PfR Commands

active-probe (PfR)

To configure a Performance Routing (PfR) active probe for a target prefix, use the **active-probe** command in PfR master controller configuration mode. To disable the active probe, use the **no** form of this command.

active-probe *probe-type ip-address* **target-port** *number* [**codec** *codec-name*]

no active-probe *probe-type ip-address*

Syntax Description

probe-type	Type of probe. Must be one of the following: • **echo**—Uses Internet Control Message Protocol (ICMP) echo (ping) messages. • **jitter**—Uses jitter messages. • **tcp-conn**—Uses TCP connection messages. • **udp-echo**—Uses UDP echo messages.
ip-address	Target IP address of a prefix to be monitored using the specified type of probe.
target-port	(Not specified for echo probes.) Specifies the destination port number for the active probe.
number	Port number in the range from 1 to 65535.
codec	(Optional) Only used with the jitter probe type. Specifies the codec value used for Mean Opinion Score (MOS) calculation.
codec-name	(Optional) Codec value, must be one of the following: • **g711alaw**—G.711 A Law 64000 bps. • **g711ulaw**—G.711 U Law 64000 bps. • **g729a**—G.729 8000 bps.

Command Default

No active probes are configured.

Command Modes

PfR master controller configuration (config-pfr-mc)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **active-probe** command is entered on a PfR master controller.

This command is used to optionally configure a master controller to command a border router to transmit active probes to a target IP address or prefix. The active probe is used to measure the delay (round-trip response time) of the target prefix to determine the performance of the current exit and to detect if the prefix is out-of-policy. The border router collects these performance statistics from the active probe and

transmits this information to the master controller, which uses this information to optimize the prefix and to select the best available exit based on default and user-defined policies. The performance information is applied to the most specific optimized prefix, which includes the active probe host address. If the prefix is optimized and is currently using the best in-policy exit link, the master controller does not take any action.

Active probing requires you to configure a specific host or target address. The target address can also be learned by PfR through the NetFlow or Top Talker and Delay learning functionality. Active probes must be sent out of a PfR-managed external interface, which may or may not be the preferred route for an Optimized Prefix (OP). PfR can be configured to use the following four types of active probes:

- ICMP Echo—A ping is sent to the target address. Configuring an ICMP echo probe does not require knowledgeable cooperation from the target device. However, repeated probing could trigger an Intrusion Detection System (IDS) alarm in the target network. If an IDS is configured in a target network that is not under your administrative control, we recommend that you notify the target network administration entity.
- Jitter—A jitter probe is sent to the target address. A target port number must be specified. A remote responder must be enabled on the target device, regardless of the configured port number. An optional codec value can be configured. The codec value is required for Mean Opinion Score (MOS) calculations.

Note In Cisco IOS Release 15.1(2)T and later releases, when you configure a jitter probe the default codec value, g729a, is not nvgened in the running configuration. In Cisco IOS Release 15.1(1)T, 12.2(33(SRE), 12.2(33)SXH, and prior releases, if you did not specify a codec value while configuring the **active-probe jitter** command, the default codec value, g729a, was displayed in the output of the **show running-config** command.

- TCP Connection—A TCP connection probe is sent to the target address. A target port number must be specified. A remote responder must be enabled if TCP messages are configured to use a port number other than TCP well-known port number 23.
- UDP Echo—A UDP echo probe is sent to the target address. A target port number must be specified. A remote responder must be enabled on the target device, regardless of the configured port number.

PfR uses Cisco IOS IP Service Level Agreements (SLAs), a standard feature in Cisco IOS software, to command a border router to transmit an active probe to the target address. No explicit IP SLA configuration is required on the master controller or the border router. Support for IP SLAs is enabled by default when the PfR process is created. However, a remote responder must be enabled on the target device when configuring an active probe using jitter, UDP echo messages, or when configuring an active probe using TCP connection messages that are configured to use a port other than the TCP well-known port number 23. The remote responder is enabled by configuring the **ip sla monitor responder** global configuration command on the target device.

Note For external BGP (eBGP) peering sessions, the IP address of the eBGP peer must be reachable from the border router via a connected route in order for active probes to be generated.

Examples

The following example configures an active probe using an ICMP reply (ping) message. The 10.4.9.1 address is the target. No explicit configuration is required on the target device.

```
Router(config)# pfr master
Router(config-pfr-mc)# active-probe echo 10.4.9.1
```

The following example configures an active probe using jitter messages. The 10.4.9.2 address is the target. The target port number must be specified when configuring this type of probe, and a remote responder must also be enabled on the target device. An optional codec value of g711alaw is specified to be used for MOS calculations.

```
Router(config)# pfr master
Router(config-pfr-mc)# active-probe jitter 10.4.9.2 target-port 1001 codec g711alaw
```

The following example configures an active probe using a TCP connection message. The 10.4.9.3 address is the target. The target port number must be specified when configuring this type of probe.

```
Router(config)# pfr master
Router(config-pfr-mc)# active-probe tcp-conn 10.4.9.3 target-port 23
```

The following example configures an active probe using UDP messages. The 10.4.9.4 address is the target. The target port number must be specified when configuring this type of probe, and a remote responder must also be enabled on the target device.

```
Router(config)# pfr master
Router(config-pfr-mc)# active-probe udp-echo 10.4.9.4 target-port 1001
```

Related Commands

Command	Description
ip sla monitor responder	Enables the IP SLAs Responder for general IP SLAs operations.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.
set active-probe (PfR)	Configures a PfR active probe with a forced target assignment within a PfR map.
show pfr border active-probes	Displays connection and status information about active probes on a PfR border router.
show pfr master active-probes	Displays connection and status information about active probes on a PfR master controller.

active-probe address source (PfR)

To configure an interface on a Performance Routing (PfR) border router as the source of the active probe, use the **active-probe address source** command in PfR border router configuration mode. To configure active probing to use a default exit interface, use the **no** form of this command.

active-probe address source interface *type number*

no active-probe address source interface

Syntax Description

interface	Specifies the interface type and number.
type	Interface type.
number	Interface or subinterface number.

Command Default

The source IP address is taken from the default PfR external interface that transmits the active probe.

Command Modes

PfR border router configuration (config-pfr-br)

Command History

Release	Modification
15.1(2)T	This command was introduced.
Cisco IOS XE Release 3.1S	This command was integrated into Cisco IOS XE Release 3.1S.

Usage Guidelines

The **active-probe address source** command is entered on a border router and allows you to specify the source interface from which active probes are transmitted. When this command is configured, the primary IP address of the specified interface is used as the active probe source. The IP address of the active probe source interface must be unique to ensure that the probe reply is routed back to the specified source interface. If the interface is not configured with an IP address, the active probe will not be generated. If the IP address is changed after the interface has been configured as an active probe source, active probing is stopped and then restarted with the new IP address. If the IP address is removed after the interface has been configured as an active probe source, active probing is stopped and is not restarted until a valid primary IP address is reconfigured.

Note For external Border Gateway Protocol (eBGP) peering sessions, the IP address of the eBGP peer must be reachable from the border router via a connected route in order for active probes to be generated.

Examples

The following example configures Fast Ethernet interface 0/0 as the active probe source:

```
Router(config)# pfr border
Router(config-pfr-br)# active-probe address source interface FastEthernet 0/0
```

The following example configures Gigabit Ethernet interface 0/0/0 as the active probe source:

```
Router(config)# pfr border
Router(config-pfr-br)# active-probe address source interface GigabitEthernet 0/0/0
```

Related Commands

Command	Description
active-probe (PfR)	Configures an active probe for a target prefix.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.
set active-probe (PfR)	Configures a PfR active probe with a forced target assignment within a PfR map.

aggregation-type (PfR)

To configure a Performance Routing (PfR) master controller to aggregate learned prefixes based on the type of traffic flow, use the **aggregation-type** command in PfR Top Talker and Top Delay learning configuration mode. To set learned prefix aggregation to the default type, use the **no** form of this command.

aggregation-type {**bgp** | **non-bgp** | **prefix-length** *prefix-mask*}

no aggregation-type

Syntax Description

bgp	Configures the aggregation of learned prefixes based on the Border Gateway Protocol (BGP) routing table.
non-bgp	Configures the aggregation of learned prefixes based on any other protocol. Prefixes specified with this keyword can be learned only if they are not in the BGP routing table.
prefix-length	Configures aggregation based on the specified prefix length.
prefix-mask	Prefix mask in the range from 1 to 32. Default is 24.

Command Default

If this command is not configured or if the **no** form of this command is entered, the default prefix mask for aggregating learned prefixes is 24.

Command Modes

PfR Top Talker and Top Delay learning configuration (config-pfr-mc-learn)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **aggregation-type** command is entered on a master controller. This command is used to configure PfR to aggregate learned prefixes based on the traffic flow type. BGP prefixes or non-BGP prefixes can be aggregated, and traffic flows can be aggregated based on prefix length.

Entering the **bgp** keyword configures the aggregation of learned prefixes based on prefix entries in the BGP routing table. This keyword is used if internal BGP (iBGP) peering is enabled in the PfR managed network.

Entering the **non-bgp** keyword configures the aggregation of learned prefixes based on any other routing protocol. Prefix entries that are present in the BGP routing table are ignored when this keyword is entered.

Examples

The following example configures the aggregation of learned BGP prefixes:

```
Router(config)# pfr master
Router(config-pfr-mc)# learn
Router(config-pfr-mc-learn)# aggregation-type bgp
```

Related Commands

Command	Description
learn (PfR)	Enters PfR Top Talker and Top Delay learning configuration mode to configure prefixes for PfR to learn.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

api provider (PfR)

To register an application programming interface (API) provider with a Performance Routing (PfR) master controller and to enter PfR master controller application interface provider configuration mode, use the **api provider** command in PfR master controller configuration mode. To unregister the application interface provider, use the **no** form of this command.

api provider *provider-id* [**priority** *value*]

no api provider *provider-id*

Syntax Description

provider-id	A number in the range from 1 to 65535 that represents the ID assigned to the provider. API provider IDs in the range of 1 to 100 are reserved for internal Cisco applications.
priority	(Optional) Sets the priority of the provider.
value	(Optional) A number in the range from 1 to 65535. The lower the number, the higher the priority. The default priority is 65535. API provider priority values in the range of 1 to 100 are reserved for internal Cisco applications.

