Cisco Nexus 9000 Series NX-OS ePBR Configuration Guide, Release 9.3(x)

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Preface

This preface includes the following sections:

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- Document Conventions, on page v
- Related Documentation for Cisco Nexus 9000 Series Switches, on page vi
- Documentation Feedback, on page vi
- Communications, services, and additional information, on page vi

Audience

This publication is for network administrators who install, configure, and maintain Cisco Nexus switches.

Document Conventions

Command descriptions use the following conventions:

Convention	Description
bold	Bold text indicates the commands and keywords that you enter literally as shown.
Italic	Italic text indicates arguments for which you supply the values.
[x]	Square brackets enclose an optional element (keyword or argument).
[x | y]	Square brackets enclosing keywords or arguments that are separated by a vertical bar indicate an optional choice.
{x | y}	Braces enclosing keywords or arguments that are separated by a vertical bar indicate a required choice.
[x {y | z}]	Nested set of square brackets or braces indicate optional or required choices within optional or required elements. Braces and a vertical bar within square brackets indicate a required choice within an optional element.

Convention	Description
`variable`	Indicates a variable for which you supply values, in context where italics cannot be used.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string includes the quotation marks.

Examples use the following conventions:

Convention	Description
`screen font`	Terminal sessions and information the switch displays are in screen font.
`boldface screen font`	Information that you must enter is in boldface screen font.
italic screen font	Arguments for which you supply values are in italic screen font.
< >	Nonprinting characters, such as passwords, are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

Related Documentation for Cisco Nexus 9000 Series Switches

The entire Cisco Nexus 9000 Series switch documentation set is available at the following URL:

https://www.cisco.com/en/US/products/ps13386/tsd_products_support_series_home.html

Documentation Feedback

To provide technical feedback on this document, or to report an error or omission, please send your comments to nexus9k-docfeedback@cisco.com. We appreciate your feedback.

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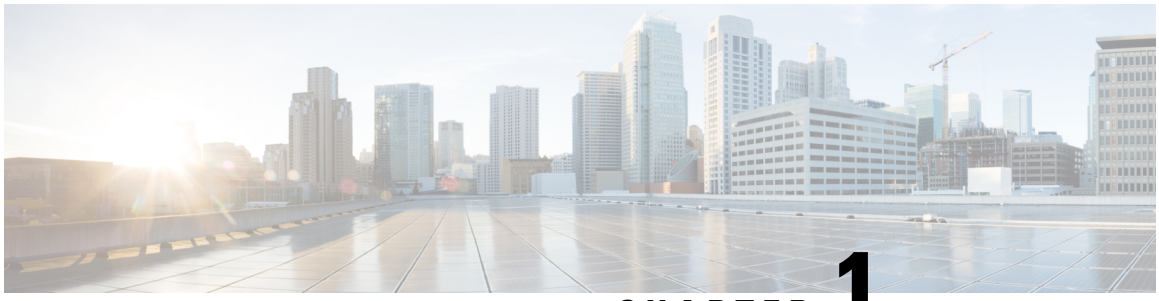


CHAPTER 1

New and Changed Information

This chapter provides release-specific information for each new and changed feature in the *Cisco Nexus 9000 Series NX-OS ePBR Configuration Guide, Release 9.3(x)*.

- New and Changed Information, on page 1

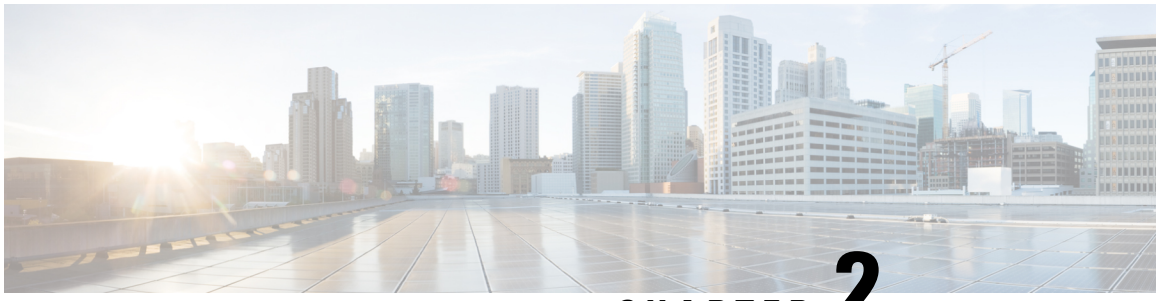
New and Changed Information

This table summarizes the new and changed features for the *Cisco Nexus 9000 Series NX-OS Multicast Routing Configuration Guide, Release 9.3(x)* and where they are documented.

Table 1: New and Changed Features

Feature	Description	Changed in Release	Where Documented
Enhanced Policy-Based Routing (ePBR)	Provides traffic redirection and service chaining across the NX-OS and fabric topologies, leveraging policy-based routing solution and achieves service chaining without adding additional headers.	9.3(5)	Information About ePBR L3, on page 5 Configuring ePBR L3, on page 10
ePBR with Probes	ePBR creates SLA and Track objects based on the probe types configured on the policies and supports various probes and timers.	9.3(5)	Information About ePBR L3, on page 5 Configuring ePBR L3, on page 10
ePBR Multi-Hop	Maintains the symmetry when fail-action bypass is configured for all the services in the service chain.	9.3(5)	Information About ePBR L3, on page 5

Feature	Description	Changed in Release	Where Documented
ePBR with User-Defined Probes	Enables users to define tracks separately and assign the track ID to each service-endpoint in ePBR.	9.3(5)	Information About ePBR L3, on page 5 Configuring ePBR L3, on page 10



CHAPTER 2

Overview

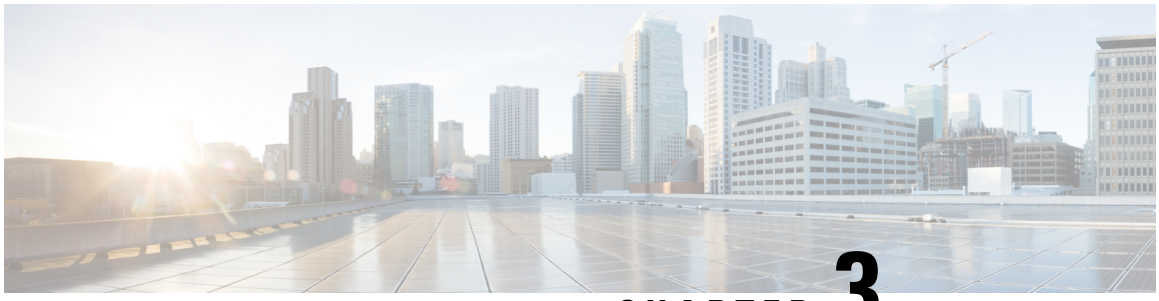
- Licensing Requirements, on page 3
- Supported Platforms, on page 3

Licensing Requirements

For a complete explanation of Cisco NX-OS licensing recommendations and how to obtain and apply licenses, see the *Cisco NX-OS Licensing Guide* and the *Cisco NX-OS Licensing Options Guide* .

