Sun Ethernet Fabric Operating System PIMv6 Administration Guide

ORACLE®

Contents

Using This Documentation

- **Overview** – Describes the configuration of the PIMv6 protocol in Oracle SEFOS for efficiently routing to multicast groups that span over WANs and LANs
- **Audience** – Users implementing PIMv6 protocol with other protocols in the router stack
- **Required Knowledge** – Basic knowledge of the PIMv6 protocol

Product Notes

Documentation and resources for this product and related products are available at:

- http://www.oracle.com/goto/es2-72_es2-64/docs
- http://www.oracle.com/goto/ES1-24/docs
- http://www.oracle.com/goto/sn-10gbE-72p/docs
- http://www.oracle.com/goto/sb6k-24p-10gbe/docs

Acronyms and Abbreviations

Acronym or Abbreviation	Explanation
BGP	Border Gateway Protocol
BSR	Boot strap router
C-BSR	Candidate BSR
C-RP	Candidate RP
FSAP	Flexible software architecture for portability
IETF	Internet Engineering Task Force
LAN	Local area network
MIB	Management information base
MLD	Multicast listener discovery
MRT	Multicast routing table
PIM	Protocol independent multicast
PIM-SM	PIM Sparse mode

Acronym or Abbreviation	Explanation
PMBR	PIMv6 multicast border routers
RP	Reverse path
RPF	Reverse path forwarding
RPT	Reverse path tree
SNMP	Simple Network Management Protocol
SRM	State refresh module
SPT	Shortest path tree
SSM	Source-specific multicast
WAN	Wide area network

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 `logout` or `exit` 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 `logout` or `exit` command to return to the Oracle ILOM prompt.
Global Configuration	From User EXEC mode, use the `enable` command.	`SEFOS(config)#`	Use the `end` command to return to Privileged EXEC mode.
Interface Configuration	From Global Configuration mode, use the `interface interface-type interface-id` command.	`SEFOS(config-if)#`	Use the `exit` command to return to Global Configuration mode, or use the `end` command to return to Privileged EXEC mode.

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SEFOS PIMv6 Overview

This section provides an overview of the supported features and a description of the PIMv6 protocol that is implemented in SEFOS.

- "Supported Features" on page 9
- "Protocol Description" on page 10
- "Default Settings" on page 11
- "Topology Example" on page 11
- "Configuring the Topology Example" on page 12

Supported Features

The current version of the SEFOS PIMv6 protocol supports these features:

- Multicast forwarding engine with clear separation between the control (routing) and multicast forwarding planes.
- Support for multiple components.
- RP and rooted shared trees (that is, multicast delivery trees), built and maintained by using periodic and triggered join and prune messages.
- Switching from RPT to SPT when a particular source generates heavy traffic.
- Unicast route changes.
- Configuration as BSR, propagating RP-set information into the network.
- IETF standards in RP and BSR elections.
- Configuration as a canditate-RP, which sends out the CRP information periodically to the BSR of the domain.
- Independent configuration as candidate-RP on each interface.
- Regular housekeeping functions such as neighbor discovery and timeout.
- Operations under multi-access networks by suppressing and overriding joins and prunes and by electing a single forwarder through asserts in sparse mode.
- Operations over point-to-point interfaces.
- Interoperation between components by using the rules specified in RFC2715. Each component can also function independently, which enables complete separation between components.

- GenID implementation, which is required to rebuild the multicast forwarding state when a router goes offline and restarts.

These features are configured by default:

- RP-related configurations
- Switching from RPT to SPT configurations
- BSR configurations
- PMBR configurations
- Interface configurations related to PIM components

Protocol Description

PIMv6 is a family of multicast routing protocols for IPv6 networks that provide one-to-many and many-to-many distribution of data over a LAN or WAN, or over the internet. PIMv6 is termed protocol-independent because PIMv6 does not include its own topology discovery mechanism. Instead, PIMv6 uses routing information supplied by other traditional routing protocols, such as the BGP.

There are two supported modes in the PIMv6 Protocol:

- Sparse mode

  PIM-SM uses a pull model to deliver multicast traffic. Only network segments with active receivers, which explicitly request the data, receive the traffic. PIM-SM distributes information about active sources by forwarding data packets on the shared tree.

  PIM-SM initially uses shared trees, so it requires the use of an RP, which must be configured in the network. Sources register with the rendezvous point and subsequently forward data down the shared tree to the receivers. The edge routers learn about a particular source when they receive data packets on the shared tree from that source through the RP. The edge router then sends PIMv6 (source or group) join messages to that source.

  Each router along the reverse path compares the unicast routing metric of the RP address to the metric of the source address. If the metric for the source address is better, the router forwards a PIMv6 (source or group) join message to the source. If the metric for the RP is equal or better, the join message is sent in the same direction as the RP. In this case, the shared tree and the source tree are the same.

- Source-specific multicast

  SSM bypasses the shared tree of PIM-SM and immediately creates the shortest-path tree. SSM accomplishes this because:

  - MLDv2 can specify the source in its request to the local router.
  - Sources must be able to inform receivers of their existence through a method other than registering with the network (for example, a web page).

