Subscriber Traffic Management for the Cisco CMTS

This document describes the Subscriber Traffic Management (STM) through Version 1.1. STM 1.1 supports DOCSIS 1.1-compliant cable modems.

The STM feature enables service providers to identify and control subscribers who exceed the maximum bandwidth allowed under their registered quality-of-service (QoS) profiles. STM 1.1 works with Network-Based Application Recognition (NBAR) and access control lists (ACLs) to ensure full network performance to other network subscribers that abide by their service agreements. STM 1.1 also works in conjunction with the Cisco Broadband Troubleshooter 3.2 to support additional network management and troubleshooting functions in the Cisco CMTS. For more information, see Feature Overview, page 3.

Feature Specifications for Subscriber Traffic Management

Feature History	
Release	**Modification**
Release 12.3(9a)BC	Extends earlier STM functions to monitor a subcriber's traffic on DOCSIS 1.1 primary service flows and supports these additional features: • Cisco STM version 1.1 supports Cisco Broadband Troubleshooter 3.2. • Cisco STM version 1.1 supports DOCSIS 1.1 cable modems. • Cisco STM version 1.1 monitors and applies traffic management policies on a service-flow basis. • Cisco STM version 1.1 increases the available monitoring window from seven to 30 days. • Monitoring window duration is increased from seven to 30 days.
Release 12.2(15)BC1	This feature was introduced.

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 that appear.

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Contents

This document includes the following major sections:

Prerequisites for Subscriber Traffic Management

The Subscriber Traffic Management feature has the following prerequisites:

- For the Cisco uBR10012 router, the Cisco CMTS must be running Cisco IOS Release 12.2(15)BC1 or later Cisco IOS Release 12.2 BC release.
- For the Cisco uBR7246VXR router, the Cisco CMTS must be running Cisco IOS Release 12.3(9a)BC or later Cisco IOS Release 12.3 BC release.
- Cisco uBR7100 series routers, the Cisco CMTS must be running Cisco IOS Release 12.3(9a)BC or later Cisco IOS Release 12.3 BC release

Restrictions for Subscriber Traffic Management

The Subscriber Traffic Management feature has the following restrictions and limitations:

- Cisco IOS Release 12.2(15)BC1 supports monitoring and controlling only cable modems that have registered for DOCSIS 1.0 operations (using the quality-of-service (QoS) profile/service ID (SID) model).
- Cisco IOS Release 12.3(9a)BC supports monitoring and controlling only cable modems that have registered for DOCSIS 1.1 operations (using the quality-of-service (QoS) profile/service ID (SID) model).
- The registered QoS profile specified by an enforce rule must exactly match a QoS profile that exists on the Cisco CMTS. To manage a cable modem that is using a modem-created QoS profile, you must first create that same exact QoS profile on the Cisco CMTS. All parameters in the QoS profile must match before the cable modem can be managed by the enforce rule.
- Cisco IOS Release 12.2(15)BC1 supports a maximum of 20 enforce-rules on each Cisco CMTS.
- Changing the configuration of an enforce-rule automatically resets all byte counters for the subscribers who are mapped to that enforce-rule.
- When specifying a QoS profile to be enforced when users violate their registered QoS profiles, both the originally provisioned QoS profile and the enforced QoS profile must be created on the Cisco CMTS.

Information About Subscriber Traffic Management

This section describes the Subscriber Traffic Management feature:

Feature Overview

The Subscriber Traffic Management feature allows service providers to identify and control subscribers who exceed the maximum bandwidth allowed under their registered quality-of-service (QoS) profiles. This feature supplements current techniques such as Network-Based Application Recognition (NBAR) and access control lists (ACLs), to ensure that a minority of users do not consume a majority of the cable network's bandwidth.

Current subscriber controls, such as NBAR and ACLs, examine all packets coming into the CMTS. These techniques can curb a large volume of problem traffic, but they are not as effective in dealing with the latest generation of peer-to-peer file-sharing applications that can place heavy demands on a network's available bandwidth. The Subscriber Traffic Management feature allows service providers to focus on a minority of potential problem users without impacting network performance or other users who are abiding by their service agreements.

In addition, when a cable modem goes offline and remains offline for 24 hours, the Cisco CMTS deletes its service flow IDs from its internal databases, and also deletes the modem's traffic counters. This can allow some users to exceed their bandwidth limits, go offline, and come back online with new counters.

The Subscriber Traffic Management feature helps to thwart these types of theft-of-service attacks by implementing a penalty period for cable modems that violate their service level agreements (SLAs). Even if the cable modem goes offline, its counters are still reset, and the CMTS continues to enforce the penalty period.

Feature List

The Subscriber Traffic Management feature has the following operational features:

- Subscriber Traffic Management 1.1 (STM1.1) supports cable modems that have registered for DOCSIS 1.1 operations (using the service class/service flow ID (SFID) model).
- Up to 20 enforce-rules can be created on each CMTS.
- Separate enforce-rules can be used for downstream traffic and for upstream traffic.
- Each enforce-rule uses a subscriber's registered QoS profile to identify which users should be monitored for excessive traffic. The registered QoS profile must exist on the Cisco CMTS. If you want to manage cable modems that are using QoS profiles that were created by the cable modem, you must first manually create a QoS profile with the exact same QoS parameters on the Cisco CMTS, and then allow the cable modem to come online using the manually created profile.
- Each rule specifies the maximum number of bytes a user can transmit during a specified window.

- Subscribers who exceed the maximum bandwidth that is specified by their enforce-rule can be automatically switched to a separate enforced QoS profile that limits their network use for a customizable penalty period. The enforced QoS profile can change the guaranteed bandwidth, priority, or any other aspect of the traffic that the service provider considers an acceptable response to subscribers who violate their service agreements.
- Subscribers are automatically switched back to their registered QoS profile at the end of their penalty period. A technician at the service provider's network operations center (NOC) can also can switch them back before the penalty period expires.
- This feature also supports a **no-persistence** option, so that the enforced QoS profile does not remain in effect when a cable modem reboots. This option is particularly useful when the feature is initially implemented, so that the service providers can identify problem subscribers and applications, without creating a major impact on the entire user base. When repeat offenders are found, they can then be switched to an enforce-rule that does keep the enforced QoS profile in effect even when the cable modem reboots.
- Service providers can display a list of all subscribers' current usage statistics. Service providers can also display a list of just those subscribers who are overconsuming bandwidth.
- The penalty period persists across reboots of the cable modem, so subscribers cannot avoid the enforced QoS profile by resetting their modems and reregistering on the cable network. This allows service providers to set an appropriate penalty for those users that consistently exceed the maximum bandwidth they have been allocated.
- If a user that is using excessive bandwidth then decides to upgrade to a higher level of service, the service provider can reconfigure the provisioning system to assign a new QoS profile to the cable modem. The user can then reboot the cable modem and come online using the new level of service.

Sliding Window for Monitoring Service Flows

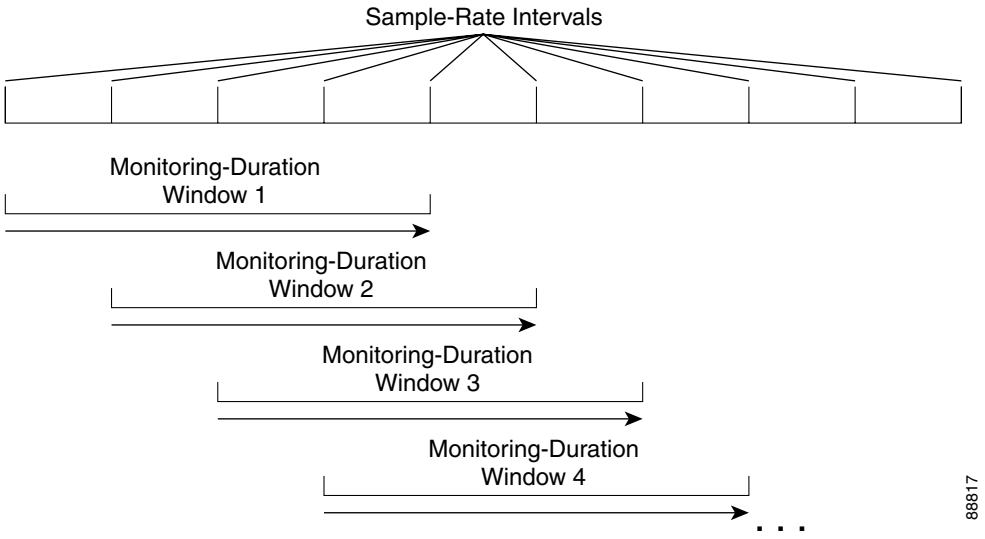
When an enforce-rule is activated, the CMTS periodically checks the bandwidth being used by subscribers to determine whether any subscribers are consuming more bandwidth than that specified by their registered QoS profile. The CMTS keeps track of the subscribers using a sliding window that begins at each sample-rate interval and continues for the monitoring-duration period.

Each sample-rate interval begins a new sliding window period for which the CMTS keeps track of the total bytes transmitted. At the end of each sliding window period, the CMTS examines the byte counters to determine if any subscriber is currently overconsuming bandwidth on the network.

For example, with the default sample-rate interval of 15 minutes and the default monitoring-duration window of 360 minutes (6 hours), the CMTS samples the bandwidth usage every 15 minutes and determines the total bytes transmitted at the end of each 360 minute window. Therefore, every 15 minutes, the CMTS determines each subscriber's usage statistics for the preceding 6-hour period.

Figure 1 illustrates how this process works, with a new sliding window beginning at the beginning of each sample-rate interval period.

Figure 1 Monitoring-Duration Windows



SNMP Trap Notifications

Cisco IOS Release 12.2(15)BC1 (for the Cisco uBR10012 router) and Cisco IOS Release 12.3(9a)BC (for the Cisco uBR7246VXR router and the Cisco uBR7100 series routers) support an signeling network management protocol (SNMP) trap notification that can be sent whenever a subscriber violates the enforce-rule. This trap is defined in the CISCO-CABLE-QOS-MONITOR-MIB and is enabled using the **snmp-server enable traps cable** command.

Each SNMP notification contains the following information:

- MAC address of the subscriber's cable modem
- Name of the enforce-rule being applied to this subscriber
- Total bytes sent by the subscriber during the monitoring-duration window
- Time at which the subscriber's penalty period expires

The CISCO-CABLE-QOS-MONITOR-MIB MIB also contains the following tables that provide information about the Subscriber Traffic Management configuration and about subscribers who violate their enforce-rules:

- ccqmCmtsEnforceRuleTable—Contains the attributes of the enforce-rules that are currently configured on the Cisco CMTS.
- ccqmEnfRuleViolateTable—Provides a snapshot list of the subscribers who violated their enforce rules over the monitoring-duration sliding window.

Cable Modem Interaction with the Subscriber Traffic Management Feature

The Subscriber Traffic Management feature ensures that users cannot bypass the QoS restrictions by rebooting their cable modems or performing other configuration changes. The service provider, however, continues to be able to change the modems' profiles and other configuration parameters as desired.

When the Subscriber Traffic Management feature is enabled, the following behavior is in effect:

- The primary service flow counters for downstream and upstream traffic are preserved when the cable modem reboots. The service provider, however, can reset the counters by changing the QoS profile for the cable modem using the **cable modem qos profile** command and resetting the cable modem.
- Secondary service flow counters are reset whenever the cable modem reboots. This happens regardless of the enforce-rule configuration.
- The cable modem retains its current primary downstream and upstream service flows when it reboots. If the cable modem is in an enforced QoS profile penalty period when it reboots, it continues using the enforced QoS profile after the reboot. Service providers can manually change the profile by assigning a new QoS profile using the **cable modem qos profile** command.

  Note Changing the QoS profile for a cable modem using the **cable modem qos profile** command, also changes the enforce-rule for the cable modem when it reboots. When the cable modem comes back online, it begins operating under the enforce-rule whose registered QoS profile (see the **qos-profile registered** command) matches the new QoS profile the modem is using.

- Service providers can also change the enforce-rule configuration. The following happens when the provider changes the enforce-rule configuration:
  - If the enforce-rule is disabled (using the **no enabled** command), all cable modems using that rule's registered QoS profile are no longer managed by the Subscriber Traffic Management feature.
  - If the registered QoS profile for the rule is changed (using the **qos-profile registered** command), the cable modems that are using the previous registered QoS profile are no longer managed by the Subscriber Traffic Management feature. Instead, any cable modems that use the new registered QoS profile begin being managed by this rule.
  - If the enforced QoS profile for the rule is changed (using the **qos-profile enforced** command), any cable modems using this rule that are currently in the penalty period continue using the previously configured enforced QoS profile. Any cable modems that enter the penalty period after this configuration change, however, use the new enforced QoS profile.
- Service providers also have the option of making an enforce-rule nonpersistent, so that the enforced QoS profile does not remain in force when a cable modem reboots. Instead, when the cable modem reboots and reregisters with the Cisco CMTS, the CMTS assigns it the QoS profile that is specified in its DOCSIS configuration file.

How to Configure the Subscriber Traffic Management Feature

This section describes the following tasks that are required to implement the Subscriber Traffic Management feature:

Creating and Configuring an Enforce-Rule

Use the following procedure to create and configure an enforce-rule. The enforce-rule does not become active until the **enabled** subcommand is given.

Restrictions

The registered and enforced QoS profiles must have been previously created on the CMTS before creating an enforce-rule that uses those profiles. If you want to manage a cable modem that currently uses a modem-created QoS profile, you must first manually create a new QoS profile on the CMTS with the same QoS parameters as the modem-created profile. Then allow the modem to come online using the manually created profile, before beginning this procedure.

