Configuring Policy-Based Routing

This chapter describes how to configure policy based routing on the Cisco NX-OS device.

This chapter includes the following sections:

Information About Policy-Based Routing

Policy-based routing allows you to configure a defined policy for IPv4 and IPv6 traffic flows, lessening reliance on routes derived from routing protocols. All packets received on an interface with policy-based routing enabled are passed through enhanced packet filters or *route maps*. The route maps dictate the policy, determining where to forward packets.

Route maps are composed of match and set statements that you can mark as permit or deny. You can interpret the statements as follows:

- If the packets match any route map statements, all the set statements are applied. One of these actions involves choosing the next hop.
- If the statement is marked as permit and the packets do not match any route-map statements, the packets are sent back through the normal forwarding channels and destination-based routing is performed.

For more information, see the "Route Maps" section on page 14-282.

Policy-based routing includes the following features:

- Source-based routing—Routes traffic that originates from different sets of users through different connections across the policy routers.

This section includes the following topics:

- Policy Route Maps, page 15-302
- Set Criteria for Policy-Based Routing, page 15-302

Policy Route Maps

Each entry in a route map contains a combination of match and set statements. The match statements define the criteria for whether appropriate packets meet the particular policy (that is, the conditions to be met). The set clauses explain how the packets should be routed once they have met the match criteria.

You can mark the route-map statements as permit or deny. If the statement is marked as a deny, the packets that meet the match criteria are sent back through the normal forwarding channels (destination-based routing is performed). If the statement is marked as permit and the packets meet the match criteria, all the set clauses are applied. If the statement is marked as permit and the packets do not meet the match criteria, those packets are also forwarded through the normal routing channel.

> **Note** Policy routing is specified on the interface that receives the packets, not on the interface from which the packets are sent.

Set Criteria for Policy-Based Routing

The set criteria in a route map are evaluated in the order listed in the route map. Set criteria specific to route maps used for policy-based routing are as follows:

- List of specified IP addresses—The IP address can specify the adjacent next-hop router in the path toward the destination to which the packets should be forwarded. The first IP address associated with a connected interface that is currently up is used to route the packets.

If the packets do not meet any of the defined match criteria, the packets are routed through the normal destination-based routing process.

Licensing Requirements for Policy-Based Routing

The following table shows the licensing requirements for this feature:

Product	License Requirement
Cisco NX-OS	Policy-based routing requires an Enterprise Services license. For a complete explanation of the Cisco NX-OS licensing scheme and how to obtain and apply licenses, see the *Cisco NX-OS Licensing Guide*.

Prerequisites for Policy-Based Routing

Policy-based routing has the following prerequisites:

- Install the correct license.

- You must enable policy-based routing (see the "Enabling the Policy-Based Routing Feature" section on page 15-303).

- Assign an IP address on the interface and bring the interface up before you apply a route map on the interface for policy-based routing.

Guidelines and Limitations for Policy-Based Routing

Policy-based routing has the following configuration guidelines and limitations:

- A policy-based routing route map can have only one match or set statement per route-map statement.

- A **match** command can refer to only one ACL in a route map used for policy-based routing.

- An ACL used in a policy-based routing route map cannot include a deny statement.

- The same route map can be shared among different interfaces for policy-based routing as long as the interfaces belong to the same virtual routing and forwarding (VRF) instance.

- The Cisco Nexus 5500 does not support multi-sequence configuration in policy-based routing.

- The Cisco Nexus 5500 does not support policy-based routing over Equal Cost Multi Path (ECMP).

Default Settings

Table 15-1 lists the default settings for policy-based routing parameters.

Table 15-1   Default Policy-based Routing Parameters

Parameters	Default
Policy-based routing	Disabled

Configuring Policy-Based Routing

This section includes the following topics:

- Enabling the Policy-Based Routing Feature, page 15-303

- Configuring a Route Policy, page 15-304

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Note   If you are familiar with the Cisco IOS CLI, be aware that the Cisco NX-OS commands for this feature might differ from the Cisco IOS commands that you would use.

Enabling the Policy-Based Routing Feature

You must enable the policy-based routing feature before you can configure a route policy.

SUMMARY STEPS

1. **configure terminal**

2. feature pbr

3. (Optional) show feature

4. (Optional) copy running-config startup-config

DETAILED STEPS

	Command	Purpose

Step 1	`configure terminal`
	
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	`feature pbr`
	
	Example:
	`switch(config)# feature pbr`
		Enables the policy-based routing feature.

Step 3	`show feature`
	
	Example:
	`switch(config)# show feature`
		(Optional) Displays enabled and disabled features.

Step 4	`copy running-config startup-config`
	
	Example:
	`switch(config)# copy running-config`
	`startup-config`
		(Optional) Saves this configuration change.

Use the **no feature pbr** command to disable the policy-based routing feature and remove all associated configuration.

