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FAQs

Catalyst 2950 Series Switches Quality of Service (QoS) FAQ

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Introduction

This document addresses the Frequently Asked Questions (FAQs) on the Quality of Service (QoS) features of the Cisco Catalyst 2950 series switches.

Q. What is the software version requirement for the QoS features on Catalyst 2950 series switches?

A. The 2950 supports egress queuing and scheduling based on IEEE 802.1p class of service (CoS) values with Cisco IOS® Software Release 12.0(5)WC(1) and later. Each port on the switch gets a default priority value. Frames that are received untagged are assigned this value. For those frames that are received tagged, the 2950 uses the value in the tag. The 2950 queues frames at the egress port into one of four priority queues. The switch makes the queue assignments on the basis of the priority or CoS value that is assigned to the frame at ingress. You can configure egress scheduling as either strict priority or weighted round-robin (WRR) scheduling. The Catalyst 2950 series switches run two feature sets of Cisco IOS Software, a standard image (SI) and an enhanced image (EI). Several feature differences exist between the SI version and the EI version. The SI only supports the output scheduling QoS features, whereas the EI adds support for classification, marking, and policing. Refer to the [Release Notes for the Catalyst 2955, Catalyst 2950, and Catalyst 2940 Switches, Cisco IOS Release 12.1\(22\)EA4](#) for hardware and software compatibility.

Q. What QoS features does the 2950 standard image (SI) support?

A. The 2950 with the SI supports queuing and scheduling at egress. The 2950 with SI supports ingress classification with use of port trust states in Cisco IOS Software Release 12.1(11)EA1 and later. You can configure the ingress port to trust either class of service (CoS) or differentiated services code point (DSCP), where the default port trust state is untrusted. You can configure egress scheduling as either strict priority scheduling or weighted round-robin (WRR) scheduling.

In Cisco IOS Software Releases 12.0, SI only supports configuration on CoS priorities and WRR. In Cisco IOS Software Releases 12.1 and later, SI added these features:

- Classification
 - Classification on the basis of Cisco Discovery Protocol (CDP) from a Cisco IP phone
- Output queuing and scheduling
 - Strict priority scheduling
 - WRR scheduling

Q. What QoS features does the 2950 enhanced image (EI) support?

A. The 2950 with the EI supports Layer 2 (L2)–Layer 4 (L4) classification at ingress with use of:

- Port trust states
- QoS access control lists (ACLs)
- Class maps and policy maps

The 2950 with EI also supports policing and marking at ingress as well as queuing and scheduling at egress. You can configure egress scheduling as either strict priority scheduling or weighted round-robin (WRR) scheduling. Refer to the [Release Notes for the Catalyst 2955, Catalyst 2950, and Catalyst 2940 Switches, Cisco IOS Release 12.1\(22\)EA4](#) for hardware and software compatibility.

In Cisco IOS Software Releases 12.0, EI only supports configuration on class of service

(CoS) priorities and WRR. In Cisco IOS Software Releases 12.1, EI added these features:

- Classification
 - Classification on the basis of:
 - Port trust state
 - Access control lists (ACLs)
 - Policy maps
 - Cisco Discovery Protocol (CDP) from a Cisco IP phone
 - Trust of CoS/differentiated services code point (DSCP)
 - Ports CoS configuration
- Marking
- Policing
 - Ingress policing
- Configuration of the mapping table
 - CoS-to-DSCP
 - DSCP-to-CoS
- Output queuing and scheduling
 - Strict priority scheduling
 - WRR scheduling

Q. Do the Catalyst 2950 series switches support rate-limiting or policing on ports or VLANs?

A. Catalyst 2950 series switches that run the enhanced image (EI) support ingress policing on physical interfaces only. Policers do not have support on VLAN interfaces. Catalyst 2950 series switches that run the standard image (SI) do not support policing. The minimum release with support is Cisco IOS Software Release 12.1.

Q. Can the Catalyst 2950 series switches mark or rewrite IP precedence (type of service [ToS]) bits in an IP packet?

A. Yes, the Catalyst 2950 series switches that run the enhanced image (EI) can mark or rewrite ToS bits in the header of an IP version 4 (IPv4) packet. Use a policy map that contains the **set ip dscp** statement. Or configure a policer to mark down or rewrite the differentiated services code point (DSCP) value on frames that do not conform to the rules in the policer.

