



Policy-Based Routing (PBR)

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Note

- For complete syntax and usage information for the commands used in this chapter, see these publications:
http://www.cisco.com/en/US/products/ps9536/prod_command_reference_list.html
 - Cisco IOS Release 12.2SY supports only Ethernet interfaces. Cisco IOS Release 12.2SY does not support any WAN features or commands.
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Tip

For additional information about Cisco Catalyst 6500 Series Switches (including configuration examples and troubleshooting information), see the documents listed on this page:

http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html

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Prerequisites for PBR

None.

Restrictions for PBR

The PFC and any DFCs provide the hardware support for the following:

- These IPv4 PBR commands:
 - **match ip address**
 - **match length**
 - **set ip next-hop** (2,000 instances)
 - **set ip default next-hop**
 - **set interface null0**
 - **set default interface null0**
 - **set ip vrf**
 - **set ip default vrf**
- If the RP address falls within the range of a PBR ACL, traffic addressed to the RP is policy routed in hardware instead of being forwarded to the RP. To prevent policy routing of traffic addressed to the RP, configure PBR ACLs to deny traffic addressed to the RP.
- Local PBR.
- IPv4 PBR recursive next-hop with load balancing.
- IPv6 PBR is supported in software.
- IPv6 PBR recursive next-hop is not supported.

Information About PBR

- [PBR Overview, page 31-2](#)
- [PBR Recursive Next Hop for IPv4 Traffic, page 31-3](#)

PBR Overview

PBR is an alternative to routing protocols and allows you to configure a policy for unicast traffic flows, which provides more control over routing than a routing protocol does and avoids the need to configure interface-level traffic classification. PBR can route unicast traffic along a different path than a routing protocol would use. PBR can provide:

- Equal access
- Protocol-sensitive routing
- Source-sensitive routing
- Routing based on interactive rather than batch traffic
- Routing based on dedicated links

PBR route maps can be configured to do the following:

- Allow or deny paths based on the identity of a particular end system, an application protocol, or the size of packets or a combination of these values.
- Classify traffic based on extended access list criteria.

- Set IP precedence bits.
- Route packets to specific paths.

PBR applies a route map to all ingress unicast traffic received on a PBR-enabled interface. PBR cannot be applied to egress traffic or to multicast traffic.

If the ingress unicast traffic does not match any route map statements, the route map applies all the configured set clauses. Routing protocols forward traffic that matches a route-map deny statement and traffic that does not match any route-map permit statements.

PBR Recursive Next Hop for IPv4 Traffic

The PBR Recursive Next Hop feature enables configuration of a recursive next-hop address in a PBR route map. The recursive next-hop address is installed in the routing table and can be a subnet that is not directly connected. If the recursive next-hop address is not available, traffic is routed using a default route.

Default Settings for PBR

None.

How to Configure PBR

- [Configuring PBR](#)
- [Configuring Local PBR](#)
- [Configuring PBR Recursive Next Hop](#)

**Note**

For information about Multi-VRF Selection Using Policy Based Routing (PBR VRF), see this document:
http://www.cisco.com/en/US/docs/ios/mps/configuration/guide/mp_mltvrf_slct_pbr.html