Command Default

An API provider is not registered with a PfR master controller.

Command Modes

PfR master controller configuration (config-pfr-mc)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The PfR application interface defines the mode of communication and messaging between applications and the network for the purpose of optimizing the traffic associated with the applications. A provider is defined as an entity outside the network in which the router configured as a PfR master controller exists, for example, an ISP, or a branch office of the same company. The provider has one or more host devices running one or more applications that use the PfR application interface to communicate with a PfR master controller. A provider must be registered with a PfR master controller before an application on a host device can interface with PfR. Use the **api provider** command to register the provider, and use the **host-address** (PfR) command to configure a host device. After registration, a host device in the provider network can initiate a session with a PfR master controller. The PfR application interface provides an automated method for networks to be aware of applications and provides application-aware performance routing.

Use the optional **priority** keyword to specify a priority value for the provider when multiple providers are registered with PfR. The number 1 assigns the highest priority to any requests through the application interface. If you assign a priority, each provider must be assigned a different priority number. If you try to assign the same priority number to two different providers, an error message is displayed on the console.

Note API provider IDs and API priority values in the range of 1 to 100 are reserved for internal Cisco applications.

Use the **show pfr api provider** command to view information about the currently registered providers. Use the **show pfr master policy** command with the **dynamic** keyword to display information about policies created dynamically by an application using the PfR application interface.

Examples

The following example shows how to register a provider on a master controller. In this example, more than one provider is configured, so the priority is set for each provider. For the single host device configured for provider 101, no priority is set and the default priority value of 65535 is assigned, giving this host device a lower priority than each of the host devices configured for provider 102.

```
Router(config)# pfr master
Router(config-pfr-mc)# api provider 101
Router(config-pfr-mc-api-provider)# host-address 10.1.2.2 key-chain PFR_HOST
Router(config-pfr-mc-api-provider)# exit
Router(config-pfr-mc)# api provider 102 priority 4000
Router(config-pfr-mc-api-provider)# host-address 10.2.2.2 key-chain PFR_HOST
priority 3000
Router(config-pfr-mc-api-provider)# host-address 10.2.2.3 key-chain PFR_HOST
priority 4000
Router(config-pfr-mc-api-provider)# end
```

Related Commands

Command	Description
host-address (PfR)	Configures information about a host device used by an application interface provider to communicate with a PfR master controller.
pfr master	Enables a PfR process and configures a router as a PfR master controller.
show pfr api provider	Displays information about application interface providers registered with PfR.
show pfr master policy	Displays policy settings on a PfR master controller.

application define (PfR)

To configure a user-defined custom application to be monitored by Performance Routing (PfR), use the **application define** command in PfR master controller configuration mode. To remove the definition of a user-defined custom application to be monitored by PfR, use the **no** form of this command.

application define *application-name* {**access-list** *access-list-name* | **nbar**}

no application define *application-name*

Syntax Description

application-name	Name of the user-defined custom application.
access-list	Defines an application using an access list.
access-list-name	Name of an access list.
nbar	Defines a user-defined custom application to be identified using Network-Based Application Recognition (NBAR).

Command Default

No custom-defined applications are configured for use with PfR.

Command Modes

PfR master controller configuration (config-pfr-mc)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **application define** command allows a user-defined custom application to be configured on the master controller as an application that can be used in PfR configuration to create a traffic class that can be measured and controlled using PfR techniques. An access list can be used to define the traffic flows to create a custom application.

PfR supports the ability to define a custom application to be identified using NBAR. NBAR includes many defined applications, but a Packet Description Language Module (PDLM) can be used to add a new protocol to the list of supported NBAR applications. A PDLM uses a mapping of static TCP and UDP port numbers to create a custom application. The application defined by a PDLM file must be recognized on a PfR border router and configured on the master controller using the **application define** command. The PfR master controller makes a request to the border router to determine if the application is supported. Use the **show pfr master nbar application** command to check if the application is supported on each border router.

To display defined applications, use the **show pfr master defined** or the **show pfr border defined** commands.

Examples

The following example, starting in global configuration mode, shows how to define a custom application named ACCESS_DEFINE using an access list. The access list is configured to identify all TCP traffic from any destination or source and from a destination port number of 500.

```
Router(config)# ip access-list ACCESS_DEFINE
Router(config-ext-nacl)# permit tcp any any 500
Router(config-ext-nacl)# exit
Router(config)# pfr master
Router(config-pfr-mc)# application define APP_ACCESS access-list ACCESS_DEFINE
Router(config-pfr-mc)# end
```

The following example, starting in global configuration mode, shows how to define a custom application named APP_NBAR1 to be identified using NBAR and used in PfR configuration to create a traffic class that can be measured and controlled using PfR techniques.

```
Router(config)# pfr master
Router(config-pfr-mc)# application define APP_NBAR1 nbar
Router(config-pfr-mc)# end
```

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.
show pfr border defined	Displays all applications that are defined to be monitored by a PfR border router.
show pfr master defined	Displays all applications that are defined on a PfR master controller.
show pfr master nbar application	Displays information about the status of an application identified using NBAR for each PfR border router.

backoff (PfR)

To set the backoff timer to adjust the time period for prefix policy decisions, use the **backoff** command in PfR master controller configuration mode. To set the backoff timer to the default values, use the **no** form of this command.

backoff *min-timer max-timer* [*step-timer*]

no backoff

Syntax Description

min-timer	Sets the minimum value for the backoff timer in seconds. The configurable time period for this argument is from 180 to 7200. The default timer value is 300.
max-timer	Sets the maximum value for the backoff timer in seconds. The configurable time period for this argument is from 180 to 7200. The default timer value is 3000.
step-timer	(Optional) Sets the value of the time period for the step timer in seconds. The step timer is used to add time to the out-of-policy waiting period each time the backoff timer expires and Performance Routing (PfR) is unable to find an in-policy exit. The configurable time period for this argument is from 180 to 7200. The default timer value is 300.

Command Default

PfR uses the following default values if this command is not configured or if the **no** form of this command is entered:

min-timer: 300
max-timer: 3000
step-timer: 300

Command Modes

PfR master controller configuration (config-pfr-mc)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **backoff** command is entered on a PfR master controller. This command is used to adjust the transition period during which the master controller holds an out-of-policy prefix. The master controller waits for the transition period before making an attempt to find an in-policy exit. This command is configured with a minimum and maximum timer value and can be configured with an optional step timer.

The *min-timer* argument is used to set the minimum transition period in seconds. If the current prefix is in-policy when this timer expires, no change is made and the minimum timer is reset to the default or configured value. If the current prefix is out-of-policy, PfR will move the prefix to an in-policy and reset the minimum timer to the default or configured value.

The *max-timer* argument is used to set the maximum length of time PfR holds an out-of-policy prefix when there are no PfR controlled in-policy prefixes. If all PfR controlled prefixes are in an out-of-policy state and the value from the *max-timer* argument expires, PfR will select the best available exit and reset the minimum timer to the default or configured value.

The *step-timer* argument allows you to optionally configure PfR to add time each time the minimum timer expires until the maximum time limit has been reached. If the maximum timer expires and all PfR managed exits are out-of-policy, PfR will install the best available exit and reset the minimum timer.

Configuring a new timer value will immediately replace the existing value if the new value is less than the time remaining. If the new value is greater than the time remaining, the new timer value will be used when the existing timer value expires.

Examples

The following example sets the minimum timer to 400 seconds, the maximum timer to 4000 seconds, and the step timer to 400 seconds:

```
Router(config)# pfr master
Router(config-pfr-mc)# backoff 400 4000 400
```

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.
set backoff (PfR)	Configures a PfR map to set the backoff timer to adjust the time period for prefix policy decisions.

border (PfR)

To enter PfR managed border router configuration mode to establish communication with a Performance Routing (PfR) border router, use the **border** command in PfR master controller configuration mode. To disable communication with the specified border router, use the **no** form of this command.

border *ip-address* [**key-chain** *key-name*]

no border *ip-address*

Syntax Description

ip-address	IP address of the border router.
key-chain	(Optional) Specifies the key used to authenticate communication between the border router and the master controller. The authentication key must be specified during the initial configuration to establish communication, but is not required to enter PfR managed border router configuration mode.
key-name	(Optional) String that represents a key.

Command Default

No communication is established between a PfR border router and a master controller.

Command Modes

PfR master controller configuration (config-pfr-mc)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **border** command is entered on a master controller. This command is used to establish communication between a master controller and a border router. Border key-chain configuration is required during initial configuration. Once configured, the **key-chain** keyword is optional. Communication is established between the master controller and the border router processes to allow the master controller to monitor and control prefixes and exit links. Communication must also be established on the border router using the **master** command. Passive monitoring in PfR observe mode is enabled by default when communication is established between a PfR border router and a master controller.

At least one border router must be configured to enable PfR. A maximum of ten border routers can be configured to communicate with a single master controller. The IP address that is used to specify the border router must be assigned to an interface that is physically located on the border router and the IP address must be reachable by the master controller.

Communication between the master controller and the border router is protected by key-chain authentication. The authentication key must be configured on both the master controller and the border router before communication can be established. The key-chain configuration is defined in global configuration mode on both the master controller and the border router before key-chain authentication is enabled for master controller to border router communication. For more information about key management in Cisco IOS software, see the "Managing Authentication Keys" section in the "Configuring IP Protocol-Independent Features" chapter of the *Cisco IOS IP Routing: Protocol-Independent Configuration Guide*.

When the **border** command is entered, the router enters PfR managed border router configuration mode. Local interfaces must be defined as internal or external using the **interface** (PfR) command. A single PfR master controller can support up to 20 interfaces.

Enabling a Border Router and Master Controller Process on the Same Router

A Cisco router can be configured to perform in dual operation and run a master controller process and a border router process on the same router. However, this router will use more memory than a router that is configured to run only a border router process. This factor should be considered when selecting a router for dual operation.

