MPLS QoS via TLV for non-L2VPN Service Flow

The MPLS QoS via TLV for non-L2VPN Service Flow feature allows to mark TC bits for MPLS L3VPN imposition packets and classify downstream packets based on TC bits of MPLS disposition packets, using vendor-specific TLVs.

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Hardware Compatibility Matrix for Cisco cBR Series Routers

Note The hardware components introduced in a given Cisco IOS-XE Release are supported in all subsequent releases unless otherwise specified.

Table 1: Hardware Compatibility Matrix for the Cisco cBR Series Routers

Cisco CMTS Platform	Processor Engine	Interface Cards
Cisco cBR-8 Converged Broadband Router	**Cisco IOS-XE Release 3.15.0S and Later Releases** Cisco cBR-8 Supervisor: • PID—CBR-SUP-250G • PID—CBR-CCAP-SUP-160G • PID—CBR-CCAP-SUP-60G[1] • PID—CBR-SUP-8X10G-PIC	**Cisco IOS-XE Release 3.15.0S and Later Releases** Cisco cBR-8 CCAP Line Cards: • PID—CBR-LC-8D30-16U30 • PID—CBR-LC-8D31-16U30 • PID—CBR-RF-PIC • PID—CBR-RF-PROT-PIC Cisco cBR-8 Downstream PHY Modules: • PID—CBR-D30-DS-MOD • PID—CBR-D31-DS-MOD Cisco cBR-8 Upstream PHY Modules: • PID—CBR-D30-US-MOD

1 Effective with Cisco IOS-XE Release 3.17.0S, CBR-CCAP-SUP-60G supports 8 cable line cards. The total traffic rate is limited to 60 Gbps, the total number of downstream service flows is limited to 72268, and downstream unicast low-latency flow does not count against the limits.

Restrictions for MPLS QoS via TLV for non-L2VPN Service Flow

- This feature supports only IPv4. It will not support IPv6.
- This feature does not support SNMP.
- This feature does not support dynamic service flows.
- Only up to four VPNs and eight upstream service flows per CM can be configured.
- For a VPN, only a maximum of eight DS classifiers (using TC bits in the range from 0 to 7) can be configured.
- If TC bits downstream classifiers are configured for a VPN, then the downstream MPLS packets belonging to the VPN are processed only on TC bits classification. It will not process general IP header field classification.

Information About MPLS QoS via TLV for non-L2VPN Service Flow

The MPLS QoS via TLV for non-L2VPN Service Flow feature is a QoS enhancement based on MPLS Traffic Class (TC) bits for MPLS L3VPN. The MPLS TC bits were previously known as MPLS EXP bits. RFC 5462 has renamed the MPLS EXP field to MPLS TC field.

For upstream service flow encoding, use Cisco-specific TLV to set TC bits value for MPLS imposition packets. For downstream classifier encoding, use Cisco-specific TLV to implement downstream classification based on TC bits of MPLS disposition packets.

Configuring MPLS QoS via TLV for non-L2VPN Service Flow

Note This feature is configured using a cable modem configuration file and is dependent on the general configuration of the L3VPN.

This section describes how to configure traffic class bits for MPLS imposition and disposition packets and on how to use vendor-specific TLVs with AToM L2VPN and MPLS L3VPN.

Traffic Class for MPLS Imposition Packets

The table lists the vendor-specific TLV to be included in the cable modem configuration file to configure TC bits for MPLS imposition packets. The MPLS-TC-SET TLV is defined in the upstream and is associated with the VPN RD in upstream service flow encoding.

Table 2: TLV to Configure TC Bits for MPLS Imposition Packets

TLV Name	SubType	Length	Value
MPLS-TC-SET TLV	43.5.43.34	1	Imposition MPLS-TC-SET bits

Traffic Classification for MPLS Disposition Packets

The table lists the vendor-specific TLV to be included in the cable modem configuration file to classify DS packets based on TC bits of MPLS disposition packets.

The MPLS-TC-RANGE TLV is defined only under DS classifier encodings. It supports multi-downstream flow in a CM belonging to the same MPLS L3VPN, associated with the VPN RD in downstream classifier encoding.

Table 3: TLV to Classify TC Bits for MPLS Disposition Packets

TLV Name	SubType	Length	Value
MPLS-TC-RANGE	43.5.43.35	2	MPLS-TC-low and MPLS-TC-high

Using Vendor-Specific TLVs with AToM L2VPN and MPLS L3VPN

If both AToM L2VPN (L2 MPLS) and MPLS L3VPN (L3 MPLS) are using the same set of TLVs (MPLS-TC-SET and MPLS-TC-RANGE), then you should differentiate them. Configure the TLVs for upstream service flow encoding and downstream classifier encodings as indicated below:

Upstream Service Flow Encoding

- For L2VPN, configure MPLS-TC-SET (43.5.43.34) and L2VPN ID (43.5.1).
- For MPLS L3VPN, configure MPLS-TC-SET (43.5.43.34) and VPN RD (43.5.1).