Default Settings

This table shows the default values configured in the router when PIMv6 is enabled. These default values can be changed at any time.

Feature	Default Value
Module status	Disable
SPT group threshold	0
SPT source threshold	0
SPT switch period	0 second
RP threshold	0
RP switch period	0 second
regstop rate limit period	5 seconds
PMBR status	Disabled
Static RP	Disabled
Component mode	Sparse
RP-candidate hold time	0 second
Query interval	30 seconds
Message interval	60 seconds
BSR candidate	0
Component ID	1
Hello hold time	105 seconds
DR priority	1
Override interval	0 second
LAN delay	0 second
LAN-prune delay	Disable

Topology Example

Before enabling PIMv6 in a router, you must configure the router and the host with the IP address and VLAN connectivity. The following example topology is referenced in the configuration steps in this guide.
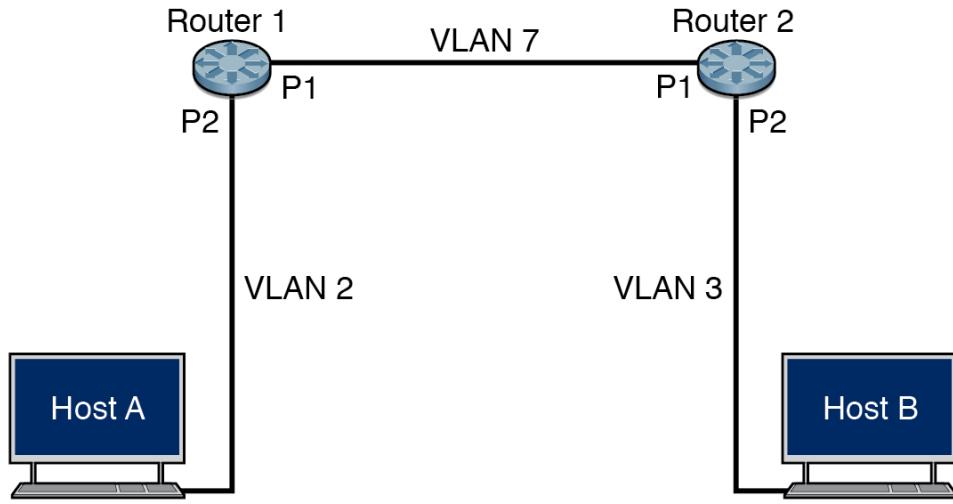
This topology consists of two routers (router A and router B) with two physical interfaces (`P1` and `P2`), which are `extreme-ethernet 0/1` and `extreme-ethernet 0/2` respectively.

The following table shows the configuration values of the IPv4 and IPv6 addresses for each interface.

Switch or Host	Interface	IPv4 Address	IPv6 Address and Prefix Length
Router A	Port 3 (`VLAN 7`)		`7777::11/112`
	Port 15 (`VLAN 2`)		`2222::12/112`
	Port 4 (`VLAN 1`)	`12.0.0.1/24`	`1111::14/112`
Router B	Port 3 (`VLAN 7`)		`7777::21/112`
	Port 15 (`VLAN 3`)		`3333::22/112`
	Port 4 (`VLAN 1`)	`12.0.0.2/24`	`1111::24/112`
Host B	Port 3 (`VLAN 3`)		`3333::53/112`
Host A	Port 5 (`VLAN 2`)		`2222::63/112`

Configuring the Topology Example

This section contains procedures that you must perform to set up the topology before you can configure the PIMv6 features.

■ "Enable IPv6 Support and Assign IPv6 Addresses" on page 13
■ "Configure PIMv6 in Router A" on page 13

- ■ "Configure PIMv6 in Router B" on page 15

▼ Enable IPv6 Support and Assign IPv6 Addresses

1. **Enable IPv6 support in the VLAN.**

```
SEFOS# configure terminal
SEFOS(config)# interface vlan vlan_id
SEFOS(config-if)# ipv6 enable
```

2. **Configure the IPv6 address in the interface.**

```
SEFOS(config-if)# ipv6 address ipv6_address mask
SEFOS(config-if)# ipv6 address ipv6_address scope_of_the_ipv6_address
```

▼ Configure PIMv6 in Router A

1. **Enable IPv6, and configure the interface in VLAN 7.**

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# shutdown
SEFOS(config-if)# ipv6 enable
SEFOS(config-if)# ipv6 address 7777::11 112 unicast
SEFOS(config-if)# ipv6 address fe80::7777:11 link-local
SEFOS(config-if)# no shutdown
SEFOS(config-if)# exit
SEFOS(config)# int ext 0/3
SEFOS(config-if)# switchport acce vlan 7

% Access VLAN does not exist.,Creating vlan
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
```

2. **Enable IPv6, and configure the interface in VLAN 2.**

```
SEFOS(config)# interface vlan 2
SEFOS(config-if)# shutdown
SEFOS(config-if)# ipv6 enable
SEFOS(config-if)# ipv6 address 2222::12 112 unicast
SEFOS(config-if)# ipv6 address fe80::2222:12 link-local
SEFOS(config-if)# no shutdown
SEFOS(config-if)# exit
```

```
SEFOS(config)# int extreme-ethernet 0/15
SEFOS(config-if)# switchport access vlan 2

% Access VLAN does not exist.,Creating vlan
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
```

3.   Add a static route by using the local address for the sender and listener.

