MQC—Traffic Shaping Overhead Accounting for ATM

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The MQC—Traffic Shaping Overhead Accounting for ATM feature enables a broadband aggregation system (BRAS) to account for various encapsulation types when applying quality of service (QoS) functionality to packets. Typically, in Ethernet digital subscriber line (DSL) environments, the encapsulation from the router to the digital subscriber line access multiplexer (DSLAM) is Gigabit Ethernet and the encapsulation from the DSLAM to the customer premises equipment (CPE) is ATM. ATM overhead accounting enables the router to account for ATM encapsulation on the subscriber line and for the overhead added by cell segmentation. This functionality enables the service provider to prevent overruns at the subscriber line and ensures that the router executes QoS features on the actual bandwidth used by ATM packets.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. 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 MQC—Traffic Shaping Overhead Accounting for ATM" section on page 16.

Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS and Catalyst OS software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

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Prerequisites for Traffic Shaping Overhead Accounting for ATM

Traffic classes must be configured using the **class-map** command.

Restrictions for Traffic Shaping Overhead Accounting for ATM

- The router supports ATM overhead accounting only for the **shape** and **bandwidth** commands.
- If you enable ATM overhead accounting on a child policy, then you must enable ATM overhead accounting on the parent policy.
- In a policy map, you must either enable ATM overhead accounting for all classes in the policy or disable overhead accounting for all classes in the policy. You cannot enable overhead accounting for some classes and disable overhead accounting for other classes in the same policy.
- The encapsulation type used within a policy map and between the parent policy map and the child policy map (in a hierarchical policy map structure) must be consistent.
- When you enter the **show policy-map session** command, the resulting classification byte counts and the queuing feature byte counts do not match. This is because the classification byte count does not consider overhead, whereas the queuing features do consider overhead.

  Note This restriction applies to the Cisco 10000 series router only. This restriction does not apply to the Cisco 7600 series router.

- You must attach a policy map that is configured with ATM overhead accounting to only an Ethernet interface (or an IP session on an Ethernet interface).

Information About Traffic Shaping Overhead Accounting for ATM

Before configuring traffic shaping overhead accounting for ATM, you should understand the following concepts:

Benefits of Traffic Shaping Overhead Accounting for ATM

The Traffic Shaping Overhead Accounting for ATM feature enables the broadband aggregation system (BRAS) to account for various encapsulation types when applying QoS to packets. Typically, in Ethernet digital subscriber line (DSL) environments, the encapsulation from the BRAS to the DSLAM is Gigabit Ethernet and the encapsulation from the DSLAM to the CPE is ATM. ATM overhead accounting enables the BRAS to account for ATM encapsulation on the subscriber line and for the overhead added by cell segmentation. This functionality enables the service provider to prevent overruns at the subscriber line and ensures that the router executes QoS features on the actual bandwidth used by ATM subscriber traffic.

BRAS and Encapsulation Types

Broadband aggregation system (BRAS) uses the encapsulation type that is configured for the DSLAM-CPE side to calculate the ATM overhead per packet.

DSLAM-CPE encapsulation types are based on Subnetwork Access Protocol (SNAP) and multiplexer (MUX) formats of ATM adaptation layer 5 (AAL5), followed by routed bridge (RBE), x-1483, x-dot1q-rbe, IP, PPP over Ethernet (PPPoE), or PPP over ATM (PPPoA) encapsulations. Because the DSLAM treats IP and PPPoE packets as payload, the BRAS does not account for IP and PPPoE encapsulations.

On the BRAS-DSLAM side, encapsulation is IEEE 802.1Q VLAN or Q-in-Q (qinq). However, because the DSLAM removes the BRAS-DSLAM encapsulation, the BRAS does not account for 802.1Q or qinq encapsulation.

AAL5 segmentation processing adds the additional overhead of the 5-byte cell headers, the AAL5 Common Part Convergence Sublayer (CPCS) padding, and the AAL5 trailer. For more information, see the "ATM Overhead Calculation" section on page 4.

