

class copp-s-glean
  police pps 500
class copp-s-l3mtufail
  police pps 100
class copp-s-ttl1
  police pps 100
class copp-s-ipmcmis
  police pps 400
class copp-s-l3slowpath
  police pps 100
class copp-s-dhcpreq
  police pps 300
class copp-s-dhcpresp
  police pps 300
class copp-s-dai
  police pps 300
class copp-s-igmp
  police pps 400
class copp-s-routingProto2
  police pps 1200
class copp-s-v6routingProto2
  police pps 1200
class copp-s-eigrp
  police pps 200
class copp-s-pimreg
  police pps 200
class copp-s-pimautorp
  police pps 200
class copp-s-routingProto1
  police pps 900
class copp-s-arp
  police pps 200
class copp-s-ntp
  police pps 1000
class copp-s-bfd
  police pps 350
class copp-s-bpdu
  police pps 12300
class copp-icmp
  police pps 200
class copp-telnet
  police pps 500
class copp-ssh
  police pps 500
class copp-snmp
  police pps 500
class copp-ntp
  police pps 100
class copp-tacacsradius
  police pps 400
class copp-stftp
  police pps 400

```

## Layer 3 CoPP Policy

This policy has the following configuration:

```

policy-map type control-plane copp-system-policy
  class copp-s-selfIp
    police pps 500
  class copp-s-default
    police pps 400
  class copp-s-l2switched
    police pps 200
  class copp-s-ping
    police pps 100
  class copp-s-l3destmiss
    police pps 100
  class copp-s-glean

```

