QoS - Hierarchical Queuing for Ethernet DSLAMs

First Published: November, 2006

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 on a Cisco 10000 series router. The QoS - Hierarchical Queuing for E-DSLAM feature supports IEEE 802.1 QinQ VLAN Tag Termination to configure inner Virtual LAN (VLAN) identifiers on E-DSLAMs.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for QoS - Hierarchical Queuing for Ethernet DSLAMs" section on page 16.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click Cancel at the login dialog box and follow the instructions.

Contents

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Prerequisites for QoS - Hierarchical Queuing for Ethernet DSLAMs

- You must configure traffic classes using the **class-map** command.
- This feature requires a Performance Routing Engine 3 (PRE3).

Restrictions for QoS - Hierarchical Queuing for Ethernet DSLAMs

- Cisco IOS Release 12.2(31)SB2 does not include Modular QoS CLI (MQC) support for these session-based queuing policies:
  - IP sessions
  - Inner VLAN sessions
- This feature is not supported in combination with load balancing when a session service policy is routed to an L2TP tunnel. Do not configure load balancing on an L2TP tunnel if per-session queuing is enabled.

Information about QoS - Hierarchical Queuing for Ethernet DSLAMs

Traffic downstream from a Broadband Router Access Server (BRAS) requires different levels of Quality of Service (QoS) provisioning depending on the network architecture between the BRAS and subscriber. Figure 1 on page 3 shows multiple entities where QoS provisioning is required for different reasons.

The following examples are entities that may require different traffic shaping:

- A VLAN shaped to a certain aggregate traffic rate to limit the traffic to a group of subscribers (different 802.1Q interfaces in Figure 1).
- Individual sessions shaped with certain QoS services for different classes of traffic (individual PCs in Figure 1).

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

The integrated queuing 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 queuing control plane sets up and enables the queuing features.

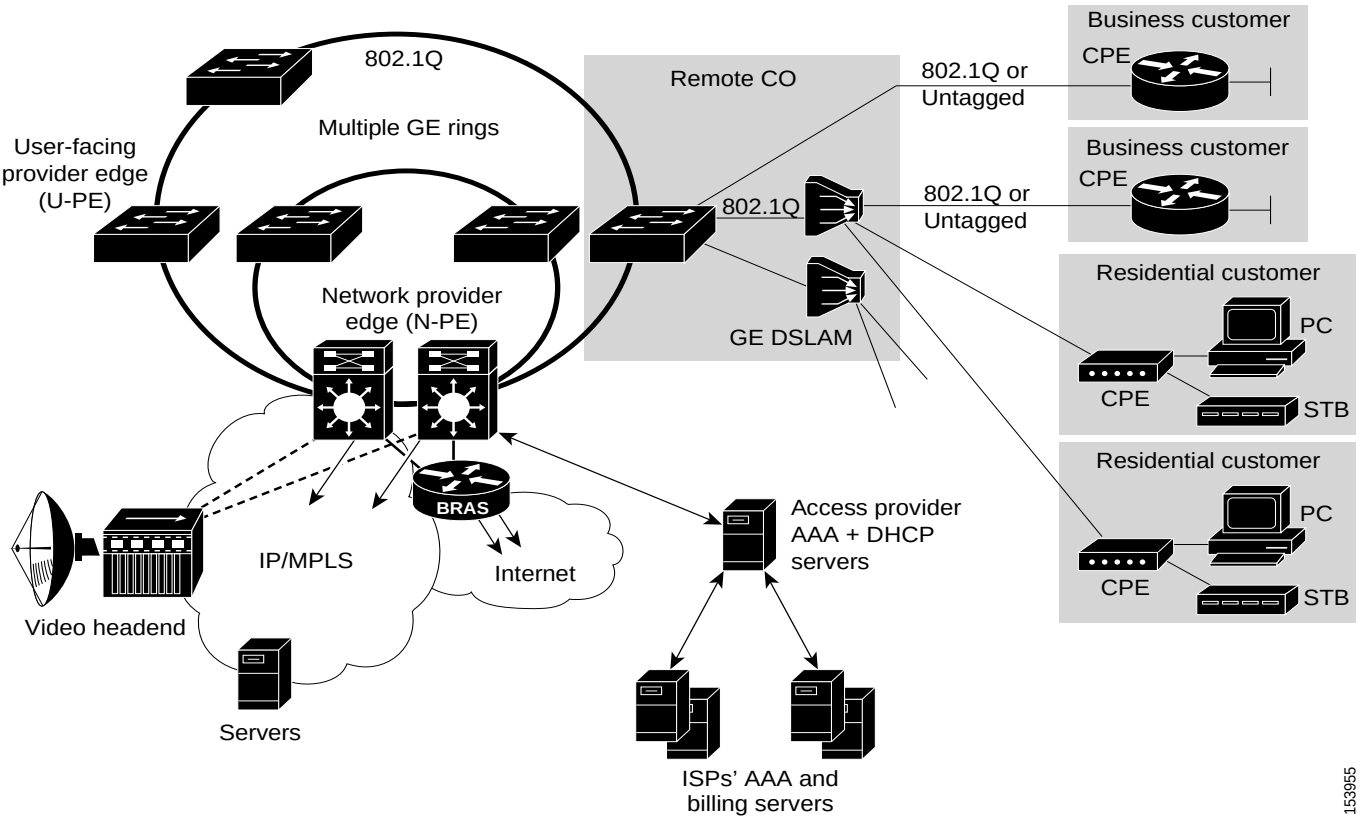
Session-to-interface associations are resolved to determine the physical interface on which to form the integrated queuing hierarchy for all levels of QoS provisioning. As subinterface session-based policies are added, the respective queues are created and integrated into the queuing hierarchy.