To display quality-of-service (QoS) profiles for a Cisco CMTS, use the **show cable qos profile** command in privileged EXEC mode.

show cable qos profile *profile-index* [**verbose**]

To configure a QoS profile, use the **cable qos profile** command in global configuration mode. To set a particular value to its default, or to delete the profile when no specific parameters have been set, use the **no** form of this command.

cable qos profile *groupnum* [**grant-interval** *interval* | **grant-size** *size* | **guaranteed-upstream** *rate* | **ip-precedence** *value* | **max-burst** *rate* | **max-downstream** *rate* | **max-upstream** *rate* | **name** *string* | **priority** *value* | **privacy** | **tos-overwrite** *tos-mask tos-value*]

For additional information about these commands, refer to the *Cisco Broadband Cable Command Reference Guide* on Cisco.com:

http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html

Only DOCSIS 1.1 modems that register with a service class name are monitored.

Only primary upstream and downstream service flows are supported.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable qos enforce-rule** <*name*>
4. **monitoring-basics** *{legacy / peak_offpeak} {docsis10 / docsis1}*
5. **qos-profile registered** <*id*>
6. **qos-profile enforced** <*id*>
7. **service-class** *{enforced | registered}* <*name*>
8. **duration** <*in minutes*> **avg-rate** <*in kbits/sec*> **sample-interval**<*in minutes*> <**upstream | downstream**> [**enforce**]
9. **peak-time 1** <*time of day in hours*> **duration** <*in minutes*> **avg-rate** <*rate in kbits/sec*> [**peak-time 2** <*time of day in hours*> **duration** <*in minutes*> **avg-rate** <*rate in kbits/sec*>][**duration** <*in minutes*> **avg-rate** <*rate in kbits/sec>]* **sample-interval** <*in minutes*> <**upstream/downstream**> [**enforce**]
10. **penalty-period <***minute***>***s*
11. **enabled**
12. **exit**
13. **exit**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**enable**
	
	Example:
	`Router> enable`
	`Router#`
		Enables privileged EXEC mode. Enter your password if prompted.

Step 2	**configure terminal**
	
	Example:
	`Router# configure terminal`
	`Router(config)#`
		Enters global configuration mode.

Step 3	**cable qos enforce-rule** *name*
	
	Example:
	`Router(config)# cable qos enforce-rule <name>`
	`Router(enforce-rule)#`
		Creates an enforce-rule with the specified *name* and enters enforce-rule configuration mode. The *name* parameter can be any arbitrary and unique string from 1 to 15 characters in length.

	Command or Action	Purpose

Step 4	**monitoring-basics** {**legacy** | **peak-offpeak**} {**docsis10** | **docsis11**)
	
	Example:
	`Router(enforce-rule)# monitoring-basics ?`
	`  legacy  Enable legacy (same average rate for all day)  monitor`
	`  peak-offpeak  Enable peak-offpeak monitoring`
	
	`Router(enforce-rule)# monitoring-basics 1 ?`
	`  docsis10  Enforce-rule will map to docsis 1.0 modems`
	`  docsis11  Enforce-rule will map to docsis 1.1 modems`
	
	`Router(enforce-rule)# monitoring-basics 1 docsis10 ?`
	`  <cr>`
	
	`Router(enforce-rule)# monitoring-basics 1 docsis10`
	`Router(enforce-rule)#`
		Defines the kind of monitoring desired (legacy or peak-offpeak) and defines the type of modems (DOCSIS 1.0 or DOCSIS 1.1). Default is legacy and DOCSIS 1.0.
		
		See the "Sample Output for the legacy Option in Step 4." section on page 12.
		
		Note For offpeak monitoring, use the **show qos enforce-rule** command to display the monitoring duration and average-rate values applicable for that time of day. If no monitoring is taking place, 0 is displayed.

Step 5	**qos-profile registered** profile-id
	
	Example:
	`Router(enforce-rule)# qos-profile registered ?`
	`  <1-255>  Registered QoS profile index`
	
	`Router(enforce-rule)# qos-profile registered 1`
	`Router(enforce-rule)#`
		Specifies the registered quality-of-service (QoS) profile that should be used for this enforce-rule.
		
		If you want to manage a cable modem that currently uses a modem-created QoS profile, you must first manually create a new QoS profile on the CMTS with the same QoS parameters as the modem-created profile. Then allow the modem to come online using the manually created profile, before giving this command.

Step 6	**qos-profile enforced** profile-id [**no-persistence**]
	
	Example:
	`router(enforce-rule)# qos-profile enforced ?`
	`  <1-255>  Enforced Qos profile index`
	
	`router(enforce-rule)# qos-profile enforced 1 ?`
	`  no-persistence  The QoS profile would not be enforced across CM reboots.`
	`  <cr>`
	
	Example:
	`Router(enforce-rule)# q`
	`Router(enforce-rule)# qos-profile e`
	`ROuter(enforce-rule)# qos-profile enforced 4`
		Specifies the quality-of-service (QoS) profile that should be enforced when users violate their registered QoS profiles.
		
		The default is without this option, so that the enforced rule does remain in effect even when a cable modem reboots.)

Step 7	**service-class {enforced | registered}** <name>
	
	Example:
	`Router(enforce-rule)# service-class ?`
	`  enforced  Enforced service class`
	`  registered  Registered service class`
		(Optional) The service class defines a particular QoS parameter. The **service-class** option allows operators to modify the implementation of a given service.

	Command or Action	Purpose

Step 8	**duration** <in minutes> **avg-rate** <in kbits/sec> **sample-interval** <in minutes> <upstream / downstream> [**enforce**]
	
	Example:
	`Router(enforce-rule)# duration ?`
	`  <10-44640>  Duration in minutes`
	
	`Router(enforce-rule)# duration 10 ?`
	`  avg-rate  Average rate for the duration in kbits/sec`
	
	`Router(enforce-rule)#duration 10 a ?`
	`  <1-400000>  average rate in kbits/sec`
	
	`Router(enforce-rule)# duration 10 a 500 ?`
	`  sample-interval  Rate of sampling in Minutes`
	
	`Router(enforce-rule)#duration 10 a 500 s ?`
	`  <1-30>  Sampling rate in Minutes`
	
	`Router(enforce-rule)# duration 10 a 500 s 10 ?`
	`  downstream  downstream`
	`  upstream  upstream`
	
	`Router(enforce-rule)#duration 10 a 500 s 10 d ?`
	`  enforce  enforce the qos-profile automatically`
	`  <cr>`
	
	`Router(enforce-rule)#duration 10 a 500 s 10 d enforce`
	
	`Router(enforce-rule)#`
		Specifies the time period and sample rate used for monitoring subscribers. Use the **duration** command in enforce-rule configuration mode.

Step 9	**peak-time 1** *<time of day in hours>* **duration** *<in minutes>* **avg-rate** *<rate in kbits/sec>* [**peak-time 2** *<time of day in hours>* **duration** *<in minutes>* **avg-rate** *<rate in kbits/sec>*][**duration** *<in minutes>* **avg-rate** *<rate in kbits/sec>]* **sample-interval** *<in minutes>* <**upstream**	**downstream**> [**enforce**]
		
		`Router(enforce-rule)#peak-time1 6 d`
		`Router(enforce-rule)#peak-time1 6 duration ?`
		`  <60-1440>  Duration in minutes`
		
		`Router(enforce-rule)#peak-time1 6 duration 180 ?`
		`  avg-rate  First peak average rate in kbits/sec`
		`Router(enforce-rule)#peak-time1 6 duration 180 a`
		`Router(enforce-rule)#peak-time1 6 duration 180 avg-rate ?`
		`  <1-4294967>  Average rate in kbits/sec`
		`Router(enforce-rule)#peak-time1 6 duration 180 avg-rate 2 ?`
		`  duration  Off-peak duration`
		`  peak-time2  Second peak time`
		`  sample-interval  Rate of sampling in minutes`
		`Router(enforce-rule)#peak-time1 6 duration 180 avg-rate 2 p`
		`Router(enforce-rule)#peak-time1 6 duration 180 avg-rate 2 peak-time2 ?`
		`  <10-1440>  Start of second peak time`
			Note To set peak-time in this step, you need to have selected peak-time in Step 4.
			
			Specifies peak monitoring times. A maximum of two peak durations are defined within a day, and the remaining hours, if the offpeak duration and threshold are defined. The monitoring duration and threshold for first peak, second peak, and offpeak, can be different. However, the monitoring duration for any peak or offpeak cannot be more than a day.
			
			See the "Monitoring the Subscriber Traffic Management Feature" section on page 18.
			
			Note In STM1.1 (refer to CSCef53390), the sampling rate range (duration) is calculated using the monitoring duration rather then the constant range (10 - 30 minutes) used in STM1.0.
			
			See Sample Output for peak-time Option in Step 9, page 15.

Command or Action	Purpose

Router(enforce-rule)#peak-time1 6 duration 180 avg-rate 2 peak-time2 18 ?
  duration Second peak duration
Router(enforce-rule)#peak-time1 6 duration 180 avg-rate 2 peak-time2 18 d
Router(enforce-rule)#$6 duration 180 avg-rate 2 peak-time2 18 duration ?
  <10-1440> Duration in minutes
Router(enforce-rule)#$6 duration 180 avg-rate 2 peak-time2 18 duration 240 ?
  avg-rate Second peak average rate in kbits/sec
Router(enforce-rule)#$6 duration 180 avg-rate 2 peak-time2 18 duration 240 a
Router(enforce-rule)#$ 180 avg-rate 2 peak-time2 18 duration 240 avg-rate ?
  <1-4294967> Average rate in kbits/sec
 	
Router(enforce-rule)#$ 180 avg-rate 2 peak-time2 18 duration 240 avg-rate 3 ?
  duration Off-peak duration
  sample-interval Rate of sampling in minutes
 	
Router(enforce-rule)#$ 180 avg-rate 2 peak-time2 18 duration 240 avg-rate 3 d
Router(enforce-rule)#$-time2 18 duration 240 avg-rate 3 duration 120 ?
  avg-rate Off-peak average rate in kbits/sec
Router(enforce-rule)#$-time2 18 duration 240 avg-rate 3 duration 120 a
Router(enforce-rule)#$duration 240 avg-rate 3 duration 120 avg-rate 1 ?
  sample-interval Rate of sampling in minutes
enforce enforce the qos-profile automatically
  <cr>
 	
Router(enforce-rule)#$duration 240 avg-rate 3 duration 120 avg-rate 1 s
Router(enforce-rule)#$40 avg-rate 3 duration 120 avg-rate 1 sample-interval ?
  <1-30> Sampling rate in Minutes
 	
Router(enforce-rule)#$e 3 duration 120 avg-rate 1 sample-interval 10 ?
  downstream downstream
  upstream upstream
 	
Router(enforce-rule)#duration 10 avg-rate 2 sample-interval 10 u
Router(enforce-rule)#duration 10 avg-rate 2 sample-interval 10 upstream ?
  enforce enforce the qos-profile automatically
  <cr>
 	
Router(enforce-rule)#duration 10 avg-rate 2 sample-interval 10 upstream enf
Router(enforce-rule)#$ avg-rate 2 sample-interval 10 upstream enforce
Router(enforce-rule)#enabled
Router(enforce-rule)#end
	Calculation example:
	a. The maximum memory to be used per line card for STM is 10 megaBytes.
	b. The maximum number of modems that can be supported is 6000 per line card.
	c. Per sample memory consumption is 8 bytes
	So, the maximum number of samples that can be allowed are 10 * 10 ^ 6 / (6 * 10 ^ 3 * 2 * 8) ~ 100
	The duration sample rate is calculated as duration / 100 = sample rate, only if the duration is more than 1440. For a monitoring duration of less than 1440, the sample rate range would be 10 - 30 minutes.
	If you are using STM 1.0 with a duration of 2 days and a sample rate of 20 minutes, and you try to restore that configuration in STM1.1, the command fails because now the range is 28 to 86 minutes. The feature to convert the STM1.0 configuration to STM1.1 was committed through CSCee58978.

Step 10 **penalty-period** *minutes* **Example:** Router(enforce-rule)# penalty-period 10 Router(enforce-rule)#	(Optional) Specifies the time period, in minutes, that an enforced quality-of-service (QoS) profile should be in force for subscribers who violate their registered QoS profile. The valid range for *minutes* is 1 to 10080 minutes (7 days), with a default value of 10080 minutes (7 days).

	Command or Action	Purpose

Step 11	**enabled**
	
	Example:
	`Router(enforce-rule)# enabled`
	`Router(enforce-rule)#`
		(Optional) Activates the enforce-rule and begins subscriber traffic management.

Step 12	**exit**
	
	Example:
	`Router(enforce-rule)# exit`
	`Router(config)#`
		Exits enforce-rule configuration mode.

Step 13	**exit**
	
	Example:
	`Router(config)# exit`
	`Router#`
		Exits global configuration mode.

Sample Output for the legacy Option in Step 4.

The following sample output is seen when you select the **legacy** option in Step 4. This choice does not allow you to select peak-time reporting.

