Set Inner CoS Bits for QinQ

First Published: September 2007

Revised: November 2009

This document describes the Set Inner CoS Bits for QinQ feature that allows you to mark both inner and outer VLAN tags of a QinQ frame with the same Class of Service (CoS) values.

History for the Set Inner CoS Bits for QinQ

Release	Modification
12.2(33)XNE	Support was added for the PRE4.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions.

Contents

Prerequisites for Set Inner CoS Bits for QinQ

- You must configure Cisco Express Forwarding (CEF) on both the interface receiving the packet and the interface sending the packet. For information on CEF switching, refer to the *Cisco IOS Switching Services Configuration Guide*.
- This feature requires a Performance Routing Engine 3 (PRE3) or later PRE.

Feature Overview

The Set Inner CoS Bits for QinQ feature allows you to mark both the inner and outer VLAN tags of a QinQ frame with the same CoS values.

The router uses the CoS values to determine how to prioritize packets and can also use CoS marking to perform Layer 2 to Layer 3 mapping. Using the CoS field, you can differentiate user-defined QoS services for packets leaving a router and entering a switch.

Switches already have the ability to match and set CoS values; therefore, a router can set the CoS value of a packet to enable Layer 2 to Layer 3 mapping. The switch can then process the Layer 2 CoS header marking.

1. You assign the CoS value for an inner or outer VLAN tag to a class in a policy map.
2. If no inner CoS marking is explicitly set, the default marking of 802.1p CoS values on encapsulated IP packets is set to the value of the IP header precedence bits.
3. The parallel express forwarding (PXF) copies the class-based CoS values to the inner and outer VLAN tags.
4. The Layer 3 IP header Type of Service (ToS) field to CoS mapping applies the class-based CoS values on the downstream traffic from the Layer Access Concentrator (LAC) to the subscriber.

This feature is supported only for the subinterfaces that are configured with an inner (customer) VLAN.

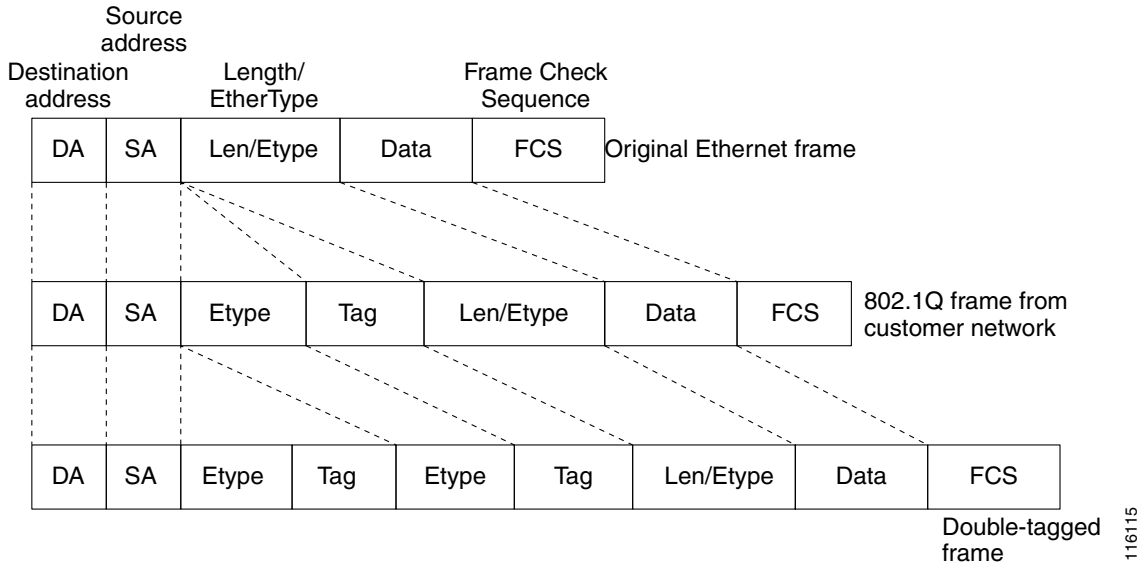
PPPoE—QinQ Support on Subinterfaces

PPPoE—QinQ Support adds another layer of IEEE 802.1Q tag (called metro tag or PE-VLAN) to the 802.1Q tagged packets that enter the network. This additional layer expands the VLAN space by tagging the tagged packets, thus producing a double-tagged frame. The expanded VLAN space allows the service provider to provide certain services, such as Internet access on specific VLANs for specific customers, and yet still allows the service provider to provide other types of services for their other customers on other VLANs.

Service providers can allow their customers to use this feature to safely assign their own VLAN IDs on subinterfaces because these subinterface VLAN IDs are encapsulated within a service provider-designated VLAN ID for that customer. Therefore no overlap of VLAN IDs among customers exists, nor does traffic from different customers become mixed.