Supported Platforms

Starting with Cisco NX-OS release 7.0(3)I7(1), use the Nexus Switch Platform Support Matrix to know from which Cisco NX-OS releases various Cisco Nexus 9000 and 3000 switches support a selected feature.



CHAPTER 3

Configuring ePBR L3

This chapter describes how to configure Enhanced Policy-based Redirect (ePBR) on Cisco NX-OS devices.

- Information About ePBR L3, on page 5
- Guidelines and Limitations for ePBR L3, on page 8
- Configuring ePBR L3, on page 10
- Configuration Examples for ePBR L3, on page 17
- Additional References, on page 25

Information About ePBR L3

Enhanced Policy-based Redirect (ePBR) in Elastic Services Re-direction (ESR) provides traffic redirection and service chaining across the NX-OS and fabric topologies by leveraging policy-based redirect solution and achieves service chaining without adding extra headers, and avoids latency in using extra headers.

ePBR enables application-based routing and provides a flexible, device-agnostic policy-based redirect solution without impacting application performance. The ePBR service flow includes the following tasks:

Licensing Requirements

For a complete explanation of Cisco NX-OS licensing recommendations and how to obtain and apply licenses, see the *Cisco NX-OS Licensing Guide* and the *Cisco NX-OS Licensing Options Guide* .

Configuring ePBR Service and Policy

You must first create an ePBR service which defines the attributes of service end points. Service end points are the service appliances such as firewall, IPS, etc., that can be associated with switches. You can also define probes to monitor the health of the service end points and can define the forward and reverse interfaces where the traffic policies are applied. ePBR also supports load balancing along with service chaining. ePBR allows you to configure multiple service end points as a part of the service configuration.

In events of service endpoint failures, traffic that was redirecting to the failed service endpoints will redirect to other reachable service endpoints, configured in the ePBR service. Resilient hashing is supported during endpoint failures for an ePBR service that has multiple service endpoints. Traffic that was always being redirected to a specific service endpoint continues to redirect to the same device in events of failures of other service endpoints that are part of the same service.

Beginning with Cisco NX-OS Release 10.2(1)F, the VRF of every service in a chain may either be unique or may be exactly identical. The service endpoints and interfaces defined for a service, should pertain to the VRF defined for the service.

Service end-point interfaces having an existing IPv4 PBR policy cannot be used inside an IPv4 ePBR service. Similarly service end-point interfaces having an existing ipv6 PBR policy cannot be used inside an IPv6 ePBR service.

After creating the ePBR service, you must create an ePBR policy. The ePBR policy allows you to define traffic selection, redirection of traffic to the service end point and various fail-action mechanisms on the end point health failure. You may use IP access-list end points with permit access control entries (ACE) to define the traffic of interest to match and take the appropriate action.

The ePBR policy supports multiple ACL match definitions. A match can have multiple services in a chain which can be sequenced by a sequence number. This allows flexibility to add, insert, and modify elements in a chain in a single service policy. In every service sequence, you can define the fail action method such as drop, forward, and bypass. The ePBR policy allows you to specify source or destination-based load balancing and bucket counts in order to have granular load balancing of traffic.

Applying ePBR to an Interface

After creating the ePBR policy you need to apply the policy on an interface. This allows you to define the interface at which the traffic ingresses into the NX-OS or Nexus fabric. You can also apply the policy in both the forward and reverse directions. There may only be two IPv4/IPv6 policies applied to the interface, one in the forward and one in the reverse direction.

Creating Bucket and Load Balancing

ePBR computes the number of traffic buckets based on the service that has maximum number of service-end-points in the chain. If you configure the load balance buckets, your configuration will have the precedence. ePBR supports load balancing methods of source IP and destination IP but does not support L4-based source or destination load balancing methods.

ePBR Object Tracking, Health Monitoring, and Fail-Action

ePBR creates SLA and Track objects based on the probe types configured in the service and supports various probes and timers such as ICMP, TCP, UDP, DNS, and HTTP. ePBR also supports user defined tracks, which allows you to create tracks with various parameters including milli second probes in associating with ePBR.

ePBR monitors the health of the end points by provisioning IP SLA probes and object tracks to track the IP SLA reachability when you apply the ePBR probe configuration.

You can configure the ePBR probe options for a service or for each of the forward or reverse end points. You can also configure frequency, timeout, retry up and down counts, and source loopback interface so that they can be used for source IP of an IP SLA session. The retry-up and down counts are used as multipliers for the frequency to determine **delay-up** and **delay-down** intervals. Once the service endpoint is initially detected as failed or recovered, the system will act on these events after the expiry of these intervals. You can define any type of tracks and associate them with the forward or the reverse end points. The same track objects is re-used for all policies using the same ePBR service.

You can define tracks separately and assign the track ID to each service-end point in ePBR. If you do not assign any user-defined track to an endpoint, ePBR will create a track using probe method for the end point.

If no probe method is defined at the end point level, the probe method configured for the service level will be used.

ePBR supports the following fail-action mechanisms for its service chain sequences:

- Bypass
- Drop on Fail
- Forward

Bypass of a service sequence indicates that the traffic must be redirected to the next service sequence when there is a failure of the current sequence.

Drop on fail of a service sequence indicates that the traffic must be dropped when all the service-end-points of the service become unreachable.

Forward is the default option and indicates that upon failure of the current service, traffic should use the regular routing tables. This is the default fail-action mechanism.

Note Symmetry is maintained when fail-action bypass is configured for all the services in the service chain. In other fail-action scenarios, when there are one or more failed services, symmetry is not maintained in the forward and the reverse flow.

ePBR Session-based Configuration

ePBR sessions allow addition, deletion or modification of the following aspects of in-service services or policies. The in-service refers to a service that is associated with a policy that has been applied to an active interface or a policy that is being modified and currently configured on an active interface.

