Configuring QoS

This chapter describes how to configure quality of service (QoS) on Catalyst enterprise LAN switches.

Note For complete syntax and usage information for the commands that are used in this chapter, refer to the *Catalyst 4500 Series, Catalyst 2948G, Catalyst 2948G-GE-TX, and Catalyst 2980G Switches Command Reference*.

This chapter consists of these sections:

- Understanding How QoS Works, page 14-1
- Software Requirements, page 14-4
- QoS Default Configuration, page 14-4
- Configuring QoS on the Switch, page 14-4

Understanding How QoS Works

These sections describe how QoS works:

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- Understanding QoS Terminology, page 14-2
- Understanding Classification and Marking at the Ingress Port, page 14-3
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QoS Overview

Typically, networks operate on a best-effort delivery basis, which means that all traffic has equal priority and an equal chance of being delivered in a timely manner. When congestion occurs, all traffic has an equal chance of being dropped.

QoS selects network traffic, prioritizes it according to its relative importance, and provides priority-indexed treatment through congestion-avoidance techniques. Implementing QoS in your network makes network performance more predictable and bandwidth utilization more effective.

QoS classifies traffic by assigning priority-indexed 802.1p class of service (CoS) values to frames at ingress ports. If traffic is tagged with a CoS value at the ingress port, the switch forwards the value. If traffic is native, then the switch can rewrite the CoS tag.

QoS implements scheduling on supported egress ports with transmit queue drop thresholds and multiple transmit queues that use the 802.1p CoS values to give preference to higher-priority traffic.

Figure 14-1 shows how QoS affects the traffic flow.

Figure 14-1   Traffic Flow Through the Switch with QoS Enabled—Catalyst 4500 Series, Catalyst 2948G, and Catalyst 2980G Switches
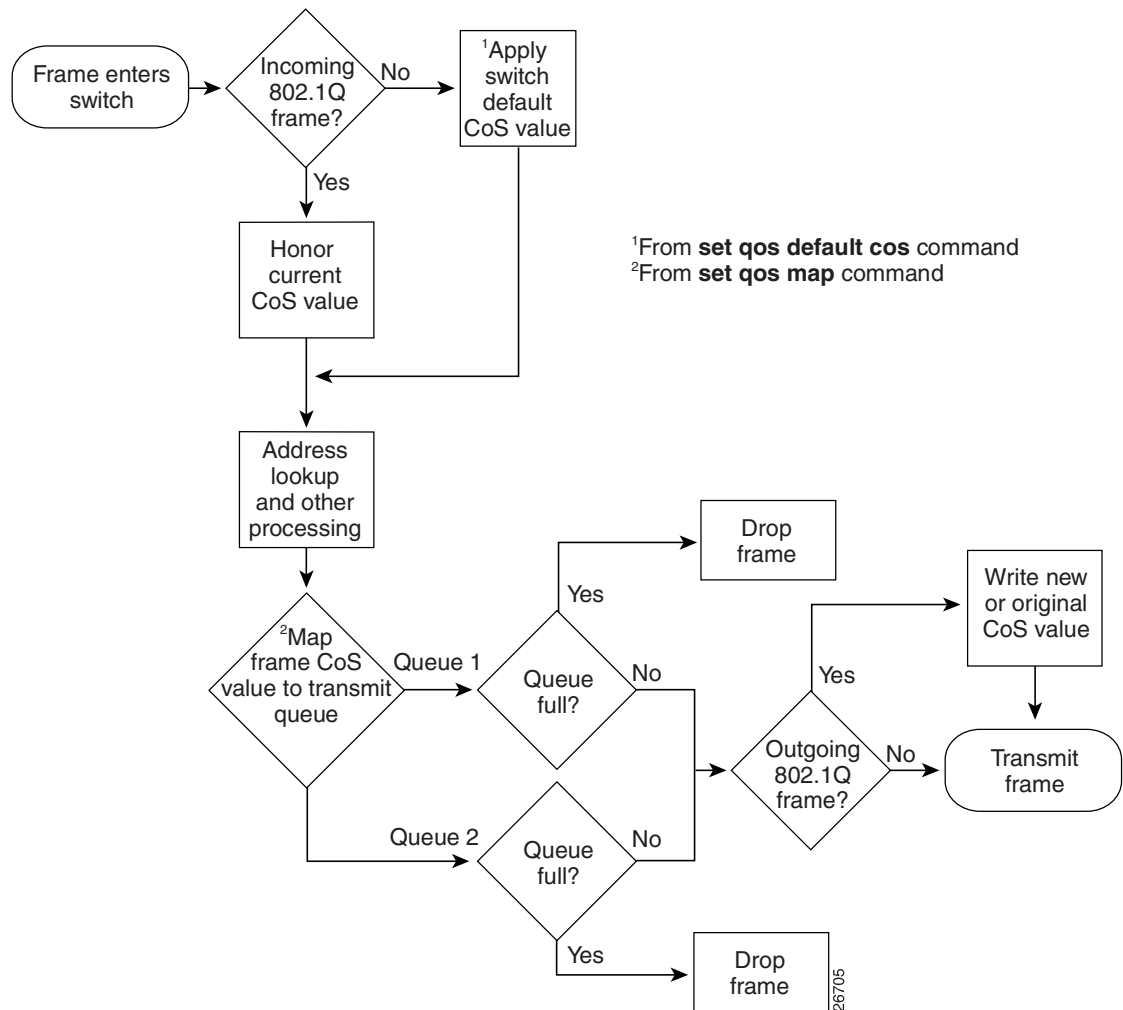
Understanding QoS Terminology

