Using Modular QoS CLI

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About MQC

Cisco Modular Quality of Service Command Line Interface (MQC) provides a language to define QoS policies.

You configure QoS policies by following these three steps:

1. Define traffic classes.
2. Associate policies and actions with each traffic class.
3. Attach policies to logical or physical interfaces.

MQC provides a command type to define traffic classes and policies:

- **policy-map**—Defines a policy map that represents a set of policies to be applied on a class-by-class basis to class maps.

  The policy map defines a set of actions to take on the associated traffic class, such as limiting the bandwidth or dropping packets.

You define the following class-map and policy-map object types when you create them:

- **network qos**—Defines MQC objects that you can use for system level-related actions.
- **qos**—Defines MQC objects that you can use for marking and policing.
- **queuing**—Defines MQC objects that you can use for queuing and scheduling.

Note The **qos** type is the default.

Egress QoS policies are not supported on the subinterfaces.

You can attach policies to ports, port channels, or subinterfaces by using the **service-policy** command.

You can view all or individual values for MQC objects by using the **show class-map** and **show policy-map** commands.

Caution In the interface configuration mode, the device can accept QoS and access control list (ACL) commands irrespective of the line card on which the interface host is up or down. However, you cannot enter the interface submode when the line card is down because the device does not accept any preconfiguration information.

Guidelines and Limitations for Modular QoS CLI

Modular QoS CLI has the following configuration guidelines and limitations:

- On devices with R-Series line cards, data forwarding is not supported when configured with 4q mode policies. Instead, configure the device with 8q mode policies.

System Classes

The system qos is a type of MQC target. You use a service policy to associate a policy map with the system qos target. A system qos policy applies to all interfaces on the device unless a specific interface has an overriding service-policy configuration. The system qos policies are used to define system classes, the classes of traffic across the entire device, and their attributes.

If service policies are configured at the interface level, the interface-level policy always takes precedence over the system class configuration or defaults.

When you configure QoS features, and the system requests MQC objects, you can use system-defined MQC objects for 4q mode or system-defined objects for 8q mode.

On the Cisco Nexus device, a system class is uniquely identified by a qos-group value. A total of four system classes are supported. The device supports one default class which is always present on the device. Up to three additional system classes can be created by the administrator. Only egress queuing, network-qos, and type qos for FEX policies are supported on the system QoS target.

Default System Classes

The device provides the following system classes:

- Drop system class

By default, the software classifies all unicast and multicast Ethernet traffic into the default drop system class. This class is identified by qos-group 0.

Using an MQC Object

You configure QoS and queuing policies using the MQC class-map and policy-map objects. After you configure class maps and policy maps, you can attach one policy map of each type to an interface. A QoS policy can only be applied to the ingress direction.

A policy map contains either a QoS policy or queuing policy. The policy map references the names of class maps that represent traffic classes. For each class of traffic, the device applies the policies on the interface or VLAN that you select.

A packet is matched sequentially to a class of traffic starting from the first traffic class definition. When a match is found, the policy actions for that class are applied to the packet.

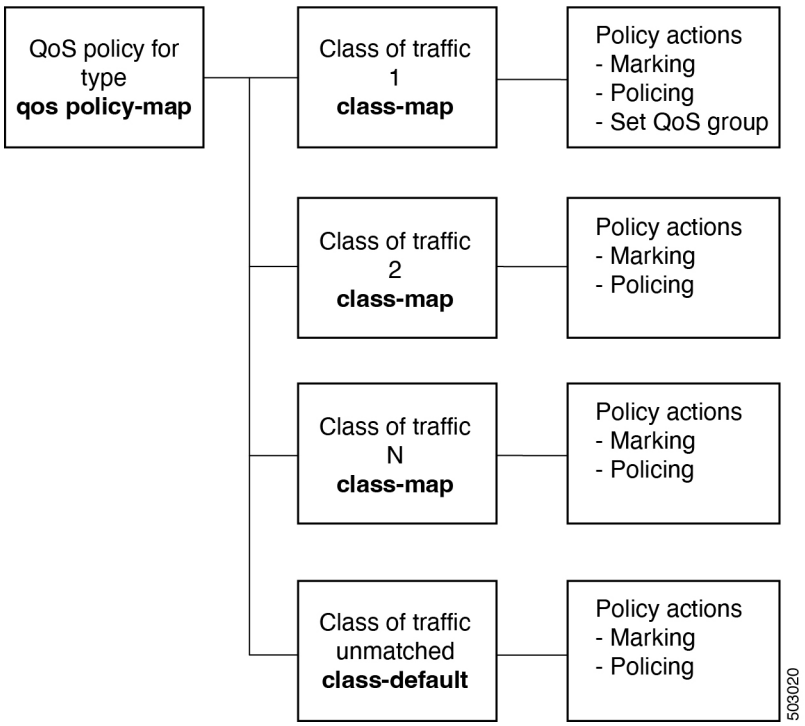
The reserved class map class-default receives all traffic that is not matched in type qos policies, and the device applies the policy actions as it would for any other traffic class.

Type qos Policies

You use type qos policies to mark and to police packets, and to set qos-groups, which drive matching conditions for system-defined type network-qos and type queuing class-maps.

The following figure shows the QoS policy structure with the associated MQC objects of type qos. The MQC objects are shown in bold.

