QoS-MQC Support for MTR

The QoS-MQC Support for MTR feature enables Multitopology Routing (MTR) traffic classification. Traffic classification is used to associate different classes of traffic with different topologies when multiple topologies are configured on the same device. This module describes how to configure quality of service (QoS) with modular QoS CLI (MQC) support for MTR.

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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 module.

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Prerequisites for QoS-MQC Support for MTR

- Be familiar with the concepts documented in the “MTR Traffic Classification” section.

- Define a topology globally rather than at the interface level as in quality of service (QoS) before configuring traffic classification
- Ensure that all devices throughout the network have the same definition of classifiers and the same sequencing of classifiers.
- Carefully coordinate simultaneous configuration in a network where Multitopology Routing (MTR) and QoS traffic classification are configured.

Restrictions for QoS-MQC Support for MTR

- Multitopology Routing (MTR) classification values must be unique for each topology. An error message is generated if you attempt to configure overlapping values.
- A topology cannot be placed in the shutdown state if it is referenced by any active policy map.
- A subset of differentiated services code point (DSCP) bits is used to encode classification values in the IP packet header. Certain DSCP values are reserved. These DSCP values are commonly used by routing software components for purposes unrelated to MTR (for example, Open Shortest Path First [OSPF], Bidirection Forwarding Detection [BFD], and Simple Network Management Protocol [SNMP]). If you use these values for MTR classification, they are likely to interfere with correct operation of the device and is strongly discouraged. These DSCP values are:
  - DSCP 16 (cs2)
  - DSCP 48 (cs6)

Information About QoS-MQC Support for MTR

MTR Traffic Classification

Multitopology Routing (MTR) cannot be enabled on a device until traffic classification is configured, even if only one class-specific topology is configured. Traffic classification is used to configure topology-specific forwarding behaviors when multiple topologies are configured on the same device. Traffic classification must be applied consistently throughout the network. Class-specific packets are associated with the corresponding topology table forwarding entries.

Traffic classification is configured when you use the modular quality of service (QoS) CLI (MQC). MTR traffic classification is similar to QoS traffic classification. However, there is an important distinction. MTR traffic classification is defined globally for each topology, rather than at the interface level as in QoS.

A subset of differentiated services code point (DSCP) bits is used to encode classification values in the IP packet header. You configure a class map to define the traffic class by entering the **class-map** *class-map-name* command in global configuration mode. Only the **match-any** keyword is supported for MTR. You associate the traffic class with a policy by configuring the **policy-map type class-routing ipv4 unicast** command in global configuration mode. You activate the policy for the topology by configuring the **service-policy type class-routing** command in global address family configuration mode. Then you associate the service policy with all interfaces on the device.

You can configure MTR traffic classification and IP Differentiated Services or IP Precedence-based traffic classification in the same network. However, MTR requires exclusive use of some subset of the DSCP bits in the IP packet header for specific topology traffic. In a network where MTR and QoS traffic classification are configured, you must carefully coordinate simultaneous configuration.

How to Configure QoS-MQC Support for MTR

Configuring MTR Traffic Classification

Before You Begin

Note Following the correct order of the commands in this task is very important. Ensure that all configuration that affects traffic classification is complete before entering the **service-policy type class-routing** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map match-any** *class-map-name*
4. **match** [**ip**] **dscp** *dscp-value* [*dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value*]
5. **exit**
6. **policy-map type class-routing ipv4 unicast** *policy-map-name*
7. **class** {*class-name* | **class-default**}
8. **select-topology** *topology-name*
9. **exit**
10. **exit**
11. **global-address-family ipv4** [**multicast** | **unicast**]
12. **service-policy type class-routing** *policy-map-name*
13. **end**
14. **show topology detail**
15. **show policy-map type class-routing ipv4 unicast** [**interface** [*type number*]]
16. **show mtm table**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Device> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**class-map match-any** *class-map-name* **Example:** `Device(config)# class-map match-any VOICE-CLASS`	Creates a class map to be used for matching packets to a specified class and enters quality of service (QoS) class-map configuration mode. • The Multitopology Routing (MTR) traffic class is defined using this command. **Note** The **match-any** keyword must be entered when configuring classification for MTR.
Step 4	**match** [**ip**] **dscp** *dscp-value* [*dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value*] **Example:** `Device(config-cmap)# match ip dscp 9`	Identifies a differentiated services code point (DSCP) value as a match criterion. • Use the *dcsp-value* argument to define a specific metric value. • Do not use the DSCP values 48 and 16. See the "Restrictions for QoS-MQC Support for MTR" section for more information.
Step 5	**exit** **Example:** `Device(config-cmap)# exit`	Exits QoS class-map configuration mode.
Step 6	**policy-map type class-routing ipv4 unicast** *policy-map-name* **Example:** `Device(config)# policy-map type class-routing ipv4 unicast VOICE-CLASS-POLICY`	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 7	**class** {*class-name* | **class-default**} **Example:** `Device(config-pmap)# class VOICE-CLASS`	Specifies the name of the class whose policy you want to create or change or specifies the default class and enters policy-map class configuration mode. • The class map is referenced.