Subscriber Line Encapsulation Types

The router supports the following subscriber line encapsulation types:

- snap-rbe
- mux-rbe
- snap-dot1q-rbe
- mux-dot1q-rbe
- snap-pppoa
- mux-pppoa
- snap-1483routed
- mux-1483routed

Note The encapsulation types listed above are for AAL5, qinq, and dot1q encapsulations. User-defined encapsulations with offsets based on the platform in use are also supported. (For the Cisco 10000 series router, valid offsets are –63 to +63. For the Cisco 7600 series router, valid offsets are –48 to +48.)

ATM Overhead Calculation

The Traffic Shaping Overhead Accounting for ATM feature prevents oversubscription of a subscriber line by accounting for the ATM encapsulation overhead at the BRAS. When calculating the ATM overhead, the Traffic Shaping Overhead Accounting for ATM feature considers the following:

- The encapsulation type used by the BRAS
- The CPCS trailer overhead
- The encapsulation type used between the DSLAM and the CPE

The offset size (a parameter used to calculate ATM overhead accounting) is calculated using the following formula:

Offset size in bytes = (CPCS trailer overhead) + (DSLAM to CPE) - (BRAS encapsulation type)

See Table 1 for the offset sizes, in bytes, derived from this formula.

This offset size, along with the packet size and packet assembler/disassembler (PAD) byte overhead in the CPCS, is used by the router to calculate the ATM overhead accounting rate.

Note A CPCS trailer overhead of 8 bytes corresponds to AAL5. A CPCS trailer overhead of 4 bytes corresponds to AAL3, but AAL3 is not supported.

Table 1 Offset Sizes, in Bytes, Used for ATM Overhead Calculation

Encapsulation Type in Use	BRAS	CPCS Trailer Overhead	DSLAM to CPE	Offset Size
dot1q mux-1483routed	18	8	3	–7
dot1q snap-1483routed	18	8	6	–4
dot1q mux-rbe	18	8	14	4
dot1q snap-rbe	18	8	24	14
dot1q mux-dot1q-rbe	18	8	18	8
dot1q snap-dot1q-rbe	18	8	28	18
qot1q mux-pppoa	18 + 6	8	2	–14
qot1q snap-pppoa	18 + 6	8	4	–12
qinq mux-1483routed	22	8	3	–11
qinq snap-1483routed	22	8	6	–8
qinq mux-rbe	22	8	14	0
qinq snap-rbe	22	8	24	10
qinq mux-dot1q-rbe	22	8	18	4
qing snap-dot1q-rbe	22	8	28	14
qinq mux-pppoa	22 + 6	8	2	–18
qinq snap-pppoa	22 + 6	8	4	–16

ATM Overhead Accounting and Hierarchical Policies

In hierarchical policies, you can enable ATM overhead accounting for shaping and bandwidth on parent policies and child policies. You are not required to enable ATM overhead accounting on a traffic class that does not contain the **bandwidth** or **shape** command. If you enable ATM overhead accounting on a child policy, then you must enable ATM overhead accounting on the parent policy. The parent and child classes must specify the same encapsulation type when ATM overhead accounting is enabled.

How to Configure Traffic Shaping Overhead Accounting for ATM

This section contains the following tasks.

- Configuring Traffic Shaping Overhead Accounting for ATM in a Hierarchical Policy, page 5 (required)
- Verifying the Configuration of Traffic Shaping Overhead Accounting for ATM, page 10 (optional)

Configuring Traffic Shaping Overhead Accounting for ATM in a Hierarchical Policy

To configure traffic shaping overhead accounting for ATM in a hierarchical policy map structure, perform the following steps.

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 percent** *percentage*} [**account** {**qinq** | **dot1q**} [**aal5**] {*subscriber-encapsulation* | **user-defined** *offset*}]
6. **bandwidth remaining ratio** *ratio* [**account** {**qinq** | **dot1q**} [**aal5**] {*subscriber-encapsulation* | **user-defined** *offset*}]
7. **shape** [**average** | **peak**] *mean-rate* [*burst-size*] [*excess-burst-size*] [**account** {**qinq** | **dot1q**} [**aal5**] {*subscriber-encapsulation* | **user-defined** *offset*}]
8. **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 Business`	Creates or modifies the child policy and enters policy-map configuration mode. • Enter the policy map name. This is the name of the child policy and can be a maximum of 40 alphanumeric characters.
Step 4	**class** *class-map-name* **Example:** `Router(config-pmap)# class video`	Assigns the traffic class that you specify for the policy map and enters policy-map class configuration mode. • Enter the traffic class name. This is the name of the previously configured class map and can be a maximum of 40 alphanumeric characters.

