QoS Hierarchical Queueing for Ethernet DSLAMs

This feature module describes how to configure quality of service (QoS) hierarchical queueing policy maps on sessions and subinterfaces in Ethernet Digital Subscriber Line Access Multiplexer (E-DSLAM) applications on a Cisco ASR 1000 series router. The QoS Hierarchical Queueing for Ethernet DSLAMs feature supports IEEE 802.1 QinQ VLAN tag termination to configure inner VLAN identifiers on E-DSLAMs.

- Finding Feature Information, on page 1
- Prerequisites for QoS Hierarchical Queueing for Ethernet DSLAMs, on page 1
- Restrictions for QoS Hierarchical Queueing for Ethernet DSLAMs, on page 2
- Information About QoS Hierarchical Queueing for Ethernet DSLAMs, on page 2
- How to Configure QoS Hierarchical Queueing for Ethernet DSLAMs, on page 4
- Configuration Examples for QoS Hierarchical Queueing for Ethernet DSLAMs, on page 11
- Additional References, on page 17
- Feature Information for QoS Hierarchical Queueing for Ethernet DSLAMs, on page 18

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.

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 Hierarchical Queueing for Ethernet DSLAMs

You must configure traffic classes using the class-map command.
Restrictions for QoS Hierarchical Queueing for Ethernet DSLAMs

This feature is not supported in combination with load balancing when a session service policy is routed to a Layer 2 Tunnel Protocol (L2TP) tunnel. Do not configure load balancing on an L2TP tunnel if per-session queueing is enabled.

Information About QoS Hierarchical Queueing for Ethernet DSLAMs

Different Levels of QoS Provisioning

Traffic downstream from a Broadband Router Access Server (BRAS) requires different levels of QoS provisioning (for example, traffic shaping) depending on the network architecture between the BRAS and the subscriber. The figure below illustrates an Ethernet DSL access network. The sample network includes multiple entities where QoS provisioning is required for different reasons.

Figure 1: Ethernet DSL Access Network
The following entities may require different traffic shaping:

- A VLAN that is shaped to a certain aggregate traffic rate to limit the traffic to a group of subscribers (different 802.1Q interfaces in the figure above).
- Individual sessions that is shaped with certain QoS services for different classes of traffic (individual PCs in the figure above).

**Integrated Queueing Hierarchy**

Different traffic shaping requirements result in QoS provisioning at multiple levels at the same time. The QoS-Hierarchical Queueing for Ethernet DSLAMs feature provides the ability to form one integrated queueing hierarchy that provides QoS provisioning at multiple levels with support for features such as bandwidth distribution at any of these levels.

The integrated queueing hierarchy is formed on the physical interface. When a service policy is instantiated on a session, the Subscriber Service Switch (SSS) infrastructure invokes the MQC and a common queueing control plane sets up and enables the queueing features.

Session-to-interface associations are resolved to determine the physical interface on which to form the integrated queueing hierarchy for all levels of QoS provisioning. As subinterface session-based policies are added, the respective queues are created and integrated into the queueing hierarchy.

When a subinterface is provisioned followed by session-based policy provisioning, the integrated queueing hierarchy is formed on top of the physical interface as a result of queueing policies provisioned at two different levels. When a session is provisioned before subinterface-based policy provisioning, the queueing hierarchy has a placeholder logical level between the physical queue and the session queue. The placeholder queue becomes the default queue at that level, and all other sessions are parented to that queue.

**Configuration Guidelines for Hierarchical Queueing on Ethernet DSLAMs**

When configuring the QoS Hierarchical Queueing for Ethernet DSLAMs feature, note the following guidelines:

- An individual subscriber is always identified by a PPP or IP session. A group of subscribers is identified by a particular VLAN by means of the outer tag ISP, E-DSLAM, or user-facing provider edge (U-PE).
- When a subinterface is used to aggregate a number of sessions with queueing policies, a queueing policy at a subinterface level must be a one-level policy map that is configured as class-default with only the shape and bandwidth remaining ratio feature enabled.
- Both subinterfaces and sessions can be oversubscribed and controlled by shaper and bandwidth remaining ratio.
How to Configure QoS Hierarchical Queueing for Ethernet DSLAMs