```
    police pps 500
class copp-s-l3mtufail
    police pps 100
class copp-s-ttl1
    police pps 100
class copp-s-ipmcmis
    police pps 400
class copp-s-l3slowpath
    police pps 100
class copp-s-dhcpreq
    police pps 300
class copp-s-dhcpresp
    police pps 300
class copp-s-dai
    police pps 300
class copp-s-igmp
    police pps 400
class copp-s-routingProto2
    police pps 4000
class copp-s-v6routingProto2
    police pps 1600
class copp-s-eigrp
    police pps 200
class copp-s-pimreg
    police pps 200
class copp-s-pimautorp
    police pps 200
class copp-s-routingProtol
    police pps 4000
class copp-s-arp
    police pps 200
class copp-s-ntp
    police pps 1000
class copp-s-bfd
    police pps 350
class copp-s-bpdu
    police pps 6000
class copp-icmp
    police pps 200
class copp-telnet
    police pps 500
class copp-ssh
    police pps 500
class copp-snmp
    police pps 500
class copp-ntp
    police pps 100
class copp-tacacsradius
    police pps 400
class copp-stftp
    police pps 400
```

## CoPP Class Maps

Classes within a policy are of two types:

- **Static**—These classes are part of every policy template and cannot be removed from the policy or CoPP configuration. Static classes would typically contain the traffic which is deemed critical to device operation and is required in the policy.
- **Dynamic**—These classes can be created, added or removed from a policy. Using dynamic classes, you can create classes/policing for CPU bound traffic specific to their requirements.

**Note**

Classes with names copp-s-x are static classes.

ACLs can be associated with both static and dynamic classes.

## 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).

## 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.

## Licensing Requirements for CoPP

The following table shows the licensing requirements for this feature:

Product	License Requirement
Cisco NX-OS	CoPP requires no license. Any feature not included in a license package is bundled with the Cisco NX-OS system images and is provided at no extra charge to you. For an explanation of the Cisco NX-OS licensing scheme, see the <i>Cisco NX-OS Licensing Guide</i> .

## Guidelines and Limitations for CoPP

CoPP has the following configuration guidelines and limitations:

- Cisco recommends that you choose the default, L2, or L3 policy, depending upon your deployment scenario and later modify the CoPP policies based on observed behavior.
- Customizing CoPP is an ongoing process. CoPP must be configured according to the protocols and features used in your specific environment as well as the supervisor features that are required by the server environment. As these protocols and features change, CoPP must be modified.
- Cisco recommends 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 use a different CoPP policy or modify the customized CoPP policy.



- The Cisco NX-OS software does not support egress CoPP or silent mode. CoPP is supported only on ingress (**service-policy output copp** cannot be applied to the control plane interface).
- The creation of new CoPP policies is not supported.
- IPv6 and IPv4 CoPP ACL entries use different TCAM regions. For IPv6 CoPP to work, the IPv6 ACL SUP team region (ipv6-sup) needs to be carved to a non- zero size. For more information, see the [ACL TCAM Regions](#) and [Configuring ACL TCAM Region Sizes](#) topics.

## Upgrade Guidelines for CoPP

If you upgrade from a Cisco NX-OS release that does not support the CoPP feature to a release that does support the CoPP feature, you must run the setup utility after the upgrade to enable CoPP on the device. Not configuring CoPP protection can leave your NX-OS device vulnerable to DoS attacks.

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 additional classes for new protocols, you must run the setup utility for the new CoPP classes to be available.

For example, if you upgrade from Cisco NX-OS Release 5.0(3)U2(2) (which supports the CoPP feature) to Cisco NX-OS Release 5.0(3)U3(1) (which adds CoPP classes for IPv6 support), you must run the setup script to enable the IPv6 CoPP feature on the device.

Because the setup script modifies the policing rates corresponding to different flows coming into the CPU, we recommend that you run the setup script during a scheduled maintenance period and not during a time when there is traffic on the device.

## Configuring 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 IPv4 or 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
Step 1	<b>configure terminal</b>  <b>Example:</b> switch# configure terminal switch(config)#	Enters global configuration mode.

	Command or Action	Purpose
<b>Step 2</b>	<b>class-map type control-plane match-any</b> <i>class-map-name</i>  <b>Example:</b> <pre>switch(config)# class-map type control-plane ClassMapA 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>Note</b> You cannot use class-default, match-all, or match-any as class map names.
<b>Step 3</b>	<b>match access-group name</b> <i>access-list-name</i>  <b>Example:</b> <pre>switch(config-cmap)# match access-group name MyAccessList</pre>	(Optional) Specifies matching for an IP ACL. You can repeat this step to match more than one IP ACL.  <b>Note</b> The <b>permit</b> and <b>deny</b> ACL keywords are ignored in the CoPP matching.
<b>Step 4</b>	<b>exit</b>  <b>Example:</b> <pre>switch(config-cmap)# exit switch(config)#</pre>	Exits class map configuration mode.
<b>Step 5</b>	<b>show class-map type control-plane</b> <i>[class-map-name]</i>  <b>Example:</b> <pre>switch(config)# show class-map type control-plane</pre>	(Optional) Displays the control plane class map configuration.
<b>Step 6</b>	<b>copy running-config startup-config</b>  <b>Example:</b> <pre>switch(config)# copy running-config startup-config</pre>	(Optional) 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 default PPS for that class is 0.

You can configure policies for IPv4 or IPv6 packets.

### Before You Begin

Ensure that you have configured a control plane class map.

## Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> switch# configure terminal switch(config)#	Enters global configuration mode.
<b>Step 2</b>	<b>policy-map type control-plane</b> <i>policy-map-name</i>  <b>Example:</b> switch(config)# policy-map type control-plane copp-system-policy 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 3</b>	<b>class</b> { <i>class-map-name</i> [ <b>insert-before</b> <i>class-map-name2</i> ]   <b>class</b> }  <b>Example:</b> switch(config-pmap)# class ClassMapA switch(config-pmap-c)#	Specifies a control plane class map name or the class default and enters control plane class configuration mode.
<b>Step 4</b>	<b>police</b> [pps] { <i>pps-value</i> }  <b>Example:</b> switch(config-pmap-c)# police pps 100	Specifies the rate limit in terms of packets per second ( PPS ). The PPS range is 0 - 20,000. The default PPS is 0.
<b>Step 5</b>	<b>exit</b>  <b>Example:</b> switch(config-pmap-c)# exit switch(config-pmap)#	Exits policy map class configuration mode.
<b>Step 6</b>	<b>exit</b>  <b>Example:</b> switch(config-pmap)# exit switch(config)#	Exits policy map configuration mode.
<b>Step 7</b>	<b>show policy-map type control-plane</b> [expand] [name <i>class-map-name</i> ]  <b>Example:</b> switch(config)# show policy-map type control-plane	(Optional) Displays the control plane policy map configuration.
<b>Step 8</b>	<b>copy running-config startup-config</b>  <b>Example:</b> switch(config)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

## Configuring the Control Plane Service Policy

### Before You Begin

Configure a control plane policy map.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> switch# configure terminal switch(config)#	Enters global configuration mode.
<b>Step 2</b>	<b>control-plane</b>  <b>Example:</b> switch(config) # control-plane switch(config-cp)#	Enters control plane configuration mode.
<b>Step 3</b>	<b>[no] service-policy input <i>policy-map-name</i></b>  <b>Example:</b> switch(config-cp)# service-policy input copp-system-policy	Specifies a policy map for the input traffic.
<b>Step 4</b>	<b>exit</b>  <b>Example:</b> switch(config-cp)# exit switch(config)#	Exits control plane configuration mode.
<b>Step 5</b>	<b>show running-config copp [all]</b>  <b>Example:</b> switch(config)# show running-config copp	(Optional) Displays the CoPP configuration.
<b>Step 6</b>	<b>copy running-config startup-config</b>  <b>Example:</b> switch(config)# copy running-config startup-config	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

## CoPP Show Commands

To display CoPP configuration information, enter one of the following show commands:

Command	Purpose
<b>show ip access-lists</b> [ <i>acl-name</i> ]	Displays all IPv4 ACLs configured in the system, including the CoPP ACLs.
<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.
<b>show ipv6 access-lists</b>	Displays all of the IPv6 ACLs configured on the device, including the CoPP IPv6 ACLs.
<b>show arp access-lists</b>	Displays all of the ARP ACLs configured on the device, including the CoPP ARP ACLs.
<b>show policy-map type control-plane</b> [ <i>expand</i> ] [ <i>name policy-map-name</i> ]	Displays the control plane policy map with associated class maps and PPS values.
<b>show running-config copp</b> [ <i>all</i> ]	Displays the CoPP configuration in the running configuration.
<b>show running-config aclmgr</b> [ <i>all</i> ]	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 startup-config copp</b> [ <i>all</i> ]	Displays the CoPP configuration in the startup configuration.
<b>show startup-config aclmgr</b> [ <i>all</i> ]	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>	<b>show copp status</b>  <b>Example:</b> switch# show copp status	Displays the configuration status for the CoPP feature.

## Monitoring CoPP

### Procedure

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

## Clearing the CoPP Statistics

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>show policy-map interface control-plane</b>  <b>Example:</b> switch# show policy-map interface control-plane	(Optional) Displays the currently applied CoPP policy and per-class statistics.
<b>Step 2</b>	<b>clear copp statistics</b>  <b>Example:</b> switch# clear copp statistics	Clears the CoPP statistics.

# CoPP Configuration Examples

## Creating an IP ACL