When a subinterface is provisioned followed by session-based policy provisioning, the integrated queuing hierarchy is formed on top of the physical interface as a result of queuing policies provisioned at two different levels. When a session is provisioned before subinterface-based policy provisioning, the

queuing 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.

A PRE3 supports three hierarchical levels of scheduling: physical port, session, and class queues. When sessions are established within a subinterface configured with a shaping policy, the subinterface level is lowered to the physical layer.

Figure 1 Ethernet DSL Access Network



Configuration Guidelines and Restrictions

- An individual subscriber is always identified by a PPP or IP session. A group of subscribers is identified by a particular VLAN via outer tag ISP, E-DSLAM, or user-facing provider edge (U-PE).
- When a subinterface is used to aggregate a number of sessions with queuing policies, a queuing policy at a subinterface level must be a one-level policy map configured as class-default with only the shape feature.
- Do not oversubscribe sessions to ensure distributed bandwidth for sessions with configured shape rates.

Configuring QoS - Hierarchical Queuing for Ethernet DSLAMs

This section includes the following procedures:

Configuring and Applying QoS - Hierarchical Queuing Policy Maps to Sessions

Perform this task to configure and apply a QoS hierarchical queuing policy map to PPP/IP sessions through a virtual template.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map-name*
4. **class** *class-map-name*
5. (Optional) **bandwidth** {*bandwidth-kbps*| **percent** *percentage* | **remaining percent** *percentage*}
6. (Optional) **precedence** *precedence min-threshold max-threshold mark-probability-denominator*
7. (Optional) **set cos** *cos-value*
8. **policy-map** *policy-map-name*
9. **class class-default**
10. **shape average** *cir* [*bc*] [*be*]
11. **bandwidth remaining ratio** *weight*
12. **service-policy** *policy-map-name*
13. **exit**
14. **exit**
15. **interface virtual-template** *number*
16. **service-policy output** *policy-map-name*

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 session_a_child`	Creates a child policy. Enters policy-map configuration mode. • *policy-map-name*—A maximum of 40 alphanumeric characters.
Step 4	**class** *class-map-name* **Example:** `Router(config-pmap)# class voip`	Configures the traffic class you specify. Enters policy-map class configuration mode. • *class-map-name*—Name of a previously configured class map.
Step 5	**bandwidth** {*bandwidth-kbps* | **percent** *percentage*| **remaining percent** *percentage*} **Example:** `Router(config-pmap-c)# bandwidth 10000`	(Optional) Enables class-based fair queuing. • *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. • **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. • **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.

