



Two-Rate Policer

This document describes the Two-Rate Policer feature and explains how to configure the feature.

Feature History

Release	Modification
12.2(4)T	This feature was introduced.
12.2(4)T3	Support for the Cisco 7500 series routers was added.
12.0(26)S	This feature was integrated into Cisco IOS Release 12.0(26)S for the Cisco 7200 and 7500 series routers.
12.2(27)SBA	This feature was integrated into Cisco IOS Release 12.2(27)SBA.

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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Feature Overview

Networks police traffic by limiting the input or output transmission rate of a class of traffic based on user-defined criteria. Policing traffic allows you to control the maximum rate of traffic sent or received on an interface and to partition a network into multiple priority levels or class of service (CoS).

The Two-Rate Policer performs the following functions:

- Limits the input or output transmission rate of a class of traffic based on user-defined criteria.
- Marks packets by setting the IP precedence value, IP differentiated services code point (DSCP) value, Multiprotocol Label Switching (MPLS) experimental value, Quality of Service (QoS) group, ATM Cell Loss Priority (CLP) bit, and the Frame Relay Discard Eligibility (DE) bit.

With the Two-Rate Policer, you can enforce traffic policing according to two separate rates—committed information rate (CIR) and peak information rate (PIR). You can specify the use of these two rates, along with their corresponding values, by using two keywords, **cir** and **pir**, of the **police** command.

The Two-Rate Policer manages the maximum rate of traffic through a token bucket algorithm. The token bucket algorithm can use the user-configured values to determine the maximum rate of traffic allowed on an interface at a given moment in time. The token bucket algorithm is affected by all traffic entering or leaving the interface (depending on the location of the interface on which the Two-Rate Policer is configured) and is useful in managing network bandwidth in cases where several large packets are sent in the same traffic stream.

The token bucket algorithm provides users with three actions for each packet: a conform action, an exceed action, and an optional violate action. Traffic entering the interface with Two-Rate Policer configured is placed in to one of these categories. Within these three categories, users can decide packet treatments. For instance, packets that conform can be configured to be sent, packets that exceed can be configured to be sent with a decreased priority, and packets that violate can be configured to be dropped.

The Two-Rate Policer is often configured on interfaces at the edge of a network to limit the rate of traffic entering or leaving the network. In the most common configurations, traffic that conforms is sent and traffic that exceeds is sent with a decreased priority or is dropped. Users can change these configuration options to suit their network needs.

**Note**

Additionally, the Two-Rate Policer enables you to implement Differentiated Services (DiffServ) Assured Forwarding (AF) Per-Hop Behavior (PHB) traffic conditioning. For more information about DiffServ, refer to the “Implementing DiffServ for End-to-End Quality of Service” chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide*, Release 12.3.

**Note**

Starting with Cisco IOS Release 12.1(5)T, you can police traffic by using the Traffic Policing feature (sometimes referred to as the single-rate policer). The Two-Rate Policer (available with Cisco IOS Release 12.2(4)T) is in addition to the Traffic Policing feature, and it provides additional functionality. For more information about the Traffic Policing feature, refer to the “Policing and Shaping Overview” chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide*, Release 12.2.

Benefits

Bandwidth Management Through Rate Limiting

This feature provides improved bandwidth management through rate limiting. Before this feature was available, you could police traffic with the single-rate Traffic Policing feature. The Traffic Policing feature provided a certain amount of bandwidth management by allowing you to set the peak burst size (be). The Two-Rate Policer supports a higher level of bandwidth management and supports a sustained excess rate. With the Two-Rate Policer, you can enforce traffic policing according to two separate rates—CIR and PIR—specified in bits per second (bps).

Packet Marking Through IP Precedence, DSCP Value, MPLS Experimental Value, and the QoS Group Setting

In addition to rate-limiting, the Two-Rate Policer allows you to independently mark the packet according to whether the packet conforms, exceeds, or violates a specified rate. Packet marking also allows you to partition your network into multiple priority levels or classes of service (CoS).

- Use the Two-Rate Policer to set the IP precedence value, the IP DSCP value, or the MPLS experimental value for packets that enter the network. Then networking devices within your network can use this setting to determine how the traffic should be treated. For example, the Weighted Random Early Detection (WRED) feature uses the IP precedence value to determine the probability that a packet will be dropped.
- Use the Two-Rate Policer to assign packets to a QoS group. The router uses the QoS group to determine how to prioritize packets within the router.

If you want to mark traffic but do not want to use the Two-Rate Policer, see the *Class-Based Marking* feature module available with Cisco IOS Release 12.2(2)T. More information about the Class-Based Marking feature is available from the Cisco documentation website (Cisco.com) or the Cisco documentation CD.