Configuring and Applying QoS Hierarchical Queueing Policy Maps to Sessions

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `policy-map policy-map-name`
4. `class class-map-name`
5. `bandwidth {bandwidth-kbps | percent percentage | remaining percentage}`
6. `precedence precedence min-threshold max-threshold mark-probability-denominator`
7. `set cos cos-value`
8. `exit`
9. `exit`
10. `policy-map policy-map-name`
11. `class class-default`
12. `shape average cir`
13. `bandwidth remaining ratio ratio`
14. `service-policy output policy-map-name`
15. `exit`
16. `exit`
17. `interface virtual-template number`
18. `service-policy output policy-map-name`
19. `end`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td><code>Router&gt; enable</code></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td><code>Router# configure terminal</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td><code>policy-map policy-map-name</code></td>
<td>Creates a child policy and enters policy-map configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
<td>• Enter the policy-map name.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
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<td></td>
</tr>
<tr>
<td>Router(config)# policy-map session_a_child</td>
<td>Configures the traffic class that you specify and enters policy-map class configuration mode.</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> class class-map-name</td>
<td>Configures the traffic class that you specify and enters policy-map class configuration mode.</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>- Enter the name of a previously configured class map.</td>
<td></td>
</tr>
<tr>
<td>Router(config-pmap)# class voip</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> bandwidth {bandwidth-kbps</td>
<td>(Optional) Enables class-based weighted fair queuing based on the keywords and arguments specified, as described below.</td>
<td></td>
</tr>
<tr>
<td>\ percent percentage</td>
<td>- bandwidth-kbps--Specifies the minimum bandwidth allocated for a class belonging to a policy map. Valid values are from 8 to 2,488,320, which represents from 1 to 99 percent of the link bandwidth.</td>
<td></td>
</tr>
<tr>
<td>\ remaining percent percentage</td>
<td>- percent percentage--Specifies the minimum percentage of the link bandwidth allocated for a class belonging to a policy map. Valid values are from 1 to 99.</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>- remaining percent percentage--Specifies the minimum percentage of unused link bandwidth allocated for a class belonging to a policy map. Valid values are from 1 to 99.</td>
<td></td>
</tr>
<tr>
<td>Router(config-pmap-c)# bandwidth 10000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>- bandwidth-kbps--Specifies the minimum bandwidth allocated for a class belonging to a policy map. Valid values are from 8 to 2,488,320, which represents from 1 to 99 percent of the link bandwidth.</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> precedence precedence min-threshold max-threshold mark-probability-denominator</td>
<td>(Optional) Configures a precedence level for the traffic class based on the arguments specified, as described below.</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>- precedence--Specifies the IP precedence number. Valid values are from 0 to 7.</td>
<td></td>
</tr>
<tr>
<td>Router(config-pmap-c)# precedence 0 32 256 100</td>
<td>- min-threshold--Specifies the minimum threshold in number of packets. Valid values are from 1 to 4096.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- max-threshold--Specifies the maximum threshold in number of packets. Valid values are from the minimum threshold to 4096.</td>
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</tr>
<tr>
<td></td>
<td>- mark-probability-denominator--Specifies the denominator for the fraction of packets dropped when the average queue depth is equal to the maximum threshold. For example, if the denominator is 512, 1 out of every 512 packets is dropped when the average queue is at the maximum threshold. Valid values are from 1 to 65536. The default value is 10 (1 out of every 10 packets is dropped at the maximum threshold).</td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>Command or Action</td>
