Marking Network Traffic

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Marking network traffic allows you to set or modify the attributes for traffic (that is, packets) belonging to a specific class or category. When used in conjunction with network traffic classification, marking network traffic is the foundation for enabling many quality of service (QoS) features on your network. This module contains conceptual information and the configuration tasks for marking network traffic.

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 Marking Network Traffic

In order to mark network traffic, Cisco Express Forwarding must be configured on both the interface receiving the traffic and the interface sending the traffic.

Restrictions for Marking Network Traffic

Traffic marking can be configured on an interface, a subinterface, or an ATM permanent virtual circuit (PVC). Marking network traffic is not supported on the following interfaces:

- Any interface that does not support Cisco Express Forwarding
- ATM switched virtual circuit (SVC)
- Fast EtherChannel
- PRI
- Tunnel

Information About Marking Network Traffic

Purpose of Marking Network Traffic

Traffic marking is a method used to identify certain traffic types for unique handling, effectively partitioning network traffic into different categories.

After the network traffic is organized into classes by traffic classification, traffic marking allows you to mark (that is, set or change) a value (attribute) for the traffic belonging to a specific class. For instance, you may want to change the class of service (CoS) value from 2 to 1 in one class, or you may want to change the differentiated services code point (DSCP) value from 3 to 2 in another class. In this module, these values are referred to as attributes.

Attributes that can be set and modified include the following:

- Cell loss priority (CLP) bit
- CoS value of an outgoing packet
- Discard eligible (DE) bit setting in the address field of a Frame Relay frame
- Discard-class value
- DSCP value in the type of service (ToS) byte
- MPLS EXP field value in the topmost label on either an input or an output interface
- Multiprotocol Label Switching (MPLS) experimental (EXP) field on all imposed label entries
- Precedence value in the packet header
- QoS group identifier (ID)
- ToS bits in the header of an IP packet

Benefits of Marking Network Traffic

Improved Network Performance

Traffic marking allows you to fine-tune the attributes for traffic on your network. This increased granularity helps single out traffic that requires special handling, and thus, helps to achieve optimal application performance.

Traffic marking allows you to determine how traffic will be treated, based on how the attributes for the network traffic are set. It allows you to segment network traffic into multiple priority levels or classes of service based on those attributes, as follows:

- Traffic marking is often used to set the IP precedence or IP DSCP values for traffic entering a network. Networking devices within your network can then use the newly marked IP precedence values to determine how traffic should be treated. For example, voice traffic can be marked with a particular IP precedence or DSCP and low latency queuing (LLQ) can then be configured to put all packets of that mark into a priority queue. In this case, the marking was used to identify traffic for LLQ.
- Traffic marking can be used to identify traffic for any class-based QoS feature (any feature available in policy-map class configuration mode, although some restrictions exist).
- Traffic marking can be used to assign traffic to a QoS group within a router. The router can use the QoS groups to determine how to prioritize traffic for transmission. The QoS group value is usually used for one of the two following reasons:
  - To leverage a large range of traffic classes. The QoS group value has 100 different individual markings, as opposed to DSCP and Precedence, which have 64 and 8, respectively.
  - If changing the Precedence or DSCP value is undesirable.
- If a packet (for instance, in a traffic flow) needs to be marked to differentiate user-defined QoS services is leaving a router and entering a switch, the router can set the CoS value of the traffic, because the switch can process the Layer 2 CoS header marking. Alternatively, the Layer 2 CoS value of the traffic leaving a switch can be mapped to the Layer 3 IP or MPLS value.
- Weighted random early detection (WRED) uses precedence values or DSCP values to determine the probability that the traffic will be dropped. Therefore, the Precedence and DSCP can be used in conjunction with WRED.

Two Methods for Marking Traffic Attributes

There are two methods for specifying and marking traffic attributes:

- You can specify and mark the traffic attribute by using a **set** command.

With this method, you configure individual **set** commands for the traffic attribute that you want to mark.

- You can specify and mark the traffic attribute by creating a mapping table (called a "table map").

With this method, you configure the traffic attributes that you want to mark once in a table map and then the markings can be propagated throughout the network.

These methods are further described in the sections that follow.

