

Configuring Policy-Based Routing

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

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Information About Policy-Based Routing

Policy-based routing allows you to configure a defined policy for IPv4 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.

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.
- Load sharing—Distributes traffic among multiple paths based on the traffic characteristics.

Policy Route Maps

Route-Maps are used to filter routes that are distributed across various routing protocols and between different entities in a given routing protocol. 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 is evaluated in the order listed in the route map. Set criteria specific to route maps used for policy-based routing are as follows:

1. 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 currently up connected interface is used to route the packets.



Note You can optionally configure the set criteria for next-hop addresses to load balance traffic across up to 16 IP addresses. In this case, Cisco NX-OS sends all traffic for each IP flow to a particular IP next-hop address.

2. NULL interface—Traffic that matches the match statement is dropped if you use the set null interface.

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

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).

- 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 match command cannot refer to more than 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.

Default Settings

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

Table 1: Default Policy-based Routing Parameters

Parameters	Default
Policy-based routing	Disabled

Configuring Policy-Based Routing



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

Procedure

	Command or Action	Purpose

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

Step 2	**feature pbr** **Example:** `switch(config)# feature pbr`	Enables the policy-based routing feature.
Step 3	(Optional) **show feature** **Example:** `switch(config)# show feature`	Displays enabled and disabled features.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.

Example

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.

SUMMARY STEPS

1. **configure terminal**
2. **interface** *type slot/port*
3. **ip policy route-map** *map-name*

4. (Optional) **exit**
5. (Optional) **exit**
6. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global 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.
Step 4	(Optional) **exit** **Example:** `switch(config-route-map)# exit`	Exits route-map configuration mode.
Step 5	(Optional) **exit** **Example:** `switch(config)# exit`	Exits global configuration mode.
Step 6	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves this configuration change.

Example

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 *name* [*name...*] **Example:** `switch(config-route-map)# match ip address access-list-name ACL1`	Matches an IPv4 address against one or more IP access control lists (ACLs). 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...*] { **load-share** } **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. Use the optional **load-share** keyword to load balance traffic across a maximum of 16 next-hop addresses.
set ip default next-hop *address1* [*address2...*] { **load-share** } **Example:** `switch(config-route-map)# set ip default next-hop 192.0.2.2`	Sets the IPv4 next-hop address for policy-based routing when there is no explicit route to a destination. This command uses the first valid next-hop address if multiple addresses are configured. Use the optional **load-share** keyword to load balance traffic across a maximum of 16 next-hop addresses.

Cisco NX-OS 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 policy [*name*]	Displays information about an IPv4 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.

Displaying Policy-Based Routing Statistics

Use the **show route-map** *rmap-name* **pbr-statistics** command to display the statistics for policy-based routing. The statistics are maintained for each route-map sequence. It shows the number of packets that are policy-routed

based on the match condition in a given route-map sequence. All other packets that are routed using the default routing table (could be due to unreachable next-hops in the set command) are also displayed. The PBR statistics collection must be turned on before any statistics can be shown.

This example shows how to display PBR statistics:

```
switch(config)# show route-map pbr-sample pbr-statistics
```

Clearing Policy-Based Routing Statistics

Use the **clear route-map** *rmap-name* **pbr-statistics** command to clear the counters maintained for PBR statistics of a route-map.

This example shows how to clear PBR statistics:

```
switch(config)# clear route-map pbr-sample pbr-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:

```
n3000# 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

n3000# 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:

- Configuring Route Policy Manager

Additional References

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

- Related Documents
- Standards

Related Documents

Related Topic	Document Title
Policy-based routing CLI commands	Cisco Nexus 3000 Series NX-OS Unicast Routing Command Reference

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.	—

Feature History for Policy-Based Routing

Table below lists the release history for this feature.

Table 2: Feature History for Policy-Based Routing

Feature Name	Releases	Feature Information
Policy-based routing	6.0(2)A7(1)	This feature was introduced.