SSE-F3548S/SSE-F3548SR/
SSE-X3548S/SSE-X3548SR

Switch Configuration User's Guide

Revision 1.14

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Document Revision History

Date	Revision	Description
06/27/2018	1.2	Initial document.
08/24/2018	1.3	Updated SNMP and ACL configuration details.
10/24/2018	1.4	Removed ACL egress port configuration. Updated string length in SNMP targetparams, System contact, System location commands. Corrected typo in 'lldp tlv-select' commands. Added port splitting section.
02/05/2019	1.5	Added loop protection in System Configuration section. Also added Unknown Multicast Filtering in IGMP Snooping section.
02/05/2019	1.6	Added IPv4 Layer-3 routing details.
03/25/2019	1.7	Added section 5.2.5. Removed Physical L3 Interface.
04/10/2019	1.8	Removed IGMP configurations on router ports, as we router ports are not supported yet.
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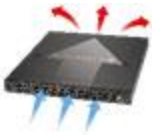
09/05/2019	1.10	Added DCBX section. Updated spanning-tree port priority value range. Updated ip pim message-interval value range. Corrected the default ip pim lan-prune-delay value to disabled. Fixed the missing page numbers. Added login authentication fallback commands.
09/11/2019	1.11	Updated the default IP PIM Hold time. Updated OSPF configuration. Updated the Interface split section.
11/12/2019	1.12	Updated default unique password. Removed the configuration IP PIM Hold time.
03/23/2020	1.13	Added Fan speed control commands.
05/14/2020	1.14	Added information related to model SSE-X3548. Updated the show interface command outputs. Added routing context section. Added copy debug-files command.

Contents

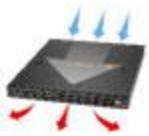
1 Introduction

This document explains the switch configuration for Supermicro switch model SSE-F3548S/ SSE-X3548S and its companion model, the SSE-F3548SR/ SSE-X3548SR. The SR models feature a data-center-friendly reverse air-flow technique for improved cooling when installed in the rear of a rack.



Regular Airflow (front to back)

SSE-F3548S/ SSE-X3548S



Reverse Airflow (back to front)

SSE-F3548SR/ SSE-X3548SR

The SSE-F3548S**/**SR Layer 2+ Ethernet switches offer 48 25Gb Ethernet (GbE) ports allowing connectivity to 25GbE servers. These 48 ports can also run in 10Gb or 1Gb mode to connect to existing low-speed network devices. The SSE-X3548S**/**SR Layer 2+ Ethernet switches offer 48 10Gb Ethernet (GbE) ports. These 48 ports can also run in 1Gb mode. The SSE-F3548S/SR and SSE-X3548S/SR also offer six ports running at 100Gbps for access to high-speed backbone networks or storage servers. These 100Gbps ports can also operate at 40Gbps or each can be split into four different ports to run at 25Gbps or 10Gbps.

This document explains the configuration for Supermicro switch models SSE-F3548S/SR and SSE-X3548S/SR.

1.1Features

Other major features of the SSE-F3548S/R and SSE-X3548S/R include:

- **Layer 2 Features**:
  - 4K VLANS
  - Spanning Tree (802.1D)
  - Rapid Spanning Tree (802.1w)
  - Multiple Spanning Trees (802.1s)
  - IEEE 802.lQ VLANs/ port-based VLANs
  - IEEE 802.3ad with LACP
  - IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
- **Advanced Layer 2 Features**:
  - Storm control
  - Flow control
  - Port mirroring
  - Uplink Failure Detection (UFD)
  - MLAG
- **System Management**:
  - Industry Standard CLI
  - Context Sensitive Help

- Command Completion
- SNMP v1/v2/v3
- SSH
- Syslog
- DHCP (Client)
- Web-based management interface
- NTP
- RMON

- **Multicast**:
  - IGMP Snooping
- **Ethernet frame**:
  - Jumbo frames up to 9KB
- **Power**:
  - Redundant Hot-pluggable 500W Power Supplies
  - AC Input: 100-127/200-240 V, 50/60 Hz
  - Power Consumption: 410 Watts
- **Physical/Environmental**:
  - 1U form factor for flexible installation
  - Net weight: 8.9 Kg (19.6 lb) with 2 PSUs
  - Size (W x D x H):
    445 x 510 x 44 mm (17.52 x 20.1 x 1.73 inches)
  - Operating Temperature: 0°C to 45°C (32°F to 113°F)
  - Operating Humidity: 0% to 95% RH

Mounting rails are included for ease of installation to a rack.

1.2 Cables

The following cables and transceivers are supported:

Item	Supermicro Part Number	Description
SFP28 Copper Cable	CBL-NTWK-0944-MS28C05M	0.5m 25GbE SFP28 to SFP28, Passive
SFP28 Copper Cable	CBL-NTWK-0944-MS28C10M	1m 25GbE SFP28 to SFP28, Passive
SFP28 Copper Cable	CBL-NTWK-0944-MS28C15M	1.5m 25GbE SFP28 to SFP28, Passive
SFP28 Copper Cable	CBL-NTWK-0944-MS28C20M	2m 25GbE SFP28 to SFP28, Passive
SFP28 Copper Cable	CBL-NTWK-0944-MS28C25M	2.5m 25GbE SFP28 to SFP28, Passive
SFP28 Copper Cable	CBL-NTWK-0944-MS28C30M	3m 25GbE SFP28 to SFP28, Passive
SFP28 Transceiver Module	AOM-SFP28-25GbE-SR-1-MLN	SFP28 Transceiver module 25G, 850nm, MMF, LC
Ethernet	CBL-NTWK-0942-MQ28C05M	Ethernet, QSFP28, 100GbE, Passive, 0.5M
Ethernet	CBL-NTWK-0942-MQ28C10M	Ethernet, QSFP28, 100GbE, Passive, 1M
Ethernet	CBL-NTWK-0942-MQ28C15M	Ethernet, QSFP28, 100GbE, Passive, 1.5M
Ethernet	CBL-NTWK-0942-MQ28C20M	Ethernet, QSFP28, 100GbE, Passive, 2M
Ethernet	CBL-NTWK-0942-MQ28C25M	Ethernet, QSFP28, 100GbE, Passive, 2.5M
Ethernet	CBL-NTWK-0942-MQ28C30M	Ethernet, QSFP28, 100GbE, Passive, 3M
Ethernet	CBL-NTWK-0943-SQ28C10M	Ethernet, QSFP28, 100GbE, Passive, 1M
QSFP28 Transceiver Module	AOM-100GBE-SR4-FT	QSFP28 transceiver module for short rage fiber cables (up to 100m), 100G, 850nm, MMF

1.3 Management Interface

The Supermicro switch can be managed in the following methods.

- Command Line Interface
- Web Interface

- SNMP
- RESTCONF – Rest APIs using OPENCONFIG Yang Models

This document discusses mainly the command line interface configuration method. To mange using RESTCONF, refer the RESTCONF user guide.

The Supermicro switch command line interface (CLI) is accessible through an RS232 console port, or viaTelnet and SSH connections. The CLI is designed to follow industry standard CLI commands. Standard features including context sensitive "help" and auto-completion-on-tab-key are supported.

Log into the switch with the user ID 'ADMIN' and the password can be found on the label stuck on the switch.

After you log into the switch CLI, you are automatically placed in the user EXEC mode. This mode supports "show" commands and minimal configuration commands.

To enter the configuration mode, use the command "*configure terminal*". For example:

SMIS# configure terminal
SMIS(config)#

To exit to EXEC mode, use the command *exit* or *end*.

1.3.1 Console Port

The SSE-F3548S/SR and SSE-X3548S/SR have an RJ45 connector for the RS232 console port.

Use the serial cable provided with the switch to connect the RS232 port to any computer.

The computer COM port settings should be as follows:

Baudrate: 115200
Data: 8 bit
Parity: none
Stop: 1 bit
Flow Control: none

Further information on Management Access can be found in Section 2.2 of this manual.

2 System Configuration

2.1 Management IP

The SSE-F3548S/SR and SSE-X3548S/SR switches come with DHCP IP settings for default IP management.

2.1.1 Static Management IP Address

The *IP address* command can be used to manually configure the management interface IP address.

Follow the steps below to manually configure the management interface IP address.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ip address [<ip-address> | <ip-address>/prefix-length] [<subnet-mask>]	Configure the management interface IP address manually. *ip-address* – A valid IPv4 Address. *ip-address/prefix-length* - A valid IPv4 Address with a prefix length of 1-32. *subnet-mask* – A valid IP subnet mask.
Step 3	end	Exits the configuration mode.
Step 4	show ip interface	Displays the management interface IP configuration.

The manual *IP address* configuration is saved automatically as part of the start-up config.

The “no ip address” command resets the switch IP address to 0.0.0.0.

The example below shows the commands used to configure the management interface IP address manually.

SMIS# configure terminal
SMIS(config)# ip address 192.168.1.10

SMIS(config)# end

2.1.2 DHCP

Supermicro switches can be configured to obtain the management IP address through DHCP protocol. In this case, the switch acts as a DHCP client and obtains an IP address for any DHCP server on the LAN.

DHCP is the default management IP address mode.

Follow the steps below to obtain the management interface IP address dynamically from a DHCP server.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode

Step 2	ip address dhcp	Configures the management interface IP address through DHCP server.
Step 3	End	Exits the configuration mode.
Step 4	show ip interface	Displays the Management interface IP configuration.

The *IP address dhcp* configuration is saved automatically as part of start-up config.

The "no ip address dhcp" command disables configuring the management interfaceIP address through DHCP server.

The example below shows the commands used to configure the management interface IP address through DHCP.

SMIS# configure terminal

SMIS(config)#ip address dhcp

SMIS(config)# end

2.1.3 Default IP Gateway

To configure default gateway on the switch follow the steps below.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ip gateway <ip-address>	Configure IP gateway. *ip-address* – IP address of a directly connected router.
Step 3	End	Exits the configuration mode.
Step 4	show ip interface	Displays the interface IP configuration.

The *IP Gateway* configuration is saved automatically as part of start-up config.

The "no ip gateway" command resets the switch IP gateway to its default value of 0.0.0.0.

The example below shows the commands used to configure the IP gateway.