The following QoS terminology is used in this chapter:

- QoS *labels* are used to prioritize traffic:

  - Layer 2 CoS values—Layer 2 802.1Q frame headers have a 2-byte Tag Control Information field that carries the CoS value in the three most significant bits (the User Priority bits). Other frame types cannot carry CoS values. CoS values range between 0 (low priority) and 7 (high priority).

- *Classification* is the selection of traffic to be marked.

- *Marking* is the application of QoS labels to traffic.

- *Scheduling* is the assignment of traffic to a queue. QoS assigns traffic based on CoS values.

- *Congestion avoidance* is the process by which QoS reserves ingress and egress port capacity for traffic with high-priority CoS values. QoS implements congestion avoidance with CoS value-based drop thresholds and transmit queues. A drop threshold is the percentage of buffer utilization at which traffic with a specified CoS value is dropped, leaving the buffer available for traffic with higher-priority CoS values. A transmit queue is a queue on the egress port where outgoing frames are stored before transmission. With multiple transmit queues, traffic with higher-priority CoS values can be placed in a reserved transmit queue.

- *Policing* is the process by which the switch limits the bandwidth that is consumed by a flow of traffic. Policing can mark or drop traffic.

Understanding Classification and Marking at the Ingress Port

ISL or 802.1Q frames are not classified or marked at the ingress port; the existing CoS value is honored.

When an 802.1Q frame enters the switch through a supported ingress port, QoS accepts the User Priority bits as the CoS value.

QoS classifies and marks all other frame types that enter the switch with the default CoS value that is configured for the entire switch. You cannot mark traffic on a per-port basis.

> **Note** The Catalyst 4500 series, 2948G, and 2980G switches support frame classification and marking only on unclassified frames entering the switch.

Understanding Scheduling

There are two user-configurable transmit queues and one non-user-configurable transmit queue drop threshold for each port. You can specify such ports using the **2q1t** keyword in QoS-related commands.

QoS uses the transmit queues to schedule transmission of network traffic from the switch through egress ports. By default, all traffic is assigned to queue 1 and threshold 1 when QoS is enabled. All traffic that is destined for a transmit queue, regardless of classification, is subject to tail drop when the queue is full (that is, frames at the end of the queue are dropped).

> **Caution** When you disable QoS, the switch assigns unicast traffic to queue 1 and broadcast, multicast, and unknown traffic to queue 2. If you enable QoS but do not modify the CoS-to-transmit queue mappings, switch performance could be affected because *all* traffic is assigned to queue 1. If you enable QoS, we recommend that you modify the CoS-to-transmit queue mappings.

> **Note** To configure the CoS values that are mapped to each transmit queue, see the "Mapping CoS Values to Transmit Queues and Drop Thresholds" section on page 14-6.

Software Requirements

QoS requires supervisor engine software release 5.2 or later releases. Use the **show port capabilities** command to determine the specific QoS support for a module.

QoS Default Configuration

Table 14-1 shows the QoS default configuration.

Table 14-1   QoS Default Configuration

Feature	Default Value
QoS global enable state	Disabled
Switch CoS value	0
Transmit queue drop threshold percentages	• Threshold 1:100%[1]
CoS value-to-drop threshold mapping	• Transmit queue drop threshold 1: CoS 0–7[1]
CoS value-to-transmit queue mapping	• Transmit queue 1: CoS 0–7
	• Transmit queue 2: None configured

1. Not user-configurable

Configuring QoS on the Switch

These sections describe how to configure QoS:

- Enabling QoS Globally, page 14-5
- Configuring the Default CoS Value for the Switch, page 14-5
- Reverting to the Default Switch CoS Value, page 14-5
- Mapping CoS Values to Transmit Queues and Drop Thresholds, page 14-6
- Reverting to the Default CoS-to-Transmit Queue and Drop Threshold Mapping, page 14-6
- Displaying QoS Information, page 14-7
- Reverting to QoS Defaults, page 14-7
- Disabling QoS, page 14-7

Note   Because entering some QoS commands disables and then reenables ports (which can cause spanning tree topology changes), enter QoS commands only when necessary.