Examples

The following example defines a key chain named MASTER in global configuration mode and then configures a master controller to communicate with the 10.4.9.6 border router. The master controller authenticates the border router using the defined key CISCO.

```
Router(config)# key chain MASTER
Router(config-keychain)# key 1
Router(config-keychain-key)# key-string CISCO
Router(config-keychain-key)# exit
Router(config-keychain)# exit
Router(config)# pfr master
Router(config-pfr-mc)# logging
Router(config-pfr-mc)# border 10.4.9.6 key-chain MASTER
Router(config-pfr-mc-br)# interface FastEthernet0/0 external
Router(config-pfr-mc-br)# interface FastEthernet0/1 internal
```

Related Commands

Command	Description
interface (PfR)	Configures a border router interface as a PfR-controlled external or internal interface.
key	Identifies an authentication key on a key chain.
key chain (IP)	Enables authentication for routing protocols.
key-string (authentication)	Specifies the authentication string for a key.
master (PfR)	Establishes communication with a PfR master controller.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

clear pfr border

To reset a connection between a Performance Routing (PfR) border router and the PfR master controller, use the **clear pfr border** command in privileged EXEC mode.

clear pfr border *

Syntax Description

*	Clears a connection between a border router and the master controller.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.
Cisco IOS XE Release 3.1S	This command was integrated into Cisco IOS XE Release 3.1S.

Usage Guidelines

The **clear pfr border** command is entered on a border router. The border router and master controller will automatically reestablish communication after this command is entered.

Examples

The following example resets a connection between a border router and a master controller:

```
Router# clear pfr border *
```

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

clear pfr master

To reset a connection between a Performance Routing (PfR) master controller process and all active border router connections, use the **clear pfr master** command in privileged EXEC mode.

clear pfr master *

Syntax Description

*	Clears the master controller process and all active border router connections.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **clear pfr master** command is entered on a master controller. The master controller will restart all configured and default processes and reestablish communication with active border routers after this command is entered.

Examples

The following example resets the master controller process and all active border router connections:

```
Router# clear pfr master *
```

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

clear pfr master border

To reset an active Performance Routing (PfR) border router connection or all connections with a PfR master controller, use the **clear pfr master border** command in privileged EXEC mode.

clear pfr master border {***** | *ip-address*}

Syntax Description

*****	Specifies all active border router connections.
ip-address	Specifies a single border router connection.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **clear pfr master border** command is entered on a master controller.

Examples

The following example resets all border router connections to the master controller:

```
Router# clear pfr master border *
```

The following example resets a single border router connection to the master controller:

```
Router# clear pfr master border 10.4.9.6
```

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

clear pfr master prefix

To clear Performance Routing (PfR) controlled prefixes from the master controller database, use the **clear pfr master prefix** command in privileged EXEC mode.

clear pfr master prefix {***** | *prefix* | **inside *** | **learned** [**inside**]}

Syntax Description

*****	Clears all prefixes.
prefix	Clears a single prefix or prefix range. The prefix address and mask are entered with this argument.
inside	Clears inside prefixes.
learned	Clears learned prefixes.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **clear pfr master prefix** command is entered on a master controller.

Examples

The following example clears learned prefixes:

```
Router# clear pfr master prefix learned
```

The following example clears all inside prefixes:

```
Router# clear pfr master prefix inside *
```

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

clear pfr master traffic-class

To clear Performance Routing (PfR) controlled traffic classes from the master controller database, use the **clear pfr master traffic-class** command in privileged EXEC mode.

clear pfr master traffic-class [**access-list** *access-list-name* | **application** *application-name* [*prefix*] | **inside** | **learned** [**delay** | **inside** | **list** *list-name* | **throughput**] | **prefix** *prefix* | **prefix-list** *prefix-list-name*]

Syntax Description

access-list	(Optional) Clears information about traffic classes defined by an access list.
access-list-name	(Optional) Name of an access list.
application	(Optional) Clears information about traffic classes defined by an application.
application-name	(Optional) Name of a predefined static application using fixed ports. See Table 1.
prefix	(Optional) An IP address and bit length mask representing a prefix to be cleared.
inside	(Optional) Clears information about inside traffic classes.
learned	(Optional) Clears information about learned traffic classes.
delay	(Optional) Clears information about learned traffic classes defined using delay.
list	(Optional) Clears information about learned traffic classes defined in a PfR learn list.
list-name	(Optional) Name of a PfR learn list.
throughput	(Optional) Clears information about learned traffic classes defined using throughput.
prefix	(Optional) Clears information about traffic classes defined by a prefix.
prefix-list	(Optional) Clears information about traffic classes defined by a prefix list.
prefix-list-name	(Optional) Name of prefix list.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **clear pfr master traffic-class** command is entered on a master controller. To clear PfR-controlled traffic classes defined by an application identified using Network-Based Application Recognition (NBAR) from the master controller database, use the **clear pfr master traffic-class application nbar** command.

Table 1 displays the keywords that represent the application that can be configured with the **clear pfr master traffic-class** command. Replace the *application-name* argument with the appropriate keyword from the table.

Table 1 Static Application List Keywords

Keyword	Protocol	Port
cuseeme	TCP UDP	7648 7649 7648 7649 24032
dhcp (Client)	UDP/TCP	68
dhcp (Server)	UDP/TCP	67
dns	UDP/TCP	53
finger	TCP	79
ftp	TCP	20 21
gopher	TCP/UDP	70
http	TCP/UDP	80
httpssl	TCP	443
imap	TCP/UDP	143 220
irc	TCP/UDP	194
kerberos	TCP/UDP	88 749
l2tp	UDP	1701
ldap	TCP/UDP	389
mssql	TCP	1443
nfs	TCP/UDP	2049
nntp	TCP/UDP	119
notes	TCP/UDP	1352
ntp	TCP/UDP	123
pcany	UDP TCP	22 5632 65301 5631
pop3	TCP/UDP	110
pptp	TCP	17233
simap	TCP/UDP	585 993 (Preferred)
sirc	TCP/UDP	994
sldap	TCP/UDP	636
smtp	TCP	25
snntp	TCP/UDP	563
spop3	TCP/UDP	123
ssh	TCP	22
telnet	TCP	23

Examples

The following example shows how to clear traffic classes defined by the Secure Shell (SSH) application and the 10.1.1.0/24 prefix:

```
Router# clear pfr master traffic-class application ssh 10.1.1.0/24
```

The following example shows how to clear traffic classes that were learned:

```
Router# clear pfr master traffic-class learned
```

Related Commands

Command	Description
clear pfr master traffic-class application nbar	Clears PfR-controlled traffic classes defined by an application identified using NBAR from the master controller database.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

clear pfr master traffic-class application nbar

To clear Performance Routing (PfR) controlled traffic classes defined by an application identified using Network-Based Application Recognition (NBAR) from the master controller database, use the **clear pfr master traffic-class application nbar** command in privileged EXEC mode.

clear pfr master traffic-class application nbar [*nbar-appl-name* [*prefix*]]

Syntax Description

nbar-appl-name	(Optional) Keyword representing the name of an application identified using NBAR. See the "Usage Guidelines" section for more details.
prefix	(Optional) An IP address and bit length mask representing a prefix to be cleared.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **clear pfr master traffic-class application nbar** command is entered on a master controller. To clear all other types of PfR-controlled traffic classes from the master controller database, use the **clear pfr master traffic-class** command.

NBAR is capable of identifying applications based on the following three types of protocols:

- Non-UDP and non-TCP IP protocols—For example, Generic Routing Encapsulation (GRE) and Internet Control Message Protocol (ICMP).
- TCP and UDP protocols that use statically assigned port numbers—For example, CU-SeeMe desktop video conference (CU-SeeMe-Server) and Post Office Protocol over Transport Layer Security (TLS) and Secure Sockets Layer (SSL) server (SPOP3-Server).
- TCP and UDP protocols that dynamically assign port numbers and require stateful inspection—For example, Real-Time Transport Protocol audio streaming (RTP-audio) and BitTorrent File Transfer Traffic (BitTorrent).

Use the **clear pfr master traffic-class application nbar ?** command to determine if an application can be identified using NBAR and replace the *nbar-appl-name* argument with the appropriate keyword from the screen display.

The list of applications identified using NBAR and available for profiling PfR traffic classes is constantly evolving. For lists of many of the NBAR applications defined using static or dynamically assigned ports, see the "Performance Routing with NBAR/CCE Application and Recognition" module.

For more details about NBAR, see the "Classifying Network Traffic Using NBAR" section of the *Cisco IOS Quality of Service Solutions Configuration Guide*.

If the *prefix* argument is specified, only the PfR-controlled traffic class that matches the application specified by the *nbar-appl-name* argument and the destination prefix specified by the *prefix* argument are cleared. If the *prefix* argument is not specified, all PfR-controlled traffic classes that match the application specified by the *nbar-appl-name* argument, regardless of the destination prefix, are cleared.

Examples

The following example shows how to determine the keyword that represents an application identified using NBAR in order to clear the PfR traffic classes defined by the application:

```
Router# clear pfr master traffic-class application nbar ?
```

The following example shows how to clear PfR traffic classes defined by the RTP-audio application that is identified using NBAR and the 10.1.1.0/24 prefix:

```
Router# clear pfr master traffic-class application nbar rtp-audio 10.1.1.0/24
```

The following example shows how to clear all PfR traffic classes defined by applications identified using NBAR:

```
Router# clear pfr master traffic-class application nbar
```

Related Commands

Command	Description
clear pfr master traffic-class	Clears PfR-controlled traffic classes from the master controller database.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

cost-minimization (PfR)

To configure Performance Routing (PfR) cost-based optimization policies on a master controller, use the **cost-minimization** command in PfR border exit interface configuration mode. To disable a cost-based optimization policy, use the **no** form of this command.

cost-minimization {**calc** {**combined** | **separate** | **sum**} | **discard** [**daily**] {**absolute** *number* | **percent** *percentage*} | **end day-of-month** *day* [**offset** [**-**] *hh:mm*] | **fixed fee** [*cost*] | **nickname** *name* | **sampling period** *minutes* [**rollup** *minutes*] | **summer-time** *start end* [*offset*] | **tier** *percentage* **fee** *fee*}

no cost-minimization {**calc** | **discard** | **end day-of-month** *day* [**offset** [**-**] *hh:mm*] | **fixed fee** [*cost*] | **nickname** | **sampling period** | **summer-time** | **tier** *percentage*}