SMIS# configure terminal

SMIS(config)# ip gateway 10.1.1.1

SMIS(config)# end

2.2 Management Access

Supermicro switches enable access control of the switch by various mechanisms:

- User name and password
- Enable password
- Authorized Managers

Defaults – Management Access

Parameter	Default Value
Default User Name	ADMIN
Password	Default password is unique for each switch and it can be found on the label stuck on the switch.
Privilege for default user ADMIN. Default privilege for configured users.	15 1
IP Authorized Managers	None

2.2.1 User Login

User accounts can be configured for switch access. Each username can be associated with a password and privilege level. Users configured with a password are authenticated while accessing the switch to the configured privilege level.

Users with privilege level 1 or above can execute all "show" commands. To execute configuration commands, access with privilege level 15 is required.

Follow the steps below to configure the username.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	username <user-name> [password <passwd>] [privilege <1-15>]	Configure username and password. *user-name*–Alphanumeric characters of length 1-20 *password* – Alphanumeric characters of length 1-20 *privilege* - Specify 1-15, any of the privilege levels
Step 3	End	Exits the configuration mode.
Step 4	list users show users	Displays the users available in the switch. Displays users that are currently logged in.

The *username* configuration is saved automatically as part of start-up config. Configured users are not displayed in 'show running config' command.

The "no username <user-name>" command deletes the configured user.

The example below shows the commands used to configure users.

```
SMIS# configure terminal
SMIS(config)# username user1 password pwd1 privilege 15

SMIS(config)# end

SMIS# list users

Users              Privilege
-----              ---------
ADMIN                 15
user1                 15
SMIS# show users


 Line         User         Peer-Address
0 con          user1         Local Peer
```

2.2.2 Enable

Supermicro switches provide support for configuring access to various CLI commands. This is achieved by *Enable* password and *privilege levels*. Fifteen privilege levels can be specified.

Follow the steps below to enable a privilege level.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	enable [<1-15> Enable Level]	Enable a privilege level. *Enable Level* – Specify 1-15, any of the privilege levels
Step 3	End	Exits the configuration mode.

The example below shows the command used to enable a particular privilege level.

```
SMIS# enable15
```

2.2.3 Enable Password

Passwords for different enable levels can be configured by the switch administrator using the *enable password* command.

Follow the steps below to enable password for any privilege level.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	enable password [level (1-15)] <LINE 'enable' password>	Configure password for a particular privilege level. *Level* – Specify 1-15, any of the privilege levels *LINE enable password* – Alphanumeric

Step 3	End	Exits the configuration mode.

The *enable password*configuration is saved automatically as part of start-up config. Enable password configuration is not displayed in the 'show running config' command.

The "no enable password [level (1-15)]" command disables the enable password parameters.

The example below shows the commands used to configure *enable password*.

SMIS# configure terminal
SMIS(config)# enable password level 10 pwd1

2.2.4 IP Authorized Manager

Supermicro switches allow configuration of IP authorized managers. This feature enhances security on the switch by using IP addresses to authorize computers are allowed to:

- Access the switch's web browser interface
- Telnet into the switch's console interface
- Use SNMP or SSH

Follow the steps below to configure authorized managers for the switch.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	authorized-manager ip-source <ip-address>[{<subnet-mask> | / <prefix-length(1 -32)>}] [interface [<interface-type <0/a-b, 0/c, ...>] [<interface-type <0/a-b, 0/c, ...>]] [vlan<a,b or a-b or a,b,c-d>] [service [snmp] [telnet] [http] [https] [ssh]]	Configure the authorized manager *ip-address* – Manager IP address *subnet mask* – For a given Authorized Manager entry, the switch applies the subnet mask to the IP address to determine a range of authorized IP addresses for management access. *prefix-length*- Prefix length of the IP address, in range 1-32. *interface-type* – Specify the interface typethrough which the IP authorized manager can access the switch.*M*ay be any of the following: fx-ethernet – fx cx-ethernet – cx interface-id is in slot/port format for all physical interfaces.

		vlan -Specify the vlan id through which the IP authorized manager can access the switch. *service* – Specify the services that can be accessed by the authorized manager
Step 3	End	Exits the configuration mode.
Step 4	show authorized-managers	Displays the Authorized Managers configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

If IP Authorized Managers are configured in a Supermicro switch, access to the switch via telnet, ssh, etc. is possible only by those hosts allowed to access. Other hosts will not be permitted access.

The “no authorized-manager ip-source <ip-address> [{<subnet-mask> | / <prefix-length(1-32)>}]” command deletes the particular authorized manager.

The example below shows the commands used to configure Authorized Managers.

SMIS# configure terminal
SMIS(config)#authorized-manager ip-source 200.200.200.10 service telnet

SMIS(config)# authorized-manager ip-source 100.100.100.10 service http

SMIS(config)# end

SMIS# show authorized-managers

Ip Authorized Manager Table

Ip Address: 100.100.100.10

Ip Mask: 255.255.255.255

Services allowed: HTTP

Ip Address: 200.200.200.10

Ip Mask: 255.255.255.255

Services allowed: TELNET

2.3 Interface Properties

The SSE-F3548S/R supports the following physical interface types.

25G Fx Ports in SSE-F3548S/SR

The SSE-F3548S/SR has 48 Fx ports by default. The Fx ports operate at 25G speed by default and can be configured to operate at 10G or 1G speed.

10G Fx Ports in SSE-X3548S/SR

The SSE-X3548S/SR has 48 Fx ports by default. The Fx ports operate at 10G speed by default and can be configured to operate at 1G speed.

100G Cx Ports

The SSE-F3548S/SR and SSE-X3548S/SR have six 100G capable Cx ports by default.
The Cx ports can also operate at 40G speed.
Additionally, each Cx ports can be split in to four ports that can operate at 25G or 10G speed.
Use the speed command in interface mode to split the ports.
The below table shows the port names in the split cases.

Port Matrix for SSE-F3548S/SR

Interface Name	Interface Numbers	Speed	Comments
Fx	1 – 48	25G default Can operate in 10G/1G	Default Physical interfaces
Cx	1 – 6	100G default Can operate in 40G Or can be split into 4 ports	Default Physical interfaces
Fx	49 – 51	25G / 10G	When Cx 0/1 splitted – it becomes Cx 0/1, Fx 49, Fx 50 and Fx 51
Fx	52 – 54	25G / 10G	When Cx 0/2 splitted – it becomes Cx 0/2, Fx 52, Fx 53 and Fx 54
Fx	55 – 57	25G / 10G	When Cx 0/3 splitted – it becomes Cx 0/3, Fx 55, Fx 56 and Fx 57
Fx	58 – 60	25G / 10G	When Cx 0/4 splitted – it becomes Cx 0/4, Fx 58, Fx 59 and Fx 60
Fx	61 – 63	25G / 10G	When Cx 0/5 splitted – it becomes Cx 0/5, Fx 61, Fx 62 and Fx 63
Fx	64 – 66	25G / 10G	When Cx 0/6 splitted – it becomes Cx 0/6, Fx 64, Fx 65 and Fx 66

Port Matrix for SSE-X3548S/SR

Interface Name	Interface Numbers	Speed	Comments
Fx	1 – 48	10G default Can operate in 1G	Default Physical interfaces
Cx	1 – 6	100G default Can operate in 40G Or can be split into 4 ports	Default Physical interfaces

Fx	49 – 51	25G / 10G	When Cx 0/1 splitted – it becomes Cx 0/1, Fx 49, Fx 50 and Fx 51
Fx	52 – 54	25G / 10G	When Cx 0/2 splitted – it becomes Cx 0/2, Fx 52, Fx 53 and Fx 54
Fx	55 – 57	25G / 10G	When Cx 0/3 splitted – it becomes Cx 0/3, Fx 55, Fx 56 and Fx 57
Fx	58 – 60	25G / 10G	When Cx 0/4 splitted – it becomes Cx 0/4, Fx 58, Fx 59 and Fx 60
Fx	61 – 63	25G / 10G	When Cx 0/5 splitted – it becomes Cx 0/5, Fx 61, Fx 62 and Fx 63
Fx	64 – 66	25G / 10G	When Cx 0/6 splitted – it becomes Cx 0/6, Fx 64, Fx 65 and Fx 66

Supermicro switches also support port channel interfaces. Each interface has different characteristics, some of which are configurable.

Parameter	Default Value
MTU	1500 bytes
Negotiation	Enabled
Storm-control	Disabled
Description	None
Duplex Operation	Full
Flow Control	Off
FEC Mode	Enabled

2.3.1 Description

Supermicro switches allow users to configure a description string to the interfaces. This description string will be useful to identify the interfaces easily.

Follow the steps below to configure interface description string.

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: fx-ethernet – fx cx-ethernet – cx interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	description <string>	Configure the interface description *String* – alphanumeric characters of length 1-64.
Step 4	End	Exits the configuration mode.
Step 5	show interface description	Displays the interface description configuration.
Step 6	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The example below shows the commands used to configure interface description.

SMIS# configure terminal
SMIS(config)# interface Fx 0/22
SMIS(config-if)# description Server_Cluster_0100
SMIS(config-if)# end
SMIS

sh int description

Interface Status Protocol Description

--- --- --- ---

Fx0/1 up down

Fx0/2 up down

Fx0/3 up down

Fx0/4 up down

Fx0/5 up down

Fx0/6 up down

Fx0/7 up down

Fx0/8 up down

Fx0/9 up down

Fx0/10	up	down	
Fx0/11	up	down	
Fx0/12	up	down	
Fx0/13	up	down	
Fx0/14	up	down	
Fx0/15	up	down	
Fx0/16	up	down	
Fx0/17	up	down	
Fx0/18	up	down	
Fx0/19	up	down	
Fx0/20	up	down	
Fx0/21	up	down	
Fx0/22	up	down	Server_Cluster_0100
Fx0/23	up	down	
Fx0/24	up	down	
Fx0/25	up	down	
Fx0/26	up	down	
Fx0/27	up	down	
Fx0/28	up	down	
Fx0/29	up	down	
Fx0/30	up	down	
Fx0/31	up	down	
Fx0/32	up	down	
Fx0/33	up	down	
Fx0/34	up	down	
Fx0/35	up	down	
Fx0/36	up	down	
Fx0/37	up	down	
Fx0/38	up	down	
Fx0/39	up	down	

Fx0/40 up down

Fx0/41 up down

Fx0/42 up down

Fx0/43 up down

Fx0/44 up down

Fx0/45 up down

Fx0/46 up down

Fx0/47 up down

Fx0/48 up down

Cx0/1 up down

Cx0/2 up down

Cx0/3 up down

Cx0/4 up down

Cx0/5 up down

Cx0/6 up down

po1 up down

po6 up down

2.3.2 Negotiation

Interface speed can be negotiated between connected devices, if both ends support negotiation.