- Method One Using a set Command, page 4
- Method Two Using a Table Map, page 4
- Traffic Marking Procedure Flowchart, page 6

Method One Using a set Command

You specify the traffic attribute you want to change with a **set**command configured in a policy map. The table below lists the available **set**commands and the corresponding attribute. The table also includes the network layer and the network protocol typically associated with the traffic attribute.

Table 1 set Commands and Corresponding Traffic Attribute, Network Layer, and Protocol

set Commands[1]	Traffic Attribute	Network Layer	Protocol
set atm-clp	CLP bit	Layer 2	ATM
set cos	Layer 2 CoS value of the outgoing traffic	Layer 2	ATM, Frame Relay
set discard-class	discard-class value	Layer 2	ATM, Frame Relay
set dscp	DSCP value in the ToS byte	Layer 3	IP
set fr-de	DE bit setting in the address field of a Frame Relay frame	Layer 2	Frame Relay
set ip tos (route-map)	ToS bits in the header of an IP packet	Layer 3	IP
set mpls experimental imposition	MPLS EXP field on all imposed label entries	Layer 3	MPLS
set mpls experimental topmost	MPLS EXP field value in the topmost label on either an input or an output interface	Layer 3	MPLS
set precedence	precedence value in the packet header	Layer 3	IP
set qos-group	QoS group ID	Layer 3	IP, MPLS

If you are using individual **set** commands, those **set** commands are specified in a policy map. The following is a sample of a policy map configured with one of the **set** commands listed in the table above.

In this sample configuration, the **set atm-clp**command has been configured in the policy map (policy1) to mark the CLP attribute.

```
policy-map policy1
 class class1
 set atm-clp
 end
```

Method Two Using a Table Map

1 **Cisco IOS set commands can vary by release. For more information, see the command documentation for the Cisco IOS release that you are using**

You can create a table map that can be used to mark traffic attributes. A table map is a kind of two-way conversion chart that lists and maps one traffic attribute to another. A table map supports a many-to-one type of conversion and mapping scheme. The table map establishes a to-from relationship for the traffic attributes and defines the change to be made to the attribute. That is, an attribute is set *to* one value that is taken *from* another value. The values are based on the specific attribute being changed. For instance, the Precedence attribute can be a number from 0 to 7, while the DSCP attribute can be a number from 0 to 63.

The following is a sample table map configuration:

```
table-map table-map1

 map from 0 to 1

 map from 2 to 3

 exit
```

The table below lists the traffic attributes for which a to-from relationship can be established using the table map.

Table 2 Traffic Attributes for Which a To-From Relationship Can Be Established

The "To" Attribute	The "From" Attribute
Precedence	CoS
	QoS group
DSCP	CoS
	QoS group
CoS	Precedence
	DSCP
QoS group	Precedence
	DSCP
	MPLS EXP topmost
MPLS EXP topmost	QoS group
MPLS EXP imposition	Precedence
	DSCP

Once the table map is created, you configure a policy map to use the table map. In the policy map, you specify the table map name and the attributes to be mapped by using the **table** keyword and the *table-map-name* argument with one of the commands listed in the table below.

Table 3 Commands Used in Policy Maps to Map Attributes

Command Used in Policy Maps	Maps These Attributes
set cos dscp table *table-map-name*	CoS to DSCP
set cos precedence table *table-map-name*	CoS to Precedence
set dscp cos table *table-map-name*	DSCP to CoS
set dscp qos-group table *table-map-name*	DSCP to qos-group
set mpls experimental imposition dscp table *table-map-name*	MPLS EXP imposition to DSCP
set mpls experimental imposition precedence table *table-map-name*	MPLS EXP imposition to precedence
set mpls experimental topmost qos-group table *table-map-name*	MPLS EXP topmost to QoS-group
set precedence cos table *table-map-name*	Precedence to CoS
set precedence qos-group table *table-map-name*	Precedence to QoS-group
set qos-group dscp table *table-map-name*	QoS-group to DSCP
set qos-group mpls exp topmost table *table-map-name*	QoS-group to MPLS EXP topmost
set qos-group precedence table *table-map-name*	QoS-group to Precedence