```
ip access-list copp-sample-acl
permit udp any any eq 3333
permit udp any any eq 4444
```

## Creating a Sample CoPP Class with an Associated IP ACL

The following example shows how to create a new CoPP class and associated ACL:

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

The following example shows how to add a class to a CoPP policy:

```
policy-map type control-plane copp-system-policy
Class copp-sample-class
Police pps 100
```

The following example shows how to modify the PPS for an existing class (copp-s-bpdu):

```
policy-map type control-plane copp-system-policy
Class copp-s-bpdu
Police pps <new_pps_value>
```

## Creating a Dynamic Class (IPv6 ACL)

The following example shows how to create an IPv6 ACL

```
ipv6 access-list copp-system-acl-eigrp6
10 permit 88 any ff02::a/128
```

The following example shows how to associate an ACL with an existing or new CoPP class:

```
class-map type control-plane copp-s-eigrp
match access-grp name copp-system-acl-eigrp6
```

The following example shows how to add a class to a CoPP policy, if the class has not already been added:

```
policy-map type control-plane copp-system-policy
class copp-s-eigrp
police pps 100
```

## Creating an ARP ACL-Based Dynamic Class

ARP ACLs use ARP TCAM. The default size of this TCAM is 0. Before ARP ACLs can be used with CoPP, this TCAM needs to be carved for a non-zero size.