Auto negotiation is enabled by default on all the Fx and Cx ports in SSE-F3548S/SR models. In SSE-X3548S/SR models auto negotiation is enabled on all Cx ports. It can be disabled if needed by using the 'no negotiation' command. **Auto negotiation is not supported for 10G and 40G speeds.** Turn off auto negotiation to set the Cx port speed to 40G or to set the Fx port speed to 10G.

Follow the steps below to configure Interface Negotiation.

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: cx-ethernet interface-id is in slot/port format for all physical 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 cx 0/1-2 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range cx 0/1-2, cx 0/3 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step3	Negotiation	Enable Interface Negotiation
Step 4	End	Exits the configuration mode.
Step 5	show interface status	Displays the interface configuration.
Step 6	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no negotiation” command disables interface negotiation.

The example below shows the commands used to configure Interface Negotiation.

SMIS# configure terminal
SMIS(config)# interface Cx 0/2
SMIS(config-if)# no negotiation

SMIS(config-if)# end
SMIS

sh int status

Port Status Duplex Speed Negotiation

---- ------ ------ ----- -----------

Fx0/1 not connected Full 25 Gbps Auto

Fx0/2 not connected Full 25 Gbps Auto

Fx0/3 not connected Full 25 Gbps Auto

Fx0/4 not connected Full 25 Gbps Auto

Fx0/5 not connected Full 25 Gbps Auto

Fx0/6 not connected Full 25 Gbps Auto

Fx0/7	not connected	Full	25 Gbps	Auto
Fx0/8	not connected	Full	25 Gbps	Auto
Fx0/9	not connected	Full	25 Gbps	Auto
Fx0/10	not connected	Full	25 Gbps	Auto
Fx0/11	not connected	Full	25 Gbps	Auto
Fx0/12	not connected	Full	25 Gbps	Auto
Fx0/13	not connected	Full	25 Gbps	Auto
Fx0/14	not connected	Full	25 Gbps	Auto
Fx0/15	not connected	Full	25 Gbps	Auto
Fx0/16	not connected	Full	25 Gbps	Auto
Fx0/17	not connected	Full	25 Gbps	Auto
Fx0/18	not connected	Full	25 Gbps	Auto
Fx0/19	not connected	Full	25 Gbps	Auto
Fx0/20	not connected	Full	25 Gbps	Auto
Fx0/21	not connected	Full	25 Gbps	Auto
Fx0/22	not connected	Full	25 Gbps	Auto
Fx0/23	not connected	Full	25 Gbps	Auto
Fx0/24	not connected	Full	25 Gbps	Auto
Fx0/25	not connected	Full	25 Gbps	Auto
Fx0/26	not connected	Full	25 Gbps	Auto
Fx0/27	not connected	Full	25 Gbps	Auto
Fx0/28	not connected	Full	25 Gbps	Auto
Fx0/29	not connected	Full	25 Gbps	Auto
Fx0/30	not connected	Full	25 Gbps	Auto
Fx0/31	not connected	Full	25 Gbps	Auto
Fx0/32	not connected	Full	25 Gbps	Auto
Fx0/33	not connected	Full	25 Gbps	Auto
Fx0/34	not connected	Full	25 Gbps	Auto
Fx0/35	not connected	Full	25 Gbps	Auto
Fx0/36	not connected	Full	25 Gbps	Auto

Fx0/37	not connected	Full	25 Gbps	Auto
Fx0/38	not connected	Full	25 Gbps	Auto
Fx0/39	not connected	Full	25 Gbps	Auto
Fx0/40	not connected	Full	25 Gbps	Auto
Fx0/41	not connected	Full	25 Gbps	Auto
Fx0/42	not connected	Full	25 Gbps	Auto
Fx0/43	not connected	Full	25 Gbps	Auto
Fx0/44	not connected	Full	25 Gbps	Auto
Fx0/45	not connected	Full	25 Gbps	Auto
Fx0/46	not connected	Full	25 Gbps	Auto
Fx0/47	not connected	Full	25 Gbps	Auto
Fx0/48	not connected	Full	25 Gbps	Auto
Cx0/1	not connected	Full	100 Gbps	Auto
Cx0/2	not connected	Full	100 Gbps	No-Negotiation
Cx0/3	not connected	Full	100 Gbps	Auto
Cx0/4	not connected	Full	100 Gbps	Auto
Cx0/5	not connected	Full	100 Gbps	Auto
Cx0/6	not connected	Full	100 Gbps	Auto

2.3.3 Speed

Interface speed can be configured for physical interfaces when auto negotiation is disabled.

25G FX ports can be configured to operate at 25G, 10G or 1G speeds.

100G CX ports can be configured to operate at 100G or 40G, or it can be split to operate at 25G/10G. The split can be done using the speed command to set the interface speed to 25G or 10G for the Cx ports.

Follow the steps below to configure the Interface speed.

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: fx-ethernet – fx cx-ethernet – cx

		interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g. int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	speed { 1000 | 10000 | 25000 | 40000 | 100000 }	Configure interface speed as 10, 100, 1000 or 10000 Mbps.
Step 4	End	Exits the configuration mode.
Step 5	show interface status	Displays the interface configuration.
Step 6	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no speed” command restores the default interface speed.

The example below shows the commands used to configure the interface speed.

```
SMIS# configure terminal
SMIS(config)# interface Fx 0/44
SMIS(config-if)# speed 1000
SMIS(config-if)# end
SMIS# show interface status


Port      Status         Duplex  Speed      Negotiation

----      ------         ------  -----      -----------

Fx0/1     not connected  Full    25 Gbps    Auto

Fx0/2     not connected  Full    25 Gbps    Auto

Fx0/3     not connected  Full    25 Gbps    Auto

Fx0/4     not connected  Full    25 Gbps    Auto

Fx0/5     not connected  Full    25 Gbps    Auto
```

Fx0/6	not connected	Full	25 Gbps	Auto
Fx0/7	not connected	Full	25 Gbps	Auto
Fx0/8	not connected	Full	25 Gbps	Auto
Fx0/9	not connected	Full	25 Gbps	Auto
Fx0/10	not connected	Full	25 Gbps	Auto
Fx0/11	not connected	Full	25 Gbps	Auto
Fx0/12	not connected	Full	25 Gbps	Auto
Fx0/13	not connected	Full	25 Gbps	Auto
Fx0/14	not connected	Full	25 Gbps	Auto
Fx0/15	not connected	Full	25 Gbps	Auto
Fx0/16	not connected	Full	25 Gbps	Auto
Fx0/17	not connected	Full	25 Gbps	Auto
Fx0/18	not connected	Full	25 Gbps	Auto
Fx0/19	not connected	Full	25 Gbps	Auto
Fx0/20	not connected	Full	25 Gbps	Auto
Fx0/21	not connected	Full	25 Gbps	Auto
Fx0/22	not connected	Full	25 Gbps	Auto
Fx0/23	not connected	Full	25 Gbps	Auto
Fx0/24	not connected	Full	25 Gbps	Auto
Fx0/25	not connected	Full	25 Gbps	Auto
Fx0/26	not connected	Full	25 Gbps	Auto
Fx0/27	not connected	Full	25 Gbps	Auto
Fx0/28	not connected	Full	25 Gbps	Auto
Fx0/29	not connected	Full	25 Gbps	Auto
Fx0/30	not connected	Full	25 Gbps	Auto
Fx0/31	not connected	Full	25 Gbps	Auto
Fx0/32	not connected	Full	25 Gbps	Auto
Fx0/33	not connected	Full	25 Gbps	Auto
Fx0/34	not connected	Full	25 Gbps	Auto
Fx0/35	not connected	Full	25 Gbps	Auto

Fx0/36 not connected Full 25 Gbps Auto

Fx0/37 not connected Full 25 Gbps Auto

Fx0/38 not connected Full 25 Gbps Auto

Fx0/39 not connected Full 25 Gbps Auto

Fx0/40 not connected Full 25 Gbps Auto

Fx0/41 not connected Full 25 Gbps Auto

Fx0/42 not connected Full 25 Gbps Auto

Fx0/43 not connected Full 25 Gbps Auto

Fx0/44 not connected Full 1 Gbps Auto

Fx0/45 not connected Full 25 Gbps Auto

Fx0/46 not connected Full 25 Gbps Auto

Fx0/47 not connected Full 25 Gbps Auto

Fx0/48 not connected Full 25 Gbps Auto

Cx0/1 not connected Full 100 Gbps Auto

Cx0/2 not connected Full 100 Gbps Auto

Cx0/3 not connected Full 100 Gbps Auto

Cx0/4 not connected Full 100 Gbps Auto

Cx0/5 not connected Full 100 Gbps Auto

Cx0/6 not connected Full 100 Gbps Auto

2.3.4 Duplex Operation

The Supermicro SSE-F3548 and SSE-X3548 switches don't support half-duplex operation on its physical interfaces.

2.3.5 MTU

The default maximum transmission unit (MTU) size for frames received and transmitted is 1500 bytes. The MTU size can be increased for an interface.

Follow the steps below to configure the interface MTU.

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:

		fx-ethernet – fx cx-ethernet – cx port-channel - po interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	mtu<frame-size(1500-9216)>	Configure interface MTU in the range 1500-9216.
Step 4	End	Exits the configuration mode.
Step 5	show interface status	Displays the interface configuration.
Step 6	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no mtu” command restores the interface MTU to its default of 1500 bytes.

To change the MTU for all the interfaces, the “system mtu” command can be used.

The example below shows the commands used to configure the interface MTU.

SMIS# configure terminal
SMIS(config)# interface fx 0/22
SMIS(config-if)# mtu 9000
SMIS(config-if)# end
SMIS

show interface fx 0/22

Fx0/22 up, line protocol is down (not connect)

Bridge Port Type: Customer Bridge Port

Hardware Address is 0c:c4:7a:2c:1f:33

MTU 9000 bytes, Full duplex, 25 Gbps, FEC is on, Auto-Negotiation

HOL Block Prevention enabled.