The following is an example of a policy map (policy2) configured to use the table map (table-map1) created earlier:

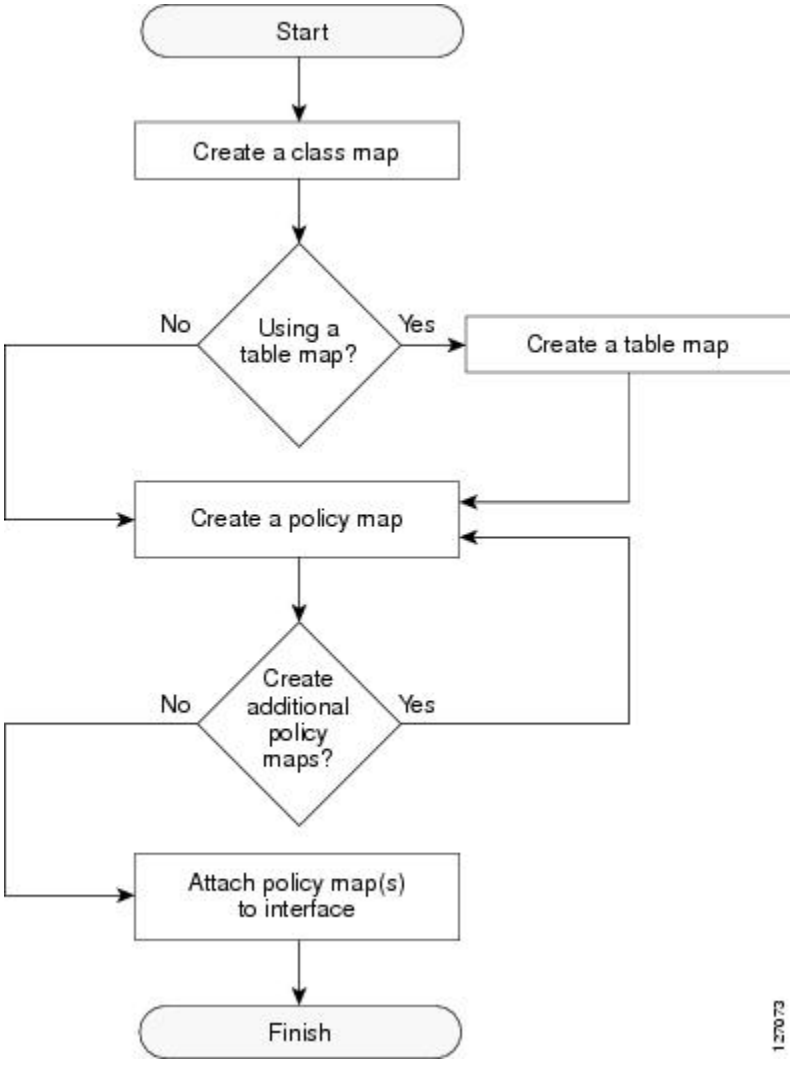
```
policy map policy2

 class class-default

 set cos dscp table table-map1

 exit
```

In this example, a mapping relationship was created between the CoS attribute and the DSCP attribute as defined in the table map.

Traffic Marking Procedure Flowchart

The figure below illustrates the order of the procedures for configuring traffic marking.

Figure 1



MQC and Network Traffic Marking

To configure network traffic marking, you use the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC).

The MQC is a CLI structure that allows you to complete the following tasks:

- Specify the matching criteria used to define a traffic class.
- Create a traffic policy (policy map). The traffic policy defines the QoS policy actions to be taken for each traffic class.
- Apply the policy actions specified in the policy map to an interface, subinterface, or ATM PVC by using the **service-policy** command.

Traffic Classification Compared with Traffic Marking

Traffic classification and traffic marking are closely related and can be used together. Traffic marking can be viewed as an additional action, specified in a policy map, to be taken on a traffic class.

Traffic classification allows you to organize into traffic classes on the basis of whether the traffic matches specific criteria. For example, all traffic with a CoS value of 2 is grouped into one class, and traffic with DSCP value of 3 is grouped into another class. The match criterion is user-defined.