<td>Purpose</td>
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</tbody>
</table>
| 7    | `set cos cos-value` | (Optional) Sets the Layer 2 class of service (CoS) value of an outgoing packet.  
  - Enter the IEEE 802.1Q CoS value from 0 to 7.  
  **Note**  
  Use the `set cos` command only in service policies that are attached in the output direction of an interface; packets that enter an interface cannot be set with a CoS value. You can configure a CoS value on an Ethernet interface that is configured for 802.1Q or on a virtual access interface that is using an 802.1Q interface. |
|      | Example: | |
|      | `Router(config-pmap-c)# set cos 1` | |
| 8    | `exit` | Exits policy-map class configuration mode. |
|      | Example: | |
|      | `Router(config-pmap-c)# exit` | |
| 9    | `exit` | Exits policy-map configuration mode. |
|      | Example: | |
|      | `Router(config-pmap)# exit` | |
| 10   | `policy-map policy-map-name` | Creates a parent policy and enters policy-map configuration mode.  
  - Enter the policy-map name. |
|      | Example: | |
|      | `Router(config)# policy-map session_a_parent` | |
| 11   | `class class-default` | Configures the traffic class as class-default and enters policy-map class configuration mode.  
  **Note**  
  Do not configure any other traffic class. |
|      | Example: | |
|      | `Router(config-pmap)# class class-default` | |
| 12   | `shape average cir` | Specifies average-rate traffic shaping for all traffic that does not match any other traffic class.  
  - Enter the **average** keyword followed by the committed information rate (CIR), in bits per second (bps). |
|      | Example: | |
|      | `Router(config-pmap-c)# shape average 10000000` | |
| 13   | `bandwidth remaining ratio ratio` | Specifies the weight (ratio) for the subinterface.  
  - Enter the relative weight of this subinterface (or class queue). This number (ratio) indicates the proportional relationship between the other subinterfaces or class queues. |
<p>|      | Example: | |
|      | <code>Router(config-pmap-c)# bandwidth remaining ratio 10</code> | |</p>
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
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</thead>
<tbody>
<tr>
<td><strong>Step 14</strong></td>
<td>Applies the child policy map to the parent class-default class.</td>
</tr>
<tr>
<td>service-policy ypolicy-map-name</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter the name of a previously configured child policy map.</td>
</tr>
<tr>
<td>Router(config-pmap-c)# service-policy session_a_child</td>
<td></td>
</tr>
<tr>
<td><strong>Step 15</strong></td>
<td>Exits policy-map class configuration mode.</td>
</tr>
<tr>
<td>exit</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-pmap-c)# exit</td>
<td></td>
</tr>
<tr>
<td><strong>Step 16</strong></td>
<td>Exits policy-map configuration mode.</td>
</tr>
<tr>
<td>exit</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-pmap)# exit</td>
<td></td>
</tr>
<tr>
<td><strong>Step 17</strong></td>
<td>Creates a virtual template and enters interface configuration mode.</td>
</tr>
<tr>
<td>interface virtual-template number</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter the virtual template number. Valid range is from 1 to 4095.</td>
</tr>
<tr>
<td>Router(config)# interface virtual-template 1</td>
<td></td>
</tr>
<tr>
<td><strong>Step 18</strong></td>
<td>Applies the service policy to the virtual interface.</td>
</tr>
<tr>
<td>service-policy output policy-map-name</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter the name of the previously configured parent policy map.</td>
</tr>
<tr>
<td>Router(config-if)# service-policy output session_a_parent</td>
<td>Note: You must specify the output keyword to apply the service policy to outbound traffic on the interface.</td>
</tr>
<tr>
<td><strong>Step 19</strong></td>
<td>(Optional) Returns to privileged EXEC mode.</td>
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<tr>
<td>end</td>
<td></td>
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<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-if)# end</td>
<td></td>
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</tbody>
</table>

