

Sun Ethernet Fabric Operating System

PIM Administration Guide



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Contents

Using This Documentation 1

- Product Notes 1
- Related Documentation 2
- Acronyms and Abbreviations 2
- CLI Command Modes 3
- Feedback 4
- Support and Accessibility 5

PIM Overview 7

- Protocol Description 7

Configuring PIM 9

- Sample Topology 10
- Default Settings 10
- SEFOS1 Configuration 11
- SEFOS2 Configuration 12
- ▼ Enable PIM 12
- Reducing Data Transmission Time Using the SPT 13
 - ▼ Specify the PIM Threshold That Triggers SPT Switching 14
 - ▼ Specify the PIM SPT Switch Period 14
 - ▼ Specify the PIM RP Threshold That Triggers Source-Specific Switching 15
 - ▼ Specify the PIM RP Switch Period 16

▼ Monitor the Data Transfer Rate After a Register Stop Message	17
Configuring PMBR Status	18
▼ Enable PMBR Status Reporting	18
▼ Disable PMBR Status Reporting	19
Enabling Static RP Configurations	19
▼ Enable Static RP	19
▼ Disable Static RP	20
▼ Associate an Interface to a PIM Component	20
▼ Delete a PIM Interface	21
Configuring Designated Routers	22
▼ Prioritize Router Messaging With PIM DR-Priority	22
▼ Restore the Default Router Priority Designation	23
Configuring the PIM Override Interval	24
▼ Specify the Interval to Delay Override Messages	24
▼ Restore the Default Override Messaging Interval	25
Configuring PIM LAN Delay	25
▼ Delay LAN Message Propagation	26
▼ Restore the Default LAN Delay Interval	27
Configuring LAN Prune Delay	27
▼ Enable LAN Prune Delay	27
▼ Disable LAN Prune Delay	28
Configuring BSR Candidates	29
▼ Prioritize BSR Candidates	29
▼ Restore the Default BSR-Candidate Value	30
Configuring PIM Query Intervals	30
▼ Specify the Hello Messaging Interval	30
▼ Restore the Default Hello Messaging Interval	31
Configuring PIM Join and Prune Messaging	32

- ▼ Specify the Join and Prune Messaging Interval 32
- ▼ Restore the Default Message Interval 33
- Managing PIM Components 33
 - ▼ Create a PIM Component 34
 - ▼ Delete a PIM Component 34
- Configuring PIM Component Data Routing Modes 35
 - ▼ Specify a Data Routing Mode 35
- Configuring RP-Candidate Behavior 36
 - ▼ Specify the Address for the Candidate RP 36
 - ▼ Delete an RP Candidate 37
- Configuring RP Candidate Hold Time 37
 - ▼ Specify RP Candidate Hold Time 38
 - ▼ Restore the Default Candidate RP Hold Time 39
- Configuring Static RPs 39
 - ▼ Specify the Address for the Static RP 39
 - ▼ Delete a Static RP 40
- ▼ Display RP Details 41
- ▼ Enable PIM Neighbor Recognition 42
- ▼ Display PIM Multicast Information 44

Using This Documentation

This document describes the configuration of PIM protocol for efficiently routing to multicast groups that might span wide-area (and inter-domain) internets. It describes the protocol from a network perspective, in particular, how the participating routers interact to create and maintain the multicast distribution tree.

- “Product Notes” on page 1
- “Related Documentation” on page 2
- “Acronyms and Abbreviations” on page 2
- “CLI Command Modes” on page 3
- “Feedback” on page 4
- “Support and Accessibility” on page 5

Product Notes

For late-breaking information and known issues about the following products, refer to the product notes at:

Sun Blade 6000 Ethernet Switched NEM 24p 10GbE:

<http://www.oracle.com/pls/topic/lookup?ctx=SB6K-24p-10GbE>

Sun Network 10GbE Switch 72p:

<http://www.oracle.com/pls/topic/lookup?ctx=SN-10GbE-72p>

Related Documentation

Documentation	Links
All Oracle products	http://oracle.com/documentation
Sun Blade 6000 Ethernet Switched NEM 24p 10GbE	http://www.oracle.com/pls/topic/lookup?ctx=SB6K-24p-10GbE
Sun Network 10GbE Switch 72p	http://www.oracle.com/pls/topic/lookup?ctx=SN-10GbE-72p
Sun Blade 6000 modular system	http://www.oracle.com/pls/topic/lookup?ctx=sb6000
Oracle Integrated Lights Out Manager (Oracle ILOM) 3.0	http://www.oracle.com/pls/topic/lookup?ctx=ilom30

For detailed information about the commands and options described in this document, refer to the *Sun Ethernet Fabric Operating System CLI Base Reference Manual*.

Acronyms and Abbreviations

Acronym or Abbreviation	Explanation
bps	Bits per second
BSR	Boot strap router
C-BSR	Candidate BSR
CLI	Command-line interface
C-RP	Candidate RP
DR	Designated router
FSAP	Flexible software architecture for portability
IIF	Incoming interface
IP	Internet Protocol

Acronym or Abbreviation	Explanation
JP	Join/prune
LAN	Local area network
MIB	Management information base
MLD	Multicast listener discovery
MRT	Multicast routing table
OIF	Outgoing interface
PIMv6	Protocol Independent Muticast version 6
PMBR	PIMv6 multicast border routers
RP	Rendezvous point
RPF	Reverse path forwarding
RPT	Rendezvous point tree
SEFOS	Sun Ethernet Fabric Operating System
SM	Sparse mode
SNMP	Simple Network Management Protocol
SRM	State refresh module
SPT	Shortest path tree
WAN	Wide area network
WC	Wild card

CLI Command Modes

The following table lists the configuration modes used in this document with their access and exit methods.