Figure 1: QoS Policy Diagram Showing Type qos MQC Object Usage

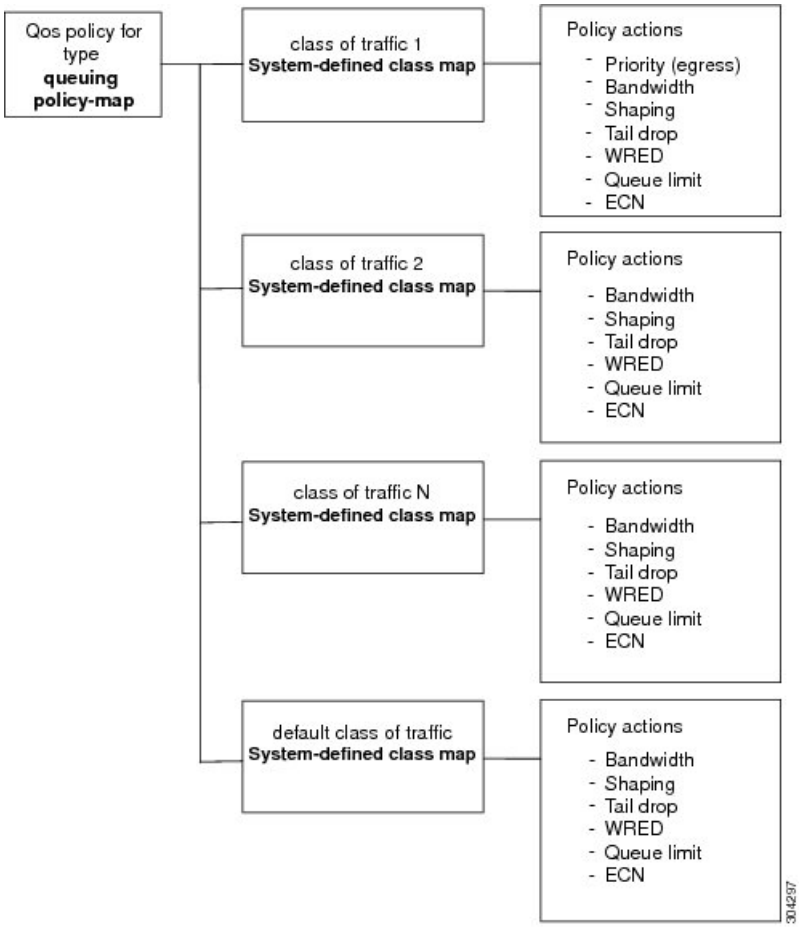


Type Queuing Policies

You use type queuing policies to shape and queue packets.

The following figure shows the QoS policy structure with associated MQC objects of type queuing. The MQC objects are shown in bold.

Figure 2: QoS Policy Diagram Showing Type Queuing MQC Object Usage



Note: See the "Configuring Queuing and Scheduling" chapter for information on configuring these parameters.

System-Defined MQC Objects

When you configure QoS features, and the system requests MQC objects, you can use system-defined objects for 4q mode or system-defined objects for 8q mode.

The system-defined objects for 8q mode are supported on the following devices:

- N9K-C92348GC-X
- Cisco Nexus 9300-EX switches

- Cisco Nexus 9300-FX switches
- Cisco Nexus 9300-FX2 switches
- Cisco Nexus 9300-GX switches
- Cisco Nexus 9504, 9508, and 9516 switches with -EX or -FX line cards.

Note When FEX is connected, it should be configured with 4q.

Note The following Cisco Nexus switches and line cards do not support system-defined objects for 8q mode:

- N9K-C9272Q
- N9K-C9332PQ
- N9K-C93120TX
- N9K-X9464PX
- N9K-X9432PQ

Note System-defined objects for 8q mode are not supported on ACI (Application Centric Infrastructure) capable linecards.

System-Defined MQC Objects for 4q Mode

When you configure QoS features, and the system requests MQC objects, you can use the following system-defined objects:

Note The Cisco Nexus 9000 series NX-OS system operates in 8q mode by default. You must enable the following MQC objects to change to 4q mode.

Note System-defined MQC objects for 4q mode are not supported on the Cisco Nexus 9508 switch (NX-OS 7.0(3)F3(3)).

- Type qos class maps

Table 1: System-Defined Type qos Class Maps

Class Map Name	Description
class-default	Type qos class map that is assigned to all packets that match none of the criteria of traffic classes that you define in a type qos policy map.

- Type queuing class maps

Table 2: System-Defined Type queuing Class Maps for 4q Mode

Class Map Queue Name	Description
c-out-q-default	Egress default queue — QoS group 0
c-out-q1	Egress queue 1 — QoS group 1
c-out-q2	Egress queue 2 — QoS group 2
c-out-q3	Egress queue 3 — QoS group 3

- Type network-qos class maps

Table 3: System-Defined Type network-qos Class Maps for 4q Mode

Class Map Network-QoS Name	Description
c-nq-default	Network-qos class — QoS group 0
c-nq1	Network-qos class — QoS group 1
c-nq2	Network-qos class — QoS group 2
c-nq3	Network-qos class — QoS group 3

- Policy maps

Table 4: System-Defined Queuing Policy Maps for 4q Mode

Queuing Policy Map Name	Description

default-out-policy	Output queuing policy map that is attached to all module ports to which you do not apply a queuing policy map. The default configuration values are as follows:
	
	`policy-map type queuing default-out-policy`
	`  class type queuing c-out-q3`
	`   priority level 1`
	`  class type queuing c-out-q2`
	`   bandwidth remaining percent 0`
	`  class type queuing c-out-q1`
	`   bandwidth remaining percent 0`
	`  class type queuing c-out-q-default`
	`   bandwidth remaining percent 100`

Queuing Policy Map Name	Description

default-network-qos-policy	Network-qos queuing policy map that is attached to all module ports to which you do not apply a queuing policy map. The default configuration values are as follows:
	
	`policy-map type network-qos default-nq-policy`
	`  class type network-qos c-nq3`
	`   match qos-group 3`
	`   mtu 1500`
	`  class type network-qos c-nq2`
	`   match qos-group 2`
	`   mtu 1500`
	`  class type network-qos c-nq1`
	`   match qos-group 1`
	`   mtu 1500`
	`  class type network-qos c-nq-default`
	`   match qos-group 0`
	`   mtu 1500`

System-Defined MQC Objects for 8q Mode

When you configure QoS features, and the system requests MQC objects, you can use the following system-defined objects:

Note System-defined MQC objects for 8q mode are the default MQC objects.

