OER Application-Aware Routing: PBR

The OER Application-Aware Routing: PBR feature introduces the capability to optimize traffic based on portions of an IP packet, other than the destination address. Independent Optimized Edge Routing (OER) policy configuration is applied to only a subset of the traffic carried by the monitored prefix. You can use this feature to apply very granular OER policy configuration based on the type of application or IP packet, without changing OER policy configuration for other traffic that is carried by the monitored prefix. The master controller uses policy-based routing (PBR) to send the subset of traffic to the external interface that conforms to the independent policy configuration.

History for the OER Application-Aware Routing: PBR Feature

Release	Modification
12.4(2)T	This feature was introduced.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

Contents

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Prerequisites for OER Application-Aware Routing: PBR

- A master controller and border router processes are enabled in your network.
- Cisco Express Forwarding (CEF) is must be enabled on all participating devices to enable PBR support. No other switching path is supported even if otherwise supported by PBR.
- Applications are monitored only within the context of a prefix; the prefix that carries the specific application traffic must be monitored by the master controller.

Restrictions for OER Application-Aware Routing: PBR

- Only named extended IP access lists are supported. Extended IP access lists provide the capability to filter specific port and protocol numbers and other fields in the IP packet header.
- The border routers must be deployed with in a single hop of each other. Policy routing is designed to configure next-hop forwarding. The next-hop to which the traffic is forwarded must be over an external OER interface.

Information About OER Application-Aware Routing: PBR

The OER Application-Aware Routing: PBR feature allows you to apply independent Optimized Edge Routing (OER) policy configuration to a subset of traffic that is carried by a monitored prefix. This feature allows you to optimize outbound traffic for specific applications based on values in the IP packet header, information other than the Layer 3 (Network) destination address.

The feature provides a very granular mechanism that allows you to define an OER policy for the monitored prefix and then apply an independent policy to only a subset of traffic carried by the monitored prefix. For example, this feature can be used to send traffic for a monitored prefix out of the network through the first available in-policy exit but then send delay sensitive application traffic, such as Telnet, out through the exit with the lowest delay characteristics.

Applications or specific types of traffic are monitored only within the context of a prefix. The prefix that carries the specific traffic must be monitored by the master controller. The monitored prefix can be learned automatically based delay or throughput characteristics or can be configured with an IP prefix list.

Traffic is Filtered in a Named Extended Access List

Independent OER policy configuration is applied to traffic that is filtered through a named extended IP access list (ACL). Only named extended ACLs are supported. The extended ACL is configured with a permit statement and then referenced in an OER map.

The extended ACL provides a very granular filter. Any IP packet header information that can be filtered through an extended ACL, can be used to define a subset of traffic that is carried by the monitored prefix. This information includes but is not limited to the following:

- DSCP, IP Precedence, or ToS values
- Protocol specific flags
- Protocol type and number
- Source and/or destination IP address

- Source and/or destination port number

For a list of IANA assigned port numbers, refer to the following document:

- http://www.iana.org/assignments/port-numbers

For a list of IANA assigned protocol numbers, refer to the following document:

- http://www.iana.org/assignments/protocol-numbers

Filtered Traffic is Policy Routed Through an OER Map

The **match ip address (OER)** command has been enhanced to support extended ACLs. The extended ACL is referenced in an OER map. Only a single match clause can be configured for each OER map sequence. Set clauses are configured to apply independent OER policies to matched traffic (subset of the monitored prefix). The OER policy is applied to all border routers to enforce policy routing for the application. Matched traffic is policy routed through the OER external interface that conforms to policy parameters.

Border Routers Must be Single Hop Peers

For this release of the OER Application-Aware Routing: PBR feature, the border routers must be one hop away from each other. However, if the design of your network requires the border routers to be separated by more than one hop, a Cisco router between the border routers can be configured as an interim border router. The interim border routers act as transit routers between the border routers in your network. The master controller discovers the paths between interim and standard border routers and policy routes traffic through the appropriate external interface on a standard border router.

Interim Border Router Configuration

The configuration of an interim border router is similar to standard border router configuration. There is only one exception. No external interfaces are defined in the master controller configuration for the interim border router. However, a single internal interface must be configured for the interim border router to establish connectivity with the master controller. The configuration on the interim border router is the same as with a standard border router.