Command Mode	Access Method	Prompt	Exit Method
User EXEC	Access SEFOS from Oracle ILOM with read-only rights (privilege level 1).	SEFOS>	Use the <code>logout</code> or <code>exit</code> command to return to the Oracle ILOM prompt.
Privileged EXEC	Access SEFOS from Oracle ILOM with full administrative rights (privilege level 15).	SEFOS#	Use the <code>logout</code> or <code>exit</code> command to return to the Oracle ILOM prompt.
Global Configuration	From User EXEC mode, use the <code>enable</code> command.	SEFOS(config)#	Use the <code>end</code> command to return to Privileged EXEC mode.
Interface Configuration	From Global Configuration mode, use the <code>interface interface-type interface-id</code> command.	SEFOS(config-if)#	Use the <code>exit</code> command to return to Global Configuration mode, or use the <code>end</code> command to return to Privileged EXEC mode.
PIM Configuration	From Global Configuration mode, use the <code>ip pim component component-id</code> command.	SEFOS(pim-comp)#	Use the <code>exit</code> command to return to Global Configuration mode, or use the <code>end</code> command to return to Privileged EXEC mode.

Feedback

Provide feedback on this documentation at:

<http://www.oracle.com/goto/docfeedback>

Support and Accessibility

Description	Links
Access electronic support through My Oracle Support	http://support.oracle.com
	For hearing impaired: http://www.oracle.com/accessibility/support.html
Learn about Oracle's commitment to accessibility	http://www.oracle.com/us/corporate/accessibility/index.html

PIM Overview

This section describes the PIM protocol.

- [“Protocol Description” on page 7](#)

Protocol Description

SEFOS PIM is a multicast routing protocol designed to provide scalable inter-domain multicast routing across the internet. PIM provides multicast routing and forwarding capability to a router that runs IP along with IGMP. PIM depends on IGMP for multicast group membership information. PIM routes the multicast data packets independent of any unicast routing protocol. PIM supports two modes of operation: sparse and dense.

Configuring PIM

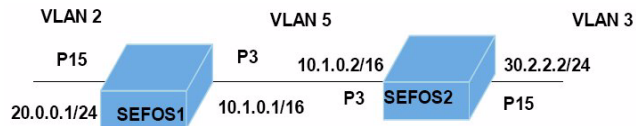
These sections describe how to configure SEFOS PIM and provide examples for using various PIM commands. For additional information about these commands and options, refer to the *Sun Ethernet Fabric Operating System CLI Enterprise Reference Manual*.

- “Sample Topology” on page 10
- “Default Settings” on page 10
- “SEFOS1 Configuration” on page 11
- “SEFOS2 Configuration” on page 12
- “Enable PIM” on page 12
- “Reducing Data Transmission Time Using the SPT” on page 13
- “Monitor the Data Transfer Rate After a Register Stop Message” on page 17
- “Configuring PMBR Status” on page 18
- “Enabling Static RP Configurations” on page 19
- “Associate an Interface to a PIM Component” on page 20
- “Delete a PIM Interface” on page 21
- “Configuring Designated Routers” on page 22
- “Configuring the PIM Override Interval” on page 24
- “Configuring PIM LAN Delay” on page 25
- “Configuring LAN Prune Delay” on page 27
- “Configuring BSR Candidates” on page 29
- “Configuring PIM Query Intervals” on page 30
- “Configuring PIM Join and Prune Messaging” on page 32
- “Managing PIM Components” on page 33
- “Configuring PIM Component Data Routing Modes” on page 35
- “Configuring RP-Candidate Behavior” on page 36
- “Configuring RP Candidate Hold Time” on page 37
- “Configuring Static RPs” on page 39
- “Display RP Details” on page 41

- “Enable PIM Neighbor Recognition” on page 42
- “Display PIM Multicast Information” on page 44

Sample Topology

In the sample topology used in this guide, two switches are configured as PIM routers. The following figure depicts these switches and the related PIM parameters.



Default Settings

The following table contains the default settings that are configured for PIM in a SEFOS switch. If the switch is rebooted for any reason, it returns to the previously saved configuration. If you have not saved a site configuration, the reboot returns the switch to the default settings. For instructions on how to save your site configuration, refer to the software configuration guide for your switch.

Feature	Default Setting
PIM module status	Enabled
PIM SPT group threshold	0
PIM SPT source threshold	0
PIM SPT-switch period	0 seconds
PIM RP-threshold	0
PIM RP-switch period	0 second
PIM regstop-ratelimit-period	5 seconds
PIM PMBR status	disable
PIM static-RP	disable
PIM component mode	sparse

Feature	Default Setting
RP-candidate holdtime	0 second
PIM query-interval	30 seconds
PIM message-interval	60 seconds
PIM bsr-candidate	0
PIM component ID	1
PIM hello-hold time	105 seconds
PIM DR-priority	1
PIM override-interval	0 second
PIM lan-delay	0 second
PIM lan-prune-delay	disable

SEFOS1 Configuration

See “[Sample Topology](#)” on page 10 for setup information. In SEFOS1, VLAN interfaces VLAN 5 and VLAN 2 are configured as follows:

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 5
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.1.0.1 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 5
SEFOS(config-vlan)# ports extreme-ethernet 0/3 untagged
extreme-ethernet 0/3
SEFOS(config-vlan)# exit
SEFOS(config)# interface vlan 2
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 20.0.0.1 255.255.255.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 2
SEFOS(config-vlan)# ports extreme-ethernet 0/15 untagged
extreme-ethernet 0/15
SEFOS(config-vlan)# exit
```

```
SEFOS(config)# interface extreme-ethernet 0/15
SEFOS(config-if)# switchport pvid 15
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
```

SEFOS2 Configuration

See “[Sample Topology](#)” on page 10 for setup information. In SEFOS2, VLAN interfaces VLAN 5 and VLAN 3 are configured as follows:

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 5
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.1.0.2 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 5
SEFOS(config-vlan)# ports extreme-ethernet 0/3 untagged
extreme-ethernet 0/3
SEFOS(config-vlan)# exit
SEFOS(config)# interface vlan 3
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 30.0.0.1 255.255.255.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 3
SEFOS(config-vlan)# ports extreme-ethernet 0/15 untagged
extreme-ethernet 0/15
SEFOS(config-vlan)# exit
SEFOS(config)# interface extreme-ethernet 0/15
SEFOS(config-if)# switchport pvid 3
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
```

▼ Enable PIM

PIM is disabled in the system, by default. Complete the following task to enable PIM.