Input flow-control is off, output flow-control is off

DCBX is Disabled

PFC is Disabled

Link Up/Down Trap is enabled

Reception Counters

Octets: 0

Unicast Packets: 0

Unicast Packets Rate: 0/Sec

Broadcast Packets: 0

Broadcast Packets Rate: 0/Sec

Multicast Packets: 0

Multicast Packets Rate: 0/Sec

Pause Frames: 0

Undersize Frames: 0

Oversize Frames: 0

CRC Error Frames: 0

Discarded Packets: 0

Error Packets: 0

Unknown Protocol: 0

Received Rate: 114 bps

Transmission Counters

Octets: 0

Unicast Packets: 0

Unicast Packets Rate: 0/Sec

Broadcast Packets: 0

Broadcast Packets Rate: 0/Sec

Multicast Packets: 0

Multicast Packets Rate: 0/Sec

Pause Frames: 0

Discarded Packets: 0

Error Packets: 0

Transmit Rate: 740 bps

show interface mtu fx-ethernet 0/22

Fx0/22 MTU size is 9000

2.3.6 Flow Control

Flow control enables Ethernet ports to control traffic during congestion to avoid packet loss.

If a port experiences congestion and cannotreceive any more traffic, it notifies other ports by sending a pause frame to stop sending until the condition clears. Upon receipt of a pause frame, the sending device stops sending any data packets to prevent any loss of data packets during the congestion period.
Follow the steps below to configure Flow Control.

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: fx-ethernet – fx cx-ethernet – cx interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	flowcontrol { send | receive} { on | off }	Configure flow control

		Send – The port can send pause frames but cannot receive pause frames from a connected device. *Receive* – The port cannot send pause frames but can receive pause frames from a connected device. On – Enable flow control Off - Disable flow control
Step 4	End	Exits the configuration mode.
Step 5	show flow-control [interface <interface-type><interface-id>]	Displays the Interface Flow control configuration.
Step 6	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The example below shows the commands used to configure Flow Control.

```
SMIS# configure terminal
SMIS(config)# interface fx 0/22
SMIS(config-if)# flowcontrol send on
SMIS(config-if)# end
SMIS# show flow-control interface fx 0/22

Port    TxFlowControl   Rx FlowControl   Tx Pause   Rx Pause
----    -------------   -------------    --------   --------
Fx0/22  on              off              0          0
```

2.3.7 Storm Control

Storm control prevents traffic on a LAN from being disrupted by a broadcast, multicast, or unicast storm on one of the physical interfaces. A LAN storm occurs when packets flood the LAN due to errors or mistakes in network configurations, etc. LAN storms degrade network performance.

Storm Control monitors packets passing from an interface to the switching bus and determines if the packet is unicast, multicast, or broadcast. The switch counts the number of packets of a specified type received within the 1-second time interval and compares the measurement with a predefined suppression-level threshold. The port blocks traffic when the rising threshold is reached and remains blocked until the traffic rate drops below the falling threshold before resuming normal forwarding.

Follow the steps below to configure Storm control.

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:

		fx-ethernet – fx cx-ethernet – cx interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	storm-control { broadcast |multicast | dlf } level <kbps (1-10000000)>	Configure Storm control for broadcast or multicast or DLF packets. Level – Threshold level in kbps, in range 1-10000000.
Step 4	End	Exits the configuration mode.
Step 5	show interfaces storm-control	Displays the interface Storm control configuration.
Step 6	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no storm-control { broadcast |multicast | dlf } level” command disables Storm Control.

The example below shows the commands used to configure Storm Control.

SMIS# configure terminal
SMIS(config)# interface fx 0/22
SMIS(config-if)#storm-control broadcast level 50000
SMIS(config-if)# end

SMIS# show interfaces fx 0/22 storm-control

Fx0/22

DLF Storm Control : Disabled
Broadcast Storm Control : Enabled

Broadcast Storm Control : 50000

Multicast Storm Control : Disabled

2.3.8 Forward Error Correction (FEC) Mode

Supermicro switches allow users to enable or disable the FEC mode on the interfaces configured for 25G and 100G. FEC is not supported for other speed settings. **It is recommended to keep FEC ON for most cables and peer devices.**

In SSE-F3548S/SR models FEC is enabled by default in all Fx and Cx ports. In SSE-X3548S/SR models FEC is enabled by default in all Cx ports.This switch supports RS_FEC, which is equivalent to cl91 FEC in some devices.

Follow the steps below to enable FEC mode on the 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: fx-ethernet – fx cx-ethernet – cx interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	Fec-mode	Enable FEC mode on interface.
Step 4	End	Exits the configuration mode.
Step 5	show interface	Displays the fec mode for the interface.
Step 6	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The example below shows the commands used to configure the interface description.

```
SMIS# configure terminal
SMIS(config)# interface Fx 0/22
SMIS(config-if)# fec-mode
```

SMIS(config-if)# end
SMIS

SMIS# sh int Fx 0/22

It is recommended to turn ON the FEC for most cables and peer devices. This switch supports FEC type RS (Reed-Solomon). Make sure the same FEC type is configured in peer devices.

2.3.9 Port Splitting

Supermicro switches allow users to split each of the Cx-ethernet ports into 4 ports that can operate at speed 25G or 10G. After splitting, the new split interfaces are created with default configuration; i.e. previously configured FEC and auto-negotiation will not be inherited by the newly created split interfaces.

Follow the steps below to split Cx-ethernet ports.

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: cx-ethernet – cx interface-id is in slot/port format for all physical 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 cx 0/1-6 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range cx 0/1-2, cx 0/4 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	speed 25000 Or speed 10000	Splits the port into four 25G ports or four 10G ports. Note: Fec-mode and negotiation have to be turned off for splitting into 4 x 10G ports.
Step 4	end	Exits the configuration mode.
Step 5	show interface status	Split ports can be viewed in the output.

Step 6	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The example below shows the commands used to split Cx 0/1 interface in SBM-25G-100 into four 25G ports.

```
SMIS# configure terminal
SMIS(config)# interface cx 0/1
SMIS(config-if)# speed 25000
SMIS(config-if)# end
```

Use show interface command to check that Fx 49, Fx 50 and Fx 51 ports were created.
```
SMIS# show interface status
```

Use show running-config command to check that Cx 0/1 speed is set to 25G.
```
SMIS# show running-config
```

The example below shows the commands used to split Cx 0/1 interface in SBM-25G-100 into four 10G ports.

```
SMIS# configure terminal
SMIS(config)# interface cx 0/1
SMIS(config)#no fec-mode
SMIS(config)#no negotiation
SMIS(config-if)# speed 10000
SMIS(config-if)# end
```

Use show interface command to check that Fx 49, Fx 50 and Fx 51 ports were created.
```
SMIS# show interface status
```

Use show running-config command to check that Cx 0/1 speed is set to 10G.
```
SMIS# show running-config
```

2.4 Time Management

The system time and date on Supermicro switches can be managed by Network Time Protocol (NTP) or configured manually.

NTP provides synchronization of network resources by a synchronized network timestamp. Supermicro switches can function as an NTP client over UDP and receive the time from an NTP server in the network.

Parameter	Default Value
Timezone offset	None
NTP status	Disabled
NTP operation	Unicast
NTP authentication	None
NTP server	None
NTP Broadcast mode	No

2.4.1 NTP Server

Supermicro switches can synchronize their time with that of an NTP server. Follow the below steps to configure NTP server parameters.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ntp server <ip_address> [key (1-65535)] [prefer]	Configure the NTP server. *ip_addr* – IP address of server. *key* – Authentication Key for server connectivity in the range 1-65535. *prefer* –This option can be used to specify a preferred NTP server when multiple NTP servers are configured in the switch. Only 1 server can be configured 'prefer' at a time.
Step 3	End	Exits the configuration mode.
Step 4	show ntp	Displays the NTP configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The "enable agent" command enables the agent. NTP servers can be deleted only when NTP status is disabled.

If a key is configured on Supermicro switches acting as NTP client, ensure the same key is configured on the NTP server(s) as well.

The example below shows the commands used to configure an NTP server.

```
SMIS# configure terminal
SMIS(config)# ntp server 200.200.200.10 key 100 prefer

SMIS(config)# ntp server 100.100.100.1 key 500

SMIS(config)# end

SMIS# show ntp

[NTP] ntp is disabled
   Server      Key   Prefer

=============== =====  ======

 200.200.200.10   100   YES

  100.100.100.1   500

 Key #    Key
======= ===================================
```

Time zone offset not set

2.4.2 Enable/Disable NTP

NTP is disabled by default in Supermicro switches.Follow the below steps to enable NTP.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ntp enable	Enable NTP in switch.
Step 3	End	Exits the configuration mode.
Step 4	show ntp	Displays the NTP configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “ntp disable” command disables NTP in the switch. NTP can be enabled in Supermicro switches only after configuring at least one NTP server.

The example below shows the commands used to configure NTP.

```
SMIS# configure terminal
SMIS(config)# ntp enable
SMIS(config)#end
SMIS# show ntp

[NTP] ntp running unicast mode

  Server     Key   Prefer
=============== =====  ======
 200.200.200.10   100   YES
  100.100.100.1   500

 Key #    Key
=======  ==================================
 Time zone offset not set
```

2.4.3 NTP Authentication

Supermicro switches support NTP authentication by the NTP server. The authentication data is encrypted by an MD5 algorithm. The NTP authentication key can be configured in the switch and this must be matched with the NTP authentication key in the NTP server. The authentication key is an NTP key number and text pair.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ntp key <key_number (1- 65535)><key_text>	Configure NTP authentication key. *Key-number* –key number in the range 1-65535, used for MD5.

		Key-text–NTP key text to be used along with key-number for MD5.
Step 3	End	Exits the configuration mode.
Step 4	show ntp	Displays the NTP configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no ntp key” command deletes the NTP authentication key.

The example below shows the commands used to configure NTP.

SMIS(config)# ntp key 200 For-server1

SMIS(config)# show ntp

[NTP] ntp is enabled

Server Key Prefer

=============== ===== ======

Key # Key

======= ==========

200 For-server1

Time zone offset not set

2.4.4 NTP Broadcast

NTP server messages can be broadcast or unicast. By default, Supermicro switches receive unicast NTP messages.

