QoS Hierarchical Queueing for ATM DSLAMs

This feature module describes how to configure quality of service (QoS) hierarchical queueing policy maps on sessions and ATM VCs in ATM Digital Subscriber Line Access Multiplexer (A-DSLAM) applications on a Cisco ASR 1000 Series Aggregation Services Router.

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 ATM DSLAMs

You must configure traffic classes using the class-map command.

# Restrictions for QoS Hierarchical Queueing for ATM DSLAMs

The QoS Hierarchical Queueing for ATM DSLAMs feature is not supported in combination with load balancing when a session service policy is routed to a Layer 2 Tunnel Protocol (L2TP) tunnel. This feature is supported only with shaped ATM VCs, which means ATM VCs that are defined as constant bit rate (CBR), Variable bit rate (VBR) or shaped unspecified bit rate (UBR), (that is, UBR with a peak cell rate).

Information About QoS Hierarchical Queueing for ATM 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 ATM DSL access network. The sample network includes multiple entities where QoS provisioning is required for different reasons.

Figure 1: ATM DSL Access Network
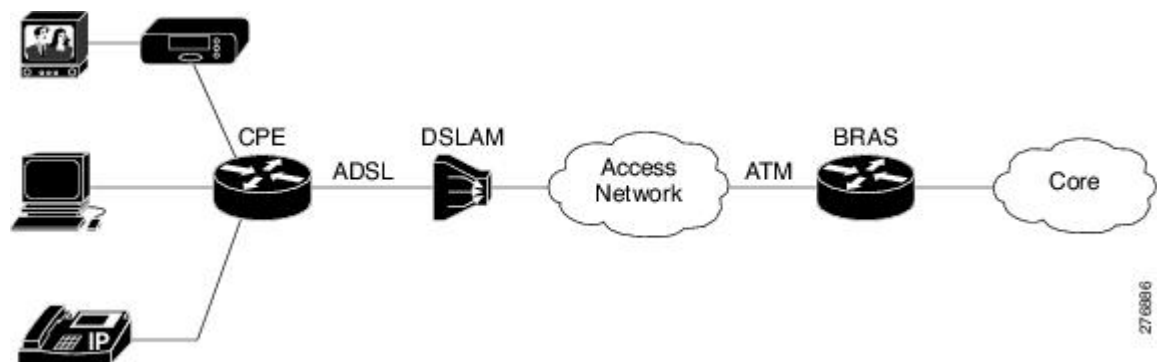
Integrated Queueing Hierarchy

Different traffic shaping requirements result in QoS provisioning at multiple levels at the same time. The QoS-Hierarchical Queueing for ATM 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 Modular QoS CLI (MQC) and a common queueing control plane sets up and enables the queueing features.

Session-to-ATM associations are resolved to determine the ATM VC on which the session QoS queues are built. QoS policies consisting of a shaper may also be applied simultaneously at the VC level.

Configuration Guidelines for Hierarchical Queueing on ATM DSLAMs

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

- When an ATM VC is used to aggregate a number of sessions with queueing policies, a queueing policy at an ATM VC level must be a one-level policy map that is configured as class-default with only the shape feature enabled.

- Both ATM VCs and sessions can be oversubscribed and controlled by shapers.

How to Configure QoS Hierarchical Queueing for ATM 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*| **remainingpercent***percentage*}
6. **exit**
7. **exit**
8. **policy-map** *policy-map-name*
9. **class class-default**
10. **shape** average {*cir*| **percent***percentage*}
11. **bandwidth remaining ratio** *ratio*
12. **service-polic** y*policy-map-name*
13. **exit**
14. **exit**
15. **interface virtual-template** *number*
16. **service-policy output** *policy-map-name*
17. **end**

DETAILED STEPS

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

	Command or Action	Purpose
	Example: Router> enable	• 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 and enters policy-map configuration mode. • Enter the policy-map name.
Step 4	**class** class-map-name **Example:** Router(config-pmap)# class voip	Configures the traffic class that you specify and enters policy-map class configuration mode. • Enter the name of a previously configured class map .
Step 5	bandwidth {*bandwidth-kbps* | **percent***percentage*| **remainingpercent***percentage*} **Example:** Router(config-pmap-c)# bandwidth 10000 **Example:**	(Optional) Enables class-based weighted fair queueing based on the keywords and arguments specified. • bandwidth-kbps--Specifies the minimum bandwidth allocated for a class belonging to a policy map. Valid values are from 1 to 2,000,000. • 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 100. • 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.
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	**policy-map** *policy-map-name*	Creates a parent policy and enters policy-map configuration mode.