```
SEFOS(config)# ipv6 route 3333::0 112 fe80::7777:21 vlan 7
SEFOS(config)# exit
```

4.   Review the IPv6 output.

```
SEFOS# show ipv6 interface

vlan1 is up, line protocol is up
    IPv6 is Enabled
    Link local address:
        fe80::221:28ff:fe56:d7a9
    Global unicast address(es):
        Not Configured.
    Joined group address(es):
        ff02::1
        ff02::2
        ff02::1:ff56:d7a9
    MTU is 1500
    ICMP redirects are enabled
    ND DAD is enabled, Number of DAD attempts: 1
    ND router advertisement is disabled
vlan7 is up, line protocol is down
    IPv6 is Enabled
    Link local address:
        fe80::7777:11    [Down]
        fe80::221:28ff:fe56:d7a9    [Down]
    Global unicast address(es):
        7777::11/112    [Down]
    Joined group address(es):
        Not Configured.
    MTU is 1500
    ICMP redirects are enabled
    ND DAD is enabled, Number of DAD attempts: 1
    ND router advertisement is disabled
vlan2 is up, line protocol is up
    IPv6 is Enabled
    Link local address:
        fe80::2222:12
    Global unicast address(es):
        2222::12/112
    Joined group address(es):
        ff02::1
        ff02::2
```

```
      ff02::1:ff00:12
      ff02::1:ff22:12
MTU is 1500
ICMP redirects are enabled

ND DAD is enabled, Number of DAD attempts: 1
ND router advertisement is disabled
```

▼ Configure PIMv6 in Router B

1. **Enable IPv6, and configure the interface in VLAN 7.**

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# shutdown
SEFOS(config-if)# ipv6 enable
SEFOS(config-if)# ipv6 address 7777::21 112 unicast
SEFOS(config-if)# ipv6 address fe80::7777:21 link-local
SEFOS(config-if)# no shutdown
SEFOS(config-if)# exit
SEFOS(config)# int extreme-ethernet 0/3
SEFOS(config-if)# switchport access vlan 7

% Access VLAN does not exist.,Creating vlan
SEFOS(config-if)# no shutdown
SEFOS(config-if)# exit
SEFOS(config)# vlan 7
SEFOS(config-if)# exit
```

2. **Enable IPv6, and configure the interface in VLAN 3.**

```
SEFOS(config)# interface vlan 3
SEFOS(config-if)# shutdown
SEFOS(config-if)# ipv6 enable
SEFOS(config-if)# ipv6 address 3333::22 112 unicast
SEFOS(config-if)# ipv6 address fe80::3333:22 link-local
SEFOS(config-if)# no shutdown
SEFOS(config-if)# exit
SEFOS(config)# int ext 0/15
SEFOS(config-if)# switchport access vlan 3

% Access VLAN does not exist.,Creating vlan
SEFOS(config-if)# no shutdown
SEFOS(config-if)# exit
SSEFOS(config)# exit
```

3. **Add a static route by using the local address for the sender and listener.**

```
SEFOS(config)# ipv6 route 2222::0 112 fe80::7777:11 vlan 7
SEFOS(config)# exit
```

4.   Review the IPv6 output.

```
SEFOS# show ipv6 interface

vlan1 is up, line protocol is up
    IPv6 is Enabled
    Link local address:
        fe80::214:4fff:fe6c:61cf
    Global unicast address(es):
        Not Configured.
    Joined group address(es):
        ff02::1
        ff02::2
        ff02::1:ff6c:61cf
    MTU is 1500
    ICMP redirects are enabled
    ND DAD is enabled, Number of DAD attempts: 1
    ND router advertisement is disabled
vlan7 is up, line protocol is up
    IPv6 is Enabled
    Link local address:
        fe80::7777:21
    Global unicast address(es):
        7777::21/112
    Joined group address(es):
        ff02::1
        ff02::2
        ff02::1:ff00:21
        ff02::1:ff77:21
    MTU is 1500
    ICMP redirects are enabled
    ND DAD is enabled, Number of DAD attempts: 1
    ND router advertisement is disabled
vlan3 is up, line protocol is up
    IPv6 is Enabled
    Link local address:
        fe80::3333:22
    Global unicast address(es):
        3333::22/112
    Joined group address(es):
        ff02::1
        ff02::2
        ff02::1:ff00:22
        ff02::1:ff33:22
    MTU is 1500
    ICMP redirects are enabled
    ND DAD is enabled, Number of DAD attempts: 1
    ND router advertisement is disabled
```