Example:

```
Router(config)# cab qos enf test
Router(enforce-rule)# mon
Router(enforce-rule)# monitoring-basics ?
  legacy        Enable legacy (same average rate for all day)  monitoring
  peak-offpeak  Enable peak-offpeak monitoring

Router(enforce-rule)# monitoring-basics l
Router(enforce-rule)# monitoring-basics legacy ?
  docsis10  Enforce-rule will map to docsis 1.0 modems
  docsis11  Enforce-rule will map to docsis 1.1 modems

Router(enforce-rule)# monitoring-basics legacy d
Router(enforce-rule)# monitoring-basics legacy docsis11
Router(enforce-rule)# se
Router(enforce-rule)# service-class ?
  enforced    Enforced service class
  registered  Registered service class

Router(enforce-rule)# service-class reg
Router(enforce-rule)# service-class registered ?
  WORD  Registered service class name

Router(enforce-rule)# service-class registered BEUS
Router(enforce-rule)# s
Router(enforce-rule)# service-class e
Router(enforce-rule)# service-class enforced test

Router(enforce-rule)# d
Router(enforce-rule)# duration ?
  <10-10080>  Duration in minutes
```

```
Router(enforce-rule)# duration 10 ?
  avg-rate  Average rate for the duration in kbits/sec

Router(enforce-rule)# duration 10 a
Router(enforce-rule)# duration 10 avg-rate ?
  <1-4294967>  average rate in kbits/sec

Router(enforce-rule)# duration 10 avg-rate 2 ?
  sample-interval  Rate of sampling in Minutes

Router(enforce-rule)# duration 10 avg-rate 2 s
Router(enforce-rule)# duration 10 avg-rate 2 sample-interval ?
  <1-30>  Sampling rate in Minutes
Router(enforce-rule)# duration 10 avg-rate 2 sample-interval 10 ?
  downstream  downstream
  upstream    upstream
Router(enforce-rule)# duration 10 avg-rate 2 sample-interval 10 u
Router(enforce-rule)# duration 10 avg-rate 2 sample-interval 10 upstream ?
  enforce  enforce the qos-profile automatically
  <cr>

Router(enforce-rule)# duration 10 avg-rate 2 sample-interval 10 upstream enf
Router(enforce-rule)# $ avg-rate 2 sample-interval 10 upstream enforce
Router(enforce-rule)# enabled
Router(enforce-rule)# end
```

Sample Output for the peak-offpeak Option in Step 4

The following sample output is seen when you select the **peak-offpeak** option in Step 4.

Example:

```
Router(config)# cab qos enf test
Router(enforce-rule)# mon
Router(enforce-rule)# monitoring-basics peak-offpeak
Router(enforce-rule)# monitoring-basics peak-offpeak d
Router(enforce-rule)# monitoring-basics peak-offpeak docsis10
Router(enforce-rule)# q
Router(enforce-rule)# qos-profile ?
  enforced    Enforced qos profile
  registered  QoS profile index

Router(enforce-rule)# qos-profile r
Router(enforce-rule)# qos-profile registered ?
  <1-255>  Registered QoS profile index

Router(enforce-rule)# qos-profile registered 5
Router(enforce-rule)# q
Router(enforce-rule)# qos-profile e
Router(enforce-rule)# qos-profile enforced 4
Router(enforce-rule)# pea
Router(enforce-rule)# peak-time1 6 ?
  duration  First peak duration

Router(enforce-rule)# peak-time1 6 d

Router(enforce-rule)# peak-time1 6 duration ?
  <60-1440>  Duration in minutes

Router(enforce-rule)# peak-time1 6 duration 180 ?
  avg-rate  First peak average rate in kbits/sec
```

```
Router(enforce-rule)# peak-time1 6 duration 180 a
Router(enforce-rule)# peak-time1 6 duration 180 avg-rate ?
  <1-4294967>  Average rate in kbits/sec

Router(enforce-rule)# peak-time1 6 duration 180 avg-rate 2 ?
  duration         Off-peak duration
  peak-time2       Second peak time
  sample-interval  Rate of sampling in minutes

Router(enforce-rule)# peak-time1 6 duration 180 avg-rate 2 p
Router(enforce-rule)# peak-time1 6 duration 180 avg-rate 2 peak-time2 ?
  <10-1440>  Start of second peak time

Router(enforce-rule)# peak-time1 6 duration 180 avg-rate 2 peak-time2 18 ?
  duration  Second peak duration

Router(enforce-rule)# peak-time1 6 duration 180 avg-rate 2 peak-time2 18 d
Router(enforce-rule)# $6 duration 180 avg-rate 2 peak-time2 18 duration ?
  <10-1440>  Duration in minutes

Router(enforce-rule)# $6 duration 180 avg-rate 2 peak-time2 18 duration 240 ?
  avg-rate  Second peak average rate in kbits/sec

Router(enforce-rule)# $6 duration 180 avg-rate 2 peak-time2 18 duration 240 a
Router(enforce-rule)# $ 180 avg-rate 2 peak-time2 18 duration 240 avg-rate ?
  <1-4294967>  Average rate in kbits/sec

Router(enforce-rule)# $ 180 avg-rate 2 peak-time2 18 duration 240 avg-rate 3 ?
  duration         Off-peak duration
  sample-interval  Rate of sampling in minutes

Router(enforce-rule)# $ 180 avg-rate 2 peak-time2 18 duration 240 avg-rate 3 d
Router(enforce-rule)# $-time2 18 duration 240 avg-rate 3 duration 120 ?
  avg-rate  Off-peak average rate in kbits/sec

Router(enforce-rule)# $-time2 18 duration 240 avg-rate 3 duration 120 a
Router(enforce-rule)# $duration 240 avg-rate 3 duration 120 avg-rate 1 ?
  sample-interval  Rate of sampling in minutes

Router(enforce-rule)# $duration 240 avg-rate 3 duration 120 avg-rate 1 s
Router(enforce-rule)# $40 avg-rate 3 duration 120 avg-rate 1 sample-interval ?
  <1-30>  Sampling rate in Minutes

Router(enforce-rule)# $e 3 duration 120 avg-rate 1 sample-interval 10 ?
  downstream  downstream
  upstream    upstream

Router(enforce-rule)# $e 3 duration 120 avg-rate 1 sample-interval 10 u
Router(enforce-rule)# $e 3 duration 120 avg-rate 1 sample-interval 10 upstream ?
  enforce  enforce the qos-profile automatically
  <cr>

Router(enforce-rule)# $on 120 avg-rate 1 sample-interval 10 upstream e
Router(enforce-rule)# $on 120 avg-rate 1 sample-interval 10 upstream enforce
Router(enforce-rule)# enabled
Router(enforce-rule)# end
```

Sample Output for peak-time Option in Step 9

The following sample output is seen when you select the **peak-time** option in Step 9.

Example:

```
Router(enforce-rule)# peak-time ?
  <0-23>  Start of first peak time, use 24 hour clock

Router(enforce-rule)# peak-time 1 ?
  duration  First peak duration

Router(enforce-rule)# peak-time 1 d ?
  <60-1440>  Duration in minutes

Router(enforce-rule)# peak-time 1 d 65 ?
First peak average rate in kbits/sec

Router(enforce-rule)# peak-time 1 d 65 a ?
<1-400000>  Average rate in kbits/sec

Router(enforce-rule)# peak-time 1 d 65 a 1000 ?
  duration         Off-peak duration
  peak-time2       Second peak time
  sample-interval  Rate of sampling in minutes

Router(enforce-rule)# peak-time 1 d 65 a 1000 d ?
  <60-1440>  Duration in minutes

Router(enforce-rule)# peak-time 1 d 65 a 1000 d 65 ?
  avg-rate  Off-peak average rate in kbits/sec

Router(enforce-rule)# peak-time 1 d 65 a 1000 d 65 a ?
  <1-400000>  Average rate in kbits/sec

Router(enforce-rule)# peak-time 1 d 65 a 1000 d 65 a 1000 ?
  sample-interval  Rate of sampling in minutes

Router(enforce-rule)# peak-time 1 d 65 a 1000 d 65 a 1000 s ?
  <1-30>  Sampling rate in Minutes

Router(enforce-rule)# peak-time 1 d 65 a 1000 d 65 a 1000 s 5 ?
  downstream  downstream
  upstream    upstream

Router(enforce-rule)# peak-time 1 d 65 a 1000 d 65 a 1000 s 5 d ?
  enforce  enforce the qos-profile automatically
  <cr>

Router(enforce-rule)# peak-time 1 d 65 a 1000 d 65 a 1000 s 5 d
```

Disabling an Enforce-Rule

Use the following procedure to disable an enforce-rule. The enforce-rule remains in the CMTS configuration file, but any subscriber traffic management that uses this enforce-rule ends.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **cable qos enforce-rule** *name*
4. **no enabled**
5. **exit**
6. **exit**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**enable**
	
	Example:
	`Router> enable`
	`Router#`
		Enables privileged EXEC mode. Enter your password if prompted.

Step 2	**configure terminal**
	
	Example:
	`Router# configure terminal`
	`Router(config)#`
		Enters global configuration mode.

Step 3	**cable qos enforce-rule** *name*
	
	Example:
	`Router(config)# cable qos monitoring ef-rule`
	`Router(enforce-rule)#`
		Creates an enforce-rule with the specified *name* and enters enforce-rule configuration mode.

Step 4	**no enabled**
	
	Example:
	`Router(enforce-rule)# enabled`
	`Router(enforce-rule)#`
		Disables the enforce-rule and ends subscriber traffic management for users with the rule's registered QoS profile.

Step 5	**exit**
	
	Example:
	`Router(enforce-rule)# exit`
	`Router(config)#`
		Exits enforce-rule configuration mode.

	Command or Action	Purpose

Step 6	**exit**
	
	Example:
	`Router(config)# exit`
	`Router#`
		Exits global configuration mode.

Removing an Enforce-Rule

Use the following procedure to delete an enforce-rule and remove it from the CMTS configuration file. Any subscriber traffic management that uses this rule also ends.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **no cable qos enforce-rule** *name*
4. **exit**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**enable**
	
	Example:
	`Router> enable`
	`Router#`
		Enables privileged EXEC mode. Enter your password if prompted.

Step 2	**configure terminal**
	
	Example:
	`Router# configure terminal`
	`Router(config)#`
		Enters global configuration mode.

Step 3	**no cable qos enforce-rule** *name*
	
	Example:
	`Router(config)# no cable qos enforce-rule ef-rule`
	`Router(enforce-rule)#`
		Deletes the enforce-rule with the specified *name*. This enforce-rule and its configuration are removed from the CMTS configuration, and any subscriber traffic management that uses this rule ends.

Step 4	**exit**
	
	Example:
	`Router(config)# exit`
	`Router#`
		Exits global configuration mode.

Monitoring the Subscriber Traffic Management Feature

This section describes the following tasks that can be used to monitor the Subscriber Traffic Management feature:

Displaying the Currently Defined Enforce-Rules

To display the enforce-rules that are currently defined on the Cisco CMTS, use the **show cable qos enforce-rule** command in privileged EXEC mode:

```
show cable qos enforce-rule
```

You can also optionally display the enforce-rules for one particular enforce-rule:

```
show cable qos enforce-rule name
```

For example, the following example shows a typical display of all enforce-rules: 1.0

```
Router# show cable qos enforce-rule get new?

            Name               Dur   Dir byte-cnt Auto rate  penalty Reg Enf Ena Persist
                              (min)      (kbytes) enf  (min) (min)   QoS QoS
 residential                   10    us  5        act  1     10080   5   10  Yes Yes
 ef-q11d                       30    ds  150      act  1     20      11  99  Yes Yes
 ef-q11u                       30    us  60       act  1     20      11  99  Yes Yes
 ef-q21                        720   us  60       act  1     10      21  81  Yes Yes
 ef-q21d                       300   ds  150      act  1     10      21  81  Yes Yes
 ef-q22                        720   us  60       act  1     10      22  82  Yes Yes
 ef-q22d                       300   ds  150      act  1     10      22  82  Yes No
 ef-q23                        720   us  60       act  1     10      23  83  Yes Yes
 ef-q23d                       300   ds  150      act  1     10      23  83  Yes Yes
 ef-q24                        720   us  60       act  1     10      24  84  Yes Yes
 ef-q24d                       300   ds  150      act  1     10      24  84  Yes Yes
 ef-q25                        720   us  60       act  1     10      25  85  Yes Yes
 ef-q25d                       300   ds  150      act  1     10      25  85  Yes Yes
 ef-q26                        720   us  60       act  1     10      26  86  Yes Yes
 ef-q26d                       300   ds  150      act  1     10      26  86  Yes Yes
 ef-q27                        720   us  60       act  1     10      27  87  Yes Yes
 ef-q27d                       300   ds  150      act  1     10      27  87  Yes Yes
 ef-q28                        720   us  60       act  1     10      28  88  Yes Yes
 ef-q28d                       300   ds  150      act  1     10      28  88  Yes No
 ef-q5d                        300   ds  150      act  1     10      5   99  Yes Yes
 ef-q5u                        720   us  600      act  1     10      5   99  Yes Yes

Router#
```

The following sample shows a typical display of all enforce-rules: DOCSIS 1.1

Example:

```
router# sh cab qos enf test
     Name         Type Dur   Dir Avg-rate Auto rate     Reg         Enf       En Per
                       (min)     kbits/s  enf  (min)
test             p-off 120   us 1        act  10     255         4         Y  Y

router# sh cab qos enf test ver
Name                : test
Version             : docsis10
Monitoring Type     : peak-offpeak
Registered          :   255
Enforced            :   4
Monitoring duration : 120 (in minutes)
Sample-rate         : 10 (in minutes)
Average-rate        : 1 kbits/sec
Direction           : upstream
Auto enforce        : active
Penalty time        : 10080 (in minutes)
Rule enabled        : Yes
Persistence         : Yes
First Peak time     : 6
Duration            : 180 (in minutes)
First Average-rate  : 2 kbits/sec
Second peak time    : 18
Duration            : 240 (in minutes)
Second Averate-rate : 3 kbits/sec
Off peak duration   : 120 (in minutes)
Offpeak Average-rate: 1 kbits/sec
router#sh clock
*17:30:50.259 UTC Thu Feb 26 2004
```

Displaying the Current Subscriber Usage

To display the usage for all subscribers on a cable interface, use the **show cable subscriber-usage** command in privileged EXEC mode.