**Examples**

The following is an example of how to configure and apply a QoS hierarchical queueing policy map to PPP/IP sessions by using a virtual template:

Router> enable
Router# configure terminal
Router(config)# policy-map session_a_child
Router(config-pmap)# class voip
Router(config-pmap-c)# police 1000000
Router(config-pmap-c)# priority level 1
Router(config-pmap-c)# exit
Router(config-pmap-c)# class video
### Configuring and Applying QoS Hierarchical Queueing Policy Maps to Subinterfaces

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map-name*
4. **class** *class-default*
5. **shape** *average cir*
6. **exit**
7. **exit**
8. **interface type slot/subslot/port.subinterface**
9. **encapsulation dot1q** *outer-vlan-id [second-dot1qinner-vlan-id]*
10. **service-policy output** *policy-map-name*
11. **end**

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><strong>enable</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
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<tr>
<td></td>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>configure terminal</strong></td>
<td>Enters global configuration mode.</td>
</tr>
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<td></td>
<td>Example:</td>
<td></td>
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<tr>
<td></td>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
<td></td>
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<tr>
<td><strong>Step 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>policy-map policy-map-name</td>
<td>Creates a policy map and enters policy-map configuration mode.</td>
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<tr>
<td>Example:</td>
<td></td>
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<tr>
<td>Router(config)# policy-map subint_1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td></td>
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</tr>
<tr>
<td>class class-default</td>
<td>Configures the traffic class as class-default and enters policy-map class configuration mode. Do not configure any other traffic class.</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Router(config-pmap)# class class-default</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td></td>
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</tr>
<tr>
<td>When a subinterface aggregates a number of sessions with queueing policies, a queueing policy at a subinterface level must be a one-level policy map configured as class-default.</td>
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<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>shape average cir</td>
<td>Specifies average-rate traffic shaping for all traffic that does not match any other traffic class.</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Router(config-pmap-c)# shape average 10000000</td>
<td></td>
<td></td>
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<tr>
<td><strong>Note</strong></td>
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</tr>
<tr>
<td>When a subinterface aggregates a number of sessions with queueing policies, a queueing policy at a subinterface level must be a one-level policy map with only the shape feature enabled.</td>
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<tr>
<td><strong>Step 6</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>exit</td>
<td>Exits policy-map class configuration mode.</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
<td></td>
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<tr>
<td>Router(config-pmap-c)# exit</td>
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<td></td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td></td>
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<tr>
<td>exit</td>
<td>Exits policy-map configuration mode.</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Router(config-pmap)# exit</td>
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<td></td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td></td>
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</tr>
<tr>
<td>interface type slot/subslot/port.subinterface</td>
<td>Specifies the subinterface on which you are attaching the policy map and enters subinterface configuration mode.</td>
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<tr>
<td>Example:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Router(config)# interface GigabitEthernet3/1/1.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter the interface type and slot number, subslot number, port number, and subinterface number.</td>
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</tr>
<tr>
<td><strong>Step 9</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>encapsulation dot1q outer-vlan-id [second-dot1q inner-vlan-id]</td>
<td>Enables IEEE 802.1Q encapsulation of traffic on the subinterface.</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Router(config-subif)# encapsulation dot1q 100</td>
<td>The second-dot1q keyword supports the IEEE 802.1 QinQ VLAN Tag Termination feature to configure an inner VLAN ID.</td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>• outer-vlan-id--The outer VLAN identifier. The range is from 1 to 4095.</td>
<td></td>
</tr>
<tr>
<td>• inner-vlan-id--The inner VLAN identifier. The range is from 1 to 4095.</td>
<td></td>
</tr>
</tbody>
</table>

### Step 10

#### Example:

```bash
Router(config-subif)# service-policy output subint_1
```

Attaches the service policy to the subinterface.

#### Note

You must specify the output keyword to apply the service policy to outbound traffic on the subinterface.

### Step 11

#### Example:

```bash
Router(config-subif)# end
```

(Optional) Returns to privileged EXEC mode.

### Examples

The following is an example of how to configure and apply a QoS hierarchical queueing policy map to a subinterface (and provide aggregate shaping for a large number of subscribers):

```bash
Router> enable
Router# configure terminal
Router(config)# policy-map subint_1
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 10000000
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface GigabitEthernet3/1/1.1
Router(config-subif)# encapsulation dot1q 100
Router(config-subif)# service-policy output subint_1
Router(config-subif)# end
```

