Packet Classification Using the Frame Relay DLCI Number

The Packet Classification Using the Frame Relay DLCI Number feature allows customers to match and classify traffic on the basis of one or more Frame Relay data-link connection identifier (DLCI) numbers. This new match criterion is in addition to the other match criteria, such as the IP precedence, differentiated service code point (DSCP) value, and class of service (CoS), currently available.

Feature History for Packet Classification Using the Frame Relay DLCI Number

Release	Modification
12.2(13)T	This feature was introduced.
12.0(26)S	This feature was integrated into Cisco IOS Release 12.0(26)S for the Cisco Series 7200 and 7500 routers.
12.0(28)S	The feature was enhanced to allow specifying a range of Frame Relay DLCI numbers as a match criterion.
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.

Contents

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Information About Packet Classification Using the Frame Relay DLCI Number

To configure Packet Classification Using the Frame Relay DLCI Number, you need to understand the following concepts:

Packet Classification Using the Frame Relay DLCI Number Benefits

Additional Match Criterion

This feature provides an additional criterion for matching and classifying traffic. With this feature, you can now specify DLCI number ranges in addition to specifying individual DLCI numbers. This new match criterion is in addition to the other match criteria, such as the IP precedence, differentiated service code point (DSCP) value, and class of service (CoS), currently available.

Extends Functionality of MQC

The Packet Classification Using the Frame Relay DLCI Number feature extends the functionality of the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC). The MQC, a feature included in the Cisco IOS software, allows customers to match traffic on the basis of user-specified criteria (for example, access lists, or IP precedences). With this feature, the MQC can now use DLCI number ranges to match and classify traffic.

Frame Relay DLCI Number Ranges

This feature allows you to specify a range of Frame Relay DLCI numbers as match criteria for matching and classifying traffic. Previously, only individual DLCI numbers could be specified.

With this feature, the **match fr-dlci** command has been modified to allow you to specify a range of DLCI numbers. A hyphen (-) keyword has been added to the command to indicate that a range of DLCI numbers will be entered. To specify a range, enter the DLCI number at the beginning of the range, the new hyphen (-) keyword, followed by the DLCI number at the end of the range. For more information about the **match fr-dlci** command, see the "Command Reference" section later in this document.

Modular Quality of Service Command-Line Interface

The Packet Classification Using the Frame Relay DLCI Number feature extends the functionality of the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC).

The MQC, a feature included in the Cisco IOS software, allows customers to match traffic on the basis of user-specified criteria (for example, access lists, or IP precedences). Traffic that matches that criteria can be organized into specific classes (class maps) that can, in turn, receive specific user-defined QoS treatment when that class is included in a policy map. The class map is placed in a policy map, and the policy map is then attached to an interface for use on the network.

The MQC is a CLI that allows you to create traffic policies and attach these policies to interfaces.

In the MQC, the **class-map** command is used to define a traffic class (which is then associated with a traffic policy). The purpose of a traffic class is to classify traffic.

The MQC consists of the following three processes:

- Defining a traffic class with the **class-map** command.
- Creating a traffic policy by associating the traffic class with one or more QoS features (using the **policy-map** command).
- Attaching the traffic policy to the interface with the **service-policy** command.

A traffic class contains three major elements: a name, a series of **match** commands, and, if more than one **match** command exists in the traffic class, an instruction on how to evaluate these **match** commands. The traffic class is named in the **class-map** command line; that is, if you enter the **class-map cisco** command while configuring the traffic class in the CLI, the traffic class would be named “cisco”.

The **match** commands are used to specify various criteria for classifying packets. Packets are checked to determine whether they match the criteria specified in the **match** commands. If a packet matches the specified criteria, that packet is considered a member of the class and is forwarded according to the quality of service (QoS) specifications set in the traffic policy. Packets that fail to meet any of the matching criteria are classified as members of the default traffic class.

DLCI Numbers and Network Addressing

A DLCI number is a data link connection identifier. Permanent virtual circuits (PVCs) and switched virtual circuits (SVCs) are identified by a DLCI number. The DLCI number defines a single virtual connection through the WAN and are the Frame Relay equivalent to a hardware address.