Note Multihop border router peerings will be supported in a future release.

How to Configure Application-Aware Policy Routing

This section contains the following procedures:

- Configuring Application-Aware Policy Routing, page 4
- Configuring an Interim Border Router, page 7

Configuring Application-Aware Policy Routing

This section describes the steps to configure application-aware policy routing. This section shows an example policy configuration to route delay sensitive traffic over interfaces with the lowest delay characteristics. However, any OER policy configuration can be configured for traffic that can be filtered with a permit statement in an extended IP access list.

This feature is configured on an OER master controller. The following tasks are completed in this section:

- An extended IP access list is configured to permit Telnet traffic
- An OER map is configured
- The extended access list is referenced with a match clause
- A delay policy is configured to ensure that Telnet traffic is sent out through exit links with a response time that is equal to or less than 30 milliseconds
- The configuration is verified with the **show oer master appl** command.

Restrictions

- Border routers must be single-hop peers. If the border routers are separated by more than one hop, you can configure any Cisco router between the border routers as an interim border router.
- Only named extended IP access lists are supported
- PBR is supported in OER only over CEF switching paths

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip access-list** {**standard** | **extended**} *access-list-name*}
4. [*sequence-number*] **permit** *protocol source source-wildcard destination destination-wildcard* [**option** *option-name*] [**precedence** *precedence*] [**tos** *tos*] [**ttl** *operator value*] [**log**] [**time-range** *time-range-name*] [**fragments**]
5. **exit**
6. **oer-map** *map-name sequence-number*
7. **match ip address** {**access-list** *name* | **prefix-list** *name*}
8. **set delay** {**relative** *percentage* | **threshold** *maximum*}
9. **set resolve**{**cost priority** *value* | **delay priority** *value* **variance** *percentage* | **loss priority** *value* **variance** *percentage* | **range priority** *value* | **utilization priority** *value* **variance** *percentage*}
10. **end**
11. **show oer master appl** [**access-list** *name*] [**detail**] | [**tcp** | **udp**] [*protocol-number*] [*min-port max-port*] [**dst** | **src**] [**detail** | **policy**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip access-list {standard | extended} access-list-name}** **Example:** `Router(config)# ip access-list extended TELNET`	Creates an extended access list and enters Extended Access List configuration mode. • Only named access lists are supported.
Step 4	**[sequence-number] permit protocol source source-wildcard destination destination-wildcard [option option-name] [precedence precedence] [tos tos] [ttl operator value] [log] [time-range time-range-name] [fragments]** **Example:** `Router(config-ext-nacl)# permit tcp 192.168.1.0 0.0.0.255 any eq telnet`	Defines the extended access list. • Any protocol, port, or other IP packet header value can be specified. • The example permits Telnet traffic that is sourced from the 192.168.1.0/24 network.
Step 5	**exit** **Example:** `Router(config-ext-nacl)# exit`	Exits Extended Access List configuration mode, and enters Global configuration mode.
Step 6	**oer-map map-name sequence-number** **Example:** `Router(config-oer-map)# oer-map BLUE`	Enters oer-map configuration mode to configure and OER map.
Step 7	**match ip address {access-list name | prefix-list name}** **Example:** `Router(config-oer-map)# match ip address access-list TELNET`	References an extended IP access list or IP prefix as match criteria in an OER map. • An extended IP access list is used to filter a subset of traffic from the monitored prefix.
Step 8	**set delay {relative percentage | threshold maximum}** **Example:** `Router(config-oer-map)# set delay threshold 30`	(Optional) Configures an oer-map to configure OER to set the delay threshold. • This example configures a delay policy. However, other policies could be configured. • The delay threshold is set to 30 milliseconds for Telnet traffic.

	Command or Action	Purpose
Step 9	**set resolve {cost priority value | delay priority value variance percentage | loss priority value variance percentage | range priority value | utilization priority value variance percentage}** **Example:** `Router(config-oer-map)# set resolve delay priority 1 variance 20`	(Optional) Configures an oer-map to set policy priority for overlapping policies. • The resolve policy configures delay policies to have the highest priority with a 20 percent variance.
Step 10	**end** **Example:** `Router(config-oer-map)# end`	Exits oer-map configuration mode, and enters Privileged EXEC mode.
Step 11	**show oer master appl [access-list name] [detail] | [tcp | udp] [protocol-number] [min-port max-port] [dst | src] [detail | policy]** **Example:** `Router# show oer master appl tcp 23 23 dst policy`	Displays information about applications monitored and controlled by an oer master controller.

