L2 / L3 Switches

Protocol Independent Multicast

(PIM)

Configuration Guide

Revision 1.0

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Manual Revision 1.0

Release Date: July 18, 2013

Contents

1. PIM Configuration Guide

This document describes the PIM feature supported in Supermicro Layer 2 / Layer 3 switch products.

The PIM configurations for the Supermicro switch listed below products are covered.

Top of Rack Switches	Blade Switches
• SSE-G24-TG4	• SBM-GEM-X2C
• SSE-G48-TG4	• SBM-GEM-X2C+
• SSE-X24S	• SBM-GEM-X3S+
• SSE-X3348S	• SBM-XEM-X10SM
• SSE-X3348T	

The majority of this document applies to the Supermicro switch products listed above. In any particular sub section however, the contents might vary across these switch product models. In those sections the differences are clearly identified with reference to particular switch product models. If any particular switch product model is not referenced, the reader can safely assume that the content is applicable to all the above listed models.

Throughout this document, the common term “switch” refers to any of the above listed Supermicro switch product models unless a particular model is noted.

1.1 IP Multicast Overview

IP communication may be one of three types:

- Unicast: Host sends packets to a single host.
- Broadcast: Host sends packets to all hosts.
- Multicast: Host sends packets to a subset of hosts simultaneously.

IP Multicast Routing enables efficient use of network resources for bandwidth intensive services including video and audio. A multicast group is a set of receivers that want to receive a particular data stream. An IP *Multicast Group Address* in the 224.0.0.0 to 239.0.0.0 is range selected for the receivers of

a multicast group. Senders transmit IP data using the multicast group address as the destination address to multicast to all group members. Receivers interested in receiving data meant for a particular group must join the group by signaling a router/switch on their subnet. IGMP is used as the signaling protocol for communicating *group membership*. Network devices that are present on the path between the source and the receivers forward data only on ports leading to the receivers rather than flooding all ports.

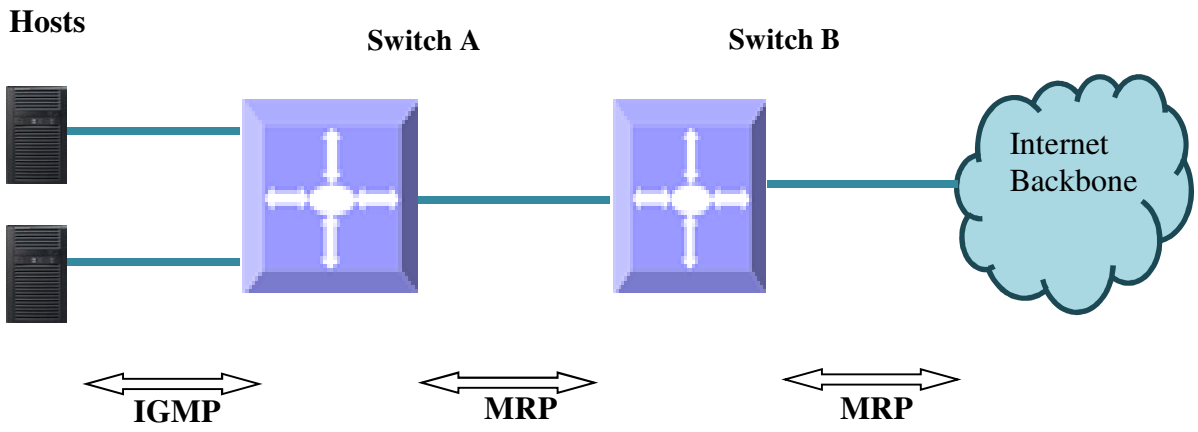
Membership in a multicast group is dynamic, as hosts can join and leave at any time. There is no restriction on the location or number of members in a multicast group. A host can be a member of more than one multicast group at a time.

Supermicro switches can send and receive multicast traffic by supporting the following multicast features:

- **IGMP** at the access end of the network that processes hosts announcing their participation in a multicast group(s).

- **Multicast Routing Protocols (MRPs)** at the enterprise and core of the network for maintaining the senders/receivers database and forwarding data from senders to receivers.

Figure PIM-1: IP Multicast Routing



1.2 PIM

Protocol Independent Multicast (PIM) is a Multicast Routing Protocol (MRP) used to maintain the Multicast distribution tree and to forward multicast data across the tree. PIM is protocol independent since it works with any unicast routing protocols like RIP, OSPF, etc. to get route information towards RP and source.

PIM *neighbors* are established by exchanging periodic Hello messages. A *Designated Router (DR)* is chosen in the subnet connected to the receivers and this is the *Last-hop DR.* A DR is chosen in the subnet connected to the source, this is the *First-hop DR*.

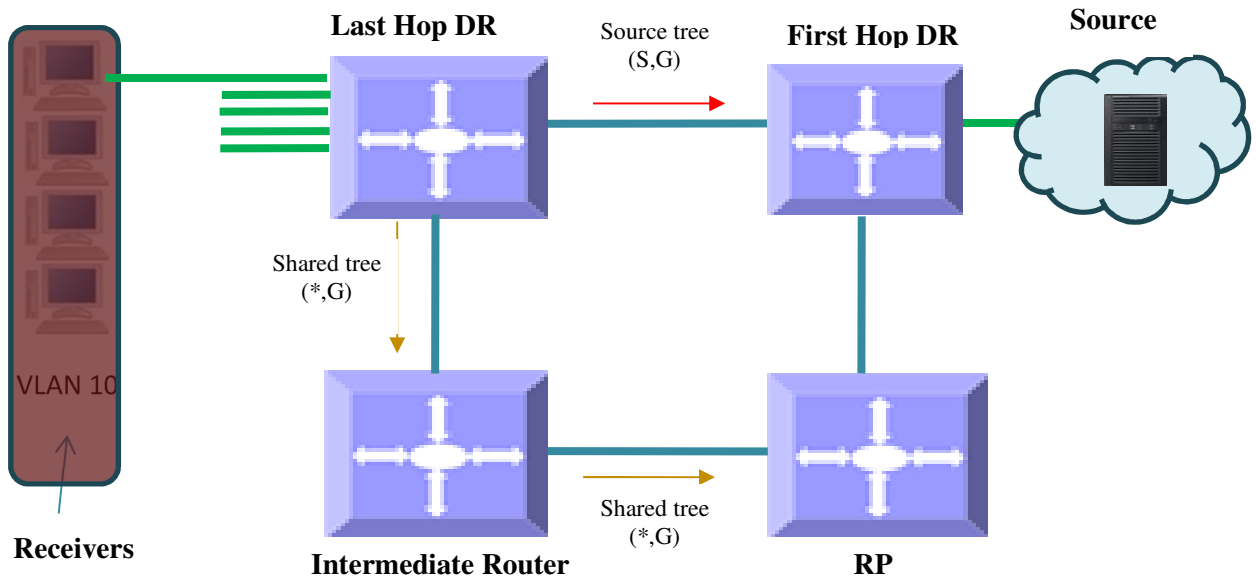
The path from receivers to the source or RP is referred to as *upstream.* The path from the source or RP towards the receivers is referred to as *downstream*-.

There are two PIM modes: Sparse (PIM-SM) and Dense (PIM-DM).

1.2.1 PIM-SM Basics

PIM Sparse mode operates on the basis that very few (or sparse) receivers intend to receive multicast data from each source. In PIM-SM, multicast data is forwarded only on branches with at least one interested receiver.

Figure PIM-2: Multicast Forwarding with PIM-SM



PIM-SM uses unicast routing protocol like OSPF, RIP, etc. to perform a *reverse-path forwarding (RPF) check* to determine upstream neighbors to source and/or RP. An RPF check helps to eliminate loops in

multicast tree formations wherein the forwarding decision for a received packet is done based on the source address in the packet rather than destination address. (If a router has a route entry to the source address in the packet, i.e. an upstream router, the packet is forwarded as an RPF check passes. Otherwise the packet is dropped as an RPF check failure.