show cable subscriber-usage cable *interface* [**upstream** *n*]

To display the usage for just those subscribers who are violating their registered quality-of-service (QoS) profiles, add the **over-consume** option to the **show cable subscriber-usage** command:

show cable subscriber-usage cable *interface* [**upstream** *n*] **over-consume**

By default, the display is sorted by the service flow ID (SFID). To sort the display by the subscriber byte count, with the largest byte counts listed first, use the **sort-byte-count** option:

show cable subscriber-usage cable *interface* [**upstream** *n*] [**over-consume**] **sort-byte-count**

For example, the following shows a default display for all users on a cable interface:

```
Router# show cable subscriber-usage cable 6/1/0

Sfid Mac Address   Enforce-rule Total-Kbyte    Last-detect    Last-penalty   Pen
                      Name        Count          time           time        Flag
3    0007.0e03.110d efrule-q5   121944817  Jan1  03:44:08  Jan1  03:54:08  Act
4    0007.0e03.110d efrule-q5d  1879076068 Jan1  03:35:05  Jan1  03:45:06  Act
5    0007.0e03.1431 efrule-q5   120052387  Jan1  03:44:18  Jan1  03:54:18  Act
```

```
6    0007.0e03.1431 efrule-q5d  1838493626 Jan1  03:34:55  Jan1  03:44:55  Act
7    0007.0e03.1445 efrule-q5   120919427  Jan1  03:44:08  Jan1  03:54:08  Act
8    0007.0e03.1445 efrule-q5d  1865955172 Jan1  03:35:06  Jan1  03:45:06  Act
9    0007.0e03.1225 efrule-q5   120200155  Jan1  03:44:18  Jan1  03:54:18  Act
10   0007.0e03.1225 efrule-q5d  1839681070 Jan1  03:34:55  Jan1  03:44:55   -
11   0007.0e03.0cb1 efrule-q5   122941643  Jan1  03:43:58  Jan1  03:53:58  Act
12   0007.0e03.0cb1 efrule-q5d  1889107176 Jan1  03:35:06  Jan1  03:45:06  Act
13   0007.0e03.1435 efrule-q5   119504795  Jan1  03:44:18  Jan1  03:54:18  Act
14   0007.0e03.1435 efrule-q5d  1835164034 Jan1  03:34:55  Jan1  03:44:55   -

Router#
```

The following example shows typical output for the **sort-byte-count** option for the **show cable subscriber-usage** command:

```
Router# show cable subscriber-usage sort-byte-count

Sfid Mac Address   Enforce-rule Total-Kbyte  Last-detect    Last-penalty   Pen
                      Name        Count       time             time        Flag
7    0007.0e03.2cad test1       65157114   Feb24 11:36:34  Mar3  11:36:34  Act
9    0007.0e03.2c45 test1       16381014                                   -
5    0007.0e03.2c25 test1       13440960                                   -

Router#
```

Configuration Examples for Subscriber Traffic Management

This section lists sample configurations for the Subscriber Traffic Management feature on a CMTS router:

Downstream Configuration

The following sample configuration shows a typical enforce-rule for traffic in the downstream direction:

```
!
cable qos enforce-rule downstream-rule
  penalty-period 10
  registered qos-profile 5
  enforced qos-profile 99
  monitoring-duration 30 sample-rate 10
  activate-rule at-byte-count 50000000 downstream enforce
  enabled
```

Upstream Configuration

The following sample configuration shows a typical enforce-rule for traffic in the upstream direction:

```
!
cable qos enforce-rule upstream-rule
  penalty-period 10
  registered qos-profile 5
```

```
  enforced qos-profile 99
  monitoring-duration 30 sample-rate 10
  activate-rule at-byte-count 50000000 upstream enforce
  enabled
```

Downstream and Upstream Configuration

The following sample configuration shows a typical enforce-rule for traffic in both the downstream and upstream directions. Two separate rules are created, using the identical configuration, except for the **upstream** and **downstream** keywords in the **activate-rule** commands.

Note The enforce rules for the upstream and downstream directions can use either an identical configuration, or they can use their own individual configurations.

```
!
cable qos enforce-rule downstream-rule
  penalty-period 10
  registered qos-profile 5
  enforced qos-profile 99
  monitoring-duration 30 sample-rate 10
  activate-rule at-byte-count 5 downstream enforce
  enabled
!
cable qos enforce-rule upstream-rule
  penalty-period 10
  registered qos-profile 5
  enforced qos-profile 99
  monitoring-duration 30 sample-rate 10
  activate-rule at-byte-count 5 upstream enforce
  enabled
```

Additional References

For additional information related to the Subscriber Traffic Management feature, refer to the following references:

Related Documents

Related Topic	Document Title
CMTS Command Reference	*Cisco Broadband Cable Command Reference Guide,* at the following URL: http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html
Cisco IOS Release 12.2 Command Reference	Cisco IOS Release 12.2 configuration guides and command references, at the following URL: http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/products_installation_and_configuration_guides_list.html

Related Topic	Document Title
Cisco IOS Release 12.3 Command Reference	Cisco IOS Release 12.3 configuration guides and command references, at the following URL: http://www.cisco.com/en/US/docs/ios/12_3/featlist/ip_vcg.html

Standards

Standards[1]	Title
SP-RFIv1.1-I09-020830	*Data-over-Cable Service Interface Specifications Radio Frequency Interface Specification, version 1.1* (http://www.cablemodem.com)
draft-ietf-ipcdn-docs-rfmibv2-06	*Radio Frequency (RF) Interface Management Information Base for DOCSIS 2.0 Compliant RF Interfaces*

1. Not all supported standards are listed.

MIBs

MIBs[1]	MIBs Link
CISCO-CABLE-QOS-MONITOR-MIB	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
DOCSIS-QOS-MIB	Currently in draft form at the following URL: http://www.ietf.org

1. Not all supported MIBs are listed.

RFCs

RFCs[1]	Title
RFC 2233	*DOCSIS OSSI Objects Support*
RFC 2665	*DOCSIS Ethernet MIB Objects Support*
RFC 2669	*Cable Device MIB*

1. Not all supported RFCs are listed.

Cisco Technical Support Website

The Cisco Technical Support Website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day, 365 days a year, at this URL:

http://www.cisco.com/cisco/web/support/index.html

Access to all tools on the Cisco Technical Support Website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

http://tools.cisco.com/RPF/register/register.do

Command Reference

This section documents the following new or modified commands that are needed to document the Subscriber Traffic Management feature.

Note Other cable-specific commands are documented in the *Cisco Broadband Cable Command Reference Guide,* at the following URL:

http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html

All other commands used with this feature are documented in the Cisco IOS Release 12.3BC command reference publications.

activate-rule at-byte-count

To specify the number of bytes that a subscriber can transmit during the monitoring period, use the **activate-rule at-byte-count** command in enforce-rule configuration mode. To reset the rule to its default values, use the **no** form of this command.

activate-rule at-byte-count *kbytes* {**downstream** | **upstream**} [**enforce**]

no activate-rule at-byte-count *kbytes* {**downstream** | **upstream**} [**enforce**]

Syntax Description

kbytes	Maximum number of kilobytes that the subscriber can transmit in the specified direction during the monitoring period. The valid range is 1 to 4294967 kilobytes, with a default of 0 (no limit). **Note** To reset the byte count to 0, use the **no** form of this command.
downstream	Specifies that the byte count applies to traffic in the downstream direction.
upstream	Specifies that the byte count applies to traffic in the upstream direction (default).
enforce	(Optional) Specifies that the enforce-rule QoS profile should be applied automatically if a user violates the registered QoS profile. **Note** You must have previously configured a registered QoS profile, using the **qos-profile registered** command, before being able to use the **enforce** option.

Defaults

The *kbytes* value defaults to 0 (no limit), **upstream** direction, and enforce-rule QoS profiles are not automatically applied (**no enforce**)

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.2(15)BC1	This command was introduced.
12.3(9a)BC	The **activate-rule at-byte-count** keyword is retired.

Usage Guidelines

The **activate-rule at-byte-count** command specifies the maximum number of bytes that a subscriber can transmit during the monitor window period (see the **duration** command). If a subscriber transmits traffic beyond this maximum value, the CMTS considers the subscriber to be over-consuming.

If the optional **enforce** keyword has been specified for an enforce-rule, the CMTS automatically switches over-consuming subscribers to the enforced QoS profile (see the **qos-profile enforced** command). The enforced QoS profile remains in force during the penalty time period (see the **qos-profile registered** command).

An enforce-rule can be created for only one direction, either upstream or downstream. To activate subscriber traffic management for both the upstream and downstream directions, create two different enforce rules, with one rule's **activate-rule** command specifying the **downstream** direction and the other rule specifying the **upstream** direction.

When you change the configuration of a currently active enforce-rule, that rule begins using the new configuration immediately to manage the cable modems tracked by this enforce-rule.

Note You can create an enforce-rule that is a duplicate of an existing enforce-rule, but the duplicate rule is not activated and applied to service flows until at least one of its parameters is changed so that it has a unique configuration.

Examples

The following example shows a typical **activate-rule** command for the downstream direction:

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential
Router(enforce-rule)# activate-rule at-byte-count 20 downstream
Router(enforce-rule)# exit
Router(config)#
```

The following example shows a typical **activate-rule** command for the upstream direction. The **enforce** option is also added so that the enforce-rule QoS profile is automatically applied to users who exceed their registered profile:

```
Router# configure terminal
Router(config)# cable qos enforce-rule test
Router(enforce-rule)# activate-rule at-byte-count 5 upstream enforce
Router(enforce-rule)# exit
Router(config)#
```

The following example shows the same command being given for a second enforce-rule. The system rejects the command because it is a duplicate of an existing rule, using the same QoS profile and direction. You must change at least one of this rule's parameters to make it unique before it is mapped and applied to service flows.

```
Router# configure terminal
Router(config)# cable qos enforce-rule test2
Router(enforce-rule)# activate-rule at-byte-count 5 upstream enforce

Enforce-rule test2 won't be mapped to service flows as it is duplicate of test1 with same
registered qos-profile 5 and same direction

Router(enforce-rule)# exit
Router(config)#
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
enabled	Activates an enforce-rule and begins subscriber traffic management.
qos-profile registered	Specifies the time period that an enforced quality-of-service (QoS) profile should be used for subscribers who violate their registered QoS profile.

Command	Description
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate the assigned QoS profiles.
qos-profile registered	Specifies the registered quality-of-service (QoS) profile that should be used for this enforce-rule.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers that are violating their registered quality-of-service (QoS) profiles.

cable qos enforce-rule

To create an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile for subscriber traffic management, and to enter enforce-rule configuration mode, use the **cable qos enforce-rule** command in interface configuration mode. To delete an enforce-rule and to remove it from the CMTS configuration, use the **no** form of this command.

cable qos enforce-rule *rule-name*

no cable qos enforce-rule *rule-name*

Syntax Description

rule-name	Name of the enforce-rule to be created and configured. This name can be any arbitrary and unique string from 1 to 15 characters in length.

Defaults

No enforce-rules are created.

Command Modes

Interface configuration (cable interface only)

Command History

Release	Modification
12.2(15)BC1	This command was introduced.
12.3(9a)BC	Added new configuration command option **cable enforce-rule** on the Cisco CMTS. This command replaces the **cable qos monitoring** command.

Usage Guidelines

The **cable qos enforce-rule** command creates an enforce-rule with the specified name and then enters enforce-rule configuration mode. After entering enforce-rule configuration mode, use the following commands to configure the enforce-rule:

- **duration**
- **enabled**
- **monitoring-basics**
- **peak-time1**
- **qos-profile registered**
- **qos-profile enforced**
- **service-class enforced**
- **service-class registered**

At the very minimum, you must use the **cable qos enforce-rule** and **qos-profile registered** commands to configure an enforce-rule, and the **enabled** command to activate it, before it takes effect.

Tip Use the **exit** command to leave enforce-rule configuration mode and to return to global configuration mode.

Note In Cisco IOS Release 12.2(15)BC1, you can create a maximum of 20 enforce-rules. If you have created 20 enforce-rules and want to create another new rule, you must first delete one of the existing rules. Otherwise, the CMTS displays an error message.

Examples

The following example shows an enforce-rule named residential being created. The system then enters the enforce-rule configuration mode:

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential
Router(enforce-rule)# ?