5.   Review the IPv6 output on router A.

```
SEFOS# show ipv6 interface

vlan1 is up, line protocol is up
    IPv6 is Enabled
    Link local address:
        fe80::221:28ff:fe56:d7a9
    Global unicast address(es):
        Not Configured.
    Joined group address(es):
        ff02::1
        ff02::2
        ff02::1:ff56:d7a9
    MTU is 1500
    ICMP redirects are enabled
    ND DAD is enabled, Number of DAD attempts: 1
    ND router advertisement is disabled
vlan7 is up, line protocol is up
    IPv6 is Enabled
    Link local address:
        fe80::7777:11
    Global unicast address(es):
        7777::11/112
    Joined group address(es):
        ff02::1
        ff02::2
        ff02::1:ff00:11
        ff02::1:ff77:11
    MTU is 1500
    ICMP redirects are enabled
    ND DAD is enabled, Number of DAD attempts: 1
    ND router advertisement is disabled
vlan2 is up, line protocol is up
    IPv6 is Enabled
    Link local address:
        fe80::2222:12
    Global unicast address(es):
        2222::12/112
    Joined group address(es):
        ff02::1
        ff02::2
        ff02::1:ff00:12
        ff02::1:ff22:12
    MTU is 1500


    ICMP redirects are enabled
    ND DAD is enabled, Number of DAD attempts: 1
    ND router advertisement is disabled
```

Global Configurations

This section contains procedures for configuring the Oracle's SEFOS PIMv6 features. The configurations are global to all of the components in a router. Some of these procedures have the default values shown in "Default Settings" on page 11. You do not need to reconfigure these values unless your administration requirements are different.

Note - In some procedures in this section, the example output has been truncated for readability.

▼ Enable PIMv6

By default, PIMv6 is disabled in the system. Enable PIMv6 in all of the routers in a network that need to support PIMv6 (for example, router A and router B in the example topology).

1. Enable PIMv6 in the router.

```
SEFOS# configure terminal
SEFOS(config)# set ip pim enable
SEFOS(config)# set ipv6 pim enable
SEFOS(config)# end
```

2. Review the configuration information.

```
SEFOS# show ipv6 pim component
```

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

▼ Configure the Group and Source Thresholds

Configuring the PIMv6 group threshold sets the maximum limit for the rate of the flow of data in the group. Configuring the source threshold sets the maximum limit for the rate of the flow of data from the source to the receiver. When the rate of the flow of data exceeds the SPT group or source threshold, switching to the SPT is initiated. You must configure the threshold value to switch to SPT.

1. Enable PIMv6 in the router.

```
SEFOS# configure terminal
SEFOS(config)# set ipv6 pim enable
SEFOS(config)# end
```

2. Set the SPT group threshold to 10 data packets.

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

3. Set the SPT source threshold to 15 data packets.

```
SEFOS(config)# set ip pim threshold spt-src 15
SEFOS(config)# end
```

4. Review the threshold values.

```
SEFOS# show ipv6 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
```

▼ Configure the SPT Switching Period

You must configure the SPT group and source thresholds before you configure the SPT switching period. The received register packets should exceed the threshold in the SPT switching period so that the receiver initiates the switching to the SPT.

1. **Set the SPT group threshold to 10 packets and the source threshold to 15 packets.**

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

2. **Set the SPT switching period to 5 seconds.**

```
SEFOS# configure terminal
SEFOS(config)# set ip pim spt-switchperiod 5
SEFOS(config)# end
```

3. **Review the SPT switching period.**

```
SEFOS# show ipv6 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
```

▼ Configure the Rendezvous Point Threshold

Configuring PIMv6 rendezvous point threshold specifies the threshold at which RP initiates switching to the source-specific SPT.

1. **Enable PIMv6.**

```
SEFOS# configure terminal
SEFOS(config)# set ipv6 enable
SEFOS(config)# end
```

2. **Set the rendezvous point threshold to 10 seconds.**

    ```
    SEFOS# configure terminal
    SEFOS(config)# set ip pim rp-threshold 5
    SEFOS(config)# end
    ```

3. **Review the rendezvous point threshold value.**

    ```
    SEFOS# show ipv6 pim thresholds

    PIM SPT Threshold Information
    ----------------------------
      Group Threshold  : 0
      Source Threshold : 0
      Switching Period : 0

    PIM SPT-RP Threshold Information
    --------------------------------
      Register Threshold    : 10
      RP Switching Period   : 0
      Register Stop rate limit : 5
    ```

▼ Configure the RP Switch Period

Configuring PIMv6 RP switch period specifies the period (in seconds) over which the RP monitors register packets for switching to the source-specific SPT. The received packets should exceed the RP threshold within the RP switch period for switching to the source-specific SPT.

1. **Set the SPT group threshold to 10 packets and the source threshold to 15 packets.**

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

2. **Set the RP switch period to 15 seconds.**

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

3. **Review the RP switch period values.**

    ```
    SEFOS# show ipv6 pim thresholds

    PIM SPT Threshold Information
    ```

```
----------------------------
  Group Threshold  : 0
  Source Threshold : 0
  Switching Period : 0

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

▼ Configure the regstop Rate Limit

A register-stop message avoids the encapsulation of multicast data packets from the first-hop router to the RP. Configuring the regstop rate limit specifies the time interval between two successive register-stop messages sent by an RP.

1. Enable PIMv6.