The double-tagged frame is assigned on a subinterface with an expanded encapsulation dot1q command that specifies the two VLAN ID tags (outer VLAN ID and inner VLAN ID) terminated on the subinterface. See Figure 1.

Figure 1 Untagged, 802.1Q-Tagged, and Double-Tagged Ethernet Frames



PPPoE—QinQ Support is generally supported on whichever Cisco IOS features or protocols are supported on the subinterface. For example, you can configure a double-tagged frame to run PPPoE on the subinterface. IPoQinQ supports IP packets that are double-tagged for QinQ VLAN tag termination by forwarding IP traffic with the double-tagged (also known as stacked) 802.1Q headers.

For more information on PPPoE—QinQ Support, refer to the *PPPoE—QinQ Support* feature module.

Configuration Tasks

To configure and verify the CoS markings for inner and outer VLAN tags of a QinQ frame, perform the following tasks:

- Configuring Inner CoS Bits for QinQ, page 3
- Verifying Traffic Marking, page 7

Configuring Inner CoS Bits for QinQ

To configure both the inner and outer VLAN tags of a QinQ frame, enter the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. If prompted, enter your **password**.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**class-map** *class-map-name* [**match-all** | **match-any**] **Example:** `Router(config)# class-map c1`	Creates a class map to be used for matching packets to a specified class. Enters class-map configuration mode. *class-map-name* is the name of the class for the class map. The name can be a maximum of 40 alphanumeric characters. **match-all** determines how packets are evaluated when multiple match criteria exist. Matches statements under this class map based on the logical AND function. One statement and another are accepted. If you do not specify the **match-all** or **match-any** keyword, the default keyword is **match-all**. **match-any** determines how packets are evaluated when multiple match criteria exist. Matches statements under this class map based on the logical OR function. One statement or another is accepted.
Step 4	**match ip** {**dscp** *dscp-list* | **precedence** *precedence-list*} **Example:** `Router(config-cmap)# match ip precedence 5`	Specifies the match criteria to classify traffic. **dscp** *dscp-list* specifies a list of up to eight IP Differentiated Services Code Point (DSCP) values to match against incoming packets. Separate each value with a space. The range is 0 to 63. **ip precedence** *precedence-list* specifies a list of up to eight IP-precedence values to match against incoming packets. Separate each value with a space. The range is 0 to 7.
Step 5	**exit** **Example:** `Router(config-cmap)# exit`	Exits class-map configuration mode.
Step 6	`Router(config)# policy-map` *policy-name* **Example:** `Router(config)# policy-map tos2cos`	Specifies the name of the service policy to configure. Enters policy-map configuration mode. *policy-map-name* is the name of the policy map.

	Command	Purpose

Step 7	`Router(config-pmap)# class class-map-name`
	
	Example:
	`Router(config-pmap)# class c1`
		Assigns the traffic class and enters policy-map class configuration mode.
		
		class-map-name is the name of the previously configured class map and is the traffic class for which you want to define QoS actions.

Step 8	`Router(config-pmap-c)# set cos value`
	
	Example:
	`Router(config-pmap-c)# set cos 3`
		Specifies the Layer 2 CoS value of an outgoing packet.
		
		value is an IEEE 802.1Q CoS value from 0 to 7.

Step 9	`Router(config-pmap-c)# set ip precedence value`
	
	Example:
	`Router(config-pmap-c)# set ip precedence 1`
		Specifies the precedence value in the IP header.
		
		value is the precedence-bit value in the IP header. The following values from 0 to 7 are allowed:
		• 0—routine
		• 1—priority
		• 2—immediate
		• 3—flash
		• 4—flash-override
		• 5—critical
		• 6—internet
		• 7—network

Step 10	`class class-default`
	
	Example:
	`Router(config-pmap-c)# class class-default`
		Configures or modifies the parent class-default class.
		
		Note You can configure only the class-default class in a parent policy. Do not configure any other traffic class.

Step 11	`Router(config-pmap-c)# set cos value`
	
	Example:
	`Router# set cos 4`
		Specifies the Layer 2 CoS value of an inbound packet.
		
		value is an IEEE 802.1Q CoS value from 0 to 7.

Step 12	`exit`
	
	Example:
	`Router(config-pmap-c)# exit`
		Exits policy-map class configuration mode.

Step 13	`exit`
	
	Example:
	`Router(config-pmap)# exit`
		Exits policy-map configuration mode.

Step 14	`Router(config)# interface type number.subinterface-number`
	
	Example:
	`Router(config)# interface gigabitethernet 1/0/0.100`
		Configures a subinterface for PPP over Ethernet (PPPoE) QinQ support. Enters subinterface configuration mode.

