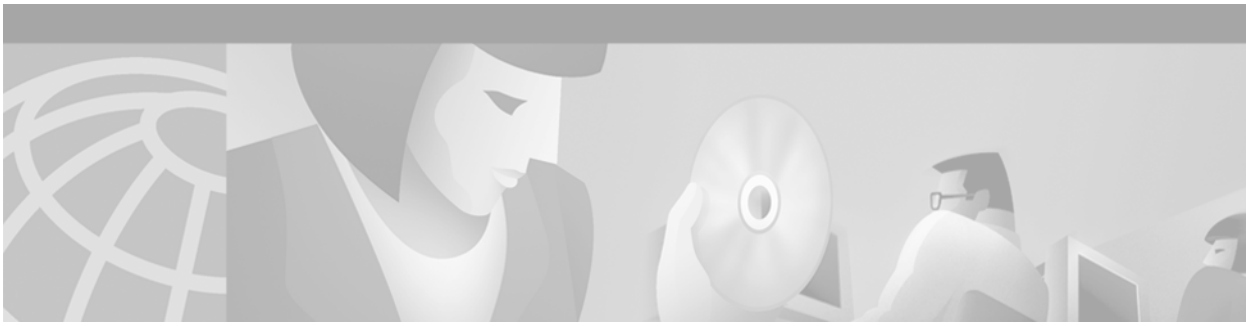

Configuring Policy-Based Routing

This chapter describes the tasks for configuring policy-based routing (PBR) on a router.

For complete conceptual information about this feature, see the section "Policy-Based Routing" in the chapter "Classification Overview" in this book.

For a complete description of the PBR commands in this chapter, refer to the *Cisco IOS Quality of Service Solutions Command Reference*. To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

To identify the hardware platform or software image information associated with a feature, use the Feature Navigator on Cisco.com to search for information about the feature or refer to the software release notes for a specific release. For more information, see the "Identifying Supported Platforms" section in the "Using Cisco IOS Software" chapter in this book.

Policy-Based Routing Configuration Task List

To configure PBR, perform the tasks described in the following sections. The task in the first section is required; the tasks in the remaining sections are optional.

- Enabling PBR (Required)
- Enabling Fast-Switched PBR (Optional)
- Enabling Local PBR (Optional)
- Enabling CEF-Switched PBR (Optional)

See the end of this chapter for the section "Policy-Based Routing Configuration Examples."

Enabling PBR

To enable PBR, you must create a route map that specifies the match criteria and the resulting action if all of the match clauses are met. Then, you must enable PBR for that route map on a particular interface. All packets arriving on the specified interface matching the match clauses will be subject to PBR.

To enable PBR on an interface, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# route-map map-tag [permit | deny] [sequence-number]`	Defines a route map to control where packets are output. This command puts the router into route-map configuration mode.

Step 2	`Router(config-route-map)# match length min max`
	
	`Router(config-route-map)# match ip address {access-list-number | name} [...access-list-number | name]`
		Specifies the match criteria.
		
		Although there are many route-map matching options, here you can specify only length and/or ip address.
		
		• **length** matches the Level 3 length of the packet.
		• **ip address** matches the source or destination IP address that is permitted by one or more standard or extended access lists.
		
		If you do not specify a **match** command, the route map applies to *all* packets.

Step 3	`Router(config-route-map)# set ip precedence [number | name]`
	
	`Router(config-route-map)# set ip df`
	
	`Router(config-route-map)# set ip vrf vrf_name`
	
	`Router(config-route-map)# set ip next-hop ip-address [... ip-address]`
	
	`Router(config-route-map)# set ip next-hop recursive ip-address [... ip-address]`
	
	`Router(config-route-map)# set interface interface-type interface-number [... type number]`
	
	`Router(config-route-map)# set ip default next-hop ip-address [... ip-address]`
	
	`Router(config-route-map)# set default interface interface-type interface-number [... type ...number]`
		Specifies the action(s) to take on the packets that match the criteria. You can specify any or all of the following:
		
		• **precedence**: Sets precedence value in the IP header. You can specify either the precedence number or name.
		• **df**: Sets the 'Don't Fragment' (DF) bit in the ip header.
		• **vrf**: Sets the VPN Routing and Forwarding (VRF) instance.
		• **next-hop**: Sets next hop to which to route the packet.
		• **next-hop recursive**: Sets next hop to which to route the packet if the hop is to a router which is not adjacent.
		• **interface**: Sets output interface for the packet.
		• **default next-hop**: Sets next hop to which to route the packet if there is no explicit route for this destination.
		• **default interface**: Sets output interface for the packet if there is no explicit route for this destination.