1. Enable PIM globally in SEFOS 1.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
SEFOS(config)# end
```

2. View the configuration.

```
SEFOS# show ip pim component

PIM Component Information
-----
Component-Id: 1
  PIM Mode: sparse,    PIM Version: 2
  Elected BSR: 0.0.0.0
  Candidate RP Holdtime: 0
```

Reducing Data Transmission Time Using the SPT

The SPT is used for the multicast transmission of packets with the shortest path from the sender to recipients. Directing data to the SPT reduces the amount of time it takes for the server to transmit data, however, it also requires more memory than configurations that do not transmit data through the SPT.

These sections provide examples to help you configure your server to transmit data through the SPT. Note that the example output shown is cumulative. The output reflects values for commands that have been defined during other tasks. Values displayed in bold reflect changes resulting from the task defined in a given section.

- [“Specify the PIM Threshold That Triggers SPT Switching” on page 14](#)
- [“Specify the PIM SPT Switch Period” on page 14](#)
- [“Specify the PIM RP Threshold That Triggers Source-Specific Switching” on page 15](#)
- [“Specify the PIM RP Switch Period” on page 16](#)

▼ Specify the PIM Threshold That Triggers SPT Switching

You can specify the number of packets (in bps) that must be transmitted from the group or source to cause data to be transmitted through the SPT. The SPT threshold must be configured to switch to SPT.

1. Configure the group and source threshold values.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
SEFOS(config)# set ip pim threshold spt-grp 10
SEFOS(config)# set ip pim threshold spt-src 15
SEFOS(config)# end
```

This example transmits data through the SPT when the data transfer rate for the group exceeds 10 bps. Data is transmitted through the SPT when the data transfer rate for the source exceeds 15 bps.

2. Ensure that the correct data transfer rate has been set.

```
SEFOS# show ip pim thresholds
PIM SPT Threshold Information
-----
  Group Threshold   : 10
  Source Threshold  : 15
  Switching Period  : 0

PIM SPT-RP Threshold Information
-----
  Register Threshold      : 0
  RP Switching Period     : 0
  Register Stop rate limit : 5
```

▼ Specify the PIM SPT Switch Period

You can specify the amount of time (in seconds) the data rate is monitored before data will be transmitted through the SPT. The SPT switching period must be configured to switch to SPT. You can instruct SPT switching to monitor the data rate for both the source and the group.

1. Configure the group and source threshold values, as well as the SPT switch period.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
SEFOS(config)# set ip pim threshold spt-grp 10
SEFOS(config)# set ip pim threshold spt-src 15
SEFOS(config)# set ip pim spt-switchperiod 5
SEFOS(config)# end
```

This example transmits data through the SPT when the data transfer rate for the group exceeds 10 bps. The switch monitors the activity for 5 seconds.

2. Ensure that the correct period of time has been set.

```
SEFOS# show ip pim thresholds

PIM SPT Threshold Information
-----
Group Threshold      : 10
Source Threshold     : 15
Switching Period     : 5

PIM SPT-RP Threshold Information
-----
Register Threshold   : 0
RP Switching Period  : 0
Register Stop rate limit : 5
```

▼ Specify the PIM RP Threshold That Triggers Source-Specific Switching

You can specify the number of registered packets that must have been received for the RP to initiate switching to the source-specific SPT.

1. Specify how many packets will trigger the RP to switch to a source-specific SPT.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
SEFOS(config)# set ip pim rp-threshold 10
SEFOS(config)# end
```

This example switch the RP to the source-specific shortest path tree after 10 registered packets are received.

2. Ensure that the correct number of packets have been set.

```
SEFOS# show ip pim thresholds
```

```
PIM SPT Threshold Information
```

```
-----
```

```
Group Threshold   : 10  
Source Threshold  : 15  
Switching Period  : 5
```

```
PIM SPT-RP Threshold Information
```

```
-----
```

```
Register Threshold      : 10  
RP Switching Period     : 0  
Register Stop rate limit : 5
```

▼ Specify the PIM RP Switch Period

You can specify the amount of time (in seconds) the RP monitors registered packets for switching to the source-specific SPT. The RP switching period must be configured to switch to SPT.

1. Configure the RP threshold, as well as the RP switch period.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable  
SEFOS(config)# set ip pim rp-threshold 10  
SEFOS(config)# set ip pim rp-switchperiod 15  
SEFOS(config)# end
```

This example switches the RP to the source-specific SPT after 10 registered packets are received and monitors the activity for 15 seconds.

2. View the switching period and group threshold values.

```
SEFOS# show ip pim thresholds
```

```
PIM SPT Threshold Information
```

```
-----
```

```
Group Threshold   : 10  
Source Threshold  : 15  
Switching Period  : 5
```

```
PIM SPT-RP Threshold Information
```

```
-----  
Register Threshold      : 10  
RP Switching Period    : 15  
Register Stop rate limit : 5
```

▼ Monitor the Data Transfer Rate After a Register Stop Message

To avoid the encapsulation of multicast data packets from the first hop router to the RP, you can send the system a register stop message. You can specify the amount of time (in seconds) the RP monitors the number of register packets after sending a register stop message.

1. Specify how long the RP will monitor the number of packets received after a register stop message.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable  
SEFOS(config)# set ip pim rp-threshold 10  
SEFOS(config)# set ip pim rp-switchperiod 15  
SEFOS(config)# set ip pim regstop-ratelimit-period 10  
SEFOS(config)# end
```

This example sets the RP to monitor the number of registered packets received for 10 seconds after a register stop message has been sent.

2. Ensure that the correct period of time has been set.

```
SEFOS# show ip pim thresholds  
  
PIM SPT Threshold Information  
-----  
Group Threshold      : 10  
Source Threshold    : 15  
Switching Period    : 5  
  
PIM SPT-RP Threshold Information  
-----  
Register Threshold      : 10  
RP Switching Period    : 15  
Register Stop rate limit : 10
```

Configuring PMBR Status

A PMBR integrates two different PIM domains (either PIM-SM or PIM-DM) to connect a PIM domain to other multicast-routing domains. You can enable or disable the reporting of PMBR status for a given domain. By enabling PMBR status reporting on a specific router, that router behaves as a PMBR router.