Syntax Description

calc	Specifies how the fee is calculated.
combined	Specifies billing based on combined egress and ingress rollup samples.
separate	Specifies billing based on separate egress and ingress rollup samples.
sum	Specifies billing based on egress and ingress rollup samples that are added and then combined.
discard	Specifies how often rollup samples are discarded.
daily	(Optional) Specifies a daily rather than monthly rollup period.
absolute *number*	Specifies an absolute number of rollup samples to be discarded. The value that can be entered for the *number* argument ranges from 1 to 1440.
percent *percentage*	Specifies a percentage of rollup samples to be discarded. The value that can be entered for the *percentage* argument ranges from 1 to 99.
end day-of-month *day*	Specifies the end billing date.
offset [**-**] *hh***:***mm*	(Optional) Specifies an offset in hours and minutes, allowing you to compensate for time zone differences. The optional "**-**" keyword is used to allow for negative hours and minutes to be specified when the time zone is ahead of UTC.
fixed fee	Specifies a nonusage-based fixed fee.
cost	(Optional) Cost for the fixed fee.
nickname *name*	Specifies a nickname for the cost structure.
sampling period *minutes*	Specifies the sampling period in minutes. The value that can be entered for the *minutes* argument ranges from 1 to 1440.
rollup *minutes*	(Optional) Specifies that samples are rolled up at the interval specified for the *minutes* argument. The value that can be entered for the *minutes* argument ranges from 1 to 1440. The minimum number that can be entered must be equal to or greater than the number that is entered for the sampling period.
summer-time	Specifies the start and end of summer time.
start	The start period is entered in following format: the week number or the words first or last, the day represented by the first three letters of the day, the month represented by the first three letters of the month, and hh:mm. For example, 1 Sun Apr 00:00.

end	The end period is entered in following format: the week number or the words first or last, the day represented by the first three letters of the day, the month represented by the first three letters of the month, and hh:mm. For example, 4 Sun Oct 23:59.
offset	(Optional) The *offset* argument allows for an offset in minutes from 1 to 120 to allow for up to two additional hours to be added in the spring and subtracted in the fall.
tier	Specifies a cost tier.
percentage	A percentage of capacity for a cost tier.
fee *fee*	Specifies the fee associated with a cost tier.

Command Default

No cost-based optimization policies are configured.

Command Modes

PfR border exit interface configuration (config-pfr-mc-br-if)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **cost-minimization** command is configured on a master controller. Cost-based optimization allows you to configure link policies based on the Internet service provider (ISP) financial cost of each exit link in your network. The **cost-minimization** command allows you to configure the master controller to send traffic over exit links that provide the most cost-effective bandwidth utilization, while still maintaining the desired performance characteristics.

Examples

The following example, starting in global configuration mode, configures cost-based optimization on a master controller. Cost optimization configuration is applied under the external interface configuration. A policy for a tiered billing cycle is configured. Calculation is configured separately for egress and ingress samples. The time interval between sampling is set to 10 minutes. These samples are configured to be rolled up every 60 minutes. In this example, summer time is configured to start the second week in March on a Sunday at 2 in the morning plus one hour, and to end on Sunday in the first week in November at 2 in the morning minus one hour. The last day of the billing cycle is on the 30th day of the month with an offset of 5 hours added to UTC to adjust for the time zone.

```
Router(config)# pfr master
Router(config-pfr-mc)# border 10.5.5.55 key-chain key
Router(config-pfr-mc-br)# interface Ethernet 0/0 external
Router(config-pfr-mc-br-if)# cost-minimization nickname ISP1
Router(config-pfr-mc-br-if)# cost-minimization summer-time 2 Sun Mar 02:00
1 Sun Nov 02:00 60
Router(config-pfr-mc-br-if)# cost-minimization end day-of-month 30 offset 23:59
Router(config-pfr-mc-br-if)# cost-minimization calc separate
Router(config-pfr-mc-br-if)# cost-minimization sampling period 10 rollup 60
Router(config-pfr-mc-br-if)# cost-minimization tier 100 fee 1000
Router(config-pfr-mc-br-if)# cost-minimization tier 90 fee 900
Router(config-pfr-mc-br-if)# cost-minimization tier 80 fee 800
Router(config-pfr-mc-br-if)# end
```

Related Commands

Command	Description
debug pfr master cost-minimization	Displays debugging information for cost-based optimization policies.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.
show pfr master cost-minimization	Displays the status of cost-based optimization policies.

count (PfR)

To set the number of traffic classes to be learned by a learn list during a Performance Routing (PfR) learn session, use the **count** command in learn list configuration mode. To reset the number of traffic classes to be learned by a learn list to the default values, use the **no** form of this command.

count *number* **max** *max-number*

no count *number* **max** *max-number*

Syntax Description

number	Number representing the number of traffic classes to be learned by a learn list during a PfR learn session. The range of numbers is from 1 to 100. The default is 50.
max	Specifies the maximum number of traffic classes to be learned by a PfR learn list (over all PfR learning sessions).
max-number	Number representing the maximum number of traffic classes to be learned for a PfR learn list. The range of numbers is from 1 to 100. The default is 100.

Command Default

If this command is not configured, the number of traffic classes to be learned by a learn list during a PfR learn session is set to the default values:
number: 50
max-number: 100

Command Modes

Learn list configuration (config-pfr-mc-learn-list)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

Use this command to set the number of traffic classes that a border router sends to the master controller for a learn list during a PfR learn session. An overall maximum number of traffic classes for a learn list can also be configured.

Examples

In the following example, the number of traffic classes to be learned in the first learn list (remote login traffic class) session is set to 50, and the maximum number of traffic classes to be learned for all sessions of the first learn list is set to 90. The second traffic class for file transfer traffic is configured with a maximum number of traffic classes set to 80, with 40 traffic classes set to be learned in a single session. Starting in global configuration mode, application traffic classes are defined using two PfR learn lists, LEARN_REMOTE_LOGIN_TC and LEARN_FILE_TRANSFER_TC. The remote login traffic class is configured using keywords representing Telnet and Secure Shell (SSH) traffic, and the resulting prefixes are aggregated to a prefix length of 24. The file transfer traffic class is configured using a keyword that represents FTP and is also aggregated to a prefix length of 24. A prefix-list is applied to the file transfer

traffic class to permit traffic from the 10.0.0.0/8 prefix. The master controller is configured to learn the top prefixes based on the highest outbound throughput for the filtered traffic, and the resulting traffic classes are added to the PfR application database.

```
Router(config)# ip prefix-list INCLUDE_10_NET 10.0.0.0/8
Router(config)# pfr master
Router(config-pfr-mc)# learn
Router(config-pfr-mc-learn)# list seq 10 refname LEARN_REMOTE_LOGIN_TC
Router(config-pfr-mc-learn-list)# count 50 max 90
Router(config-pfr-mc-learn-list)# traffic-class application telnet ssh
Router(config-pfr-mc-learn-list)# aggregation-type prefix-length 24
Router(config-pfr-mc-learn-list)# throughput
Router(config-pfr-mc-learn-list)# exit
Router(config-pfr-mc-learn)# list seq 20 refname LEARN_FILE_TRANSFER_TC
Router(config-pfr-mc-learn-list)# count 40 max 80
Router(config-pfr-mc-learn-list)# traffic-class application ftp filter INCLUDE_10_NET
Router(config-pfr-mc-learn-list)# aggregation-type prefix-length 24
Router(config-pfr-mc-learn-list)# throughput
Router(config-pfr-mc-learn-list)# end
```

Related Commands

Command	Description
learn (PfR)	Enters PfR Top Talker and Top Delay learning configuration mode to configure PfR to automatically learn traffic classes.
list (PfR)	Creates a PfR learn list to specify criteria for learning traffic classes and enters learn list configuration mode.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr api

To display Performance Routing (PfR) application interface debugging information, use the **debug pfr api** command in privileged EXEC mode. To stop the display of PfR application interface debugging information, use the **no** form of this command.

debug pfr api [**detail**]

no debug pfr api

Syntax Description

detail	(Optional) Displays detailed application interface debugging information.

Command Default

Detailed PfR application interface debugging messages are not displayed.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **debug pfr api** command is used to display messages about any configured PfR application interface providers or host devices. The PfR application interface defines the mode of communication and messaging between applications and the network for the purpose of optimizing the traffic associated with the applications. A provider is defined as an entity outside the network in which the router configured as a PfR master controller exists, for example, an ISP, or a branch office of the same company. The provider has one or more host devices running one or more applications that use the PfR application interface to communicate with a PfR master controller. A provider must be registered with a PfR master controller before an application on a host device can interface with PfR. Use the **api provider** (PfR) command to register the provider, and use the **host-address** (PfR) command to configure a host device. After registration, a host device in the provider network can initiate a session with a PfR master controller. The application interface provides an automated method for networks to be aware of applications and provides application-aware performance routing.

Caution When the **detail** keyword is entered, the amount of detailed output to be displayed can utilize a considerable amount of system resources. Use the **detail** keyword with caution in a production network.

Examples

The following example enables the display of PfR application interface debugging messages, and the output shows that a PfR policy failed due to a prefix that is not found:

```
Router# debug pfr api

OER api debugging is on
```

```
*May 26 01:04:07.278: OER API: Data set id received 5, data set len 9, host ip 10.3.3.3,
session id 1, requies2
*May 26 01:04:07.278: OER API: Received get current policy, session id 1 request id 22
*May 26 01:04:07.278: OER API: Recvd Appl with Prot 256 DSCP 0 SrcPrefix 0.0.0.0/0
SrcMask 0.0.0.0
*May 26 01:04:07.278: OER API:  DstPrefix 10.2.0.0/24 DstMask 255.255.255.0 Sport_min 0
Sport_max 0 Dport_mi0
*May 26 01:04:07.278: OER API: get prefix policy failed - prefix not found
*May 26 01:04:07.278: OER API: Get curr policy cmd received. rc 0
*May 26 01:04:07.278: OER API: Received send status response, status 0, session id 1,
request id 22, sequence0
*May 26 01:04:07.278: OER API: rc for data set 0
```

Table 2 describes the significant fields shown in the display. The content of the debugging messages depends on the commands that are subsequently entered at the router prompt.

Table 2 debug pfr api Field Descriptions

Field	Description
OER api debugging is on	Shows that application interface debugging is enabled.
OER API	Displays a PfR application interface message.