Configuration commands for QoS enforce rules:
  activate-rule        Activate rule parameters
  enabled              Enable the enforce-rule
  enforced             Enforced qos-profile
  exit                 Exit from QoS enforce rule editing mode
  duration             duration parameters
  no                   Negate a command or set its defaults
  penalty-period       Penalty-period
  registered           Registered qos-profile

Router(enforce-rule)# qos-profile registered 5
Router(enforce-rule)# enforced qos-profile 99
Router(enforce-rule)# duration 120 sample-rate 20
Router(enforce-rule)# penalty-period 1440
Router(enforce-rule)# enabled
Router(enforce-rule)# exit
Router(config)# exit
Router#
```

The following example shows the enforce-rule named test being deleted:

```
Router# configure terminal
Router(config)# no cable qos enforce-rule test
Router(config)#
```

The following example shows the error message that is displayed if you try to create more than 20 enforce-rules:

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential

Can't create more enforce-rules. The maximum number is 20.
Router(config)#
```

The following example shows the error message that is displayed when you try to name an enforce-rule with a name that is larger than 15 characters. An error message is displayed, and the name is truncated to the first 15 characters:

```
Router# configure terminal
Router(config)# cable qos enforce-rule reallyreallyreallylongname

Only the first 15 characters would be taken

Router(enforce-rule)#
```

Related Commands

Command	Description
debug cable subscriber-monitoring	Displays debugging messages the use of the **cable qos enforce-rule** command to enforce a particular quality-of-service (QoS) profile.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
enabled	Activates an enforce-rule and begins subscriber traffic management.
monitoring-basics	Defines the type of monitoring desired (legacy or peak-offpeak) Defines the type of modems (DOCSIS 1.0 or DOCSIS 1.1). Default is legacy and DOCSIS 1.0
peak-time1	Specifies peak monitoring times. Two peak durations may be defined. The remaining hours may be defined if offpeak duration and threshold are defined.
penalty-period	Specifies the time period, in minutes that an enforced QoS profile should be in force.
qos-profile registered	Specifies the time period that an enforced QoS profile should be used for subscribers who violate the registered QoS profile.
qos-profile enforced	Specifies the QoS profile that should be enforced when users violate the assigned QoS profiles.
service-class enforced	Enables the enforcing of QOS profiles according to service class.
service-class registered	Enables the enforcing of QOS profiles according to registered class.
show cable qos enforce-rule	Displays the QoS enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers that are violating their registered QoS profiles.

debug cable subscriber-monitoring

To display debugging messages for the **cable qos enforce-rule** command, use the **debug cable subscriber-monitoring** command in privileged EXEC mode. To stop the display of debugging messages, use the **no** form of this command.

debug cable subscriber-monitoring

no debug cable subscriber-monitoring

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(15)BC1	This command was introduced.

Usage Guidelines

Tip Because this command can produce a large volume of debug information, use this command only when you have also enabled debugging for a particular interface or MAC address, using the **debug cable interface** and **debug cable mac-address** commands, respectively. The **debug cable qos** command can also provide additional information that can be useful in troubleshooting.

Examples

The following example shows how to enable debugging output using the **debug cable subscriber-monitoring** command:

```
Router# debug cable subscriber-monitoring

subscriber monitoring debugging is on

cmts_enf_map_sm_to_qos: enforced=9, penalty_life_time=10080
cmts_enf_map_sm_to_qos: Found rule #=9, rule_name=name, dir=US
cmts_enf_map_sm_to_registered_qos1: us smp=0x00, ds smp=0x1F
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
debug cable interface	Enables depugging output for a specific cable interface.
debug cable mac-address	Enables debugging output for the cable modems that match the specified hardware (MAC) address or range of addresses.
debug cable qos	Enables debugging output for Qos operation on the cable interface.
show cable qos enforce-rule	Displays the QoS enforce-rules that are currently defined.

duration

To specify the time period and sample rate to be used for monitoring subscribers, use the **duration** command in enforce-rule configuration mode. To reset an enforce-rule to its default values, use the **no** form of this command.

duration *minutes* [**avg-rate** *rate in kbits/sec*] [**sample-interval** *minutes*] [upstream / downstream] **enforce**

no duration

Syntax Description

minutes	Specifies the size of the sliding window during which subscriber usage is monitored. The valid range for minutes is 10 to 44640 with a default of 360 minutes (6 hours).
avg-rate	First peak average rate in kbits/sec. To use average rate, enter **a.**
rate in kbits/sec	The valid rate for kbits/sec is 1 to 4000000 with no default.
sample-interval *minutes*	(Optional) How often, in minutes, the CMTS should sample a service flow to get an estimate of subscriber usage. The valid range is 1 to 30 minutes, with a default value of 15 minutes.
upstream	Specifies that the byte count applies to traffic in the upstream direction.
downstream	Specifies that the byte count applies to traffic in the downstream direction.
enforce	Specifies that the enforce-rule QoS profile should be applied automatically if a user violates their registered QoS profile.

Defaults

The **duration** value defaults to 360 minutes (6 hours), and the **sample-interval** value defaults to 15 minutes.

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.2(15)BC1	This command was introduced.
12.3(9a)BC	Removed *monitoring-* from command.

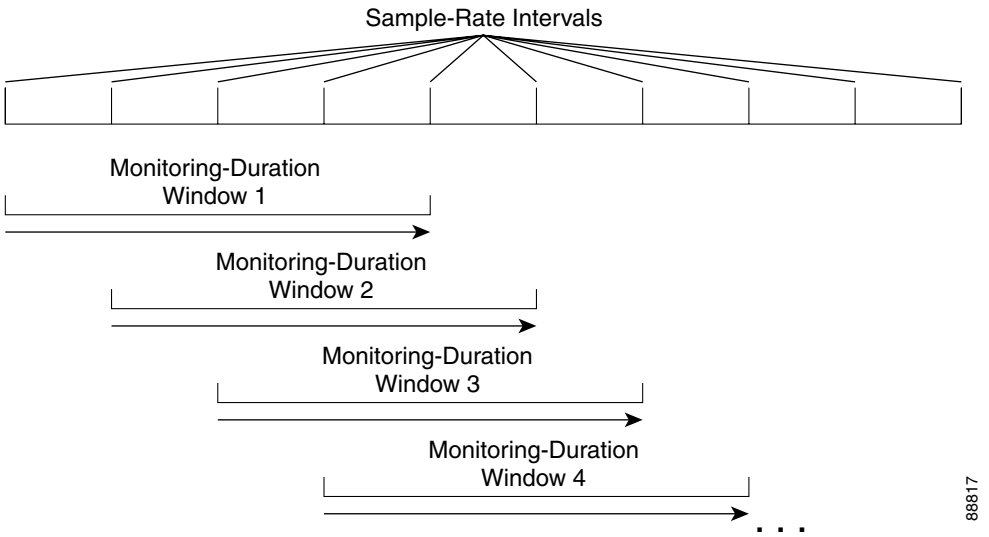
Usage Guidelines

When you enable an enforce-rule, the CMTS periodically checks the bandwidth being used by subscribers, to determine whether any subscribers are consuming more bandwidth than that specified by their registered QoS profile. The CMTS keeps track of the subscribers using a sliding window that begins at each sample-rate interval and continues for the duration period and avg-rate.

For example, with the default sample- interval of 15 minutes and the default monitoring-duration window of 360 minutes, the CMTS samples the bandwidth usage every 15 minutes and determines the total bytes transmitted at the end of each 360 minute period. Each sample-interval begins a new sliding window period for which the CMTS keeps track of the total bytes transmitted.

Figure 2 illustrates how this process works, with a new sliding window beginning at the beginning of each sample-interval period.

Figure 2 Monitoring-Duration Windows



Note Changing the duration, avg-rate, or sample-interval values resets the byte counters for that particular enforce-rule and begins a new monitoring sliding window.

When you change the configuration of a currently active enforce-rule, that rule begins using the new configuration immediately to manage the cable modems tracked by this enforce-rule.

Examples

The following example shows an enforce-rule being configured for a monitoring window that is 20 minutes in length, **avg-rate** *rate in kbits/sec* (a), and with a sampling interval of every 10 minutes.

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential
Router(enforce-rule)# duration 20 avg-rate sample-interval 10
Router(enforce-rule)# exit
Router(config)#
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
enabled	Activates an enforce-rule and begins subscriber traffic management.
debug cable subscriber-monitoring	Displays debugging messages.
monitoring-basics	Defines the type of monitoring desired (legacy or peak-offpeak) Defines the type of modems (DOCSIS 1.0 or DOCSIS 1.1). Default is legacy and DOCSIS 1.0

Command	Description
peak-time1	Specifies peak monitoring times. Two peak durations may be defined. The remaining hours may be defined if offpeak duration and threshold are defined.
qos-profile registered	Specifies the time period that an enforced quality-of-service (QoS) profile should be used for subscribers who violate their registered QoS profile.
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate the assigned QoS profiles.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

enabled

To activate an enforce-rule and begin subscriber traffic management, use the **enabled** command in enforce-rule configuration mode. To disable the enforce-rule without deleting it, use the **no** form of this command.

enabled

no enabled

Syntax Description

This commands has no arguments or keywards.

Defaults

Default is disabled (**no enabled**)

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.2(15)BC1	This command was introduced.

Usage Guidelines

An enforce-rule is created and configured using the **cable qos enforce-rule** command, but it is not activated until you give the **enabled** command. Use the **no enabled** command to disable an enforce-rule without removing it from the CMTS configuration. When you disable an enforce-rule, all cable modems with that rule's registered quality-of-service (QoS) profile are no longer tracked by the Subscriber Traffic Management feature.

Examples

The following example shows an enforce-rule being enabled.

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential
Router(enforce-rule)# enabled
Router(enforce-rule)# exit
Router(config)#
```

The following example shows an enforce-rule being disabled. The rule remains in the CMTS configuration file:

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential
Router(enforce-rule)# no enabled
Router(enforce-rule)# exit
Router(config)#
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
debug cable subscriber-monitoring	Displays debugging messages.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
monitoring-basics	Defines the type of monitoring desired (legacy or peak-offpeak) Defines the type of modems (DOCSIS 1.0 or DOCSIS 1.1). Default is legacy and DOCSIS 1.0
peak-time1	Specifies peak monitoring times. Two peak durations may be defined. The remaining hours may be defined if offpeak duration and threshold are defined.
qos-profile registered	Specifies the time period that an enforced quality-of-service (QoS) profile should be used for subscribers who violate their registered QoS profile.
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate the assigned QoS profiles.
service-class enforced	Enables the enforcing of QOS profiles according to service class.
service-class registered	Enables the enforcing of QOS profiles according to registered class.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

enforced qos-profile

To specify a quality-of-service (QoS) profile that should be enforced when users violate their registered QoS profiles, use the **enforced qos-profile** command in enforce-rule configuration mode. To delete the enforced QoS profile from the enforce-rule, use the **no** form of this command.

enforced qos-profile *profile-id* [**no-persistence**]

no enforced qos-profile *profile-id* [**no-persistence**]

Syntax Description

profile-id	Specifies the QoS profile to be enforced. The valid range is 0 to 16383, with a default of 0. **Note** Both the originally provisioned QoS profile and the enforced QoS profile must be created on the Cisco CMTS. This option does not support profiles that are created by the cable modem.
no-persistence	(Optional) Specifies that the enforced QoS profile should not remain in force when a cable modem reboots. Instead, when a cable modem that is in the penalty period reboots, it is automatically removed from the penalty period and assigned the QoS profile that is specified in its DOCSIS configuration file. The default is without this option, so that enforced QoS profiles remain in force for cable modems across reboots.

Defaults

The value of *profile-id* defaults to 0, and enforced QoS profiles are persistent across cable modem reboots.

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.2(15)BC1	This command was introduced.
12.3(9a)BC	This command is replaced by the qos-profile enforced command

Usage Guidelines

An enforce-rule can specify an enforced QoS profile, which is automatically applied to subscribers who transmit more traffic than allowed by their registered QoS profile. The enforced QoS profile remains in effect during the penalty time period (see the **qos-profile registered** command). At the end of the penalty period, the subscriber returns to the registered QoS profile.

If a cable modem reboots while it is in its penalty time period, it continues using the enforced QoS profile, unless the service provider has manually changed the modem's registered QoS profile using the **cable modem qos profile** command.

When you change the enforced QoS profile for a currently active enforce-rule, any cable modems using this rule that are currently in the penalty period continue using the previously configured enforced QoS profile. Any cable modems that enter the penalty period after this configuration change, however, use the new enforced QoS profile.

An enforced QoS profile already must have been created on the CMTS before you can assign it to an enforce-rule. If the rule does not exist, the system displays an error message.

When the **no-persistence** option is specified, the enforced QoS profile is still automatically applied to subscribers that violate their bandwidth requirements. However, when the cable modem reboots, the Cisco CMTS allows the cable modem to use the QoS profile that is specified in its DOCSIS configuration file.

The **no-persistence** option can be used when initially using the Subscriber Traffic Management feature so as to identify potential problem applications and users. When repeat offenders are identified, they can then be assigned enforce-rules that do not use the **no-persistence** option, so that they remain in the penalty period even if they reboot their cable modems.

Note The system automatically applies the enforced QoS profile to violators only if the **enforce** option has been used with the **cable qos enforce-rule** command.

Examples

The following example shows profile 12 being assigned as the enforced QoS profile to an enforce-rule:

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential
Router(enforce-rule)# enforced qos-profile 12
Router(enforce-rule)# exit
Router(config)#
```

The following example shows profile 12 being assigned as the enforced QoS profile to an enforce-rule, but with the **no-persistence** option specified, so that the enforced QoS profile does not remain in force if the cable modem reboots:

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential
Router(enforce-rule)# enforced qos-profile 12 no-persistence
Router(enforce-rule)# exit
Router(config)#
```

The following example shows the error message that is displayed when the specified QoS profile does not exist on the CMTS:

```
Router# configure terminal
Router(config)# cable qos enforce-rule test
Router(enforce-rule)# enforced qos-profile 98

The qos profile 98 doesn't exist or it's a cm created QoS profile

Router(enforce-rule)#
```

Related Commands

Command	Description
cable qos enforce-rule	Specifies the number of bytes that a subscriber can transmit during the monitoring period.
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.

Command	Description
enabled	Activates an enforce-rule and begins subscriber traffic management.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
qos-profile registered	Specifies the time period that an enforced quality-of-service (QoS) profile should be used for subscribers who violate the registered QoS profile.
qos-profile registered	Specifies the registered quality-of-service (QoS) profile that should be used for this enforce-rule.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating the registered quality-of-service (QoS) profiles.

monitoring-basics

To select the type of CMTS monitoring use the **monitoring-basics** command in configuration mode. To disable the **monitoring-basics**, use the **no** form of this command.

monitoring-basics *{legacy/peak-offpeak} {docsis10/docsis1}*

no monitoring-basics *{legacy/peak-offpeak} {docsis10/docsis1}*

Syntax Description

legacy	Provides only one threshold and one monitoring-duration.
peak-offpeak	Allows the selection of two peak durations within a day.
docsis10	Allows selection of DOCSIS 1.0
docsis1	Allows selection of DOCSIS 1.1

Defaults

Default for this command is legacy and docsis10.