Note: The Catalyst 2950 only supports ingress policing.

Q. Do the Catalyst 2950 series switches provide priority scheduling in the input/ingress port?

A. Catalyst 2950 series switches do not provide any ingress scheduling, but they do support egress queuing and scheduling. Use the **wrr-queue bandwidth** command. The default is to use FIFO.

Q. Do the Catalyst 2950 series switches honor the incoming class of service (CoS) values in IEEE 802.1p (dot1p) tags from IP phones?

A. The Catalyst 2950 series switches provide QoS-based 802.1p CoS values. In Cisco IOS Software Release 12.0(5)WC1 and later, the 2950 series switches honor the CoS value of an incoming frame by default.

Note: For untagged frames that are received on trusted and untrusted ports, QoS assigns the CoS value that the **mls qos cos** interface configuration command specifies. By default, this value is zero, which is trusted.

Q. My server or IP phone/device cannot tag class of service (CoS) values. Can the Catalyst 2950 series switches tag the traffic from the server/device for a specific CoS value?

A. Yes, the switch can tag the traffic. But you must configure the port as a trunk port and configure **mls qos cos value** , as well. In this sample configuration, interface FastEthernet 0/1 connects to an IP phone that cannot tag CoS values:

```
interface fastethernet 0/1
switchport mode trunk
mls qos cos 7
```

For IEEE 802.1Q frames with tag information, the priority value from the header frame is used. For frames that are received on the native VLAN, the default priority of the input port is used.

Q. Can I override the incoming class of service (CoS) to a specific CoS value?

A. Yes, you can override the CoS. Issue the **mls qos cos {default-cos | override}** command. The command overrides the previously configured trust state of the incoming packets and applies the default port CoS value to all incoming packets. Cisco IOS Software Release 12.1 and later support this command.

Q. What is pass-through mode?

A. In pass-through mode, the switch uses the class of service (CoS) value of incoming packets without a modification of the differentiated services code point (DSCP) value. The frame can pass through the switch with both the incoming CoS and DSCP values intact. When you disable pass-through mode and configure the switch port to trust CoS, the DSCP value is derived from the CoS-to-DSCP map. In this case, the DSCP usually changes as a result. In Cisco IOS Software releases earlier than Cisco IOS Software Release 12.1(11)EA1, this derivation of the DSCP value is on by default and you cannot change it. In Cisco IOS Software Release 12.1(11)EA1 and later, you can configure this with the enablement of pass-through mode on the port.

Here is a sample configuration:

```
interface fastethernet 0/1
switchport mode access
mls qos trust cos pass-through dscp
```

Q. Can I reclassify the class of service (CoS) value of data that are generated from a PC that connects to an IP phone? The IP phone attaches to a Catalyst 2950 series switch.

A. Yes, you can reclassify the CoS value of the data. Issue the **switchport priority extend cos** interface configuration command. The command configures the IP phone to override the priority of the traffic that comes from the PC.

Q. What kind of output scheduling do the Catalyst 2950 series switches provide?

A. The 2950 series switches support four class of service (CoS) queues for each egress port. For Cisco IOS Software releases earlier than Cisco IOS Software Release 12.1(12c)EA1, there is support for CoS priority queue and weighted round-robin (WRR) scheduling. Here is a sample configuration:

```
wrr-queue cos-map 1 0 1
wrr-queue cos-map 2 2 3
wrr-queue cos-map 3 4 5
wrr-queue cos-map 4 6 7
wrr-queue bandwidth 1 2 3 4
```

Note: 1 is the lowest CoS priority queue, and 4 is the highest.

In Cisco IOS Software Release 12.1(12c)EA1 and later, there is support for expedite queue and WRR scheduling instead. This scheduling uses one of the four egress queues (queue 4) as an expedite queue. WRR scheduling is performed on the three egress queues that remain. The expedite queue is a strict priority queue. Before the service of the other three queues, this expedite queue always receives service first, until it is empty. For all releases, strict priority scheduling is the default. Here is a sample configuration:

```
wrr-queue cos-map 1 0 1 2 4
wrr-queue cos-map 3 3 6 7
wrr-queue cos-map 4 5
wrr-queue bandwidth 20 1 80 0
```

Note: CoS 5 is mapped to queue 4. Queue 4 is the expedite queue, with bandwidth assigned to 0.