Note The default queue for Cisco Nexus 9200 Series switches is 8q.

- Type qos class maps

Table 5: System-Defined Type qos Class Maps

Class Map Name	Description
class-default	Type qos class map that is assigned to all packets that match none of the criteria of traffic classes that you define in a type qos policy map.

- Type queuing class maps

Table 6: System-Defined Type queuing Class Maps for 8q Mode (Egress)

Class Map Queue Name	Description
c-out-8q-q-default	Egress default queue — QoS group 0
c-out-8q-q1	Egress queue 1 — QoS group 1
c-out-8q-q2	Egress queue 2 — QoS group 2

Class Map Queue Name	Description
c-out-8q-q3	Egress queue 3 — QoS group 3
c-out-8q-q4	Egress queue 4 — QoS group 4
c-out-8q-q5	Egress queue 5 — QoS group 5
c-out-8q-q6	Egress queue 6 — QoS group 6
c-out-8q-q7	Egress queue 7 — QoS group 7

Table 7: System-Defined Type queuing Class Maps for 8q Mode (Ingress)

Class Map Queue Name	Description
c-in-q-default	Ingress default queue — QoS group 0
c-in-q1	Ingress queue 1 — QoS group 1
c-in-q2	Ingress queue 2 — QoS group 2
c-in-q3	Ingress queue 3 — QoS group 3
c-in-q4	Ingress queue 4 — QoS group 4
c-in-q5	Ingress queue 5 — QoS group 5
c-in-q6	Ingress queue 6 — QoS group 6
c-in-q7	Ingress queue 7 — QoS group 7

- Type network-qos class maps

Note The System-Defined Type network-qos Class Maps for 8q Mode are not supported on the Cisco Nexus 9508 switch (NX-OS 7.0(3)F3(3)).

Table 8: System-Defined Type network-qos Class Maps for 8q Mode

Class Map Network-QoS Name	Description
c-8q-nq-default	Network-qos class — QoS group 0
c-8q-nq1	Network-qos class — QoS group 1
c-8q-nq2	Network-qos class — QoS group 2
c-8q-nq3	Network-qos class — QoS group 3
c-8q-nq4	Network-qos class — QoS group 4

Class Map Network-QoS Name	Description
c-8q-nq5	Network-qos class — QoS group 5
c-8q-nq6	Network-qos class — QoS group 6
c-8q-nq7	Network-qos class — QoS group 7

- Policy maps

Table 9: System-Defined Queuing Policy Maps for 8q Mode

Queuing Policy Map Name	Description

default-8q-out-policy	Output queuing policy map that is attached to all module ports to which you do not apply a queuing policy map. The default configuration values are as follows:
	
	`policy-map type queuing default-8q-out-policy`
	`  class type queuing c-out-8q-q7`
	`   priority level 1`
	`  class type queuing c-out-8q-q6`
	`   bandwidth remaining percent 0`
	`  class type queuing c-out-8q-q5`
	`   bandwidth remaining percent 0`
	`  class type queuing c-out-8q-q4`
	`   bandwidth remaining percent 0`
	`  class type queuing c-out-8q-q3`
	`   bandwidth remaining percent 0`
	`  class type queuing c-out-8q-q2`
	`   bandwidth remaining percent 0`
	`  class type queuing c-out-8q-q1`
	`   bandwidth remaining percent 0`
	`  class type queuing c-out-8q-q-default`
	`   bandwidth remaining percent 100`

Queuing Policy Map Name	Description

default-8q-network-qos-policy	Network-qos queuing policy map that is attached to all module ports to which you do not apply a queuing policy map. The default configuration values are as follows:
	
	`policy-map type network-qos default-8q-nq-policy`
	`  class type network-qos c-8q-nq7`
	`   match qos-group 7`
	`   mtu 1500`
	`  class type network-qos c-8q-nq6`
	`   match qos-group 6`
	`   mtu 1500`
	`  class type network-qos c-8q-nq5`
	`   match qos-group 5`
	`   mtu 1500`
	`  class type network-qos c-8q-nq4`
	`   match qos-group 4`
	`   mtu 1500`
	`  class type network-qos c-8q-nq3`
	`   match qos-group 3`
	`   mtu 1500`
	`  class type network-qos c-8q-nq2`
	`   match qos-group 2`
	`   mtu 1500`
	`  class type network-qos c-8q-nq1`
	`   match qos-group 1`
	`   mtu 1500`
	`  class type network-qos c-8q-nq-default`
	`   match qos-group 0`
	`   mtu 1500`

Changing to 8q Mode

Note The Cisco Nexus 9000 series NX-OS system operates in 8q mode by default.

Use the following guidelines to change to 8q mode:

- Change the network-qos policy to 8q mode.

  You can either activate the default-8q-nq-policy (which is the system created 8q default network-qos policy); or you can copy it using the **qos copy policy-map type network-qos** command, edit it as needed, and activate it.

- Change the queuing policy to 8q mode. (This means changing the system queuing policy and optionally any interface queuing policy.)