- [“Enable PMBR Status Reporting” on page 18](#)
- [“Disable PMBR Status Reporting” on page 19](#)

▼ Enable PMBR Status Reporting

PMBR status reporting is disabled by default.

This example enables PMBR status for VLAN 5. In addition, the PIM component is configured in the router as component 1.

1. Enable the PMBR status feature.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
SEFOS(config)# set ip pim pmbr enable
```

2. Associate the interface with PIM component 1.

```
SEFOS# interface vlan 5
SEFOS(config-if)# ip pim componentId 1
SEFOS(config-if)# end
```

3. View the PMBR status.

```
SEFOS# show ip pim interface detail

Vlan5 33 is up
  Internet Address is 10.1.0.1
  Multicast Switching : Enabled
  PIM : Enabled
  PIMv6 : Disabled
    PIM version : 2, mode: Sparse
    PIM DR : 10.1.0.1
    PIM DR Priority : 1
    PIM Neighbour Count : 0
```



```
PIM Hello/Query Interval : 30
PIM Message Interval : 60
PIM Override Interval : 0
PIM Lan Delay : 0
PIM Lan-Prune-Delay : Disabled
PIM Component Id : 1
PIM domain border : enabled
```

▼ Disable PMBR Status Reporting

PMBR status reporting is disabled by default. If you have previously enabled PMBR status and want to disable it, complete these steps.

- **Disable PMBR status.**

```
SEFOS# configure terminal
SEFOS(config)# set ip pim pmbr disable
SEFOS(config)# end
SEFOS#
```

Enabling Static RP Configurations

Enabling a static RP for a multicast group can be a fairly simple way to define RPs in configurations that have few RPs, but should generally be avoided in complex environments with numerous RPs. If you enable a static RP, its settings will take precedence over other RPs.

Specify whether to use the configured static-RP by either enabling or disabling `static-rp`.

- [“Enable Static RP” on page 19](#)
- [“Disable Static RP” on page 20](#)

▼ Enable Static RP

Static RP is disabled in the system, by default. Complete the following task to enable static RP.

1. Enable a static RP.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
SEFOS(config)# set ip pim static-rp enable
SEFOS# end
```

2. Ensure that the static RP has been enabled.

```
SEFOS# show ip pim rp-static

Static-RP Enabled
```

▼ Disable Static RP

Static RP is disabled by default. If you have previously enabled static RP and want to disable it, complete the following steps.

● Disable static RP.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim static-rp disable
SEFOS(config)# end
SEFOS#
```

▼ Associate an Interface to a PIM Component

Associating an interface with PIM doesn't necessarily enable PIM on that interface. To enable PIM over an interface, you must configure a PIM query interval (see [“Configuring PIM Query Intervals” on page 30](#)).

This example associates VLAN 5 to PIM 1.

1. Enable PIM globally.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the interface with PIM component.

```
SEFOS(config-if)# ip pim componentId 1  
SEFOS(config-if)# end
```

4. View the PIM interface status.

```
SEFOS# show ip pim interface detail  
  
Vlan5 33 is up  
  Internet Address is 10.1.0.1  
  Multicast Switching : Enabled  
  PIM : Enabled  
  PIMv6 : Disabled  
    PIM version : 2, mode: Sparse  
    PIM DR : 10.1.0.1  
    PIM DR Priority : 1  
    PIM Neighbour Count : 0  
    PIM Hello/Query Interval : 30  
    PIM Message Interval : 60  
    PIM Override Interval : 0  
  
    PIM Lan Delay : 0  
    PIM Lan-Prune-Delay : Disabled  
    PIM Component Id : 1  
    PIM domain border : enabled
```

▼ Delete a PIM Interface

This example deletes the VLAN 5 interface.

1. Enable PIM globally.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Delete the VLAN interface at the PIM level.

```
SEFOS(config-if)# no ip pim interface  
SEFOS(config-if)# end
```

4. Ensure the correct PIM interface status has been set. For this example, VLAN 5 must not appear.

```
SEFOS(config-if)# show ip pim interface detail
```

Configuring Designated Routers

A DR sets up multicast router entries and sends corresponding JP and Register messages on behalf of directly connected receivers and sources, respectively. When you configure the DR priority value for the PIM interface, the router that is configured with the highest priority value will be the DR.

- [“Prioritize Router Messaging With PIM DR-Priority” on page 22](#)
- [“Restore the Default Router Priority Designation” on page 23](#)

▼ Prioritize Router Messaging With PIM DR-Priority

This example specifies that messaging is received by VLAN 5 every 10 seconds.

1. Enable PIM globally.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component.

```
SEFOS(config-if)# ip pim componentId 1
```

4. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60
```

5. Specify how often (in seconds) the router receives messages.

```
SEFOS# ip pim dr-priority 10  
SEFOS(config-if)# end
```

6. Ensure that the correct router messaging time period has been set.

```
SEFOS# show ip pim interface detail  
  
Vlan5 33 is up  
  Internet Address is 10.1.0.1  
  Multicast Switching : Enabled  
  PIM : Enabled  
  PIMv6 : Disabled  
    PIM version : 2, mode: Sparse  
    PIM DR : 10.1.0.1  
    PIM DR Priority : 10  
    PIM Neighbour Count : 0  
    PIM Hello/Query Interval : 60  
    PIM Message Interval : 60  
    PIM Override Interval : 0  
    PIM Lan Delay : 0  
    PIM Lan-Prune-Delay : Disabled  
    PIM Component Id : 1  
    PIM domain border : disabled
```

▼ Restore the Default Router Priority Designation

This example restores the default router priority to 1.

- Restore the default priority (1) for the PIM router designation.

```
SEFOS# configure terminal  
SEFOS(config)# no ip pim dr-priority  
SEFOS(config)# end
```

Configuring the PIM Override Interval

The override interval is the random amount of time (in seconds) that override messages are delayed before they are sent to avoid the synchronization of override messages when multiple downstream routers share a multi-access link.