Periodically, through the exchange of signaling messages, a network may announce a new virtual circuit with its corresponding DLCI number. However, protocol addressing is not included in the announcement. The station receiving such an indication will learn of the new connection, but will not be able to address the other side. Without a new configuration or mechanism for discovering the protocol address of the other side, this new virtual circuit is unusable.

For this reason, Inverse Address Resolution Protocol (Inverse ARP) was developed. Inverse ARP allows a Frame Relay network to discover the protocol address associated with the virtual circuit, and ARP is more flexible than relying on static configuration.

How to Configure Packet Classification Using the Frame Relay DLCI Number

This section contains the following procedures:

- Configuring the Class Map to Match on the Frame Relay DLCI Number, page 4 (required)
- Creating a Policy Map, page 5 (required)
- Attaching the Policy Map to an Interface, page 5 (required)
- Verifying the Configuration, page 6 (optional)

Configuring the Class Map to Match on the Frame Relay DLCI Number

Class maps can be used to classify packets into groups based on a user-specified criterion. For example, class maps can be configured to match packets on the basis of the DSCP value or access list number. In this case, the class map is configured to match on the Frame Relay DLCI number associated with the packet.

To configure the class map to match on the Frame Relay DLCI number, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map** *class-map-name* [**match-all** | **match-any**]
4. **match fr-dlci** *dlci-number* [- *dlci-number*]
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**class-map** *class-map-name* [**match-all** | **match-any**] **Example:** `Router(config)# class-map class1`	Specifies the name of the class map to be created and enters class-map configuration mode. • Enter class map name. **Note** If the **match-all** or **match-any** keyword is not specified, traffic must match all the match criteria to be classified as part of the traffic class.
Step 4	**match fr-dlci** *dlci-number* [- *dlci-number*] **Example:** `Router(config-cmap) match fr-dlci 25 510-512 55`	Configures the class map created above to match traffic based on the Frame Relay DLCI number associated with the packet. • Enter the DLCI numbers or DLCI ranges. Enter as many DLCI numbers, DLCI ranges, or both as needed.
Step 5	**exit** **Example:** `Router(config-cmap)# exit`	(Optional) Exits class-map configuration mode.

Creating a Policy Map

Traffic that matches a user-specified criterion can be organized into specific classes (class maps) that can, in turn, receive specific user-defined QoS treatment when that class is included in a policy map. A policy map (traffic policy) is created using the MQC.

To create a policy map using the MQC, refer to the instructions in the "Configuring the Modular Quality of Service Command-Line Interface" chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Attaching the Policy Map to an Interface

After a policy map is created, the next step is to attach the policy map to an interface. Policy maps can be attached to either the input or output direction of the interface.

Depending on the needs of your network, you may need to attach the policy map to a subinterface, an ATM PVC, a Frame Relay DLCI, or other type of interface.

To attach the policy map to an interface, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **pvc** [*name*] *vpi/vci* [**ilmi** | **qsaal** | **smds**]
5. **service-policy** {**input** | **output**} *policy-map-name*
6. **exit**

DETAILED STEPS

	Command or Action	Purpose

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

Step 2	`configure terminal`
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	`interface` *type number* **Example:** `Router(config)# interface s4/0`	Configures an interface (or subinterface) type and enters interface configuration mode. • Enter the interface type number.

	Command or Action	Purpose
Step 4	**pvc** [*name*] *vpi*/*vci* [**ilmi** | **qsaal** | **smds**] **Example:** `Router(config-if)# pvc cisco 0/16 ilmi`	(Optional) Creates or assigns a name to an ATM PVC and specifies the encapsulation type on an ATM PVC. Enters ATM VC configuration mode. **Note** This step is required only if you are attaching the policy map to an ATM PVC. If you are not attaching the policy map to an ATM PVC, skip this step and proceed with Step 5.
Step 5	**service-policy** {**input** | **output**} *policy-map-name* **Example:** `Router(config-if)# service-policy input policy1`	Specifies the name of the policy map to be attached to the input *or* output direction of the interface. **Note** Policy maps can be configured on ingress or egress routers. They can also be attached in the input or output direction of an interface. The direction (input or output) and the router (ingress or egress) to which the policy map should be attached varies according your network configuration. When using the **service-policy** command to attach the policy map to an interface, be sure to choose the router and the interface direction that are appropriate for your network configuration. • Enter the policy map name.
Step 6	**exit** **Example:** `Router(config-if)# exit`	(Optional) Exits interface configuration mode.