	Command or Action	Purpose
		• For a class map to be referenced in a class-routing policy map, you must first define it by using the **class-map** command as shown in Step 3.
Step 8	**select-topology** *topology-name* **Example:** `Device(config-pmap-c)# select-topology VOICE`	Attaches the policy map to the topology.
Step 9	**exit** **Example:** `Device(config-pmap-c)# exit`	Exits QoS policy-map class configuration mode.
Step 10	**exit** **Example:** `Device(config-pmap)# exit`	Exits QoS policy-map configuration mode.
Step 11	**global-address-family ipv4** [**multicast** | **unicast**] **Example:** `Device(config)# global-address-family ipv4`	Enters global address family configuration mode to configure MTR.
Step 12	**service-policy type class-routing** *policy-map-name* **Example:** `Device(config-af)# service-policy type class-routing VOICE-CLASS-POLICY`	Attaches the service policy to the policy map for MTR traffic classification and activates MTR. • The *policy-map-name* argument must match the value configured in step 6. **Note** Traffic classification is enabled after this command is entered. Ensure that all configuration that affects traffic classification is complete before entering this command.
Step 13	**end** **Example:** `Device(config-af)# end`	Exits global address family configuration mode and returns to privileged EXEC mode.
Step 14	**show topology detail** **Example:** `Device# show topology detail`	(Optional) Displays detailed information about class-specific and base topologies.

	Command or Action	Purpose
Step 15	**show policy-map type class-routing ipv4 unicast** [**interface** [*type number*]] **Example:** `Device# show policy-map type class-routing ipv4 unicast`	(Optional) Displays the class-routing policy map configuration. • If you specify the **interface** keyword without the argument, statistics for all interfaces are displayed.
Step 16	**show mtm table** **Example:** `Device# show mtm table`	(Optional) Displays information about the DSCP values assigned to each topology.

Configuration Examples for QoS-MQC Support for MTR

Examples: MTR Traffic Classification

The following example shows how to configure classification and activate Multitopology Routing (MTR) for two topologies:

```
global-address-family ipv4
 topology VOICE
  all-interfaces
  exit
 topology VIDEO
  forward-base
  maximum routes 1000 90
  exit
 exit
class-map match-any VOICE-CLASS
 match ip dscp 9
 exit
class-map match-any VIDEO-CLASS
 match ip dscp af11
 exit
policy-map type class-routing ipv4 unicast MTR
 class VOICE-CLASS
  select-topology VOICE
  exit
 class VIDEO-CLASS
  select-topology VIDEO
  exit
 exit
global-address-family ipv4
 service-policy type class-routing MTR
end
```