	Command or Action	Purpose
Step 5	**bandwidth** {*bandwidth-kbps* | **percent** *percentage* | **remaining percent** *percentage*} [**account** {**qinq** | **dot1q**} [**aal5**] {*subscriber-encapsulation* | **user-defined** *offset*}] **Example:** `Router(config-pmap-c)# bandwidth 8000 account dot1q aal5 snap-pppoa`	Enables Class-Based Weighted Fair Queuing (CBWFQ) on the basis of the keywords and arguments specified, such as the following: • *bandwidth-kbps*—Specifies or modifies the minimum bandwidth allocated for a class that belongs to a policy map. Valid values are from 8 to 2488320, which represents from 1 to 99 percent of the link bandwidth. • **percent** *percentage*—Specifies or modifies the minimum percentage of the link bandwidth allocated for a class that belongs to a policy map. Valid values are from 1 to 99. • **remaining percent** *percentage*—Specifies or modifies the minimum percentage of unused link bandwidth allocated for a class that belongs to a policy map. Valid values are from 1 to 99. • **account**—Enables ATM overhead accounting. • **qinq**—Specifies queue-in-queue encapsulation as the BRAS-DSLAM encapsulation type. • **dot1q**—Specifies IEEE 802.1Q VLAN encapsulation as the BRAS-DSLAM encapsulation type. • **aal5**—Specifies the ATM adaptation layer 5 that supports connection-oriented variable bit rate (VBR) services. • *subscriber-encapsulation*—Specifies the encapsulation type at the subscriber line. For more information, see the "Subscriber Line Encapsulation Types" section on page 3. • **user-defined**—Specifies the offset size that the router uses when calculating the ATM overhead. • *offset*—Specifies the offset size when calculating ATM overhead. Valid values are from –63 to +63 bytes. **Note** For the Cisco 7600 series router, valid values are from –48 to +48 bytes.

	Command or Action	Purpose
Step 6	**bandwidth remaining ratio** *ratio* [**account** {**qinq** | **dot1q**} [**aal5**] {*subscriber-encapsulation* | **user-defined** *offset*}] **Example:** `Router(config-pmap-c)# bandwidth remaining ratio 10 account dot1q aal5 snap-pppo`	(Optional) Specifies the bandwidth-remaining ratio for the subinterface along with ATM accounting parameters: • *ratio*—Specifies the bandwidth-remaining ratio for the subinterface. Valid values are 1 to 100. The default value is 1. **Note** For the Cisco 7600 series router, valid values are from 1 to 10000. The default value is 1. • **account**—Enables ATM overhead accounting. • **qinq**—Specifies queue-in-queue encapsulation as the BRAS-DSLAM encapsulation type. • **dot1q**—Specifies IEEE 802.1Q VLAN encapsulation as the BRAS-DSLAM encapsulation type. • **aal5**—Specifies the ATM adaptation layer 5 that supports connection-oriented VBR services. • *subscriber-encapsulation*—Specifies the encapsulation type at the subscriber line. For more information, see the "Subscriber Line Encapsulation Types" section on page 3. • **user-defined**—Specifies the offset size that the router uses when calculating the ATM overhead. • *offset*—Specifies the offset size, in bytes, when calculating ATM overhead. Valid values are from –63 to +63. **Note** For the Cisco 7600 series router, valid values are from –48 to +48.