```
hardware profile tcam region arpacl 128
copy running-config startup-config
reload
```

## Creating an ARP ACL

```
arp access-list copp-arp-acl
permit ip 20.1.1.1 255.255.255.0 mac any
```

The procedure to associate an ARP ACLs with a class, and adding that class to the CoPP policy, is the same as the procedure for IP ACLs.

## Creating a CoPP Class and Associating an ARP ACL

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

**Removing a Class from a CoPP Policy**

```
policy-map type control-plane copp-system-policy
  no class-abc
```

**Removing a Class from the System**

```
no class-map type control-plane copp-abc
```

**Using the insert-before option to see if a packet matches multiple classes and the priority needs to be assigned to one of them**

```
policy-map type control-plan copp-system-policy
class copp-ping insert-before copp-icmp
```

## Sample CoPP Configuration

The following example shows a sample CoPP configuration with ACLs, classes, policies, and individual class policing:

```
IP access list copp-system-acl-eigrp
  10 permit eigrp any 224.0.0.10/32
IP access list copp-system-acl-icmp
  10 permit icmp any any
IP access list copp-system-acl-igmp
  10 permit igmp any any
IP access list copp-system-acl-ntp
  10 permit udp any any eq ntp
  20 permit udp any eq ntp any
IP access list copp-system-acl-pimreg
  10 permit pim any any
IP access list copp-system-acl-ping
  10 permit icmp any any echo
  20 permit icmp any any echo-reply
IP access list copp-system-acl-routingprotol
  10 permit tcp any gt 1024 any eq bgp
  20 permit tcp any eq bgp any gt 1024
  30 permit udp any 224.0.0.0/24 eq rip
  40 permit tcp any gt 1024 any eq 639
  50 permit tcp any eq 639 any gt 1024
  70 permit ospf any any
  80 permit ospf any 224.0.0.5/32
  90 permit ospf any 224.0.0.6/32
IP access list copp-system-acl-routingproto2
  10 permit udp any 224.0.0.0/24 eq 1985
  20 permit 112 any 224.0.0.0/24
IP access list copp-system-acl-snmpp
  10 permit udp any any eq snmp
  20 permit udp any any eq snmptrap
IP access list copp-system-acl-ssh
  10 permit tcp any any eq 22
  20 permit tcp any eq 22 any
IP access list copp-system-acl-stftpp
  10 permit udp any any eq tftp
  20 permit udp any any eq 1758
  30 permit udp any eq tftp any
  40 permit udp any eq 1758 any
  50 permit tcp any any eq 115
  60 permit tcp any eq 115 any
IP access list copp-system-acl-tacacsradius
  10 permit tcp any any eq tacacs
  20 permit tcp any eq tacacs any
  30 permit udp any any eq 1812
  40 permit udp any any eq 1813
  50 permit udp any any eq 1645
  60 permit udp any any eq 1646
  70 permit udp any eq 1812 any
```



```

    80 permit udp any eq 1813 any
    90 permit udp any eq 1645 any
    100 permit udp any eq 1646 any
IP access list copp-system-acl-telnet
    10 permit tcp any any eq telnet
    20 permit tcp any any eq 107
    30 permit tcp any eq telnet any
    40 permit tcp any eq 107 any
IP access list copp-system-dhcp-relay
    10 permit udp any eq bootps any eq bootps
IP access list test
    statistics per-entry
    10 permit ip 1.2.3.4/32 5.6.7.8/32 [match=0]
    20 permit udp 11.22.33.44/32 any [match=0]
    30 deny udp 1.1.1.1/32 any [match=0]

IPv6 access list copp-system-acl-dhccp6
    10 permit udp any any eq 546
IPv6 access list copp-system-acl-dhcps6
    10 permit udp any ff02::1:2/128 eq 547
    20 permit udp any ff05::1:3/128 eq 547
IPv6 access list copp-system-acl-eigrp6
    10 permit 88 any ff02::a/128
IPv6 access list copp-system-acl-v6routingProto2
    10 permit udp any ff02::66/128 eq 2029
    20 permit udp any ff02::fb/128 eq 5353
IPv6 access list copp-system-acl-v6routingprotol
    10 permit 89 any ff02::5/128
    20 permit 89 any ff02::6/128
    30 permit udp any ff02::9/128 eq 521

