QoS on Layer 3 Terminated MLPPP Interfaces

Table 1: Feature History

Feature Name	Release Information	Description
QoS on Layer 3-terminated MLPPP Interface	Cisco IOS XE Dublin 17.10.1	You can configure QoS features such as classification, shaping, queuing, bandwidth, and weighted random early detection on the layer 3-terminated MLPPP interfaces at the egress direction for the following interface modules: • 1 port OC-48/STM-16 or 4 port OC-12/OC-3 / STM-1/STM-4 + 12 port T1/E1 + 4 port T3/E3 CEM Interface Module (A900-IMA3G-IMSG) • 1-Port OC-192 or 8-Port Low Rate CEM 20G Bandwidth Interface Module (A900-IMA1Z8S-CXMS)

Starting with the Cisco IOS XE Dublin 17.10.1 release, you can configure the following QoS features on the Layer 3-terminated MLPPP interface on the SONET or SDH controller for the Cisco RSP3 module.

- **Egress Classification**—Classification based on the QoS group.
- **Egress Shaping**—Shaping at the egress direction only based on the class QoS group. The shaping average range is from 384 Kbps to 100 Gbps.
- **Egress Queuing**—Supports egress class-based weighted fair queuing (CBWFQ) and egress Low-Latency queuing (LLQ) with two-level priority and shaping.
- **Egress Bandwidth**—Supports bandwidth (in kbps), bandwidth remaining ratio (BRR), and bandwidth remaining percent (BRP).
    - You can configure bandwidth committed information rate (CIR) from 100 Kbps to 10 Gbps.

  - If the **priority** command is configured, then you can configure the **bandwidth remaining** only for the other classes.
  - The BRR ratio that you can configure is 1–63 (1-4096).

- **Egress Weighted Random Early Detection (WRED)**
  - WRED is based on the discard-class only.
  - The class-map match condition is based on the QoS group whereas the WRED is based on the discard class.
  - The queuing features such as shape or bandwidth supportsWRED in a class.
  - Supports minimum and maximum thresholds (bytes or microseconds only).
  - The two WRED profiles that are supported per class are DC0 and DC1.

- Queue limit (in bytes and usec).

For more information on QoS, refer the Quality of Service Configuration Guidelines for RSP3 Module.

Restrictions For Layer 3 Terminated MLPPP Interface

- QoS in ingress is not supported.
- Different bandwidth ranges cannot be combined in the same policy. You cannot configure BRR in one class and BRP in another class for the same policy.
- When configuring BRR or BRP, 15% of the total bandwidth should be allocated to the class-default.
- For policy without any queuing actions (for example, classification), you should remove the policy first before changing members in a multilink interface to a different interface module.

How to Configure QoS on Layer 3 Terminated MLPPP Interface

Configuring Classification

Configuring Class Map

The following is a sample configuration to create class map that matches any of the listed criteria.

```
class-map match-any qos-group0
 match qos-group 0
class-map match-any qos-group1
 match qos-group 1
class-map match-any qos-group2
 match qos-group 2
class-map match-any qos-group3
 match qos-group 3
class-map match-any qos-group4
 match qos-group 4
class-map match-any qos-group5
 match qos-group 5
class-map match-any qos-group6
 match qos-group 6
class-map match-any qos-group7
 match qos-group 7
```

Enabling SDM Template

Enter the following command to enable the **egr_l3vpn_cm** SDM template:

```
Router(config)# sdm prefer enable_egr_l3vpn_cm
```

Note Starting with Cisco IOS XE 17.14.1 release, you must enable the **egr_l3vpn_cm** template before attaching a policy map to an interface.

For the SDM template to take effect, restart the router.

Configuring Policy Map

The following is a sample configuration to create a policy map for Layer 3 egress QoS group that specifies several classes.

```
policy-map l3egressqos-groupbrp
 class qos-group0
 class qos-group1
 class qos-group2
 class qos-group3
 class qos-group4
 class qos-group5
 class qos-group6
 class qos-group7
```

You can apply the policy map on the MLPPP interface.

```
router#configure terminal
router(config)#interface Serial0/7/19.1
router(config-if)#service-policy output l3egressqos-groupbrp
router(config-if)#end
```

Configuring Shaping

The following is a sample configuration for a Layer 3 egress QoS group for a policy map having class QoS groups 0, 1, and 2 configured with shape average.

```
policy-map l3egressqos-groupbrp
class qos-group0
             shape average 384000
class qos-group1
             shape average 384000
class qos-group2
             shape average 384000
```

Configuring Bandwidth

The following is a sample configuration for a Layer 3 egress QoS group for a policy map having class QoS groups 0, 1, and 2 configured with various bandwidth percent.

```
policy-map l3egressqos-groupbrp
class qos-group0
             bandwidth percent 10
class qos-group1
             bandwidth percent 10
class qos-group2
             bandwidth percent 20
```

Configuring Bandwidth Remaining Percent

The following is a sample configuration for a Layer 3 egress QoS group for a policy map having class QoS groups 0, 1, and 2 configured with various bandwidth remaining percent.

```
policy-map l3egressqos-groupbrp
class qos-group0
             bandwidth remaining percent 10
class qos-group1
             bandwidth remaining percent 20
class qos-group2
             bandwidth remaining percent 30
```