- Service endpoints with their interfaces and probes
- Reverse endpoints and probes
- Matches under policies
- Load-balance methods for matches
- Match sequences and fail-action

Note In ePBR Sessions, you cannot move interfaces from one service to another service in the same session. To move interfaces from one service to another service, perform the following steps:

1. Use a session operation to first remove it from the existing service.
2. Use a second session operation to add it to the existing service.

ACL Refresh

ePBR session ACL refresh allows you to update the policy generated ACLs, when the user-provided ACL gets modified or added or deleted with ACEs. On the refresh trigger, ePBR will identify the policies that are impacted by this change and create or delete or modify the buckets' generated ACLs for those policies.

For ePBR scale values, see Cisco Nexus 9000 Series NX-OS Verified Scalability Guide.

Guidelines and Limitations for ePBR L3

ePBR has the following guidelines and limitations:

- The L3 ePBR feature requires sufficient ing-racl TCAM to function properly. To verify the current TCAM carving, use the **show hardware access-list tcam region** command. If the appropriate TCAM size is not allocated, use the **hardware access-list tcam region ing-racl** *size multiple of 256* command to allocate the appropriate TCAM.
- Beginning with Cisco Nexus NX-OS Release 10.1(2), ePBR with IPv4 and IPv6 is supported on N9K-C93108TC-FX3P switch.
- ePBR policies require at least one match with redirect action.
- When fail-action is specified in any match statement, probe is mandatory in the configuration.
- Whenever there is OTM track changes ePBR statistics is reset due to RPM reprogramming.
- Do not share the same user defined ACL across multiple match statements in the ePBR configuration.
- Symmetry in traffic is maintained only when fail-action bypass is configured for ePBR Service. For the other fail-actions such as forward/drop in the service chain, symmetry is not maintained for the forward and reverse flow of traffic.
- Unique layer-4 source and destination port parameters should be specified for the match filters if traffic is required to match any source and any destination IP as per the match access-list definition, and is required to be redirected to devices distributed in a VXLAN environment in both forward and reverse directions or service-chained through one-arm devices.
- Feature ePBR and feature ITD cannot co-exist with the same ingress interface.
- With scaled ePBR configuration, it is recommended to remove the policies before you use the **no feature epbr** command.
- It is recommended that you classify probe traffic in a separate CoPP class. Otherwise, probe traffic will go in the default CoPP class and might be dropped causing IP SLA bouncing for probe traffic. For information on CoPP configuration for IP SLA, see Configuring CoPP for IP SLA Packets.
- ePBR is supported on the Cisco Nexus 9500 and Cisco Nexus 9300 platform switches with EX, FX, and FX2 line cards.
- ePBRv4 over VXLAN and NX-OS ePBR are supported on Cisco Nexus 9500 series switches.
- ePBRv6 over VXLAN is not supported on Cisco Nexus 9500 series switches.
- Beginning with Cisco NX-OS Release 9.3(5) Catena feature is deprecated.

- If you want to remove the ePBR service endpoint which is configured to a port-channel that is removed from the system, perform the following steps:
  1. Delete the existing ePBR policy.
  2. Delete the existing ePBR service.
  3. Reconfigure the ePBR service endpoint to the required port-channel.
- Please do not modify the dynamically created access-list entries of ePBR that begin with the name "epbr_". These access-lists are reserved for ePBR internal use.

Note Modifying these prefix strings can cause the ePBR to not function properly and would impact ISSU.

- Router ACLs may be enabled alongside layer-3 ePBR policies on supported layer-3 interfaces, only when statistics is not enabled for either ePBR policies or the router ACLs. See **Guidelines and Limitations for Policy-Based Routing** in the Policy-based routing chapter of *Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide* for details on this limitation.
- Configuration rollback and configuration replace are supported only when the ePBR policy is not associated with any interfaces and the ePBR service definitions are not used in any active ePBR policy in both the source and target configurations. However, configuration rollback and configuration replace do not support policy to interface association and disassociation.
- Disabling the atomic update may allow more TCAM resources to be made available for the ePBR policies, but it may cause possible disruption in traffic during configuration changes to the policies or during fail-over and recovery of service endpoints. For further details, see **Atomic ACL Updates** section of *Cisco Nexus 9000 Series NX-OS Security Configuration Guide*.
- Unique policies are generated for every interface that is configured with an ePBR policy. Additionally unique policies are also generated for every service interface that needs to steer the traffic to the next service function inside a service-chain configured for a match inside an ePBR policy. The scale of supported EPBR policies may vary with the available ACL labels in the system for PBR policies. For further details on ACL labels sizes, see **Maximum Label Sizes Supported for ACL Types** section of *Cisco Nexus 9000 Series NX-OS Security Configuration Guide*.
- For one-arm service devices, the reverse IP address must be explicitly configured to match the forward IP address.

The following guidelines and limitations apply to ePBR over VXLAN feature:

- In VXLAN fabric, service chaining cannot be done to devices within same VLAN. All devices must be present in separate VLANs.
- When every service in the chain is in the same VRF, ePBR is only supported at a single site in a VXLAN multisite fabric.
- When every service in the chain is in the same VRF:
  - Active/Standby chain is supported with two service nodes with no restrictions.
  - Active/Standby chain with three or more service nodes in chain requires no two nodes of different type behind same service leaf.

- In VXLAN fabric you cannot stitch traffic from one service in a leaf and come back later to the same leaf.

Note These restrictions are not applicable if every service in the chain is in a different VRF context.

- When service endpoints are distributed in a VXLAN environment or on VPC peers, the service endpoints must be configured in an identical order on all switches.
- For service-endpoints distributed in a VXLAN environment, you must configure source loopback interfaces for the probe, so that a unique source IP may be used for IP SLA sessions.

The following guidelines and limitations apply to the match ACL feature:

- Only ACEs with the permit method are supported in the ACL. ACEs with any other method (such as deny or remark) are ignored.
- A maximum of 256 permit ACEs are supported in one ACL.
- Layer-4 ACE rules with port operations other than port equality operations are not supported.
- ACEs with object-groups specified as address-groups or port-groups in either source or destination parameters are not supported.