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.3(9a)BC	This command was introduced and replaces the **monitoring-duration** command.

Usage Guidelines

Legacy monitoring occurs 24 hours a day, with no distinction between peak and offpeak hours. Monitoring duration is between 10 minutes and 31 days.

Use the **peak-offpeak** monitoring option to set up monitoring duration and threshold for first peak, second peak, and offpeak. Each one can be different. After setting up fist peak and second peak, the remaining hours are treated as offpeak. Monitoring happens during offpeak hours if the offpeak duration and threshold are defined. Monitoring duration is between 60 minutes and 23 hours.

Examples

The following example shows monitoring dudration and average rate for legacy monitoring:

```
monitoring duration   : 10 minutes
              Average rate          : 2kbits/sec
```

An example when both peaks and offpeak are defined is:

```
              First peak:
                    monitoring duration: Between 6am to 9am i.e., 3hours
                    Average rate       : 2kbits/sec
              Second peak:
                    monitoring duration: Between 6pm to 10pm i.e., 4hrs
                    Average rate       : 3kbits/sec
```

```
Off peak:
      Remaining hours in the day i.e.,
      12 midnight to 6:00am,
      9am to 6pm and 10pm to 12mignight.
      monitoring duration: 2 hours
      Average rate       : 1kbits/sec.
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
debug cable subscriber-monitoring	Displays debugging messages.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
peak-time1	Specifies peak monitoring times. Two peak durations may be defined. The remaining hours may be defined if offpeak duration and threshold are defined.
qos-profile registered	Specifies the time period that an enforced quality-of-service (QoS) profile should be used for subscribers who violate their registered QoS profile.
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate the assigned QoS profiles.
service-class enforced	Enables the enforcing of QOS profiles according to service class.
service-class registered	Enables the enforcing of QOS profiles according to registered class.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

monitoring-duration

To specify the time period and sample rate to be used for monitoring subscribers, use the **monitoring-duration** command in enforce-rule configuration mode. To reset an enforce-rule to its default values, use the **no** form of this command.

monitoring-duration *minutes* [**sample-rate** *minutes*]

no monitoring-duration

Syntax Description

minutes	The valid range is 10 to 10080 minutes, with a default of 360 minutes (6 hours).
sample-rate *minutes*	(Optional) Rate of sampling, in minutes. The valid range is 10 to 30 minutes, with a default value of 15 minutes.

Defaults

The **monitoring-duration** value defaults to 360 minutes (6 hours), and the **sample-rate** value defaults to 15 minutes.

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.2(15)BC1	This command was introduced.
12.3(9a)BC	This command is replaced by the **monitoring-basics** command.

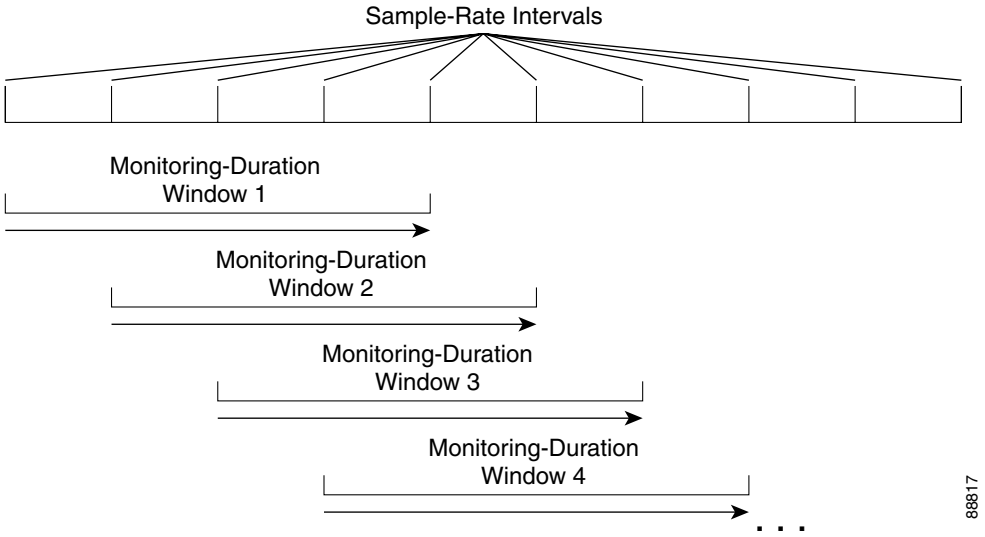
Usage Guidelines

When you an enable an enforce-rule, the CMTS periodically checks the bandwidth being used by subscribers, to determine whether any subscribers are consuming more bandwidth than specified by their registered QoS profile. The CMTS keeps track of the subscribers using a sliding window that begins at each sample-rate interval and continues for the monitoring-duration period.

For example, with the default sample-rate interval of 15 minutes and the default monitoring-duration window of 360 minutes, the CMTS samples the bandwidth usage every 15 minutes and determines the total bytes transmitted at the end of each 360 minute period. Each sample-rate interval begins a new sliding window period for which the CMTS keeps track of the total bytes transmitted.

Figure 2 illustrates how this process works, with a new sliding window beginning at the beginning of each sample-rate interval period.

Figure 3 Monitoring-Duration Windows



Note Changing the **monitoring-duration** and **sample-rate** values resets the byte counters for that particular enforce-rule and begins a new monitoring sliding window.

When you change the configuration of a currently active enforce-rule, that rule begins using the new configuration immediately to manage the cable modems tracked by this enforce-rule.

Examples

The following example shows an enforce-rule being configured for a monitoring window that is 20 minutes in length, with a sampling rate of every 10 minutes.

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential
Router(enforce-rule)# monitoring-duration 20 sample-interval 10
Router(enforce-rule)# exit
Router(config)#
```

Related Commands

Command	Description
cable qos enforce-rule	Specifies the number of bytes that a subscriber can transmit during the monitoring period.
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
enabled	Activates an enforce-rule and begins subscriber traffic management.
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate the assigned QoS profiles.
qos-profile registered	Specifies the time period that an enforced quality-of-service (QoS) profile should be used for subscribers who violate their registered QoS profile.
qos-profile registered	Specifies the registered quality-of-service (QoS) profile that should be used for this enforce-rule.

Command	Description
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

peak-time1

To specify peak monitoring times use the enforce-rule **peak-time1** command in configuration mode. Two peak durations may be defined. The remaining hours may be defined if offpeak duration and threshold are defined.

peak-time1 <*time of day in hours*> **duration** < *in minutes*> **avg-rate** <*rate in kbits/sec*> *[peak-time2* <*time of day in hours*> **duration** <*in minutes*> ***avg-rate*** <*rate in kbits/sec*>*][**duration*** <*in minutes*> ***avg-rate*** <*rate in kbits/sec*>*]* ***sample-interval*** <*in minutes*> <*upstream/downstream*> *[**enforce**]*

Syntax Description

time of day in hours	Sets the time of day that monitoring occurs.
duration *in minutes*	Specifies the size of the sliding window during which the subscriber usage is monitored. Valid range is 1 to 44640 minutes with a default of 360 minutes (6 hours).
avg-rate	Specifies average rate of byte count (enter **a** for average).
rate in kbits/sec	Average rate in kbits/sec. Maximum number of bites, in kilobites, from 10 to 44640 kilobites, with no default.
sample-interval *in minutes*	Optional) How often, in minutes, the CMTS should sample a service flow to get an estimate of subscriber usage. The valid range for *minutes* is 1 to 30 minutes, with a default value of 15 minutes.
upstream/downstream	Species that the byte count applies to traffic in the upstream **u** or downstream **d** direction.
enforce	Specifies that the enforce-rule QoS profile should be applied automatically if a user violates the registered QoS profile.

Defaults

duration *minutes*—360 minutes (6 hours)

sample-interval *in minutes*—15 minutes

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.3(9a)BC	This command was introduced.

Usage Guidelines

Use this command to set the peak-offpeak monitoring times.

Examples

The following example shows peak-offpeak monitoring values defined:

```
>cable qos enforce-rule monitoring
    monitoring-basics peak-offpeak docsis10
    penalty-period 60
    qos-profile registered 6
    qos-profile enforced 100
    peak-time1 10 d 120 avg 10 peak-time2 23 d 60 avg 10 sa 10 up enf
    enabled
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
debug cable subscriber-monitoring	Displays debugging messages.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
monitoring-basics	Defines the type of monitoring desired (legacy or peak-offpeak) Defines the type of modems (DOCSIS 1.0 or DOCSIS 1.1). Default is legacy and DOCSIS 1.0
qos-profile registered	Specifies the time period that an enforced quality-of-service (QoS) profile should be used for subscribers who violate their registered QoS profile.
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate the assigned QoS profiles.
service-class enforced	Enables the enforcing of QOS profiles according to service class.
service-class registered	Enables the enforcing of QOS profiles according to registered class.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating the registered quality-of-service (QoS) profiles.

penalty-period

To specify the time period that an enforced quality-of-service (QoS) profile should be in force for subscribers who violate their registered QoS profile, use the **penalty-period** command in enforce-rule configuration mode. To reset an enforce-rule to its default penalty period, use the **no** form of this command.

penalty-period *minutes*

no penalty-period

Syntax Description

minutes	The valid range is 1 to 10080 minutes (7 days), with a default value of 10080 minutes (7 days).

Defaults

10080 minutes (7 days)

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.2(15)BC1	This command was introduced.

Usage Guidelines

When a subscriber over-consumes the maximum bandwidth that is specified in their enforce-rule, the CMTS can automatically switch the subscriber to an enforced QoS profile for the penalty period specified with the **penalty-period** command. When the penalty period expires, the CMTS restores the subscriber to the registered QoS profile.

The penalty period continues across reboots of the cable modem, so a user cannot avoid the enforced QoS profile by trying to reset the modem and reregister on the cable network. This allows service providers to set an appropriate penalty for those users who consistently exceed the maximum bandwidth they have been allocated.

Note To manually move a cable modem back to its registered profile before the end of the penalty period, use the **cable modem** *mac-address* **qos profile** *id* command.

When you change the configuration of a currently active enforce-rule, that rule begins using the new configuration immediately to manage the cable modems tracked by this enforce-rule.

Examples

The following example shows an enforce-rule being configured for a penalty period of 1440 minutes (1 day):

```
Router# configure terminal
Router(config)# cable qos enforce-rule test
Router(enforce-rule)# penalty 1440
Router(enforce-rule)# exit
Router(config)#
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
debug cable subscriber-monitoring	Displays debugging messages.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
enabled	Activates an enforce-rule and begins subscriber traffic management.
monitoring-basics	Defines the type of monitoring desired (legacy or peak-offpeak) Defines the type of modems (DOCSIS 1.0 or DOCSIS 1.1). Default is legacy and DOCSIS 1.0
peak-time1	Specifies peak monitoring times. Two peak durations may be defined. The remaining hours may be defined if offpeak duration and threshold are defined.
qos-profile registered	Specifies the registered quality-of-service (QoS) profile that should be used for this enforce-rule.
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate the assigned QoS profiles.
service-class enforced	Enables the enforcing of QOS profiles according to service class.
service-class registered	Enables the enforcing of QOS profiles according to registered class.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

qos-profile enforced

To specify a quality-of-service (QoS) profile that should be enforced when users violate their registered QoS profiles, use the **enforced qos-profile** command in enforce-rule configuration mode. To delete the enforced QoS profile from the enforce-rule, use the **no** form of this command.

qos-profile enforced *profile-id* [**no-persistence**]

no qos-profile enforced *profile-id* [**no-persistence**]

Syntax Description

profile-id	Specifies the QoS profile to be enforced. The valid range is 0 to 16383, with a default of 0. **Note** Both the originally provisioned QoS profile and the enforced QoS profile must be created on the Cisco CMTS. This option does not support profiles that are created by the cable modem.
no-persistence	(Optional) Specifies that the enforced QoS profile should not remain in force when a cable modem reboots. Instead, when a cable modem that is in the penalty period reboots, it is automatically removed from the penalty period and assigned the QoS profile that is specified in its DOCSIS configuration file. The default is without this option, so that enforced QoS profiles remain in force for cable modems across reboots.

Defaults

The value of *profile-id* defaults to 0, and enforced QoS profiles are persistent across cable modem reboots.

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.3(9a)BC	This command replaces the **enforced qos-profile** command.

Usage Guidelines

An enforce-rule can specify an enforced QoS profile, which is automatically applied to subscribers who transmit more traffic than allowed by their registered QoS profile. The enforced QoS profile remains in effect during the penalty time period (see the **qos-profile registered** command). At the end of the penalty period, the subscriber returns to the registered QoS profile.

If a cable modem reboots while it is in its penalty time period, it continues using the enforced QoS profile, unless the service provider has manually changed the modem's registered QoS profile using the **cable modem qos profile** command.

When you change the enforced QoS profile for a currently active enforce-rule, any cable modems using this rule that are currently in the penalty period continue using the previously configured enforced QoS profile. Any cable modems that enter the penalty period after this configuration change, however, use the new enforced QoS profile.

An enforced QoS profile must already have been created on the CMTS before you can assign it to an enforce-rule. If the rule does not exist, the system displays an error message.

When the **no-persistence** option is specified, the enforced QoS profile is still automatically applied to subscribers who violate their bandwidth requirements. However, when the cable modem reboots, the Cisco CMTS allows the cable modem to use the QoS profile that is specified in its DOCSIS configuration file.