Configuring Bandwidth Remaining Ratio

The following is a sample configuration for a Layer 3 egress QoS group for a policy map having class QoS groups 0, 1, and 2 configured with various bandwidth remaining ratio.

```
policy-map l3egressqos-groupbrp
class qos-group0
             bandwidth remaining ratio 10
class qos-group1
             bandwidth remaining ratio 20
```

```
class qos-group2
            bandwidth remaining ratio 30
```

Configuring Priority

The following is a sample configuration for a Layer 3 egress QoS group for a policy map having class QoS groups 0 configured with shape priority percent.

```
policy-map l3egressqos-groupbrp
class qos-group0
            priority Percent 20
policy-map l3egressqos-groupbrp
class qos-group0
            priority percent 40
```

Configuring WRED

```
class-map match-all qos1
 match qos-group 1
policy-map egress
  class qos1
  shape average 100000000
  queue-limit 300 us
  random-detect discard-class-based
  random-detect discard-class 0 100 us 200 us 100
  random-detect discard-class 1 200 us 300 us 100
```

Verifying QoS Configuration on Layer 3 Terminated MLPPP Interface

The following **show policy-map** command for egress QoS shows bandwidth that is configured for each QoS group.

```
router#show policy-map
  Policy Map l3egressqos-groupbrp
    Class qos-group0
      bandwidth 10 (%)
    Class qos-group1
      bandwidth 10 (%)
    Class qos-group2
      bandwidth 10 (%)
    Class qos-group3
      bandwidth 10 (%)
    Class qos-group4
      bandwidth 10 (%)
    Class qos-group5
      bandwidth 10 (%)
    Class qos-group6
      bandwidth 10 (%)
    Class qos-group7
      bandwidth 10 (%)
```

The following **show policy-map interfac** command shows the policy map statistics on the MLPPP interface.

```
router#show policy-map interface Multilink 1
 Serial0/7/19.1
  Service-policy output: l3egressqos-groupbrp
    Class-map: qos-group0 (match-any)
      1135 packets, 1135000 bytes
      30 second offered rate 303000 bps
      Match: qos-group 0
    Class-map: qos-group1 (match-any)
      1135 packets, 1135000 bytes
      30 second offered rate 303000 bps
      Match: qos-group 1
    Class-map: qos-group2 (match-any)
      1135 packets, 1135000 bytes
      30 second offered rate 303000 bps
      Match: qos-group 2
    Class-map: qos-group3 (match-any)
      1135 packets, 1135000 bytes
      30 second offered rate 303000 bps
      Match: qos-group 3
Class-map: qos-group4 (match-any)
      1135 packets, 1135000 bytes
      30 second offered rate 303000 bps
      Match: qos-group 4
    Class-map: qos-group5 (match-any)
      1135 packets, 1135000 bytes
      30 second offered rate 303000 bps
      Match: qos-group 5
    Class-map: qos-group6 (match-any)
      1135 packets, 1135000 bytes
      30 second offered rate 303000 bps
      Match: qos-group 6
    Class-map: qos-group7 (match-any)
      1135 packets, 1135000 bytes
      30 second offered rate 303000 bps
      Match: qos-group 7
    Class-map: class-default (match-any)
      0 packets, 0 bytes
      30 second offered rate 0000 bps, drop rate 0000 bps
      Match: any
```

The following **show platform hardware** command details the egress QoS resource details for debugging purposes.

```
router#show platform hardware pp active feature qos resource-summary 0
RSP3 QoS Resource Summary
Type                                      Total       Used        Free
-------------------------------------------------------------------------------
QoS TCAM                                  2048         0          2048
VOQs                                      49152       784         48368
QoS Policers                              32768        0          32768
QoS Policer Profiles                      1023         0          1023
Ingress CoS Marking Profiles              16           1          15
Egress CoS Marking Profiles               16           1          15
Ingress Exp & QoS-Group Marking Profiles  64           3          61
Ingress QOS LPM Entries                   32768        0          32768

router#show platform hardware pp active feature qos resource-summary 1
RSP3 QoS Resource Summary
Type                                      Total       Used        Free
-------------------------------------------------------------------------------
QoS TCAM                                  2048         0          2048
```

```
VOQs                                    49152       784         48368
QoS Policers                            32768        0          32768
QoS Policer Profiles                    1023         0          1023
Ingress CoS Marking Profiles            16           1          15
Egress CoS Marking Profiles             16           1          15
Ingress Exp & QoS-Group Marking Profiles  64         3          61
Ingress QOS LPM Entries                 32768        0          32768

router#show platform ha pp active bshell "diag cosq voq con=1"

Ingress VOQs Sizes (format: [queue_id(queue_size)]):
[8504(1032192B)]        [8505(1032192B)]        [8506(1032192B)]        [8507(1031168B)]
[8508(1032192B)]        [8509(1032192B)]        [8510(1032192B)]        [8511(1032192B)]

router#show platform ha pp active bshell "diag count voq voq queue=8504"
voq[8504] num_cosq[1 ]
        voq max occupancy0 level: 12, refresh: true
        voq enqueue packet: 240[]
        voq dequeue packet: 1358182[]
        voq total discarded packet: 3315[]
        voq deleted packet: 0[]
```