The following guidelines and limitations applies if you are using source IP-based load balancing and load-balancing traffic to more than 1 endpoint:

- The source IPv4 subnet mask of the ACE inside the match access-list cannot be /32, or the subnet mask of the source IPv6 address inside the match access-list cannot be /128.
- The destination IPv4 subnet mask of the ACE inside the match access-list cannot be /32, or the subnet mask of the source IPv6 address inside the match access-list cannot be /128.
- The subnet masks for the source address or destination address inside the match access-list, based on the load-balance method, must be compatible with the buckets configured for the match or must be compatible with the number of buckets required, based on the number of endpoints in the services being used for the match.

Configuring ePBR L3

Before you begin

Make sure you have configured IP SLA and PBR features before configuring the ePBR feature.

Configuring ePBR Service, Policy, and Associating to an Interface

The following section provides information about configuring the ePBR Service, ePBR Policy, and associating the policy on to an interface.

SUMMARY STEPS

1. **configure terminal**
2. **epbr service** *service-name*
3. [**no**] **probe** {**icmp** | *l4-proto port-number* [**control** *status*] | **http get** [*url-name* | **dns host***host-name* **ctp**} [**frequency** *freq-num* | **timeout** *seconds* | **retry-down-count** *down-count* | **retry-up-count** *up-count* | **source-interface** *src-intf*
4. **vrf** *vrf-name*
5. **service-endpoint** {**ip** *ipv4 address* | **ipv6** *ipv6 address*} [**interface** *interface-name interface-number*]
6. **probe track** *track ID*
7. **reverse ip** *ip address* **interface** *interface-name interface-number*
8. **exit**
9. **epbr policy** *policy-name*
10. **match** { [**ip address** *ipv4 acl-name*] | [**ipv6 address** *ipv6 acl-name*] }
11. [**no**] **load-balance** [**method** { **src-ip** | **dst-ip**}] [**buckets** *sequence-number*]
12. *sequence-number* **set service** *service-name* [**fail-action** { **bypass** | **drop** | **forward**}]
13. **interface** *interface-name interface-number*
14. **epbr** { **ip** | **ipv6**} **policy** *policy-name* [**reverse**]
15. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose

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

Step 2	**epbr service** *service-name* **Example:** `switch(config)# epbr service firewall`	Creates a new ePBR service.
Step 3	[**no**] **probe** {**icmp**	*l4-proto port-number* [**control** *status*]	**http get** [*url-name*	**dns host***host-name* **ctp**} [**frequency** *freq-num*	**timeout** *seconds*	**retry-down-count** *down-count*	**retry-up-count** *up-count*	**source-interface** *src-intf* **Example:** `switch(config)# probe icmp`	Configures the probe for the ePBR service. The probe types supported are ICMP, TCP, UDP, DNS, and HTTP, CTP. The options are as follows: • frequency—Specifies the frequency of the probe in seconds. The range is from 1 to 604800. • retry-down-count —Specifies the number of recounts undertaken by the probe when the node goes down. The range is from 1 to 5.

	Command or Action	Purpose
		• retry-up-count —Specifies the number of recounts undertaken by the probe when the node comes back up. The range is from 1 to 5. • timeout —Specifies the length of the timeout period in seconds. The range is from 1 to 604800.
Step 4	**vrf** *vrf-name* **Example:** `switch(config)# vrf tenant_A`	Specifies the VRF for the ePBR service.
Step 5	**service-endpoint** {**ip** *ipv4 address* | **ipv6** *ipv6 address*} [**interface** *interface-name interface-number*] **Example:** `switch(config-vrf)# service-endpoint ip 172.16.1.200 interface VLAN100`	Configures service endpoint for the ePBR service. You can repeat steps 2 to 5 to configure another ePBR service.
Step 6	**probe track** *track ID* **Example:** `switch(config-vrf)# probe track 30`	Defines a track separately and assign an existing track ID to each service-endpoint in ePBR. You can assign track ID to each endpoint.
Step 7	**reverse ip** *ip address* **interface** *interface-name interface-number* **Example:** `switch(config-vrf)# reverse ip 172.16.30.200 interface VLAN201`	Defines the reverse IP and interfaces where the traffic policies are applied. **Note** For one-arm service devices, the reverse IP address must be explicitly configured to match the forward IP address.
Step 8	**exit** **Example:** `switch(config-vrf)# exit`	Exits VRF configuration mode and enters global configuration mode.
Step 9	**epbr policy** *policy-name* **Example:** `switch(config)# epbr policy Tenant_A-Redirect`	Configures the ePBR policy.
Step 10	**match** { [**ip address** *ipv4 acl-name*] | [**ipv6 address** *ipv6 acl-name*] } **Example:** `switch(config)# match ip address WEB`	Matches an IPv4 or IPv6 address against an IP or IPv6 ACLs. You can repeat this step to match multiple ACLs based on the requirement.
Step 11	[**no**] **load-balance** [**method** { **src-ip** | **dst-ip**}] [**buckets** *sequence-number*] **Example:** `switch(config)# load-balance method src-ip mask-position 3`	Computes the load balance method and the number of buckets to be used by the ePBR service.

	Command or Action	Purpose
Step 12	*sequence-number* **set service** *service-name* [**fail-action** { **bypass** | **drop** | **forward**}] **Example:** `switch(config)# set service firewall fail-action drop`	Computes the fail-action mechanism.
Step 13	**interface** *interface-name interface-number* **Example:** `switch(config)# interface vlan 2010`	Configures an interface and enters interface configuration mode.
Step 14	**epbr** { **ip** | **ipv6**} **policy** *policy-name* [**reverse**] **Example:** `switch(config-if)# epbr ip policy Tenant_A-Redirect`	An interface may be associated at any time with one or more of the following: • an IPV4 policy in the forward direction • an IPv4 policy in the reverse direction • an IPv6 policy in the forward direction • an IPv6 policy in the reverse direction
Step 15	**exit** **Example:** `switch(config-if)# end`	Exits interface configuration mode and returns to global configuration mode.

Modifying a Service Using ePBR Session

The following steps explain how to modify a service using ePBR session.

SUMMARY STEPS

1. **epbr session**
2. **epbr service** *service-name*
3. [**no**] **service-endpoint** {**ip** *ipv4 address* | **ipv6** *ipv6 address*} [**interface** *interface-name interface-number*]
4. **service-endpoint** {**ip** *ipv4 address* | **ipv6** *ipv6 address*} [**interface** *interface-name interface-number*]
5. **reverse ip** *ip address* **interface** *interface-name interface-number*
6. **commit**
7. **abort**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**epbr session** **Example:**	Enters ePBR session mode.