	Command or Action	**Purpose**
		• Enter the policy-map name.
	Example:	
	`Router(config)# policy-map` `session_a_parent`	
Step 9	**class class-default**	Configures the traffic class as class-default and enters policy-map class configuration mode.
	Example:	**Note** Do not configure any other traffic class.
	`Router(config-pmap)# class class-default`	
Step 10	**shape** average {*cir*| **percent***percentage*}	Specifies average-rate traffic shaping for all traffic that does not match any other traffic class.
	Example:	• Enter the **average** keyword followed by the committed information rate (CIR), in bits per second (bps), or enter the **average** keyword followed by **percentage** keyword to specify a percentage of the interface bandwidth for the CIR. Valid values are from 1 to 100.
	`Router(config-pmap-c)# shape average` `10000000`	
Step 11	**bandwidth remaining ratio** *ratio*	Specifies the weight (ratio) for the ATM VC.
	Example:	• Enter the relative weight of this ATM VC (or class queue). This number (ratio) indicates the proportional relationship between the other ATM VCs or class queues.
	`Router(config-pmap-c)# bandwidth` `remaining ratio 10`	
Step 12	**service-polic** y*policy-map-name*	Applies the child policy map to the parent class-default class.
	Example:	• Enter the name of a previously configured child policy map.
	`Router(config-pmap-c)# service-policy` `session-a-child`	
Step 13	**exit**	Exits policy-map class configuration mode.
	Example:	
	`Router(config-pmap-c)# exit`	
Step 14	**exit**	Exits policy-map configuration mode.
	Example:	
	`Router(config-pmap)# exit`	
Step 15	**interface virtual-template** *number*	Creates a virtual template and enters interface configuration mode.
	Example:	• Enter the virtual template number. Valid range is from 1 to 4095.
	`Router(config)# interface` `virtual-template 1`	

	Command or Action	Purpose
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. • Enter the name of the previously configured parent policy map. **Note** You must specify the output keyword to apply the service policy to outbound traffic on the interface.
Step 17	**end** **Example:** Router(config-if)# 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 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)# class video
Router(config-pmap-c)# police 100000
Router(config-pmap-c)# priority level 2
Router(config-pmap-c)# exit
Router(config-pmap)# class precedence_0
Router(config-pmap-c)# bandwidth remaining ratio 10
Router(config-pmap-c)# exit
Router(config-pmap)# class precedence_1
Router(config-pmap-c)# bandwidth remaining ratio 20
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# policy-map session_a_parent
Router(config-pmap-c)# exit
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 Queueing Policy Maps to ATM VCs

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map-name*
4. **class class-default**
5. **shape average** {*cir*| **percent***percentage*}
6. **exit**
7. **exit**
8. interface type slot/subslot/port**.**subinterface
9. pvc [*name*] *vpi*/*vci* [**ces** | **ilmi** | **qsaal** | **smds**| **l2transport**]
10. **vbr-nrt** *peak-cell-rate average-cell-rate*
11. **service-policy output** *policy-map-name*
12. **end**

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 a policy map and enters policy-map configuration mode. • policy-map-name--The name of the policy map.
Step 4	**class class-default** **Example:** `Router(config-pmap)# class class-default`	Configures the traffic class as class-default and enters policy-map class configuration mode. • Do not configure any other traffic class.