Related Commands

Command	Description
api provider	Registers an application interface provider with a PfR master controller and enters PfR master controller application interface provider configuration mode.
host-address	Configures information about a host device used by an application interface provider to communicate with a PfR master controller.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.
show pfr api provider	Displays information about application interface providers registered with PfR.

debug pfr border

To display general Performance Routing (PfR) border router debugging information, use the **debug pfr border** command in privileged EXEC mode. To stop the display of PfR debugging information, use the **no** form of this command.

debug pfr border

no debug pfr border

Syntax Description

This command has no arguments or keywords.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.
Cisco IOS XE Release 3.1S	This command was integrated into Cisco IOS XE Release 3.1S.

Usage Guidelines

The **debug pfr border** command is entered on a border router. This command is used to display debugging information about the PfR border process, controlled routes, and monitored prefixes.

Examples

The following example enables the display of general PfR debugging information:

```
Router# debug pfr border

*May  4 22:32:33.695: OER BR: Process Message, msg 4, ptr 33272128, value  140
*May  4 22:32:34.455: OER BR: Timer event, 0
```

Table 3 describes the significant fields shown in the display.

Table 3 debug pfr border Field Descriptions

Field	Description
OER BR:	Indicates debugging information for PfR border process.

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr border active-probe

To display debugging information for active probes configured on the local border router, use the **debug pfr border active-probe** command in privileged EXEC mode. To stop the display of debug event information, use the **no** form of this command.

debug pfr border active-probe [**detail**]

no debug pfr border active-probe [**detail**]

Syntax Description

detail	(Optional) Displays detailed information.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.
Cisco IOS XE Release 3.1S	This command was integrated into Cisco IOS XE Release 3.1S.

Usage Guidelines

The **debug pfr border active-probe** command is entered on a border router. This command is used to display the status and results of active probes that are configured on the local border router.

Examples

The following example enables the display of active-probe debug information on a border router:

```
Router# debug pfr border active-probe

*May  4 23:47:45.633: OER BR ACTIVE PROBE: Attempting to retrieve Probe
Statistics.
      probeType = echo, probeTarget = 10.1.5.1, probeTargetPort = 0
      probeSource = Default, probeSourcePort = 0, probeNextHop = Default
      probeIfIndex = 13
*May  4 23:47:45.633: OER BR ACTIVE PROBE: Completed retrieving Probe
Statistics.
      probeType = echo, probeTarget = 10.1.5.1, probeTargetPort = 0
      probeSource = Default, probeSourcePort = 0, probeNextHop = 10.30.30.2
      probeIfIndex = 13, SAA index = 15
*May  4 23:47:45.633: OER BR ACTIVE PROBE: Completions 11, Sum of rtt 172,
Max rtt 36, Min rtt 12
*May  4 23:47:45.693: OER BR ACTIVE PROBE: Attempting to retrieve Probe
Statistics.
      probeType = echo, probeTarget = 10.1.4.1, probeTargetPort = 0
      probeSource = Default, probeSourcePort = 0, probeNextHop = Default
      probeIfIndex = 13
*May  4 23:47:45.693: OER BR ACTIVE PROBE: Completed retrieving Probe
Statistics.
      probeType = echo, probeTarget = 10.1.4.1, probeTargetPort = 0
```

```
probeSource = Default, probeSourcePort = 0, probeNextHop = 10.30.30.2
probeIfIndex = 13, SAA index = 14
```

Table 4 describes the significant fields shown in the display.

Table 4 debug pfr border active-probe Field Descriptions

Field	Description
OER BR ACTIVE PROBE:	Indicates debugging information for Performance Routing (PfR) active probes on a border router.
Statistics	The heading for PfR active probe statistics.
probeType	The active probe type. The active probe types that can be displayed are ICMP, TCP, and UDP.
probeTarget	The target IP address of the active probe.
probeTargetPort	The target port of the active probe.
probeSource	The source IP address of the active probe. Default is displayed for a locally generated active probe.
probeSourcePort	The source port of the active probe.
probeNextHop	The next hop for the active probe.
probeIfIndex	The active probe source interface index.
SAA index	The IP SLAs collection index number.

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr border learn

To display debugging information about learned prefixes on the local border router, use the **debug pfr border learn** command in privileged EXEC mode. To stop the display of debug event information, use the **no** form of this command.

debug pfr border learn [**top** *number*]

no debug pfr border learn [**top** *number*]

Syntax Description

top *number*	(Optional) Displays debugging information about the top delay or top throughput prefixes. The number of top delay or throughput prefixes can be specified. The range of prefixes that can be specified is a number from 1 to 65535.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.
Cisco IOS XE Release 3.1S	This command was integrated into Cisco IOS XE Release 3.1S.

Usage Guidelines

The **debug pfr border learn** command is entered on a border router. This command is used to display debugging information about prefixes learned on the local border router.

Examples

The following example enables the display of active-probe debug information on a border router:

```
Router# debug pfr border learn

*May  4 22:51:31.971: OER BR LEARN: Reporting prefix 1: 10.1.5.0, throughput 201
*May  4 22:51:31.971: OER BR LEARN: Reporting 1 throughput learned prefixes
*May  4 22:51:31.971: OER BR LEARN: State change, new STOPPED, old STARTED, reason Stop
Learn
```

Table 5 describes the significant fields shown in the display.

Table 5 debug pfr border learn Field Descriptions

Field	Description
OER BR LEARN:	Indicates debugging information for the Performance Routing (PfR) border router learning process.

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr border routes

To display debugging information for Performance Routing (PfR) controlled or monitored routes on the local border router, use the **debug pfr border routes** command in privileged EXEC mode. To stop the display of debug event information, use the **no** form of this command.

debug pfr border routes {**bgp** | **eigrp** [**detail**] | **piro** [**detail**] | **static**}

no debug pfr border routes {**bgp** | **eigrp** | **piro** | **static**}

Syntax Description

bgp	Displays debugging information for Border Gateway Protocol (BGP) routes.
eigrp	Displays debugging information for Enhanced Interior Gateway Routing Protocol (EIGRP) routes.
detail	(Optional) Displays detailed debugging information. This keyword applies only to EIGRP or Protocol Independent Route Optimization (PIRO) routes.
piro	Displays debugging information for PIRO routes.
static	Displays debugging information for static routes.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.
Cisco IOS XE Release 3.1S	This command was integrated into Cisco IOS XE Release 3.1S.

Usage Guidelines

The **debug pfr border routes** command is entered on a border router. This command is used to display the debugging information about PfR-controlled or monitored routes on the local border router.

PIRO provides the ability for PfR to search for a parent route—an exact matching route, or a less specific route—in any IP Routing Information Base (RIB). If a parent route for the traffic class exists in the RIB, policy-based routing is used to control the prefix.

EIGRP route control provides the ability for PfR to search for a parent route—an exact matching route, or a less specific route—in the EIGRP routing table. If a parent route for the traffic class exists in the EIGRP routing table, temporary EIGRP routes are injected and identified by adding a configurable extended community tag value.

The following example enables the display of active-probe debug information on a border router:

```
Router# debug pfr border routes bgp

*May  4 22:35:53.239: OER BGP: Control exact prefix 10.1.5.0/24
*May  4 22:35:53.239: OER BGP: Walking the BGP table for 10.1.5.0/24
*May  4 22:35:53.239: OER BGP: Path for 10.1.5.0/24 is now under OER control
*May  4 22:35:53.239: OER BGP: Setting prefix 10.1.5.0/24 as OER net#
```

Table 6 describes the significant fields shown in the display.

Table 6 debug pfr border routes Field Descriptions

Field	Description
OER BGP:	Indicates debugging information for PfR-controlled BGP routes.
OER STATIC:	Indicates debugging information for PfR-controlled Static routes. (Not displayed in the example output.)

The following example enables the display of detailed debugging information for PIRO routes and shows that the parent route for the prefix 10.1.1.0 is found in the RIB and a route map is created to control the application. Note that detailed border PBR debugging is also active.

```
Router# debug pfr border routes piro detail

Feb 21 00:20:44.431: PIRO: Now calling ip_get_route
Feb 21 00:20:44.431: PFR PIRO: Parent lookup found parent 10.1.1.0, mask 255.255.255.0,
nexthop 10.1.1.0 for network 10.1.1.0/24
...
Feb 21 00:22:46.771: PFR PIRO: Parent lookup found parent 10.1.1.0, mask 255.255.255.0,
nexthop 10.1.1.0 for network 10.1.1.0/24
Feb 21 00:22:46.771: PFR PIRO: Control Route, 10.1.1.0/24, NH 0.0.0.0, IF Ethernet4/2
Feb 21 00:22:46.771: PIRO: Now calling ip_get_route
Feb 21 00:22:46.771: PIRO: Now calling ip_get_route
Feb 21 00:22:46.771: PFR PIRO: Parent lookup found parent 10.1.1.0, mask 255.255.255.0,
nexthop 10.1.1.0 for network 10.1.1.0/24
Feb 21 00:22:46.771: OER BR PBR(det): control app: 10.1.1.0/24, nh 0.0.0.0, if
Ethernet4/2,ip prot 256, dst opr 0, src opr 0, 0 0 0 0, src net 0.0.0.0/0, dscp 0/0
Feb 21 00:22:46.771: OER BR PBR(det): Create rmap 6468E488
Feb 21 00:22:46.775: PfR-RIB RIB_RWATCH: (default:ipv4:base) T 10.1.1.0/24 EVENT Track
start
Feb 21 00:22:46.775: PfR-RIB RIB_RWATCH: (default:ipv4:base) N 10.1.1.0/24 Adding track
Feb 21 00:22:46.775: PfR-RIB RIB_RWATCH: (default:ipv4:base) N 10.1.1.0/24 QP Schedule
query
Feb 21 00:22:46.775: PfR-RIB RIB_RWATCH: (default:ipv4:base) T 10.1.1.0/24 EVENT Query
found route
Feb 21 00:22:46.775: PfR-RIB RIB_RWATCH: (default:ipv4:base) N 10.1.1.0/24 Adding route
Feb 21 00:22:46.775: PfR-RIB RIB_RWATCH: (default:ipv4:base) R 10.1.1.0/24  d=0 p=0 ->
Updating
Feb 21 00:22:46.775: PfR-RIB RIB_RWATCH: (default:ipv4:base) R 10.1.1.0/24  d=110 p=1 ->
Et4/2 40.40.40.2 40 Notifying
Feb 21 00:22:46.775: PfR-RIB RIB_RWATCH: Adding to client notification queue
Feb 21 00:22:46.775: PfR-RIB RIB_RWATCH: (default:ipv4:base) W 10.1.1.0/24 c=0x15 Client
notified reachable
Feb 21 00:22:46.779: PFR PIRO: Route update rwinfo 680C8E14, network 10.1.1.0, mask_len 24
event Route Up
Feb 21 00:22:46.779: OER BR PBR(det): PIRO Path change notify for prefix:10.1.1.0,
masklen:24, reason:1
```

Table 7 describes the significant fields shown in the display.