Command	Purpose

`no feature pbr`
 	
Example:
`switch(config)# no feature pbr`
	Disables policy-based routing and removes all associated configuration.

Configuring a Route Policy

You can use route maps in policy-based routing to assign routing policies to the inbound interface. See the "Configuring Route Maps" section on page 14-292.

SUMMARY STEPS

1. configure terminal

2. interface *type slot/port*

3. ip policy route-map *map-name*

or

ipv6 policy route-map *map-name*

4. (Optional) exit

5. **(Optional) exit**

6. **(Optional) copy running-config startup-config**

DETAILED STEPS

	Command	Purpose

Step 1	`configure terminal`
	
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	`interface` *type slot/port*
	
	Example:
	`switch(config)# interface ethernet 1/2`
	`switch(config-if)#`
		Enters interface configuration mode.

Step 3	`ip policy route-map` *map-name* **Example:** `switch(config-if)# ip policy route-map Testmap`	Assigns a route map for IPv4 policy-based routing to the interface.
	`ipv6 policy route-map` *map-name* **Example:** `switch(config-if)# ipv6 policy route-map TestIPv6map`	Assigns a route map for IPv6 policy-based routing to the interface.

Step 4	`exit`
	
	Example:
	`switch(config-route-map)# exit`
		(Optional) Exits route-map configuration mode.

Step 5	`exit`
	
	Example:
	`switch(config)# exit`
		(Optional) Exits global configuration mode.

Step 6	`copy running-config startup-config`
	
	Example:
	`switch# copy running-config startup-config`
		(Optional) Saves this configuration change.

This example shows how to add a route map to an interface:

```
switch# configure terminal
switch(config)# interface ethernet 1/2
switch(config-if)# ip policy route-map Testmap
switch(config)# exit
switch(config)# copy running-config startup-config
```

You can configure the following optional match parameters for route maps in route-map configuration mode:

Command	Purpose
match ip address *access-list-name* **Example:** switch(config-route-map)# match ip address ACL1	Matches an IPv4 address against an IP access control list (ACL). This command is used for policy-based routing and is ignored by route filtering or redistribution.
match ipv6 address *access-list-name* **Example:** switch(config-route-map)# match ipv6 address ACLv6	Matches an IPv6 address against an IPv6 ACL. This command is used for policy-based routing and is ignored by route filtering or redistribution.

You can configure the following optional set parameters for route maps in route-map configuration mode:

Command	Purpose
set ip next-hop *address1* [*address2...*] **Example:** switch(config-route-map)# set ip next-hop 192.0.2.1	Sets the IPv4 next-hop address for policy-based routing. This command uses the first valid next-hop address if multiple addresses are configured.
set ipv6 next-hop *address1* [*address2...*] **Example:** switch(config-route-map)# set ipv6 next-hop 2001:0DB8::1	Sets the IPv6 next-hop address for policy-based routing. This command uses the first valid next-hop address if multiple addresses are configured.
set interface {**null0**} **Example:** switch(config-route-map)# set interface null0	Sets the interface used for routing. Use the **null0** interface to drop packets.

Cisco Nexus 5500 routes the packet as soon as it finds a next hop and an interface.

Verifying the Policy-Based Routing Configuration

To display policy-based routing configuration information, perform one of the following tasks:

Command	Purpose
show [**ip**	**ipv6**] **policy** [*name*]	Displays information about an IPv4 or IPv6 policy.
show route-map [*name*] **pbr-statistics**	Displays policy statistics.

Use the **route-map** *map-name* **pbr-statistics** to enable policy statistics. Use the **clear route-map** *map-name* **pbr-statistics** to clear these policy statistics

Configuration Examples for Policy-Based Routing

This example shows how to configure a simple route policy on an interface:

```
feature pbr
ip access-list pbr-sample
  permit tcp host 10.1.1.1 host 192.168.2.1 eq 80
!
route-map pbr-sample
 match ip address pbr-sample
 set ip next-hop 192.168.1.1
!
route-map pbr-sample pbr-statistics

 interface ethernet 1/2
  ip policy route-map pbr-sample
```

The following output verifies this configuration:

```
switch# show route-map pbr-sample

route-map pbr-sample, permit, sequence 10
 Match clauses:
   ip address (access-lists): pbr-sample
 Set clauses:
   ip next-hop 192.168.1.1

switch# show route-map pbr-sample pbr-statistics

route-map pbr-sample, permit, sequence 10
 Policy routing matches: 84 packets
```

Related Topics

The following topics can give more information on Policy Based Routing:

- Chapter 14, "Configuring Route Policy Manager"

Additional References

For additional information related to implementing IP, see the following sections:

Related Documents

Related Topic	Document Title
Policy-based routing CLI commands	*Cisco Nexus 5500 Series NX-OS Unicast Routing Command Reference, Release 6.x*

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.	—