```
SEFOS# configure terminal
SEFOS(config)# set ipv6 pim enable
```

2. Set the regstop rate limit value to 10 seconds.

```
SEFOS(config)# set ip pim regstop-ratelimit-period 10
SEFOS(config)# end
```

3. Review the regstop rate limit value.

```
SEFOS# show ipv6 pim thresholds

PIM SPT Threshold Information
----------------------------
  Group Threshold  : 0
  Source Threshold : 0
  Switching Period : 0
PIM SPT-RP Threshold Information
--------------------------------
  Register Threshold      : 10
  RP Switching Period     : 15
  Register Stop rate limit : 10
```

▼ Configure the PMBR Status

A PMBR connects a PIMv6 domain to other multicast-routing domains. Configuring the PMBR status enables or disables the PMBR.

1. **Enable PIMv6.**

```
SEFOS# configure terminal
SEFOS(config)# set ipv6 pim enable
```

2. **Enable the PMBR status.**

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

3. **In VLAN 7, associate the interface with PIMv6 component 1.**

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# end
```

4. **Review the PMBR status.**

```
SEFOS# show ipv6 pim interface detail

...
    PIM Component Id : 1
    PIM domain border : enabled
...
```

5. **Review the interface details.**

```
SEFOS# show ipv6 pim interface detail

...
    PIM Component Id : 1
    PIM domain border : disabled
...
```

Configuring PIMv6 on an Interface

The instructions in this section explain how to configure an interface to run PIMv6.

- "Associate the PIMv6 Component to an Interface" on page 25
- "Configure the Query-Interval Value" on page 25
- "Configure the DR Priority Value" on page 26
- "Configure the Override Interval" on page 27
- "Configure the LAN Delay" on page 27
- "Configure the LAN Prune Delay" on page 28

▼ Associate the PIMv6 Component to an Interface

The `ipv6 pim componentId` command adds an interface to the PIMv6 component and enables PIMv6 on the interface. You must associate a PIMv6 component with the interface to turn the interface into a supported PIMv6 module. In addition, you must create a component before you associate that component with an interface, except for the default component 1. See "Configuring the PIMv6 Component" on page 30 for instructions on how to create a component.

1. **Enable PIMv6.**

```
SEFOS# configure terminal
SEFOS(config)# set ipv6 pim enable
```

2. **Enter the configuration mode for VLAN 1, and associate the VLAN interface with the PIMv6 component ID (2 in this case).**

```
SEFOS(config)# interface vlan 1
SEFOS(config-if)# ipv6 pim componentId 2
SEFOS(config-if)# end
```

3. **Review the interface status.**

```
SEFOS# show ipv6 pim interface detail

...
    PIM Lan-Prune-Delay : Disabled
    PIM Component Id : 2
...
```

▼ Configure the Query-Interval Value

The query-interval value enables PIMv6 on an interface, and sets the frequency at which PIMv6 hello messages are transmitted on the interface.

1. **Associate the VLAN 7 interface with PIMv6 component 1.**

```
SEFOS(config)# interface vlan 7
```

```
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# end
```

2.   Set the query interval to 60 seconds for the VLAN 7 interface.

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim query-interval 60
SEFOS(config-if)# end
```

3.   Review the PIMv6 query interval.

```
SEFOS# show ipv6 pim interface detail

vlan7 34 is up
...
    PIM Hello/Query Interval : 60
...
```

▼ Configure the DR Priority Value

Configuring the PIMv6 DR priority configures the designated router priority value for the PIMv6 interface. A designated router sets up multicast route entries and sends corresponding join or prune messages and register messages on behalf of directly connected receivers and sources, respectively.

1.   Associate the VLAN 7 interface with PIMv6 component 1.

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# end
```

2.   Set the DR priority to 10.

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim dr-priority 10
SEFOS(config-if)# end
```

3.   Review the DR priority.

```
SEFOS# show ipv6 pim interface detail

vlan7 34 is up
```

```
...
    PIM DR Priority: 10
...
```

▼ Configure the Override Interval

The override interval is the amount of time-delay used for sending override messages to avoid synchronization of override messages when multiple downstream routers share a multiaccess link.

1. **Associate the VLAN 7 interface with PIMv6 component 1.**

    ```
    SEFOS(config)# interface vlan 7
    SEFOS(config-if)# ipv6 pim componentId 1
    SEFOS(config-if)# end
    ```

2. **Set the override interval to 10 seconds.**

    ```
    SEFOS# configure terminal
    SEFOS(config)# interface vlan 7
    SEFOS(config-if)# ipv6 pim override-interval 10
    SEFOS(config-if)# end
    ```

3. **Review the DR priority.**

    ```
    SEFOS# show ipv6 pim interface detail

    vlan7 34 is up
    ...
        PIM Override Interval: 10
    ...
    ```

▼ Configure the LAN Delay

The LAN delay, inserted by a router in the LAN prune delay option, expresses the expected message propagation delay on the interface. Upstream routers use the delay to discover the delayed time interval for a join override message before pruning an interface.

1. **Associate the VLAN 7 interface with the PIMv6 component 1.**

    ```
    SEFOS(config)# interface vlan 7
    SEFOS(config-if)# ipv6 pim componentId 1
    ```