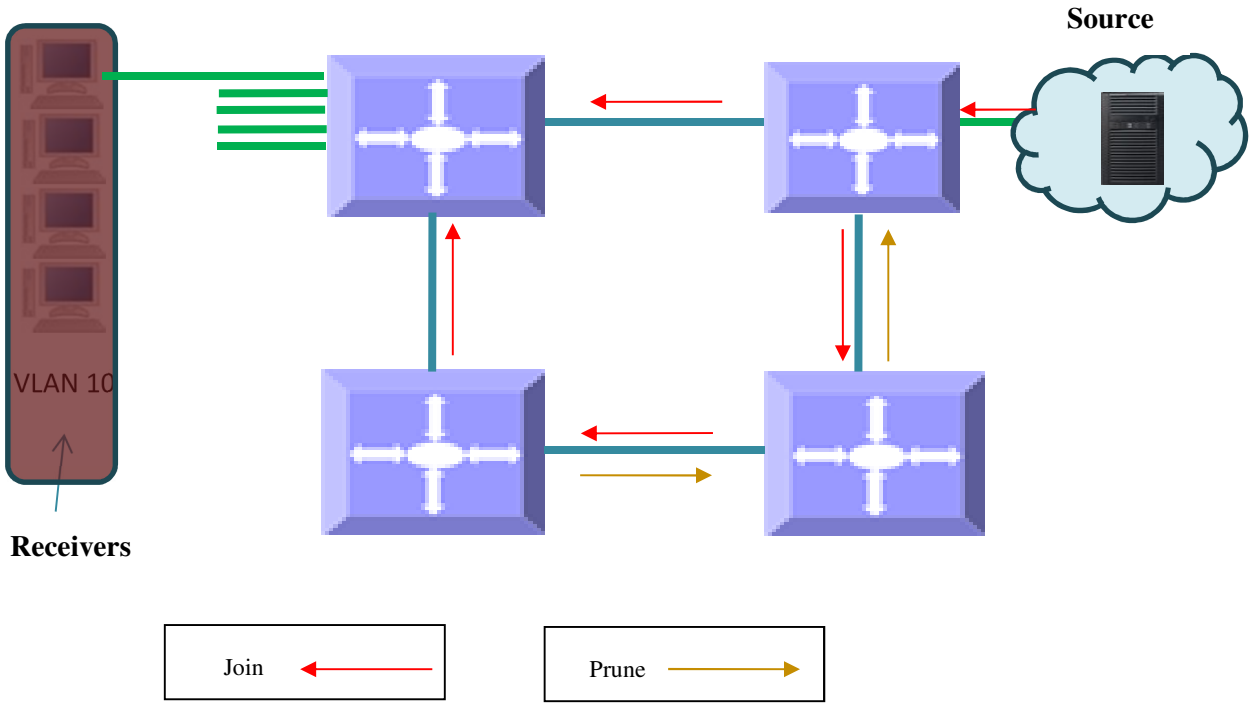
PIM Sparse mode builds a *shared tree or RPT* with a root called a *Rendezvous Point (RP).* A *Candidate RP (CRP)* is then configured for every group by using a *Bootstrap Router (BSR)* mechanism. CRP is populated as a *RP-set* across the domain. After receiving the RP set, every router performs a uniform hashing to elect one RP from the RP-set for every group.

Receivers interested in particular multicast group data from any source send a (*, G) join to the upstream neighbor towards the router that was elected as the RP for the particular group. The last-hop DR can choose to receive multicast data directly from each source for that group instead of from the RP. In this case, the last-hop DR sends (S, G) join to upstream towards the source. This is called *Source-Specific Tree or Shortest Path Tree (SPT)*. PIM-SM is typically used in WAN environments.

1.2.2 PIM-DM Basics

PIM Dense mode operates on the basis that almost all possible subnets have at least one interested receiver. Hence in PIM-DM, multicast data is flooded on all possible branches and then pruning those branches that do not want multicast data from a particular group and/or source. PIM-DM is typically used in LAN environments.

Figure PIM-3: Multicast Forwarding with PIM-DM



1.3 PIM Support

Supermicro switches support both PIM-SM and PIM-DM.

An IP multicast routing table can hold 2550 entries, which includes 255 groups and 10 sources per group.

PIM requires a unicast routing protocol such as RIP or OSPF to learn the routes to a source, CRP, and CBSR. PIM uses this information for RPF checks.

1.4 PIM Defaults

Parameter	Default Value
PIM-SM global status	Disabled
Component identifier	1
Static RP status	Disabled
PMBR status	Disabled
Shortest Path Tree (SPT) threshold	0 packets
RP threshold	0 packets
Shortest Path Tree (SPT) switchover period	0 seconds
RP switchover period	0 seconds
Register stop rate limit period	5 seconds

PIM Component Defaults

Parameter	Default Value
PIM Component Mode	Sparse
CRP hold time	70 seconds
CRP priority	192
Static RP	None

PIM Interface Defaults

Parameter	Default Value
Hello hold time	30 seconds
DR priority	1
Override interval	0
LAN prune delay status	Enabled
LAN prune delay	0
Hello interval	30 seconds

CBSR preference	-1
Hello interval	60 seconds

1.5 Enabling PIM

PIM is disabled by default in Supermicro switches.

PIM needs to be enabled globally for IP multicast operations. Follow the steps below to enable PIM.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**set ip pim enable**	Enables PIM globally. PIM creates the default PIM Component Identifier 1, once PIM is enabled.
Step 3	**end**	Exits the configuration mode.
Step 4	**show ip pim component**	Displays the PIM information.
Step 5	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

If PIM is enabled globally, all PIM components are also automatically PIM enabled. All PIM configuration and display commands operate only when PIM is enabled.

The example below shows the commands used to enable PIM.

SMIS# **configure terminal**
SMIS(config)# **set ip pim enable**
SMIS(config)# **end**

SMIS# **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

1.6 PIM Components and Interface

Supermicro switches provide multiple instances of PIM in a router. The PIM instances are referred to as *PIM components*. Every component can be associated with one or more layer3 VLAN interface(s) and is identified by a *component identifier*.

Follow the steps below to create a PIM component(s).

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**ip pim component <ComponentId (1-255)>**	Creates the PIM component and enters the Component mode. The Component Identifier value can be any number from 1-255. Default is 1.
Step 3	**interface <*interface-type*> <*interface-id*>** or **interface range <*interface-type*> <*interface-id*> ….**	Enters the interface configuration mode. *interface-type* – may be any of the following: gigabit ethernet – gi extreme-ethernet – ex qx-ethernet – qx vlan *interface-id* is in *slot/port* format for all physical interfaces. It may be the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hyphen (-) between the start and end interface numbers. E.g.: **int range gi 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range gi 0/1-10, gi 0/20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces. Note: While configuring PIM on physical interfaces (gi, ex, qx), make sure those interfaces are configured as

		layer 3 interfaces using the "no switchport" command in interface configuration mode.
Step 4	**ip pim componentId <value(1-255)>**	Configures the Interface Component Identifier value. The Component Identifier value can be any number from 1-255. Default is 1.
Step 5	**end**	Exits the configuration mode.
Step 6	**show ip pim interface [{ Vlan <vlan-id> | <interface-type> <interface-id> | detail }]** **show ip pim component [ComponentId <1-255>]**	Displays the component information for the given interface.
Step 7	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

Components can be created only if PIM is enabled. An interface can be associated with a Component Identifier, only if a Component Identifier has already been created.