- “Specify the Interval to Delay Override Messages” on page 24
- “Restore the Default Override Messaging Interval” on page 25

▼ Specify the Interval to Delay Override Messages

This example delays override messages from VLAN 5 for 10 seconds before sending them.

1. Enable PIM globally.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component.

```
SEFOS(config-if)# ip pim componentId 1
```

4. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60
```

5. Specify how many seconds override messages are delayed.

```
SEFOS# ip pim override-interval 10  
SEFOS(config-if)# end
```

6. Ensure the correct override interval is set.

```
SEFOS# show ip pim interface detail

Vlan5 33 is up
  Internet Address is 10.1.0.1
  Multicast Switching : Enabled
  PIM : Enabled
  PIMv6 : Disabled
    PIM version : 2, mode: Sparse
    PIM DR : 10.1.0.1
    PIM DR Priority : 1
    PIM Neighbour Count : 0
    PIM Hello/Query Interval : 60
    PIM Message Interval : 60
    PIM Override Interval : 10
    PIM Lan Delay : 0
    PIM Lan-Prune-Delay : Disabled
    PIM Component Id : 1
    PIM domain border : disabled
```

▼ Restore the Default Override Messaging Interval

This example restores the default override messaging interval to 0.

- Restore the default override value.

```
SEFOS# configure terminal
SEFOS(config)# no ip pim override-interval
SEFOS(config)# end
```

Configuring PIM LAN Delay

The LAN delay expresses the expected message propagation delay on the interface. Upstream routers use this delay to determine the delayed time interval for a Join override message before pruning an interface.

- [“Delay LAN Message Propagation” on page 26](#)
- [“Restore the Default LAN Delay Interval” on page 27](#)

▼ Delay LAN Message Propagation

This example delays messages from VLAN 5 before sending them to the interface for 120 seconds.

1. Enable PIM globally.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component.

```
SEFOS(config-if)# ip pim componentId 1
```

4. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60
```

5. Specify how many seconds message propagation is delayed.

```
SEFOS# ip pim lan-delay 120  
SEFOS(config-if)# end
```

6. Ensure that the correct interval is set.

```
SEFOS# show ip pim interface detail  
  
Vlan5 33 is up  
  Internet Address is 10.1.0.1  
  Multicast Switching : Enabled  
  PIM : Enabled  
  PIMv6 : Disabled  
  PIM version : 2, mode: Sparse  
  PIM DR : 10.1.0.1  
  PIM DR Priority : 1  
  PIM Neighbour Count : 0  
  PIM Hello/Query Interval : 60  
  PIM Message Interval : 60  
  PIM Override Interval : 0  
  PIM Lan Delay : 120
```



```
PIM Lan-Prune-Delay : Disabled
PIM Component Id : 1
PIM domain border : disabled
```

▼ Restore the Default LAN Delay Interval

This example restores the default LAN message propagation interval to 0.

- Restore the default LAN delay value.

```
SEFOS# configure terminal
SEFOS(config)# no ip pim lan-delay
SEFOS(config)# end
```

Configuring LAN Prune Delay

The LAN delay inserted by a router in the `LAN-prune-delay` option expresses the expected message propagation delay on the interface. This delay is used by upstream routers to determine the delayed time interval for a join override message before pruning an interface. If the timer expires without a message, the link is pruned. If you notice that temporary forwarding outages are occurring, you might try increasing this value.

- [“Enable LAN Prune Delay” on page 27](#)
- [“Disable LAN Prune Delay” on page 28](#)

▼ Enable LAN Prune Delay

LAN prune delay is disabled in the system, by default.

1. Enable PIM globally.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component.

```
SEFOS(config-if)# ip pim componentId 1
```

4. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60
```

5. Enable LAN prune delay.

```
SEFOS# ip pim lan-prune-delay enable  
SEFOS(config-if)# end
```

6. Ensure the correct interval is set.

```
SEFOS# show ip pim interface detail  
  
Vlan5 33 is up  
  Internet Address is 10.1.0.1  
  Multicast Switching : Enabled  
  PIM : Enabled  
  PIMv6 : Disabled  
    PIM version : 2, mode: Sparse  
    PIM DR : 10.1.0.1  
    PIM DR Priority : 1  
    PIM Neighbour Count : 0  
    PIM Hello/Query Interval : 60  
    PIM Message Interval : 60  
    PIM Override Interval : 0  
    PIM Lan Delay : 120  
    PIM Lan-Prune-Delay : Enabled  
    PIM Component Id : 1  
    PIM domain border : disabled
```

▼ Disable LAN Prune Delay

LAN prune delay is disabled by default. If you have previously enabled LAN prune delay and want to disable it, complete these steps.

- Disable LAN prune delay.

```
SEFOS# configure terminal
```

```
SEFOS(config)# interface vlan 5
SEFOS(config)# set ip pim lan-prune-delay disable
SEFOS(config)# end
```

Configuring BSR Candidates

A BSR is a dynamically elected router within a PIM domain that enables routers to learn RP information. To specify which router is used as the BSR, you can assign a value for the local interface as a candidate BSR. The router with the highest priority value is used as the BSR. If two or more routers have the same priority value, the router with the largest IP address becomes the BSR.

- [“Prioritize BSR Candidates” on page 29](#)
- [“Restore the Default BSR-Candidate Value” on page 30](#)

▼ Prioritize BSR Candidates

LAN prune delay is disabled in the system by default. This example configures VLAN 5 as a BSR candidate with a preference value of 20. VLAN 5 is used as the BSR unless another router is identified as a BSR candidate with a higher `bsr-candidate` value.

1. Enable PIM globally.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component.

```
SEFOS(config-if)# ip pim componentId 1
```

4. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60
```

5. Configure the candidate preference for the PIM interface VLAN 5 as 20.

```
SEFOS(config-if)# ip pim bsr-candidate 20
SEFOS(config-if)# end
```

6. Ensure that the correct BSR preference is set.

```
SEFOS# show ip pim bsr

PIMv2 Bootstrap Configuration For Component 1
-----
This system is the PIMv4 Bootstrap Router (BSR)
BSR Address : 10.1.0.1
BSR Priority : 20, Hash Mask Length : 30
```

▼ Restore the Default BSR-Candidate Value

This example restores the default BSR-candidate value for VLAN 5 to 0.