### Displaying Policy-Map Information for Hierarchical Queueing

#### SUMMARY STEPS

1. enable
2. show policy-map
3. show policy-map interface type number
4. show policy-map session
5. exit
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Router&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> show policy-map</td>
<td>(Optional) Displays all information for all class maps.</td>
</tr>
<tr>
<td>Example: Router# show policy-map</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> show policy-map interface <strong>type number</strong></td>
<td>(Optional) Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.</td>
</tr>
<tr>
<td>Example: Router# show policy-map interface GigabitEthernet4/0/0.1</td>
<td>• Enter the interface type and number.</td>
</tr>
<tr>
<td><strong>Step 4</strong> show policy-map session</td>
<td>(Optional) Displays the QoS policy map in effect for the SSS session.</td>
</tr>
<tr>
<td>Example: Router# show policy-map session</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> exit</td>
<td>(Optional) Exits privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Router# exit</td>
<td></td>
</tr>
</tbody>
</table>

### Configuration Examples for QoS Hierarchical Queueing for Ethernet DSLAMs

#### Example Policy Maps on VLANs or QinQ Subinterfaces

The following example shows how to configure and apply QoS hierarchical queueing policy maps on VLANs or QinQ subinterfaces. A child queueing policy is applied to each parent subscriber line level policy. In this example, the policy maps are applied to create subscriber groups on subinterfaces.

Router> enable
Router# configure terminal
Router(config)# policy-map service_a_out
Router(config-pmap)# class voip
Router(config-pmap-c)# priority
Router(config-pmap-c)# police cIR percent 20 bc 300 ms pIR percent 40
Router(config-pmap-c)# set cos 1
Router(config-pmap-c)# exit
Router(config-pmap)# class video
Router(config-pmap-c)# police cir percent 20 bc 300 ms pir prectent 40
Router(config-pmap-c)# set cos 2
Router(config-pmap-c)# exit
Router(config-pmap)# class gaming
Router(config-pmap-c)# bandwidth remaining percent 80
Router(config-pmap-c)# set cos 3
Router(config-pmap-c)# exit
Router(config-pmap)# class class-default
Router(config-pmap-c)# bandwidth remaining percent 20
Router(config-pmap-c)# set cos 4
Router(config-pmap-c)# exit
Router(config-pmap)# exit

Router(config)# policy-map service_z_out
Router(config-pmap)# exit

Router(config)# policy-map rate_1_service_a_in
Router(config-pmap)# class voip
Router(config-pmap-c)# police cir percent 25 4 ms 1 ms
Router(config-pmap-c)# exit
Router(config-pmap)# class gaming
Router(config-pmap-c)# police cir percent 50 2 ms 1 ms
Router(config-pmap-c)# exit
Router(config-pmap)# class class-default
Router(config-pmap-c)# police percent 20 bc 300 ms pir 40
Router(config-pmap-c)# exit
Router(config-pmap)# exit

Router(config)# policy-map rate_1_service_a_out
Router(config-pmap)# class class-default
Router(config-pmap-c)# bandwidth remaining ratio 10
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# service-policy service_a_out
Router(config-pmap-c)# exit
Router(config-pmap)# exit

Router(config)# policy-map rate_x_service_z_in
Router(config-pmap)# class class-default
Router(config-pmap-c)# bandwidth remaining ratio 10
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# service-policy service_z_in
Router(config-pmap-c)# exit
Router(config-pmap)# exit

Router(config)# interface GigabitEthernet1/0/0.1
Router(config-subif)# encapsulation dot1q 5 second dot1q 20
Router(config-subif)# service-policy output rate_1_service_a_out
Router(config-subif)# service-policy input rate_1_service_a_in
Router(config-subif)# exit
Router(config)# interface GigabitEthernet1/0/0.2
Router(config-subif)# encapsulation dot1q 5 second dot1q 25
Router(config-subif)# service-policy output rate_x_service_z_out
Router(config-subif)# service-policy input rate_x_service_z_in
Router(config-subif)# end
Example Policy Maps on VLANs with Arbitrary QinQ

The following example shows how to configure and apply QoS hierarchical queueing policy maps on VLANs with subscriber lines grouped by arbitrary QinQ. A child queueing policy is applied to each parent subscriber line level policy. This example includes the configuration of multiple class maps.