	Command or Action	Purpose
Step 6	**precedence** *precedence min-threshold max-threshold mark-probability-denominator* **Example:** `Router(config-pmap-c)# precedence 0 32 256 100`	(Optional) Configures a precedence level for the traffic class. • *precedence*—Specifies the IP precedence number. Valid values are from 0 to 7. • *min-threshold*—Specifies the minimum threshold in number of packets. Valid values are from 1 to 4096. • *max-threshold*—Specifies the maximum threshold in number of packets. Valid values are from the minimum threshold to 4096. • *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).
Step 7	**set cos** *cos-value* **Example:** `Router(config-pmap)# set cos 1`	(Optional) Sets the Layer 2 class of service (CoS) value of an outgoing packet. • *cos-value*—Specifies an 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 entering 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.
Step 8	**policy-map** *policy-map-name* **Example:** `Router(config-pmap)# policy-map session_a_parent`	Creates a parent policy. Enters policy-map configuration mode. • *policy-map-name*—A maximum of 40 alphanumeric characters.
Step 9	**class class-default** **Example:** `Router(config-pmap)# class class-default`	Configures the traffic class as **class-default**. Do not configure any other traffic class.
Step 10	**shape average** *cir* [*bc*] [*be*] **Example:** `Router(config-pmap-c)# shape average 10000000`	Specifies average or peak rate traffic shaping for all traffic that does not match any other traffic class. • **average**—Average rate shaping. • *cir*—Committed information rate (CIR), in bits per second (bps). • *bc*—(Optional) Committed Burst size, in bits. • *be*—(Optional) Excess Burst size, in bits.

	Command or Action	Purpose
Step 11	**bandwidth remaining ratio** *weight* **Example:** `Router(config-pmap-c)# bandwidth remaining ratio 10`	Specifies the weight for the subinterface. • *weight*—Specifies the relative weight of the subinterface with respect to other subinterfaces, during periods of congestion.
Step 12	**service-policy** *policy-map-name* **Example:** `Router(config-pmap-c)# service-policy session_a_child`	Applies the child policy to the parent class-default class. • *policy-map-name*—Specifies the name of a previously configured child policy.
Step 13	**exit** **Example:** `Router(config-pmap-c)# exit`	Exits policy-map class configuration mode.
Step 14	**exit** **Example:** `Router(config-pmap)# exit`	Exits policy-map configuration mode.
Step 15	**interface virtual-template** *number* **Example:** `Router(config)# interface virtual-template 1`	Creates a virtual template. Enters interface configuration mode. • *number*—Identifies the virtual template. Valid range is from 1 to 200.
Step 16	**service-policy output** *policy-map-name* **Example:** `Router(config-if)# service-policy output session_a_parent`	Applies the service policy to the virtual interface. • *policy-map-name*—Specifies the name of the previously configured parent policy. **Note** You must specify the **output** keyword to apply the service policy to outbound traffic on the interface.

Example

```
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)# class video
Router(config-pmap-c)# police 100000
Router(config-pmap-c)# priority level 2
Router(config-pmap-c)# class precedence_0
Router(config-pmap-c)# bandwidth remaining ratio 10
Router(config-pmap-c)# class precedence_1
Router(config-pmap-c)# bandwidth remaining ratio 20
Router(config-pmap-c)# policy-map session_a_parent
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 10000000
Router(config-pmap-c)# bandwidth remaining ratio 10
Router(config-pmap-c)# service-policy session_a_child
Router(config-pmap-c)# exit
Router(config-pmap)# exit
```

```
Router(config)# interface virtual-template 20
Router(config-if)# service-policy output session_a_parent
Router(config-if)# end
```

Configuring and Applying QoS - Hierarchical Queuing Policy Maps to Subinterfaces

Perform this task to configure and apply a QoS hierarchical queuing policy map to a subinterface. This provides aggregate shaping for a large number of subscribers.

Note When a subinterface is used to aggregate a number of sessions with queuing policies, a queuing policy at a subinterface level must be a one-level policy map configured as class-default with only the shape feature.

SUMMARY STEPS

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

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 subint_1`	Creates the policy map. Enters policy-map configuration mode. • *policy-map-name*—A maximum of 40 alphanumeric characters.
Step 4	**class class-default** **Example:** `Router(config-pmap)# class class-default`	Configures the traffic class as **class-default**. Do not configure any other traffic class.
Step 5	**shape average** *cir* [*bc*] [*be*] **Example:** `Router(config-pmap-c)# shape average 10000000`	Specifies average or peak rate traffic shaping for all of the traffic that does not match any other traffic class. • **average**—Average rate shaping. • *cir*—Committed information rate (CIR), in bits per second (bps). • *bc*—(Optional) Committed Burst size, in bits. • *be*—(Optional) Excess Burst size, in bits.
Step 6	**exit** **Example:** `Router(config-pmap-c)# exit`	Exits policy-map class configuration mode.
Step 7	**exit** **Example:** `Router(config-pmap)# exit`	Exits policy-map configuration mode.
Step 8	**interface** *type slot/subslot/port.subinterface* **Example:** `Router(config)# interface g3/1/1.1`	Specifies the subinterface on which you are attaching the policy map. Enters subinterface configuration mode.