- Restore the default BSR preference value.

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 5
SEFOS(config-if)# no ip pim bsr-candidate
SEFOS(config-if)# end
```

Configuring PIM Query Intervals

You can configure PIM query intervals to inform neighboring PIM routers of the presence of other routers on the interface. You do this by specifying the frequency (in seconds) with which PIM hello messages are transmitted on the interface.

- [“Specify the Hello Messaging Interval” on page 30](#)
- [“Restore the Default Hello Messaging Interval” on page 31](#)

▼ Specify the Hello Messaging Interval

This example transmits hello messages from VLAN 5 to neighboring PIM routers every 80 seconds.

1. Enable PIM globally.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component.

```
SEFOS(config-if)# ip pim componentId 1
```

4. Configure the query interval for the PIM interface.

```
SEFOS(config-if)# ip pim query-interval 80  
SEFOS(config-if)# end
```

5. Ensure that the correct PIM query interval is set.

```
SEFOS# show ip pim interface detail  
Vlan5 33 is up  
  Internet Address is 10.1.0.1  
  Multicast Switching : Enabled  
  PIM : Enabled  
  PIMv6 : Disabled  
  PIM version : 2, mode: Sparse  
  PIM DR : 10.1.0.1  
  PIM DR Priority : 1  
  PIM Neighbour Count : 0  
  PIM Hello/Query Interval : 80  
  PIM Message Interval : 60  
  PIM Override Interval : 0  
  PIM Lan Delay : 0  
  PIM Lan-Prune-Delay : Disabled  
  PIM Component Id : 1  
  PIM domain border : disabled
```

▼ Restore the Default Hello Messaging Interval

This example restores the default hello messaging interval to 30 seconds.

- Restore the default hello/query interval.

```
SEFOS# configure terminal  
SEFOS(config)# interface vlan 5  
SEFOS(config-if)# no ip pim query-interval
```

Configuring PIM Join and Prune Messaging

You can specify the frequency with which PIM join and prune messages are transmitted on a PIM interface. The join and prune message interval used must be the same on all PIM routers in the PIM domain. If all the routers do not use the same timer interval, then the performance of PIM sparse can be adversely affected.

- “Specify the Join and Prune Messaging Interval” on page 32
- “Restore the Default Message Interval” on page 33

▼ Specify the Join and Prune Messaging Interval

This example transmits PIM join and prune messages from VLAN 5 every 120 seconds.

1. Enable PIM globally.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component.

```
SEFOS(config-if)# ip pim componentId 1
```

4. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60
```

5. Specify how frequently the PIM interface sends join and prune messages.

```
SEFOS(config-if)# ip pim message-interval 120
SEFOS(config-if)# end
```

6. Ensure that the correct join and prune messaging interval is set.

```
SEFOS# show ip pim interface detail

Vlan5 33 is up
  Internet Address is 10.1.0.1
  Multicast Switching : Enabled
  PIM : Enabled
  PIMv6 : Disabled
    PIM version : 2, mode: Sparse
    PIM DR : 10.1.0.1
    PIM DR Priority : 1
    PIM Neighbour Count : 0
    PIM Hello/Query Interval : 60
    PIM Message Interval : 120
    PIM Override Interval : 0
    PIM Lan Delay : 0
    PIM Lan-Prune-Delay : Disabled
    PIM Component Id : 1
    PIM domain border : disabled
```

▼ Restore the Default Message Interval

This example restores the default message interval to 60 seconds.

- Restore the default join and prune messaging interval.

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 5
SEFOS(config-if)# no ip pim message-interval
```

Managing PIM Components

A PIM component corresponds to each instance of a PIM domain and classifies it as sparse or dense mode. PIM component 1 is the default component and cannot be deleted.

- “Create a PIM Component” on page 34
- “Delete a PIM Component” on page 34

▼ Create a PIM Component

This example creates PIM component 2.

1. Create a PIM component.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
SEFOS(config)# ip pim component 2
SEFOS(pim-comp) # end
```

2. Ensure that PIM component 2 was created.

```
SEFOS# show ip pim component 2

PIM Component Information
-----
Component-Id: 2
  PIM Mode: sparse,    PIM Version: 2
  Elected BSR: 0.0.0.0
  Candidate RP Holdtime: 0
```

▼ Delete a PIM Component

This example deletes PIM component 2.

● Delete a PIM component.

```
SEFOS(config)# no ip pim component 2
```

Configuring PIM Component Data Routing Modes

PIM components can be set to either sparse mode or dense mode. Sparse mode is the default.

Sparse-mode routing protocols use shared trees. In a shared tree, sources forward multicast datagrams to a directly connected router, the designated router. The designated router encapsulates the datagram and unicasts it to an assigned RP router, which then forwards the datagram to members of multicast groups.

Dense-mode protocols are data driven, where multicast sources start sending multicast data packets, and receivers join if they want data packets or prune themselves.

- [“Specify a Data Routing Mode” on page 35](#)

▼ Specify a Data Routing Mode

This example defines sparse mode for PIM component 2. You can use the same procedure to set the mode to dense, but you would specify `set mode dense`.

1. Create a PIM component.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
SEFOS(config)# ip pim component 2
SEFOS(pim-comp)# set mode sparse
SEFOS(pim-comp)# end
```

2. Ensure that sparse mode is defined for PIM component 2.

```
SEFOS# show ip pim component 2

PIM Component Information
-----
Component-Id: 2
  PIM Mode: sparse,   PIM Version: 2
  Elected BSR: 0.0.0.0
  Candidate RP Holdtime: 0
```

Configuring RP-Candidate Behavior

You can configure an RP candidate to send periodic candidate-RP-advertisement messages to the BSR and to process JP or register messages for the advertised group prefix, when it is elected as an RP.

Use `RP-candidate RP-address` to configure the address of the interface that is advertised as a candidate-RP. In addition, you can specify the group address for which the entry that contains routing information and the group mask, which provides the group prefix for the entry that contains information about the RP.

- [“Specify the Address for the Candidate RP” on page 36](#)
- [“Delete an RP Candidate” on page 37](#)

▼ Specify the Address for the Candidate RP

This example advertises 10.1.0.1 as a candidate RP on PIM component 1, with a group address of 224.1.0.0 and a group mask of 255.255.0.0.

1. Enable PIM globally.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component.