After the traffic is organized into traffic classes, traffic marking allows you to mark (that is, set or change) an attribute for the traffic belonging to that specific class. For instance, you may want to change the CoS value from 2 to 1, or you may want to change the DSCP value from 3 to 2.

The match criteria used by traffic classification are specified by configuring a **match** command in a class map. The marking action taken by traffic marking is specified by configuring a **set** command in a policy map. These class maps and policy maps are configured using the MQC.

The table below compares the features of traffic classification and traffic marking.

Table 4 Traffic Classification Compared with Traffic Marking

	Traffic Classification	Traffic Marking
Goal	Groups network traffic into specific traffic classes on the basis of whether the traffic matches the user-defined criterion.	After the network traffic is grouped into traffic classes, modifies the attributes for the traffic in a particular traffic class.
Configuration Mechanism	Uses class maps and policy maps in the MQC.	Uses class maps and policy maps in the MQC.
CLI	In a class map, uses **match** commands (for example, **match cos**) to define the traffic matching criterion.	Uses the traffic classes and matching criterion specified by traffic classification. In addition, uses **set** commands (for example, **set cos**) in a policy map to modify the attributes for the network traffic. If a table map was created, uses the **table** keyword and *table-map-name* argument with the **set** commands (for example, **set cos precedence table** *table-map-name*) in the policy map to establish the to-from relationship for mapping attributes.

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Creating a Class Map for Marking Network Traffic

Note The **match fr-dlci** command is included in the steps below. The **match fr-dlci**command is just an example of one of the **match** commands that can be used. See the command documentation for the Cisco IOS release that you are using for a complete list of **match** commands.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map** *class-map-name* [**match-all**| **match-any**]
4. **match fr-dlci** *dlci-number*
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	**class-map** *class-map-name* [**match-all**| **match-any**] **Example:** `Router(config)# class-map class1`	Creates a class map to be used for matching traffic to a specified class and enters class-map configuration mode. • Enter the class map name.

	Command or Action	Purpose
Step 4	**match fr-dlci** *dlci-number* **Example:** `Router(config-cmap)# match fr-dlci 500`	(Optional) Specifies the Frame Relay DLCI number as a match criterion in a class map. **Note** The **match fr-dlci** command classifies traffic on the basis of the Frame Relay DLCI number. The **match fr-dlci**command is just an example of one of the **match** commands that can be used. The **match** commands vary by Cisco IOS release. See the command documentation for the Cisco IOS release that you are using for a complete list of **match** commands.
Step 5	**end** **Example:** `Router(config-cmap)# end`	(Optional) Returns to privileged EXEC mode.

Creating a Table Map for Marking Network Traffic

Note If you are not using a table map, skip this procedure and advance to Creating a Policy Map for Applying a QoS Feature to Network Traffic, page 12.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **table-map** *table-map-name* **map from** *from-value* **to** *to-value* [**default** *default-action-or-value*]
4. **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	**table-map** *table-map-name* **map from** *from-value* **to** *to-value* [**default** *default-action-or-value*] **Example:** **Example:** `Router(config)# table-map table-map1 map from 2 to 1`	Creates a table map using the specified name and enters tablemap configuration mode. • Enter the name of the table map you want to create. • Enter each value mapping on a separate line. Enter as many separate lines as needed for the values you want to map. • The **default** keyword and *default-action-or-value* argument set the default value (or action) to be used if a value is not explicitly designated.

Step 4	**end**
	
	Example:
	
	`Router(config-tablemap)#`
	
	`end`
		(Optional) Exits tablemap configuration mode and returns to privileged EXEC mode.

Creating a Policy Map for Applying a QoS Feature to Network Traffic

Note

- The **set atm-clp** command is supported on the following adapters only:
  - Enhanced ATM Port Adapter (PA-A3)
  - ATM Inverse Multiplexer over ATM Port Adapter with 8 T1 Ports (PA-A3-8T1IMA)
  - ATM Inverse Multiplexer over ATM Port Adapter with 8 E1 Ports (PA-A3-8E1IMA)
- Before modifying the encapsulation type from IEEE 802.1 Q to ISL, or vice versa, on a subinterface, detach the policy map from the subinterface. After changing the encapsulation type, reattach the policy map.
- A policy map containing the **set qos-group** command can only be attached as an input traffic policy. QoS group values are not usable for traffic leaving a router.
- A policy map containing the **set cos**command can only be attached as an output traffic policy.
- A policy map containing the **set atm-clp** command can be attached as an output traffic policy only. The **set atm-clp** command does not support traffic that originates from the router.