  Make a copy of the default-8q-out-policy (the default 8q queuing policy created by the system) using the **qos copy policy-map type queuing** command. Edit the copy of the default-8q-out-policy as needed and activate it at the system level and optionally at the interface level.

- After the network-qos and queuing policies are changed to 8q mode, you can start using **set qos-group** action for qos-groups 4-7 to steer the traffic to queues 4-7.

Notes About 8q Mode

The following are notes about 8q mode:

- When 8q policies are in active use, the system cannot be downgraded to a system image that does not support 8q mode.

Note As a best practice to avoid incompatibilities, remove the 8q policies before a downgrade.

The following example shows some incompatibilities when trying to downgrade to a system image that does not support 8q mode.

```
switch# show incompatibility nxos bootflash:n9000-dk9.6.1.2.I1.2.bin

The following configurations on active are incompatible with  the system image

1) Service : ipqosmgr , Capability : CAP_FEATURE_IPQOS_8Q_QUE_POLICY_ACTIVE
Description : QoS Manager - 8Q queuing policy active
Capability requirement : STRICT
Enable/Disable command : Please remove 8q queuing policy

2) Service : ipqosmgr , Capability : CAP_FEATURE_IPQOS_8Q_NQOS_POLICY_ACTIVE
Description : QoS Manager - 8Q network-qos policy active
Capability requirement : STRICT
Enable/Disable command : Please remove 8q network-qos policy
```

- No 8q policies can be activated on a system that has linecards that do not support 8-queues. All ACI (Application Centric Infrastructure) capable linecards do not support 8-queues.

Note As a best practice, power off all linecards that do not support 8-queues before using 8-queue functionality.

The following example shows some of the errors that occur when you attempt to use 8-queue functionality on a system that has linecards that do not support 8-queues.

```
switch(config)# system qos
  switch(config-sys-qos)# service-policy type queuing output default-8q-out-policy
  ERROR: policy-map default-8q-out-policy can be activated only on 8q capable platforms


  switch(config)# system qos
  switch(config-sys-qos)# service-policy type network-qos default-8q-nq-policy
  ERROR: policy-map default-8q-nq-policy can be activated only on 8q capable platforms


  switch(config)# policy-map p1
  switch(config-pmap-qos)# class c1
  switch(config-pmap-c-qos)# set qos-group 7
  ERROR: set on qos-group 4-7 is supported only on 8q capable platforms
```

Example of Changing to 8q Mode

The following is an example of changing to 8q mode:

Note This example is not applicable to the Cisco Nexus 9508 switch (NX-OS 7.0(3)F3(3)).

```
switch# qos copy policy-map type network-qos default-8q-nq-policy prefix my
switch# show policy-map type network-qos

  Type network-qos policy-maps
  ============================
  policy-map type network-qos my8q-nq
    class type network-qos c-8q-nq7
      mtu 1500
    class type network-qos c-8q-nq6
      mtu 1500
    class type network-qos c-8q-nq5
      mtu 1500
    class type network-qos c-8q-nq4
      mtu 1500
    class type network-qos c-8q-nq3
      mtu 1500
    class type network-qos c-8q-nq2
      mtu 1500
    class type network-qos c-8q-nq1
      mtu 1500
    class type network-qos c-8q-nq-default
      mtu 1500

switch# config t
switch(config)# policy-map type network-qos my8q-nq
switch(config-pmap-nqos)# class type network-qos c-8q-nq1
switch(config-pmap-nqos-c)# mtu 9216
switch(config-pmap-nqos-c)# class type network-qos c-8q-nq2
switch(config-pmap-nqos-c)# mtu 2240
switch(config-pmap-nqos-c)# class type network-qos c-8q-nq4
switch(config-pmap-nqos-c)# pause pfc-cos 4
switch(config-pmap-nqos-c)# class type network-qos c-8q-nq5
switch(config-pmap-nqos-c)# mtu 2240
switch(config-pmap-nqos-c)# pause pfc-cos 5
switch(config-pmap-nqos-c)# class type network-qos c-8q-nq6
switch(config-pmap-nqos-c)# mtu 9216
switch(config-pmap-nqos-c)# pause pfc-cos 6
switch(config-pmap-nqos-c)# show policy-map type network-qos my8q-nq

  Type network-qos policy-maps
  ============================
  policy-map type network-qos my8q-nq
    class type network-qos c-8q-nq7
      mtu 1500
    class type network-qos c-8q-nq6
      pause pfc-cos 6
      mtu 9216
    class type network-qos c-8q-nq5
      pause pfc-cos 5
      mtu 2240
    class type network-qos c-8q-nq4
      pause pfc-cos 4
      mtu 1500
    class type network-qos c-8q-nq3
      mtu 1500
    class type network-qos c-8q-nq2
      mtu 2240
    class type network-qos c-8q-nq1
```

```
      mtu 9216
    class type network-qos c-8q-nq-default
      mtu 1500

switch(config)# system qos
switch(config-sys-qos)# service-policy type network-qos my8q-nq
switch(config-sys-qos)# 2014 Jun 12 11:13:48 switch %$ VDC-1 %$
%IPQOSMGR-2-QOSMGR_NETWORK_QOS_POLICY_CHANGE: Policy my8q-nq is now active

switch(config-sys-qos)# show policy-map system type network-qos

  Type network-qos policy-maps
  ============================
  policy-map type network-qos my8q-nq
    class type network-qos c-8q-nq7
      match qos-group 7
      mtu 1500
    class type network-qos c-8q-nq6
      match qos-group 6
      pause pfc-cos 6
      mtu 9216
    class type network-qos c-8q-nq5
      match qos-group 5
      pause pfc-cos 5
      mtu 2240
    class type network-qos c-8q-nq4
      match qos-group 4
      pause pfc-cos 4
      mtu 1500
    class type network-qos c-8q-nq3
      match qos-group 3
      mtu 1500
    class type network-qos c-8q-nq2
      match qos-group 2
      mtu 2240
    class type network-qos c-8q-nq1
      match qos-group 1
      mtu 9216
    class type network-qos c-8q-nq-default
      match qos-group 0
      mtu 1500

switch# qos copy policy-map type queuing default-8q-out-policy prefix my
switch# show policy-map type queuing my8q-out


  Type queuing policy-maps
  ========================

  policy-map type queuing my8q-out
    class type queuing c-out-8q-q7
      priority level 1
    class type queuing c-out-8q-q6
      bandwidth remaining percent 0
    class type queuing c-out-8q-q5
      bandwidth remaining percent 0
    class type queuing c-out-8q-q4
      bandwidth remaining percent 0
    class type queuing c-out-8q-q3
      bandwidth remaining percent 0
    class type queuing c-out-8q-q2
      bandwidth remaining percent 0
    class type queuing c-out-8q-q1
      bandwidth remaining percent 0
```

```
    class type queuing c-out-8q-q-default
     bandwidth remaining percent 100

switch# config t
switch(config)# policy-map type queuing my8q-out
switch(config-pmap-c-que)# class type queuing c-out-8q-q-default
switch(config-pmap-c-que)# bandwidth remaining percent 30
switch(config-pmap-c-que)# class type queuing c-out-8q-q1
switch(config-pmap-c-que)# bandwidth remaining percent 15
switch(config-pmap-c-que)# class type queuing c-out-8q-q2
switch(config-pmap-c-que)# bandwidth remaining percent 15
switch(config-pmap-c-que)# class type queuing c-out-8q-q3
switch(config-pmap-c-que)# bandwidth remaining percent 10
switch(config-pmap-c-que)# class type queuing c-out-8q-q4
switch(config-pmap-c-que)# bandwidth remaining percent 10
switch(config-pmap-c-que)# class type queuing c-out-8q-q5
switch(config-pmap-c-que)# bandwidth remaining percent 10
switch(config-pmap-c-que)# class type queuing c-out-8q-q6
switch(config-pmap-c-que)# bandwidth remaining percent 10
switch(config-pmap-c-que)# show policy-map type queuing my8q-out


  Type queuing policy-maps
  ========================

  policy-map type queuing my8q-out
    class type queuing c-out-8q-q7
      priority level 1
    class type queuing c-out-8q-q6
      bandwidth remaining percent 10
    class type queuing c-out-8q-q5
      bandwidth remaining percent 10
    class type queuing c-out-8q-q4
      bandwidth remaining percent 10
    class type queuing c-out-8q-q3
      bandwidth remaining percent 10
    class type queuing c-out-8q-q2
      bandwidth remaining percent 15
    class type queuing c-out-8q-q1
      bandwidth remaining percent 15
    class type queuing c-out-8q-q-default
      bandwidth remaining percent 30

switch(config)# system qos
switch(config-sys-qos)# service-policy type queuing output my8q-out
switch(config-sys-qos)# show policy-map system type queuing



  Service-policy output:   my8q-out
          Service-policy (queuing) output:   my8q-out
            policy statistics status:   disabled (current status: disabled)

            Class-map (queuing):   c-out-8q-q7 (match-any)
              priority level 1

            Class-map (queuing):   c-out-8q-q6 (match-any)
              bandwidth remaining percent 10

            Class-map (queuing):   c-out-8q-q5 (match-any)
              bandwidth remaining percent 10

            Class-map (queuing):   c-out-8q-q4 (match-any)
              bandwidth remaining percent 10
```

```
Class-map (queuing):   c-out-8q-q3 (match-any)
  bandwidth remaining percent 10

Class-map (queuing):   c-out-8q-q2 (match-any)
  bandwidth remaining percent 15

Class-map (queuing):   c-out-8q-q1 (match-any)
  bandwidth remaining percent 15

Class-map (queuing):   c-out-8q-q-default (match-any)
  bandwidth remaining percent 30
```

Example of set qos-groups

The following is an example to set qos-groups with values 4-7.

```
switch(config)# policy-map p1
switch(config-pmap-qos)# class c1
switch(config-pmap-c-qos)# set qos-group 1
switch(config-pmap-c-qos)# ex
switch(config-pmap-qos)# class c2
switch(config-pmap-c-qos)# set qos-group 4
switch(config-pmap-c-qos)# ex
switch(config-pmap-qos)# class c3
switch(config-pmap-c-qos)# set qos-group 7
switch(config-pmap-c-qos)# ex
switch(config-pmap-qos)# ex
switch(config)# show policy-map p1


  Type qos policy-maps
  ====================

  policy-map type qos p1
    class  c1
      set qos-group 1
    class  c2
      set qos-group 4
    class  c3
      set qos-group 7
switch(config)# conf t
switch(config)# int ethernet 2/1
switch(config-if)# service-policy type qos input p1
switch(config-if)# show policy-map interface ethernet 2/1


Global statistics status :   enabled

Ethernet2/1

  Service-policy (qos) input:   p1
    SNMP Policy Index:  285226505

    Class-map (qos):   c1 (match-all)
      Match: dscp 10
      set qos-group 1

    Class-map (qos):   c2 (match-all)
      Match: dscp 20
      set qos-group 4
```

```
Class-map (qos):   c3 (match-all)
  Match: dscp 30
  set qos-group 7
```

Changing from 8q Mode to 4q Mode

Note Changing from 8q mode to 4q mode is not supported on the Cisco Nexus 9508 switch (NX-OS 7.0(3)F3(3)).