```
SEFOS(config-if)# ip pim componentId 1
```

4. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60  
SEFOS(config-if)# exit  
SEFOS(config)#
```

5. Configure the PIM component 1.

```
SEFOS(config)# ip pim component 1
```

6. Configure the RP-candidate values.

```
SEFOS(pim-comp)# rp-candidate rp-address 224.1.0.0 255.255.0.0  
10.1.0.1  
SEFOS(pim-comp)# end
```

7. Ensure that the correct RP-candidate values are set.

```
SEFOS# show ip pim rp-candidate 1
```

CompId	GroupAddress	Group Mask	RPAddress/Priority
1	224.1.0.0	255.255.0.0	10.1.0.1/192

▼ Delete an RP Candidate

This example deletes the RP candidate created in the preceding example.

- Delete an RP candidate.

```
SEFOS# configure terminal  
SEFOS(config)# ip pim component 1  
SEFOS(config)# no rp-candidate rp-address 224.1.0.0 255.255.0.0  
10.0.0.1  
SEFOS(config)# end  
SEFOS#
```

Configuring RP Candidate Hold Time

Hold time is the amount of time the candidate RP advertisement is valid. Configure `rp-candidate holdtime` to set the hold time of the component when it is a candidate RP in the local domain.

- [“Specify RP Candidate Hold Time” on page 38](#)
- [“Restore the Default Candidate RP Hold Time” on page 39](#)

▼ Specify RP Candidate Hold Time

This example specifies that the candidate RP advertisement for PIM component 1 will be valid for 30 seconds.

1. Enable PIM globally.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component.

```
SEFOS(config-if)# ip pim componentId 1
```

4. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60  
SEFOS(config-if)# exit  
SEFOS(config)#
```

5. Configure PIM component 1.

```
SEFOS(config)# ip pim component 1
```

6. Configure the RP candidate.

```
SEFOS(pim-comp)# rp-candidate rp-address 224.1.0.0 255.255.0.0  
10.1.0.1
```

7. Configure the RP-candidate hold time for the PIM component.

```
SEFOS(pim-comp)# rp-candidate holdtime 30  
SEFOS(pim-comp)# end
```

8. Ensure that the correct RP-candidate hold time is set.

```
SEFOS# show ip pim component 1  
  
PIM Component Information
```

```
-----  
Component-Id: 1  
  PIM Mode: sparse,    PIM Version: 2  
  Elected BSR: 0.0.0.0  
  Candidate RP Holdtime: 30
```

▼ Restore the Default Candidate RP Hold Time

This example restores the default hold time for VLAN 5 to 0.

- Restore the default RP candidate hold time.

```
SEFOS# configure terminal  
SEFOS(config)# interface vlan 5  
SEFOS(pim-comp)# no rp-candidate holdtime
```

Configuring Static RPs

Static configuration allows additional structuring of the multicast traffic by directing the multicast JP messages to statically configured RPs. Configure `rp-static rp-address` to set the address for the interface that will be advertised as a static RP.

- [“Specify the Address for the Static RP” on page 39](#)
- [“Delete a Static RP” on page 40](#)

▼ Specify the Address for the Static RP

This example advertises 10.1.0.2 as a static RP on PIM component 1, with a group address of 224.1.0.0 and a group mask of 255.255.0.0.

1. Enable PIM globally.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable
```

2. Enable static RP.

```
SEFOS(config)# set ip pim static-rp enable
SEFOS(config)# interface vlan 5
SEFOS(config-if)# ip pim componentId 1
```

3. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60
SEFOS(config-if)# exit
SEFOS(config)#
```

4. Configure the PIM component.

```
SEFOS(config)# ip pim component 1
```

5. Configure the RP candidate.

```
SEFOS(pim-comp)# rp-static rp-address 224.1.0.0 255.255.0.0
10.1.0.2
SEFOS(pim-comp)# end
SEFOS#
```

6. Ensure that the static RP configuration is correct.

```
SEFOS# show ip pim rp-static 1
```

Static-RP	Enabled		
CompId	GroupAddress	Group Mask	RPAddress
-----	-----	-----	-----
1	224.1.0.0	255.255.0.0	10.1.0.2

▼ Delete a Static RP

This example deletes the RP address created in the preceding example.

● Delete an RP-static RP-address.

```
SEFOS# configure terminal
SEFOS(config)# ip pim component 1
SEFOS(pim-comp)# no rp-static rp-address 224.1.0.0 255.255.0.0
```

▼ Display RP Details

After configuring a static RP, you can view the group prefix, RP address, and hold and expiration times for the interface.

1. Enable static RP.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim static-rp enable
SEFOS(config)# interface vlan 5
SEFOS(config-if)# ip pim componentId 1
```

2. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60
```

3. Configure the BSR.

```
SEFOS(config-if)# ip pim bsr-candidate 30
SEFOS(config-if)# exit
```

4. Configure the RP candidate.

```
SEFOS(config)# ip pim component 1
SEFOS(pim-comp)# rp-candidate holdtime 30
SEFOS(pim-comp)# rp-candidate rp-address 224.1.0.0 255.255.0.0
10.1.0.1
SEFOS(pim-comp)# end
```

5. Configure PIM component 1.

```
SEFOS(config)# ip pim component 1
```

6. Configure the RP-static RP-address 10.1.0.1 for the group 224.1.0.0/16 in PIM component 1.

```
SEFOS(pim-comp)# rp-static rp-address 224.1.0.0 255.255.0.0
10.1.0.1
SEFOS(pim-comp)# end
```

7. View the RP details for the interface (in this example, PIM component 1).

