



QoS—Ingress Hierarchical Policing for Cisco 12000 Series Router Line Cards

Part Number: OL-8681-01 (Rev. A0) November 16, 2007

Feature History

Release	Modification
12.0(30)S1	The feature was introduced for the Cisco 12000 4-port GE ISE line card.
12.0(31)S	This feature was marketed as part of the major release.
12.0(32)S	This feature was enhanced to work as an MQC based solution, on more Integrated Services Engine (ISE) and multiservice engine line cards, and with less restrictions.

This feature module contains the following sections:

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QoS—Ingress Hierarchical Policing Feature Overview

QoS—Ingress Hierarchical Policing for Cisco IOS software Release 12.0(32)S is a Cisco IOS Modular Quality of Service CLI (MQC)-based solution that supports hierarchical policing on the ingress interfaces of Integrated Services Engine (ISE) and multiservice engine line cards on Cisco 12000 series routers.

This feature allows enforcement of SLA agreements while applying classification sub-models for different QoS classes on the inbound provider edge interfaces.

QoS—Ingress Hierarchical Policing provides support for a 2-level hierarchical policy-map:

- Parent level—Consists of class-default or match-vlan class (in nCmD model) only and only has **police** with **transmit/drop** actions.
- Child level—Consists of a flat policy that can be configured with any action or class within the current restrictions of the hardware and the Cisco IOS release version.

This allows the user to police the ingress interface while applying different classification submodels on ingress interfaces.

The order of the actions within the hierarchical policy-map is from child to parent, except the queuing action (**shape**), which is executed after any **police/set** actions. If a police action is configured in a child policy, the child police action is executed first, then the parent police action.

The parent police bandwidth value is used as the reference bandwidth for the child policy in child percentage commands. The parent police bandwidth is calculated as follows:

```
if conform & exceed actions are drop => reference rate is zero.
else if conform action is drop => reference rate is: interface_rate-cir
(if interface_rate > cir then reference rate is zero).
else if exceed action is drop => reference rate is MIN(cir, interface_rate)
else reference rate is interface_rate.
```

The hierarchical policing policy map shown below first executes the police action of the nested policy map, child, and secondly, the main policy map, parent. The action invoked in the parent policy is the **police** command with only **transmit/drop actions** under **conform-action** and **exceed-action** options specified for class-default traffic. The child level consists of a flat policy that can be configured with any action or class within the current restrictions of the hardware and the Cisco IOS software release. Thus:

- Precedence 1 traffic from the customer edge router is policed to 100 megabits per second, with conforming packets retransmitted and remarked as precedence 3.
- Precedence 2 and precedence 3 traffic is policed to 100 megabits per second and is retransmitted, and all other traffic is policed to 200 megabits per second and retransmitted.

2-Level Policing with Hierarchical Policy Map

```
Router#
Router#config t
Router(config)#policy-map parent
Router(config-pmap)#Class class-default
Router(config-pmap-c)#police cir 200000000 bc 100000 be 100000
Router(config-pmap-c)#conform-action transmit
Router(config-pmap-c)#exceed-action drop
Router(config-pmap-c)#service-policy child
Router(config-pmap-c)#exit
Router(config-pmap)#exit
Router(config)#
Router(config)#policy-map child
Router(config-pmap)#class prec1
Router(config-pmap-c)#police cir 100000000 bc 3125000 be 3125000
Router(config-pmap-c)#conform-action set-prec-transmit 3
Router(config-pmap-c)#exceed-action drop
Router(config-pmap-c)#exit
Router(config-pmap)#class prec2
Router(config-pmap-c)#police cir 100000000 bc 3125000 be 3125000
Router(config-pmap-c)#conform-action transmit
Router(config-pmap-c)#exceed-action drop
Router(config-pmap-c)#exit
Router(config-pmap)#class prec3
```

```

Router(config-pmap-c)#police cir 100000000 bc 3125000 be 3125000
Router(config-pmap-c)#conform-action transmit
Router(config-pmap-c)#exceed-action drop
Router(config-pmap-c)#exit
Router(config-pmap)#exit
Router(config)#class-map match-any Prec1
Router(config-cmap)#Match ip precedence 1
Router(config-cmap)#exit
Router(config)#class-map match-any Prec2
Router(config-cmap)#Match ip precedence 2
Router(config-cmap)#exit
Router(config)#class-map match-any Prec3
Router(config-cmap)#Match ip precedence 3
Router(config-cmap)#exit
Router(config)#
Router(config)#interface gigabitEthernet 1/0.1
Router(config-if)#service-policy input parent
Router(config-if)#exit
Router(config)#exit
Router#

```

Class match counters of the parent class, as shown by the **show policy-map interface** command are the sum of all class match counters of the child classes. Dropped packets in the child class are counted in the class match counters of the parent. However, packets that are dropped by a child class due to a police action are not counted in the parent police.

**Note**

When traffic is dropped by a parent police action, there is no fairness between the traffic of its child classes.

Benefits

QoS—Ingress Hierarchical Policing for Cisco IOS Release 12.0(32)S is a Cisco IOS Modular Quality of Service CLI (MQC)-based solution.

Restrictions

QoS—Ingress Hierarchical Policing for Cisco IOS Release 12.0(32)S has the following restrictions.

1. Only configure parent police using transmit and drop actions.
2. The 2-rate, 3-color policer is not supported in hierarchical policing.
3. Random-detect and police cannot be configured in the same class in child policy.
4. QoS—Ingress Hierarchical Policing is not supported on Cisco 12000 SIP-400 Shared Port Adapters (SPAs).
5. In the nCmd QoS model, QoS—Ingress Hierarchical Policing is not supported on the 4GE-SFP-LC.
6. Hierarchical policing for Any Transport over MPLS (AToM) interfaces is supported only on Ethernet interfaces and subinterfaces.
7. QoS—Ingress Hierarchical Policing is not supported for link bundling interfaces.
8. Label sharing in TCAM, is not supported with ingress hierarchical policy-map on ATM line cards.
9. IPv6 is not supported.