The '**no ip pim component <ComponentId>**' command deletes the component and its associated details.

The example below shows the commands used to configure a PIM component.

SMIS# **configure terminal**
SMIS(config)# **ip pim component 50**
SMIS(pim-comp)# **end**

SMIS# **configure terminal**
SMIS(config)# **vlan 100**
SMIS(config-vlan)# **ports Gi 0/22 untagged**
SMIS(config-vlan)# **end**

SMIS# **configure terminal**
SMIS(config)# **interface vlan 100**
SMIS(config-if)# **ip address 100.100.100.1 255.0.0.0**
SMIS(config-if)# **ip pim componentId 50**
SMIS(config-if)# **end**

SMIS# **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

Component-Id: 50
  PIM Mode: sparse,   PIM Version: 2
  Elected BSR: 0.0.0.0
  Candidate RP Holdtime: 0
```

SMIS# **show ip pim interface detail**

```
vlan100 504 is up
  Internet address is 100.100.100.1
  Muticast Switching: Enabled
  PIM: Enabled
  PIMv6: Disabled
    PIM version: 2, mode: Sparse
    PIM DR : 100.100.100.1
    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 : 50
    PIM domain border: disabled
```

1.7 PIM Mode

PIM operates in sparse mode by default in Supermicro switches. PIM mode can be changed at anytime for any component. All routers in a PIM domain must have the same PIM mode.

Follow the steps below to set PIM mode in components.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**ip pim component <ComponentId (1-255)>**	Enters the PIM component configuration mode. Component Identifier may be any value from 1 to 255. Default is 1.
Step 3	**set mode {sparse | dense}**	Configures Sparse or dense PIM mode for the component.
Step 4	**end**	Exits the configuration mode.

Step 5	**show ip pim component [ComponentId <1-255>]**	Displays the PIM mode for the given component.
Step 6	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The example below shows the commands to configure PIM mode.

SMIS# **configure terminal**
SMIS(config)# **ip pim component 50**
SMIS(pim-comp)# **set mode dense**
SMIS(pim-comp)# **end**

SMIS# **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

Component-Id: 50
PIM Mode: dense, PIM Version: 2
Graft Retry Count: 1

1.8 PIM Neighbor

PIM routers exchange periodic Hello messages with routers that are directly connected. These directly connected routers are the PIM neighbors. PIM Hello messages contain different configurable options.

1.8.1 DR Priority

DR priority is used to determine the *Designated Router* in the subnet. The *Designated Router* in the subnet is the router with highest DR priority. As a last-hop router, the DR is responsible for forwarding joins to the upstream. As a first-hop router, the DR is responsible for forwarding data to the downstream.

The default DR priority is 1.

Supermicro switches provide flexibility for users to configure the DR priority for individual interfaces. Users can configure a different DR priority on different interfaces.

Follow the steps below to change the Hello interval on any interface.

Step	Command	Description

Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**interface <*interface-type*> <*interface-id*>** or **interface range <*interface-type*> <*interface-id*> ….**	Enters the interface configuration mode. *interface-type* – may be any of the following: gigabit ethernet – gi extreme-ethernet – ex qx-ethernet – qx vlan *interface-id* is in *slot/port* format for all physical interfaces. It may be the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hyphen (-) between the start and end interface numbers. E.g.: **int range gi 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range gi 0/1-10, gi 0/20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces. Note: While configuring PIM on physical interfaces (gi, ex, qx), make sure those interfaces are configured as layer 3 interfaces using the "no switchport" command in interface configuration mode.
Step 3	**ip pim dr-priority <priority(1-65535)>**	Configures the PIM DR priority value. The DR priority value can be any number from 1-65535. Default is 1.
Step 4	**end**	Exits the configuration mode.
Step 5	**show ip pim interface [{ Vlan <vlan-id> | <interface-type> <interface-id> | detail }]**	Displays the DR priority information for the given interface.
Step 6	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The '**no ip pim dr-priority**' command resets the DR priority to its default value of 1.

The example below shows the commands used to configure the PIM DR priority.

Configure PIM DR priority for layer3 VLAN 100

SMIS# **configure terminal**
SMIS(config)# **interface vlan 100**
SMIS(config-if)# **ip pim dr-priority 500**
SMIS(config-if)# **end**

SMIS# **show ip pim interface detail**
vlan100 504 is up
  Internet address is 100.100.100.1
  Muticast Switching: Enabled
  PIM: Enabled
  PIMv6: Disabled
    PIM version: 2, mode: Sparse
    PIM DR: 100.100.100.1
    PIM DR Priority: 500
    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: 50
    PIM domain border: disabled

1.8.2 Hello Interval

The PIM router sends Hello messages periodically to all its neighbors to maintain information about directly connected upstream router(s) towards source(s) or RP(s) and downstream routers towards receivers. This periodic time interval is called the *Hello Interval*.

The default Hello interval is 30 seconds.

Supermicro switches provide flexibility for users to configure a different Hello interval for individual interfaces.

Follow the steps below to change the Hello interval on any interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.

Step 2	**interface *<interface-type> <interface-id>*** or **interface range *<interface-type> <interface-id> ….***	Enters the interface configuration mode. *interface-type* – may be any of the following: gigabit ethernet – gi extreme-ethernet – ex qx-ethernet – qx vlan *interface-id* is in *slot/port* format for all physical interfaces. It may be the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hyphen (-) between the start and end interface numbers. E.g.: **int range gi 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range gi 0/1-10, gi 0/20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces. Note: While configuring PIM on physical interfaces (gi, ex, qx), make sure those interfaces are configured as layer 3 interfaces using "no switchport" command in interface configuration mode.
Step 3	**ip pim query-interval <Interval (0-65535)secs**	Configures PIM Hello interval value. The Hello interval value can be any number from 0-65535. Default is 30 seconds.
Step 4	**end**	Exits the configuration mode.
Step 5	**show ip pim interface [{ Vlan <vlan-id> | <interface-type> <interface-id> | detail }]**	Displays the Hello interval information for the given interface.
Step 6	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The '**no ip pim query-interval** ' command resets the query interval to its default value of 30.

The example below shows the commands used to configure the PIM query-interval.

Configure the PIM query-interval for a layer3 VLAN 100 switch

SMIS# **configure terminal**
SMIS(config)# **interface vlan 100**
SMIS(config-if)# **ip pim query-interval 75**
SMIS(config-if)# **end**

SMIS# **show ip pim interface detail**

vlan100 504 is up
  Internet address is 100.100.100.1
  Muticast Switching: Enabled
  PIM: Enabled
  PIMv6: Disabled
    PIM version: 2, mode: Sparse
    PIM DR: 100.100.100.1
    PIM DR Priority: 1
    PIM Neighbour Count: 0
    PIM Hello/Query Interval: 75
    PIM Message Interval: 60
    PIM Override Interval: 0
    PIM Lan Delay: 0
    PIM Lan-Prune-Delay: Disabled
    PIM Component Id: 50
    PIM domain border: disabled

1.8.3 Hold Time