Router> enable
Router# configure terminal
Router(config)# class-map match-all user_1
Router(config-cmap)# match vlan 10
Router(config-cmap)# exit
Router(config)# class-map match-all user_2
Router(config-cmap)# match vlan 11
Router(config-cmap)# exit
Router(config)# class-map match-all user_3
Router(config-cmap)# match vlan 10
Router(config-cmap)# exit
Router(config)# class-map match-any user_4
Router(config-cmap)# match vlan 11
Router(config-cmap)# exit
Router(config)# class-map match-any isp_A
Router(config-cmap)# match class user_1
Router(config-cmap)# match class user_2
Router(config-cmap)# exit
Router(config)# class-map match-any isp_Z
Router(config-cmap)# match class user_3
Router(config-cmap)# match class user_4
Router(config-cmap)# exit
!
Router(config)# policy-map service_a_out
Router(config-pmap)# class voip
Router(config-pmap-c)# priority
Router(config-pmap-c)# police cir percent 20 bc 300 ms pir percent 40
Router(config-pmap-c)# set cos 1
Router(config-pmap-c)# exit
Router(config-pmap)# class video
Router(config-pmap-c)# police cir percent 20 bc 300 ms pir percent 40
Router(config-pmap-c)# set cos 2
Router(config-pmap-c)# exit
Router(config-pmap)# class gaming
Router(config-pmap-c)# bandwidth remaining percent 80
Router(config-pmap-c)# set cos 3
Router(config-pmap-c)# exit
Router(config-pmap)# class class-default
Router(config-pmap-c)# bandwidth remaining percent 20
Router(config-pmap-c)# set cos 4
Router(config-pmap-c)# exit
Router(config-pmap)# exit
!
Router(config)# policy-map service_z_out
Router(config-pmap)# class voip
Router(config-pmap-c)# police cir percent 25 4 ms 1 ms
Router(config-pmap-c)# set cos 1
Router(config-pmap-c)# exit
Router(config-pmap)# class gaming
Router(config-pmap-c)# police cir percent 50 2 ms 1 ms
Router(config-pmap-c)# set cos 3
Router(config-pmap-c)# exit
Router(config-pmap)# class class-default
Router(config-pmap-c)# police cir percent 20 bc 300 ms pir percent 40
Router(config-pmap-c)# exit
Example CPolicy Maps on Sessions

The following example shows how to configure and apply QoS hierarchical queueing policy maps on sessions. A child queueing policy is applied to each parent subscriber line level policy.
Router> enable
Router# configure terminal
Router(config)# policy-map service_a_out
Router(config-pmap)# class voip
Router(config-pmap-c)# priority
Router(config-pmap-c)# set cos 1
Router(config-pmap-c)# exit
Router(config-pmap)# class video
Router(config-pmap-c)# set cos 2
Router(config-pmap-c)# exit
Router(config-pmap)# class gaming
Router(config-pmap-c)# bandwidth remaining percent 80
Router(config-pmap-c)# set cos 3
Router(config-pmap-c)# exit
Router(config-pmap)# class class-default
Router(config-pmap-c)# bandwidth remaining percent 20
Router(config-pmap-c)# set cos 4
Router(config-pmap-c)# exit
Router(config-pmap)# exit
!
Router(config)# policy-map service_z_out
Router(config-pmap)# exit
!
Router(config)# policy-map rate_1_service_a_out
Router(config-pmap)# class class-default
Router(config-pmap-c)# bandwidth remaining ratio 10
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# service-policy service_a_out
Router(config-pmap-c)# exit
Router(config-pmap)# exit
!
Router(config)# policy-map rate_x_service_z_out
Router(config-pmap)# class class-default
Router(config-pmap-c)# bandwidth remaining ratio 10
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# service-policy service_z_out
Router(config-pmap-c)# exit
Router(config-pmap)# exit
!
Router(config)# policy-map rate_1_service_a_in
Router(config-pmap)# class voip
Router(config-pmap-c)# police cir percent 25 4 ms 1 ms
Router(config-pmap-c)# exit
Router(config-pmap)# class gaming
Router(config-pmap-c)# police cir percent 50 2 ms 1 ms
Router(config-pmap-c)# exit
Router(config-pmap)# class class-default
Router(config-pmap-c)# police cir percent 20 bc 300 ms pir percent 40
Router(config-pmap-c)# exit
Router(config-pmap)# exit
!
Router(config)# policy-map rate_x_service_z_in
Router(config-pmap)# exit
!
Router(config)# policy-map isp_A_out
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# bandwidth remaining ratio 10
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# exit
Router(config)# policy-map isp_Z_out
Router(config-pmap-c)# exit
Example Policy Maps on Sessions with Aggregate Shaping