Note The **set cos**command and **set cos dscp table** *table-map-name*command are shown in the steps t
The **set cos**command and **set cos dscp table** *table-map-name*command are examples the **set** co
that can be used when marking traffic. Other **set** commands can be used. For a list of other **set** c
see Creating a Policy Map for Applying a QoS Feature to Network Traffic, page 12 and Creati
Map for Applying a QoS Feature to Network Traffic, page 12.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map-name*
4. **class** {*class-name* | **class-default**}
5. **set cos** *cos-value*
6.
7. **set cos dscp table** *table-map-name*
8. Router(config-pmap-c)# set cos 2
9.
10. Router(config-pmap-c)# set cos dscp table table-map1
11. **end**
12. **show policy-map**
13.
14. **show policy-map** *policy-map* **class** *class-name*
15. Router# show policy-map
16.
17. Router# show policy-map policy1 class class1
18. **exit**

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 policy1`	Specifies the name of the policy map created earlier and enters policy-map configuration mode. • Enter the policy map name.

	Command or Action	Purpose
Step 4	**class** {*class-name* | **class-default**} **Example:** `Router(config-pmap)# class class1`	Specifies the name of the class whose policy you want to create and enters policy-map class configuration mode. This class is associated with the class map created earlier. • Enter the name of the class or enter the **class-default**keyword.
Step 5	**set cos** *cos-value* **Example:**	(Optional) Sets the CoS value in the type of service (ToS) byte. **Note** The **set cos**command is an example of one of the **set** commands that can be used when marking traffic. Other **set** commands can be used. For a list of other **set** commands, see Creating a Policy Map for Applying a QoS Feature to Network Traffic, page 12.
Step 6		or
Step 7	**set cos dscp table** *table-map-name* **Example:**	(Optional) If a table map has been created earlier, sets the CoS value based on the DSCP value (or action) defined in the table map. **Note** The **set cos dscp table** *table-map-name*command is an example of one of the commands that can be used. For a list of other commands, see Creating a Policy Map for Applying a QoS Feature to Network Traffic, page 12.
Step 8	Router(config-pmap-c)# set cos 2	
Step 9		
Step 10	Router(config-pmap-c)# set cos dscp table table-map1	
Step 11	**end** **Example:** `Router(config-pmap-c)# end`	Returns to privileged EXEC mode.
Step 12	**show policy-map**	(Optional) Displays all configured policy maps.
Step 13		or
Step 14	**show policy-map** *policy-map* **class** *class-name* **Example:**	(Optional) Displays the configuration for the specified class of the specified policy map. • Enter the policy map name and the class name.
Step 15	Router# show policy-map	
Step 16		
Step 17	Router# show policy-map policy1 class class1	

	Command or Action	Purpose
Step 18	**exit** **Example:** `Router# exit`	(Optional) Exits privileged EXEC mode.

- What to Do Next, page 15

What to Do Next

Create and configure as many policy maps as you need for your network. To create and configure additional policy maps, repeat the steps in the Creating a Policy Map for Applying a QoS Feature to Network Traffic, page 12. Then attach the policy maps to the appropriate interface, following the instructions in the Attaching the Policy Map to an Interface, page 15.