Use the following guidelines to change from 8q mode to 4q mode:

- Ensure that none of the active input QoS policies have **set qos-group** action for qos-groups 4-7, so that no traffic flows towards queues 4-7.
- Ensure that all 8q interface policies and 8q system level policies are replaced with corresponding 4q policies.
- Replace the 8q network-qos policy with a corresponding 4q policy.

Configuring an MQC Object

When you specify an MQC object command, the device creates the object if it does not exist and then enters map mode.

To remove a class-map or policy-map object, use the **no** form of the command that you used to create the object.

Configuring or Modifying a Class Map

You can create or modify a class map. You can then reference class maps in policy maps.

Note You cannot create a queuing class map; you must use one of the system-defined queuing class maps.

SUMMARY STEPS

1. **configure terminal**
2. **class-map type qos** [**match-any** | **match-all**] *class-name*
3. **exit**
4. **class-map type queuing match-any** *class-name*
5. **exit**
6. **show class-map** [**type qos** [*class-name*]]
7. **show class-map** [**type queuing** [*class-name*]]
8. **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**class-map type qos** [**match-any** | **match-all**] *class-name*
	Example:
	`switch(config)# class-map type qos class1`
	`switch(config-cmap-qos)#`
		Creates or accesses the class map of type qos and then enters class-map qos mode. Class-map names can contain alphabetic, hyphen, or underscore characters, are case sensitive, and can be up to 40 characters.

Step 3	**exit**
	Example:
	`switch(config-cmap-qos)# exit`
	`switch(config)#`
		Exits class-map qos mode and enters global configuration mode.

Step 4	**class-map type queuing match-any** *class-name*
	Example:
	`switch(config)# class-map type queuing match-any c-out-q2`
	`switch(config-cmap-que)#`
		Creates or accesses the class map of type queuing and then enters class-map queuing mode.

Step 5	**exit**
	Example:
	`switch(config-cmap-que)# exit`
	`switch(config)#`
		Exits class map queuing mode and enters global configuration mode.

Step 6	**show class-map** [**type qos** [*class-name*]] **Example:** `switch(config)# show class-map type qos`	(Optional) Displays information about all configured class maps, all class maps of type qos, or a selected class map of type qos.
Step 7	**show class-map** [**type queuing** [*class-name*]] **Example:** `switch(config)# show class-map type queuing`	(Optional) Displays information about all configured class maps, all class maps of type queuing, or a selected class map of type queuing.
Step 8	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Saves the running configuration to the startup configuration.

Configuring or Modifying a Policy Map

You can create or modify a policy map that you can use to define actions to perform on class maps.

SUMMARY STEPS

1. **configure terminal**
2. **policy-map type qos** { [**match-first**] *policy-map-name*}
3. **exit**
4. **policy-map type queuing** {[**match-first**] *policy-map-name}*
5. **exit**
6. **show policy-map** [**type qos** [*policy-map-name*]]
7. **show policy-map** [**type queuing** [*policy-map-name* | *default-out-policy*]]
8. **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**policy-map type qos** { [**match-first**] *policy-map-name*}
	Example:
	`switch(config)# policy-map type qos policy1`
	`switch(config-pmap-qos)#`
		Creates or accesses the policy map of type qos and then enters policy-map mode. Policy-map names can contain alphabetic, hyphen, or underscore characters, are case sensitive, and can be up to 40 characters.

Step 3	**exit**
	Example:
	`switch(config-pmap)# exit`
	`switch(config)#`
		Exits policy-map mode and enters global configuration mode.

Step 4	**policy-map type queuing** {[**match-first**] *policy-map-name}*
	Example:
	`switch(config)# policy-map type queuing policy_queue1`
	`switch(config-pmap-que)#`
		Configures the policy map of type queuing and then enters policy-map mode for the policy-map name you specify. Policy-map names can contain alphabetic, hyphen, or underscore characters, are case sensitive, and can be up to 40 characters.

Step 5	**exit**
	Example:
	`switch(config-pmap)# exit`
	`switch(config)#`
		Exits policy map mode and enters global configuration mode.

Step 6	**show policy-map** [**type qos** [*policy-map-name*]] **Example:** `switch(config)# show policy-map type qos`	(Optional) Displays information about all configured policy maps, all policy maps of type qos, or a selected policy map of type qos.

	Command or Action	Purpose
Step 7	**show policy-map** [**type queuing** [*policy-map-name* | *default-out-policy*]] **Example:** `switch(config)# show policy-map type queuing`	(Optional) Displays information about all configured policy maps, all policy maps of type queuing, a selected policy map of type queuing or the default output queuing policy.
Step 8	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Saves the running configuration to the startup configuration.

Applying Descriptions to MQC Objects

You can use the **description** command to add a description to a MQC object.

SUMMARY STEPS

1. **configure terminal**
2. Specify the MQC object whose description you want to set:
   - Class-map:

     class-map [**type qos**] [**match-any** | **match-all**] *class-name*
   - Policy-map:

     policy-map [**type qos**] [**match-first**] *policy-map-name*
3. **description** *string*
4. **exit**
5. **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	Specify the MQC object whose description you want to set: • Class-map: **class-map** [**type qos**] [**match-any** | **match-all**] *class-name* • Policy-map: **policy-map** [**type qos**] [**match-first**] *policy-map-name*	• Class-map: Creates or accesses the class map and then enters class-map mode. The class-map name can contain alphabetic, hyphen, or underscore characters, is case sensitive, and can be up to 40 alphanumeric characters. • Policy-map:

	Command or Action	Purpose

	Example:
	• Class-map:
	`switch(config-cmap)# class-map class1`
	`switch(config-cmap)#`
	• Policy-map:
	`switch(config)# policy-map policy1`
	`switch(config-pmap)#`
		Creates or accesses the policy map and then enters policy-map mode. The policy-map name can contain alphabetic, hyphen, or underscore characters, is case sensitive, and can be up to 40 characters.