Packet Marking for Frame Relay Frames

The Two-Rate Policer allows users to mark the Frame Relay DE bit of the Frame Relay frame. The Frame Relay DE bit is one bit and, therefore, can be set to either 0 or 1. In congested environments, frames that have the DE bit set to 1 are discarded before frames that have the DE bit set to 0.

Packet Marking for ATM Cells

The Two-Rate Policer allows users to mark the ATM CLP bit in ATM cells. The ATM CLP bit is used to prioritize packets in ATM networks. The ATM CLP bit is one bit and, therefore, can be set to either 0 or 1. In congested environments, cells that have the ATM CLP bit set to 1 are discarded before cells that have the ATM CLP bit set to 0.

Restrictions

The following restrictions apply to the Two-Rate Policer:

- On a Cisco 7500 series router, traffic policing can monitor Cisco Express Forwarding (CEF) or Distributed CEF (dCEF) switching paths only. To use the Two-Rate Policer, CEF or dCEF must be configured on both the interface receiving the packet and the interface sending the packet.
- On a Cisco 7500 series router, traffic policing cannot be applied to packets that originated from or are destined to a router.
- Two-rate policing can be configured on an interface, a subinterface, a Frame Relay data-link connection identifier (DLCI), and an ATM permanent virtual circuit (PVC).
- Two-rate policing is not supported on the following interfaces:

- Fast EtherChannel
- PRI
- Any interface on a Cisco 7500 series router that does not support CEF or dCEF

Prerequisites

Supported Platforms

- Cisco 2600 series
- Cisco 3620
- Cisco 3640
- Cisco 7100 series
- Cisco 7200 series
- Cisco 7500 series (VIP-based platform only)



Note

To use the *set-clp-transmit* action available with this feature, the Enhanced ATM Port Adapter (PA-A3) is required. Therefore, the *set-clp-transmit* action is not supported on any platform that does not support the PA-A3 adapter (such as the Cisco 2600 series router, the Cisco 3620 router, and the 3640 router). For more information, refer to the documentation for your specific router.

- On a Cisco 7500 series router, CEF or dCEF must be configured on the interface before you can use the Two-Rate Policer. For additional information on CEF or dCEF, refer to the *Cisco IOS Switching Services Configuration Guide*, Release 12.2.
- To configure the Two-Rate Policer, a traffic class and a service policy must be created, and the service policy must be attached to a specified interface. These tasks are performed using the Modular QoS CLI. For information on the Modular QoS CLI, see the “Modular Quality of Service Command-Line Interface” chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide*, Release 12.2.

Configuration Tasks

See the following sections for configuration tasks for the Two-Rate Policer feature. Each task in the list is identified as either required or optional.

- [Configuring the Two-Rate Policer](#) (required)
- [Verifying the Two-Rate Policer Configuration](#) (optional)

Configuring the Two-Rate Policer

The Two-Rate Policer is configured in the service policy. To configure the Two-Rate Policer, use the following command in policy-map class configuration mode:

Command	Purpose
<code>Router(config-pmap-c)# police {cir cir} [bc conform-burst] {pir pir} [be peak-burst]</code>	Specifies that both the CIR and the PIR are to be used for two-rate traffic policing. The bc and be keywords and their associated arguments (<i>conform-burst</i> and <i>peak-burst</i> , respectively) are optional.

Although not required for configuring the Two-Rate Policer, the command syntax of the **police** command also allows you to specify the action to be taken on a packet when you enable an optional *action* argument. The resulting action corresponding to the keyword choices are listed in [Table 1](#).

Table 1 *police Command Action Keywords*

Keyword	Resulting Action
drop	Drops the packet.
set-clp-transmit	Sets the ATM CLP bit from 0 to 1 on the ATM cell and sends the packet with the ATM CLP bit set to 1.
set-dscp-transmit <i>new-dscp</i>	Sets the IP DSCP value and sends the packet with the new IP DSCP value setting.
set-frde-transmit	Sets the Frame Relay DE bit from 0 to 1 on the Frame Relay frame and sends the packet with the DE bit set to 1.
set-mpls-exp-transmit	Sets the MPLS experimental bits from 0 to 7 and sends the packet with the new MPLS experimental bit value setting.
set-prec-transmit <i>new-prec</i>	Sets the IP precedence and sends the packet with the new IP precedence value setting.
set-qos-transmit <i>new-qos</i>	Sets the QoS group value and sends the packet with the new QoS group value setting.
transmit	Sends the packet with no alteration.

The Two-Rate Policer works by using a token bucket mechanism. There are currently two types of token bucket algorithms: a single token bucket algorithm (available through the Traffic Policing feature) and a two token bucket algorithm (available through the Two-Rate Policer).