	Command or Action	Purpose
Step 7	**shape** [**average** | **peak**] *mean-rate* [*burst-size*] [*excess-burst-size*][**account** {**qinq** | **dot1q**} [**aal5**] {*subscriber-encapsulation* | **user-defined** *offset*}] **Example:** `Router(config-pmap-c)# shape 8000 account qinq aal5 snap-dot1q-rbe`	Shapes traffic to the indicated bit rate and enables ATM overhead accounting on the basis of the keywords and arguments specified, such as the following: • **average**—(Optional) The committed burst (Bc) that specifies the maximum number of bits sent out in each interval. • **peak**—(Optional) Specifies the maximum number of bits sent out in each interval (the Bc + excess burst [Be]). The Cisco 10000 router and the SIP400 (on the Cisco 7600 series router) do not support this option. • *mean-rate*—Also called committed information rate (CIR). Indicates the bit rate used to shape the traffic, in bits per second. • *burst-size*—(Optional) The number of bits in a measurement interval (Bc). • *excess-burst-size*—(Optional) The acceptable number of bits permitted to go over the Be. • **account**—Enables ATM overhead accounting. • **qinq**—Specifies queue-in-queue encapsulation as the BRAS-DSLAM encapsulation type. • **dot1q**—Specifies IEEE 802.1Q VLAN encapsulation as the BRAS-DSLAM encapsulation type. • **aal5**—The ATM adaptation layer 5 that supports connection-oriented variable bit rate (VBR) services. • *subscriber-encapsulation*—Specifies the encapsulation type at the subscriber line. For more information, see the "Subscriber Line Encapsulation Types" section on page 3. • **user-defined**—Specifies the offset size that the router uses when calculating the ATM overhead. • *offset*—Specifies the offset size when calculating ATM overhead. Valid values are from –63 to +63 bytes. **Note** For the Cisco 7600 series router, valid values are from –48 to +48 bytes.
Step 8	**end** **Example:** `Router(config-pmap-c)# end`	Exits policy-map class configuration mode.

Verifying the Configuration of Traffic Shaping Overhead Accounting for ATM

To verify the configuration of traffic shaping overhead accounting for ATM, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **show policy-map** [*policy-map-name*]
3. **show policy-map session**
4. **show running-config**
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show policy-map** [*policy-map-name*] **Example:** `Router# show policy-map unit-test`	(Optional) Displays the configuration of all classes for a specified policy map or of all classes for all existing policy maps. • (Optional) Enter the policy map name. The name can be a maximum of 40 alphanumeric characters.
Step 3	**show policy-map session** **Example:** `Router# show policy-map session`	(Optional) Displays the QoS policy map in effect for a IPoE/PPPoE session.
Step 4	**show running-config** **Example:** `Router# show running-config`	(Optional) Displays the contents of the currently running configuration file.
Step 5	**exit** **Example:** `Router# exit`	Exits privileged EXEC mode.

Configuration Examples for Traffic Shaping Overhead Accounting for ATM

This section provides the following configuration examples:

- Enabling Traffic Shaping Overhead Accounting for ATM: Example, page 11
- Verifying Traffic Shaping Overhead Accounting for ATM: Example, page 12

Enabling Traffic Shaping Overhead Accounting for ATM: Example

The following example shows how to enable ATM overhead accounting using a hierarchical policy map structure. The Child policy map has two classes: Business and Non-Business. The Business class has priority and is policed at 128,000 kbps. The Non-Business class has ATM overhead accounting enabled and has a bandwidth of 20 percent of the available bandwidth. The Parent policy map shapes the aggregate traffic to 256,000 kbps and enables ATM overhead accounting.

Notice that Layer 2 overhead accounting is not explicitly configured for the Business traffic class. If the class-default class of a parent policy has ATM overhead accounting enabled, you are not required to enable ATM overhead accounting on a child traffic class that does not contain the **bandwidth** or **shape** command. Therefore, in this example, the Business priority queue implicitly has ATM overhead accounting enabled because its parent class-default class has overhead accounting enabled.

```
policy-map Child
 class Business
  priority
  police 128000
 class Non-Business
  bandwidth percent 20 account dot1q aal5 snap-rbe-dot1q
  exit
 exit
policy-map Parent
 class class-default
  shape 256000 account dot1q aal5 snap-rbe-dot1q
  service-policy Child
```

In the following example, overhead accounting is enabled for bandwidth on the gaming and class-default class of the child policy map named subscriber_classes and on the class-default class of the parent policy map named subscriber_line. The voip and video classes do not have accounting explicitly enabled; these classes have ATM overhead accounting implicitly enabled because the parent policy has overhead accounting enabled. Notice that the features in the parent and child policies use the same encapsulation type.

```
policy-map subscriber_classes
 class voip
  priority level 1
  police 8000
 class video
  priority level 2
  police 8000
 class gaming
  bandwidth remaining percent 80 account dot1q aal5 snap-rbe-dot1q
 class class-default
  bandwidth remaining percent 20 account dot1q aal5 snap-rbe-dot1q
policy-map subscriber_line
 class class-default
  bandwidth remaining ratio 10 account dot1q aal5 snap-rbe-dot1q
  shape average 512 account aal5 dot1q snap-rbe-dot1q
  service policy subscriber_classes
```