The following example shows how to configure and apply QoS hierarchical queueing policy maps on sessions with multiple PPP/IP sessions per subscriber line. In this example, the same policies are applied to all sessions using the same virtual interface.

Router> enable
Router# configure terminal
Router(config)# policy-map service_a_out
Router(config-pmap)# class voip
Router(config-pmap-c)# priority
Router(config-pmap-c)# police cir percent 25 4 ms 1 ms
Router(config-pmap-c)# set cos 1
Router(config-pmap-c)# exit
Router(config-pmap)# class video
Router(config-pmap-c)# police cir percent 30 5 ms 1 ms
Router(config-pmap-c)# set cos 2
Router(config-pmap-c)# exit
Router(config-pmap)# class class-default
Router(config-pmap-c)# bandwidth remaining percent 20
Router(config-pmap-c)# set cos 3
Router(config-pmap-c)# exit
}
Router(config)# policy-map service_z_out
Router(config-pmap)# exit
!
Router(config)# policy-map rate_1_service_a_in
Router(config-pmap)# class voip
Router(config-pmap-c)# police cir percent 25 4 ms 1 ms
Router(config-pmap-c)# exit
Router(config-pmap)# class video
Router(config-pmap-c)# police cir percent 30 2 ms 1 ms
Router(config-pmap-c)# exit
Router(config-pmap)# class class-default
Router(config-pmap-c)# police cir percent 40 2 ms 1 ms
Router(config-pmap-c)# exit
}
Router(config)# policy-map rate_x_service_z_in
Router(config-pmap)# exit
!
Router(config)# policy-map rate_1_service_a_out
Router(config-pmap)# class class-default
Router(config-pmap-c)# bandwidth remaining ratio 10
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# service policy service_a_out
Router(config-pmap-c)# exit
Router(config-pmap)# exit
!
Router(config)# policy-map rate_x_service_z_out
Router(config-pmap-c)# class class-default
Router(config-pmap-c)# bandwidth remaining ratio 10
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# service policy service_z_out
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface GigabitEthernet1/0/0
Router(config-if)# encapsulation dot1q 1
Router(config-if)# service-policy output isp_A_out
Router(config-if)# exit
Router(config)# interface GigabitEthernet2/0/0
Router(config-if)# encapsulation dot1q 2
Router(config-if)# service-policy output isp_Z_out
Router(config-if)# end

## Additional References

### Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples</td>
<td><em>Cisco IOS Quality of Service Solutions Command Reference</em></td>
</tr>
<tr>
<td>Traffic shaping</td>
<td>&quot;Regulating Traffic Flow Using Traffic Shaping&quot; module</td>
</tr>
<tr>
<td>MQC</td>
<td>&quot;Applying QoS Features Using the MQC&quot; module</td>
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### Standards

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### MIBs

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<tr>
<td>No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.</td>
<td>To locate and download MIBs for selected platforms, Cisco IOS XE Software releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
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### RFCs

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### Technical Assistance

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<th>Link</th>
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<tr>
<td>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.</td>
<td><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></td>
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</tbody>
</table>

### Feature Information for QoS Hierarchical Queueing for Ethernet DSLAMs

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](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

<table>
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<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
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<tr>
<td>QoS Hierarchical Queueing for Ethernet DSLAMs</td>
<td>Cisco IOS XE Release 2.4</td>
<td>This feature module describes how to configure QoS hierarchical queuing policy maps on sessions and subinterfaces in Ethernet Digital Subscriber Line Access Multiplexer (E-DSLAM) applications. This feature was implemented on Cisco ASR 1000 Series Routers.</td>
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