	Command or Action	Purpose
	`switch(config)# epbr session`	
Step 2	**epbr service** *service-name* **Example:** `switch(config-epbr-sess)# epbr service TCP_OPTIMIZER`	Specifies the configured ePBR service in the ePBR session mode.
Step 3	[**no**] **service-endpoint** {**ip** *ipv4 address* | **ipv6** *ipv6 address*} [**interface** *interface-name interface-number*] **Example:** `switch(config-epbr-sess-svc)# no service-end-point ip 172.16.20.200 interface VLAN200`	Disables the configured service endpoint for the ePBR service.
Step 4	**service-endpoint** {**ip** *ipv4 address* | **ipv6** *ipv6 address*} [**interface** *interface-name interface-number*] **Example:** `switch(config-epbr-sess-svc)#service-end-point ip 172.16.25.200 interface VLAN200`	Modifies the service endpoint and replaces the IP for the ePBR service.
Step 5	**reverse ip** *ip address* **interface** *interface-name interface-number* **Example:** `switch(config-epbr-sess-svc-ep)# reverse ip 172.16.30.200 interface VLAN201`	Defines the reverse IP and interfaces where the traffic policies are applied.
Step 6	**commit** **Example:** `switch(config-epbr-sess)# commit`	Completes the modification of the ePBR service using the ePBR session. **Note** Restart the ePBR session after you complete this step.
Step 7	**abort** **Example:** `switch(config-epbr-sess)# abort`	Aborts the session and clears or resets the current configuration under the session. Use this command to abandon the current session configuration in case of errors or unsupported configuration identified during commits. **Note** Restart a new ePBR session after this with the rectified configuration.

Modifying a Policy Using ePBR Session

The following steps explain how to modify a policy using ePBR Session.

SUMMARY STEPS

1. **epbr session**
2. **epbr policy** *policy-name*

3. [**no**] **match** { [**ip address** *ipv4 acl-name*] | [**ipv6 address** *ipv6 acl-name*] [**l2 address** *ipv6 acl-name*]} **vlan** {**vlan** | **vlan range** | **all**}}
4. **match** { [**ip address** *ipv4 acl-name*] | [**ipv6 address** *ipv6 acl-name*] [**l2 address** *ipv6 acl-name*]} **vlan** {**vlan** | **vlan range** | **all**}}
5. *sequence-number* **set service** *service-name* [**fail-action** { **bypass** | **drop** | **forward**}]
6. [**no**] **load-balance** [**method** { **src-ip** | **dst-ip**}] [**buckets** *sequence-number*]
7. **commit**
8. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**epbr session** **Example:** `switch(config)# epbr session`	Enters ePBR session mode.
Step 2	**epbr policy** *policy-name* **Example:** `switch(config-epbr-sess)# epbr policy Tenant_A-Redirect`	Specifies the configured ePBR policy in the ePBR session mode.
Step 3	[**no**] **match** { [**ip address** *ipv4 acl-name*] | [**ipv6 address** *ipv6 acl-name*] [**l2 address** *ipv6 acl-name*]} **vlan** {**vlan** | **vlan range** | **all**}} **Example:** `switch(config-epbr-sess-pol)# no match ip address WEB`	Disables the IP address matching against the IP or IPv6 ACLs.
Step 4	**match** { [**ip address** *ipv4 acl-name*] | [**ipv6 address** *ipv6 acl-name*] [**l2 address** *ipv6 acl-name*]} **vlan** {**vlan** | **vlan range** | **all**}} **Example:** `switch(config-epbr-sess-pol)# match ip address HR`	Modifies the IP address matching against the IP or IPv6 ACLs.
Step 5	*sequence-number* **set service** *service-name* [**fail-action** { **bypass** | **drop** | **forward**}] **Example:** `switch(config-epbr-sess-pol-match)# set service firewall fail-action drop`	Adds, modifies, or deletes sequences for a match, or modifies the fail-action for an existing sequence.
Step 6	[**no**] **load-balance** [**method** { **src-ip** | **dst-ip**}] [**buckets** *sequence-number*] **Example:** `switch(config-epbr-sess-pol-match)# load-balance method src-ip mask-position 3`	Computes the load balance method and the number of buckets to be used by the ePBR service. **Note** On omitting this configuration in the session context while modifying the service-chain for an existing match, the

	Command or Action	Purpose
		load-balance configuration for the match will be reset to default.
Step 7	**commit** **Example:** `switch(config-epbr-sess)#commit`	Completes the modification of the ePBR policy using the ePBR session.
Step 8	**end** **Example:** `switch(config-epbr-sess)#end`	Exits the ePBR session mode.

Updating the Access-list Used by ePBR Policies

The following steps explain how to update the access-list used by ePBR policies:

SUMMARY STEPS

1. **epbr session access-list** *acl-name* **refresh**
2. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**epbr session access-list** *acl-name* **refresh** **Example:** `switch(config)# epbr session access-list WEB refresh`	Updates or refreshes the policy generated ACLs.
Step 2	**end** **Example:** `switch(config)# end`	Exits the global configuration mode.

ePBR Show Commands

The following list provides the show commands associated with ePBR.

SUMMARY STEPS

1. **show epbr policy** *policy-name* [**reverse**]
2. **show epbr statistics** *policy-name* [**reverse**]
3. **show tech-support epbr**
4. **show running-config epbr**