Attaching the Policy Map to an Interface

Note Depending on the needs of your network, policy maps can be attached to an interface, a subinterface, or an ATM permanent virtual circuit (PVC).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number* [**name-tag**]
4. **pvc** [*name*] *vpi* / *vci* [**ilmi**|**qsaal**|**smds**| **l2transport**]
5. **exit**
6. **service-policy** {**input** | **output**} *policy-map-name*
7. **end**
8. **show policy-map interface** *type number*
9. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* [**name-tag**] **Example:** `Router(config)# interface serial4/0`	Configures an interface type and enters interface configuration mode. • Enter the interface type and number.
Step 4	**pvc** [*name*] *vpi* / *vci* [**ilmi**|**qsaal**|**smds**|**l2transport**] **Example:** `Router(config-if)# pvc cisco 0/16`	(Optional) Creates or assigns a name to an ATM permanent virtual circuit (PVC), specifies the encapsulation type on an ATM PVC, and enters ATM virtual circuit configuration mode. • Enter the PVC name, the ATM network virtual path identifier, and the network virtual channel identifier. **Note** This step is required only if you are attaching the policy map to an ATM PVC. If you are not attaching the policy map to an ATM PVC, advance to Attaching the Policy Map to an Interface, page 15.
Step 5	**exit** **Example:** `Router(config-atm-vc)# exit`	(Optional) Returns to interface configuration mode. **Note** This step is required only if you are attaching the policy map to an ATM PVC and you completed Attaching the Policy Map to an Interface, page 15. If you are not attaching the policy map to an ATM PVC, advance to Attaching the Policy Map to an Interface, page 15.
Step 6	**service-policy** {**input** | **output**} *policy-map-name* **Example:** `Router(config-if)# service-policy input policy1`	Attaches a policy map to an input or output interface. • Enter the policy map name. **Note** 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 varies according your network configuration. When using the **service-policy** command to attach the policy map to an interface, be sure to choose the router and the interface direction that are appropriate for your network configuration.
Step 7	**end** **Example:** `Router(config-if)# end`	Returns to privileged EXEC mode.

	Command or Action	Purpose
Step 8	**show policy-map interface** *type number* **Example:** `Router# show policy-map interface serial4/0`	(Optional) Displays traffic statistics of all classes configured for all service policies on the specified interface, subinterface, or PVC on the interface. When there are multiple instances of the same class in a policy-map, and this policy-map is attached to an interface, **show policy-map interface** `<interface_name>` **output class** `<class-name>` returns only the first instance. • Enter the interface type and number.
Step 9	**exit** **Example:** `Router# exit`	(Optional) Exits privileged EXEC mode.

Configuring QoS When Using IPsec VPNs

Note This task is required only if you are using IPsec Virtual Private Networks (VPNs). Otherwise, this task is not necessary. For information about IPsec VPNs, see the "Configuring Security for VPNs with IPsec" module.

Note This task uses the **qos pre-classify** command to enable QoS preclassification for the packet. QoS preclassification is not supported for all fragmented packets. If a packet is fragmented, each fragment might received different preclassifications.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **crypto map** *map-name seq-num*
4. **exit**
5. **interface** *type number* [**name-tag**]
6. **qos pre-classify**
7. **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	**crypto map** *map-name seq-num* **Example:** `Router(config)# crypto map mymap 10`	Enters crypto map configuration mode and creates or modifies a crypto map entry. • Enter the crypto map name and sequence number.
Step 4	**exit** **Example:** `Router(config-crypto-map)# exit`	Returns to global configuration mode.
Step 5	**interface** *type number* [**name-tag**] **Example:** `Router(config)# interface serial4/0`	Configures an interface type and enters interface configuration mode. • Enter the interface type and number.
Step 6	**qos pre-classify** **Example:** `Router(config-if)# qos pre-classify`	Enables QoS preclassification.
Step 7	**end** **Example:** `Router(config-if)# end`	(Optional) Exits interface configuration mode and returns to privileged EXEC mode.

Configuration Examples for Marking Network Traffic

Example Creating a Class Map for Marking Network Traffic

The following is an example of creating a class map to be used for marking network traffic. In this example, a class called class1 has been created. The traffic with a Frame Relay DLCI value of 500 will be put in this class.

```
Router> enable

Router# configure terminal

Router(config)# class-map class1

Router(config-cmap)# match fr-dlci 500

Router(config-cmap)# end
```

Example Table Map for Marking Network Traffic

In the following example, the **table-map** (value mapping) command has been used to create and configure a table map called table-map1. This table map will be used to establish a to-from relationship between one traffic-marking value and another.