Table 7 debug pfr border routes Field Descriptions

Field	Description
PFR PIRO	Indicates debugging information for Performance Routing-controlled PIRO activities.
OER BR PBR	Indicates debugging information about policy-based routing activities on the border router.
PfR-RIB RIB_RWATCH	Indicates debugging information about RIB activities.

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr border traceroute reporting

To display debugging information for traceroute probes on the local border router, use the **debug pfr border traceroute reporting** command in privileged EXEC mode. To stop the display of debug event information, use the **no** form of this command.

debug pfr border traceroute reporting [**detail**]

no debug pfr border traceroute reporting [**detail**]

Syntax Description

detail	(Optional) Displays detailed traceroute debug information.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.
Cisco IOS XE Release 3.1S	This command was integrated into Cisco IOS XE Release 3.1S.

Usage Guidelines

The **debug pfr border traceroute reporting** command is entered on a border router. This command is used to display the debugging information about traceroute probes sourced on the local border router.

Examples

The following example enables the display of active-probe debug information on a border router:

```
Router# debug pfr border traceroute reporting

May 19 03:46:23.807: OER BR TRACE(det): Received start message: msg1 458776,
msg2 1677787648, if index 19, host addr 100.1.2.1, flags 1, max ttl 30,
protocol 17, probe delay 0
May 19 03:46:26.811: OER BR TRACE(det): Result msg1 458776,
msg2 1677787648 num hops 30 sent May 19 03:47:20.919: OER BR TRACE(det):
Received start message: msg1 524312, msg2 1677787648, if index 2,
host addr 100.1.2.1, flags 1, max ttl 30, protocol 17, probe delay 0
May 19 03:47:23.923: OER BR TRACE(det): Result msg1 524312,
msg2 1677787648 num hops 3 sent
```

Table 8 describes the significant fields shown in the display.

Table 8 debug pfr border traceroute reporting Field Descriptions

Field	Description
OER BR TRACE:	Indicates border router debugging information for traceroute probes.

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr cc

To display Performance Routing (PfR) communication control debugging information for master controller and border router communication, use the **debug pfr cc** command in privileged EXEC mode. To stop the display of PfR debugging information, use the **no** form of this command.

debug pfr cc [**detail**]

no debug pfr cc [**detail**]

Syntax Description

detail	(Optional) Displays detailed information.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.
Cisco IOS XE Release 3.1S	This command was integrated into Cisco IOS XE Release 3.1S.

Usage Guidelines

The **debug pfr cc** command can be entered on a master controller or on a border router. This command is used to display messages exchanged between the master controller and the border router. These messages include control commands, configuration commands, and monitoring information. Enabling this command will cause very detailed output to be displayed and can utilize a considerable amount of system resources. This command should be enabled with caution in a production network.

Examples

The following example enables the display of PfR communication control debugging messages:

```
Router# debug pfr cc

*May  4 23:03:22.527: OER CC: ipflow prefix reset received: 10.1.5.0/24
```

Table 9 describes the significant fields shown in the display.

Table 9 debug pfr cc Field Descriptions

Field	Description
OER CC:	Indicates debugging information for PfR communication messages.

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr master border

To display debugging information for Performance Routing (PfR) border router events on a PfR master controller, use the **debug pfr master border** command in privileged EXEC mode. To stop border router event debugging, use the **no** form of this command.

debug pfr master border [*ip-address*]

no debug pfr master border

Syntax Description

ip-address	(Optional) Specifies the IP address of a border router.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **debug pfr master border** command is entered on a master controller. The output displays information related to the events or updates from one or more border routers.

Examples

The following example shows the status of two border routers. Both routers are up and operating normally.

```
Router# debug pfr master border

OER Master Border Router debugging is on
Router#
1d05h: OER MC BR 10.4.9.7: BR I/F update, status UP, line 1 index 1, tx bw 10000
0, rx bw 100000, time, tx ld 0, rx ld 0, rx rate 0 rx bytes 3496553, tx rate 0,
tx bytes 5016033
1d05h: OER MC BR 10.4.9.7: BR I/F update, status UP, line 1 index 2, tx bw 10000
0, rx bw 100000, time, tx ld 0, rx ld 0, rx rate 0 rx bytes 710149, tx rate 0, t
x bytes 1028907
1d05h: OER MC BR 10.4.9.6: BR I/F update, status UP, line 1 index 2, tx bw 10000
0, rx bw 100000, time, tx ld 0, rx ld 0, rx rate 0 rx bytes 743298, tx rate 0, t
x bytes 1027912
1d05h: OER MC BR 10.4.9.6: BR I/F update, status UP, line 1 index 1, tx bw 10000
0, rx bw 100000, time, tx ld 0, rx ld 0, rx rate 0 rx bytes 3491383, tx rate 0,
tx bytes 5013993
```

Table 10 describes the significant fields shown in the display.

Table 10 debug pfr master border Field Descriptions

Field	Description
OER MC BR *ip-address*:	Indicates debugging information for a border router process. The *ip-address* identifies the border router.

Related Commands

pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr master collector

To display data collection debugging information for PfR monitored prefixes, use the **debug pfr master collector** command in privileged EXEC mode. To disable the display of this debugging information, use the **no** form of this command.

debug pfr master collector {**active-probes** [**detail** [**trace**]] | **netflow**}

no debug pfr master collector {**active-probes** [**detail** [**trace**]] | **netflow**}

Syntax Description

active-probes	Displays aggregate active probe results for a given prefix on all border routers that are executing the active probe.
detail	(Optional) Displays the active probe results from each target for a given prefix on all border routers that are executing the active probe.
trace	(Optional) Displays aggregate active probe results and historical statistics for a given prefix on all border routers that are executing the active probe.
netflow	Displays information about the passive (NetFlow) measurements received by the master controller for prefixes monitored from the border router.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **debug pfr master collector** command is entered on a master controller. The output displays data collection information for monitored prefixes.

Examples

debug pfr master collector active-probes Example

The following example enables the display of aggregate active probe results for the 10.1.0.0/16 prefix on all border routers that are configured to execute this active probe:

```
Router# debug pfr master collector active-probes

*May  4 22:34:58.221: OER MC APC: Probe Statistics Gathered for prefix 10.1.0.0/16 on all
exits,notifying the PDP
*May  4 22:34:58.221: OER MC APC: Summary Exit Data (pfx 10.1.0.0/16, bdr 10.2.2.2, if 13,
nxtHop Default):savg delay 13, lavg delay 14, sinits 25, scompletes 25
*May  4 22:34:58.221: OER MC APC: Summary Prefix Data: (pfx 10.1.0.0/16) sloss 0, lloss 0,
sunreach 25, lunreach 25, savg raw delay 15, lavg raw delay 15, sinits 6561, scompletes
6536, linits 6561, lcompletes 6536
*May  4 22:34:58.221: OER MC APC: Active OOP check done
```

Table 11 describes the significant fields shown in the display.

Table 11 debug pfr master collector active-probes Field Descriptions

Field	Description
OER MC APC:	Indicates debugging information for active probes from the PfR master collector.

debug pfr master collector active-probes detail Example

The following example enables the display of aggregate active probe results from each target for the 10.1.0.0/16 prefix on all border routers that are configured to execute this active probe:

```
Router# debug pfr master collector active-probes detail

*May  4 22:36:21.945: OER MC APC: Rtrv Probe Stats: BR 10.2.2.2, Type echo,
Tgt 10.1.1.1,TgtPt 0, Src Default, SrcPt 0, NxtHp Default, Ndx 13
*May  4 22:36:22.001: OER MC APC: Remote stats received: BR 10.2.2.2, Type
echo, Tgt 10.15.1, TgtPt 0, Src Default, SrcPt 0, NxtHp Default, Ndx 13
*May  4 22:36:22.313: OER MC APC: Perf data point (pfx 10.1.0.0/16, bdr
10.2.2.2, if 13, xtHop Default):  avg delay 20, loss 0, unreach 0,
initiations 2, completions 2, delay sum40, ldelay max 20, ldelay min 12
*May  4 22:36:22.313: OER MC APC: Perf data point (pfx 10.1.0.0/16, bdr
10.2.2.2, if 13, xtHop Default):  avg delay 20, loss 0, unreach 0,
initiations 2, completions 2, delay sum40, ldelay max 20, ldelay min 12
*May  4 22:36:22.313: OER MC APC: Probe Statistics Gathered for prefix
10.1.0.0/16 on al exits, notifying the PDP
*May  4 22:36:22.313: OER MC APC: Active OOP check done
```

Table 12 describes the significant fields shown in the display.

Table 12 debug pfr master collector active-probes detail Field Descriptions

Field	Description
OER MC APC:	Indicates debugging information for active probes from the PfR master collector.

debug pfr master collector active-probes detail trace Example

The following example enables the display of aggregate active probe results and historical statistics from each target for the 10.1.0.0/16 prefix on all border routers that are configured to execute this active probe:

```
Router# debug pfr master collector active-probes detail trace

*May  4 22:40:33.845: OER MC APC: Rtrv Probe Stats: BR 10.2.2.2, Type echo,
Tgt 10.1.5.1, TgtPt 0, Src Default, SrcPt 0, NxtHp Default, Ndx 13
*May  4 22:40:33.885: OER MC APC: Remote stats received: BR 10.2.2.2, Type
echo, Tgt 10.1.5.1, TgtPt 0, Src Default, SrcPt 0, NxtHp Default, Ndx 13
*May  4 22:40:34.197: OER MC APC: Remote stats received: BR 10.2.2.2, Type
echo, Tgt 10.1.2.1, TgtPt 0, Src Default, SrcPt 0, NxtHp Default, Ndx 13
*May  4 22:40:34.197: OER MC APC: Updating Probe (Type echo Tgt 10.1.2.1
TgtPt 0) Total Completes 1306, Total Attempts 1318
*May  4 22:40:34.197: OER MC APC: All stats gathered for pfx 10.1.0.0/16
Accumulating Stats
*May  4 22:40:34.197: OER MC APC: Updating Curr Exit Ref (pfx 10.1.0.0/16,
bdr 10.2.2.2, if 13, nxtHop Default) savg delay 17, lavg delay 14, savg loss
0, lavg loss 0, savg unreach 0, lavg unreach 0
*May  4 22:40:34.197: OER MC APC: Probe Statistics Gathered for prefix
```

```
10.1.0.0/16 on all exits, notifying the PDP
*May  4 22:40:34.197: OER MC APC: Active OOP check done
```

Table 13 describes the significant fields shown in the display.