The **no-persistence** option can be used when initially using the Subscriber Traffic Management feature to identify potential problem applications and users. When repeat offenders are identified, they can then be assigned enforce-rules that do not use the **no-persistence** option, so that they remain in the penalty period even if they reboot their cable modems.

Note The system automatically applies the enforced QoS profile to violators only if the **enforce** option has been used with the **cable qos enforce-rule** command.

Examples

The following example shows profile 12 being assigned as the enforced QoS profile to an enforce-rule:

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential
Router(enforce-rule)# qos-profile enforced 12
Router(enforce-rule)# exit
Router(config)#
```

The following example shows profile 12 being assigned as the enforced QoS profile to an enforce-rule, but with the **no-persistence** option specified, so that the enforced QoS profile does not remain in force if the cable modem reboots:

```
Router# configure terminal
Router(config)# cable qos enforce-rule residential
Router(enforce-rule)# qos-profile enforced 12 no-persistence
Router(enforce-rule)# exit
Router(config)#
```

The following example shows the error message that is displayed when the specified QoS profile does not exist on the CMTS:

```
Router# configure terminal
Router(config)# cable qos enforce-rule test
Router(enforce-rule)# qos-profile enforced 98

The qos profile 98 doesn't exist or it's a cm created QoS profile

Router(enforce-rule)#
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
debug cable subscriber-monitoring	Displays debugging messages.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
enabled	Activates an enforce-rule and begins subscriber traffic management.

Command	Description
monitoring-basics	Defines the type of monitoring desired (legacy or peak-offpeak) Defines the type of modems (DOCSIS 1.0 or DOCSIS 1.1). Default is legacy and DOCSIS 1.0
peak-time1	Specifies peak monitoring times. Two peak durations may be defined. The remaining hours may be defined if offpeak duration and threshold are defined.
qos-profile registered	Specifies the registered quality-of-service (QoS) profile that should be used for this enforce-rule.
service-class enforced	Enables the enforcing of QOS profiles according to service class.
service-class registered	Enables the enforcing of QOS profiles according to registered class.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

qos-profile registered

To specify the registered quality-of-service (QoS) profile that should be used for this enforce-rule, use the **registered qos-profile** command in enforce-rule configuration mode. To remove the registered QoS profile from the enforce-rule, use the **no** form of this command.

qos-profile registered *profile-id*

no qos-profile registered *profile-id*

Syntax Description

profile-id	Specifies the QoS profile to be monitored. This profile must be created on the Cisco CMTS. If you want to manage a cable modem that uses a modem-created QoS profile, you must first create that exact QoS profile on the CMTS before using this command. The valid range is 0 to 16383, with a default of 0.

Defaults

Default is 0.

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.3(9a)BC	This command replaces **registered qos-profile**.

Usage Guidelines

You must specify a registered QoS profile for each enforce-rule. The CMTS then uses the registered profile ID to match subscribers' service flows to the proper enforce-rules.

When you change the registered QoS profile for an active rule, the cable modems that had been using the previous registered QoS profile are no longer managed by the Subscriber Traffic Management feature. Instead, the rule begins managing those cable modems that use the new registered QoS profile.

Note The registered QoS profile must be created on the Cisco CMTS before you can assign it to an enforce-rule. If the rule does not exist, the system displays an error message. If you want to manage a cable modem that is currently using a modem-created QoS profile, you must first manually create a new QoS profile on the CMTS that has the same QoS paramters as the modem-created profile. Then allow the modem to come online using the manually created profile, before giving the **qos-profile registered** command.

Examples

The following example shows profile 50 being assigned as the registered QoS profile to an enforce-rule:

```
Router# configure terminal
Router(config)# cable qos enforce-rule enforce-rule
Router(enforce-rule)# qos-profile registered 50
Router(enforce-rule)# exit
Router(config)#
```

The following example shows the error message that is displayed when the specified QoS profile does not exist on the CMTS:

```
Router# configure terminal
Router(config)# cable qos enforce-rule test
Router(enforce-rule)# qos-profile registered 99

The qos profile 99 doesn't exist or it's a cm created QoS profile

Router(enforce-rule)#
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
debug cable subscriber-monitoring	Displays debugging messages.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
enabled	Activates an enforce-rule and begins subscriber traffic management.
monitoring-basics	Defines the type of monitoring desired (legacy or peak-offpeak) Defines the type of modems (DOCSIS 1.0 or DOCSIS 1.1). Default is legacy and DOCSIS 1.0
peak-time1	Specifies peak monitoring times. Two peak durations may be defined. The remaining hours may be defined if offpeak duration and threshold are defined.
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate the assigned QoS profiles.
service-class enforced	Enables the enforcing of QOS profiles according to service class.
service-class registered	Enables the enforcing of QOS profiles according to registered class.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

registered qos-profile

To specify the registered quality-of-service (QoS) profile that should be used for this enforce-rule, use the **registered qos-profile** command in enforce-rule configuration mode. To remove the registered QoS profile from the enforce-rule, use the **no** form of this command.

registered qos-profile *profile-id*

no registered qos-profile *profile-id*

Syntax Description

profile-id	Specifies the QoS profile to be monitored. This profile must be created on the Cisco CMTS. If you want to manage a cable modem that uses a modem-created QoS profile, you must first create that exact QoS profile on the CMTS before using this command. The valid range is 0 to 16383, with a default value of 0.

Defaults

Default value is 0.

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.2(15)BC1	This command was introduced.
12.3(9a)BC	This command is replaced by the **qos-profile registered** command.

Usage Guidelines

You must specify a registered QoS profile for each enforce-rule. The CMTS then uses the registered profile ID to match subscribers' service flows to the proper enforce-rules.

When you change the registered QoS profile for an active rule, the cable modems that had been using the previous registered QoS profile are no longer managed by the Subscriber Traffic Management feature. Instead, the rule begins managing those cable modems that use the new registered QoS profile.

Note The registered QoS profile must be created on the Cisco CMTS before you can assign it to an enforce-rule. If the rule does not exist, the system displays an error message. If you want to manage a cable modem that is currently using a modem-created QoS profile, you must first manually create a new QoS profile on the CMTS that has the same QoS paramters as the modem-created profile. Then allow the modem to come online using the manually created profile, before giving **registered qos-profile** command.

Examples

The following example shows profile 50 being assigned as the registered QoS profile to an enforce-rule:

```
Router# configure terminal
Router(config)# cable qos enforce-rule enforce-rule
Router(enforce-rule)# registered qos-profile 50
```

```
Router(enforce-rule)# exit
Router(config)#
```

The following example shows the error message that is displayed when the specified QoS profile does not exist on the CMTS:

```
Router# configure terminal
Router(config)# cable qos enforce-rule test
Router(enforce-rule)# registered qos-profile 99

The qos profile 99 doesn't exist or it's a cm created QoS profile

Router(enforce-rule)#
```

Related Commands

Command	Description
cable qos enforce-rule	Specifies the number of bytes that a subscriber can transmit during the monitoring period.
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
enabled	Activates an enforce-rule and begins subscriber traffic management.
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate their assigned QoS profiles.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
qos-profile registered	Specifies the time period that an enforced quality-of-service (QoS) profile should be used for subscribers who violate their registered QoS profile.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

service-class enforced

To identify a particular service class, use the **service-class (enforced | registered)** command in configuration mode. The service class defines a particular QOS parameter.

command service-class (*enforced* | *registered*) <name> **keyword**

Syntax Description

enforced	Selects a particular service class.
name	Specifies the name of a particular enforce-rule .

Defaults

No default behavior or values

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.3(9a)BC	This command was introduced.

Usage Guidelines

The service-class option allows operators to modify the implementation of a given service. Displays only the subscribers that are over-consumed.

Examples

The following example shows the service class option:

```
Router(enforce-rule)# service-class ?
  enforced    Enforced service class
  registered  Registered service class
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
debug cable subscriber-monitoring	Displays debugging messages.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
enabled	Activates an enforce-rule and begins subscriber traffic management.
monitoring-basics	Defines the type of monitoring desired (legacy or peak-offpeak) Defines the type of modems (DOCSIS 1.0 or DOCSIS 1.1). Default is legacy and DOCSIS 1.0
peak-time1	Specifies peak monitoring times. Two peak durations may be defined. The remaining hours may be defined if offpeak duration and threshold are defined.

Command	Description
qos-profile registered	Specifies the registered quality-of-service (QoS) profile that should be used for this enforce-rule.
service-class registered	Enables the enforcing of QOS profiles according to registered class.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

service-class registered

To identify a particular service class, use the **service-class (enforced | registered)** command in enforce-rule configuration mode. The service class defines a particular QOS parameter.

command service-class (*enforced* | *registered*) <name> **keyword**

Syntax Description

service-class enforced	Enables the enforcing of QOS profiles according to service class.
registered	Selects a registered service class.
name	Specifies the name of a particular service class.

Defaults

No default behavior or values.

Command Modes

Enforce-rule configuration

Command History

Release	Modification
12.3(9a)BC	This command was introduced.

Examples

The following example shows the **service class** command.

```
Router(enforce-rule)# service-class ?

  enforced    Enforced service class
  registered  Registered service class
```

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
debug cable subscriber-monitoring	Displays debugging messages the use of the **cable qos enforce-rule** command to enforce a particular quality-of-service (QoS) profile.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
enabled	Activates an enforce-rule and begins subscriber traffic management.
monitoring-basics	Defines the type of monitoring desired (legacy or peak-offpeak) Defines the type of modems (DOCSIS 1.0 or DOCSIS 1.1). Default is legacy and DOCSIS 1.0
peak-time1	Specifies peak monitoring times. Two peak durations may be defined. The remaining hours may be defined if offpeak duration and threshold are defined.
qos-profile registered	Specifies the registered quality-of-service (QoS) profile that should be used for this enforce-rule.

Command	Description
service-class registered	Enables the enforcing of QOS profiles according to registered class.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

show cable qos enforce-rule

To display the quality-of-service (QoS) enforce-rules that are currently defined, use the **show cable qos enforce-rule** command in privileged EXEC mode.

show cable qos enforce-rule [*name*]

Syntax Description

name	(Optional) Specifies the name of a particular enforce-rule to be displayed.

Defaults

All enforce-rules are displayed.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(15)BC1	This command was introduced.

Examples

The following example shows typical output for the default version of the **show cable qos enforce-rule** command:

```
Router# show cable qos enforce-rule

            Name              Dur  Dir byte-cnt Auto rate  penalty Reg Enf Ena Persist
                             (min)     (kbytes) enf  (min) (min)   QoS QoS
 residential                  10   us  5        act  1     10080   5   10  Yes Yes
 ef-q11d                      30   ds  150      act  1     20      11  99  Yes Yes
 ef-q11u                      30   us  60       act  1     20      11  99  Yes Yes
 ef-q21                       720  us  60       act  1     10      21  81  Yes Yes
 ef-q21d                      300  ds  150      act  1     10      21  81  Yes Yes
 ef-q22                       720  us  60       act  1     10      22  82  Yes Yes
 ef-q22d                      300  ds  150      act  1     10      22  82  Yes No
 ef-q23                       720  us  60       act  1     10      23  83  Yes Yes
 ef-q23d                      300  ds  150      act  1     10      23  83  Yes Yes
 ef-q24                       720  us  60       act  1     10      24  84  Yes Yes
 ef-q24d                      300  ds  150      act  1     10      24  84  Yes Yes
 ef-q25                       720  us  60       act  1     10      25  85  Yes Yes
 ef-q25d                      300  ds  150      act  1     10      25  85  Yes Yes
 ef-q26                       720  us  60       act  1     10      26  86  Yes Yes
 ef-q26d                      300  ds  150      act  1     10      26  86  Yes Yes
 ef-q27                       720  us  60       act  1     10      27  87  Yes Yes
 ef-q27d                      300  ds  150      act  1     10      27  87  Yes Yes
 ef-q28                       720  us  60       act  1     10      28  88  Yes Yes
 ef-q28d                      300  ds  150      act  1     10      28  88  Yes No
 ef-q5d                       300  ds  150      act  1     10      5   99  Yes Yes
 ef-q5u                       720  us  600      act  1     10      5   99  Yes Yes

Router#
```

The following example shows sample output from the **show cable qos enforce-rule** command for one particular enforce-rule:

```
Router# show cable qos enforce-rule residential

            Name              Dur  Dir byte-cnt Auto rate  penalty Reg Enf Ena Persist
                             (min)     (kbytes) enf  (min) (min)   QoS QoS
 residential                  10   us  5        act  1     10080   5   10  Yes Yes

Router#
```

Table 1 describes the significant fields displayed by the **show cable qos enforce-rule** command.

Table 1 show cable qos enforce-rule Field Descriptions

Field	Description
Name	Name of the enforce-rule.
Dur (min)	Monitor-duration time period, in minutes.
Dir	Direction in which the byte-count is applied: • DS = downstream direction • US = upstream direction
byte-cnt (kbytes)	Maximum number of bytes, in kilobytes, that subscribers using this enforce-rule can transmit during the monitoring-duration window before being considered to be over-consuming.
Auto enf	Displays whether the enforce-rule QoS profile is automatically activated when a subscriber exceeds the allowed bandwidth.
rate (min)	Size of the sample-rate interval, in minutes.
penalty (min)	Size of the penalty period, in minutes.
Reg QoS	Profile ID for the registered QoS profile.
Enf QoS	Profile ID for the enforced QoS profile.
Ena	Displays whether this enforce-rule is currently enabled and active.
Persist	Displays whether this enforce-rule keeps the enforced QoS profile in force across cable modem reboots: • **Yes** = Enforced QoS profiles remain in effect across cable modem reboots. • **No** = Enforced QoS profiles do not remain in effect when a cable modem reboots. See the **no-persistence** option for the **qos-profile enforced** command.