	Command	Purpose
Step 4	`Router(config-route-map)# interface interface-type interface-number`	Specifies the interface, and puts the router into interface configuration mode.
Step 5	`Router(config-if)# ip policy route-map map-tag`	Identifies the route map to use for PBR. One interface can have only one route map tag; but you can have several route map entries, each with its own sequence number. Entries are evaluated in order of their sequence numbers until the first match occurs. If no match occurs, packets are routed as usual.

The **set** commands can be used in conjunction with each other. They are evaluated in the order shown in Step 3 in the previous task table. A usable next hop implies an interface. Once the local router finds a next hop and a usable interface, it routes the packet.

Note Enabling PBR disables fast switching of all packets arriving on this interface.

If you want PBR to be fast-switched, see the section "Enabling Fast-Switched PBR," which follows.

Enabling Fast-Switched PBR

IP PBR can now be fast-switched. Prior to Cisco IOS Release 12.0, PBR could only be process-switched, which meant that on most platforms the switching rate was approximately 1000 to 10,000 packets per second. This speed was not fast enough for many applications. Users that need PBR to occur at faster speeds can now implement PBR without slowing down the router.

Fast-switched PBR supports all of the **match** commands and most of the **set** commands, with the following restrictions:

- The **set ip default next-hop** and **set default interface** commands are not supported.
- The **set interface** command is supported only over point-to-point links, unless a route cache entry exists using the same interface specified in the **set interface** command in the route map. Also, at the process level, the routing table is consulted to determine if the interface is on a reasonable path to the destination. During fast switching, the software does not make this check. Instead, if the packet matches, the software blindly forwards the packet to the specified interface.

PBR must be configured before you configure fast-switched PBR. Fast switching of PBR is disabled by default. To enable fast-switched PBR, use the following command in interface configuration mode:

Command	Purpose
`Router(config-if)# ip route-cache policy`	Enables fast switching of PBR.

To display the cache entries in the policy route cache, use the **show ip cache policy** command. To display which route map is associated with which interface, use the **show ip policy** command.

Enabling Local PBR

Packets that are generated by the router are not normally policy-routed. To enable local PBR for such packets, indicate which route map the router should use by using the following command in global configuration mode:

Command	Purpose
`Router(config)# ip local policy route-map map-tag`	Identifies the route map to use for local PBR.

All packets originating on the router will then be subject to local PBR.

Use the **show ip local policy** command to display the route map used for local PBR, if one exists.

Enabling CEF-Switched PBR

Beginning in Cisco IOS Release 12.0, PBR is supported in the Cisco Express Forwarding (CEF) switching path. CEF-switched PBR has better performance than fast-switched PBR and, therefore, is the optimal way to perform PBR on a router.

No special configuration is required to enable CEF-switched PBR. It is on by default as soon as you enable CEF and PBR on the router.

Note The **ip route-cache policy** command is strictly for fast-switched PBR and, therefore, not required for CEF-switched PBR.

Policy-Based Routing Configuration Examples

The following sections provide PBR configuration examples:

- Equal Access Example
- Differing Next Hops Example

For information on how to configure policy-based routing, see the section "Policy-Based Routing Configuration Task List" in this chapter.

Note The examples shown below involve the use of the **access-list** command (ACL). The log keyword should not be used with this command in policy-based routing (PBR) because logging is not supported at the interrupt level for ACLs.

Equal Access Example

The following example provides two sources with equal access to two different service providers. Packets arriving on asynchronous interface 1 from the source 209.165.200.225 are sent to the router at 209.165.200.228 if the router has no explicit route for the destination of the packet. Packets arriving from

the source 209.165.200.226 are sent to the router at 209.165.200.229 if the router has no explicit route for the destination of the packet. All other packets for which the router has no explicit route to the destination are discarded.

```
access-list 1 permit 209.165.200.225
access-list 2 permit 209.165.200.226
!
interface async 1
 ip policy route-map equal-access
!
route-map equal-access permit 10
 match ip address 1
 set ip default next-hop 209.165.200.228
route-map equal-access permit 20
 match ip address 2
 set ip default next-hop 209.165.200.229
route-map equal-access permit 30
 set default interface null0
```

Differing Next Hops Example

The following example illustrates how to route traffic from different sources to different places (next hops), and how to set the Precedence bit in the IP header. Packets arriving from source 209.165.200.225 are sent to the next hop at 209.165.200.227 with the Precedence bit set to priority; packets arriving from source 209.165.200.226 are sent to the next hop at 209.165.200.228 with the Precedence bit set to critical.

```
access-list 1 permit 209.165.200.225
access-list 2 permit 209.165.200.226
!
interface ethernet 1
 ip policy route-map Texas
!
route-map Texas permit 10
 match ip address 1
 set ip precedence priority
 set ip next-hop 209.165.200.227
!
route-map Texas permit 20
 match ip address 2
 set ip precedence critical
 set ip next-hop 209.165.200.228
```