QoS Classification, Policing, and Marking on a LAC

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The QoS Classification, Policing, and Marking on a LAC feature allows service providers to classify packets based upon the IP type of service (ToS) bits in an embedded IP packet. The classification is used to police the incoming traffic according to the differentiated services code point (DSCP) value. The purpose of classifying the packet by examining its encapsulation is to simplify the implementation and configuration needed for a large number of PPP sessions.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for QoS Classification, Policing, and Marking on a LAC" section on page 12.

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Prerequisites for QoS Classification, Policing, and Marking on a LAC

- You must configure the client router, the Layer 2 Tunneling Protocol (L2TP) Access Concentrator (LAC), and the L2TP Network Server (LNS) before applying the QoS policy map as described in the "Configuration Examples for QoS Classification, Policing, and Marking on a LAC" section on page 5.
- You must use the **show sss session** command to verify that the user sessions are enabled on a LAC.
- You must configure the virtual-template interface before applying the policy map to the session.

Restrictions for QoS Classification, Policing, and Marking on a LAC

The following restrictions apply to the QoS Classification, Policing, and Marking on a LAC feature:

- Service-policy on Point-to-Point Protocol over X.25 (PPPoX) interfaces is not supported.
- Class-based queueing and class-based shaping are not supported.
- Layer 2 marking is not supported.
- The QoS MIB is not supported.
- The **clear counters** command does not clear the counters of the QoS policy map.
- Multihop virtual private dial-up networks (VPDNs) are not supported.

Information About QoS Classification, Policing, and Marking on a LAC

To use the QoS Classification, Policing, and Marking on a LAC feature, you should understand the following concepts:

- Benefits of the QoS Classification, Policing, and Marking on a LAC Feature, page 3
- QoS Policy Maps and a LAC, page 3
- Upstream Traffic from the LAC to the LNS, page 3
- Downstream Traffic from the LNS to the LAC, page 3
- SSS Sessions on the LAC, page 3

Benefits of the QoS Classification, Policing, and Marking on a LAC Feature

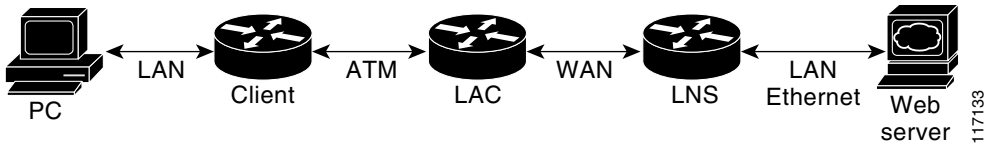
- This feature provides policing and marking on a per-session basis for traffic forwarded into L2TP tunnels to the appropriate LNS and for traffic coming from an L2TP tunnel toward a customer edge router.
- This feature helps recognize the IP ToS value in the Point-to-Point Protocol over Ethernet (PPPoE) encapsulated traffic in order to classify and police the traffic according to the DSCP value.

QoS Policy Maps and a LAC

QoS policing and marking can be achieved by attaching a QoS policy map to the user interface on a LAC in the input and output directions. By using tunnels, input and output service policies can be attached to interfaces. Policy maps get enforced as the packet enters or leaves the tunnel.

Figure 1 shows the deployment of QoS on PPPoE sessions originating at the client and terminating at the LNS.

Figure 1 Sample Topology for QoS on PPoE Sessions



Note In this sample topology, the LAC is a Cisco 7200 series router.

Upstream Traffic from the LAC to the LNS

Upstream traffic corresponds to packets traversing from the tunnel source to the tunnel destination; in this case, the traffic moves from the LAC to the LNS. The input QoS policy map acts on the upstream traffic before the packet gets encapsulated with the tunnel header.

Downstream Traffic from the LNS to the LAC

Downstream traffic corresponds to packets traversing from the tunnel destination to tunnel source; in this case, the traffic going from the LNS to the LAC. The output QoS policy map acts on the downstream traffic after the tunnel encapsulation is removed from the packet header.

SSS Sessions on the LAC

The Subscriber Service Switch (SSS) session provides you with the infrastructure to apply QoS features on a per-session basis. The SSS session is preconfigured on the virtual template, and you can use this template to provide QoS classification, policing, and marking.

You can verify the statistics of the upstream and downstream traffic from a QoS policy map in an SSS session by using the **show policy-map session** command.

How to Configure QoS Classification, Policing, and Marking on a LAC

Enabling the Service Provider to Verify Traffic Statistics

SUMMARY STEPS

1. **enable**
2. **show policy-map session** [**uid** *uid-number*] [**input** | **output** [**class** *class-name*]]
3. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show policy-map session** [**uid** *uid-number*] [**input** | **output** [**class** *class-name*]] **Example:** `Router# show policy-map session uid 401 output`	Displays the information about the session identified by the unique ID.
Step 3	**exit** **Example:** `Router# exit`	(Optional) Exits privileged EXEC mode.