	Command or Action	**Purpose**
		Note When an ATM VC aggregates a number of sessions with queueing policies, a queueing policy at an ATM VC level must be a one-level policy map that is configured as class-default.
Step 5	**shape average** {*cir*| **percent***percentage*} **Example:** Router(config-pmap-c)# shape average 10000000	Specifies average-rate traffic shaping for all traffic that does not match any other traffic class. • Enter the **average** keyword followed by the CIR, in bps or enter the **average** keyword followed by **percentage** keyword to specify a percentage of the interface bandwidth for the CIR. Valid values are from 1 to 100. **Note** When an ATM VC aggregates a number of sessions with queueing policies, a queueing policy at an ATM VC level must be a one-level policy map with only the shape feature enabled.
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 ATM 3/1/1.1	Specifies the ATM VC on which you are attaching the policy map and enters ATM VC configuration mode. • Enter the interface type and slot number, subslot number, port number, and ATM VC number.
Step 9	pvc [*name*] *vpi*/*vci* [**ces** | **ilmi** | **qsaal** | **smds**| **l2transport**] **Example:** Router(config-if-atm-vc)# pvc 2/100	Selects the ATM VC to which the service policy is to be applied.
Step 10	**vbr-nrt** *peak-cell-rate average-cell-rate* **Example:** Router(config-if-atm-vc)# vbr-nrt 800000 800000	Sets the VC type to VBR with a peak and average cell rate.
Step 11	**service-policy output** *policy-map-name*	Attaches the service policy to the ATM VC.

	Command or Action	Purpose
	Example: Router(config-subif)# service-policy output subint-1	• policy-map-name--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 ATM VC.
Step 12	**end** **Example:** 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 an ATM VC (and provide aggregate shaping for a large number of subscribers):

```
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 ATM 3/1/1.1
Router(config-if-atm-vc)# pvc 2/100
Router (config-if-atm-vc)# vbr-nrt 800000 800000
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

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

	Command or Action	Purpose
	Example: `Router> enable`	• Enter your password if prompted.
Step 2	**show policy-map** **Example:** `Router# show policy-map`	(Optional) Displays all information for all class maps.

Step 3	**show policy-map interface** *type number*
	
	Example:
	
	`Router#`
	`show policy-map interface ATM 4/0/0.1`
		(Optional) Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or ATM VC or on a specific PVC on the interface.
		
		• Enter the interface type and number.

Step 4	**show policy-map session**
	
	Example:
	
	`Router#`
	`show policy-map session`
		(Optional) Displays the QoS policy map in effect for the SSS session.

Step 5	**exit** **Example:** `Router# exit`	(Optional) Exits privileged EXEC mode.

Configuration Examples for QoS Hierarchical Queueing for ATM DSLAMs

Example Policy 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 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-1-service-a-in
Router(config-pmap)# class voip
Router(config-pmap-c)# police percent 25
Router(config-pmap-c)# exit
Router(config-pmap)# class gaming
Router(config-pmap-c)# police percent 50
Router(config-pmap-c)# exit
Router(config-pmap)# class class-default
Router(config-pmap-c)# police percent 20
Router(config-pmap-c)# exit
Router(config-pmap)# exit
!
Router(config)# interface virtual-template 20
Router(config-if)# service-policy output rate-1-service-a-out
Router(config-if)# service-policy input rate-1-service-a-in
Router(config-if)# end
```

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, queueing is configured as in previous example. The VC is configured as follows:

```
Router(config)# policy-map isp_A_out
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 500000
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface ATM 1/0/0.1
Router(config-subif)# pvc 10/100
Router(config-if-atm-vc)# vbr-nrt 800000 800000
Router(config-if-atm-vc)# service-policy output isp-A-out
Router(config-if-atm-vc)# exit
Router(config-subif)# exit
```

Additional References

Related Documents

Related Topic	Document Title
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	*Cisco IOS Quality of Service Solutions Command Reference*
Traffic shaping	"Regulating Traffic Flow Using Traffic Shaping" module
MQC	"Applying QoS Features Using the MQC" module

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 XE Software 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 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 Hierarchical Queueing for ATM 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 . An account on Cisco.com is not required.

Table 1: Feature Information for QoS Hierarchical Queueing for ATM DSLAMs

Feature Name	Releases	Feature Information
QoS Hierarchical Queueing for ATM DSLAMs	Cisco IOS XE Release 2.4 Cisco IOS XE Release 2.5	This feature module describes how to configure QoS hierarchical queueing policy maps on sessions and ATM VCs in ATM Digital Subscriber Line Access Multiplexer (A-DSLAM) applications. This feature was implemented on Cisco ASR 1000 Series Aggregation Services Routers.