Verifying the Configuration

To verify the configuration, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **show class-map** [*class-map-name*]

   and/or

   show policy-map interface *interface-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 class-map** [*class-map-name*] **Example:** `Router# show class-map class1`	Displays all information about a class map, including the match criteria.
	and/or	
	show policy-map interface *interface-name* **Example:** `Router# show policy-map interface s4/0`	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface. • Enter the interface name.
Step 3	**exit** **Example:** `Router# exit`	(Optional) Exits EXEC mode.

Troubleshooting Tips

The commands in the "Verifying the Configuration" section allow you to verify that you achieved the intended configuration and that the feature is functioning correctly.

If, after using the **show** commands listed above, you find that the configuration is not correct or the feature is not functioning as expected, perform these steps:

1. Use the **show running-config** command and analyze the output of the command.
2. If the policy map does not appear in the output of the **show running-config** command, enable the **logging console** command.
3. Attach the policy map to the interface again.

If the packets are not being matched correctly (for example, the packet counters are not incrementing correctly), complete the following steps:

1. Run the **show policy-map** command and analyze the output of the command.
2. Run the **show running-config** command and analyze the output of the command.
3. Use the **show policy-map interface** command and analyze the output of the command. Check the the following findings:
   a. If a policy map applies queueing, and the packets are matching the correct class, but you see unexpected results, compare the number of the packets in the queue with the number of the packets matched.
   b. If the interface is congested, and only a small number of the packets are being matched, check the tuning of the tx ring, and evaluate whether the queueing is happening on the tx ring. To do this, use the **show controllers** command, and look at the value of the tx count in the output of the command.

Configuration Examples for Packet Classification Using the Frame Relay DLCI Number

This section provides the following configuration example:

- Configuring the Frame Relay DLCI Number As a Match Criterion: Example, page 8

Configuring the Frame Relay DLCI Number As a Match Criterion: Example

In the following example, two PVCs are configured on one serial interface. QoS is provisioned so that one PVC receives 70 percent of the bandwidth and the other PVC receives 25 percent of the bandwidth. When configured as shown below, all traffic belonging to Frame Relay DLCI-102 is guaranteed 70 percent of the bandwidth, while traffic belonging to Frame Relay DLCI-105 is guaranteed 25 percent of the bandwidth.

```
Router(config)# class-map match-all dlci-102
Router(config-cmap)# match fr-dlci 102 110-155 350

Router(config)# class-map match-all dlci-105
Router(config-cmap)# match fr-dlci 105 110 117 200-210

Router(config)# policy-map test-policy
Router(config-pmap)# class dlci-102
Router(config-pmap-c)# bandwidth percent 70
Router(config-pmap)# class dlci-105
Router(config-pmap-c)# bandwidth percent 25

Router(config)# interface Serial9/0/0:0
Router(config-if)# service-policy output test-policy
```

In the following example, QoS is further provisioned for traffic for a PVC (while also guaranteeing bandwidth to the PVC) by using a hierarchical policy. In this configuration example, traffic for PVC 102 (Frame Relay DLCI-102, shown above) is allocated 40 percent of the bandwidth.

```
Router(config)# class-map match-all precedence2
Router(config-cmap)# match ip precedence 2
```

```
Router(config)# policy-map child
Router(config-pmap)# class precedence2
Router(config-pmap-c)# bandwidth percent 40

Router(config)# policy-map test-policy
Router(config-pmap)# class dlci-102
Router(config-pmap-c)# bandwidth percent 70
Router(config-pmap-c)# service-policy child
Router(config-pmap)# class dlci-105
Router(config-pmap-c)# bandwidth percent 25

Router(config)# interface Serial9/0/0:0
Router(config-if)# service-policy output test-policy
```

Additional References

The following sections provide references related to the Packet Classification Using the Frame Relay DLCI Number feature.