class-map type control-plane match-any copp-icmp
    match access-group name copp-system-acl-icmp
class-map type control-plane match-any copp-ntp
    match access-group name copp-system-acl-ntp
class-map type control-plane match-any copp-s-arp
class-map type control-plane match-any copp-s-bfd
class-map type control-plane match-any copp-s-bpdu
class-map type control-plane match-any copp-s-dai
class-map type control-plane match-any copp-s-default
class-map type control-plane match-any copp-s-dhcpreq
    match access-group name copp-system-acl-dhcps6
class-map type control-plane match-any copp-s-dhcpresp
    match access-group name copp-system-acl-dhccp6
    match access-group name copp-system-dhcp-relay
class-map type control-plane match-any copp-s-eigrp
    match access-group name copp-system-acl-eigrp
    match access-group name copp-system-acl-eigrp6
class-map type control-plane match-any copp-s-glean
class-map type control-plane match-any copp-s-igmp
    match access-group name copp-system-acl-igmp
class-map type control-plane match-any copp-s-ipmcmis
class-map type control-plane match-any copp-s-l2switched
class-map type control-plane match-any copp-s-l3destmiss
class-map type control-plane match-any copp-s-l3mtufail
class-map type control-plane match-any copp-s-l3slowpath
class-map type control-plane match-any copp-s-pimautorp
class-map type control-plane match-any copp-s-pimreg
    match access-group name copp-system-acl-pimreg
class-map type control-plane match-any copp-s-ping
    match access-group name copp-system-acl-ping
class-map type control-plane match-any copp-s-ptp
class-map type control-plane match-any copp-s-routingProto1
    match access-group name copp-system-acl-routingprotol
    match access-group name copp-system-acl-v6routingprotol
class-map type control-plane match-any copp-s-routingProto2
    match access-group name copp-system-acl-routingproto2
class-map type control-plane match-any copp-s-selfIp
class-map type control-plane match-any copp-s-ttl1
class-map type control-plane match-any copp-s-v6routingProto2
    match access-group name copp-system-acl-v6routingProto2
class-map type control-plane match-any copp-snmp
    match access-group name copp-system-acl-snmp

```

```

class-map type control-plane match-any copp-ssh
  match access-group name copp-system-acl-ssh
class-map type control-plane match-any copp-stftp
  match access-group name copp-system-acl-stftp
class-map type control-plane match-any copp-tacacsradius
  match access-group name copp-system-acl-tacacsradius
class-map type control-plane match-any copp-telnet
  match access-group name copp-system-acl-telnet
policy-map type control-plane copp-system-policy
  class copp-s-selfIp
    police pps 500
  class copp-s-default
    police pps 400
  class copp-s-l2switched
    police pps 200
  class copp-s-ping
    police pps 100
  class copp-s-l3destmiss
    police pps 100
  class copp-s-glean
    police pps 500
  class copp-s-l3mtufail
    police pps 100
  class copp-s-ttl1
    police pps 100
  class copp-s-ipmcmis
    police pps 400
  class copp-s-l3slowpath
    police pps 100
  class copp-s-dhcpreq
    police pps 300
  class copp-s-dhcpresp
    police pps 300
  class copp-s-dai
    police pps 300
  class copp-s-igmp
    police pps 400
  class copp-s-routingProto2
    police pps 1300
  class copp-s-v6routingProto2
    police pps 1300
  class copp-s-eigrp
    police pps 200
  class copp-s-pimreg
    police pps 200
  class copp-s-pimautorp
    police pps 200
  class copp-s-routingProto1
    police pps 1000
  class copp-s-arp
    police pps 200
  class copp-s-ptp
    police pps 1000
  class copp-s-bfd
    police pps 350
  class copp-s-bpdu
    police pps 12000
  class copp-icmp
    police pps 200
  class copp-telnet
    police pps 500
  class copp-ssh
    police pps 500
  class copp-snmp
    police pps 500
  class copp-ntp
    police pps 100
  class copp-tacacsradius
    police pps 400
  class copp-stftp
    police pps 400
control-plane
  service-policy input copp-system-policy

```

## Example: 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

  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 : switch

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

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

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

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

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

  Configure CoPP System Policy Profile ( default / 12 / 13 ) [default]: 12

The following configuration will be applied:
switchname switch
telnet server enable
no ssh server enable
policy-map type control-plane copp-system-policy ( 12 )

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

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

[#####] 100%
```

## 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>
Command reference	<i>Cisco Nexus 3000 Series Command Reference</i>

## Feature History for CoPP

**Table 1: Feature History for CoPP**

Feature Name	Feature Information
CoPP	Introduced in 5.0(3)U2(1)
IPv6	Introduced in 5.0(3)U3(1)
Multiple ACLs can be associated with a CoPP class, including IPv4 and IPv6 access lists.	Introduced in 5.0(3)U3(1)