Examples

The following example matches Telnet traffic sourced from the 192.168.1.0/24 network and applies a policy to ensure it is sent out through exit links with that have a response time that is equal to or less than 30 milliseconds:

```
Router(config)# ip access-list extended TELNET
Router(config-ext-nacl)# permit tcp 192.168.1.0 0.0.0.255 any eq telnet
Router(config-ext-nacl)# exit
Router(config)# oer-map BLUE
Router(config-route-map)# match ip address access-list TELNET
Router(config-route-map)# set delay threshold 30
Router(config-route-map)# set resolve delay priority 1 variance 20
Router(config-route-map)# end
```

The following example shows TCP application traffic filtered based on port 23 (Telnet):

```
Router# show oer master appl tcp 23 23 dst policy
Prefix              Appl Prot       Port                 Port Type       Policy
------------------------------------------------------------------------------
10.1.1.0/24         tcp             [23, 23]             src             10
```

What to Do Next

If the design of your network requires the border routers to be separated by more than one hop, a Cisco router between the border routers can be configured as an interim border router. See the next section for more information.

Configuring an Interim Border Router

This section describes the steps to configure an Interim border router. The configuration of an interim border router is similar to standard border router configuration. The physical configuration on the interim border router is the same as on a standard border router. The difference is in the configuration on the master controller. Only a single internal interface is configured. No external interface configuration is required.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **key chain** *name-of-chain*
4. **key** *key-id*
5. **key-string** *text*
6. **exit**
7. **exit**
8. **oer master**
9. **border** *ip-address* [*key-chain key-chain-name*]
10. **interface** *type number* **internal**
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**key chain name-of-chain** **Example:** `Router(config)# key chain OER`	Enables key-chain authentication. • Key-chain authentication protects the communication session between the master controller and the border router. The key ID and key string must match in order for communication to be established.
Step 4	**key key-id** **Example:** `Router(config-keychain)# key 1`	Identifies an authentication key on a key chain. • The key ID must match the key ID configured on the border router.

	Command or Action	Purpose
Step 5	**key-string text** **Example:** `Router(config-keychain-key)# key-string CISCO`	Specifies the authentication string for the key. • The authentication string must match the authentication string configured on the border router. • Any encryption level can be configured.
Step 6	**exit** **Example:** `Router(config-keychain-key)# exit`	Exits key chain key configuration mode, and enters key chain configuration mode.
Step 7	**exit** **Example:** `Router(config-keychain)# exit`	Exits key chain configuration mode, and enters Global configuration mode.
Step 8	**oer border | master** **Example:** `Router(config)# oer master`	Enters OER master controller configuration mode to configure a router as a master controller. • A master controller and border router process can be enabled on the same router. For example, in a network that has a single router with two exit links to different service providers.
Step 9	**border ip-address [key-chain key-chain-name]** **Example:** `Router(config-oer-mc)# border 10.100.1.1 key-chain OER`	Enters OER managed border router configuration mode to establish communication with a border router. • An IP address is configured to identify the border router. • At least one border router must be specified to create an OER managed network. A maximum of 10 border routers can be controlled by a single master controller. • The value for the *key-chain-name* argument must match the key-chain name configured in Step 3. **Note** The key-chain keyword and argument must be entered when a border router is initially configured. However, this keyword is optional when reconfiguring an existing border router.
Step 10	**interface type number internal** **Example:** `Router(config-oer-mc-br)# interface Ethernet 0/1 internal`	Configures a border router interface as an OER controlled internal interface. • Internal interfaces are used for passive monitoring only. Internal interfaces do not forward traffic. • At least one internal interface must be configured on each border router.
Step 11	**end** **Example:** `Router(config-oer-mc-learn)# end`	Exits OER Top Talker and Top Delay learning configuration mode, and enters privileged EXEC mode.