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*, Release 12.3 T
Modular QoS Command-Line Interface (CLI) (MQC)	*Cisco IOS Quality of Service Solutions Configuration Guide*
Information about attaching policy maps to interfaces	*Cisco IOS Quality of Service Solutions Configuration Guide*
Information about attaching policy maps to Frame Relay DLCIs	*Cisco IOS Wide-Area Networking Configuration Guide*
Additional match criteria that can be used for packet classification	*Cisco IOS Quality of Service Solutions Configuration Guide*
Frame Relay configuration information and information about DLCIs	*Cisco IOS Wide-Area Networking Configuration Guide*
Frame Relay commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	*Cisco IOS Wide-Area Networking Command Reference*, Release 12.3 T

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

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
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
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 documents modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.3 command reference publications.

- **match fr-dlci**
- **show class-map**
- **show policy-map interface**

match fr-dlci

To specify the Frame Relay data-link connection identifier (DLCI) number as a match criterion in a class map, use the **match fr-dlci** command in class-map configuration mode. To remove a previously specified DLCI number as a match criterion, use the **no** form of this command.

match fr-dlci *dlci-number*

no match fr-dlci *dlci-number*

Syntax Description

dlci-number	Number of the DLCI associated with the packet.

Defaults

No DLCI number is specified.

Command Modes

Class-map configuration

Command History

Release	Modification
12.2(13)T	This command was introduced.
12.2(27)SBA	This command was integrated into Cisco IOS Release 12.2(27)SBA.

Usage Guidelines

This match criterion can be used in main interfaces and point-to-multipoint subinterfaces in Frame Relay networks, and it can also be used in hierarchical policy maps.

Examples

In the following example a class map called “class1” has been created and the Frame Relay DLCI number of 500 has been specified as a match criterion. Packets matching this criterion are placed in class1.

```
Router(config)# class-map class1
Router(config-cmap)# match fr-dlci 500
Router(config-cmap)# end
```

Related Commands

Command	Description
show class-map	Displays all class maps and their matching criteria.
show policy-map interface	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.

show class-map

To display all class maps and their matching criteria, use the **show class-map** command in EXEC mode.

show class-map [*class-map-name*]

Syntax Description

class-map-name	(Optional) Name of the class map. The class map name can be a maximum of 40 alphanumeric characters.

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.2(13)T	This command was modified to display the Frame Relay data-link connection identified (DLCI) number as a criterion for matching traffic inside a class map. In addition, this command was modified to display Layer 3 packet length as a criterion for matching traffic inside a class map.
12.2(27)SBA	This command was integrated into Cisco IOS Release 12.2(27)SBA.

Usage Guidelines

You can use the **show class-map** command to display all class maps and their matching criteria. If you enter the optional *class-map-name* argument, the specified class map and its matching criteria will be displayed.

Examples

In the following example, three class maps are defined. Packets that match access list 103 belong to class c3, IP packets belong to class c2, and packets that come through input Ethernet interface 1/0 belong to class c1. The output from the **show class-map** command shows the three defined class maps.

```
Router# show class-map

 Class Map c3
 Match access-group 103

 Class Map c2
 Match protocol ip

 Class Map c1
 Match input-interface Ethernet1/0
```

In the following example, a class map called “c1” has been defined, and the Frame Relay DLCI number of 500 has been specified as a match criterion:

```
Router# show class-map

class map match-all c1
   match fr-dlci 500
```

Table 1 describes the significant fields shown in the display.

Table 1 show class-map Field Descriptions[1]

Field	Description
Class-map	Class of traffic being displayed. Output is displayed for each configured class map in the policy. The choice for implementing class matches (for example, match-all or match-any) can also appear next to the traffic class.
Match	Match criteria specified for the class map. Choices include criteria such as the Frame Relay DLCI number, Layer 3 packet length, IP precedence, IP differentiated services code point (DSCP) value, Multiprotocol Label Switching (MPLS) experimental value, access groups, and quality of service (QoS) groups.

1. A number in parentheses may appear next to the class-map name, and match criteria information. The number is for Cisco internal use only and can be disregarded.