Hold time is the neighbor timeout set for every neighbor on a PIM interface. If a PIM Hello message is not received from a neighbor router for the period of the hold time, then the neighbor will be deleted from the list of neighbors. Hold time value is sent as an option in the PIM Hello message to neighbors.

The default hold time is 30 seconds.

Supermicro switches provide flexibility for users to configure different hold times on different interfaces.

Follow the steps below to change the hold time on any interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.

Step 2	**interface <*interface-type*> <*interface-id*>** or **interface range <*interface-type*> <*interface-id*> ….**	Enters the interface configuration mode. *interface-type* – may be any of the following: gigabit ethernet – gi extreme-ethernet – ex qx-ethernet – qx vlan *interface-id* is in *slot/port* format for all physical interfaces. It may be the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hyphen (-) between the start and end interface numbers. E.g.: **int range gi 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range gi 0/1-10, gi 0/20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces. Note: While configuring PIM on physical interfaces (gi, ex, qx), make sure those interfaces are configured as layer 3 interfaces using the "no switchport" command in interface configuration mode.
Step 3	**ip pim hello-holdtime <holdtime(1-65535)>**	Configures Hello hold time value. The Hello hold time value can be any number from 1-65535. Default is 30 seconds.
Step 4	**end**	Exits the configuration mode.
Step 5	**show ip pim interface [{ Vlan <vlan-id> | <interface-type> <interface-id> | detail }]**	Displays the Hello hold time information for the given interface.
Step 6	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The '**no ip pim hello-holdtime**' command resets the hold time to its default value of 30.

The example below shows the commands used to configure the PIM Hello hold time.

Configure the PIM Hello hold time for layer3 VLAN 100

SMIS# **configure terminal**
SMIS(config)# **interface vlan 100**
SMIS(config-if)# **ip pim hello-holdtime 90**
SMIS(config-if)# **end**

1.9 Multicast Routing Table

The multicast routing table contains information about active multicast trees. This table lists both forwarding and non-forwarding entries, i.e. multicast entries which have data flow and entries which do not have data flow.

Every entry in the multicast routing table has one Incoming Interface (IIF) and one or more Outgoing Interfaces (OIF). The entry can be (*.G) or (S,G). (*,G) entries have the W and R bit set, while (S,G) entries have the Shortest Path Tree (SPT) bit set. The RP and RPF neighbors are also listed.

The route to the BSR, RP and Source must be reachable via any unicast protocol. Otherwise the multicast routing table is not formed due to an RPF check failure.

The example below shows a PIM multicast routing table display output.

SMIS# **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 50
(*, 225.1.1.1) ,00:00:02/--- ,RP : 100.100.100.1
  Incoming Interface: vlan100 ,RPF nbr : NULL ,Route Flags : WR
  Outgoing InterfaceList:
    vlan100, Forwarding/Sparse ,00:00:02/---

1.10 PMBR

A PIM Multicast Border Router (PMBR) is the border between two or more PIM domains running different MRP's such as PIM-SM, PIM-DM or DVMRP. PMBRs connect each PIM domain to the rest of the Internet. The PMBR forwards multicast packets across different domains, hence receivers in one domain receive packets from sources in another domain. In a PMBR, different interfaces can be configured as DVMRP, PIM-SM or PIM-DM interfaces.

PMBR is disabled by default in Supermicro switches.

Follow the steps below to enable PMBR.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**set ip pim pmbr enable**	Enables or disables PMBR.
Step 3	**end**	Exits the configuration mode.
Step 4	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The **'set ip pim pmbr disable'** command disables PMBR functionality.

The example below shows the commands used to configure PIM PMBR.

SMIS# **configure terminal**
SMIS(config)# **set ip pim pmbr enable**
SMIS(config)# **end**

SMIS# **show ip pim interface detail**

vlan100 504 is up
  Internet address is 100.100.100.1
  Muticast Switching: Enabled
  PIM: Enabled
  PIMv6: Disabled
    PIM version: 2, mode: Sparse
    PIM DR: 100.100.100.1
    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: 50
PIM domain border: enabled

1.11 Disabling PIM

PIM is disabled by default in Supermicro switches.

Once enabled, disabling PIM needs to be done globally.

Follow the steps below to disable PIM.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**set ip pim disable**	Disables PIM globally.
Step 3	**end**	Exits the configuration mode.
Step 4	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The example below shows the commands used to disable PIM.

SMIS# **configure terminal**
SMIS(config)# **set ip pim disable**
SMIS(config)# **end**

1.12 PIM-SM Specific Configuration

This section covers Supermicro switch commands that are applicable only in PIM-SM mode.

1.12.1 PIM Join/Prune

1.12.1.1 Join-Prune Interval

A PIM router sends Join messages periodically to upstream routers towards RP or source to keep the multicast tree active. Periodic Prune messages are sent when existing receivers do not want multicast data. This periodic time interval for sending Join/Prune is called the *Join-Prune interval*.

The default Join-Prune interval is 60 seconds.

Supermicro switches provide flexibility for users to configure different Join-Prune intervals on different interfaces.

Follow the steps below to change the Join-Prune interval on any interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**interface <*interface-type*> <*interface-id*>** or **interface range <*interface-type*> <*interface-id*> ….**	Enters the interface configuration mode. *interface-type* – may be any of the following: gigabit ethernet – gi extreme-ethernet – ex qx-ethernet – qx vlan *interface-id* is in *slot/port* format for all physical interfaces. It may be the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hyphen (-) between the start and end interface numbers. E.g.: **int range gi 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range gi 0/1-10, gi 0/20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces. Note: While configuring PIM on physical interfaces (gi, ex, qx), make sure those interfaces are configured as layer 3 interfaces using the "no switchport" command in interface configuration mode.
Step 3	**ip pim message-interval <Interval(0-65535)>**	Configures PIM Join prune interval value. The Join-Prune interval value can be any number from 0-65535. Default is 60.
Step 4	**end**	Exits the configuration mode.
Step 5	**show ip pim interface [{ Vlan <vlan-id> | <interface-type> <interface-id> | detail }]**	Displays the Join-Prune interval information for the given interface.
Step 6	**write startup-config**	Optional step – saves this PIM

		configuration to be part of the startup configuration.

The '**no ip pim message-interval**' command resets the Join-Prune interval to its default value of 60.

The example below shows the commands used to configure the PIM Join-Prune interval.

Configure the PIM Join-Prune interval for layer3 VLAN 100

SMIS# **configure terminal**
SMIS(config)# **interface vlan 100**
SMIS(config-if)# **ip pim message-interval 300**
SMIS(config-if)# **end**

SMIS# **show ip pim interface detail**

vlan100 504 is up
  Internet address is 100.100.100.1
  Muticast Switching: Enabled
  PIM: Enabled
  PIMv6: Disabled
    PIM version: 2, mode: Sparse
    PIM DR: 100.100.100.1
    PIM DR Priority: 1