Q. Can I use access control lists (ACLs) to define traffic for the application of QoS features?

A. Yes, you can use IP standard, IP extended, and Layer 2 (L2) MAC ACLs in order to define a group of packets with the same characteristics. This definition of a group of packets classifies the packets. However, configuration of a deny action is not supported in QoS ACLs on the switch. Also, if there is a match with a permit action, the switch takes the specified action that relates to QoS and exits the list. If there is no match with all entries in the list, then the QoS processing does not occur on the packet. For all Cisco IOS Software releases, this process has support in enhanced image (EI) only. Cisco IOS Software Release 12.1(11)EA1 and later support the match on the basis of the differentiated services code point (DSCP) value.

Q. How do I configure the Catalyst 2950 series switches with voice VLANs for Cisco IP phone connections?

A. For Cisco IOS Software Release 12.1(12c)EA1 and later, when you configure the 2950 as an access layer switch for voice, first modify the default class of service (CoS)-to-differentiated services code point (DSCP) mapping table so that:

- CoS 3 maps to DSCP 26
- CoS 4 maps to DSCP 34
- CoS 5 maps to DSCP 46

Next, enable voice and data VLANs on the phone port and set the IP phone trust boundary. Issue the **mls qos trust cos** command from the IP phone. Finally, modify the CoS-to-egress-queue mapping and enable the expedite queue. With enablement of the expedite queue, voice packets always receive service before all other packets. Here is a sample configuration:

```
c2950(config)# mls qos map cos-dscp 0 8 16 26 34 46 48 56
c2950(config)# mls qos bandwidth 10 20 70 0
c2950(config)# interface fastethernet 0/1
c2950(config-if)# mls qos trust cos
c2950(config-if)# switchport voice vlan 100
c2950(config-if)# switchport access vlan 10
c2950(config-if)# switchport priority extend cos 0
```

Also, the auto-QoS feature has support in Cisco IOS Software Release 12.1(12c)EA1 and later. You can use the auto-QoS feature to simplify the deployment of existing QoS features. Auto-QoS makes assumptions about the network design. As a result, the switch can prioritize different traffic flows and appropriately use the egress queues instead of the default QoS behavior. The switch offers best-effort service to each packet, regardless of the packet contents or size, and sends the packet from a single queue. When you enable auto-QoS, the feature automatically classifies traffic on the basis of traffic type and ingress packet label. The switch uses the classification in order to choose the appropriate egress queue. You use auto-QoS commands in order to identify ports that connect to Cisco IP phones. You can also identify ports that receive trusted VoIP traffic through an uplink. Auto-QoS then performs these functions:

- Detects the presence or absence of IP phones
- Configures QoS classification
- Configures egress queues

Q. How do I verify the QoS configuration on the Catalyst 2950 series switches?

A. Use the commands in this table in order to verify your QoS configuration:

Command	Purpose
show class-map [<i>class-map-name</i>] ¹	To display QoS class maps, which define the match criteria to classify traffic.
show policy-map [<i>policy-map-name</i>] [<i>class class-name</i>] ¹	To display QoS policy maps, which define classification criteria for incoming traffic.
show mls qos maps [<i>cos-dscp</i> <i>dscp-cos</i>] ¹	To display QoS mapping information. Maps enable the generation of an internal DSCP ² value, which represents the priority of the traffic.
	To display QoS information at the interface level. This information includes:

show mls qos interface [<i>interface-id</i>] [policers] ¹	<ul style="list-style-type: none"> • The configuration of the egress queues and the CoS³-to-egress-queue map • Which interfaces have configured policers • Ingress and egress statistics, which includes the number of bytes that have been dropped
show wrp-queue cos-map	To display the mapping of the CoS priority queues.
show wrp-queue bandwidth	To display the WRR ⁴ bandwidth allocation for the CoS priority queues.

¹ This command is available only on a switch that runs the enhanced image (EI).

² DSCP = differentiated services code point

³ CoS = class of service

⁴ WRR = weighted round-robin

Q. What is the show command to check on the policer metrics on a Catalyst 2950 series switch?

A. On a Catalyst 2950 series switch, there are not any **show** commands to display the policer conform / exceed / drop rates, or the number of packets matching the ACLs in the policer. As a workaround, measure a single constant bit rate flow with the input rate on the ingress interface and the output rate on the egress interface. Then, verify if the policer did the job as expected.

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