Table 13 debug pfr master collector active-probes detail trace Field Descriptions

Field	Description
OER MC APC:	Indicates debugging information for active probes from the PfR master collector.

debug pfr master collector netflow Example

The following example enables the display of passive monitoring results for the 10.1.5.0/24 prefix:

```
Router# debug pfr master collector netflow

*May  4 22:31:45.739: OER MC NFC: Rcvd  egress update from BR 10.1.1.2
  prefix 10.1.5.0/24  Interval 75688  delay_sum 0  samples 0  bytes 20362  pkts 505  flows
359  pktloss 1 unreach 0
*May  4 22:31:45.739: OER MC NFC: Updating exit_ref; BR 10.1.1.2 i/f Et1/0, s_avg_delay
655, l_avg_delay 655, s_avg_pkt_loss 328, l_avg_pkt_loss 328, s_avg_flow_unreach 513,
l_avg_flow_unreach 513
*May  4 22:32:07.007: OER MC NFC: Rcvd ingress update from BR 10.1.1.3
  prefix 10.1.5.0/24  Interval 75172  delay_sum 42328  samples 77  bytes 22040  pkts 551
flows 310  pktloss 0 unreach 0
```

Table 14 describes the significant fields shown in the display.

Table 14 debug pfr master collector netflow Field Descriptions

Field	Description
OER MC NFC:	Indicates debugging information for the PfR master collector from passive monitoring (NetFlow).

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr master cost-minimization

To display debugging information for cost-based optimization policies, use the **debug pfr master cost-minimization** command in privileged EXEC mode. To disable the display of this debugging information, use the **no** form of this command.

debug pfr master cost-minimization [**detail**]

no debug pfr master cost-minimization [**detail**]

Syntax Description

detail	(Optional) Displays detailed information.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **debug pfr master cost-minimization** command is entered on a master controller. The output displays debugging information for cost-minimization policies.

Examples

The following example enables the display of detailed cost-based optimization policy debug information:

```
Router# debug pfr master cost-minimization detail

OER Master cost-minimization Detail debugging is on
*May 14 00:38:48.839: OER MC COST: Momentary target utilization for exit 10.1.1.2 i/f
Ethernet1/0 nickname ISP1 is 7500 kbps, time_left 52889 secs, cumulative 16 kb, rollup
period 84000 secs, rollup target 6000 kbps, bw_capacity 10000 kbps
*May 14 00:38:48.839: OER MC COST: Cost OOP check for border 10.1.1.2, current util: 0
target util: 7500 kbps
*May 14 00:39:00.199: OER MC COST: ISP1 calc separate rollup ended at 55 ingress Kbps
*May 14 00:39:00.199: OER MC COST: ISP1 calc separate rollup ended at 55 egress bytes
*May 14 00:39:00.199: OER MC COST: Target utilization for nickname ISP1 set to 6000,
rollups elapsed 4, rollups left 24
*May 14 00:39:00.271: OER MC COST: Momentary target utilization for exit 10.1.1.2 i/f
Ethernet1/0 nickname ISP1 is 7500 kbps, time_left 52878 secs, cumulative 0 kb, rollup
period 84000 secs, rollup target 6000 kbps, bw_capacity 10000 kbps
*May 14 00:39:00.271: OER MC COST: Cost OOP check for border 10.1.1.2, current util: 0
target util: 7500 kbps
```

Table 15 describes the significant fields shown in the display.

Table 15 debug pfr master cost-minimization detail Field Descriptions

Field	Description
OER MC COST:	Indicates debugging information for cost-based optimization on the master controller.

Related Commands

Command	Description
cost-minimization (PfR)	Configures cost-based optimization policies on a master controller.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.
show pfr master cost-minimization	Displays the status of cost-based optimization policies.

debug pfr master exit

To display debug event information for Performance Routing (PfR) managed exits, use the **debug pfr master exit** command in privileged EXEC mode. To stop the display of debug event information, use the **no** form of this command.

debug pfr master exit [**detail**]

no debug pfr master exit [**detail**]

Syntax Description

detail	Displays detailed PfR managed exit information.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **debug pfr master exit** command is entered on a master controller. This command is used to display debugging information for master controller exit selection processes.

Examples

The following example shows output from the **debug pfr master exit** command, entered with the **detail** keyword:

```
Router# debug pfr master exit detail

*May  4 11:26:51.539: OER MC EXIT: 10.1.1.1, intf Fa4/0 INPOLICY
*May  4 11:26:52.195: OER MC EXIT: 10.2.2.3, intf Se2/0 INPOLICY
*May  4 11:26:55.515: OER MC EXIT: 10.1.1.2, intf Se5/0 INPOLICY
*May  4 11:29:14.987: OER MC EXIT: 7 kbps should be moved from 10.1.1.1, intf Fa4/0
*May  4 11:29:35.467: OER MC EXIT: 10.1.1.1, intf Fa4/0 in holddown state so skip OOP
check
*May  4 11:29:35.831: OER MC EXIT: 10.2.2.3, intf Se2/0 in holddown state so skip OOP
check
*May  4 11:29:39.455: OER MC EXIT: 10.1.1.2, intf Se5/0 in holddown state so skip OOP
check
```

Table 16 describes the significant fields shown in the display.

Table 16 debug pfr master exit detail Field Descriptions

Field	Description
OER MC EXIT:	Indicates PfR master controller exit event.

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr master learn

To display debug information for PfR master controller learning events, use the **debug pfr master learn** command in privileged EXEC mode. To stop the display of debug information, use the **no** form of this command.

debug pfr master learn [**detail**]

no debug pfr master learn [**detail**]

Syntax Description

detail	(Optional) Displays detailed information.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **debug pfr master learn** command is entered on a master controller. This command is used to display debugging information for master controller learning events.

Examples

The following example shows output from the **debug pfr master learn** command. The output shows PfR Top Talker debug events. The master controller is enabling prefix learning for new border router process:

```
Router# debug pfr master learn

06:13:43: OER MC LEARN: Enable type 3, state 0
06:13:43: OER MC LEARN: OER TTC: State change, new RETRY, old DISABLED, reason TT start
06:13:43: OER MC LEARN: OER TTC: State change, new RETRY, old DISABLED, reason TT start
request
06:13:43: OER MC LEARN: OER TTC: State change, new RETRY, old DISABLED, reason T
T start request
06:14:13: OER MC LEARN: TTC Retry timer expired
06:14:13: OER MC LEARN: OER TTC: State change, new STARTED, old RETRY, reason At
 least one BR started
06:14:13: %OER_MC-5-NOTICE: Prefix Learning STARTED
06:14:13: OER MC LEARN: MC received BR TT status as enabled
06:14:13: OER MC LEARN: MC received BR TT status as enabled
06:19:14: OER MC LEARN: OER TTC: State change, new WRITING DATA, old STARTED, reason
Updating DB
06:19:14: OER MC LEARN: OER TTC: State change, new SLEEP, old WRITING DATA, reason
Sleep state
```

Table 17 describes the significant fields shown in the display.

Table 17 debug pfr master learn Field Descriptions

Field	Description
OER MC LEARN:	Indicates PfR master controller learning events.

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr master prefix

To display debug events related to prefix processing on a Performance Routing (PfR) master controller, use the **debug pfr master prefix** command in privileged EXEC mode. To disable the display of debug information, use the **no** form of this command.

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

no debug pfr 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) Displays information about prefixes used by applications monitored and controlled by a PfR master controller.
detail	(Optional) Displays detailed PfR prefix processing information.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **debug pfr 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 pfr 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 18 describes the significant fields shown in the display.

Table 18 debug pfr master prefix Field Descriptions

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

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr master prefix-list

To display debug events related to prefix-list processing on a Performance Routing (PfR) master controller, use the **debug pfr master prefix-list** command in privileged EXEC mode. To disable the display of debug information, use the **no** form of this command.

debug pfr master prefix-list *list-name* [**detail**]

no debug pfr master prefix-list *list-name*

Syntax Description

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

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **debug pfr master prefix-list** command is entered on a master controller. This command displays debugging information related to prefix-list processing.

Examples

The following example shows output from the **debug pfr master prefix-list** command.

```
Router# debug pfr master prefix-list

23:02:16.283: OER MC PFX 10.1.5.0/24: Check PASS REL loss: loss 0, policy 10%, notify TRUE
23:02:16.283: OER MC PFX 10.1.5.0/24: Passive REL loss in-policy
23:02:16.283: OER MC PFX 10.1.5.0/24: Check PASS REL delay: delay 124, policy 50%, notify
TRUE
23:02:16.283: OER MC PFX 10.1.5.0/24: Passive REL delay in policy
23:02:16.283: OER MC PFX 10.1.5.0/24: Prefix not OOP
23:02:16.283: OER MC PFX 10.1.5.0/24: Check PASS REL unreachable: unreachable 0, policy
50%, notify TRUE
23:02:16.283: OER MC PFX 10.1.5.0/24: Passive REL unreachable in-policy
23:02:16.283: OER MC PFX 10.1.5.0/24: Check PASS REL loss: loss 0, policy 10%, notify TRUE
23:02:16.283: OER MC PFX 10.1.5.0/24: Passive REL loss in policy
```

Table 19 describes the significant fields shown in the display.

Table 19 debug pfr master prefix-list Field Descriptions

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

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr master process

To display debug information about the PfR master controller process, use the **debug pfr master process** command in privileged EXEC mode. To stop displaying debug information, use the **no** form of this command.

debug pfr master process [**detail**]

no debug pfr master process [**detail**]

Syntax Description

detail	(Optional) Displays detailed information.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **debug pfr master process** command is entered on a master controller.