    PIM Neighbour Count: 0
    PIM Hello/Query Interval: 30
    PIM Message Interval: 300
    PIM Override Interval: 0
    PIM Lan Delay: 0
    PIM Lan-Prune-Delay: Disabled
    PIM Component Id: 50
    PIM domain border: disabled

1.12.1.2 LAN Prune Delay

The LAN Prune Delay option is used in multi-access networks to delay the processing of prune messages received at upstream routers. This ensures that there is no flapping of multicast data in a multi-access LAN due to joins by some routers and prunes by other routers.

When an upstream router in a multi-access LAN receives prune message from a downstream router, it does not prune the tree immediately, but instead maintains the tree for the duration of the LAN prune delay interval. The tree is maintained only if a '*Join override*' message is received from another downstream router in the multi-access LAN. Otherwise the tree is pruned after the LAN Prune Delay interval.

The default LAN delay flag is in the Enabled state. The default value of the LAN prune delay is 0 seconds.

Supermicro switches provide flexibility for users to configure different LAN prune delays on different interfaces.

Follow the steps below to change the LAN prune delay on any interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**interface *<interface-type> <interface-id>*** or **interface range <*interface-type> <interface-id> ….**	Enters the interface configuration mode. *interface-type* – may be any of the following: gigabit ethernet – gi extreme-ethernet – ex qx-ethernet – qx vlan *interface-id* is in *slot/port* format for all physical interfaces. It may be the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hyphen (-) between the start and end interface numbers. E.g.: **int range gi 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range gi 0/1-10, gi 0/20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces. Note: While configuring PIM on physical interfaces (gi, ex, qx), make sure those interfaces are configured as layer 3 interfaces using the "no switchport" command in interface configuration mode.
Step 3	**set ip pim lan-prune-delay { enable | disable }**	Configures the LAN prune delay value.

	ip pim lan-delay <value(0-65535)>	LAN prune delay is enabled by default. The LAN prune delay value can be any number from 0-65535. Default is 0.
Step 4	**end**	Exits the configuration mode.
Step 5	**show ip pim interface [{ Vlan <vlan-id> | <interface-type> <interface-id> | detail }]**	Displays the LAN prune delay information for the given interface.
Step 6	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The '**no ip pim lan-delay**' command resets the LAN delay to its default value of 0.

The example below shows the commands used to configure the PIM LAN delay.

Configure the PIM LAN delay for layer3 VLAN 100

SMIS# **configure terminal**
SMIS(config)# **interface vlan 100**
SMIS(config-if)# **set ip pim lan-prune-delay enable**
SMIS(config-if)# **ip pim lan-delay 200**
SMIS(config-if)#**end**

SMIS# **show ip pim interface detail**

vlan100 504 is up
  Internet address is 100.100.100.1
  Muticast Switching: Enabled
  PIM: Enabled
  PIMv6: Disabled
    PIM version: 2, mode: Sparse
    PIM DR: 100.100.100.1
    PIM DR Priority: 1
    PIM Neighbour Count: 0
    PIM Hello/Query Interval: 30
    PIM Message Interval: 60
    PIM Override Interval: 0
    PIM Lan Delay: 200
    PIM Lan-Prune-Delay: Enabled
    PIM Component Id: 50
    PIM domain border: disabled

1.12.1.3 Override Interval

The Join/Prune override interval is used in a multi-Access network by downstream routers. The downstream router in a multi-access LAN waits for the *override interval* period after sending a prune message to send a second prune message if it still continues to receive data due to other routers in multi-access LAN that still want to receive multicast data.

In a multi-access LAN, the override interval ensures multicast data is forwarded only if there is at least one router with receivers interested in a particular group so data is not flooded unnecessarily in the multi-access LAN.

The default override interval is 0 seconds.

Supermicro switches provide flexibility for user to configure different Join/Prune override intervals on different interfaces.

Follow the steps below to configure the override interval.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**interface <*interface-type*> <*interface-id*>** or **interface range <*interface-type*> <*interface-id*> ….**	Enters the interface configuration mode. *interface-type* – may be any of the following: gigabit ethernet – gi extreme-ethernet – ex qx-ethernet – qx vlan *interface-id* is in *slot/port* format for all physical interfaces. It may be the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hyphen (-) between the start and end interface numbers. E.g.: **int range gi 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range gi 0/1-10, gi 0/20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces.

		Note: While configuring PIM on physical interfaces (gi, ex, qx), make sure those interfaces are configured as layer 3 interfaces using the "no switchport" command in interface configuration mode.
Step 3	**ip pim override-interval <interval(0-65535)>**	Configures the PIM override interval value. The override interval value can be any number from 0-65535. Default is 0.
Step 4	**end**	Exits the configuration mode.
Step 5	**show ip pim interface [{ Vlan <vlan-id> | <interface-type> <interface-id> | detail }]**	Displays the override interval information for the given interface.
Step 6	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The '**no ip pim override-interval**' command resets the override interval to its default value of 0.

The example below shows the commands used to configure the PIM override interval.

Configure the PIM override interval for layer3 VLAN 100

SMIS# **configure terminal**
SMIS(config)# **interface vlan 100**
SMIS(config-if)# **ip pim override-interval 500**
SMIS(config-if)# **end**

SMIS# **show ip pim interface detail**

vlan100 504 is up
  Internet address is 100.100.100.1
  Muticast Switching: Enabled
  PIM: Enabled
  PIMv6: Disabled
    PIM version: 2, mode: Sparse
    PIM DR: 100.100.100.1
    PIM DR Priority: 1
    PIM Neighbour Count: 0
    PIM Hello/Query Interval: 30
    PIM Message Interval: 60
    PIM Override Interval: 500

PIM Lan Delay: 0
PIM Lan-Prune-Delay: Disabled
PIM Component Id: 50
PIM domain border: disabled

1.12.2 Shared Tree (RPT)

All routers send Join/Prune information as well as active source information to the RP. Hence other non-RP routers need not maintain this information. This also reduces unnecessary network flooding. All routers in a PIM domain must have the same RP information for a particular group.

RP's in a PIM domain can be learned by a Bootstrap Router (BSR) mechanism or Static RP.

1.12.2.1 Bootstrap Router (BSR)

BSR distributes PIM RP information for all groups within the domain. Each PIM domain can have only one elected BSR. Several routers are configured as candidate BSRs, the BSR with highest preference is elected as the router. The elected RP's send their information to the BSR, which maintains RP-to-group mapping as the RP-set.

Supermicro switches provide flexibility for user to configure the BSR for individual interfaces.

Follow the steps below to configure the Bootstrap Router (BSR)

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**interface <interface-type> <interface-id>** **or** **interface range <interface-type> <interface-id> ….**	Enters the interface configuration mode. *interface-type* – may be any of the following: gigabit ethernet – gi extreme-ethernet – ex qx-ethernet – qx vlan *interface-id* is in *slot/port* format for all physical interfaces. It may be the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hyphen (-) between the start and end interface numbers. E.g.: **int range gi 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range gi 0/1-10, gi 0/20**