Note Do not configure the TLVs for L2VPN and MPLS L3VPN at the same time for upstream service flow encodings, as it will result in a TLV error.

Downstream Classifier Encoding

- L2VPN—Configure MPLS-TC-RANGE (43.5.43.35) and L2VPN ID (43.5.1).
- MPLS L3VPN—Configure MPLS-TC-RANGE (43.5.43.35) and VPN RD (43.5.1).

Configuration Examples

This section provides the following configuration examples:

Example: Upstream Service Flow Marking TLV

The following example shows a sample CM configuration TLV for the provisioning of TC bits for MPLS imposition packets:

```
24 (Upstream Service Flow Encoding)
   S01 (Service Flow Reference)         = 2
   S06 (QoS Parameter Set Type)         = 7
   S43 (Vendor Specific Options)
       T08 (Vendor ID)  = 00 00 0c
       T004 (VPN Route Distinguisher) = xx xx xx xx xx xx xx xx
            S005 (Vendor specific L2VPN TLV)
            S043 (Cisco Vendor Specific)
       T034 (MPLS-TC-SET) = 04 # MPLSTC-SET = 4
```

Example: Downstream Packet Classification TLV

The following example shows a sample CM configuration TLV for classifying downstream packets based on TC bits of MPLS disposition packets:

```
23 (Downstream Packet Classification Encoding)
   S01 (Classifier Reference)           = 13
   S03 (Service Flow Reference)         = 13
   S11 (IEEE 802.1P/Q Packet Classification Encodings)
   S43 (Vendor Specific Options)
       T08 (Vendor ID)  = 00 00 0c
       S004 (VPN Route Distinguisher) = xx xx xx xx xx xx xx xx
       S005 (Vendor specific L2VPN TLV)
           S043 (Cisco Vendor Specific)
           S035 (MPLS-TC-RANGE)   = 04  05      # MPLSTC-EGRESS_RANGE= 4 – 5
```