5. **show startup-config epbr**

DETAILED STEPS

Procedure

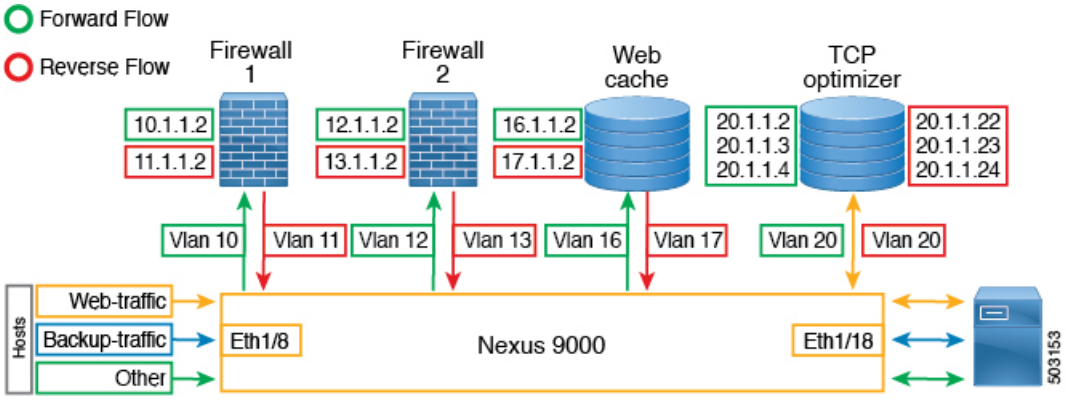
	Command or Action	Purpose
Step 1	**show epbr policy** *policy-name* [**reverse**] **Example:** `switch# show epbr policy Tenant_A-Redirect`	Displays information on the ePBR policy applied in forward or reverse direction.
Step 2	**show epbr statistics** *policy-name* [**reverse**] **Example:** `switch# show ePBR statistics policy pol2`	Displays the ePBR policy statistics.
Step 3	**show tech-support epbr** **Example:** `switch# show tech-support epbr`	Displays the technical support information for ePBR.
Step 4	**show running-config epbr** **Example:** `switch# show running-config epbr`	Displays the running configuration for ePBR.
Step 5	**show startup-config epbr** **Example:** `switch# show startup-config epbr`	Displays the startup configuration for ePBR

Configuration Examples for ePBR L3

Example: ePBR NX-OS Configuration

The following topology illustrates ePBR NX-OS configuration.

Figure 1: ePBR NX-OS Configuration



Example: Use-Case: Create a Service Chain for Web Traffic in Forward Direction Only

The following configuration example shows how to create a service chain for web traffic in forward direction only.

```
IP access list web_traffic
        10 permit tcp any any eq www

ePBR service FW1
  service-end-point ip 10.1.1.2 interface Vlan10
    reverse interface Vlan11

ePBR service FW2
  service-end-point ip 12.1.1.2 interface Vlan12
    reverse interface Vlan13

ePBR service Web_cache
  service-end-point ip 16.1.1.2 interface Vlan16
    reverse interface Vlan17

ePBR policy tenant_1
  match ip address web-traffic
    10 set service FW1
    20 set service FW2
    30 set service Web_cache

interface Eth1/8
  ePBR ip policy tenant_1
```

The following example shows how to verify the configuration of service chain creation for web traffic in forward direction.

```
switch# show ePBR policy tenant_1

Policy-map : tenant_1
  Match clause:
    ip address (access-lists): web-traffic
  Service chain:
    service FW1, sequence 10, fail-action No fail-action
      IP 10.1.1.2
    service FW2, sequence 20, fail-action No fail-action
      IP 12.1.1.2
    service Web_cache, sequence 30, fail-action No fail-action
      IP 16.1.1.2
  Policy Interfaces:
    Eth1/8
```

Example: Use-Case : Load Balance TCP Traffic Using ePBR in Forward Direction Only

The following configuration example shows how to load balance TCP traffic using ePBR in forward direction only.

```
IP access list tcp_traffic
        10 permit tcp any any

ePBR service TCP_Optimizer
  service-interface Vlan20
  service-end-point ip 20.1.1.2
  service-end-point ip 20.1.1.3
  service-end-point ip 20.1.1.4

ePBR policy tenant_1
  match ip address tcp_traffic
    10 set service TCP_Optimizer

interface Eth1/8
  ePBR ip policy tenant_1
```

The following example shows how to verify the configuration of load balance TCP traffic using EPBR in forward direction.

```
switch# show ePBR policy tenant_1

Policy-map : tenant_1
  Match clause:
    ip address (access-lists): tcp_traffic
  Service chain:
    service TCP_Optimizer, sequence 10, fail-action No fail-action
      IP 20.1.1.2
      IP 20.1.1.3
      IP 20.1.1.4
  Policy Interfaces:
    Eth1/8
```

Example: Use-Case: Create a Service Chain for Web Traffic in Both Directions

The following configuration example shows how to create a service chain for web traffic in both forward and reverse directions.

```
IP access list web_traffic
        10 permit tcp any any eq www


ePBR service FW1
  service-end-point ip 10.1.1.2 interface Vlan10
    reverse ip 11.1.1.2 interface Vlan11

ePBR service FW2
  service-end-point ip 12.1.1.2 interface Vlan12
    reverse ip 13.1.1.2 interface Vlan13

ePBR service Web_cache
  service-end-point ip 16.1.1.2 interface Vlan16
    reverse ip 17.1.1.2 interface Vlan17

ePBR policy tenant_1
  match ip address web-traffic
    10 set service FW1
    20 set service FW2
    30 set service Web_cache

interface Eth1/8
```

```
  ePBR ip policy tenant_1

interface Eth1/18
  ePBR ip policy tenant_1 reverse
```

The following example shows how to verify the configuration of service chain creation for web traffic in both forward and reverse directions.

```
switch# show ePBR policy tenant_1

Policy-map : tenant_1
  Match clause:
    ip address (access-lists): web-traffic
  Service chain:
    service FW1, sequence 10, fail-action No fail-action
      IP 10.1.1.2
    service FW2, sequence 20, fail-action No fail-action
      IP 12.1.1.2
    service Web_cache, sequence 30, fail-action No fail-action
      IP 16.1.1.2
  Policy Interfaces:
    Eth1/8

switch# show ePBR policy tenant_1 reverse

Policy-map : tenant_1
  Match clause:
    ip address (access-lists): web-traffic
  Service chain:
    service Web_cache, sequence 30, fail-action No fail-action
      IP 17.1.1.2
    service FW2, sequence 20, fail-action No fail-action
      IP 13.1.1.2
    service FW1, sequence 10, fail-action No fail-action
      IP 11.1.1.2
  Policy Interfaces:
    Eth1/18
```

Example: Use-Case: Load Balance TCP Traffic Using ePBR in Both Directions

The following configuration example shows how to load balance TCP traffic using ePBR in both forward and reverse directions.

```
ePBR service TCP_Optimizer
  service-interface Vlan20
  service-end-point ip 20.1.1.2
    reverse ip 20.1.1.22
  service-end-point ip 20.1.1.3
    reverse ip 20.1.1.23
  service-end-point ip 20.1.1.4
    reverse ip 20.1.1.24

ePBR policy tenant_1
  match ip address tcp_traffic
    10 set service TCP_Optimizer

interface Eth1/8
  ePBR ip policy tenant_1

interface Eth1/18
  ePBR ip policy tenant_1 reverse
```

