QoS Tunnel Marking for GRE Tunnels

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The QoS Tunnel Marking for GRE Tunnels feature introduces the capability to define and control the quality of service (QoS) for both incoming and outgoing customer traffic on the provider edge (PE) router in a service provider network.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for QoS Tunnel Marking for GRE Tunnels

- You must determine the topology and interfaces that need to be configured to mark incoming and outgoing traffic.

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Restrictions for QoS Tunnel Marking for GRE Tunnels

- GRE tunnel marking is not supported on the following paths:
  - IPsec tunnels
  - Multiprotocol Label Switching over generic routing encapsulation (MPLSoGRE)
  - Layer 2 Tunneling Protocol (L2TP)

Information About QoS Tunnel Marking for GRE Tunnels

GRE Definition

Generic routing encapsulation (GRE) is a tunneling protocol developed by Cisco that can encapsulate a wide variety of protocol packet types inside IP tunnels, creating a virtual point-to-point link to Cisco routers at remote points over an IP internetwork.

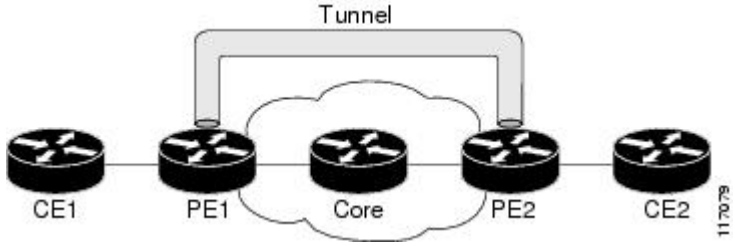
GRE Tunnel Marking Overview

The QoS Tunnel Marking for GRE Tunnels feature allows you to define and control QoS for incoming and outgoing customer traffic on the PE router in a service provider (SP) network. This feature lets you set (mark) either the IP precedence value or the differentiated services code point (DSCP) value in the header of an GRE tunneled packet. GRE tunnel marking can be implemented by a QoS marking command, such as **set ip** {**dscp** | **precedence**} [**tunnel**], and it can also be implemented in QoS traffic policing. This feature reduces administrative overhead previously required to control customer bandwidth by allowing you to mark the GRE tunnel header on the tunnel interface on the PE routers.

Note The **set ip** {**dscp** | **precedence**} [**tunnel**] command is equivalent to the **set** {**dscp** | **precedence**} [**tunnel**] command.

The figure below shows traffic being received from the CE1 router through the incoming interface on the PE1 router on which tunnel marking occurs. The traffic is encapsulated (tunneled), and the tunnel header is marked on the PE1 router. The marked packets travel (tunnel) through the core and are decapsulated automatically on the exit interface of the PE2 router. This feature is designed to simplify classifying customer edge (CE) traffic and is configured only in the service provider network. This process is transparent to the customer sites. The CE1 and CE2 routers exist as a single network.

Figure 1 Tunnel Marking



GRE Tunnel Marking and the MQC

Before you can configure tunnel marking for GRE tunnels, you must first configure a class map and a policy map and then attach that policy map to the appropriate interface. These three tasks can be accomplished by using the MQC.

For information on using the MQC, see the “Applying QoS Features Using the MQC” module.

GRE Tunnel Marking and DSCP or IP Precedence Values

GRE tunnel marking is configured with the **set ip precedence tunnel** or **set ip dscp tunnel** command on PE routers that carry incoming traffic from customer sites. GRE tunnel marking allows you to mark the header of a GRE tunnel by setting a DSCP value from 0 to 63 or an IP precedence value from 0 to 7 to control GRE tunnel traffic bandwidth and priority.

GRE traffic can also be marked under traffic policing with the **set-dscp-tunnel-transmit** and the **set-prec-tunnel-transmit** actions (or keywords) of the **police** command. The tunnel marking value is from 0 to 63 for the **set-dscp-tunnel-transmit** actions and from 0 to 7 for the **set-prec-tunnel-transmit** command. Under traffic policing, tunnel marking can be applied with conform, exceed, and violate action statements, allowing you to automatically apply a different value for traffic that does not conform to the expected traffic rate.

After the tunnel header is marked, GRE traffic is carried through the tunnel and across the service provider network. This traffic is decapsulated on the interface of the PE router that carries the outgoing traffic to the other customer site. The configuration of GRE tunnel marking is transparent to customer sites. All internal configuration is preserved.