	Command	Purpose
Step 15	**encapsulation dot1q** *vlan-id* **second-dot1q** {**any** | *vlan-id*[,*vlan-id*[-*vlan-id*]]} **Example:** Router(config-subif)# **encapsulation dot1q 100 second-dot1q 200**	(Optional) Enables IEEE 802.1Q encapsulation of traffic on a subinterface in a virtual LAN (VLAN). *vlan-id* is the VLAN ID, an integer in the range 1 to 4094. Hyphen must be entered to separate the starting and ending VLAN ID values that are used to define a range of VLAN IDs. (Optional) Comma must be entered to separate each VLAN ID range from the next range. **second-dot1q** supports the IEEE 802.1QinQ VLAN Tag Termination feature to configure an inner VLAN ID. **any** is any second tag in the range 1 to 4094.
Step 16	Router(config-subif)# **pppoe enable** [**group** *group-name*] **Example:** Router(config-subif)# **pppoe enable**	(Optional) Enables PPPoE sessions on a subinterface. (Optional) **group s**pecifies that a PPPoE profile will be used by PPPoE sessions on the interface. (Optional) *group-name* is the name of the PPPoE profile to be used by PPPoE sessions on the subinterface.
Step 17	Router(config-subif)# **service-policy output** *policy-map-name* **Example:** Router(config-subif)# **service-policy output tos2cos**	Attaches the policy map you specify to the subinterface. The router applies the service policy to packets on the subinterface in the output direction. **output** indicates to apply the service policy to outbound packets. *policy-map-name* is the name of the policy map.
Step 18	Router(config-subif)# **exit** **Example:** Router(config-subif)# **exit**	Exits subinterface configuration mode.

Verifying Traffic Marking

The router collects statistical information about the number of packets and bytes marked. To verify traffic marking, enter any of the following commands in privileged EXEC configuration mode:

Command	Purpose
`Router# show policy-map`	Displays configuration information for all configured policy maps.
`Router# show policy-map` *policy-map-name*	Displays configuration information for the policy map you specify.
`Router# show policy-map interface`	Displays configuration and statistical information for all of the output policies that are attached to an interface.
`Router# show policy-map interface` *interface*	Displays configuration and statistical information for the output policies attached to the interface you specify. *interface* is the name of the interface or subinterface whose policy configuration you want to display.
`Router# show policy-map interface` *interface* `[output]`	Displays the configuration of all classes configured for all outbound policy maps attached to the specified interface. *interface* is the name of the interface or subinterface whose policy configuration you want to display. **output** indicates to display the statistics for the attached outbound policy. **Note** If you do not specify **output**, the router shows information about all classes that are configured for all policies attached to the interface you specify.
`Router# show policy-map` *policy-map-name* `class` *class-name*	Displays the configuration of the class you specify for the policy map you specify. *policy-map-name* is the name of the policy map that contains the class configuration you want to display. *class-name* is the name of the class whose configuration you want to display.

Configuration Example

This section provides the following configuration example:

- Configuring Inner CoS Bits for QinQ

Configuring Inner CoS Bits for QinQ

Example 1 shows how to configure the inner and outer VLAN tags of a QinQ frame with CoS values. In the example, a policy map called tos2cos is created. The class map named c1 and the default policy class map use the same CoS value on outbound and inbound packets on the Gigabit Ethernet 2/0/1 interface.

Example 1 Configuring Inner CoS Bits for QinQ

```
Router> enable
Router# configure terminal
Router(config)# class-map c1
Router(config-cmap)# match ip precedence 5
Router(config-cmap)# exit
Router(config)# policy-map tos2cos
Router(config-pmap)# class c1
Router(config-pmap-c)# set cos 3
Router(config-pmap-c)# set ip precedence 2
Router(config-pmap-c)# class class-default
Router(config-pmap-c)# set cos 3
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface GigabitEthernet 1/0/0.100
Router(config-subif)# encapsulation dot1q 100
Router(config-subif)# pppoe enable
Router(config-subif)# service-policy output tos2cos
Router(config-subif)# exit
```

Additional References

The following sections provide references related to the Set Inner CoS Bits for QinQfeature.

Related Documents

Related Topic	Document Title
PPPoE—QinQ Support	*PPPoE—QinQ Support* feature module
Classification and Marking	*Cisco IOS Quality of Service Solutions Configuration Guide, Release 12.2* Part 1: Classification > Configuring Class-Based Packet Marking *Class-Based Marking, Release 12.0(26)S* feature module *Configuring Packet Marking on Frame Relay PVCs* *QoS Packet Marking, Implementing Quality of Service*

Related Topic	Document Title
Class of Service Marking	*Service Provider Quality of Service Design Guide* *Cisco IOS Quality of Service Solutions Configuration Guide, Release 12.2* Part 1: Classification > Configuring Class-Based Packet Marking
IP Precedence Marking	*Service Provider Quality of Service Design Guide* *Cisco IOS Quality of Service Solutions Configuration Guide, Release 12.2* Part 1: Classification > Configuring Class-Based Packet Marking

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards was not modified by this feature.	—

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs was not modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator at: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs was not modified by this feature.	—

Command Reference

This section documents modified commands. All other commands used with this feature are documented in the *Cisco IOS Command Reference* publication for your Cisco IOS software release.