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
enabled	Activates an enforce-rule and begins subscriber traffic management.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.
qos-profile registered	Specifies the time period that an enforced quality-of-service (QoS) profile should be used for subscribers that violate their registered QoS profile.

Command	Description
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate their assigned QoS profiles.
qos-profile registered	Specifies the registered quality-of-service (QoS) profile that should be used for this enforce-rule.
show cable subscriber-usage	Displays subscribers who are violating their registered quality-of-service (QoS) profiles.

show cable subscriber-usage

To display subscribers who are violating their registered quality-of-service (QoS) profiles, use the **show cable subscriber-usage** command in privileged EXEC mode.

show cable subscriber-usage [**over-consume**]
[{**cable** *slot/port* | **cable** *slot/subslot/port*}[**upstream** *n*]] [**sort-byte-count**]

Syntax Description

over-consume	(Optional) Displays only those subscribers who have exceeded their maximum allowed bandwidth.
cable *slot/port*	(Optional) Identifies the a interface and downstream port on the Cisco uBR7100 series and Cisco uBR7200 series routers. On the Cisco uBR7100 series router, the only valid value is **1/0**. On the Cisco uBR7200 series router, *slot* can range from 3 to 6, and *port* can be 0 or 1, depending on the cable interface.
cable *slot/subslot/port*	(Optional) Identifies a cable interface on the Cisco uBR10012 router. The following are the valid values: • *slot* = 5 to 8 • *subslot* = 0 or 1 • *port* = 0 to 4 (depending on the cable interface)
upstream *port*	(Optional) Displays information for a particular upstream on the selected cable interface. The *port* value starts with 0 and continues up, depending on the type of cable interface card.
sort-byte-count	(Optional) Sort the list by the subscriber byte count, with the highest byte counts listed first. The default is to sort the list by service flow ID (SFID).

Defaults

All subscribers are shown, with the display sorted by SFID.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(15)BC1	This command was introduced.

Usage Guidelines

The **show cable subscriber-usage** command displays the current usage statistics for all subscribers on the Cisco CMTS, for all subscribers on a particular cable interface, or for only those subscribers who are marked as over-consuming bandwidth.

Examples

The following example shows typical output for the default version of the **show cable subscriber-usage** command:

```
Router# show cable subscriber-usage

Sfid Mac Address   Enforce-rule Total-Kbyte  Last-detect    Last-penalty   Pen
                      Name        Count         time           time        Flag
3    0007.0e03.110d efrule-q5   121944817  Jan1  03:44:08  Jan1  03:54:08  Act
4    0007.0e03.110d efrule-q5d  1879076068 Jan1  03:35:05  Jan1  03:45:06  Act
5    0007.0e03.1431 efrule-q5   120052387  Jan1  03:44:18  Jan1  03:54:18  Act
6    0007.0e03.1431 efrule-q5d  1838493626 Jan1  03:34:55  Jan1  03:44:55  Act
7    0007.0e03.1445 efrule-q5   120919427  Jan1  03:44:08  Jan1  03:54:08  Act
8    0007.0e03.1445 efrule-q5d  1865955172 Jan1  03:35:06  Jan1  03:45:06  Act
9    0007.0e03.1225 efrule-q5   120200155  Jan1  03:44:18  Jan1  03:54:18  Act
10   0007.0e03.1225 efrule-q5d  1839681070 Jan1  03:34:55  Jan1  03:44:55   -
11   0007.0e03.0cb1 efrule-q5   122941643  Jan1  03:43:58  Jan1  03:53:58  Act
12   0007.0e03.0cb1 efrule-q5d  1889107176 Jan1  03:35:06  Jan1  03:45:06  Act
13   0007.0e03.1435 efrule-q5   119504795  Jan1  03:44:18  Jan1  03:54:18  Act
14   0007.0e03.1435 efrule-q5d  1835164034 Jan1  03:34:55  Jan1  03:44:55   -
15   0007.0e02.f80d efrule-q5   119250047  Jan1  03:44:18  Jan1  03:54:18  Act
16   0007.0e02.f80d efrule-q5d  1832034114 Jan1  03:34:55  Jan1  03:44:55   -
17   0007.0e03.1469 efrule-q5   117562137  Jan1  03:44:18  Jan1  03:54:18  Act
18   0007.0e03.1469 efrule-q5d  1816957486 Jan1  03:34:55  Jan1  03:44:55   -
19   0007.0e03.11f9 efrule-q5   124265775  Jan1  03:44:18  Jan1  03:54:18  Act
20   0007.0e03.11f9 efrule-q5d  1959957066 Jan1  03:35:46  Jan1  03:45:46  Act
21   0007.0e03.1461 efrule-q5   113314731  Jan1  03:34:55  Jan1  03:44:55   -
22   0007.0e03.1461 efrule-q5d  1827583110 Jan1  03:35:46  Jan1  03:45:46  Act
23   0007.0e03.11d9 efrule-q5   104607787  Jan1  03:34:55  Jan1  03:44:55   -
24   0007.0e03.11d9 efrule-q5d  1675444338 Jan1  03:34:55  Jan1  03:44:55   -
25   0007.0e03.1475 efrule-q5   113751019  Jan1  03:34:55  Jan1  03:44:55   -
26   0007.0e03.1475 efrule-q5d  1841060070 Jan1  03:35:56  Jan1  03:45:56  Act
27   0007.0e03.10d9 efrule-q5   113713981  Jan1  03:34:55  Jan1  03:44:55   -
28   0007.0e03.10d9 efrule-q5d  1840272262 Jan1  03:35:56  Jan1  03:45:56  Act
29   0007.0e03.1065 efrule-q5   113443243  Jan1  03:34:55  Jan1  03:44:55   -
30   0007.0e03.1065 efrule-q5d  1834855264 Jan1  03:35:56  Jan1  03:45:56  Act
31   0007.0e03.1081 efrule-q5   119843737  Jan1  03:44:18  Jan1  03:54:18  Act
32   0007.0e03.1081 efrule-q5d  1852632338 Jan1  03:35:56  Jan1  03:45:56  Act
33   0007.0e03.1179 efrule-q5   118522795  Jan1  03:44:18  Jan1  03:54:18  Act
34   0007.0e03.1179 efrule-q5d  1834693996 Jan1  03:35:56  Jan1  03:45:56  Act
35   0007.0e03.1471 efrule-q5   122182565  Jan1  03:43:58  Jan1  03:53:58  Act
36   0007.0e03.1471 efrule-q5d  1881390866 Jan1  03:34:55  Jan1  03:44:55   -
37   0007.0e03.1341 efrule-q5   129557931  Jan1  03:43:48  Jan1  03:53:48  Act
38   0007.0e03.1341 efrule-q5d  2016792338 Jan1  03:35:56  Jan1  03:45:56  Act

Router#
```

The following example shows typical output for subscribers on a particular cable interface:

```
Router# show cable subscriber-usage c6/0/0

Sfid Mac Address   Enforce-rule Total-Kbyte  Last-detect    Last-penalty   Pen
                      Name        Count         time           time        Flag
7    0007.0e03.2cad test1       0          Jan1  00:00:00  Jan1  00:00:00   -
9    0007.0e03.2c45 test1       0          Jan1  00:00:00  Jan1  00:00:00   -

Router#
```

The following example shows typical output for the **show cable subscriber-usage** command for one upstream on a particular cable interface:

```
Router# show cable subscriber-usage c6/0/1 upstream 0

Sfid Mac Address   Enforce-rule Total-Kbyte  Last-detect    Last-penalty   Pen
                      Name        Count       time            time        Flag
5    0007.0e03.2c25 test1       0          Jan1  00:00:00  Jan1  00:00:00   -

Router#
```

The following example shows typical output for the **sort-byte-count** option for the **show cable subscriber-usage** command:

```
Router# show cable subscriber-usage sort-byte-count

Sfid Mac Address   Enforce-rule Total-Kbyte  Last-detect    Last-penalty   Pen
                      Name        Count       time            time        Flag
7    0007.0e03.2cad test1       65157114   Feb24 11:36:34  Mar3  11:36:34  Act
9    0007.0e03.2c45 test1       16381014                                    -
5    0007.0e03.2c25 test1       13440960                                    -

Router#
```

Table 2 describes the fields shown by the **show cable subscriber-usage** command.

Table 2 show cable subscriber-usage Field Descriptions

Field	Description
SFID	Number of the service flow ID.
Mac Address	Hardware address (MAC address) of the subscriber's cable modem.
Enforce-rule Name	Name of the enforce-rule being applied to this subscriber.
Total Kbyte count	Total number of kilobytes consumed by the subscriber's cable modem during the last monitoring-duration window. **Note** The total byte count is reset to 0 whenever an enforce-rule's configuration is changed.
Last-detect Time	Last time period, if any, at which it was determined that the cable modem was using more bandwidth than allowed by the subscribers QoS profile. This value also shows the time at which the enforced QoS profile was automatically applied, if this option has been enabled.
Last-penalty Time	If an enforced QoS profile is currently in effect, this field shows the time period after which the subscriber's current penalty time expires, at which point their original registered QoS profile is restored.
Penalty Flag	Identifies whether a penalty enforce-rule has been applied to this cable modem.

Related Commands

Command	Description
cable qos enforce-rule	Creates an enforce-rule to be used to enforce a particular quality-of-service (QoS) profile and enters enforce-rule configuration mode.
duration	Specifies the time period and sample rate to be used for monitoring subscribers.

Command	Description
enabled	Activates an enforce-rule and begins subscriber traffic management.
qos-profile enforced	Specifies the quality-of-service (QoS) profile that should be enforced when users violate their assigned QoS profiles.
qos-profile registered	Specifies the registered quality-of-service (QoS) profile that should be used for this enforce-rule.
show cable qos enforce-rule	Displays the quality-of-service (QoS) enforce-rules that are currently defined.

snmp-server enable traps cable

To enable the sending of Simple Network Management Protocol (SNMP) traps for cable-related events, use the **snmp-server enable traps cable** command in global configuration mode. To disable the sending of traps, use the **no** form of this command.

snmp-server enable traps cable [**cm-chover**] [**cm-onoff**] [**cm-remote-query**] [**cmts-event**] [**enforce-rule**] [**hccp-failover**] [**hopping**]

no snmp-server enable traps cable [**cm-chover**] [**cm-onoff**] [**cm-remote-query**] [**cmts-event**] [**enforce-rule**] [**hccp-failover**] [**hopping**]

Syntax Description

cm-chover	Enables traps that are sent upon completion of CMTS channel override operations, as defined in CISCO-DOCS-EXT-MIB.
cm-onoff	Enables traps for cable modem online/offline status changes, as defined in CISCO-DOCS-EXT-MIB.
cm-remote-query	Enables traps that are sent when the remote polling of cable modems has been completed, as defined in CISCO-DOCS-REMOTE-QUERY-MIB.
cmts-event	Enables traps for CMTS events, as defined in DOCS-CABLE-DEVICE-MIB and DOCS-CABLE-DEVICE-TRAP-MIB.
enforce-rule	Enables traps that are sent when a user violates their quality-of-service (QoS) profile, as defined in the CISCO-CABLE-QOS-MONITOR-MIB.
hccp-failover	Enables traps for hot-standby connection-to-connection protocol (HCCP) redundancy switchover events, as defined in CISCO-CABLE-AVAILABILITY-MIB.
hopping	Enables traps for spectrum hopping events, as defined in CISCO-CABLE-SPECTRUM-MIB.

Defaults

No SNMP traps for cable-related events are enabled. You can specify one type of trap or any combination of traps. When the **snmp-server enable traps cable** command is given without any options, all cable-related traps are enabled.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command, with the **cm-chover** and **cm-onoff** options, was added.
12.0(7)XR2, 12.1(1)T	The **cm-remote-query option**, along with the CISCO-DOCS-REMOTE-QUERY-MIB, was introduced.
12.1(2)EC1	Supported in the Cisco IOS Release 12.1 EC train.
12.1(7)CX1	The **hopping** and **cmts-event** options were introduced.
12.2(4)BC1	Supported on the Cisco uBR10012 universal broadband router.
12.2(8)BC1	The **hccp-failover** option was supported on the Cisco uBR10012 router.

Release	Modification
12.2(11)BC1	The **hccp-failover** option was supported on the Cisco uBR7200 series router.
12.2(15)BC1	The **enforce-rule** option was added to generate traps for subscribers who violate their enforce-rule QoS profile.

Usage Guidelines

For other SNMP commands that affect the operation of the CMTS, see the *Cisco IOS Configuration Fundamentals Command Reference Guide*.

Examples

The following example shows how to enable all traps for cable-related events except HCCP switchovers and enforce-rule violations on the CMTS:

```
Router# configure terminal
Router(config)# snmp-server enable traps cable cm-chover cm-onoff cm-remote-query
cmts-event hopping
Router(config)#
```

The following example shows how to enable traps for any HCCP switchovers that occur on the CMTS:

```
Router# configure terminal
Router(config)# snmp-server enable traps cable hccp-failover
Router(config)#
```

The following example shows how to enable traps for when a user violates the maximum bandwidth for the quality-of-service (QoS) profile specified by their enforce-rule.

```
Router# configure terminal
Router(config)# snmp-server enable traps cable enforce-rule
Router(config)#
```

Related Commands

Command	Description
cable modem remote-query	Enables and configures the remote-query feature to gather cable modem performance statistics on the CMTS.
debug cable remote-query	Turns on debugging to gather information from remote cable modems.
show cable modem remote-query	Displays the statistics accumulated by the remote-query feature.