There is a different between the **set ip precedence** and **set ip dscp** commands and the **set ip precedence tunnel** and **set ip dscp tunnel** commands:

- The **set ip precedence** and **set ip dscp** commands are used to set the IP precedence value or DSCP value in the header of an IP packet.
- The **set ip precedence tunnel** and **set ip dscp tunnel** commands are used to set (mark) the IP precedence value or DSCP value in the tunnel header that encapsulates the GRE traffic.
- The **set ip precedence tunnel** and **set ip dscp tunnel** commands have no effect on egress traffic that is not encapsulated in a GRE tunnel.

Benefits of GRE Tunnel Marking

GRE tunnel marking provides a simple mechanism to control the bandwidth of customer GRE traffic. The QoS Tunnel Marking for GRE Tunnels feature is configured entirely within the service provider network and on interfaces that carry incoming and outgoing traffic on the PE routers.

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- GRE Tunnel Marking Values, page 4

GRE Tunnel Marking and Traffic Policing

Traffic policing allows you to control the maximum rate of traffic sent or received on an interface and to partition a network into multiple priority levels or class of service (CoS). If you use traffic policing in your network, you can also implement the GRE tunnel marking feature with the **set-dscp-tunnel-transmit** or **set-prec-tunnel-transmit** action (or keyword) of the **police** command in policy-map class configuration mode. Under traffic policing, tunnel marking can be applied with conform, exceed, and violate action

statements, allowing you to apply a different value automatically for traffic that does not conform to the expected traffic rate.

GRE Tunnel Marking Values

The range of the tunnel marking values for the **set ip dscp tunnel** and **set-dscp-tunnel-transmit** commands is from 0 to 63, and the range of values for the **set ip precedence tunnel** and **set-prec-tunnel-transmit** commands is from 0 to 7.

How to Configure Tunnel Marking for GRE Tunnels

Configuring a Class Map

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map** [**match-all** | **match-any**] *class-map-name*
4. **match ip precedence** *precedence-value*
5. **exit**
6. **class-map** [**match-all** | **match-any**] *class-map-name*
7. **match ip dscp** *dscp-value*
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**class-map** [**match-all** | **match-any**] *class-map-name* **Example:** `Router(config)# class-map match-any MATCH_PREC`	Specifies the name of the class map to be created and enters QoS class map configuration mode. • The class map defines the criteria to use to differentiate the traffic. For example, you can use the class map to differentiate voice traffic from data traffic, based on a series of match criteria defined using the **match** command. **Note** If the **match-all** or **match-any** keyword is not specified, traffic must match all the match criteria to be classified as part of the traffic class.
Step 4	**match ip precedence** *precedence-value* **Example:** `Router(config-cmap)# match ip precedence 0`	Enables packet matching on the basis of the IP precedence values you specify. **Note** You can enter up to four matching criteria, as number abbreviation (0 to 7) or criteria names (critical, flash, and so on), in a single match statement.
Step 5	**exit** **Example:** `Router(config-cmap)# exit`	Returns to global configuration mode.
Step 6	**class-map** [**match-all** | **match-any**] *class-map-name* **Example:** `Router(config)# class-map match-any MATCH_DSCP`	Specifies the name of the class map to be created and enters QoS class map configuration mode.
Step 7	**match ip dscp** *dscp-value* **Example:** `Router(config-cmap)# match ip dscp 0`	Enables packet matching on the basis of the DSCP values you specify. • This command is used by the class map to identify a specific DSCP value marking on a packet. • The treatment of these marked packets is defined by the user through the setting of QoS policies in policy-map class configuration mode.
Step 8	**end** **Example:** `Router(config-cmap)# end`	(Optional) Returns to privileged EXEC mode.

Creating a Policy Map

Perform this task to create a tunnel marking policy marp and apply the map to a specific interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map-name*
4. **class** {*class-name* | **class-default**}
5. **set ip precedence tunnel** *precedence-value*
6. **exit**
7. **class** {*class-name* | **class-default**}
8. **set ip dscp tunnel** *dscp-value*
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**policy-map** *policy-map-name* **Example:** `Router(config)# policy-map TUNNEL_MARKING`	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy, and enters QoS policy-map configuration mode.
Step 4	**class** {*class-name* | **class-default**} **Example:** `Router(config-pmap)# class MATCH_PREC`	Specifies the name of the class whose policy you want to create or change or specifies the default class (commonly known as the class-default class) before you configure its policy. • Enters policy-map class configuration mode.
Step 5	**set ip precedence tunnel** *precedence-value* **Example:** `Router(config-pmap-c)# set ip precedence tunnel 3`	Sets the IP precedence value in the tunnel header of a GRE-tunneled packet on the ingress interface. The tunnel marking value is a number from 0 to 7 when IP precedence is configured.