```
SEFOS# show ip pim rp-set

PIM Group-to-RP mappings
-----
Group Address : 224.1.0.0 Group Mask : 255.255.0.0
  RP: 10.1.0.1
Component-Id : 1
  Hold Time : 30, Expiry Time : 00:00:19
```

▼ Enable PIM Neighbor Recognition

Enable PIM in the switches so they exchange the PIM hello message and become neighbors with other switches.

This example enables PIM in SEFOS1 and SEFOS2.

1. Enable PIM globally.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component in the first switch (in this example, SEFOS 1).

```
SEFOS(config-if)# ip pim componentId 1
```

4. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60
SEFOS(config-if)# exit
SEFOS(config)#
```


5. Enable the interconnect between the switches.

```
SEFOS(config)# interface extreme-ethernet 0/3  
SEFOS(config-if)# no shut  
SEFOS(config-if)# exit
```

6. Associate the VLAN interface with the PIM component in the second switch (in this example, SEFOS 2).

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable  
SEFOS(config)# interface vlan 5  
SEFOS(config-if)# ip pim componentId 1
```

7. Specify how often (in seconds) PIM messages are sent on the interface.

```
SEFOS(config-if)# ip pim query-interval 60  
SEFOS(config-if)# exit  
SEFOS(config)#
```

8. Enable the interconnect between the two switches.

```
SEFOS(config)# interface extreme-ethernet 0/3  
SEFOS(config-if)# no shut  
SEFOS(config-if)# exit  
SEFOS(config) #
```

9. View the neighbor.

In SEFOS1:

```
SEFOS# show ip pim neighbor
```

Neighbour Address	IfName/Idx	Uptime/Expiry	Ver	DRPri	CompId
10.1.0.2	Vlan5/33	00:00:19/84	v2	1	1

```
SEFOS# show ip pim neighbor vlan 5
```

Neighbour Address	IfName/Idx	Uptime/Expiry	Ver	DRPri	CompId
10.1.0.2	Vlan5/33	00:00:19/84	v2	1	1

In SEFOS2:

```
SEFOS# show ip pim neighbor
```

Neighbour Address	IfName/Idx	Uptime/Expiry	Ver	DRPri	CompId
10.1.0.1	Vlan5/33	00:00:19/84	v2	1	1

```
SEFOS# show ip pim neighbor vlan 5
```

Neighbour Address	IfName/Idx	Uptime/Expiry	Ver	DRPri	CompId
10.1.0.1	Vlan5/33	00:00:19/84	v2	1	1

▼ Display PIM Multicast Information

You can view the component ID, the multicast group address used by the listed RP, the network address for the source of the multicast routing information, and a summary of the mroute information.

1. Enable PIM globally.

```
SEFOS# configure terminal  
SEFOS(config)# set ip pim enable
```

2. Enter Interface Configuration mode for the interface.

```
SEFOS(config)# interface vlan 5
```

3. Associate the VLAN interface with the PIM component.

```
SEFOS(config-if)# ip pim componentId 1
```

4. Specify how often (in seconds) the switch sends PIM messages to the interface.

```
SEFOS(config-if)# ip pim query-interval 60  
SEFOS(config-if)# exit  
SEFOS(config)#
```

5. Set the RP by either selecting the RP with BSR, or by enabling a static RP.

- To enable RP using BSR:

a. Configure the BSR.

```
SEFOS(config)# interface vlan 5  
SEFOS(config-if)# ip pim bsr-candidate 30  
SEFOS(config-if)# exit
```

b. Configure the rp-candidate.

```
SEFOS(config)# ip pim component 1  
SEFOS(pim-comp)# rp-candidate holdtime 30  
SEFOS(pim-comp)# rp-candidate rp-address 224.1.0.0 255.255.0.0  
10.1.0.1  
SEFOS(pim-comp)# exit
```

- Alternatively, to enable static RP, use these steps:

a. Enable static-rp.

```
SEFOS(config)# interface vlan 5  
SEFOS(config)# set ip pim static-rp enable  
SEFOS(config)# ip pim component 1
```

b. Configure the PIM component and the RP information.

```
SEFOS(config)# ip pim component 1
SEFOS(pim-comp)# rp-static rp-address 224.1.0.0 255.255.0.0
10.1.0.1
SEFOS(pim-comp)# exit
```

6. Enable IGMP.

```
SEFOS(config)# set ip igmp enable
SEFOS(config)# interface vlan 5
SEFOS(config-if)# set ip igmp enable
SEFOS(config-if)# end
```

Send the IGMP v2 report with a source IP of 10.1.0.10.

7. View the mroute table.

```
SEFOS# show ip pim mroute

IP Multicast Routing Table
-----
Route Flags S: SPT Bit W: Wild Card Bit R: RPT Bit
Timers: Uptime/Expires
Interface State: Interface, State/Mode

PIM Multicast Routing Table For Component 1
(*, 224.1.0.0) ,00:03:53/--- ,RP : 10.1.0.1
  Incoming Interface : Vlan5 ,RPF nbr : NULL ,Route Flags : WR
  Outgoing InterfaceList :
    Vlan5, Forwarding/Sparse ,00:03:53/---
```

Alternatively, you can view the mroute table for specific component.

```
SEFOS# show ip pim mroute 1 summary

IP Multicast Routing Table
-----
Route Flags S: SPT Bit W: Wild Card Bit R: RPT Bit
Timers: Uptime/Expires
Interface State: Interface, State/Mode

PIM Multicast Routing Table For Component 1
(*, 224.1.0.0) ,00:03:53/--- ,RP : 10.1.0.1
  Incoming Interface : Vlan5 ,RPF nbr : NULL ,Route Flags : WR
  Outgoing InterfaceList :
    Vlan5, Forwarding/Sparse ,00:03:53/---
```

Or, you can also view the mroute table for a specific group.

```
SEFOS# show ip pim mroute 224.1.0.0 summary

IP Multicast Routing Table
-----
Route Flags S: SPT Bit W: Wild Card Bit R: RPT Bit
Timers: Uptime/Expires
PIM Multicast Routing Table For Component 1
(*, 224.1.0.0) ,00:11:44/--- ,RP : 10.1.0.1
  ,Route Flags : WR
```

8. Send the multicast data on VLAN 2 to populate the (S,G) entry.