- **set cos**

set cos

To set the Layer 2 class of service (CoS) value of an outgoing packet, use the **set cos** command in policy-map class configuration mode. To remove a specific CoS value setting, use the **no** form of this command.

set cos {*cos-value* | *from-field* [**table** *table-map-name*]}

no set cos {*cos-value* | *from-field* [**table** *table-map-name*]}

Cisco 10000 Series Router

set cos *cos-value*

Syntax Description

cos-value	Specific IEEE 802.1Q CoS value from 0 to 7.
from-field	Specific packet-marking category to be used to set the CoS value of the packet. If you are using a table map for mapping and converting packet-marking values, this establishes the "map from" packet-marking category. Packet-marking category keywords are as follows: • **precedence** • **dscp**
table	(Optional) Indicates that the values set in a specified table map will be used to set the CoS value.
table-map-name	(Optional) Name of the table map used to specify the CoS value. The table map name can be a maximum of 64 alphanumeric characters.

Defaults

No CoS value is set for the outgoing packet.

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.
12.2(13)T	This command was modified for Enhanced Packet Marking to allow a mapping table (table map) to be used to convert and propagate packet-marking values.
12.0(16)BX	This command was implemented on the Cisco 10000 series router for the ESR-PRE2.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Release	Modification
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB and implemented on the Cisco 10000 series router.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

CoS packet marking is supported only in the Cisco Express Forwarding switching path.

If a user wants to mark a packet that is being sent to a switch, the **set cos** command should be used by a router. Switches can leverage Layer 2 header information, including a CoS value marking.

The **set cos** command can be used only in service policies that are attached in the output direction of an interface. Packets entering an interface cannot be set with a CoS value.

The **match cos** and **set cos** commands can be used together to allow routers and switches to interoperate and provide quality of service (QoS) based on the CoS markings.

Layer 2 to Layer 3 mapping can be configured by matching on the CoS value because switches already can match and set CoS values. If a packet that needs to be marked to differentiate user-defined QoS services is leaving a router and entering a switch, the router should set the CoS value of the packet because the switch can process the Layer 2 header.

Using This Command with the Enhanced Packet Marking Feature

You can use this command as part of the Enhanced Packet Marking feature to specify the "from-field" packet-marking category to be used for mapping and setting the CoS value. The "from-field" packet-marking categories are as follows:

- Precedence
- Differentiated services code point (DSCP)

If you specify a "from-field" category but do not specify the **table** keyword and the applicable *table-map-name* argument, the default action is to copy the value associated with the "from-field" category as the CoS value. For instance, if you configure the **set cos precedence** command, the precedence value will be copied and used as the CoS value.

You can do the same for the DSCP marking category. That is, you can configure the **set cos dscp** command, and the DSCP value is copied and used as the CoS value.

Note If you configure the **set cos dscp** command, *only* the first three bits (the class selector bits) of the DSCP field are used.

Examples

In the following example, the policy map called cos-set is created to assign different CoS values for different types of traffic. This example assumes that the class maps called voice and video-data are already created.

```
Router(config)# policy-map cos-set
Router(config-pmap)# class voice
Router(config-pmap-c)# set cos 1
Router(config-pmap-c)# exit
Router(config-pmap)# class video-data
Router(config-pmap-c)# set cos 2
Router(config-pmap-c)# end
```

Enhanced Packet Marking Example

In the following example, the policy map called policy-cos is created to use the values defined in a table map called table-map1. The table map called table-map1 was created earlier with the **table-map** (value mapping) command. For more information about the **table-map** (value mapping) command, see the **table-map** (value mapping) command page.

In this example, the setting of the CoS value is based on the precedence value defined in table-map1:

```
Router(config)# policy-map policy-cos
Router(config-pmap)# class class-default
Router(config-pmap-c)# set cos precedence table table-map1
Router(config-pmap-c)# end
```

Note The **set cos** command is applied when you create a service policy in QoS policy-map configuration mode and attach the service policy to an interface or ATM virtual circuit (VC). For information on attaching a service policy, refer to the "Modular Quality of Service Command-Line Interface Overview" chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Related Commands

Command	Description
match cos	Matches a packet on the basis of Layer 2 CoS marking.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
set dscp	Marks a packet by setting the Layer 3 DSCP value in the ToS byte.
set precedence	Sets the precedence value in the packet header.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map class	Displays the configuration for the specified class of the specified policy map.
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.