In table-map1, a traffic-marking value of 0 will be mapped to a value of 1.

```
Router> enable
Router# configure terminal
Router(config)# table-map
 table-map1 map from 0 to 1

Router(config-tablemap)#
 end
```

Example Policy Map for Applying a QoS Feature to Network Traffic

Policy Map Configured to Use set Command

The following is an example of creating a policy map to be used for traffic marking. In this example, a policy map called policy1 has been created, and the **set dscp**command has been configured for class1.

```
Router> enable
```

```
Router# configure terminal
Router(config)# policy-map policy1
Router(config-pmap)# class class1
Router(config-pmap-c)# set dscp 2
Router(config-pmap-c)# end
```

Policy Map Configured to Use a Table Map

A policy map called policy1 has been created and configured to use table-map1 for setting the precedence value. In this example, the CoS value will be set according to the DSCP value defined in table-map1 created previously.

```
Router(config)# policy map policy1

Router(config-pmap)# class class-default

Router(config-pmap-c)#
 set cos dscp table table-map1

Router(config-pmap-c)#
 end
```

Note As an alternative to configuring the **set cos dscp table table-map1** command shown in the example, you could configure the command without specifying the **table** keyword and the applicable *table-map-nam*e argument (that is, you could configure the **set cos dscp**command). When the command is configured without the **table** keyword and applicable table map name, the values are copied from the specified categories. In this case, the DSCP value is copied and used to set the CoS value. When the DSCP value is copied and used for the CoS value only the *first 3 bits* (that is, the class selector bits) of the DSCP value will be used to set the CoS value. For example, if the DSCP value is EF (101110), the first 3 bits of this DSCP value will be used to set the CoS value, resulting in a CoS value of 5 (101).

Policy Map Configured to Use a Table Map for Mapping MPLS EXP Values

This section contains an example of a policy map configured to map MPLS experimental (EXP) values. The figure below illustrates the network topology for this configuration example.

Figure 2

For this configuration example, traffic arrives at the input interface (an Ethernet 1/0 interface) of the ingress label edge router (LER). The precedence value is copied and used as the MPLS EXP value of the traffic when the MPLS label is imposed. This label imposition takes place at the ingress LER.

The traffic leaves the ingress LER through the output interface (an Ethernet 2/0 interface), traverses through the network backbone into the MPLS cloud, and enters the egress LER.

At the input interface of the egress LER (an Ethernet 3/0 interface), the MPLS EXP value is copied and used as the QoS group value. At the output interface of the egress LER (an Ethernet 4/0 interface), the QoS group value is copied and used as the precedence value.

To accomplish configuration described above, three separate policy maps were required--policy1, policy2, and policy3. Each policy map is configured to convert and propagate different traffic-marking values.

The first policy map, policy1, is configured to copy the precedence value of the traffic and use it as the MPLS EXP value during label imposition.

```
Router(config)# policy-map policy1

Router(config-pmap)# class class-default

Router(config-pmap-c)#
 set mpls experimental imposition precedence

Router(config-pmap-c)#
 end
```

When the traffic leaves the LER through the output interface (the Ethernet 2/0 interface), the MPLS EXP value is copied from the precedence value during MPLS label imposition. Copying the MPLS EXP value from the precedence value ensures that the MPLS EXP value reflects the appropriate QoS treatment. The traffic now proceeds through the MPLS cloud into the egress LER.

A second policy map called policy2 has been configured to copy the MPLS EXP value in the incoming MPLS traffic to the QoS group value. The QoS group value is used for internal purposes only. The QoS group value can be used with output queueing on the output interface of the egress router. The QoS group value can also be copied and used as the precedence value, as traffic leaves the egress LER through the output interface (the Ethernet 4/0 interface).

```
Router(config)# policy-map policy2

Router(config-pmap)# class class-default

Router(config-pmap-c)#
 set qos-group mpls experimental topmost

Router(config-pmap-c)#
 end
```

A third policy map called policy3 has been configured to copy the internal QoS group value (previously based on the MPLS EXP value) to the precedence value. The QoS group value will be copied to the precedence value as the traffic leaves the egress LER through the output interface.

```
Router(config)# policy-map policy3

Router(config-pmap)# class class-default

Router(config-pmap-c)#
 set precedence qos-group

Router(config-pmap-c)#
 end
```

Configuring these policy maps as shown (and attaching them to interfaces as shown in Example Attaching the Policy Map to an Interface, page 22), causes the appropriate quality of service treatment to be preserved for the traffic as the traffic progresses along an IP network, through an MPLS cloud, and back again into an IP network.