```
SEFOS(config-if)# end
```

2. **Set the LAN delay to 120 seconds on the VLAN 7 interface.**

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim lan-delay 120
SEFOS(config-if)# end
```

3. **Review the LAN delay value.**

```
SEFOS# show ipv6 pim interface detail

vlan7 34 is up
...
    PIM Lan Delay: 120
...
```

▼ Configure the LAN Prune Delay

When you configure the PIMv6 LAN prune delay, you specify whether or not to use LAN prune delay.

1. **Associate the VLAN 7 interface with the PIMv6 component 1.**

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# end
```

2. **Enable the LAN prune-delay status for the VLAN 7 interface.**

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 7
SEFOS(config-if)# set ipv6 pim lan-prune-delay enable
SEFOS(config-if)# end
```

3. **Review the LAN prune-delay status.**

```
SEFOS# show ipv6 pim interface detail

vlan7 34 is up
...
    PIM Lan-Prune-Delay: Enabled
...
```

▼ Configure the BSR Candidate

A BSR is a dynamically elected router within a PIMv6 domain. When you configure a PIMv6 BSR candidate, you set the preference value for the local interface as a candidate bootstrap router. The no form of the command sets the default preference value for the local interface as a candidate bootstrap router.

1. **Associate the `VLAN 7` interface with the PIMv6 component 1.**

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# end
```

2. **Set the BSR-candidate preference to 20 for the `VLAN 7` interface.**

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim bsr-candidate 20
SEFOS(config-if)# end
```

3. **Review the BSR priority.**

```
SEFOS# show ipv6 pim bsr

PIMv2 Bootstrap Configuration For Component 1
-----------------------------------------------
Elected BSR for Component  1
...
  V6 BSR Priority : 20
...
```

4. **Review the PIMv6 component details.**

```
SEFOS# show ipv6 pim component

PIM Component Information
--------------------------
Component-Id: 1
  PIM Mode: sparse,   PIM Version: 2
  Elected BSR: 7777::11
  Candidate RP Holdtime: 0
```

▼ Configure the Message Interval

When you configure the PIMv6 message interval, you set the frequency at which PIMv6 join or prune messages are transmitted on a PIMv6 interface. The join or prune message interval must

be the same on all of the PIMv6 routers in the PIMv6 domain. If all of the routers do not use the same timer interval, then the performance of the PIMv6 sparse mode can be adversely affected.

1. Associate the `VLAN 7` interface with the PIMv6 component 1.

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# end
```

2. Set the message interval to 120 seconds for the `VLAN 7` interface.

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim message-interval 120
SEFOS(config-if)# end
```

3. Review the message interval.

```
SEFOS# show ipv6 pim interface detail

vlan7 34 is up
...
    PIM Message Interval : 120
...
```

Configuring the PIMv6 Component

This section contains instructions on how to configure the PIMv6 component. Component 1 is the default component, so it cannot be created or deleted.

-
-
-
-
-
-

▼ Create a PIMv6 Component

The PIMv6 component corresponds to each instance of a PIMv6 domain. The component is classified as being in the sparse mode. Dense mode is not supported in the 1.2 release.

1. **Enable PIMv6.**

   ```
   SEFOS# configure terminal
   SEFOS(config-if)# set ipv6 pim enable
   ```

2. **Enter into PIMv6 component mode for configuring a component.**

   ```
   SEFOS(config)# ip pim component component_ID
   SEFOS(pim-comp)# end
   ```

3. **Review the configuration information for the component (2 in this example).**

   ```
   SEFOS# show ipv6 pim component 2

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

▼ Set the Mode for the PIMv6 Component

You can set the PIMv6 mode to sparse, which routes protocols using 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. The default mode is sparse. As of the current release, dense mode is not supported.

1. **Enable PIMv6.**

   ```
   SEFOS# configure terminal
   SEFOS(config-if)# set ipv6 pim enable
   ```

2. **Enter into PIMv6 component mode for the component.**

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

3. **Set the mode for the PIMv6 component as Sparse.**

   ```
   SEFOS(pim-comp)# set mode sparse
   SEFOS(pim-comp)# end
   ```

4.   Review the PIMv6 mode for the component (1 in this example).

```
SEFOS# show ipv6 pim component 1

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

▼ Configure the RP-Candidate Hold Time

The hold-time value is the amount of time the candidate RP advertisement is valid. When you
configure the RP-candidate hold time, you set the hold time of the component when it is a
candidate RP in the local domain. The mode must already be set to sparse.

1.   Associate the `VLAN 7` interface with PIMv6 component 1.

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# end
```

2.   Enter the PIMv6 component mode for PIMv6 component 1.

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

3.   Configure the RP-candidate hold time to 30 seconds for PIMv6 component 1.

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

4.   Review the hold time value.