Related Commands

Command	Description
class-map	Creates a class map to be used for matching packets to a specified class.
match fr-dlci	Specifies the Frame Relay DLCI number as a match criterion in a class map.
match packet length (class-map)	Specifies and uses the length of the Layer 3 packet in the IP header as a match criterion in a class map.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.

show policy-map interface

To display the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific permanent virtual circuit (PVC) on the interface, use the **show policy-map interface** command in EXEC mode.

show policy-map interface *interface-name* [**vc** [*vpi/*] *vci*][**dlci** *dlci*] [**input** | **output**]

Syntax Description

interface-name	Name of the interface or subinterface whose policy configuration is to be displayed.
vc	(Optional) For ATM interfaces only, shows the policy configuration for a specified PVC. The name can be up to 16 characters long.
vpi/	(Optional) ATM network virtual path identifier (VPI) for this PVC. On the Cisco 7200 and 7500 series routers, this value ranges from 0 to 255. The absence of both the forward slash (*/*) and a *vpi* value defaults the *vpi* value to 0. If this value is omitted, information for all virtual circuits (VCs) on the specified ATM interface or subinterface is displayed. The *vpi* and *vci* arguments cannot both be set to 0; if one is 0, the other cannot be 0.
vci	(Optional) ATM network virtual channel identifier (VCI) for this PVC. This value ranges from 0 to 1 less than the maximum value set for this interface by the **atm vc-per-vp** command. Typically, the lower values 0 to 31 are reserved for specific traffic (F4 Operation, Administration, and Maintenance (OAM), switched virtual circuit (SVC) signaling, Integrated Local Management Interface (ILMI), and so on) and should not be used. The VCI is a 16-bit field in the header of the ATM cell. The VCI value is unique only on a single link, not throughout the ATM network, because it has local significance only. The *vpi* and *vci* arguments cannot both be set to 0; if one is 0, the other cannot be 0.
dlci	(Optional) Indicates a specific PVC for which policy configuration will be displayed.
dlci	(Optional) Specific data-link connection identifier (DLCI) number used on the interface. Policy configuration for the corresponding PVC will be displayed when a DLCI is specified.
input	(Optional) Indicates that the statistics for the attached input policy will be displayed.
output	(Optional) Indicates that the statistics for the attached output policy will be displayed.

Defaults

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was integrated into Cisco IOS Release 12.0(5)XE.
12.0(7)S	This command was integrated into Cisco IOS Release 12.0(7)S.
12.1(1)E	This command was integrated into Cisco IOS Release 12.1(1)E.
12.1(2)T	This command was modified to display information about the policy for all Frame Relay PVCs on the interface, or, if a DLCI is specified, the policy for that specific PVC. This command was also modified to display the total number of packets marked by the QoS set action.
12.1(3)T	This command was modified to display per-class accounting statistics.
12.2(4)T	This command was modified to display burst parameters and associated actions.
12.2(8)T	This command was modified to display the multiple actions configured for packets conforming to, exceeding, or violating a specific rate.
12.0(28)S	The output of this command was modified for the QoS: Percentage-Based Policing feature to include milliseconds when calculating the committed (conform) burst (bc) and excess (peak) burst (be) sizes.
12.2(27)SBA	This command was integrated into Cisco IOS Release 12.2(27)SBA.

Usage Guidelines

The **show policy-map interface** command displays the configuration for classes on the specified interface or the specified PVC only if a service policy has been attached to the interface or the PVC.

Examples

The following is sample output from the **show policy-map interface** command. This sample displays the statistics for the serial 2/0 interface on which traffic policing has been enabled. The committed (conform) burst (bc) and excess (peak) burst (be) are specified in milliseconds (ms).

```
Router# show policy-map interface s2/0
 Serial2/0

  Service-policy output: policy1 (1050)

    Class-map: class1 (match-all) (1051/1)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match: ip precedence 0  (1052)
      police:
          cir 20 % bc 300 ms
          cir 409500 bps, bc 15360 bytes
          pir 40 % be 400 ms
          pir 819000 bps, be 40960 bytes
        conformed 0 packets, 0 bytes; actions:
          transmit
        exceeded 0 packets, 0 bytes; actions:
          drop
        violated 0 packets, 0 bytes; actions:
          drop
        conformed 0 bps, exceed 0 bps, violate 0 bps

    Class-map: class-default (match-any) (1054/0)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
```

```
    Match: any  (1055)
      0 packets, 0 bytes
      5 minute rate 0 bps
```

In this example, the CIR and PIR are displayed in bps, and both the committed burst (bc) and excess burst (be) are displayed in bits.