		If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces. Note: While configuring PIM on physical interfaces (gi, ex, qx), make sure those interfaces are configured as layer 3 interfaces using the "no switchport" command in interface configuration mode.
Step 3	**ip pim bsr-candidate <value (0-255)>**	Configures the PIM BSR candidate. The BSR candidate preference value can be any number from -1 to 255. Default is -1.
Step 4	**end**	Exits the configuration mode.
Step 5	**show ip pim bsr [Component-Id (1-255)]**	Displays the BSR candidate information for the given interface.
Step 6	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The '**no ip pim bsr-candidate**' command deletes the BSR information of the particular interface.

The example below shows the commands used to configure the PIM Candidate BSR.

Configure PIM Candidate BSR for layer3 VLAN 100

SMIS# **configure terminal**
SMIS(config)# **interface vlan 100**
SMIS(config-if)# **ip pim bsr-candidate 155**
SMIS(config-if)# **end**

SMIS# **show ip pim bsr**

PIMv2 Bootstrap Configuration For Component 1

Elected BSR for Component 1
BSR Address: 0.0.0.0
BSR Priority: 0, Hash Mask Length : 30

This system is the PIMv4 Bootstrap Router (BSR)
BSR Address: 100.100.100.1
BSR Priority: 155, Hash Mask Length : 30

1.12.2.2 Candidate RP (CRP)

The RP is the central convergence point of sources and receivers. In a PIM spars e domain, there are multiple candidate RPs but only one per group is elected. The elected RP is the candidate RP having the highest IP address. The elected RPs send their information to the BSR, which maintains RP-to-group mapping as the RP set.

Supermicro switches provide flexibility for users to configure a different CRP on different components.

Follow the steps below to configure Candidate RP (CRP).

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**ip pim component <ComponentId (1-255)>**	Enters the PIM component configuration mode. Component Identifier may be any value from 1 to 255. Default is 1.
Step 3	**rp-candidate rp-address <Group Address> <Group Mask> <IP address>**	Configures Candidate RP value. *Group Address/Group Mask*: This combination can specify any IP Multicast address from 224.0.0.0 to 239.255.255.255. *IP Address* should be any interface IP address of the component.
Step 4	**rp-candidate holdtime <Holdtime value (0-255)>**	Optional. Configures the Candidate RP Hold time value. The hold time value can be any number from 0-255. Default is 70 seconds.
Step 5	**end**	Exits the configuration mode.
Step 6	**show ip pim rp-candidate [ComponentId <1-255>]**	Displays the Candidate RP information for the given interface.
Step 7	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The '**no ip pim rp-candidate**' command deletes the candidate RP information of the particular PIM component.

The example below shows the commands used to configure the PIM Candidate RP.

Configure the PIM Candidate RP for PIM component 50

SMIS# **configure terminal**
SMIS(config)# **ip pim component 50**
SMIS(pim-comp)# **rp-candidate holdtime 180**
SMIS(pim-comp)# **rp-candidate rp-address 228.0.0.0 255.0.0.0 100.100.100.1**
SMIS(pim-comp)# **end**

SMIS# **show ip pim rp-candidate**

CompId	GroupAddress	Group Mask	RPAddress/Priority
50	228.0.0.0	255.0.0.0	100.100.100.1/192

1.12.2.3 Static RP

An RP for a group range can be configured statically on a router instead of using a BSR mechanism. However using this mechanism requires configuring static RP on all routers in the PIM domain. This configuration can be useful to specify a backup RP for a particular group.

Supermicro switches provide flexibility for users to configure Static RP differently on different components.

Follow the steps below to configure Static RP.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**ip pim component <ComponentId (1-255)>**	Enters the PIM component configuration mode. Component Identifier may be any value from 1 to 255. Default is 1.
Step 3	**set ip pim static-rp enable**	Static RP is disabled by default. Use the 'enable' form of this command to enable Static RP.
Step 4	**rp-static rp-address <Group Address> <Group Mask> <IP address>**	Configures static RP value. *Group Address/Group Mask*: This combination can specify any IP Multicast address from 224.0.0.0 to

		239.255.255.255. *IP Address* should be any interface IP address of the component.
Step 5	**end**	Exits the configuration mode.
Step 6	**show ip pim rp-static [ComponentId <1-255>]**	Displays the static RP information for the given interface.
Step 7	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The '**no ip pim rp-static**' command deletes the static RP information of the particular component.

The example below shows the commands used to configure PIM Static RP.

Configure PIM Static RP for PIM component 50

SMIS(config)# **set ip pim static-rp enable**

SMIS# **configure terminal**
SMIS(config)# **ip pim component 50**
SMIS(pim-comp)# **rp-static rp-address 230.0.0.0 255.0.0.0 100.100.100.1**
SMIS(pim-comp)# **end**

SMIS# **show ip pim rp-static**

Static-RP Enabled

CompId	GroupAddress	Group Mask	RPAddress
50	230.0.0.0	255.0.0.0	100.100.100.1

1.12.2.4 Register Stop Rate Limit

When a first-hop DR receives a multicast packet, it encapsulates it in a register message and unicasts it to the RP for that group. The RP de-encapsulates each register message and forwards the extracted data packet to the downstream members on the RPT. If there are no receivers on the RP, it then sends a register stop to the first-hop DR as long as there are no receivers. The register stop rate limit is used at the RP to limit the number of register stop messages sent per second to the first-hop DR.

The default register stop rate limit is 0.

Follow the steps below to configure the register stop rate limit.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**set ip pim regstop-ratelimit-period <0-2147483647(in secs)>**	Sets the Register Stop rate limit for Group and Source. The Register Stop rate limit interval can be any number from 0 – 2147483647 seconds. Default is 0 seconds.
Step 3	**end**	Exits the configuration mode.
Step 4	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The example below shows the commands used to configure the PIM register rate limit.

SMIS# **configure terminal**
SMIS(config)# **set ip pim regstop-ratelimit-period 100**
SMIS(config)# **end**

SMIS# **show ip pim thresholds**

PIM SPT Threshold Information

Group Threshold: 0
Source Threshold: 0
Switching Period: 0

PIM SPT-RP Threshold Information

Register Threshold: 0
RP Switching Period: 0
Register Stop rate limit: 100

1.12.3 Shortest Path Tree (SPT)

1.12.3.1 SPT at RP

When a first-hop DR receives a multicast packet, it encapsulates it in a register message and unicasts it to the RP for that group. The RP de-encapsulates each register message and forwards the extracted data packet to the downstream members on the RPT.

The RP then sends an (S, G) Join to the first-hop DR to build the *Source Tree or Shortest Path Tree (SPT)* back to the source. This mechanism of RP building a SPT is called *SPT switchover at RP*.

Typically, the SPT switchover occurs when a data-rate threshold is reached, which is configurable in Supermicro switches using:

- RP switch period
- RP threshold

1.12.3.1.1 RP Switch Period