Enabling QoS Globally

To enable QoS globally on the switch, perform this task in privileged mode:

Task	Command
Enable QoS globally.	**set qos enable**

This example shows how to enable QoS globally:

```
Console> (enable) set qos enable
QoS is enabled.
Console> (enable)
```

Configuring the Default CoS Value for the Switch

QoS assigns a CoS value to unclassified frames that are received on a port. The default CoS value is zero.

To set the default CoS value on the switch, perform this task in privileged mode:

	Task	Command
Step 1	Set the CoS value.	**set qos defaultcos** *cos-value*
Step 2	Verify the CoS value.	**show qos info** [**runtime** | **config**]

This example shows how to set CoS equal to 7 in all unclassified frames that are received on the switch and verify the configuration:

```
Console> (enable) set qos defaultcos 7
qos defaultcos set to 7
Console> (enable)
```

Reverting to the Default Switch CoS Value

To revert to the default switch CoS value on the switch, perform this task in privileged mode:

	Task	Command
Step 1	Revert to the default CoS value.	**clear qos defaultcos**
Step 2	Verify that the default CoS value was restored.	**show qos info** [**runtime** | **config**]

This example shows how to revert to the default CoS value for port 8/1 and verify the configuration:

```
Console> (enable) clear qos defaultcos
qos defaultcos setting cleared.
Console> (enable)
```

Mapping CoS Values to Transmit Queues and Drop Thresholds

Enter the **set qos map** command to associate CoS values to transmit queue drop thresholds.

The *port_type* is hardware dependent. Enter the **show port capabilities** command to determine the *port_type* for your hardware. The port type is defined by the number of transmit queues and the number of drop thresholds that are supported on the port. For example, the **2q1t** port type supports two transmit queues and one drop threshold.

The *q#* is the transmit queue number. The *threshold#* is the drop threshold number for the specified queue. The *cos_list* is the list of CoS values to map to the specified transmit queue and drop threshold. CoS values must be specified in pairs (0–1, 2–3, 4–5, and 6–7).

To associate CoS values to a transmit queue and drop threshold, perform this task in privileged mode:

Task	Command
Associate a CoS value to a transmit queue and drop threshold.	**set qos map** *port_type q# threshold#* **cos** *cos_list*

This example shows how to map CoS values 4 through 7 to the second transmit queue and the first drop threshold for that queue on a **2q1t** port:

```
Console> (enable) set qos map 2q1t 2 1 cos 4-7
Qos tx priority queue and threshold mapped to cos successfully.
Console> (enable)
```

Reverting to the Default CoS-to-Transmit Queue and Drop Threshold Mapping

Enter the **clear qos map** command to revert to the default CoS-to-transmit queue and drop threshold mappings. The *port_type* is hardware dependent. Enter the **show port capabilities** command to determine the *port_type* for your hardware.

To revert to default CoS-to-transmit queue and drop threshold mappings, perform this task in privileged mode:

Task	Command
Revert to default CoS-to-transmit queue and drop threshold mappings.	**clear qos map** *port_type*

This example shows how to revert the CoS-to-transmit queue and drop threshold mappings to the default values on **2q1t** ports:

```
Console> (enable) clear qos map 2q1t
Qos map setting cleared.
Console> (enable)
```

Displaying QoS Information

To display QoS information, perform this task:

Task	Command
Display QoS information.	**show qos info** [**runtime**	**config**]

This example shows how to display the current QoS configuration information for the switch:

```
Console> show qos info config
QoS setting in NVRAM:
QoS is enabled
All ports have 2 transmit queues with 1 drop thresholds (2q1t).
Default CoS = 4
Queue and Threshold Mapping:
Queue Threshold CoS
----- --------- ---------------
1     1           0 1 2 3
2     1           4 5 6 7
Console>
```

Reverting to QoS Defaults

To revert to QoS defaults, perform this task in privileged mode:

Task	Command
Revert to QoS defaults.	**clear qos config**

This example shows how to revert to QoS defaults:

```
Console> (enable) clear qos config
This command will disable QoS and take values back to factory default.
Do you want to continue (y/n) [n]? y
QoS config cleared.
Console> (enable)
```

Note   Reverting to defaults disables QoS, because QoS is disabled by default.

Disabling QoS

To disable QoS, perform this task in privileged mode:

Task	Command
Disable QoS on the switch.	**set qos disable**

This example shows how to disable QoS:

```
Console> (enable) set qos disable
QoS is disabled.
Console> (enable)
```