Configuration Examples for QoS Classification, Policing, and Marking on a LAC

This section contains the following configuration examples:

- Example: Configuring the Routers, page 5
- Example: Verifying the SSS Session, page 8
- Example: Applying the QoS Policy Map, page 8
- Example: Configuring the LAC, page 8
- Example: Verifying the QoS Policy Map for Downstream Traffic, page 8
- Example: Applying the QoS Policy Map to the Session, page 9
- Example: Verifying the QoS Policy Map for Upstream Traffic, page 10

Note The following examples show you how to apply QoS policy maps to upstream and downstream user session traffic to achieve the required Service Level Agreements (SLAs) provided by the service provider.

Example: Configuring the Routers

The following example shows the configuration of the routers before the QoS policy map is verified.

Client Configuration

When you log in to the PC, a PPPoE session is established at the client that faces the LAC. This PPPoE session is forwarded through the L2TP tunnel from the LAC to the LNS at which point the PPPoE session terminates.

To apply QoS sessions to the user traffic that originates from the PC to the web server and to the traffic that originates from the web server to the PC, you should apply a QoS policy map to the user session on the LAC in the input and output directions. The classification will be based on the user traffic that originates at the PC and the web traffic that originates at the web server.

This topology supports bidirectional traffic, meaning that traffic can flow from the PC to the web server and from the web server to the PC.

```
username xyz@cisco.com password 0 password1
username qos4-72a password 0 password1
username qos4-72b password 0 password1

aaa authentication ppp default local
aaa session-id common

ip cef
vpdn enable
!
vpdn-group 1
 request-dialin
  protocol pppoe
!
pppoe-forwarding

interface ATM5/0
```

```
 no ip address
 no ip redirects
 no ip proxy-arp
 no ip mroute-cache
 load-interval 30
 no atm ilmi-keepalive
!
interface ATM5/0.1 point-to-point
 pvc 0/100
  encapsulation aal5snap
  pppoe max-sessions 100
  pppoe-client dial-pool-number 1
 !
!interface Dialer1
 mtu 1492
 ip address negotiated
 encapsulation ppp
 dialer pool 1
 no peer default ip address
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname xyz@cisco.com
 ppp chap password 0 cisco
 ppp ipcp dns request
!
```

LAC Configuration

The following example shows that the interfaces between the client and the LAC are ATM5/0 interfaces.

```
username xyz@cisco.com password 0 password1
username qos4-72a password 0 password1
username qos4-72b password 0 password1

aaa new-model
!
!
aaa authentication ppp default local
aaa session-id common

ip cef
vpdn enable
!
vpdn-group 1
 accept-dialin
  protocol pppoe
  virtual-template 1
!
vpdn-group 2
 request-dialin
  protocol l2tp
  domain cisco.com
 initiate-to ip 10.10.101.2
 local name lac
 no l2tp tunnel authentication
 ip tos reflect
!
pppoe-forwarding

interface Serial3/6
 bandwidth 2015
 ip address 10.10.100.1 255.255.255.0
 no ip redirects
 no ip proxy-arp
```

```
 load-interval 30
 no keepalive
 no cdp enable
!

interface ATM5/0
 no ip address
 no ip redirects
 no ip proxy-arp
 load-interval 30
 no atm ilmi-keepalive
!
interface ATM5/0.1 point-to-point
 pvc 0/100
  encapsulation aal5snap
  pppoe max-sessions 100
  protocol ppp Virtual-Template1
  protocol pppoe
!
!
interface Virtual-Template1
 mtu 1492
 no ip address
 no peer default ip address
 ppp authentication chap
!
```

LNS Configuration

The following example shows that the interface between the LAC and the LNS is a Serial3/6 interface.

```
username xyz@cisco.com password 0 password1
username qos4-72b password 0 password1
username qos4-72a password 0 password1
aaa new-model
!
!
aaa authentication ppp default local
aaa session-id common

ip cef
vpdn enable
!
vpdn-group 1
 accept-dialin
  protocol any
  virtual-template 1
 terminate-from hostname lac
 local name lns
 lcp renegotiation always
 no l2tp tunnel authentication
 ip tos reflect
!

interface Serial3/6
 bandwidth 2015
 ip address 10.10.100.1 255.255.255.0
 no ip redirects
 no ip proxy-arp
 no ip mroute-cache
 load-interval 30
 no keepalive
 no cdp enable
!
```

Example: Verifying the SSS Session

The following example from the **show sss session** command shows that a user session is enabled on the LAC:

```
Router# show sss session

Current SSS Information: Total sessions 1
Uniq ID Type       State         Service      Identifier           Last Chg
401     PPPoE/PPP  connected     Forwarded    xyz@cisco.com        00:02:06
```

Example: Applying the QoS Policy Map

The following output shows a QoS policy map to be applied to the user session in the output direction, which is the downstream traffic coming into the PC from the web server. The first subclass of traffic within the session is marked with dscp af11, the second subclass is policed, and the third subclass is dropped.

```
class-map match-any customer1234
 match ip dscp cs1  cs2  cs3  cs4
class-map match-any customer56
 match ip dscp cs5  cs6
class-map match-any customer7
 match ip dscp cs7

policy-map downstream-policy
 class customer1234
  set ip dscp af11
 class customer56
  police cir 20000 bc 10000 pir 40000 be 10000
    conform-action set-dscp-transmit af21
    exceed-action set-dscp-transmit af22
    violate-action set-dscp-transmit af23
 class customer7
   drop
```

Example: Configuring the LAC

The following example from the **interface virtual-template** command shows a QoS policy map being applied to the user session on the LAC:

```
Router# configure terminal
Router(config)# interface virtual-template1
Router(config-if)# service-policy output downstream-policy
Router(config-if)# end
```

Example: Verifying the QoS Policy Map for Downstream Traffic

In the following example from the **show policy-map session** command, the QoS policy map is applied for traffic in the downstream direction.