	Command or Action	Purpose
Step 6	**exit** **Example:** `Router(config-pmap-c)# exit`	Returns to QoS policy-map configuration mode.
Step 7	**class** {*class-name* | **class-default**} **Example:** `Router(config-pmap)# class MATCH_DSCP`	Specifies the name of the class whose policy you want to create or change or specifies the default class (commonly known as the class-default class) before you configure its policy. • Enters policy-map class configuration mode.
Step 8	**set ip dscp tunnel** *dscp-value* **Example:** `Router(config-pmap-c)# set ip dscp tunnel 3`	Sets the differentiated services code point (DSCP) value in the tunnel header of a GRE-tunneled packet on the ingress interface. The tunnel marking value is a number from 0 to 63 when DSCP is configured.
Step 9	**end** **Example:** `Router(config-pmap-c)# end`	(Optional) Returns to privileged EXEC mode.

Attaching the Policy Map to an Interface or a VC

Policy maps can be attached to main interfaces, subinterfaces, or ATM permanent virtual circuits (PVCs). Policy maps are attached to interfaces by using the **service-policy** command and specifying either the **input** or **output** keyword to indicate the direction of the interface.

Note Tunnel marking policy can be applied on Ingress or Egress direction. A tunnel marking policy can be applied as an ingress policy on the ingress physical interface of a Service Provider Edge (SPE) router or as an egress policy on a tunnel interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **service-policy** {**input** | **output**} *policy-map-name*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface GigabitEthernet 0/0/1`	Configures an interface type and enters interface configuration mode.
Step 4	**service-policy** {**input** | **output**} *policy-map-name* **Example:** `Router(config-if)# service-policy input TUNNEL_MARKING`	Specifies the name of the policy map to be attached to the input or output direction of the interface. • Policy maps can be configured on ingress or egress routers. They can also be attached in the input or output direction of an interface. The direction (input or output) and the router (ingress or egress) to which the policy map should be attached vary according your network configuration.
Step 5	**end** **Example:** `Router(config-if)# end`	(Optional) Returns to privileged EXEC mode.

Verifying the Configuration of Tunnel Marking for GRE Tunnels

Use the **show** commands in this procedure to view the GRE tunnel marking configuration settings. The **show** commands are optional and can be entered in any order.

SUMMARY STEPS

1. **enable**
2. **show policy-map interface** *interface-name*
3. **show policy-map** *policy-map*
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show policy-map interface** *interface-name* **Example:** `Router# show policy-map interface GigabitEthernet0/0/1`	(Optional) Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface.
Step 3	**show policy-map** *policy-map* **Example:** `Router# show policy-map TUNNEL_MARKING`	(Optional) Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
Step 4	**exit** **Example:** `Router# exit`	(Optional) Returns to user EXEC mode.

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Troubleshooting Tips

If you find that the configuration is not functioning as expected, perform these operations to troubleshoot the configuration:

- Use the **show running-config** command and analyze the output of the command.
- If the policy map does not appear in the output of the **show running-config** command, enable the **logging console** command.
- Attach the policy map to the interface again.

Configuration Examples for QoS Tunnel Marking for GRE Tunnels

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• Example: Verifying the Tunnel Marking for GRE Tunnels Configuration, page 10

Example: Configuring Tunnel Marking for GRE Tunnels

The following is an example of a GRE tunnel marking configuration. In this example, a class map called "MATCH_PREC" has been configured to match traffic based on the DSCP value.

```
Router> enable
Router# configure terminal
Router(config)# class-map MATCH_DSCP
Router(config-cmap)# match ip dscp 0
Router(config-cmap)# end
```

In the following part of the example configuration, a policy map called "TUNNEL_MARKING" has been created and the **set ip dscp tunnel** command has been configured in the policy map. You could use the **set ip precedence tunnel** command instead of the **set ip dscp tunnel** command if you do not use DSCP in your network.

```
Router(config)# policy-map TUNNEL_MARKING
Router(config-pmap)# class MATCH_DSCP
Router(config-pmap-c)# set ip dscp tunnel 3
Router(config-pmap-c)# end
```

Note The following part of the example configuration is not required to configure this feature if you use the **set ip dscp tunnel** or **set ip precedence tunnel** commands to enable GRE tunnel marking. This example shows how GRE tunnel marking can be enabled under traffic policing.