Step 3	**description** *string*
	Example:
	`switch(config-cmap)# description my traffic class`
	`switch(config-cmap)#`
		Adds a description string to the MQC object. The description can be up to 200 alphanumeric characters.
		Note
		You cannot modify the description of system-defined queuing class maps.

Step 4	**exit**
	Example:
	`switch(config-cmap)# exit`
	`switch(config)#`
		Exits class-map mode and enters global configuration mode.

Step 5	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Saves the running configuration to the startup configuration.

Verifying an MQC Object

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

Command	Purpose
show class-map [**type qos** [*class-name*]]	Displays information about all configured class maps, all class maps of type qos, or a selected class map of type qos.
show class-map [**type queuing** [*class-name*]]	Displays information about all configured class maps, all class maps of type queuing, or a selected class map of type queuing.
show policy-map [**type qos** [*policy-map-name*]]	Displays information about all configured policy maps, all policy maps of type qos, or a selected policy map of type qos.
show policy-map [**type queuing** [*policy-map-name* | **default-out-policy**]]	Displays information about all configured policy maps, all policy maps of type queuing, a selected policy map of type queuing, or the default output queuing policy.

Attaching and Detaching a QoS Policy Action

The software does not allow you to enable or disable QoS features with a configuration command. To enable or disable QoS features, you must attach or detach QoS policies to or from interfaces or VLANs as described in this section.

The system-defined type queuing policy maps are attached to each interface unless you specifically attach a different policy map.

Note The device allows only one queuing policy per interface.

Policies that are defined at multiple interfaces have the following restrictions:

- A QoS policy attached to the physical port takes effect when the port is not a member of a port channel.
- A QoS policy attached to a port channel takes effect even when policies are attached to member ports.
- A QoS policy attached to a VLAN is applied to all ports in that VLAN that do not have other policies specifically applied.
- One ingress QoS policy is supported for each Layer 3 port and Layer 3 port-channel interface.
- One ingress QoS policy is supported for each VLAN.
- When a VLAN or port channel, or both, touches multiple forwarding engines, all policies that enforce a rate are enforced per forwarding engine.

  For example, if you configure a policer on a specific VLAN that limits the rate for the VLAN to 100 Mbps and if you configure one switch port in the VLAN on one module and another switch port in the VLAN on another module, each forwarding engine can enforce the 100-Mbps rate. In this case, you could actually have up to 200 Mbps in the VLAN that you configured to limit the rate to 100 Mbps.

Note Default queuing policies are active, unless you configure and apply another policy.

The interface where a QoS policy is applied is summarized in the following table. Each row represents the interface levels. The entry descriptions are as follows:

- Applied—Interface where an attached policy is applied.
- Present—Interface where a policy is attached but not applied.
- Not present—Interface where no policy is attached.
- Present or not—Interface where a policy is either attached or not, but not applied.

Table 10: QoS Policy Interfaces

Port Policy	Port-Channel Policy	VLAN Policy
Applied	Not present	Present or not

Present or not	Applied	Present or not
Not present	Not present	Applied

To attach a policy map to an interface or VLAN, use the **service-policy** command. The policies defined in the policy map are applied to the input stream of packets on the interface.

To detach a policy map from an interface, use the **no** form of the **service-policy** command.

Configuring a Service Policy for a Layer 2 Interface

Before you begin

Ensure that the ternary content addressable memory (TCAM) is carved for port QoS.

For more details, see the Configuring QoS TCAM Carving section.

SUMMARY STEPS

1. **configure terminal**
2. **interface interface** *slot/port*
3. **switchport**
4. **service-policy type** {**qos input** | **queuing output**} | {**qos output** | **queuing output**} *policy-map-name* [**no-stats**]
5. **show policy-map interface** *interface slot/port* **type** {**qos** | **queuing**}
6. **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**interface interface** *slot/port*
	Example:
	`switch(config)# interface ethernet 1/1`
	`switch(config-if)#`
		Enters configuration interface mode.

Step 3	**switchport** **Example:** `switch(config-if)# switchport`	Selects the Layer 2 interface.

	Command or Action	Purpose

Step 4	**service-policy type** {**qos input** | **queuing output**} | {**qos output** | **queuing output**} *policy-map-name* [**no-stats**]
	Example:
	`switch(config-if)# service-policy input policy1`
	`switch(config-if)#`
	Example:
	`switch(config-if)# interface intf1`
	`switch(config-if)# service-policy type qos output egressqos`
	`switch(config-if)# exit`
	`switch(config)#`
		Specifies the policy map to use as the service policy for the Layer 2 interface. There are two policy-map configuration modes:
		• qos input or qos output — qos input is the default classification mode. To set the classification mode to egress, use qos output.
		• queuing output —Queuing mode.
		Note
		The **output** keyword specifies that this policy map should be applied to traffic transmitted from an interface. You can only apply **output** to a queuing policy.

Step 5	**show policy-map interface** *interface slot/port* **type** {**qos** | **queuing**} **Example:** `switch(config)# show policy-map interface ethernet 1/1 type qos`	(Optional) Displays information about policy maps that are applied to the specified interface. You can limit what the device displays to qos or queuing policies.
Step 6	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Saves the running configuration to the startup configuration.