Examples

The following configuration example configures an interim border router on a master controller:

```
Router(config)# key chain OER
Router(config-keychain)# key 1
Router(config-keychain-key)# key-string CISCO
Router(config-keychain-key)# exit
Router(config-keychain)# exit
Router(config)# oer master
Router(config-oer-mc)# border 10.100.1.1 key-chain OER
Router(config-oer-mc-br)# interface Ethernet 0/1 internal
Router(config-oer-mc-br)# end
```

Configuration Examples for Application-Aware Policy Routing

This section provides the following example for the OER Application-Aware Routing: PBR feature:

- Moving Delay Sensitive Traffic To Links with the Lowest Delay: Example, page 9

Moving Delay Sensitive Traffic To Links with the Lowest Delay: Example

Telnet traffic is delay sensitive. Long TCP delays can make Telnet sessions difficult to use. The following example matches Telnet traffic sourced from the 192.168.1.0/24 network and applies a policy to ensure it is sent out through exit links with that have a response time that is equal to or less than 30 milliseconds:

```
Router(config)# ip access-list extended TELNET
Router(config-ext-nacl)# permit tcp 192.168.1.0 0.0.0.255 any eq telnet
Router(config-ext-nacl)# exit
Router(config)# oer-map BLUE
Router(config-route-map)# match ip address access-list TELNET
Router(config-route-map)# set delay threshold 30
Router(config-route-map)# set resolve delay priority 1 variance 20
Router(config-route-map)# end
```

The following example shows TCP application traffic filtered based on port 23 (Telnet):

```
Router# show oer master appl tcp 23 23 dst policy

Prefix              Appl Prot       Port                 Port Type       Policy
-------------------------------------------------------------------------------
10.1.1.0/24         tcp             [23, 23]             src             10
```

Additional References

The following sections provide references related to the OER Application-Aware Routing: PBR feature:

Related Documents

Related Topic	Document Title
Extended Access Lists —The Cisco IOS IP Application Services Configuration Guide, Release 12.4 provides information about the configuration of extended access lists.	http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hiap_c/index.htm
IP Protocol-Number Assignment—The IANA website provides a list of assigned protocol numbers.	http://www.iana.org/assignments/protocol-numbers
IP Port-Number Assignment—The IANA website provides a list of assigned port numbers.	http://www.iana.org/assignments/port-numbers

Standards

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

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing standards has not been modified by this feature.	—

Technical Assistance

Description	Link
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport

Command Reference

This section documents new and modified commands.

debug oer border pbr

To display debugging information for Policy-Based Routing (PBR) events on a border router, use the debug oer border pbr command in privileged EXEC mode. To stop the display of OER debugging information

debug oer border pbr [**detail**]

no debug oer border pbr [**detail**]

Syntax Description

detail	Displays detailed debugging information.

Command Default

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.4(2)T	This command was introduced.

Usage Guidelines

The **debug oer border pbr** command is used to display debugging information for the OER Application-Aware Routing: PBR feature. This command is entered on the border router.

Examples

The following example enables the display of PBR events on a border router:

```
Router# debug oer border pbr
Sep  1 12:30:22.291: OER BR PBR:
```

Table 1 describes the significant fields shown in the display.

Table 1 debug oer border pbr Field Descriptions

Field	Description
OER BR PBR:	Indicates a PBR event.

Related Commands

Command	Description
oer	Enables an OER process and configures a router as an OER border router or as an OER master controller.

debug oer master prefix

To display debug events related to prefix processing on an OER master controller, use the **debug oer master prefix** command in privileged EXEC mode. To disable the display of debug information, use the **no** form of this command.

debug oer master prefix [*prefix* | **appl**] [**detail**]

no debug oer master prefix [*prefix* | **appl**] [**detail**]

Syntax Description

prefix	(Optional) Specifies a single prefix or prefix range. The prefix address and mask are entered with this argument.
appl	(Optional)
detail	(Optional) Displays detailed OER prefix processing information.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.3(8)T	This command was introduced.

Usage Guidelines

The **debug oer master prefix** command is entered on a master controller. This command displays debugging information related to prefix monitoring and processing.