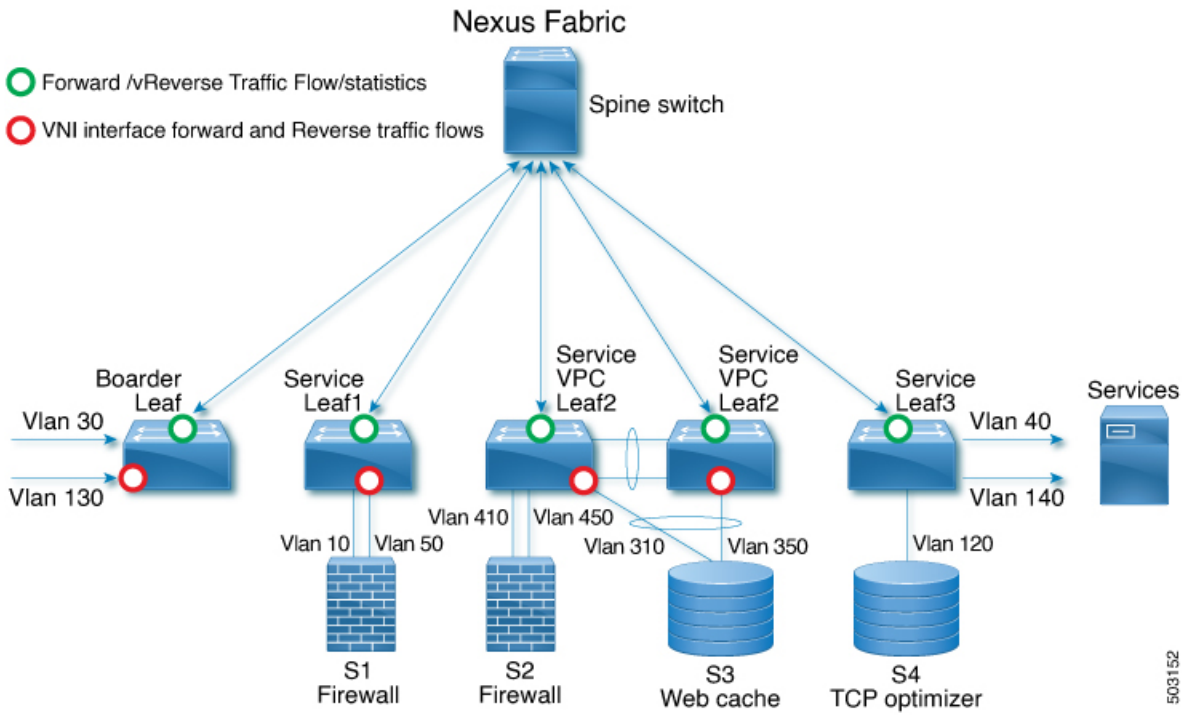
The following example shows how to verify the configuration of load balance TCP traffic using ePBR in both directions.

```
switch# show ePBR policy tenant_1

Policy-map : tenant_1
  Match clause:
    ip address (access-lists): tcp_traffic
  Service chain:
    service TCP_Optimizer, sequence 10, fail-action No fail-action
      IP 20.1.1.2
      IP 20.1.1.3
      IP 20.1.1.4
  Policy Interfaces:
    Eth1/8

switch# show ePBR policy tenant_1 reverse

Policy-map : tenant_1
  Match clause:
    ip address (access-lists): tcp_traffic
  Service chain:
    service TCP_Optimizer, sequence 10, fail-action No fail-action
      IP 20.1.1.22
      IP 20.1.1.23
      IP 20.1.1.24
  Policy Interfaces:
    Eth1/18
```

Example: ePBR Policy Creation with VXLAN Fabric

The following example/topology shows how to configure ePBR over VXLAN fabric.

Figure 2: Configuring ePBR over VXLAN Fabric




```
ip access-list acl1
        10 permit ip 30.1.1.0/25 40.1.1.0/25
        20 permit ip 30.1.1.128/25 40.1.1.128/25
ip access-list acl2
```

```
        10 permit ip 130.1.1.0/25 140.1.1.0/25
        20 permit ip 130.1.1.128/25 140.1.1.128/25

epbr service s1
  vrf vrf_s1
  service-end-point ip 10.1.1.2 interface Vlan10
     probe icmp frequency 4 retry-down-count 1 retry-up-count 1 timeout 2 source-interface
 loopback9
    reverse ip 50.1.1.2 interface Vlan50

      probe icmp frequency 4 retry-down-count 1 retry-up-count 1 timeout 2 source-interface
 loopback10

epbr service s2
  vrf vrf_s2
  service-end-point ip 41.1.1.2 interface Vlan410
     probe icmp source-interface loopback11
    reverse ip 45.1.1.2 interface Vlan450

       probe icmp source-interface loopback12

 epbr service s3
  vrf vrf_s3
  service-end-point ip 31.1.1.2 interface Vlan310
     probe http get index.html source-interface loopback13
    reverse ip 35.1.1.2 interface Vlan350

     probe http get index.html source-interface loopback14

epbr service s4
  service-interface Vlan120
  vrf vrf_s4
   probe udp 6900 control enable source-interface loopback15
  service-end-point ip 120.1.1.2

    reverse ip 120.1.1.2

epbr policy p1
 statistics
  match ip address acl1
    load-balance buckets 16 method src-ip
    10 set service s1 fail-action drop
    20 set service s2 fail-action drop
    30 set service s4 fail-action bypass
  match ip address acl2
    load-balance buckets 8 method dst-ip
    10 set service s1 fail-action drop
    20 set service s3 fail-action forward
    30 set service s4 fail-action bypass

! VXLAN L3 VNI interface for vrf_s1, vrf_s2, vrf_s3, vrf_s4 to which the policy is applied
 on all service leafs
interface vlan 100
epbr ip policy p1
epbr ip policy p1 reverse

interface vlan 101
epbr ip policy p1
epbr ip policy p1 reverse

interface vlan 102
epbr ip policy p1
epbr ip policy p1 reverse
```

```
interface vlan 103
epbr ip policy p1
epbr ip policy p1 reverse

Apply forward policy on ingress interface in border leaf where traffic coming in needs to
be service-chained:

interface Vlan 30 - Traffic matching acl1
  epbr ip policy p1
  int vlan 130  -  Traffic matching acl2
  epbr ip policy p1

Apply the reverse policy On leaf connected to server if reverse traffic flow needs to be
enabled:

int vlan 40 - Traffic matching reverse flow for acl1
epbr ip policy p1 rev
int vlan 140 - Traffic matching reverse flow for acl1
epbr ip policy p1 rev
```