Note This configuration could also have been accomplished by first creating a table map (used to map one value to another) and then specifying the **table** keyword and *table-map-name* argument in each of the **set** commands (for example, **set precedence qos-group table tablemap1**). In the MPLS configuration example, a table map was not created, and the **set** commands were configured without specifying the **table** keyword and *table-map-name* argument (for example, **set precedence qos-group)**. When the **set** commands are configured without specifying the **table** keyword and *table-map-name* argument, the values are copied from the specified categories. In this case, the QoS group value was copied and used to set the precedence value. When the DSCP value is copied and used for the MPLS EXP value, only the *first 3 bits* (that is, the class selector bits) of the DSCP value will be used to set the MPLS value.

Example Attaching the Policy Map to an Interface

The following is an example of attaching the policy map to the interface. In this example, the policy map called policy1 has been attached in the input direction of the Serial4/0 interface.

```
Router> enable
Router# configure terminal
Router(config)# interface serial4/0
Router(config-if)# service-policy input policy1
Router(config-if)# end
```

Example Configuring QoS When Using IPsec VPNs

The following is an example of configuring QoS when using IPsec VPNs. In this example, the **crypto map** command specifies the IPsec crypto map (mymap 10) to which the **qos pre-classify** command will be applied.

```
Router> enable
Router# configure terminal
Router(config)# crypto map mymap 10

Router(config-crypto-map)# qos pre-classify
Router(config-crypto-map)# exit
```

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
Classifying network traffic	"Classifying Network Traffic" module
IPsec and VPNs	"Configuring Security for VPNs with IPsec" module
Committed Access Rate (CAR)	"Configuring Committed Access Rate" module

Standards

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

MIBs

MIB	MIBs Link
No new or modified MIBs are supported, and support for existing MIBs has not been modified.	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, and support for existing RFCs has not been modified.	--

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 Marking Network Traffic

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 5 Feature Information for Marking Network Traffic

Feature Name	Software Releases	Feature Configuration Information
Enhanced Packet Marking	12.2(13)T	The Enhanced Packet Marking feature allows you to map and convert the marking of a packet from one value to another by using a kind of conversion chart called a table map. The table map establishes an equivalency from one value to another. For example, the table map can map and convert the class of service (CoS) value of a packet to the precedence value of the packet. This value mapping can be propagated for use on the network, as needed.

Feature Name	Software Releases	Feature Configuration Information
QoS Packet Marking	12.2(8)T	The QoS Packet Marking feature allows you to mark packets by setting the IP precedence bit or the IP differentiated services code point (DSCP) in the Type of Service (ToS) byte, and associate a local QoS group value with a packet.
Class-Based Marking	12.2(2)T	The Class-Based Packet Marking feature provides users with a user-friendly command-line interface (CLI) for efficient packet marking by which users can differentiate packets based on the designated markings.
Quality of Service for Virtual Private Networks	12.2(2)T	The QoS for VPNs feature provides a solution for making Cisco IOS QoS services operate in conjunction with tunneling and encryption on an interface. Cisco IOS software can classify packets and apply the appropriate QoS service before the data is encrypted and tunneled. The QoS for VPN feature allows users to look inside the packet so that packet marking can be done based on original port numbers and based on source and destination IP addresses. This allows the service provider to treat mission critical or multi-service traffic with higher priority across their network.
ATM Cell Loss Priority (CLP) Setting Class-Based Ethernet CoS Matching and Marking (802.1p and ISL CoS) Class-Based Marking Custom Queueing (CQ) PXF Based Frame Relay DE Bit Marking QoS Packet Marking	15.0(1)S	The ATM Cell Loss Priority (CLP) Setting, Class-Based Ethernet CoS Matching and Marking (802.1p and ISL CoS), Class-Based Marking, Custom Queueing (CQ), PXF Based Frame Relay DE Bit Marking, QoS Packet Marking and features were integrated into theCisco IOS Release 15.0(1)S release.