Example: MPLS QoS Configuration File

The following example shows a cable modem being configured to mark TC bits for MPLS L3VPN imposition packets and classify downstream packets based on TC bits of MPLS L3VPN disposition packets, using vendor-specific TLVs:

```
CM-CONFIG
=========
03 (Net Access Control)                      = 1
18 (Maximum Number of CPE)       = 16
22 (Upstream Packet Classification Encoding Block)
   S01 (Classifier Reference)              = 2
   S03 (Service Flow Reference)        = 2
   S05 (Rule Priority)                             = 2
   S09 (IP Packet Encodings)
       T01 (IP Type of Srv Rng & Mask)             = 00 20 ff
22 (Upstream Packet Classification Encoding Block)
   S01 (Classifier Reference)              = 3
   S03 (Service Flow Reference)        = 3
   S05 (Rule Priority)                             = 3
   S09 (IP Packet Encodings)
       T01 (IP Type of Srv Rng & Mask)             = 40 80 ff
22 (Upstream Packet Classification Encoding Block)
   S01 (Classifier Reference)              = 4
   S03 (Service Flow Reference)        = 4
   S05 (Rule Priority)                             = 4
   S09 (IP Packet Encodings)
       T01 (IP Type of Srv Rng & Mask)             = a0 e0 ff
23 (Downstream Packet Classification Encoding Block)
   S01 (Classifier Reference)             = 12
   S03 (Service Flow Reference)        = 12
   S05 (Rule Priority)                             = 2
   S09 (IP Packet Encodings)
       T01 (IP Type of Srv Rng & Mask)             = 00 ff ff
   S43 (Vendor Specific Options)
       T08 (Vendor ID)            = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 09 08 03 00 00 0c 23 02 01 01
23 (Downstream Packet Classification Encoding Block)
   S01 (Classifier Reference)             = 13
   S03 (Service Flow Reference)        = 13
   S05 (Rule Priority)                             = 3
   S09 (IP Packet Encodings)
       T01 (IP Type of Srv Rng & Mask)             = 00 ff ff
   S43 (Vendor Specific Options)
       T08 (Vendor ID)            = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 09 08 03 00 00 0c 23 02 02 02
```

```
23 (Downstream Packet Classification Encoding Block)
   S01 (Classifier Reference)              = 14
   S03 (Service Flow Reference)         = 14
   S05 (Rule Priority)                             = 4
   S09 (IP Packet Encodings)
       T01 (IP Type of Srv Rng & Mask)             = 00 ff ff
   S43 (Vendor Specific Options)
       T08 (Vendor ID)           = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 09 08 03 00 00 0c 23 02 03 03
24 (Upstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 1
   S06 (QoS Parameter Set Type)     = 7
24 (Upstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 2
   S06 (QoS Parameter Set Type)     = 7
   S43 (Vendor Specific Options)
       T08 (Vendor ID)           = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 08 08 03 00 00 0c 22 01 04
24 (Upstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 3
   S06 (QoS Parameter Set Type)     = 7
   S43 (Vendor Specific Options)
       T08 (Vendor ID)           = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 08 08 03 00 00 0c 22 01 05
24 (Upstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 4
   S06 (QoS Parameter Set Type)     = 7
   S43 (Vendor Specific Options)
       T08 (Vendor ID)           = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 08 08 03 00 00 0c 22 01 06
25 (Downstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 11
   S06 (QoS Parameter Set Type)     = 7
   S07 (Traffic Priority)                          = 7
25 (Downstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 12
   S06 (QoS Parameter Set Type)     = 7
25 (Downstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 13
   S06 (QoS Parameter Set Type)     = 7
25 (Downstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 14
   S06 (QoS Parameter Set Type)     = 7
25 (Downstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 15
   S06 (QoS Parameter Set Type)     = 7
25 (Downstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 16
   S06 (QoS Parameter Set Type)     = 7
25 (Downstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 17
   S06 (QoS Parameter Set Type)     = 7
25 (Downstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 18
   S06 (QoS Parameter Set Type)     = 7
23 (Downstream Packet Classification Encoding Block)
   S01 (Classifier Reference)              = 19
   S03 (Service Flow Reference)         = 19
   S09 (IP Packet Encodings)
       T01 (IP Type of Srv Rng & Mask)             = 00 ff ff
   S43 (Vendor Specific Options)
       T08 (Vendor ID)           = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 09 08 03 00 00 0c 23 02 00 00
23 (Downstream Packet Classification Encoding Block)
   S01 (Classifier Reference)              = 15
   S03 (Service Flow Reference)         = 15
   S05 (Rule Priority)                             = 3
   S09 (IP Packet Encodings)
```

```
       T01 (IP Type of Srv Rng & Mask)            = 00 ff ff
   S43 (Vendor Specific Options)
       T08 (Vendor ID)           = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 09 08 03 00 00 0c 23 02 04 04
23 (Downstream Packet Classification Encoding Block)
   S01 (Classifier Reference)               = 16
   S03 (Service Flow Reference)         = 16
   S05 (Rule Priority)                          = 3
   S09 (IP Packet Encodings)
       T01 (IP Type of Srv Rng & Mask)            = 00 ff ff
   S43 (Vendor Specific Options)
       T08 (Vendor ID)           = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 09 08 03 00 00 0c 23 02 05 05
23 (Downstream Packet Classification Encoding Block)
   S01 (Classifier Reference)               = 17
   S03 (Service Flow Reference)         = 17
   S05 (Rule Priority)                          = 3
   S09 (IP Packet Encodings)
       T01 (IP Type of Srv Rng & Mask)            = 00 ff ff
   S43 (Vendor Specific Options)
       T08 (Vendor ID)           = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 09 08 03 00 00 0c 23 02 06 06
23 (Downstream Packet Classification Encoding Block)
   S01 (Classifier Reference)               = 18
   S03 (Service Flow Reference)         = 18
   S09 (IP Packet Encodings)
       T01 (IP Type of Srv Rng & Mask)            = 00 ff ff
   S43 (Vendor Specific Options)
       T08 (Vendor ID)           = 00 00 0c
       T004 (Unknown sub-type)          = 00 00 00 01 00 00 00 01
       T005 (Unknown sub-type)          = 2b 09 08 03 00 00 0c 23 02 07 07
25 (Downstream Service Flow Encodings)
   S01 (Service Flow Reference)         = 19
   S06 (QoS Parameter Set Type)     = 7
#<EOF>
```

Additional References

Related Documents

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

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature Information for MPLS QoS via TLV for non-L2VPN Service Flow

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note The table below 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.

Table 4: Feature Information for MPLS QoS via TLV for non-L2VPN Service Flow

Feature Name	Releases	Feature Information
MPLS QoS via TLV for non-L2VPN Service Flow	Cisco IOS-XE Release 3.17.0S	This feature was introduced on the Cisco cBR Series Converged Broadband Routers.