Follow the below steps to configure Supermicro switches to receive NTP broadcast messages from the NTP server.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ntp broadcast [authentication]	Configure NTP broadcast. *authentication* – If specified, NTP authentication is enabled for broadcast mode.
Step 3	End	Exits the configuration mode.
Step 4	show ntp	Displays the NTP configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no ntp broadcast” command disables NTP Broadcast.

The example below shows the commands used to configure NTP Broadcast.

SMIS(config)# ntp broadcast authentication

SMIS(config)# show ntp

[NTP] ntp running broadcast mode

Server Key Prefer

=============== ===== ======

Key # Key

======= ==========

Time zone offset not set

2.4.5 System Clock

The system clock in Supermicro switches run from the time the moment the switch starts up and keeps track of system date and time. The system clock can also be manually configured. The system time configured manually remains accurate until next restart. Manual configuration of system clock is useful when the system time cannot be obtained from any other source, such as NTP associations.

Follow the steps below to set the system clock.

Step	Command	Description
Step 1	clock set hh:mm:ss day<1-31>month<january|february|march|april|may|june|july|august|september|october|november|december> year<2000 - 2035>	Configure the system clock. *hh:mm:ss* – Time in Hours:Minutes:Seconds format. *day* – Day in 1-31 format. *month* – Month in January-December format. *year* – Year in yyyy format.
Step 2	show clock	Displays the system clock.

The example below shows the commands used to configure system clock.

SMIS# clock set 09:26:15 31 august 2013

Wed Aug 31 09:26:15 2013

SMIS# show clock

Wed Aug 31 09:26:20 2013

2.4.6 Time Zone

The system clock maintains time based on Universal Time Coordinated (UTC), also known as Greenwich Mean Time (GMT). The local time zone can be specified as an offset from UTC.

Follow the below steps to configure the time zone.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	tz posix <std><offset>[<dst>]	Configure the time zone. <std> - Standard time text e.g. PST <offset> - Time zone offset in $[+\|-]hh[:mm[:ss]]$ format. This is the value needed to be added to local time to get to UST. This value is positive if the local time zone is in west of the Prime Merdian, otherwise it is negative. <dst> - Day light savings time text e.g. PDT
Step 3	end	Exits the configuration mode.
Step 4	show system information	Displays the time zone configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The example below shows the commands used to configure the time zone offset.

SMIS# configure terminal
SMIS(config)# tz posix PST8
SMIS(config)# end

SMIS# show system information

Switch Name: SMIS
Switch Base MAC Address: 00:30:48:e3:70:bc
SNMP EngineID: 80.00.08.1c.04.46.53
System Contact: http://www.supermicro.com/support
System Location: Supermicro
Logging Option: Console Logging
Login Authentication Mode: Local
Snoop Forward Mode: MAC based
Config Restore Status: Not Initiated
Config Restore Option: No restore
Config Restore Filename: iss.conf
Config Save IP Address: 0.0.0.0
Device Up Time: 0 days 0 hrs 48 mins 5 secs

Boot-up Flash Area: Normal

NTP Broadcast Mode: No

[NTP] ntp is disabled

Server Key Prefer

=============== ===== ======

Key # Key

======= ==========

Time zone offset value: PST8

2.5 System Management

Supermicro switches can be administered by configuring various operations.

- Switch Name
- Switch Location
- Switch Contact
- System MTU
- Port mirroring
- MAC aging
- Reload or reset

Defaults – System Management

Parameter	Default Value
Switch name	SMIS
System contact	http://www.supermicro.com
System location	Supermicro
MAC aging	300 secs
MAC table static entries	None
System MTU	1500 bytes
Port mirroring	Disabled
Port mirroring direction	Both

2.5.1 Switch Name

Supermicro switches can be assigned a name for identification purpose. The default switch name is SMIS. The switch name is also used as a prompt.

Follow the steps below to configure the Switch Name.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	device name <devname(15)>	Configure Switch Name and prompt.

		Devname– Switch name specified as 1-15 alphanumeric characters.
Step 3	End	Exits the configuration mode.
Step 4	show system information	Displays the system information configuration.

The *device name* configuration is automatically stored as part of startup-config file.

The example below shows the commands used to configure the switch name.

SMIS# configure terminal
SMIS(config)# **device name switch1**
switch1(config)# end

switch1# show system information

Switch Name: switch1

Serial Number: SSC36SR08200014

Switch Management MAC Address: 0c:c4:7a:2c:1f:1d

Switch Base MAC Address: 0c:c4:7a:2c:1f:1e

SNMP EngineID: 80.00.08.1c.04.46.53

System Contact: http://www.supermicro.com/support

System Location: Supermicro

Logging Option: Console Logging

Login Authentication Mode: Local

ZTP Config Restore Option: ZTP Enabled

Config Restore Status: Successful

Config Restore Option: Restore

Config Restore ZTP Filename:

Config Restore ZTP TFTP IP Address: 0.0.0.0

Config Restore Local Filename: iss.conf

Config Save IP Address: 0.0.0.0

Device Up Time: 0 days 3 hrs 43 mins 6 secs

Boot-up Flash Area: Normal

NTP Broadcast Mode: No

[NTP] ntp is disabled
Server Key Prefer
=============== ===== ======
Key # Key
======= ==========
Time zone offset not set

2.5.2 Switch Contact

Supermicro switches provide an option to configure the switch in charge of contact details, usually an email ID.

Follow the steps below to configure the switch contact.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	system contact <string - to use more than one word, provide the string within double quotes>	Configure Switch Contact. *String* – Contact information entered as a String of maximum length 64.
Step 3	End	Exits the configuration mode.
Step 4	show system information	Displays the System information configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The *System Contact* configuration is automatically stored as part of the startup-config file.

The example below shows the commands used to configure the switch contact.

SMIS# configure terminal
SMIS(config)# system contact "User1 at CA”

SMIS(config)# end

SMIS# show system information

Switch Name: SMIS
Serial Number: SSC36SR08200014
Switch Management MAC Address: 0c:c4:7a:2c:1f:1d
Switch Base MAC Address: 0c:c4:7a:2c:1f:1e
SNMP EngineID: 80.00.08.1c.04.46.53
System Contact: User1 at CA
System Location: Supermicro
Logging Option: Console Logging
Login Authentication Mode: Local

```
ZTP Config Restore Option: ZTP Enabled
Config Restore Status: Successful
Config Restore Option: Restore
Config Restore ZTP Filename:
Config Restore ZTP TFTP IP Address: 0.0.0.0
Config Restore Local Filename: iss.conf
Config Save IP Address: 0.0.0.0
Device Up Time: 0 days 3 hrs 48 mins 33 secs
Boot-up Flash Area: Normal
NTP Broadcast Mode: No
[NTP] ntp is disabled

   Server     Key   Prefer
=============== =====  ======

 Key #    Key
=======  ==================================
 Time zone offset not set
```

2.5.3 System Location

Supermicro switches provide option to configure the switch location details.

Follow the steps below to configure the system location.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	system location <location name>	Configure System Location. location name –Location of the switch specified as a string of maximum size 238.
Step 3	End	Exits the configuration mode.
Step 4	show system information	Displays the System Location configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The *System Location* configuration is automatically stored as part of the startup-config file.

The example below shows the commands used to configure the system location.

```
SMIS# configure terminal
SMIS(config)# system location "Santa Clara"

SMIS(config)# end

SMIS# show system information
```

```
Switch Name: SMIS
Serial Number: SSC36SR08200014
Switch Management MAC Address: 0c:c4:7a:2c:1f:1d
Switch Base MAC Address: 0c:c4:7a:2c:1f:1e
SNMP EngineID: 80.00.08.1c.04.46.53
System Contact: http://www.supermicro.com/support
System Location: Santa Clara
Logging Option: Console Logging
Login Authentication Mode: Local
ZTP Config Restore Option: ZTP Enabled
Config Restore Status: Successful
Config Restore Option: Restore
Config Restore ZTP Filename:
Config Restore ZTP TFTP IP Address: 0.0.0.0
Config Restore Local Filename: iss.conf
Config Save IP Address: 0.0.0.0
Device Up Time: 0 days 3 hrs 55 mins 33 secs
Boot-up Flash Area: Normal
NTP Broadcast Mode: No
[NTP] ntp is disabled
    Server      Key   Prefer
================ =====  ======
 Key #    Key
=======  ==================================
 Time zone offset not set
```

2.5.4 System MTU

The default maximum transmission unit (MTU) size for frames received and transmitted on all interfaces of the switch is 1500 bytes. The MTU size can be increased for all interfaces of the switch at the same time by using the '*system MTU*' command.

Follow the steps below to configure the system MTU.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	system mtu <frame-size(1500-9216)>	Configure System MTU. frame-size – Specify MTU of frame in range 1500-9216.
Step 3	End	Exits the configuration mode.
Step 4	show interface mtu	Displays the interface MTU.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The "no system mtu" command resets the system MTU to its default value of 1500 bytes.

The example below shows the commands used to configure the system MTU.

SMIS# configure terminal
SMIS(config)# system mtu 9200
SMIS(config)# end

SMIS
show interface mtu

Fx0/1 MTU size is 9200

Fx0/2 MTU size is 9200

Fx0/3 MTU size is 9200

Fx0/4 MTU size is 9200

Fx0/5 MTU size is 9200

Fx0/6 MTU size is 9200

Fx0/7 MTU size is 9200

Fx0/8 MTU size is 9200

Fx0/9 MTU size is 9200

Fx0/10 MTU size is 9200

Fx0/11 MTU size is 9200

Fx0/12 MTU size is 9200

Fx0/13 MTU size is 9200

Fx0/14 MTU size is 9200

Fx0/15 MTU size is 9200

Fx0/16 MTU size is 9200

Fx0/17 MTU size is 9200

Fx0/18 MTU size is 9200

Fx0/19 MTU size is 9200

Fx0/20 MTU size is 9200

Fx0/21 MTU size is 9200

Fx0/22 MTU size is 9200

Fx0/23 MTU size is 9200

Fx0/24 MTU size is 9200

Fx0/25 MTU size is 9200

Fx0/26 MTU size is 9200

Fx0/27 MTU size is 9200

Fx0/28 MTU size is 9200

Fx0/29 MTU size is 9200

Fx0/30 MTU size is 9200

Fx0/31 MTU size is 9200

Fx0/32 MTU size is 9200

Fx0/33 MTU size is 9200

Fx0/34 MTU size is 9200

Fx0/35 MTU size is 9200

Fx0/36 MTU size is 9200

Fx0/37 MTU size is 9200

Fx0/38 MTU size is 9200

Fx0/39 MTU size is 9200

Fx0/40 MTU size is 9200

Fx0/41 MTU size is 9200

Fx0/42 MTU size is 9200

Fx0/43 MTU size is 9200

Fx0/44 MTU size is 9200

Fx0/45 MTU size is 9200

Fx0/46 MTU size is 9200

Fx0/47 MTU size is 9200

Fx0/48 MTU size is 9200

Cx0/1 MTU size is 9200

Cx0/2 MTU size is 9200

Cx0/3 MTU size is 9200

Cx0/4 MTU size is 9200

Cx0/5 MTU size is 9200

Cx0/6 MTU size is 9200
SMIS#

2.5.5 Static MAC

The MAC address table stores MAC addresses used by the switch to forward traffic between ports. Supermicro switches allow for static configuration of entries in MAC addresses.