In the following part of the example configuration, the policy map called "TUNNEL_MARKING" has been created and traffic policing has also been configured by using the **police** command and specifying the appropriate policing actions. The **set-dscp-tunnel-transmit** command can be used instead of the **set-prec-tunnel-transmit** command if you use DSCP in your network.

```
Router(config)# policy-map TUNNEL_MARKING
Router(config-pmap)# class class-default
Router(config-pmap-c)# police 8000 conform-action set-prec-tunnel-transmit 4 exceed-
action set-prec-tunnel-transmit 0
Router(config-pmap-c)# end
```

In the following part of the example configuration, the policy map is attached to GigabitEthernet interface 0/0/1 in the inbound (input) direction by specifying the **input** keyword of the **service-policy** command:

```
Router(config)# interface GigabitEthernet 0/0/1
Router(config-if)# service-policy input TUNNEL_MARKING
Router(config-if)# end
```

In the final part of the example configuration, the policy map is attached to tunnel interface 0 in the outbound (output) direction using the **output** keyword of the **service-policy** command:

```
Router(config)# interface Tunnel 0
Router(config-if)# service-policy output TUNNEL_MARKING
Router(config-if)# end
```

Example: Verifying the Tunnel Marking for GRE Tunnels Configuration

This section contains sample output from the **show policy-map interface** and the **show policy-map** commands. The output from these commands can be used to verify and monitor the feature configuration in your network.

The following is sample output from the **show policy-map interface** command. In this sample output:

- The character string “ip dscp tunnel 3” indicates that GRE tunnel marking has been configured to set the DSCP value in the header of a GRE-tunneled packet.
- The character string “ip precedence tunnel 3” indicates that GRE tunnel marking has been configured to set the precedence value in the header of a GRE-tunneled packet.

```
Router# show policy-map interface GigabitEthernet0/0/1
 Service-policy input: TUNNEL_MARKING

    Class-map: MATCH_PREC (match-any)
      22 packets, 7722 bytes
      5 minute offered rate 0000 bps, drop rate 0000 bps
      Match: ip precedence 0
      QoS Set
        ip precedence tunnel 3
          Marker statistics: Disabled

    Class-map: MATCH_DSCP (match-any)
      0 packets, 0 bytes
      5 minute offered rate 0000 bps, drop rate 0000 bps
      Match: ip dscp default (0)
      QoS Set
        ip dscp tunnel 3
          Marker statistics: Disabled

    Class-map: class-default (match-any)
      107 packets, 8658 bytes
      5 minute offered rate 0000 bps, drop rate 0000 bps
      Match: any
```

The following is sample output from the **show policy-map** command. In this sample output, the character string “ip precedence tunnel 3” indicates that the GRE tunnel marking feature has been configured to set the IP precedence value in the header of an GRE-tunneled packet.

```
Router# show policy-map

Policy Map TUNNEL_MARKING
    Class MATCH_PREC
      set ip precedence tunnel 3
    Class MATCH_DSCP
      set ip dscp tunnel 3
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	*Cisco IOS Master Commands List, All Releases*
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	*Cisco IOS Quality of Service Solutions Command Reference*
MQC	“Applying QoS Features Using the MQC” module
Tunnel marking for Layer 2 Tunnel Protocol Version 3 (L2TPv3) tunnels	“QoS: Tunnel Marking for L2TPv3 Tunnels” module

Related Topic	Document Title
DSCP	"Overview of DiffServ for Quality of Service" module

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

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

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for QoS Tunnel Marking for GRE Tunnels

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software

release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1 Feature Information for QoS Tunnel Marking for GRE Tunnels

Feature Name	Releases	Feature Information
QoS Tunnel Marking for GRE Tunnels	Cisco IOS XE Release 3.5S	The QoS Tunnel Marking for GRE Tunnels feature introduces the capability to define and control the QoS for incoming customer traffic on the PE router in a service provider network. The following commands were introduced or modified: **match atm-clp**, **match cos**, **match fr-de**, **police**, **police (two rates)**, **set ip dscp tunnel**, **set ip precedence tunnel**, **show policy-map**, **show policy-map interface**.