The RP switch period is used together with the RP threshold to specify the time when the RP can switch over to Shortest Path Tree (SPT). The multicast data packet count is checked every RP-switch-period interval and if it exceeds the RP threshold, the RP switches from RP tree to Shortest Path Tree (SPT).

The RP switch period is disabled by default in Supermicro switches, i.e. an RP will switch to SPT immediately upon receipt of a multicast data packet.

Follow the steps below to configure RP switch period.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**set ip pim rp-switchperiod <0-2147483647(in secs)>**	Sets the RP switch period at RP. The RP switch period can be any number from 0 – 2147483647 seconds. Default is 0 seconds.
Step 3	**end**	Exits the configuration mode.
Step 4	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The example below shows the commands used to configure the PIM RP switch period.

SMIS# **configure terminal**
SMIS(config)# **set ip pim rp-switchperiod 300**
SMIS(config)# **end**

SMIS# **show ip pim thresholds**

PIM SPT Threshold Information

Group Threshold: 0
Source Threshold: 0
Switching Period: 0

PIM SPT-RP Threshold Information

Register Threshold: 0
RP Switching Period: 300
Register Stop rate limit: 5

1.12.3.1.2 RP Threshold

The RP threshold is used together with the RP switch period to specify the time when the RP can switch over to Shortest Path Tree (SPT). The multicast data packet count is checked every RP-switch-period interval and if it exceeds the RP threshold, the RP switches from RP tree to Shortest Path Tree (SPT).

The RP threshold is disabled by default in Supermicro switches, i.e. an RP will switch to SPT immediately upon receipt of a multicast data packet.

Follow the steps below to configure the RP threshold.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**set ip pim rp-threshold < number of packets(0-2147483647)>**	Sets the SPT threshold for Group and Source. The number of packets can be any number from 0 – 2147483647. Default is 0 packets.
Step 3	**end**	Exits the configuration mode.
Step 4	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The example below shows the commands used to configure the PIM RP threshold.

SMIS# **configure terminal**
SMIS(config)# **set ip pim rp-threshold 50**
SMIS(config)# **end**

SMIS# **show ip pim thresholds**

PIM SPT Threshold Information

Group Threshold: 0
Source Threshold: 0
Switching Period: 0

PIM SPT-RP Threshold Information

Register Threshold: 50
RP Switching Period: 0
Register Stop rate limit: 5

1.12.3.2 SPT at Last-Hop DR

When the last-hop DR receives a multicast packet from the *Shared Tree or RP Tree*, it sends an (S, G) Join to the first-hop DR to build a *Source-tree or Shortest Path Tree (SPT)* back to the source. This mechanism of last-hop DR building a SPT is called *SPT switchover at Last-hop DR*. Once SPT is established at the last-hop DR, the RPT is pruned and data is then received by SPT only.

Typically, the SPT switchover occurs when a data-rate threshold is reached, which is configurable in Supermicro switches using:

- SPT switch period
- SPT threshold

1.12.3.2.1 SPT Switch Period

The Shortest Path Tree (SPT) switch period is used together with the SPT threshold to specify the time when the last-hop router can switch over to Shortest Path Tree (SPT). The multicast data packet count is checked every 'SPT-switch-period' interval and if it exceeds the SPT threshold, the last-hop router switches from RP tree to Shortest Path Tree (SPT).

The Shortest Path Tree (SPT) switch period is disabled by default in Supermicro switches, i.e. last-hop routers switch to SPT immediately upon receipt of a multicast data packet.

Follow the steps below to configure the period for the Shortest Path Tree (SPT) switch.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**set ip pim spt-switchperiod <0-2147483647(in secs)>**	Sets the Shortest Path Tree (SPT) threshold for Group and Source. The Number of packets can be any number from 0 – 2147483647. Default is 0 packets.
Step 3	**end**	Exits the configuration mode.
Step 4	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The example below shows the commands used to configure the SPT switch period.

SMIS# **configure terminal**
SMIS(config)# **set ip pim spt-switchperiod 30**
SMIS(config)# **end**

SMIS# **show ip pim thresholds**

PIM SPT Threshold Information

Group Threshold: 0
Source Threshold: 0
Switching Period: 30

PIM SPT-RP Threshold Information

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

1.12.3.2.2 SPT Threshold

The Shortest Path Tree (SPT) threshold is used together with the SPT switch period to specify the time when the last-hop router can switch over to SPT. The multicast data packet count is checked every SPT-switch-period interval and if the count exceeds the SPT threshold, the last-hop router switches from RP tree to SPT.

The Shortest Path Tree (SPT) threshold is disabled by default in Supermicro switches, i.e. last-hop routers switch to SPT immediately upon receipt of a multicast data packet.

Follow the steps below to configure the Shortest Path Tree (SPT) threshold.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**set ip pim threshold { spt-grp | spt-src } < number of packets(0-2147483647)>**	Sets the Shortest Path Tree (SPT) threshold for Group and Source. The number of packets can be any number from 0 – 2147483647. Default is 0 packets.
Step 3	**end**	Exits the configuration mode.
Step 4	**write startup-config**	Optional step – saves this PIM configuration to be part of the startup configuration.

The example below shows the commands to configure PIM SPT threshold.

SMIS# **configure terminal**
SMIS(config)# **set ip pim threshold spt-grp 100**
SMIS(config)# **set ip pim threshold spt-src 200**
SMIS(config)# **end**

SMIS# **show ip pim thresholds**

PIM SPT Threshold Information

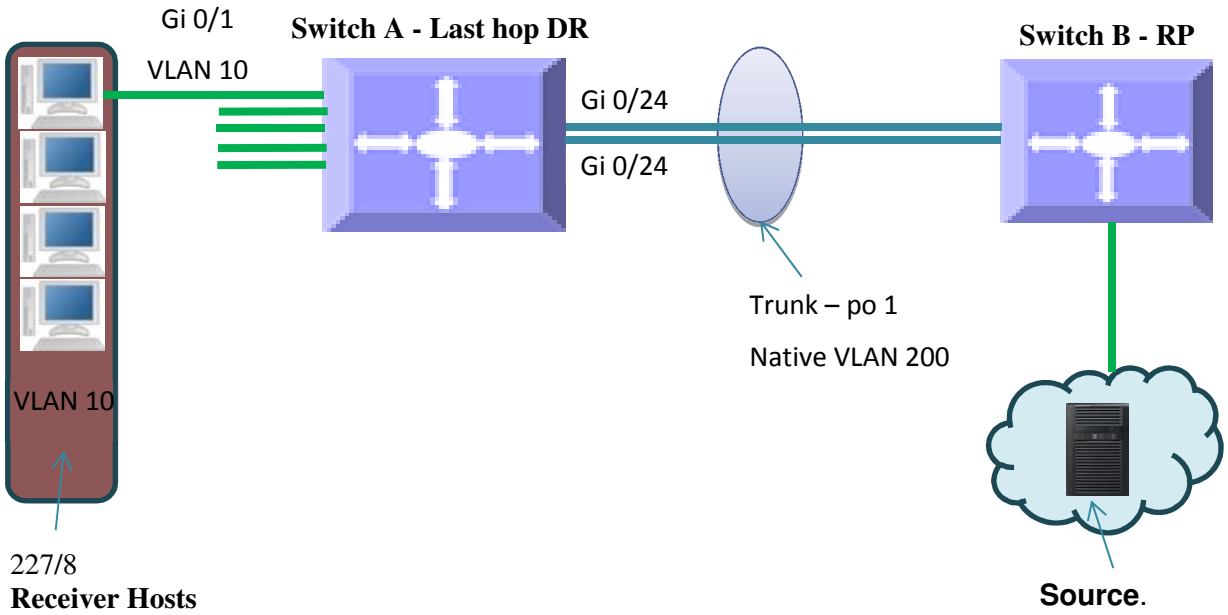
Group Threshold: 100
Source Threshold: 200
Switching Period: 0

PIM SPT-RP Threshold Information

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

1.13 PIM Configuration Example

Figure PIM-4: PIM Configuration Example



On switch A

1) Enable PIM and IGMP globally
2) Configure PIM component 110
3) Create layer 3 VLAN interfaces 10 and 200
4) Configure PIM Component Identifier as 110 for both layer3 VLANs 10 and 200
5) Configure static RP on Component Identifier 110
6) Configure static IGMP groups on layer 3 VLAN interface 10

On switch B

1) Enable PIM and IGMP globally
2) Configure PIM component 100

3) Create layer 3 VLAN interface 200
4) Configure PIM Component Identifier as 100 for layer3 VLAN 200
5) Configure static RP on Component Identifier 100

Configuration on switch A

#configure Layer3 VLAN
SMIS# configure terminal
SMIS(config)# vlan 10
SMIS(config-vlan)# ports Gi 0/1 untagged
SMIS(config-vlan)# exit
SMIS(config)# vlan 200
SMIS(config-vlan)# ports Gi 0/24 untagged
SMIS(config-vlan)# end

SMIS# configure terminal
SMIS(config)# interface vlan 200
SMIS(config-if)# ip address 200.200.200.5 255.255.255.0
SMIS(config-if)# exit
SMIS(config)# interface vlan 10
SMIS(config-if)# ip address 10.10.10.10 255.255.255.0
SMIS(config-if)# end

#Enable PIM and IGMP
SMIS# configure terminal
SMIS(config)# interface vlan 10
SMIS(config-if)# set ip igmp enable
SMIS(config-if)# exit

SMIS(config)# set ip igmp enable
SMIS(config)# set ip pim enable
SMIS(config)# end

#configure Component
SMIS# configure terminal
SMIS(config)# ip pim component 110
SMIS(pim-comp)# end

SMIS# configure terminal
SMIS(config)# interface vlan 200
SMIS(config-if)# ip pim componentId 110
SMIS(config-if)# end

SMIS# configure terminal
SMIS(config)# interface vlan 10
SMIS(config-if)# ip pim componentId 110
SMIS(config-if)# end