The following example shows how to display detailed information about the VOICE and VIDEO topologies:

```
Device# show topology detail

Topology: base
  Address-family: ipv4
```

```
  Associated VPN VRF is default
  Topology state is UP
  Associated interfaces:
    Ethernet0/0, operation state: UP
    Ethernet0/1, operation state: DOWN
    Ethernet0/2, operation state: DOWN
    Ethernet0/3, operation state: DOWN
    Loopback0, operation state: UP

Topology: VIDEO
  Address-family: ipv4
  Associated VPN VRF is default
  Topology state is UP
  Topology fallback is enabled
  Topology maximum route limit 1000, warning limit 90% (900)
  Associated interfaces:
Topology: VOICE
  Address-family: ipv4
  Associated VPN VRF is default
  Topology state is UP
  Topology is enabled on all interfaces
  Associated interfaces:
    Ethernet0/0, operation state: UP
    Ethernet0/1, operation state: DOWN
    Ethernet0/2, operation state: DOWN
    Ethernet0/3, operation state: DOWN
    Loopback0, operation state: UP
Topology: base
  Address-family: ipv4 multicast
  Associated VPN VRF is default
  Topology state is DOWN
  Multicast multi-topology mode is enabled.
  Route Replication Enabled:
    from unicast topology VOICE all route-map BLUE
  Associated interfaces:
    Ethernet0/0, operation state: UP
    Ethernet0/1, operation state: DOWN
    Ethernet0/2, operation state: DOWN
    Ethernet0/3, operation state: DOWN
    Loopback0, operation state: UP
```

The following example shows how to display the classification values for the VOICE and VIDEO topologies:

```
Device# show mtm table

MTM Table for VRF: default, ID:0
Topology                Address Family   Associated VRF         Topo-ID
base                    ipv4              default                 0
VOICE                    ipv4             default                 2051
Classifier: ClassID:3
DSCP: cs1
DSCP: 9
VIDEO                    ipv4             default                 2054
Classifier: ClassID:4
DSCP: af11
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases

Related Topic	Document Title
Multitopology Routing (MTR) commands	Cisco IOS Multitopology Routing Command Reference
QoS commands	Cisco IOS Quality of Service Solutions Command Reference
QoS concepts and tasks	*Quality of Service Solutions Configuration Guide Library*

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-MQC Support for MTR

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.

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Table 1: Feature Information for QoS-MQC Support for MTR

Feature Name	Releases	Feature Information
QoS-MQC Support for MTR	12.2(33)SRB 15.0(1)S	This feature enables Multitopology Routing (MTR) traffic classification. Traffic classification is used to associate different classes of traffic with different topologies when multiple topologies are configured on the same device. A subset of differentiated services code point (DSCP) bits is used to encode classification values in the IP packet header and mark the packet for classification. When MTR traffic classification is enabled, MTR is activated and ready for the routing protocols to start contributing to the topologies. The following commands were introduced or modified: **policy-map type class-routing ipv4 unicast**, **select topology**, **service-policy type class-routing**, **show mtm table**, **show policy-map type class-routing ipv4 unicast**.

Glossary

base topology—The entire network for which the usual set of routes are calculated. This topology is the same as the default global routing table that exists without Multitopology Routing (MTR) being used.

class-specific topology—New topologies that are defined over and above the existing base topology; each class-specific topology is represented by its own Routing Information Base (RIB) and Forwarding Information Base (FIB).

classification—Selection and matching of traffic that needs to be provided with a different treatment based on its mark. Classification is a read-only operation.

DSCP—differentiated services code point. Six bits in the Type of Service (ToS) field. Two bits are used for Explicit Congestion Notification, which are used to mark the packet.

incremental forwarding mode—Incremental forwarding mode is designed to support transitional or incremental deployment of MTR, where devices are in the network that are not MTR enabled. In this mode, the device looks for a forwarding entry first in the class-specific FIB. If an entry is not found, the device then looks for the longest match in the base topology FIB. If an entry is found in the base topology FIB, the packet is forwarded on the base topology. If a forwarding entry is not found in the base topology FIB, the packet is dropped.

marking—Setting a value in the packet or frame. Marking is a read and write operation.

multitopology—Multitopology means that each topology routes and forward a subset of the traffic as defined by the classification criteria.

NLRI—Network Layer Reachability Information.

strict forwarding mode—Strict forwarding mode is the default forwarding mode for MTR. Only routes in the topology-specific routing table are considered. Among these, the longest match for the destination address is used. If no route containing the destination address can be found in the topology specific table, the packet is dropped.

TID—Topology Identifier. Each topology is configured with a unique topology ID. The topology ID is configured under the routing protocol and is used to identify and group NLRI for each topology in updates for a given protocol.