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:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong>&lt;br&gt;Router(config)# <code>route-map map-tag</code> [permit</td>
<td>deny] [sequence-number]</td>
</tr>
<tr>
<td><strong>Step 2</strong>&lt;br&gt;Router(config-route-map)# <code>match length</code> min max&lt;br&gt;Router(config-route-map)# <code>match ip address</code> { access-list-number</td>
<td>name } [...access-list-number</td>
</tr>
<tr>
<td><strong>Step 3</strong>&lt;br&gt;Router(config-route-map)# <code>set ip precedence</code> [number</td>
<td>name]</td>
</tr>
</tbody>
</table>
Configuring Policy-Based Routing

Policy-Based Routing Configuration Task List

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:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>Router(config-if)# ip route-cache policy</code></td>
<td>Enables fast switching of PBR.</td>
</tr>
</tbody>
</table>

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:

```
Router(config)# ip local policy route-map map-tag
```

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.

**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 1.1.1.1 are sent to the router at 6.6.6.6 if the router has no explicit route for the destination of the packet. Packets arriving from the source 2.2.2.2 are sent to the router at 7.7.7.7 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 ip 1.1.1.1
access-list 2 permit ip 2.2.2.2
!
interface async 1
  ip policy route-map equal-access
!
```
route-map equal-access permit 10
match ip address 1
set ip default next-hop 6.6.6.6
route-map equal-access permit 20
match ip address 2
set ip default next-hop 7.7.7.7
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 1.1.1.1 are sent to the next hop at 3.3.3.3 with the Precedence bit set to priority; packets arriving from source 2.2.2.2 are sent to the next hop at 3.3.3.5 with the Precedence bit set to critical.

access-list 1 permit ip 1.1.1.1
access-list 2 permit ip 2.2.2.2
!
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 3.3.3.3
!
route-map Texas permit 20
match ip address 2
set ip precedence critical
set ip next-hop 3.3.3.5