The CIR, PIR bc, and be are calculated on the basis of the formulas described below.

Formula for Calculating the CIR

When calculating the CIR, the following formula is used:

- CIR percentage specified (as shown in the output of the **show policy-map** command) * bandwidth (BW) of the interface (as shown in the output of the **show interfaces** command) = total bits per second

According to the output of the **show interfaces** command for the serial 2/0 interface, the interface has a bandwidth (BW) of 2048 kbps.

```
Router # show interfaces s2/0
Serial2/0 is administratively down, line protocol is down
  Hardware is M4T
  MTU 1500 bytes, BW 2048 Kbit, DLY 20000 usec, rely 255/255, load 1/255
```

The following values are used for calculating the CIR:

20 % * 2048 kbps = 409600 bps

Formula for Calculating the PIR

When calculating the PIR, the following formula is used:

- PIR percentage specified (as shown in the output of the **show policy-map** command) * bandwidth (BW) of the interface (as shown in the output of the **show interfaces** command) = total bits per second

According to the output of the **show interfaces** command for the serial 2/0 interface, the interface has a bandwidth (BW) of 2048 kbps.

```
Router # show interfaces s2/0
Serial2/0 is administratively down, line protocol is down
  Hardware is M4T
  MTU 1500 bytes, BW 2048 Kbit, DLY 20000 usec, rely 255/255, load 1/255
```

The following values are used for calculating the PIR:

40 % * 2048 kbps = 819200 bps

Note Discrepancies between this total and the total shown in the output of the **show policy-map interface** command can be attributed to a rounding calculation or to differences associated with the specific interface configuration.

Formula for Calculating the Committed Burst (bc)

When calculating the bc, the following formula is used:

- The bc in milliseconds (as shown in the **show policy-map** command) * the CIR in bits per seconds = total number bytes

The following values are used for calculating the bc:

300 ms * 409600 bps = 15360 bytes

Formula for Calculating the Excess Burst (be)

When calculating the bc and the be, the following formula is used:

- The be in milliseconds (as shown in the **show policy-map** command) * the PIR in bits per seconds = total number bytes

The following values are used for calculating the be:

400 ms * 819200 bps = 40960 bytes

Table 2 describes the significant fields shown in the display.

Table 2 show policy-map interface Field Descriptions[1]

Field	Description
Service-policy output	Name of the output service policy applied to the specified interface or VC.
Class-map	Class of traffic being displayed. Output is displayed for each configured class in the policy. The choice for implementing class matches (for example, match-all or match-any) can also appear next to the traffic class.
packets and bytes	Number of packets (also shown in bytes) identified as belonging to the class of traffic being displayed.
offered rate	Rate, in kbps, of packets coming in to the class.
drop rate	Rate, in kbps, at which packets are dropped from the class. The drop rate is calculated by subtracting the number of successfully transmitted packets from the offered rate.
Match	Match criteria specified for the class of traffic. Choices include criteria such as the Layer 3 packet length, IP precedence, IP differentiated services code point (DSCP) value, Multiprotocol Label Switching (MPLS) experimental value, access groups, and quality of service (QoS) groups. For more information about the variety of match criteria options that are available, refer to the "Configuring the Modular Quality of Service Command-Line Interface" chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide*.
police	Indicates that traffic policing has been enabled. Display includes the CIR, PIR (in both a percentage of bandwidth and in bps) and the bc and be in bytes and milliseconds. Also displays the optional conform, exceed, and violate actions, if any, and the statistics associated with these optional actions.

1. A number in parentheses may appear next to the service-policy output name, class-map name, and match criteria information. The number is for Cisco internal use only and can be disregarded.

Related Commands

Command	Description
police (percent)	Configures traffic policing on the basis of a percentage of bandwidth available on an interfaces.
shape (percent)	Specifies average or peak rate traffic shaping on the basis of a percentage of bandwidth available on an interface.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.
show interfaces	Displays statistics for all interfaces configured on the router or access server.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map class	Displays the configuration for the specified class of the specified policy map.