Note The session ID, 401, is obtained from the output of the **show sss session** command in the "Example: Verifying the SSS Session" section on page 8.

```
Router# show policy-map session uid 401 output

SSS session identifier 401 -

  Service-policy output: downstream-policy

    Class-map: customer1234 (match-any)
      4464 packets, 249984 bytes
      5 minute offered rate 17000 bps, drop rate 0 bps
      Match: ip dscp cs1  cs2  cs3  cs4
        4464 packets, 249984 bytes
        5 minute rate 17000 bps
      QoS Set
        dscp af11
          Packets marked 4464

    Class-map: customer56 (match-any)
      2232 packets, 124992 bytes
      5 minute offered rate 8000 bps, drop rate 0 bps
      Match: ip dscp cs5  cs6
        2232 packets, 124992 bytes
        5 minute rate 8000 bps
      police:
          cir 20000 bps, bc 10000 bytes
          pir 40000 bps, be 10000 bytes
        conformed 2232 packets, 124992 bytes; actions:
          set-dscp-transmit af21
        exceeded 0 packets, 0 bytes; actions:
          set-dscp-transmit af22
        violated 0 packets, 0 bytes; actions:
          set-dscp-transmit af23
        conformed 8000 bps, exceed 0 bps, violate 0 bps

    Class-map: customer7 (match-any)
      1116 packets, 62496 bytes
      5 minute offered rate 4000 bps, drop rate 4000 bps
      Match: ip dscp cs7
        1116 packets, 62496 bytes
        5 minute rate 4000 bps
      drop

    Class-map: class-default (match-any)
      1236 packets, 68272 bytes
      5 minute offered rate 4000 bps, drop rate 0 bps
      Match: any
```

Example: Applying the QoS Policy Map to the Session

In the following example, the service provider applies a QoS policy map to the user session in order to limit the amount of bandwidth that the user session is permitted to consume in the upstream direction from the PC to the web server.

```
Router# configure terminal
Router(config)# policy-map upstream-policy
Router(config-pmap)# class class-default
```

```
Router(config-pmap-c) police cir 8000 bc 1500 be 1500 conform-action transmit
exceed-action drop
Router(config-if)# end
```

This QoS policy map is then applied to the user session as follows:

```
Router# configure terminal
Router(config)# interface virtual-template1
Router(config-if)# service-policy input upstream-policy
Router(config-if)# end
```

Example: Verifying the QoS Policy Map for Upstream Traffic

In the following example from the **show policy-map session** command, the QoS policy map is applied for traffic in the upstream direction.

Note The session ID, 401, is obtained from the output of the **show sss session** command in the "Example: Verifying the SSS Session" section on page 8.

```
Router# show policy-map session uid 401 input

 SSS session identifier 401 -

  Service-policy input: upstream-policy

    Class-map: class-default (match-any)
      1920 packets, 111264 bytes
      5 minute offered rate 7000 bps, drop rate 5000 bps
      Match: any
      police:
          cir 8000 bps, bc 1500 bytes
        conformed 488 packets, 29452 bytes; actions:
          transmit
        exceeded 1432 packets, 81812 bytes; actions:
          drop
        conformed 7000 bps, exceed 5000 bps
```

Command Reference

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

- **show policy-map session**

Additional References

Related Documents

Related Topic	Document Title
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	*Cisco IOS Quality of Service Solutions Command Reference*
Information about attaching policy maps to interfaces using the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC)	"Applying QoS Features Using the MQC" module
DSCP	"Overview of DiffServ for Quality of Service" module

Standards

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

MIBs

MIB	MIBs Link
No new or modified MIBs are supported, and support for existing MIBs has not been modified.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported, and support for existing RFCs has not been modified.	—

Technical Assistance

Description	Link
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Feature Information for QoS Classification, Policing, and Marking on a LAC

Table 1 lists the release history for this feature.

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Note Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 1 Feature Information for QoS Classification, Policing, and Marking on a LAC

Feature Name	Releases	Feature Information
QoS Classification, Policing, and Marking on a LAC	12.3(8)T	The QoS Classification, Policing, and Marking on the feature allows service providers to classify packets based upon the IP type of service (ToS) bits in an embedded IP packet. The classification is used to police the incoming traffic according to the differentiated services code point (DSCP) value. The following sections provide information about this feature: • Information About QoS Classification, Policing, and Marking on a LAC, page 2 • How to Configure QoS Classification, Policing, and Marking on a LAC, page 4 The following command was introduced or modified by this feature: **show policy-map session**.

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