	Command or Action	Purpose
Step 9	**encapsulation dot1q** *outer-vlan-id* [**second-dot1q** *inner-vlan-id*] **Example:** `Router(config-subif)# encapsulation dot1q 100`	Enables IEEE 802.1Q encapsulation of traffic on the subinterface. The **second-dot1q** keyword supports the IEEE 802.1 QinQ VLAN Tag Termination feature to configure an inner VLAN ID. • *outer-vlan-id*—The outer VLAN identifier. The range is from 1 to 4095. • *inner-vlan-id*—The inner VLAN identifier. The range is from 1 to 4095.
Step 10	**service-policy output** *policy-map-name* **Example:** `Router(config-subif)# service-policy output subint_1`	Attaches the service policy to the subinterface. • *policy-map-name*—Specifies the name of the previously configured policy map. **Note** You must specify the **output** keyword to apply the service policy to outbound traffic on the subinterface.

Example

```
Router> enable
Router# configure terminal
Router(config-pmap-c)# 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 g3/1/1.1
Router(config-subif)# encapsulation dot1q 1 second-dot1q 10
Router(config-subif)# service-policy output subint_1
Router(config-subif)# end
```

Displaying Policy Map Information

Table 1 lists the **show** commands to display policy map information.

Table 1 show policy-map Commands

Field	Displays
show policy-map	Configuration of all classes for a specified service policy or all classes for all existing policy maps.
show policy-map session	Policy maps in effect for subscriber sessions.
show policy-map subinterface	Statistics for policy maps enabled on a subinterface.

Configuration Examples for QoS - Hierarchical Queuing for E-DSLAMs

This section provides the following configuration examples:

- Configuring QoS - Hierarchical Queuing Policy Maps on VLANs or QinQ Subinterfaces: Example
- Configuring QoS - Hierarchical Queuing Policy Maps on VLANs with Arbitrary QinQ: Example
- Configuring QoS - Hierarchical Queuing Policy Maps on Sessions: Example
- Configuring QoS - Hierarchical Queuing Policy Maps on Sessions with Aggregate Shaping: Example

Configuring QoS - Hierarchical Queuing Policy Maps on VLANs or QinQ Subinterfaces: Example

The following example shows how to configure and apply QoS hierarchical queuing policy maps on VLANs or QinQ subinterfaces. A child queuing 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 percent 20 bc 300 ms pir 40
Router(config-pmap-c)# set cos 1
Router(config-pmap-c)# class video
Router(config-pmap-c)# police percent 20 bc 300 ms pir 40
Router(config-pmap-c)# set cos 2
Router(config-pmap-c)# class gaming
Router(config-pmap-c)# bandwidth remaining percent 80
Router(config-pmap-c)# set cos 3
Router(config-pmap-c)# class class-default
Router(config-pmap-c)# bandwidth remaining percent 20
Router(config-pmap-c)# set cos 4
!
Router(config-pmap-c)# policy-map service_z_out
Router(config-pmap)# policy-map rate_1_service_a_in
Router(config-pmap)# class voip
Router(config-pmap-c)# police percent 25 4 ms 1 ms
Router(config-pmap-c)# class gaming
Router(config-pmap-c)# police percent 50 2 ms 1 ms
Router(config-pmap-c)# class class-default
Router(config-pmap-c)# police percent 20 bc 300 ms pir 40
Router(config-pmap-c)# policy-map rate_x_service_z_in
Router(config-pmap)# 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)# policy-map rate_x_serviice_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)# 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-if)# 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-if)# end
```

Configuring QoS - Hierarchical Queuing Policy Maps on VLANs with Arbitrary QinQ: Example

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

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