```
SEFOS# show ipv6 pim component 1

PIM Component Information
--------------------------
Component-Id: 1
  PIM Mode: sparse,   PIM Version: 2

  Elected BSR: ::
  Candidate RP Holdtime: 30
```

▼ Configure the RP-Candidate Address

An RP-candidate router is a router that is configured to send periodic RP-candidate advertisement messages to the BSR. This router also processes join or prune messages or registers messages for the advertised group prefix when it is elected as an RP. When you configure the RP-candidate address, you set the address of the interface that is advertised as an RP-candidate.

1. **Associate the `VLAN 7` interface with the PIMv6 component 1.**

    ```
    SEFOS(config)# interface vlan 7
    SEFOS(config-if)# ipv6 pim componentId 1
    SEFOS(config-if)# exit
    ```

2. **Enter the PIMv6 component mode for PIMv6 component 1.**

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

3. **Set the RP-candidate hold time to 30 seconds for PIMv6 component 1.**

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

4. **Set the RP-candidate address for the group in PIMv6 component 1.**

    ```
    SEFOS(pim-comp)# ipv6 pim rp-candidate rp-address ff02::e001:0 128 7777::11
    SEFOS(pim-comp)# end
    ```

5. **Review the RP-candidate RP-address.**

    ```
    SEFOS# show ipv6 pim rp-candidate

    CompId   GroupAddress/PrefixLength       RPAddress/Priority
    ------   ------------------------        ---------- -------
         1        ff02::e001:1/128             7777::11/4
    ```

6. **Review the RP-candidate details for PIMv6 component 1.**

    ```
    SEFOS# show ipv6 pim rp-candidate 1

    CompId   GroupAddress/PrefixLength       RPAddress/Priority
    ------   ------------------------        ---------- -------
         1        ff02::e001:1/128             7777::11/4
    ```

▼ Configure the RP Static Address

Static configuration allows additional structuring of the multicast traffic by directing the multicast join or prune messages to statically configured RPs.

1. Associate the `VLAN 7` interface with the PIMv6 component 1.

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# end
```

2. Enable the static-RP configuration for the router.

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

3. Enter the PIMv6 component mode for the component (2 in this example).

```
SEFOS(config)# ip pim component 2
```

4. Set the RP static RP address (`7777::11`) with a mask length of 128 for group `ff02::e001:1` in PIMv6 component 1.

This step uses the following parameters:

- RP address: 7777::11
- Mask length: 128
- Group address: ff02::e001:1

```
SEFOS(pim-comp)# ipv6 pim rp-static rp-address ff02::e001:1 128 7777::11
SEFOS(pim-comp)# end
```

5. Review the RP static RP address.

```
SEFOS# show ipv6 pim rp-static 2

Static-RP Enabled
CompId    GroupAddress/PrefixLength      RPAddress
------    -------------------------      ---------
     2              ff02::e001:1/128        7777::11
```

▼ Create an RP-Set Table

1. **In router A, associate the VLAN 7 interface with PIMv6 component 1.**

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# exit
```

2. **Enter PIMv6 component mode for component 1.**

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

3. **Set the RP-candidate hold time to 30 seconds for PIMv6 component 1.**

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

4. **Set the RP-candidate RP address (7777::11) for the group (ff02::e001:1) with a mask length of 128 in PIMv6 component 1.**

```
SEFOS(pim-comp)# ipv6 pim rp-candidate rp-address ff02::e001:1 128 7777::11
SEFOS(pim-comp)# exit
```

5. **Enter the interface configuration mode for VLAN 7.**

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 7
SEFOS(config-if)# shutdown
```

6. **Set the BSR-candidate preference to 20 for the VLAN 7 interface.**

```
SEFOS(config-if)# ipv6 pim bsr-candidate 20
SEFOS(config-if)# exit
```

7. **In router B, associate the VLAN 7 interface with PIMv6 component 1.**

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# exit
```

8. **Enter PIMv6 component mode for component 1.**

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

9. **Set the RP-candidate hold time to 30 seconds for PIMv6 component 1.**

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

10. **Set the RP-candidate address (`7777::11`) for the group (`ff02::e001:1`) with a mask length of 128 in PIMv6 component 1.**

```
SEFOS(pim-comp)# ipv6 pim rp-candidate rp-address ff02::e001:1 128 7777::21
SEFOS(pim-comp)# exit
```

11. **In router A, review the RP-set table.**

```
SEFOS# show ipv6 pim rp-set

PIM Group-to-RP mappings
------------------------
Group Address : ff02::e001:1Group Mask : 128
  RP: 7777::11
   Component-Id : 1
     Hold Time : 100, Expiry Time : 00:01:17

Group Address : ff02::e001:1Group Mask : 128
  RP: 7777::21
   Component-Id : 1
     Hold Time : 110, Expiry Time : 00:01:37
```

12. **In router B, review the RP-set table.**