Configuring PBR

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

	Command	Purpose
Step 1	Router(config)# route-map <i>map-tag</i> [permit deny] [<i>sequence-number</i>]	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 <i>min max</i> Router(config-route-map)# match ip address { <i>access-list-number</i> <i>name</i> } [... <i>access-list-number</i> <i>name</i>]	Specifies the match criteria. Although there are many route-map matching options, here you can specify only length and/or ip address. <ul style="list-style-type: none"> 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 <i>all</i> packets.
Step 3	Router(config-route-map)# set ip precedence [<i>number</i> <i>name</i>] Router(config-route-map)# set ip df Router(config-route-map)# set ip vrf <i>vrf_name</i> Router(config-route-map)# set ip next-hop <i>ip-address</i> [... <i>ip-address</i>] Router(config-route-map)# set ip next-hop recursive <i>ip-address</i> [... <i>ip-address</i>] Router(config-route-map)# set interface <i>interface-type interface-number</i> [... <i>type number</i>] Router(config-route-map)# set ip default next-hop <i>ip-address</i> [... <i>ip-address</i>] Router(config-route-map)# set default interface <i>interface-type interface-number</i> [... <i>type ...number</i>]	Specifies the action(s) to take on the packets that match the criteria. You can specify any or all of the following: <ul style="list-style-type: none"> 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 <i>interface-type</i> <i>interface-number</i>	Specifies the interface, and puts the router into interface configuration mode.
Step 5	Router(config-if)# ip policy route-map <i>map-tag</i>	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.

Configuring Local PBR

To configure PBR for all traffic that originates on the switch, perform this task:

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



Note

- Local PBR traffic is processed in software on the RP.
- Use the **show ip local policy** command to display the route map used for local PBR.

Configuring PBR Recursive Next Hop

- [Setting the Recursive Next-Hop IP Address, page 31-5](#)
- [Verifying the Recursive Next-Hop Configuration, page 31-6](#)

Setting the Recursive Next-Hop IP Address



Note

PBR supports only one recursive next-hop IP address per route-map entry.

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	access-list permit source Example: Router(config)# access-list 101 permit 10.60.0.0 0.0.255.255	Configures an access list. The example configuration permits any source IP address that falls within the 10.60.0.0. 0.0.255.255 subnet.
Step 4	route-map map-tag Example: Router(config)# route-map abccomp	Enables policy routing and enters route-map configuration mode.
Step 5	set ip next-hop ip-address Example: Router(config-route-map)# set ip next-hop 10.10.1.1	Sets a next-hop router IP address. Note Set this IP address separately from the next-hop recursive router configuration.
Step 6	set ip next-hop {ip-address [...ip-address] recursive ip-address} Example: Router(config-route-map)# set ip next-hop recursive 10.20.3.3	Sets a recursive next-hop IP address. Note This configuration does not ensure that packets get routed using the recursive IP address if an intermediate IP address is a shorter route to the destination.
Step 7	match ip address access-list-number Example: Router(config-route-map)# match ip address 101	Sets an access list to be matched.
Step 8	end Example: Router(config-route-map)# end	Exits route-map configuration mode and returns to privileged EXEC mode.

Verifying the Recursive Next-Hop Configuration

To verify the recursive next-hop configuration, perform the following steps.

Step 1 show running-config | begin abccomp

Use this command to verify the IP addresses for a next-hop and recursive next-hop IP address, for example:

```
Router# show running-config | begin abccomp

route-map abccomp permit 10
  match ip address 101 ! Defines the match criteria for an access list.
  set ip next-hop recursive 10.3.3.3 ! If the match criteria are met, the recursive IP
  address is set.
  set ip next-hop 10.1.1.1 10.2.2.2 10.4.4.4
```

Step 2 show route-map *map-name*

Use this command to display the route maps, for example:

```
Router# show route-map abccomp

route-map abccomp, permit, sequence 10
  Match clauses:
    ip address (access-lists): 101
  Set clauses:
    ip next-hop recursive 10.3.3.3
    ip next-hop 10.1.1.1 10.2.2.2 10.4.4.4
  Policy routing matches: 0 packets, 0 bytes
```

Configuration Examples for PBR

- [Equal Access Example](#)
- [Differing Next Hops Example](#)
- [Recursive Next-Hop IP Address: Example](#)



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
```

Recursive Next-Hop IP Address: Example

The following example shows the configuration of IP address 10.3.3.3 as the recursive next-hop router:

```
route-map abccomp
  set ip next-hop 10.1.1.1
  set ip next-hop 10.2.2.2
  set ip next-hop recursive 10.3.3.3
  set ip next-hop 10.4.4.4
```



Tip

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