Static MAC Characteristics:

- Static MAC addresses do not age and are automatically stored as part of startup-config so they are available after restart.
- Static MAC addresses can be unicast or multicast.

Forwarding Behavior for Static MAC:

- Supermicro switches provide flexibility to configure forwarding behavior for static MAC addresses, i.e. how a port that receives a packet forwards it to another port for transmission.
- A packet with a static address that arrives on a VLAN on which a static MAC address has been configured, is flooded to all ports and not learned.
- A static address is created by specifying the destination MAC unicast address and theVLAN from which it is received. Packets received with this destination address are forwarded to the interface specified with the interface-id option.

Follow the steps below to configure static MAC.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	mac-address-table static multicast <aa:aa:aa:aa:aa:aa> vlan <vlan-id(1-4069)> interface ([<interface-type><0/a-b,0/c,...>] [<interface-type><0/a-b,0/c,...>] [port-channel <a,b,c-d>]]) mac-address-table static unicast <aa:aa:aa:aa:aa:aa> vlan <vlan-id(1-4069)> interface <interface-type><iface>	Configure Multicast or unicast static MAC. *Vlan* – Specify the VLAN for which the packet with thespecified MAC address is received. Valid VLAN IDs are 1 to 4094. Interface - specify the interface to which the received packet is forwarded. Valid interfaces include physical ports or port channels.

		Interface-type - may be any of the following: fx-ethernet – fx cx-ethernet – cx interface-id is in slot/port format for all physical interfaces.
Step 3	End	Exits the configuration mode.
Step 4	show mac-address-table static multicast [vlan <vlan-range>] [address <aa:aa:aa :aa:aa:aa>] [{interface <interface-type><interface-id> }] show mac-address-table static unicast [vlan <vlan-range>] [address <aa:aa:aa:a a:aa:aa>] [{interface <interface-type><interface-id> }]	Displays the static MAC configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “ no mac-address-table static multicast <aa:aa:aa:aa:aa:aa> vlan <vlan-id(1-4069)> [recv-port <interface-type><interface-id>]andno mac-address-table static unicast <aa:aa:aa:aa:aa:aa> vlan <vlan-id(1-4069)> [recv-port <interface-type><interface-id>]” command deletes the particular static MAC entry.

The “no mac-address-table static multicast <aa:aa:aa)> [recv-port <interface-type><interface-id>]” command deletes the particular staticmulticast MAC entry.

The example below shows the commands used to configure a static MAC.

```
SMIS# configure terminal
SMIS(config)# mac-address-table static unicast 90:4e:e5:0c:03:75 vlan 1 interface fx 0/14 status permanent
SMIS(config)# end

SMIS# show mac-address-table static unicast

Vlan  Mac Address            Status       Ports
----  -----------            ------       -----
1     90:4e:e5:0c:03:75        Permanent     Fx0/14


Total Mac Addresses displayed: 1
```

2.5.6 MAC Aging

Dynamic MAC address table entries are addresses learned by the switch that age when not in use. The MAC aging time can be configured by users.

Follow the steps below to configure MAC aging.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	mac-address-table aging-time <10-1000000 seconds>	Configure MAC Aging time in range 10-1000000 seconds.
Step 3	End	Exits the configuration mode.
Step 4	show mac-address-table aging-time	Displays the MAC address table aging time.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The "no mac-address-table aging-time" command resets MAC aging to its default value of 300 seconds.

The example below shows the commands used to configure MAC Aging.

SMIS# configure terminal
SMIS(config)# mac-address-table aging-time 50000

SMIS(config)# end

SMIS# show mac-address-table aging-time

Mac Address Aging Time: 50000

SMIS# show mac-address-table

Vlan Mac Address Type Ports
---- ----------- ---- -----
1 90:4c:e5:0b:04:77 Learnt Fx0/21
1 94:d7:23:94:88:d8 Learnt Fx0/21
Total Mac Addresses displayed: 2

2.5.7 System Fan Speed

The fan speed, by default, is set to auto. When the fan speed is set to auto, the software controls the fan speed based on the switch temperature. The fan speed can also be set manually by the user; there are 10 speed levels to choose. If the temperature of the switch needs a higher fan speed than the one configured by the user, then the software automatically overrides the user setting to prevent any damage to the switch.

Follow the steps below to configure fan speed.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	set fan speed {auto | level <speed(1-10)>}	Sets the fan speed to auto or to the user specified level. Default speed setting is auto.
Step 3	End	Exits the configuration mode.

Step 4	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The fan speed may not be applied immediately after changing the speed. The new speed takes effect over a period.

The example below shows the commands used to configure the fan speed.

SMIS# configure terminal
SMIS(config)# set fan speed level 5

To display the current fan speed use the below show command.

SMIS# show system environment fan

Fan Speed :12500 PRM
Fan PWM :50 %
Fan Level :5

2.6 System Logging (Syslog)

Supermicro switches send system message output to a klogging process called System Message Logging (Syslog). Logging can be done at various locations:

- Console
- File
- Server

Parameter	Default Value
Syslog status	Enabled
Logging buffer size	50 entries
Console logging	Enabled
File Logging	Disabled
Trap Logging	Critical
MAC Address table update Logging	Disabled
Facility	Local0

2.6.1 Enable/Disable Syslog

Syslog is enabled by default in Supermicro switches.

Follow the steps below to disableSyslog.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode

Step 2	**logging disable**	Disable Syslog.
Step 3	End	Exits the configuration mode.
Step 4	show logging	Displays the Syslog configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The "logging enable" **command enables the Syslog feature.**

The example below shows the commands used to disable Syslog.

SMIS# configure terminal
SMIS(config)# **logging disable**
SMIS(config)# end
SMIS# show logging

System Log Information

Syslog logging: disabled(Number of messages 0)
Console logging: disabled(Number of messages 0)
File logging: disabled(Number of messages 0)
Log File Name:
File Max Entries: 500
TimeStamp option: enabled
Trap logging: Critical
Log server IP: None
Facility: Default (local0)
Buffered size: 50 Entries
LogBuffer: (0 Entries)

LogFile(0 Entries)

2.6.2 Syslog Server

In Supermicro switches, Syslog messages can be re-directed to a Syslog server.

Follow the steps below to configure the Syslog server.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	logging <ip-address>	Configure Syslog Server. *ip-address* –IP address of Syslog server
Step 3	End	Exits the configuration mode.
Step 4	show logging	Displays the Syslog configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no logging <ip-address>” command deletes the Syslog server.

The example below shows the commands used to configure a Syslog server.

SMIS# configure terminal
SMIS(config)# logging 192.168.1.3

SMIS(config)# end

SMIS# show logging

System Log Information

Syslog logging: enabled(Number of messages 0)
Console logging: disabled(Number of messages 0)
File logging: disabled(Number of messages 0)
Log File Name:
File Max Entries: 500
TimeStamp option: enabled
Trap logging: Critical
Log server IP: 192.168.1.3
Facility: Default (local0)
Buffered size: 50 Entries

LogBuffer: (0 Entries)

LogFile: (0 Entries)

2.6.3 Console Log

System logging messages can be displayed in switch console.

Follow the steps below to enable the Syslog console.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	logging console	Enable Syslog Console.
Step 3	End	Exits the configuration mode.
Step 4	show logging	Displays the Syslog configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no logging console” command disables console logging.

The example below shows the commands used to enable Syslog console.

SMIS# configure terminal

```
SMIS(config)# logging console
SMIS(config)# end
SMIS# show logging

System Log Information

----------------------
Syslog logging: enabled(Number of messages 0)
Console logging: enabled(Number of messages 0)
File logging: disabled(Number of messages 0)
Log File Name:
File Max Entries: 500
TimeStamp option: enabled
Trap logging: Critical
Log server IP: None
Facility: Default (local0)
Buffered size: 50 Entries
LogBuffer: (0 Entries)

LogFile: (0 Entries)
```

2.6.4 Log File

System logging messages can be stored as a log file in the switch NVRAM.

Follow the steps below to enable storing logs in a file.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	logging file <filename> max-entries <short (1-8000)>	Enable storing Logs in a File. *Filename* – Specify file name of upto 32 characters. *Short*–Specify entries that can stored in file in range 1-8000.
Step 3	End	Exits the configuration mode.
Step 4	show logging	Displays the Syslog configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no logging file” command disables the logging of system message in a file.