```
Router(config-pmap-c)# policy-map service_z_in
Router(config-pmap)# policy-map isp_A_out
Router(config-pmap)# class user_1
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)# class user_n
Router(config-pmap-c)# bandwidth remaining ratio 20
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# service policy service_z_out
Router(config-pmap-c)# policy-map isp_Z_out
Router(config-pmap)# policy-map isp_A_in
Router(config-pmap)# class user_1
Router(config-pmap-c)# service policy service_a_in
Router(config-pmap-c)# class user_n
Router(config-pmap-c)# service policy service_z_in
Router(config-pmap-c)# policy-map isp_Z_in
Router(config-pmap)# policy-map interface_policy_out
Router(config-pmap)# class isp_A
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# service policy isp_A_out
Router(config-pmap-c)# class isp_Z
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# service policy isp_Z_out
Router(config-pmap-c)# policy-map interface_policy_in
Router(config-pmap)# class isp_A
Router(config-pmap-c)# service policy isp_A_in
Router(config-pmap-c)# class isp_Z
Router(config-pmap-c)# service policy isp_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 any
Router(config-subif)# service-policy output interface_policy_out
Router(config-subif)# service-policy input interface_policy_in
Router(config-if)# end
```

Configuring QoS - Hierarchical Queuing Policy Maps on Sessions: Example

The following example shows how to configure and apply QoS hierarchical queuing policy maps on sessions. A child queuing 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)# class video
Router(config-pmap-c)# set cos 2
Router(config-pmap-c)# class gaming
Router(config-pmap-c)# bandwidth remaining percent 80
Router(config-pmap-c)# set cos 3
Router(config-pmap-c)# class class-default
Router(config-pmap-c)# bandwidth remaining percent 20
Router(config-pmap-c)# set cos 4
!
Router(config-pmap-c)# policy-map service_z_out
Router(config-pmap)# 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)# 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)# policy-map rate_1_service_a_in
Router(config-pmap)# class voip
Router(config-pmap-c)# police percent 25 4 ms 1 ms
Router(config-pmap-c)# class gaming
Router(config-pmap-c)# police percent 50 2 ms 1 ms
Router(config-pmap-c)# class class-default
Router(config-pmap-c)# police cir percent 20 bc 300 ms pir 40
!
Router(config-pmap-c)# policy-map rate_x_service_z_in
Router(config-pmap)# policy-map isp_A_out
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# policy-map isp_Z_out
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 100000
Router(config-pmap-c)# exit
Router(config-pmap)# exit
!
Router(config)# interface GigabitEthernet1/0/0.1
Router(config-if)# encapsulation dot1q 1
Router(config-if)# service-policy output isp_A_out
Router(config-if)# exit
Router(config)# interface GigabitEthernet2/0/0.2
Router(config-if)# encapsulation dot1q 2
Router(config-if)# service-policy output isp_Z_out
```

Configuring QoS - Hierarchical Queuing Policy Maps on Sessions with Aggregate Shaping: Example

The following example shows how to configure and apply QoS hierarchical queuing 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 percent 25 4 ms 1 ms
Router(config-pmap-c)# set cos 1
Router(config-pmap-c)# class video
Router(config-pmap-c)# police percent 30 5 ms 1 ms
Router(config-pmap-c)# set cos 2
Router(config-pmap-c)# class class-default
Router(config-pmap-c)# bandwidth remaining percent 20
Router(config-pmap-c)# set cos 3
!
Router(config-pmap-c)# policy-map service_z_out
Router(config-pmap)# policy-map rate_1_service_a_in
Router(config-pmap)# class voip
Router(config-pmap-c)# police percent 25 4 ms 1 ms
```

```
Router(config-pmap-c)# class video
Router(config-pmap-c)# police percent 30 2 ms 1 ms
Router(config-pmap-c)# class class-default
Router(config-pmap-c)# police percent 40 2 ms 1 ms
!
Router(config-pmap-c)# policy-map rate_x_service_z_in
Router(config-pmap-c)# policy-map rate_1_service_a_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_a_out
!
Router(config-pmap-c)# 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)# 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

The following sections provide references related to the QoS - Hierarchical Queuing for E-DSLAM feature.

Related Documents

Related Topic	Document Title
QoS provisioning and traffic shaping	*Cisco 10000 Series Router Quality of Service Configuration Guide*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	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 by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
The Cisco Technical Support & Documentation website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport

Command Reference

This feature uses no new or modified commands.

Feature Information for QoS - Hierarchical Queuing for Ethernet DSLAMs

Table 2 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Cisco IOS software images are specific to a Cisco IOS software release, a feature set, and a platform. Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

Note Table 2 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 2 Feature Information for Configuring

Feature Name	Releases	Feature Information
QoS - Hierarchical Queuing for Ethernet DSLAMs	12.2(31)SB2	This feature was introduced and implemented on the Cisco 10000 series router for the PRE3.