Example: Configuring ePBR Service

The following example shows how to configure ePBR service.

```
epbr service FIREWALL
  probe icmp
  vrf TENANT_A
  service-endpoint ip 172.16.1.200 interface VLAN100
        reverse ip 172.16.2.200 interface VLAN101
service-endpoint ip 172.16.1.201 interface VLAN100
        reverse ip 172.16.2.201 interface VLAN101

epbr service TCP_Optimizer
   probe icmp
   vrf TENANT_A
service-endpoint ip 172.16.20.200 interface VLAN200
       reverse ip 172.16.30.200 interface VLAN201
```

Example: Configuring ePBR Policy

The following example shows how to configure ePBR Policy.

```
epbr service FIREWALL
  probe icmp
  service-end-point ip 1.1.1.1 interface Ethernet1/1
     reverse ip 1.1.1.2 interface Ethernet1/2
epbr service TCP_Optimizer
 probe icmp
 service-end-point ip 1.1.1.1 interface Ethernet1/3
     reverse ip 1.1.1.4 interface Ethernet1/4
epbr policy Tenant_A-Redirect
 match ip address WEB
  load-balance method src-ip
  10 set service FIREWALL fail-action drop
  20 set service TCP_Optimizer fail-action bypass
match ip address APP
  10 set service FIREWALL fail-action drop
match ip address exclude_acl exclude
match ip address drop_acl drop
```

Example: Associating an Interface with ePBR Policy

The following example shows how to configure ePBR Policy.

```
interface vlan 2010
  epbr ip policy Tenant_A-Redirect

interface vlan 2011
  epbr ip policy Tenant_A-Redirect reverse
```

Example: ePBR Policy applied in forward direction

The following example shows the sample Output for policy applied in forward direction.

```
show epbr policy Tenant_A-Redirect
policy-map Tenant_A-Redirect
 Match clause:
  ip address (access-lists): WEB
 Service chain:
  service FIREWALL  , sequence 10 , fail-action drop
   ip 172.16.1.200 track 10  [ UP ]
   ip 172.16.1.201 track 11 [ DOWN ]
                    service TCP_Optimizer, sequence 20 , fail-action bypass
   ip 172.16.20.200 track 12  [ UP] ]

 Match clause:
  ip address (access-lists): APP
 Service chain:
  service FIREWALL  , sequence 10 , fail-action drop
   ip 172.16.1.200 track 10  [ UP ]
   ip 172.16.1.201 track 11 [ DOWN ]

 Policy Interfaces:
     Vlan 2010
```

Example: ePBR Policy applied in reverse direction

The following example shows the sample Output for policy applied in reverse direction.

```
show epbr policy Tenant_A-Redirect reverse
policy-map Tenant_A-Redirect
 Match clause:
  ip address (access-lists): WEB

 Service chain:
  service TCP_Optimizer, sequence 20 , fail-action bypass
   ip 172.16.30.200 track 15  [ UP] ]

  service FIREWALL  , sequence 10 , fail-action drop
   ip 172.16.2.200 track 13  [ UP ]
   ip 172.16.2.201 track 14 [ DOWN ]

 Match clause:
  ip address (access-lists): APP

 Service chain:

  service FIREWALL  , sequence 10 , fail-action drop
   ip 172.16.2.200 track 13  [ UP ]
   ip 172.16.2.201 track 14 [ DOWN ]

 Policy Interfaces:
     Vlan 2011
```

Example: User-defined Track

The following example shows to assign track ID to each end point.

```
epbr service FIREWALL
  probe icmp
```

```
  service-end-point ip 1.1.1.2 interface Ethernet1/21
probe track 30
reverse ip 1.1.1.3 interface Ethernet1/22
  probe track 40
 service-end-point ip 1.1.1.4 interface Ethernet1/23
    reverse ip 1.1.1.5 interface Ethernet1/24
```

Example: Modifying ePBR Service Using ePBR Session

The following example shows to replace the IP of ePBR service and add another service end point.

```
switch(config)#epbr session
switch(config-epbr-sess)#epbr service TCP_OPTIMIZER
switch(config-epbr-sess-svc)# no service-end-point ip 172.16.20.200 interface VLAN200
switch(config-epbr-sess-svc)#service-end-point ip 172.16.25.200 interface VLAN200
switch(config-epbr-sess-svc-ep)# reverse ip 172.16.30.200 interface VLAN201
switch(config-epbr-sess)#commit
```

Example: Modifying ePBR Policy Using EPBR Session

The following example shows to replace the IP of ePBR policy and add a service chain for the modified policy traffic.

```
switch(config)#epbr session
switch(config-epbr-sess)#epbr policy Tenant_A-Redirect
switch(config-epbr-sess-pol)# no match ip address WEB
switch(config-epbr-sess-pol)#match ip address WEB
switch(config-epbr-sess-pol-match)# 10  set service Web-FW fail-action drop load-balance
method src-ip
switch(config-epbr-sess-pol-match)# 20 set service TCP_Optimizer fail-action bypass
switch(config-epbr-sess-pol)#match ip address HR
switch(config-epbr-sess-pol-match)# 10  set service Web-FW
switch(config-epbr-sess-pol-match)# 20 set service TCP_Optimizer
switch(config-epbr-sess)#commit
```

Example: Displaying ePBR Statistics Policy

The following example shows the display of ePBR statistics policy.

```
switch# show epbr statistics policy pol2

Policy-map pol2, match testv6acl

    Bucket count: 2

      traffic match : epbr_pol2_1_fwd_bucket_1
        two : 0
      traffic match : epbr_pol2_1_fwd_bucket_2
        two : 0
```

Additional References

For additional information related to configuring ePBR, see the following sections:

Related Documents

Related Topic	Document Title
Configuring CoPP for IP SLA Packets	*Cisco Nexus 9000 Series NX-OS IP SLAs Configuration G 9.3(x)*

Related Topic	Document Title
ePBR Licensing	*Cisco NX-OS Licensing Guide*
ePBR Scale Values	*Cisco Nexus 9000 Series NX-OS Verified Scalability Guide*

Standards

Standards
No new or modified standards are supported by this feature, and support for existing standards has not been modified by feature.