Examples

The following is sample debug output for a master controller process:

```
Router# debug pfr master process

01:12:00: OER MC PROCESS: Main msg type 15, ptr 0, value 0
```

Table 20 describes the significant fields shown in the display.

Table 20 debug pfr master process Field Descriptions

Field	Description
OER MC PROCESS:	Indicates a master controller process debugging message.

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

debug pfr master traceroute reporting

To display debug information about traceroute probes, use the **debug pfr master traceroute reporting** command in privileged EXEC mode. To stop displaying debug information, use the **no** form of this command.

debug pfr master traceroute reporting [**detail**]

no debug pfr master traceroute reporting [**detail**]

Syntax Description

detail	(Optional) Displays detailed information.

Command Default

No debugging messages are enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **debug pfr master traceroute reporting** command is entered on a master controller. This command is used to display traceroute events on a master controller.

Examples

The following is sample debug output for a master controller process:

```
Router# debug pfr master traceroute reporting detail

*May 12 18:55:14.239: OER MC TRACE: sent start message msg1 327704, msg2 167838976, if
index 2, host add 10.1.5.2, flags 1, max ttl 30, protocol 17
*May 12 18:55:16.003: OER MC TRACE: sent start message msg1 393240, msg2 167838976, if
index 2, host add 10.1.5.2, flags 1, max ttl 30, protocol 17
master#
*May 12 18:55:17.303: OER MC TRACE: Received result: msg_id1 327704, prefix 10.1.5.0/24,
hops 4, flags 1
*May 12 18:55:19.059: OER MC TRACE: Received result: msg_id1 393240, prefix 10.1.5.0/24,
hops 4, flags 1
```

Table 21 describes the significant fields shown in the display.

Table 21 debug pfr master traceroute reporting detail Field Descriptions

Field	Description
OER MC PROCESS:	Indicates master controller debugging information for traceroute probes.

Related Commands

Command	Description
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

delay (PfR)

To configure PfR traffic class learning based on highest delay times or to set a delay threshold for a Performance Routing (PfR) policy, use the **delay** command in master controller, Top Talker and Top Delay learning, or learn list configuration mode. To reset the delay values to their default, use the **no** form of this command.

Master Controller Configuration Mode

delay {**relative** *percentage* | **threshold** *maximum*}

no delay

Top Talker and Top Delay Learning and Learn List Configuration Modes

delay

no delay

Syntax Description

relative *percentage*	Sets a relative delay policy based on a comparison of short-term and long-term delay percentages. The range of values that can be configured for this argument is a number from 1 to 1000. Each increment represents one tenth of a percent. The default is 500 (50 percent).
threshold *maximum*	Sets the absolute maximum delay time, in milliseconds. The range of values that can be configured for this argument is from 1 to 10000. The default is 5000.

Command Default

Master Controller Configuration Mode

PfR uses the default values if this command is not configured or if the **no** form of this command is entered. Default values:

percentage: 500 (50 percent)
maximum: 5000

Top Talker and Top Delay Learning and Learn List Configuration Modes

None

Command Modes

Master controller configuration (config-pfr-mc)
Top Talker and Top Delay learning configuration (config-pfr-mc-learn)
Learn list configuration (config-pfr-mc-learn-list)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

Configuring in Master Controller Configuration Mode

Use the **delay** command entered in PfR master controller configuration mode to set the delay threshold for a traffic class within a PfR policy as a relative percentage or as an absolute value. If the configured delay threshold is exceeded, the traffic class is out-of-policy.

The **relative** keyword is used to configure a relative delay percentage. The relative delay percentage is based on a comparison of short-term and long-term measurements. The short-term measurement reflects the delay percentage within a 5-minute period. The long-term measurement reflects the delay percentage within a 60-minute period. The following formula is used to calculate this value:

> Relative delay measurement = ((short-term measurement – long-term measurement) / long-term measurement) * 100

The master controller measures the difference between these two values as a percentage. If the percentage exceeds the user-defined or default value, the delay percentage is determined to be out-of-policy. For example, if the long-term delay measurement is 100 milliseconds and the short-term delay measurement is 120 milliseconds, the relative delay percentage is 20 percent.

The **threshold** keyword is used to configure the absolute maximum delay period in milliseconds.

Configuring in Top Talker and Top Delay Learning and Learn List Configuration Modes

Use the **delay** command under the Top Talker and Top Delay learning or learn list configuration mode to enable traffic class learning based on the highest delay time. PfR measures the delay for optimized prefixes when this command is enabled, and the master controller creates a list of traffic classes based on the highest delay time.

Examples

Master Controller Configuration Mode

The following example shows how to set a 20 percent relative delay threshold:

```
Router(config)# pfr master
Router(config-pfr-mc)# delay relative 200
```

Top Talker and Top Delay Learning Configuration Mode

The following example shows how to configure a master controller to learn traffic classes based on the highest delay times:

```
Router(config)# pfr master
Router(config-pfr-mc)# learn
Router(config-pfr-mc-learn)# delay
```

Learn List Configuration Mode

The following example shows how to configure a master controller to learn traffic classes based on the highest delay times for a learn list named LEARN_REMOTE_LOGIN_TC for Telnet and Secure Shell (ssh) application traffic classes:

```
Router(config)# pfr master
Router(config-pfr-mc)# learn
Router(config-pfr-mc-learn)# list seq 10 refname LEARN_REMOTE_LOGIN_TC
Router(config-pfr-mc-learn-list)# traffic-class application telnet ssh
Router(config-pfr-mc-learn-list)# aggregation-type prefix-length 24
Router(config-pfr-mc-learn-list)# delay
```

Related Commands

Command	Description
learn (PfR)	Enters PfR Top Talker and Top Delay learning configuration mode to configure PfR to automatically learn traffic classes.
list (PfR)	Creates a PfR learn list to specify criteria for learning traffic classes and enters learn list configuration mode.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.
set delay (PfR)	Configures a PfR map to configure PfR to learn prefixes based on the lowest delay.

downgrade bgp (PfR)

To specify route downgrade options for a Performance Routing (PfR) managed interface using Border Gateway Protocol (BGP) advertisements, use the **downgrade bgp** command in PfR border exit interface configuration mode. To remove the route downgrade options, use the **no** form of this command.

downgrade bgp community *community-number*

no downgrade bgp community

Syntax Description

community	Specifies a BGP community number that will be added to the BGP advertisement.
community-number	BGP community number entered in AA:NN format. The community format consists of a 4-byte value. The first two bytes represent the autonomous system number, and the trailing two bytes represent a user-defined network number. A number in the range from 1 to 65535 can be entered for each 2-byte value.

Command Default

No route downgrade options are specified.

Command Modes

PfR border exit interface configuration (config-pfr-mc-br-if)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

Use the **downgrade bgp** command to attach a BGP prepend community number to an inside prefix BGP advertisement from the network to another autonomous system such as an Internet service provider (ISP). The BGP prepend community will increase the number of autonomous system hops in the advertisement of the inside prefix from the ISP to its peers. Autonomous system prepend BGP community is the preferred method to be used for PfR BGP inbound optimization because there is no risk of the local ISP filtering the extra autonomous system hops.

Examples

The following example shows how to enforce an entrance link selection for learned inside prefixes using the BGP autonomous system number community prepend technique. The **downgrade bgp** command is configured under PfR border exit interface configuration mode to add the BGP community number 3:1 to BGP advertisements to packets that travel through this entrance link on the border router.

```
Router> enable
Router# configure terminal
Router(config)# pfr master
Router(config-pfr-mc)# max range receive percent 35
Router(config-pfr-mc)# border 10.1.1.2 key-chain PFR_KEY
Router(config-pfr-mc-br)# interface ethernet1/0 external
Router(config-pfr-mc-br-if)# maximum utilization receive absolute 2500
Router(config-pfr-mc-br-if)# downgrade bgp community 3:1
```

```
Router(config-pfr-mc-br-if)# exit
Router(config-pfr-mc-br)# exit
Router(config-pfr-mc)# exit
Router(config)# pfr-map INSIDE_LEARN 10
Router(config-pfr-map)# match pfr learn inside
Router(config-pfr-map)# set delay threshold 400
Router(config-pfr-map)# set resolve delay priority 1
Router(config-pfr-map)# set mode route control
Router(config-pfr-map)# end
```

Related Commands

Command	Description
border (PfR)	Enters PfR managed border router configuration mode to establish communication with a PfR border router.
max range receive (PfR)	Sets the maximum utilization range for all PfR managed entrance links.
maximum utilization receive (PfR)	Sets the maximum utilization on a single PfR managed entrance link.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.

expire after (PfR)

To set the length of time for which Performance Routing (PfR) learned prefixes are kept in the central policy database, use the **expire after** command in PfR Top Talker and Top Delay learning configuration mode. To disable the expiration timer and restore default behavior, use the **no** form of this command.

expire after {**session** *number* | **time** *minutes*}

no expire after

Syntax Description

session	Configures a session-based expiration timer.
number	A number from 1 to 65535 can be entered. Each increment represents one monitoring period.
time	Configures a time-based expiration timer.
minutes	A number from 1 to 65535 can be entered. This argument is entered in minutes.

Command Default

New prefixes are not learned if router memory utilization is greater than 90 percent. Inactive prefixes are removed (oldest first) from the central policy database as memory is needed.

Command Modes

PfR Top Talker and Top Delay learning configuration (config-pfr-mc-learn)

Command History

Release	Modification
15.1(2)T	This command was introduced.

Usage Guidelines

The **expire after** command is entered on a PfR master controller in PfR Top Talker and Top Delay learning configuration mode. This command is used to configure a session- or time-based expiration period for learned prefixes. Each session is equal to one monitoring period plus a periodic interval time that separates monitoring periods. The time-based expiration timer is configured in minutes.

Examples

The following example configures learned prefixes to be removed from the central policy database after 100 monitoring periods:

```
Router(config)# pfr master
Router(config-pfr-mc)# learn
Router(config-pfr-mc-learn)# expire after session 100
```

Related Commands

Command	Description
learn (PfR)	Enters PfR Top Talker and Top Delay learning configuration mode to configure prefixes for PfR to learn.
max prefix (PfR)	Sets the maximum number of prefixes that the master controller will monitor or learn.
pfr	Enables a PfR process and configures a router as a PfR border router or as a PfR master controller.