The example below shows the commands used to enable storing logs in a file.

```
SMIS# configure terminal
SMIS(config)#logging file log1
SMIS(config)# end
SMIS# show logging file
```

```
LogFile(2 Entries)
<129> Apr 29 10:11:30 2013:INTF-1:Interface Fx0/22 status changed to UP

<129> Apr 29 10:11:31 2013:INTF-1:Interface Fx0/22 status changed to UP

SMIS#
SMIS# show logging

System Log Information

----------------------
Syslog logging: enabled(Number of messages 0)
Console logging: disabled(Number of messages 0)
File logging: enabled(Number of messages 2)
Log File Name: log1
File Max Entries: 500
TimeStamp option: enabled
Trap logging: Critical
Log server IP: None
Facility: Default (local0)
Buffered size: 50 Entries

LogBuffer: (11 Entries)
<135> Apr 29 10:11:05 2013:DHC-7: Exitting DHCPC Task Init
<135> Apr 29 10:11:05 2013:DHC-7: Entered in DhcpCIntSelectTaskMain fn
<135> Apr 29 10:11:05 2013:DHC-7: Entered in DhcpCSocketOpen fn
<135> Apr 29 10:11:06 2013:DHC-7: Rcvd Event 4
<135> Apr 29 10:11:06 2013:DHC-7: Rcvd Msg 13cf2878 type : 1
<135> Apr 29 10:11:06 2013:DHC-7: Rcvd Msg 13cf2890 type : 1
<135> Apr 29 10:11:06 2013:DHC-7: Rcvd Event 4
<135> Apr 29 10:11:06 2013:DHC-7: Rcvd Msg 13cf4448 type : 1
<135> Apr 29 10:11:07 2013:DHC-7: Rcvd Event 4
<135> Apr 29 10:11:07 2013:DHC-7: Rcvd Msg 13cf4908 type : 1
<129> Apr 29 10:11:31 2013:INTF-1: Interface Fx0/22 status changed to UP
LogFile(2 Entries)
<129> Apr 29 10:11:30 2013:INTF-1: Interface Fx0/22 status changed to UP

<129> Apr 29 10:11:31 2013:INTF-1: Interface Fx0/22 status changed to UP
```

2.6.5 Logging Buffer

The log messages are stored in a circular internal buffer in which older messages are overwritten once the buffer is full. The Syslog buffer size is configurable in Supermicro switches.

Follow the steps below to configure the Syslog buffer.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	logging buffered <size (1-200)>	Configure Syslog Buffer with maximum size of 200 entries.
Step 3	End	Exits the configuration mode.
Step 4	show logging	Displays the Syslog configuration.

Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no logging buffered” command resets the logging buffer to its default value of 50 entries.

The example below shows the commands used to configure Syslog Buffer.

SMIS# configure terminal
SMIS(config)#logging buffered 200
SMIS(config)# end
SMIS# show logging

System Log Information

Syslog logging: enabled(Number of messages 0)
Console logging: disabled(Number of messages 0)
File logging: disabled(Number of messages 0)
Log File Name:
File Max Entries: 500
TimeStamp option: enabled
Trap logging: Critical
Log server IP: None
Facility: Default (local0)
Buffered size: 200 Entries

LogBuffer(11 Entries)
<135> Apr 29 10:11:05 2013:DHC-7:Exitting DHCPC Task Init
<135> Apr 29 10:11:05 2013:DHC-7:Entered in DhcpCIntSelectTaskMain fn
<135> Apr 29 10:11:05 2013:DHC-7:Entered in DhcpCSocketOpen fn
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Event 4
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Msg 13cb8128 type: 1
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Event 4

<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Msg 13cb8128 type: 1
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Event 4
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Msg 13cf4258 type: 1
<135> Apr 29 10:11:08 2013:DHC-7:Rcvd Event 4
<135> Apr 29 10:11:08 2013:DHC-7:Rcvd Msg 13cf4858 type: 1
LogFile: (0 Entries)

2.6.6 Facility

The Syslog facility provides approximate details regarding which part of the system the Syslog message originated from.

Follow the steps below to configure the Syslog facility.

Step	Command	Description

Step 1	configure terminal	Enters the configuration mode
Step 2	logging facility {local0 | local1 | local2 | local3 | local4 | local5 | local6 | local7|}	Configure Syslog Facility.
Step 3	End	Exits the configuration mode.
Step 4	show logging	Displays the Syslog configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The "nologging facility" command resets the logging facility to its default value of Local0.

The example below shows the commands used to configure the Syslog facility.

SMIS# configure terminal
SMIS(config)#logging facility local5
SMIS(config)# end
SMIS# show logging

System Log Information

Syslog logging: enabled(Number of messages 0)
Console logging: disabled(Number of messages 0)
File logging: disabled(Number of messages 0)
Log File Name:
File Max Entries: 500
TimeStamp option: enabled
Trap logging: Critical
Log server IP: None
Facility: local5

Buffered size: 50 Entries
LogBuffer: (0 Entries)

LogFile: (0 Entries)

2.6.7 Traps

Supermicro switches provide an option for specifying the type of traps that are to be logged.

Follow the steps below to configure logging traps.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	logging trap [{ <level (0-7)> | alerts | critical | debugging | emergencies |errors |informational | notification | warnings }]	Configure Logging Traps. There are various levels of traps that can be logged.

		Level 0 – Emergencies Used for logging messages that are equivalent to a panic condition. *Level 1 –Alerts* Used for logging messages that require immediate attention. *Level 2 – Critical* Used for logging critical errors. *Level 3 –Errors* Used for error messages. *Level 4 –Warning* Used for logging warning messages *Level 5 –Notification* Used for logging messages that require attention but are not errors *Level 6 – Informational* Used for logging informational messages. *Level 7 – Debugging* Used for logging debug messages.
Step 3	End	Exits the configuration mode.
Step 4	show logging	Displays the Syslog configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no logging trap” command resets trap logging to its default value of ‘Critical’.

The example below shows the commands used to configure logging traps.

```
SMIS# configure terminal
SMIS(config)# logging trap 5
SMIS# end
SMIS(config)# show logging

System Log Information

----------------------
Syslog logging: enabled(Number of messages 0)
Console logging: disabled(Number of messages 0)
File logging: disabled(Number of messages 0)
```

Log File Name:
File Max Entries: 500
TimeStamp option: enabled
Trap logging: Notification

Log server IP: None
Facility: Default (local0)
Buffered size: 200 Entries
LogBuffer: (11 Entries)
<135> Apr 29 10:11:05 2013:DHC-7:Exitting DHCPC Task Ini
<135> Apr 29 10:11:05 2013:DHC-7:Entered in DhcpCIntSelectTaskMain fn
<135> Apr 29 10:11:05 2013:DHC-7:Entered in DhcpCSocketOpen fn
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Event 4
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Msg 13cb8128 type : 1
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Event 4
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Msg 13cb8128 type : 1
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Event 4
<135> Apr 29 10:11:07 2013:DHC-7:Rcvd Msg 13cf4258 type : 1
<135> Apr 29 10:11:08 2013:DHC-7:Rcvd Event 4
<135> Apr 29 10:11:08 2013:DHC-7:Rcvd Msg 13cf4858 type : 1

LogFile(0 Entries)

2.6.8 Clear Log Buffer

The Syslog buffer can be cleared to enable the fresh logging of messages.

Follow the steps below to clear the log buffer.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	clear log buffer	Clear Logging Buffer.
Step 3	End	Exits the configuration mode.
Step 4	show logging	Displays the Syslog configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The example below shows the commands used to clear the log buffer.

SMIS# configure terminal
SMIS(config)# clear log buffer
SMIS(config)# end
SMIS# show logging

System Log Information

Syslog logging: enabled(Number of messages 0)
Console logging: disabled(Number of messages 0)
File logging: disabled(Number of messages 0)
Log File Name:
File Max Entries: 500

TimeStamp option: enabled
Trap logging: Critical
Log server IP: None
Facility: Default (local0)
Buffered size: 50 Entries
LogBuffer: (0 Entries)

LogFile: (0 Entries)

2.6.9 Clear Log File

The Syslog file can be cleared to enable the fresh logging of messages.

Follow the steps below to clear the log file.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	clear log file	Clear Logging File.
Step 3	End	Exits the configuration mode.
Step 4	show logging	Displays the Syslog configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The example below shows the commands used to clear the log file.

SMIS# configure terminal
SMIS(config)# clear log file
SMIS(config)# end
SMIS# show logging

System Log Information

Syslog logging: enabled(Number of messages 0)
Console logging: disabled(Number of messages 0)
File logging: disabled(Number of messages 0)
Log File Name:
File Max Entries: 500
TimeStamp option: enabled
Trap logging: Critical
Log server IP: None
Facility: Default (local0)
Buffered size: 50 Entries
LogBuffer: (0 Entries)

LogFile: (0 Entries)

2.7 Configuration Management

This section describes the steps to save and manage the configuration files on the switch. It also describes the firmware upgrade and “restore to factory defaults” functions.

2.7.1 Save Startup-Config

Switch configurations can be saved using the command *write startup-config*. A configuration saved as a startup configuration will be loaded automatically when switch reboots. The default startup configuration file name is iss.conf. This startup configuration file is stored in the flash memory.

Follow the steps below to write existing switch configuration as startup-config.

Step	Command	Description
Step 1	write startup-config	Configure Writing of Switch Configuration to a file or startup-config.
Step 2	show startup-config	Displays the startup configuration.

The example below shows the command used to write existing switch configuration as startup-config.

SMIS# write startup-config

Building configuration, Please wait. May take a few minutes ...
[OK]

To change the default startup config file name, use the “set startup-config” command.

2.7.2 Save Running Configuration to File

Switch configurations can be saved to a file either in local flash memory or to a remote TFTP server.

Follow the steps below to write an existing switch configuration to a file.

Step	Command	Description
Step 1	write { flash:filename | tftp://ip-address/filename}	Configure Writing of Switch Configuration to a file in the local flash memory or in a remote TFTP server. filename – name of the configuration file.
Step 2	show stored-config<filename>	Displays the stored configuration file from local flash memory. filename – name of the configuration file.

The example below shows the commands used to write an existing switch configuration to a file.

SMIS# write flash: r1sw1.conf

Building configuration, please wait. May take a few minutes ...
[OK]

SMIS# writetftp://192.168.1.100/r1sw1.conf

Building configuration, please wait. May take a few minutes ...
[OK]

SMIS# show stored-config r1sw1.conf

vlan 1
ports fx 0/1-48 untagged
ports cx 0/1-4 untagged
exit
snmp view restricted 1 excluded nonvolatile
setip igmp enable
setip pim enable
ip pim component 1
exit

2.7.3 Configuring Startup Config File Name

Supermicro switches provide an option to select a file stored in flash memory as the startup configuration file that gets loaded when the switch is powered on or restarted.

Follow the steps below to configure the startup configuration.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	set startup-config<filename>	Configure Startup-config file name. filename – name of the configuration file.
Step 3	End	Exits the configuration mode.
Step 4	show startup-config	Displays the configured startup configuration file contents.

The example below shows the commands used to configure the switch startup configuration.