Configuring a Service Policy for a Layer 3 Interface

Before you begin

Ensure that the ternary content addressable memory (TCAM) is carved for Layer 3 QoS.

For more details, see the Configuring QoS TCAM Carving section.

SUMMARY STEPS

1. **configure terminal**
2. **interface interface** *slot/port*
3. **no switchport**
4. **service-policy type** {**qos input** \| **queuing output**} \| {**qos output** \| **queuing output**} *policy-map-name* [**no-stats**]
5. **show policy-map interface** *interface slot/port* **type** {**qos** \| **queuing**}
6. **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**interface interface** *slot/port*
	Example:
	`switch(config)# interface ethernet 1/1`
	`switch(config-if)#`
		Enters configuration interface mode.

Step 3	**no switchport** **Example:** `switch(config-if)# no switchport`	Selects the Layer 3 interface.

Step 4	**service-policy type** {**qos input** | **queuing output**} | {**qos output** | **queuing output**} *policy-map-name* [**no-stats**]
	Example:
	`switch(config-if)# service-policy input policy1`
	`switch(config-if)#`
	Example:
	`switch(config-if)# service-policy output policy1`
	`switch(config-if)#`
		Specifies the policy map to use as the service policy for the Layer 3 interface. There are two policy-map configuration modes:
		• qos input or qos output — qos input is the default classification mode. To set the classification mode to egress, use qos output.
		• queuing output —Queuing mode.
		Note
		The **output** keyword specifies that this policy map should be applied to traffic transmitted from an interface. You can only apply **output** to a queuing policy.

Step 5	**show policy-map interface** *interface slot/port* **type** {**qos** | **queuing**} **Example:** `switch(config)# show policy-map interface ethernet 1/1 type qos`	(Optional) Displays information about policy maps that are applied to the specified interface. You can limit what the device displays to qos or queuing policies.
Step 6	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Saves the running configuration to the startup configuration.

Attaching the System Service Policy

The **service-policy** command specifies the system class policy map as the service policy for the system.

SUMMARY STEPS

1. **configure terminal**
2. **system qos**
3. **service-policy type** {**network-qos** | **queuing output**} *policy-map-name*

DETAILED STEPS

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**system qos**
	Example:
	`switch(config)# system qos`
	`switch(config-sys-qos)#`
		Enters system class configuration mode.

Step 3	**service-policy type** {**network-qos**	**queuing output**} *policy-map-name* **Example:** `switch(config-sys-qos)# service-policy input default-nq-policy`	Specifies the policy map to use as the service policy (default-nq-policy) for the system. There are two policy-map configuration modes: • network-qos—Network-wide (system qos) mode. **Note** To restore the system to the default service policies, use the **no** form of the command. • queuing—Queuing mode (output at system qos and interface). **Note** There is no default policy-map configuration mode. You must specify the type. The **output** keyword specifies that this policy map should be applied to traffic transmitted from an interface. You can only apply **output** to a queuing policy.

Attaching a QoS Policy Action to a VLAN

Before you begin

Ensure that the ternary content-addressable memory (TCAM) is carved for VLAN QoS.

For more details, see the QoS TCAM carving chapter.

SUMMARY STEPS

1. **configure terminal**
2. **vlan configuration** *vlan-id-list*
3. **service-policy** [**type qos**] {**input**} | {**qos output** } {*policy-map-name*} [**no-stats**]
4. **show policy-map** [**interface** *interface* | **vlan** *vlan-id*] [**input**] [**type qos** | **queuing**] [**class** [**type qos** | **queuing**] *class-map-name*]
5. **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**vlan configuration** *vlan-id-list*
	Example:
	`switch(config)# vlan configuration 2`
	`switch(config-vlan-config)#`
		Enters VLAN configuration mode.
		Note
		vlan-id-list is a space-separated list of VLANs.

Step 3	**service-policy** [**type qos**] {**input**} | {**qos output** } {*policy-map-name*} [**no-stats**]
	Example:
	`switch(config-vlan-config)# service-policy type qos input policy1`
	Example:
	`switch(config-if)# service-policy type qos output egressqos`
	`switch(config-if)# exit`
	`switch(config)#`
		Adds the policy map to the input packets of a VLAN.
		Only one input policy can be attached to a VLAN. The example adds policy1 to the VLAN.
		Label sharing only occurs when QoS policies under VLANs are configured with the **no-stats** option. With the **no-stats** option, the QoS label gets shared when the same QoS policy is applied on multiple VLANs.
		Note
		When the **no-stats** option is configured, the ingress QoS policy-map statistics on a VLAN basis are not available because the label is shared.

Step 4	**show policy-map** [**interface** *interface* | **vlan** *vlan-id*] [**input**] [**type qos** | **queuing**] [**class** [**type qos** | **queuing**] *class-map-name*] **Example:** `switch(config)# show policy-map vlan 2`	(Optional) Displays information about policy maps that are applied to all interfaces or the specified interface. You can limit what the device displays to input policies, qos or queuing polices, and to a specific class.
Step 5	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Saves the running configuration to the startup configuration.

Session Manager Support for QoS

Session Manger supports the configuration of QoS. This feature allows you to verify the QoS configuration and confirm that the resources required by the configuration are available prior to committing them to the running configuration. For information about Session Manager, see the *Cisco Nexus 9000 Series NX-OS System Management Configuration Guide*.

After you start the configuration session, do not enter any configuration commands using the configure terminal configuration mode until the configuration session is aborted or committed. Entering parallel configurations (one configuration that uses the configuration session and another using the configuration terminal configuration mode) might cause verification failures in the configuration session mode.