```
SEFOS# show ipv6 pim rp-set 7777::11

PIM Group-to-RP mappings
------------------------
  Group Address : ff02::e001:1Group Mask : 128
    RP: 7777::11
    Component-Id : 1
    Hold Time : 30, Expiry Time : 00:01:08
```

▼ Create a PIMv6 Neighbor

Before you attempt to use the instructions in this section, you must enable PIMv6 in router A and router B so that they exchange the PIMv6 hello message and form neighbors. See "Enable PIMv6" on page 19 for instructions.

1. **In both routers, associate the `VLAN 7` interface with PIMv6 component 1.**

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# end
```

2.   In router A, review the PIMv6 neighbor router for the PIMv6 enabled router.

```
SEFOS# show ipv6 pim neighbor

Neighbor IfName/Idx Uptime/Expiry Ver  DRPri CompId  Override   LanDelay
Address                              /Mode         Interval
--------- ---------- ------------- ---   -----  ------  -------   -------
fe80::7777::21 vlan7/34   00:02:09/95   v2  1        1        0   0
```

3.   In router A, review the PIMv6 neighbor for `VLAN 7`.

```
SEFOS# show ipv6 pim neighbor vlan 7

Neighbor     IfName/Idx Uptime/Expiry Ver DRPri   CompId   Override  LanDelay
Address                              /Mode           Interval

---------     ---------- ------------- --- -----   ------   -------- --------
fe80::7777::21 vlan7/34   00:09:30/75    v2  1        1        0   0
```

▼ Create Multicast Routes

To handle MLDv1 report packets, you must enable MLD over the interfaces.

1.   On routers A and B, enable MLD routing on interfaces.

```
SEFOS# conf t
SEFOS(config)# int vlan 7
SEFOS(config-if)# ipv6 mld router
SEFOS(config-if)# end
```

2.   Associate the `VLAN 2` interface with PIMv6 component 1.

```
SEFOS(config)# interface vlan 2
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# exit
```

3.   Associate the `VLAN 7` interface with PIMv6 component 1.

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
```

```
SEFOS(config-if)# end
```

4. **Enter the interface configuration mode for VLAN 7.**

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 7
SEFOS(config-if)# shutdown
```

5. **Configure the BSR-candidate preference to 20 for the VLAN 7 interface.**

```
SEFOS(config-if)# ipv6 pim bsr-candidate 20
```

6. **Send the multicast data from host A to router A to populate the source-group entry with the source IP as the IPv6 unicast address of host A and the group address of ff02::e001:0.**

7. **In router B, associate PIMv6 component 1 with the VLAN 3 interface.**

```
SEFOS(config)# interface vlan 3
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# exit
```

8. **Associate the VLAN 7 interface with PIMv6 component 1.**

```
SEFOS(config)# interface vlan 7
SEFOS(config-if)# ipv6 pim componentId 1
SEFOS(config-if)# end
```

9. **Enter the PIMv6 component mode for PIMv6 component 1.**

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

10. **Set the RP-candidate hold time to 30 seconds for PIMv6 component 1.**

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

11. **Set the RP-candidate RP-address for the group in PIMv6 component 1.**

```
SEFOS(pim-comp)# ipv6 pim rp-candidate rp-address ff02::e001:0  128  7777::21
SEFOS(pim-comp)# end
```

12. **Send the MLDv1 report message to router B from host B using the source IP of the IPv6 link-local address of host B and the group ff02::e001:0.**

13. **In router A, review the multicast route table.**

```
SEFOS# show ipv6 pim mroute

IP Multicast Routing Table
--------------------------
Route Flags S: SPT Bit W: Wild Card Bit R: RPT Bit
IIF State P: Pruned F: Forwarding A: Graft Ack Pending
Timers: Uptime/Expires
Interface State: Interface, State/Mode

PIM Multicast Routing

 Table For Component 1
(2222::18,ff02::e001:0) ,00:00:21/ 05:32:29 ,  Incoming Interface : vlan2 ,RPF nbr : NULL ,
Route Flags : S

 Outgoing InterfaceList :    vlan7, Forwarding/Sparse ,00:00:10/05:32:29
```

14. **In router B, review the multicast route table.**

```
SEFOS# show ipv6 pim mroute

IP Multicast Routing Table
--------------------------
Route Flags S: SPT Bit W: Wild Card Bit R: RPT Bit
IIF State P: Pruned F: Forwarding A: Graft Ack Pending
Timers: Uptime/Expires
Interface State: Interface, State/Mode

PIM Multicast Routing

 Table For Component 1
(2222::18,ff02::e001:0) ,00:17:31/ 05:10:59 ,  Incoming Interface : vlan7 ,RPF nbr :    fe80::
7777:11 ,Route Flags : S

 Outgoing InterfaceList :    vlan3, Forwarding/Sparse ,00:17:31/---

(*, ff02::e001:0) ,00:17:36/ ---7777::21)  Incoming Interface : vlan7 ,RPF nbr : NULL ,Route
 Flags : WR

 Outgoing InterfaceList :    vlan3, Forwarding/Sparse ,00:17:36/---
```