10. Hierarchical policing is supported at interface and subinterfaces levels, except for ATM, where it is supported at virtual connection (VC) levels.

Related Features and Technologies

Cisco IOS Quality of Service (QoS) Solutions for Cisco 12000 series routers

Related Documents

For additional information on configuring Cisco 12000 series routers, refer to the following documents.

- *Cisco 12000 Series Router Configuration Guide for Cisco IOS Release 12.0S*
- *4-Port Gigabit Ethernet ISE Line Card for Cisco 12000 Series Internet Router*
- *Cisco IOS Release 12.0S Features for Cisco 12000 Series Internet Router*
- *Cisco IOS Quality of Service Solutions Configuration Guide, Release 12.2*
- *Cisco IOS Quality of Service Solutions Command Reference, Release 12.2*

Also, refer to the installation and configuration guide for a specific Cisco 12000 series router.

Supported Platforms

QoS—Ingress Hierarchical Policing is supported on the following Cisco 12000 series router Integrated Services Engine (ISE) and multiservice engine line cards and SPAs running Cisco IOS Release 12.0(32)S:

- POS line cards
 - 1-port OC-48c/STM16c POS
 - 1-port CHOC-48/STM16>OC-12/STM4>OC-3/STM1>DS3/E3
 - 4-port OC-12c/STM16c POS
 - 4-port CHOC-12/STM4>OC-3/STM1>DS3/E3
 - 16-port OC-3c/STM1c POS
 - 4-port OC-3c/STM1c POS
 - 8-port OC-3c/STM1c POS
- ATM line cards
 - 4-port OC-12/STM4 ATM LC
 - 8-port OC-3/STM1 ATM LC
 - 4-port OC-3/STM-1 ATM LC
- Channelized line cards
 - 1-port OC-12 DS1
- Cisco 12000 SIP-600 SPAs
 - 1-port OC-192c/STM-64c POS/RPR SPA
 - 1-port 10-Gigabit Ethernet SPA

- 5-port Gigabit Ethernet SPA
- 10-port Gigabit Ethernet SPA
- Cisco 12000 SIP-601 SPAs
 - 8-port Fast Ethernet SPA
 - 2-port Gigabit Ethernet SPA
 - 1-port channelized STM-1/OC-3 SPA
 - 1-port OC-192c STM-64 POS RPR XFP SPA
 - 2-port OC-48 POS RPR SPA
 - 2-port OC-3c/STM-1 POS SPA
 - 4-port OC-3c/STM-1 POS SPA

Supported Standards, MIBs, and RFCs

Standards

No new or modified standards are supported, and support for existing standards was not modified.

MIBs

No new or modified MIBs are supported, and support for existing MIBs was not modified.

RFCs

No new or modified RFCs are supported, and support for existing RFCs was not modified.

Prerequisites

No prerequisites are required for this feature.

Configuration Tasks

See [Configuration Examples](#).

Verifying, Monitoring, and Troubleshooting QoS—Ingress Hierarchical Policing

Use the following show commands to verify, monitor, and troubleshoot QoS—Ingress Hierarchical Policing.

Command	Purpose
Router# show class-map	Displays the QoS class map.
Router# show policy-map	Displays the QoS policy map.
Router# show policy-map interface <ifType> <slot/port>	Displays the policy maps and information for the specified interface (<i>ifType</i>).

Configuration Examples

Configure QoS–Ingress Hierarchical Policing as follows:

For 1CnD, nCnD QoS models:

```
Router#
Router#config t
Router (config) #Policy-map parent
Router (config-pmap) #class class-default
Router (config-pmap-c) #police 200M conform transmit exceed drop
Router (config-pmap-c) #service-policy child
Router (config-pmap-c) #exit
Router (config) #
Router (config) #policy-map child
Router (config-pmap) #class prec1
Router (config-pmap-c) #police 100M conform set-prec-transmit 2 exceed drop
Router (config-pmap-c) #exit
Router (config) #interface gigabitEthernet 1/0.1
Router (config-if) #service-policy input parent
Router (config-if) #exit
Router (config) #exit
Router#
```

For the nCmD QoS model:

```
Router#
Router#config t
Router (config) #class-map match-any customera
Router (config-cmap) #match vlan 1 - 3
Router (config-cmap) #exit
Router (config) #class-map match-any customerb
Router (config-cmap) #match vlan 4 - 6
Router (config-cmap) #exit
Router (config) #policy-map parent
Router (config-pmap) #class customera
Router (config-pmap-c) #police 200M conform transmit exceed drop
Router (config-pmap-c) #service-policy childa
Router (config-pmap-c) #exit
Router (config-pmap) #class customerb
Router (config-pmap-c) #police 300M conform transmit exceed drop
Router (config-pmap-c) #service-policy childb
Router (config-pmap-c) #exit
Router (config-pmap) #exit
Router (config) #interface gigabitEthernet 1/0.1
Router (config-if) #service-policy input parent
Router (config-if) #exit
Router (config) #exit
Router#
```

Command Reference

No new or modified commands were introduced for the QoS–Ingress Hierarchical Policing feature for Cisco IOS Release 12.0(32)S.

Glossary

AToM	Any Transport over MPLS
QoS	Cisco IOS Quality of Service
MQC	Cisco IOS Modular Quality of Service CLI (MQC)
SLA	Service level agreements
VC	Virtual connection

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