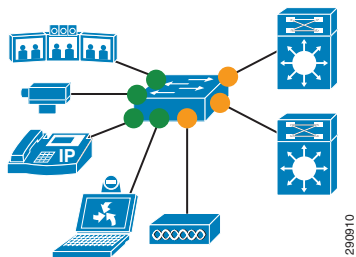


## Role in Campus Network

The Cisco Catalyst 2960-X series switches are well suited to the role of access switches in campus networks. As such, these switches may connect directly to a variety of endpoints, as well as to distribution-layer switches, as shown in Figure 1.

**Figure 1 Cisco Catalyst 2960-X Switches in a Campus Network**



## QoS Design Steps

There are four main steps to configure QoS on Cisco Catalyst 2960-X series switches:

1. Enable QoS
2. Configure Ingress QoS Model(s):
  - Trust DSCP Model
  - Conditional Trust Model
  - Service Policy Models
3. Configure Egress Queuing

### Step 1: Globally Enable QoS

QoS is globally enabled on the Cisco Catalyst 2960-X with the **mls qos** command.

### Step 2: Configure Ingress QoS Model(s)

The three most utilized ingress QoS models for campus networks are:

- Trust DSCP Model
- Conditional Trust Model
- Service Policy Models

Combinations of these ingress QoS models may be used at the same time.

### Trust DSCP Model

This model is configured with the **mls qos trust dscp** interface-configuration command.

The Trust DSCP model configures the interface to statically accept and preserve the Layer 3 DSCP markings of all incoming packets. This model is suitable for interfaces connecting to endpoints that can mark DSCP values and are administratively controlled (such as WLAN controllers) as well as for any uplinks to distribution layer switches. Switch ports that can be set to trust DSCP are shown as yellow circles in Figure 1.

### Conditional Trust Model

This model is configured with the **mls qos trust device** interface-configuration command.

The Conditional Trust model configures the interface to **dynamically** accept markings from endpoints that have met a specific condition (currently based on a successful Cisco Discovery Protocol identification). This model is suitable for switch ports connecting to Cisco IP phones (with the **cisco-phone** option), Cisco TelePresence Systems (with the **cts** option), Cisco IP Video Surveillance cameras (with the **ip-camera** option), and Cisco Digital Media Players (with the **media-player** option). This model is also suitable for PCs and untrusted devices, since the ports connecting to such devices will remain in their default untrusted state. Switch ports that can be set to conditional trust are shown as green circles in Figure 1.

### Service Policy Models

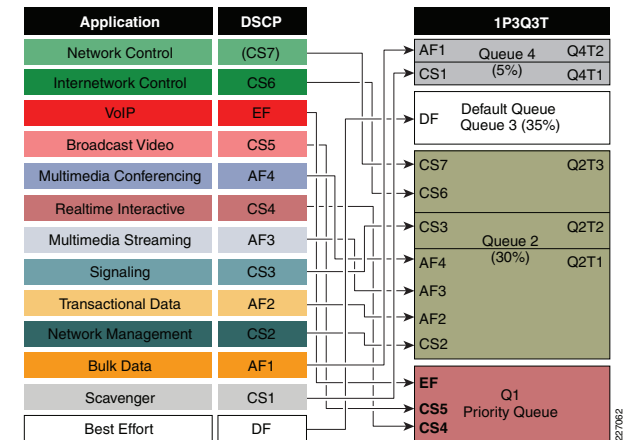
There may be cases where administrators require more detailed or granular policies on their ingress edges and as such they may construct MQC-based policies to implement classification, marking, and/or policing policies. These policies are constructed with:

- class-maps which identify the flows using packet markings or by access-lists or other criteria
- policy-maps which specify policy actions to be taken on a class-by-class basis
- service-policy statements which apply a specific policy-map to an interface(s) and specify direction

## Step 3: Configure Egress Queuing

The egress queuing model for the Cisco Catalyst 2960-X is shown in Figure 2.

**Figure 2 Catalyst 2960-X Egress Queuing Model**



## EtherChannel QoS

QoS policies on the Cisco Catalyst 2960-X are configured on the physical port-member interfaces only (and not on the logical Port-Channel interface).

## Cisco Validated Design

The Cisco Validated Design for Cisco Catalyst 2960-X series switches in the role of an access switch in a campus network is presented below.

<p><b>Step 1: Enable QoS:</b>  <code>mls qos</code></p>	<p><b>Step 3 : Configure Egress Queuing</b></p> <pre> mls qos queue-set output 1 buffers 15 30 35 20 mls qos queue-set output 1 threshold 1 100 100 100 100 mls qos queue-set output 1 threshold 2 80 90 100 400 mls qos queue-set output 1 threshold 3 100 100 100 400 mls qos queue-set output 1 threshold 4 60 100 100 400 mls qos srr-queue output cos-map queue 1 threshold 3 4 5 mls qos srr-queue output cos-map queue 2 threshold 1 2 mls qos srr-queue output cos-map queue 2 threshold 2 3 mls qos srr-queue output cos-map queue 2 threshold 3 6 7 mls qos srr-queue output cos-map queue 3 threshold 3 0 mls qos srr-queue output cos-map queue 4 threshold 3 1 mls qos srr-queue output dscp-map queue 1 threshold 3 32 40 46 mls qos srr-queue output dscp-map queue 2 threshold 1 16 18 20 22 mls qos srr-queue output dscp-map queue 2 threshold 1 26 28 30 34 36 38 mls qos srr-queue output dscp-map queue 2 threshold 2 24 mls qos srr-queue output dscp-map queue 2 threshold 3 48 56 mls qos srr-queue output dscp-map queue 3 threshold 3 0 mls qos srr-queue output dscp-map queue 4 threshold 1 8 mls qos srr-queue output dscp-map queue 4 threshold 2 10 12 14 queue-set 1 srr-queue bandwidth share 1 30 35 5 priority-queue out </pre> <p>Egress Queue and Threshold Tuning</p> <p>Egress CoS-to-Queue Mapping</p> <p>Egress DSCP-to-Queue Mapping</p> <p>Egress Queuing Interface-Specific Commands</p>
<p><b>Step 2: Configure Ingress QoS Model :</b></p> <p><b>Trust DSCP Model :</b>  <code>mls qos trust dscp</code></p> <p><b>Conditional Trust Model :</b>  <code>mls qos trust device cisco-phone</code> or  <code>mls qos trust device cts</code> or  <code>mls qos trust device ip-camera</code> or  <code>mls qos trust device media-player</code></p> <p><b>Service Policy Models :</b>  [class-maps omitted for brevity]</p> <pre> policy-map MARKING-POLICY class VOIP set dscp ef class MULTIMEDIA-CONFERENCING set dscp af41 class SIGNALING set dscp cs3 class TRANSACTIONAL-DATA set dscp af21 class BULK-DATA set dscp af11 class SCAVENGER set dscp cs1 class DEFAULT set dscp default service-policy input MARKING-POLICY </pre> <p>Note : The Service-Policy Model can be expanded to include policing.</p>	

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Note: Highlighted commands are interface specific; otherwise these are global.

For more details, see Campus QoS Design 4.0:

[http://www.cisco.com/en/US/docs/solutions/Enterprise/WAN\\_and\\_MAN/QoS\\_SRND\\_40/CoSCampus\\_40.html](http://www.cisco.com/en/US/docs/solutions/Enterprise/WAN_and_MAN/QoS_SRND_40/CoSCampus_40.html)

And the Cisco Press book: **End-to-End QoS Network Design** (Second Edition)-Chapter 14