Verifying Traffic Shaping Overhead Accounting for ATM: Example

The following output from the **show policy-map interface** command indicates that ATM overhead accounting is enabled for shaping and disabled for bandwidth:

```
Router# show policy-map interface


Service-policy output:unit-test

    Class-map: class-default (match-any)
    100 packets, 1000 bytes
    30 second offered rate 800 bps, drop rate 0 bps
    Match: any
    shape (average) cir 154400, bc 7720, be 7720
    target shape rate 154400
    overhead accounting: enabled
    bandwidth 30% (463 kbps)
    overhead accounting: disabled

    queue limit 64 packets
    (queue depth/total drops/no-buffer drops) 0/0/0
    (packets output/bytes output) 100/1000
```

The following output from the **show policy-map session** command indicates that ATM overhead accounting is enabled for shaping.

```
Router# show policy-map session output

SSS session identifier 2 -

Service-policy output:  ATM_OH_POLICY


    Class-map: class-default (match-any)
      0 packets, 0 bytes
      30 second offered rate 0 bps, drop rate 0 bps
      Match: any
      Queueing
      queue limit 2500 packets
      (queue depth/total drops/no-buffer drops) 0/0/0
      (pkts output/bytes output) 0/0
      shape (average) cir 10000000, bc 40000, be 40000
      target shape rate 10000000
       Overhead Accounting Enabled
```

The following output from the **show running-config** command indicates that ATM overhead accounting is enabled for shaping. The BRAS-DSLAM encapsulation is dot1q and the subscriber line encapsulation is snap-rbe based on the AAL5 service.

```
subscriber policy recording rules limit 64
no mpls traffic-eng auto-bw timers frequency 0
call rsvp-sync
!
controller T1 2/0
    framing sf
    linecode ami
!
controller T1 2/1
    framing sf
    linecode ami
!
!
```

```
policy-map unit-test
    class class-default
        shape average percent 10 account dot1q aal5 snap-rbe
!
```

Additional References

The following sections provide references related to traffic shaping overhead accounting for ATM.

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*
Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC), hierarchical policies, policy maps	"Applying QoS Features Using the MQC" module
Policing and shaping traffic	"Policing and Shaping Overview" 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 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 website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Command Reference

The following commands are introduced or modified in the feature or features documented in this module. For information about these commands, see the *Cisco IOS Quality of Service Solutions Command Reference* at http://www.cisco.com/en/US/docs/ios/qos/command/reference/qos_book.html. For information about all Cisco IOS commands, use the Command Lookup Tool at http://tools.cisco.com/Support/CLILookup or a Cisco IOS master commands list.

- **bandwidth (policy-map class)**
- **bandwidth remaining ratio**
- **shape (policy-map class)**
- **show policy-map interface**
- **show policy-map session**
- **show running-config**

Feature Information for MQC—Traffic Shaping Overhead Accounting for ATM

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.

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

Note 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 MQC—Traffic Shaping Overhead Accounting for ATM

Feature Name	Releases	Feature Information
MQC—Traffic Shaping Overhead Accounting for ATM	12.2(31)SB2 12.2(33)SRC 12.2(33)SB	The MQC—Traffic Shaping Overhead Accounting for ATM feature enables a broadband aggregation system (BRAS) to account for various encapsulation types when applying QoS functionality to packets. In Release 12.2(31)SB2, this feature was introduced and implemented on the Cisco 10000 series router for the PRE3. In Release 12.2(33)SRC, support was added for the Cisco 7600 series router. In Release 12.2(33)SB, support was added for the Cisco 7300 series router. The following commands were introduced or modified: **bandwidth (policy-map class)**, **bandwidth remaining ratio**, **shape (policy-map class)**, **show policy-map interface**, **show policy-map session**, **show running-config**.