Examples

The following example shows the master controller searching for the target of an active probe after the target has become unreachable.

```
Router# debug oer master prefix

OER Master Prefix debugging is on
06:01:28: OER MC PFX 10.4.9.0/24: APC last target deleted for prefix, no targets
 left assigned and running
06:01:38: OER MC PFX 10.4.9.0/24: APC Attempting to probe all exits
06:02:59: OER MC PFX 10.4.9.0/24: APC last target deleted for prefix, no targets
 left assigned and running
06:03:08: OER MC PFX 10.4.9.0/24: APC Attempting to probe all exits
06:04:29: OER MC PFX 10.4.9.0/24: APC last target deleted for prefix, no targets
 left assigned and running
06:04:39: OER MC PFX 10.4.9.0/24: APC Attempting to probe all exits
06:05:59: OER MC PFX 10.4.9.0/24: APC last target deleted for prefix, no targets
 left assigned and running
06:06:09: OER MC PFX 10.4.9.0/24: APC Attempting to probe all exits
```

Table 2 describes the significant fields shown in the display.

Table 2 debug oer master prefix Field Descriptions

Field	Description
OER MC PFX *ip-address*:	Indicates debugging information for OER monitored prefixes. The *ip-address* identifies the prefix.

Related Commands

Command	Description
oer	Enables an OER process and configures a router as an OER border router or as an OER master controller.

match ip address (OER)

To reference an extended IP access list or IP prefix as match criteria in an OER map, use the **match ip address (OER)** command in oer-map configuration mode. To delete the match clause entry, use the **no** form of this command.

match ip address {**access-list** *name* | **prefix-list** *name*}

no match ip address

Syntax Description

access-list *name*	Named extended access list configured with the **ip access-list** command.
prefix-list *name*	Name of a prefix list created with the **ip prefix-list** command.

Defaults

No default behavior or values

Command Modes

oer-map

Command History

Release	Modification
12.3(8)T	This command was introduced.
12.4(2)T	Support for matching extended access lists was introduced in Cisco IOS Release 12.4(2)T.

Usage Guidelines

The **match ip address (OER)** command is entered on a master controller in oer-map configuration mode. This command is used to configure a named extended access list or IP prefix list as a match criteria in an oer-map.Only one match clause can be configured for each oer-map sequence. The access list is created with the **ip access-list** command. Only named extended IP access lists are supported. The IP prefix list is created with the **ip prefix-list** command. A prefix can be any IP network number combined with a prefix mask that specifies the prefix length.

Examples

The following example creates a prefix list named CUSTOMER. The prefix list creates a filter for the 10.4.9.0/24 network. The **match ip address (OER)** command configures the prefix list as match criteria in an oer-map.

```
Router(config)# ip prefix-list CUSTOMER permit 10.4.9.0/24
Router(config)# !
Router(config)# oer-map SELECT_EXIT 10
Router(config-oer-map)# match ip address prefix-list CUSTOMER
Router(config-oer-map)# set mode select-exit good
```

The following example creates an extended access list named FTP. The named extended access list creates a filter for FTP traffic that is sourced from the 10.1.1.0/24 network. The **match ip address (OER)** command configures the access list as match criteria in an oer-map. FTP traffic is policy routed to the first in-policy exit.

```
Router(config)# ip access-list extended FTP
```

```
Router(config-ext-nacl)# permit tcp 10.1.1.0 0.0.0.255 any eq ftp
Router(config-ext-nacl)# exit
Router(config)# oer-map SELECT_EXIT 10
Router(config-oer-map)# match ip address access-list FTP
Router(config-oer-map)# set mode select-exit good
```

Related Commands

Command	Description
ip access-list	Defines an IP access list.
ip prefix-list	Creates an entry in a prefix list.
ip prefix-list description	Adds a text description.
ip prefix-list sequence-number	Enables the generation of sequence numbers for entries in a prefix list.
oer	Enables an OER process and configures a router as an OER border router or as an OER master controller.
oer-map	Enters oer-map configuration mode to configure an oer-map to apply policies to selected IP prefixes.

show oer master active-probes

To display connection and status information about active probes on an OER master controller, use the **show oer master active-probes** command in Privileged EXEC mode.

show oer master active-probes [**appl**]

Syntax Description

appl	Filters the output display active probes generated for application traffic configured with the OER Application-Aware Routing: PBR feature.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.3(8)T	This command was introduced.
12.4(2)T	Support for the **appl** keyword was introduced in Cisco IOS Release 12.4(2)T.