For more information about the single-rate Traffic Policing feature, refer to the “Policing and Shaping Overview” chapter in the *Cisco IOS Quality of Service Solutions Configuration Guide*, Release 12.2.

For more information about the two token bucket algorithm, see the [Command Reference](#) section of this document.

Verifying the Two-Rate Policer Configuration

To verify that the Two-Rate Policer is configured on your interface, use the following command in EXEC or privileged EXEC mode:

Command	Purpose
Router# show policy-map interface	Displays statistics and configurations of all input and output policies attached to an interface.

Troubleshooting Tips

- Check the interface type. Verify that your interface is not listed as a nonsupported interface in the [Restrictions](#) section of this document.
- For input traffic policing on a Cisco 7500 series router, verify that CEF or dCEF is configured on the interface on which traffic policing is configured.
- For output traffic policing on a Cisco 7500 series router, ensure that the incoming traffic is CEF-switched or dCEF-switched. Traffic policing cannot be used on the switching path unless CEF or dCEF switching is enabled.

Monitoring and Maintaining the Two-Rate Policer

To monitor and maintain the Two-Rate Policer, use the following EXEC or privileged EXEC mode commands:

Command	Purpose
Router# show policy-map	Displays all configured policy maps.
Router# show policy-map <i>policy-map-name</i>	Displays the user-specified policy map.
Router# show policy-map interface	Displays statistics and configurations of all input and output policies that are attached to an interface.

Configuration Examples

This section provides the following configuration example:

- [Limiting the Traffic Using a Policer Class Example](#)

Limiting the Traffic Using a Policer Class Example

In this example, the Two-Rate Policer is configured on a class to limit traffic to an average committed rate of 500 kbps and a peak rate of 1 Mbps.

```
Router(config)# class-map police
Router(config-cmap)# match access-group 101
Router(config-cmap)# policy-map policy1
Router(config-pmap)# class police
Router(config-pmap-c)# police cir 500000 bc 10000 pir 1000000 be 10000 conform-action
transmit exceed-action set-prec-transmit 2 violate-action drop
Router(config-pmap-c)# interface s3/0
Router(config-if)# service-policy output policy1
Router(config-if)# end
```

```
Router# show policy-map policy1
Policy Map policy1
Class police
  police cir 500000 conform-burst 10000 pir 1000000 peak-burst 10000 conform-action
transmit exceed-action set-prec-transmit 2 violate-action drop
```

Traffic marked as conforming to the average committed rate (500 kbps) will be sent as is. Traffic marked as exceeding 500 kbps, but not exceeding 1 Mbps, will be marked with IP Precedence 2 and then sent. All traffic exceeding 1 Mbps will be dropped. The burst parameters are set to 10000 bytes.

In the following example, 1.25 Mbps of traffic is sent (“offered”) to a *policer* class.

```
Router# show policy-map interface s3/0
Serial3/0

Service-policy output: policy1

Class-map: police (match all)
  148803 packets, 36605538 bytes
  30 second offered rate 1249000 bps, drop rate 249000 bps
Match: access-group 101
police:
  cir 500000 bps, conform-burst 10000, pir 1000000, peak-burst 100000
  conformed 59538 packets, 14646348 bytes; action: transmit
  exceeded 59538 packets, 14646348 bytes; action: set-prec-transmit 2
  violated 29731 packets, 7313826 bytes; action: drop
  conformed 499000 bps, exceed 500000 bps violate 249000 bps

Class-map: class-default (match-any)
  19 packets, 1990 bytes
  30 seconds offered rate 0 bps, drop rate 0 bps
Match: any
```

The Two-Rate Policer marks 500 kbps of traffic as conforming, 500 kbps of traffic as exceeding, and 250 kbps of traffic as violating the specified rate. Packets marked as conforming will be sent as is, and packets marked as exceeding will be marked with IP Precedence 2 and then sent. Packets marked as violating the specified rate are dropped.

Additional References

The following sections provide references related to the Two Rate Policer feature.

Related Documents

Related Topic	Document Title
Modular Quality of Service Command-Line Interface	• <i>Cisco IOS Quality of Service Solutions Configuration Guide</i>, Release 12.3 • <i>Cisco IOS Quality of Service Solutions Command Reference</i>, Release 12.3
QOS features	• <i>Class-based Weighted Fair Queueing</i> • <i>Class-Based Marking</i> • <i>Traffic Policing</i>

Standards

Standards	Title
None	—

MIBs

MIBs	MIBs Link
• CISCO-CLASS-BASED-QOS-MIB • CISCO-CLASS-BASED-QOS-CAPABILITY-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

RFCs

RFCs	Title
RFC 2698	<i>A Two Rate Three Color Marker</i>

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml

Command Reference

This section does not have any new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.3 command reference publications.

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