```
#configure Static RP
SMIS# configure terminal
SMIS(config)# set ip pim static-rp enable
SMIS(config)# ip pim component 110
SMIS(pim-comp)# rp-static rp-address 227.0.0.0 255.0.0.0 200.200.200.1
SMIS(pim-comp)# end

#configure Static Group membership
SMIS# configure terminal
interface vlan 10
ip igmp static-group 227.1.1.1

# Save this PIM configuration.
SMIS# write startup-config
Building configuration, Please wait. May take a few minutes ...
[OK]
SMIS#

# Check the running-configuration for accuracy
SMIS# show running-config

Building configuration...
Switch ID      Hardware Version            Firmware Version
0              SSE-G48-TG4   (P2-01)       1.0.13-7

ip address dhcp
vlan 1
  ports gi 0/2-23 untagged
 ports gi 0/25-48 untagged
 ports ex 0/1-4 untagged
exit
vlan 10
  ports gi 0/1 untagged
exit
vlan 200
 ports gi 0/24 untagged
exit

snmp view restricted 1 excluded nonvolatile

interface vlan 1
 ip address dhcp

interface vlan 200
 ip address  200.200.200.5 255.255.255.0

interface vlan 10
```

```
 ip address  10.10.10.10 255.255.255.0
 set ip igmp enable
 ip igmp static-group 227.1.1.1

exit
set ip igmp enable

set ip pim enable
set ip pim static-rp enable
ip pim component 1
exit
ip pim component 110
 rp-static rp-address 227.0.0.0 255.0.0.0 200.200.200.1
exit
interface vlan 200
 ip pim componentId 110
exit
interface vlan 10
 ip pim componentId 110
exit

#Display PIM neighbor information
SMIS# show ip pim neighbor

Neighbour       IfName/Idx       Uptime/Expiry     Ver      DRPri/Mode   CompId   Override Lan
Address                           Interval                                        Delay
---------       ----------       -------------      ---      ----------   ------   --------  -----
200.200.200.1  vlan200/910       00:24:17/90        v2       1/S          110          0


#Display PIM interface information
SMIS# show ip pim interface detail

vlan200 910 is up
  Internet address is 200.200.200.5
  Muticast Switching: Enabled
  PIM: Enabled
  PIMv6: Disabled
    PIM version: 2, mode: Sparse
    PIM DR: 200.200.200.5
    PIM DR Priority: 1
    PIM Neighbour Count: 1
    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: 110
```

```
    PIM domain border: disabled


vlan10 912 is up
  Internet address is 10.10.10.10
  Muticast Switching: Enabled
  PIM: Enabled
  PIMv6: Disabled
    PIM version: 2, mode: Sparse
    PIM DR: 10.10.10.10
    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: 110
    PIM domain border: disabled

#Display PIM component
SMIS# 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

Component-Id: 110
  PIM Mode: sparse,   PIM Version: 2
  Elected BSR: 0.0.0.0
  Candidate RP Holdtime: 0

#Display IGMP static group membership
SMIS# show ip igmp groups

I - Include Mode,  E - Exclude Mode
S - Static Mbr,    D - Dynamic Mbr

GroupAddress    Flg Iface      UpTime               ExpiryTime      LastReporter
---------------       --- -------    ----------------       ----------------       ---------------
227.1.1.1             S   vlan10  [0d 00:23:17.94] [0d 00:00:00.00] 10.10.10.10
227.5.5.5       S   vlan10  [0d 00:12:30.67] [0d 00:00:00.00] 0.0.0.0
SMIS# show ip igmp interface
vlan10, line protocol is up
 Internet Address is 10.10.10.10/8
```

```
 IGMP is enabled on interface
 Current IGMP router version is 2
 IGMP query interval is 125 seconds
 Last member query response interval is 10 seconds
 IGMP max query response time is 100 seconds
 Robustness value is 2
 IGMP querying router is 10.10.10.10 (this system)
 Fast leave is disabled on this interface
 Number of multicast groups joined 2

#Display PIM static RP
SMIS# show ip pim rp-static

Static-RP Enabled

CompId    GroupAddress     Group Mask      RPAddress
------      ------------       ----------       ---------
  110          227.0.0.0        255.0.0.0       200.200.200.1

#Display Multicast routing table
SMIS# 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 110
(*, 227.1.1.1) ,00:14:20/--- ,RP : 200.200.200.1
  Incoming Interface : vlan200 ,RPF nbr : 200.200.200.1 ,Route Flags : WR
  Outgoing InterfaceList :
    vlan10, Forwarding/Sparse ,00:14:20/---

(*, 227.5.5.5) ,00:12:48/--- ,RP : 200.200.200.1
  Incoming Interface: vlan200 ,RPF nbr : 200.200.200.1 ,Route Flags : WR
  Outgoing InterfaceList:
    vlan10, Forwarding/Sparse ,00:12:48/---
```

Configuration on switch B

```
#configure Layer3 VLAN
SMIS# configure terminal
SMIS(config)# vlan 200
SMIS(config-vlan)# ports Gi 0/24 untagged
SMIS(config-vlan)# end
```

```
SMIS# configure terminal
SMIS(config)# interface vlan 200
SMIS(config-if)# ip address 200.200.200.1 255.255.255.0
SMIS(config-if)# end

#Enable PIM and IGMP
SMIS# configure terminal
SMIS(config)# set ip pim enable
SMIS(config)# end

#configure Component
SMIS# configure terminal
SMIS(config)# ip pim component 100
SMIS(pim-comp)# end

SMIS# configure terminal
SMIS(config)# interface vlan 200
SMIS(config-if)# ip pim componentId 100
SMIS(config-if)# end

#configure Static RP
SMIS# configure terminal
SMIS(config)# set ip pim static-rp enable
SMIS(config)# ip pim component 100
SMIS(pim-comp)# rp-static rp-address 227.0.0.0 255.0.0.0 200.200.200.1
SMIS(pim-comp)# end

# Save this PIM configuration.
SMIS# write startup-config
Building configuration, Please wait. May take a few minutes ...
[OK]
SMIS#

# Check the running-configuration for accuracy
SMIS# show running-config

Building configuration...
Switch ID      Hardware Version            Firmware Version
0           SBM-GEM-X3S+   (B4-01)        1.0.14-2t

ip address dhcp
vlan 1
  ports gi 0/1-23 untagged
 ports ex 0/1-3 untagged
exit
vlan 100
 exit
vlan 200
```

```
 ports gi 0/24 untagged
exit

interface vlan 200
 ip address  200.200.200.1 255.255.255.0

interface vlan 100

exit
set ip pim enable
set ip pim static-rp enable
ip pim component 1
exit
ip pim component 100
 rp-static rp-address 227.0.0.0 255.0.0.0 200.200.200.1
exit
interface vlan 200
 ip pim componentId 100
exit

#Display PIM component
SMIS# 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

Component-Id: 100
  PIM Mode: sparse,   PIM Version: 2
  Elected BSR: 0.0.0.0
  Candidate RP Holdtime: 0

#Display Static RP
SMIS# show ip pim rp-static

Static-RP Enabled

CompId    GroupAddress     Group Mask      RPAddress
------          ------------          ----------      ---------
   100            227.0.0.0          255.0.0.0      200.200.200.1

#Display PIM neighbor information
SMIS# show ip pim neighbor

Neighbour      IfName/Idx      Uptime/Expiry Ver DRPri/Mode CompId Override   Lan
```

```
Address                                                          Interval   Delay
---------       ----------       -------------    ---  ----------      ------    --------  ------
200.200.200.5  vlan200/504  00:21:19/84     v2    1/S     100      0          0


#Display PIM Interface information
SMIS# show ip pim interface detail

vlan200 504 is up
  Internet address is 200.200.200.1
  Muticast Switching: Enabled
  PIM: Enabled
  PIMv6: Disabled
    PIM version: 2, mode: Sparse
    PIM DR: 200.200.200.5
    PIM DR Priority: 1
    PIM Neighbour Count: 1
    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: 100
    PIM domain border: disabled

#Display Multicast routing table
SMIS# 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 100
(*, 227.1.1.1) ,00:11:02/--- ,RP : 200.200.200.1
  Incoming Interface: vlan200 ,RPF nbr : NULL ,Route Flags : WR
  Outgoing InterfaceList:
    vlan200, Forwarding/Sparse ,00:11:02/00:00:00

(*, 227.5.5.5) ,00:09:29/--- ,RP : 200.200.200.1
  Incoming Interface: vlan200 ,RPF nbr : NULL ,Route Flags : WR
  Outgoing InterfaceList:
    vlan200, Forwarding/Sparse ,00:09:29/00:00:00
```