Usage Guidelines

The **show oer master active-probes** command is entered on a master controller. This command is used to display the status of active probes. The output from this command displays the active probe type and destination, the border router that is the source of the active probe, the target prefixes that are used for active probing, and wether the probe was learned or configured. Entering the **appl** keyword filters the output to display information about applications optimized by the master controller.

Examples

The following example shows the status of configured and running active probes:

```
Router# show oer master active-probes

        OER Master Controller active-probes
Border   = Border Router running this Probe
State    = Un/Assigned to a Prefix
Prefix   = Probe is assigned to this Prefix
Type     = Probe Type
Target   = Target Address
TPort    = Target Port
How      = Was the probe Learned or Configured
N - Not applicable


The following Probes exist:

State      Prefix            Type     Target          TPort How
Assigned   10.1.1.1/32       echo     10.1.1.1          N Lrnd
Assigned   10.1.4.0/24       echo     10.1.4.1          N Lrnd
Assigned   10.1.2.0/24       echo     10.1.2.1          N Lrnd
Assigned   10.1.4.0/24       udp-echo 10.1.4.1      65534 Cfgd
Assigned   10.1.3.0/24       echo     10.1.3.1          N Cfgd
```

```
Assigned   10.1.2.0/24       tcp-conn 10.1.2.1          23 Cfgd

The following Probes are running:

Border          State    Prefix             Type     Target          TPort
192.168.2.3     ACTIVE   10.1.4.0/24       udp-echo 10.1.4.1       65534
172.16.1.1      ACTIVE   10.1.2.0/24       tcp-conn 10.1.2.1          23
```

Table 3 describes the significant fields shown in the display.

Table 3 show oer master active-probes Field Descriptions

Field	Description
The following Probes exist:	Displays the status of configured active probes
State:	Displays the status of the active probe. The output displays “Assigned” or “Unassigned.”
Prefix	Displays the prefix and prefix mask of the target active probe.
Type	Displays the type of active probe. The output displays “tcp-conn”, “echo”, or “udp-echo.”
Target	Displays the target IP address for the active probe.
TPort	Displays the target port for the active probe.
How	Displays how the active probe was created. The output will indicate the probe is configured or learned.
The following Probes are running:	Displays the status of active probes that are running.
Border	Displays the IP address of the border router.

Related Commands

Command	Description
active-probe	Configures active probes to monitor an OER controlled prefixes.
oer	Enables an OER process and configures a router as an OER border router or as an OER master controller.

show oer master appl

To display information about applications monitored and controlled by an oer master controller, use the show oer master appl command in Privileged EXEC mode.

show oer master appl [**access-list** *name*] [**detail**] | [**tcp** | **udp**] [*protocol-number*] [*min-port max-port*] [**dst** | **src**] [**detail** | **policy**]

Syntax Description[]

access-list *name*	(Optional) Filters the output based on the specified named extended access list.
detail	(Optional) Displays detailed information.
tcp	(Optional) Filters the output based on TCP traffic.
udp	(Optional) Filters the output based on UDP traffic.
protocol-number	(Optional) Filters the output based on the specified protocol number.
min-port max-port	(Optional) Filters the output based on the specified port number or range of port numbers.
dst	(Optional) Filters the output based on the destination port number.
src	(Optional) Filters the output based on the source port number.
policy	(Optional) Displays the policy for the application or port number.

Command Default

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.4(2)T	This command was introduced.

Usage Guidelines

The **show oer master appl** command is entered on an OER master controller. This command is used to display information about applications that are configured for monitoring and optimization with the OER Application-Aware Routing: PBR feature.

Examples

The following example shows TCP application traffic filtered based on port 80 (HTTP):

```
Router# show oer master appl tcp 80 80 dst policy

Prefix              Appl Prot       Port                 Port Type       Policy
--------------------------------------------------------------------------------
10.1.0.0/16         tcp             [80, 80]             dst             20
10.1.1.0/24         tcp             [80, 80]             dst             10
```

Table 4 describes the significant fields shown in the display.

Table 4 show oer master appl Field Descriptions

Field	Description
Prefix	IP address of the monitored prefix that carries the application traffic.
Appl Prot	Application protocol.
Port	Application port number.
Port Type	Source or destination application port number.
Policy	Application policy number.

Related Commands

Command	Description
oer	Enables an OER process and configures a router as an OER border router or as an OER master controller.