SMIS# configure terminal

SMIS(config)# set startup-config config2.conf

SMIS(config)# end

SMIS# show startup-config

vlan 1

ports fx 0/1-48 untagged

ports cx 0/1-4 untagged

exit

snmp view restricted 1 excluded nonvolatile

setip igmp enable

setip pim enable

ip pim component 1

exit

2.7.4 Copy Startup-config

Supermicro switches support copying the switch startup configuration to a file in flash or remote location.

Follow the steps below to copy startup-config to a file in a remote location or flash.

Step	Command	Description
Step 1	copy startup-config{flash:filename | tftp://ip-address/filename}	Copy from startup-config to a file in remote location or flash. filename – name of the configuration file.

The example below shows the commands used to copy startup-config to a file in flash.

SMIS# copy startup-config flash:config5.txt
Copied startup-config => flash:/mnt/config5.txt
SMIS#

2.7.5 Copy File

The copy command copies the configuration file from flash memory to a remote TFTP server and vice versa. This command can be used to copy files locally within the flash memory also.

Follow the steps below to copy the configuration file to a remote site/flash.

Step	Command	Description
Step 1	copy flash: filenametftp://ipaddress/filename copy tftp://ip-address/filename flash: filename copy flash: filename flash: filename	Copies a local flash file to remote TFTP server. Copies a remote file to local flash. Makes a copy of the file in the flash memory. filename – name of the configuration file.

The example below shows the commands used to copy a file to another file in remote site/flash.

SMIS# copy flash:config1.txt flash:switch1.conf

Copied flash:/mnt/config1.txt ==> flash:/mnt/switch1.conf

SMIS#

2.7.6 Copy debug files

Supermicro switches support copying the switch's current state to remote location for debugging. The information collected using this command will be very useful in troubleshooting an issue. Use this command to collect the configuration and the running state of the switch and upload the file to Supermicro technical support website while opening a support ticket.

Follow the steps below to copy debug-files to a remote TFTP location.

Step	Command	Description
Step 1	copy debug-files {tftp://ip-address/filename}	Copy debug-files to a remote TFTP location. filename – name of the configuration file.

The example below shows the commands used to copy debug-files to a TFTP location.

SMIS# copy debug-files tftp://172.18.0.253/Switch-01-techsupport-14-May-2010.tgz

Please wait. It may take a few minutes ...
Copied tech-support ==> tftp://172.18.0.253/Switch-01-techsupport-14-May-2010.tgz
SMIS#

To open the debug file from windows, use any software such as winrar, 7zip, etc that supports opening file in tgz format. To open the debug file from Linux, use tar command as shown below.

[root@Linux]# tar -xvzf Switch-01-techsupport-14-May-2010.tgz
techsupport.txt
logging.txt
issnvram.txt
dmesg.txt
system_log
[root@Linux]#

2.7.7 Deleting a Saved Configuration

Supermicro switches allow for the deletion of the switch startup configuration and other stored configuration files.

Follow the steps below to delete the startup-config file or other configuration files.

Step	Command	Description
Step 1	erase startup-config erase flash:filename	Removes the startup-config. Deletes the configuration file from local flash. filename – name of the configuration file.

The example below shows the commands used to erase the startup-config file or another file.

SMIS# erase flash:config1.txt
Do you really want to delete file config1.txt? [y/n]
% Deleted file config1.txt.
SMIS#

SMIS# erase startup-config

Do you really want to delete startup configuration? [y/n]
% Deleted startup configuration file.
SMIS#

1.1.1 Firmware Upgrade

The switch supports upgrading from both the switch CLI and the ONIE shell. To upgrade from the switch CLI, use the file with the 'swi' extension. To upgrade from the ONIE console, use the file with the 'installer' extension.

This command upgrades only the switch firmware. ONIE will not be upgraded.

1.1.1.1 Firmware Upgrade from Switch CLI

Follow the steps below to update the firmware image from the switch CLI:

Step	Command	Description
Step 1	firmware upgrade { tftp://ip-address/filename}	Updates the firmware image from the remote TFTP server.

The example below shows the commands used to configure the firmware upgrade.

SMIS# firmware upgrade tftp://100.100.100.1/SSE-3548-fw-1.2.0.3.swi

Use the file with the 'swi' extension to upgrade from the switch CLI.

1.1.1.2 Firmware Upgrade from ONIE Shell

Follow the steps below to update the firmware image from the ONIE shell:

Step	Command	Description
Step 1	Boot the switch	Boot the switch by powering on. If the switch is already on, use the 'reload' command to reboot the switch.
Step 2	From the grub menu, choose the 'ONIE' option and press enter.	The grub menu remains for only 4 seconds, after 4 seconds the switch will

		automatically boot from the 'Supermicro SSE-F/X3548 Switch' option, so, use the down arrow quick enough to move the cursor.
Step 3	From the ONIE menu, choose the 'ONIE: Install OS' option and press enter.	After 4 seconds the switch will automatically boot to the ONIE shell from the 'ONIE: Install OS' option.
Step 4	onie-discovery-stop	This step stops ONIE from discovering installer files from the network. Stopping the discovery helps stop the discovery messages on the console and prevents the switch from installing from the random ONIE source connected to the network.
Step 5	scp <username>@<hostname>:/<path>/SSE-3548-fw-x.x.x.x.installer ./	Username is the login user on the remote Linux server. Use the firmware file with the extension 'installer'.
Step 6	Type 'y' and press enter to confirm when the switch prompts "Do you want to continue connecting? (y/n)".	
Step 7	onie-nos-install ./SSE-3548-fw-x.x.x.x.installer	The switch will install the firmware and reboot with new firmware.

The example below shows the commands used to upgrade the firmware from the ONIE shell.

ONIE:/ # onie-discovery-stop

ONIE:/ # scp admin@10.10.10.10:/home/tftp/SSE-3548-fw-1.2.0.3.installer ./

ONIE:/ # onie-nos-install ./SSE-3548-fw-1.2.0.3.installer

Use the file with the 'installer' extension to upgrade from ONIE shell.

After booting to the ONIE shell, stop the ONIE discovery as quickly as possible to prevent the switch from initiating an installation from rouge ONIE boot sources. Installation from the wrong source could damage the switch.
Entering 'ONIE: Install OS' will erase the grub menu, so a new image will need to be installed before rebooting the device.

2.7.8 Boot-up Options

Supermicro switches support dual firmware images ("normal" and "fallback"). The switch boots up from the normal firmware image by default. Users can configure the switch to boot from the fallback firmware image.

Follow the steps below to configure the switch boot-up firmware option.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	set boot-up {normal | fallback}	Configure Switch Boot-Up options.
Step 3	End	Exits the configuration mode.
Step 4	show system information	Displays the system information configuration.

The *boot-up* configuration is automatically stored as part of the startup-config file.

The example below shows the commands used to configure the switch boot-up options.

```
SMIS# configure terminal
SMIS(config)# set boot-up fallback
SMIS(config)# end
SMIS# show system information

Switch Name: SMIS
Switch Base MAC Address: 00:30:48:e3:70:bc
SNMP EngineID: 80.00.08.1c.04.46.53
System Contact: http://www.supermicro.com/support
System Location: Supermicro
Logging Option: Console Logging
Login Authentication Mode: Local
Snoop Forward Mode: MAC based
Config Restore Status: Not Initiated
Config Restore Option: No restore
Config Restore Filename: iss.conf
ConfigSave IP Address: 0.0.0.0
Device Up Time: 0 days 0 hrs 0 mins 53 secs
Boot-up Flash Area: Fallback

NTP Broadcast Mode: No
[NTP] ntp is disabled

   Server     Key   Prefer
=============== =====  ======
 Key #    Key
=======  ==================================
 Time zone offset not set
```

2.7.9 Reset to Factory Defaults

Supermicro switches can be reset to the factory defaults using a CLI command.

Follow the steps below to reset to the factory defaults.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode

Step 2	reset-to-factory-defaults	Configure Factory Defaults.

Resetting to factory defaults will remove all stored configurations, files on the flash memory, user accounts and the management IP address.

After resetting to factory defaults, the switch can be managed from serial console with the default administrator user ID ADMIN and password can be found on the label stuck on the switch.

The example below shows the command to reset to the factory defaults.

```
SMIS(config)# reset-to-factory-defaults
This command will reset settings to the factory defaults.
After resetting to factory defaults, the switch will be reloaded immediately.
Do you really want to execute this command and reload the switch? [y/n]
```

2.8 Zero Touch Provisioning

Zero Touch Provisioning (ZTP) helps to auto provision Supermicro switches without manual intervention. ZTP also helps to upgrade the switch firmware automatically.

SSE-F3548S/R and SSE-X3548S/R switches come with the default management IP address set to DHCP mode. When switches boot up, the management IP address is received from the DHCP server. The DHCP server can also be configured to supply the switch configurations and firmware image when assigning IP addresses to Supermicro switches.

ZTP is enabled by default in Supermicro switches.

When users prefer to save a configuration locally on the switch using the "write startup-config" command or other similar functionalities, the switch will provide a warning message and disable the ZTP on user confirmation. This helps to restore the locally saved configuration without waiting for DHCP IP availability.

2.8.1 ZTP Config Restore

This section explains details on using ZTP to automatically configure Supermicro switches.

2.8.1.1 DHCP Server Configuration

Switches expect the following information from the DHCP server to restore configurations supplied along with DHCP IP.

1. Configuration File Name
2. TFTP Server IP Address

Configuration File Name

The configuration file name is sent to switches from the DHCP server using vendor specific option 43 in sub option 01.

This is a simple text field that carries the configuration file name with the path in respect to the TFTP server root directory. If this file is kept in the TFTP root directory in the TFTP server, this field is a simple file name.

TFTP Server IP Address

The configuration file needs to be available in a TFTP server for a switch to download.

The TFTP server's IP address is sent to switches from the DHCP server using standard DHCP option 66, ***tftp-server-name***. This field needs to be configured in IP address format (e.g. xxx.xxx.xxx.xxx). Switches cannot accept server names, as domain name resolution is not supported.

These options can be added to dhcpd.conf as shown in the example below.

```
option space smc-op;
option smc-op.config-file-name code 1 = text;
option smc-op-encapsulation code 43 = encapsulate smc-op;

# network for Supermicro switches
subnet 172.31.0.0 netmask 255.255.0.0 {
  range 172.31.30.10 172.31.30.79;
  # the below lines added for automatic restore of configuration
  option smc-op.config-file-name "smcSwitch.conf";
  option tftp-server-name "172.31.43.59";
}
```

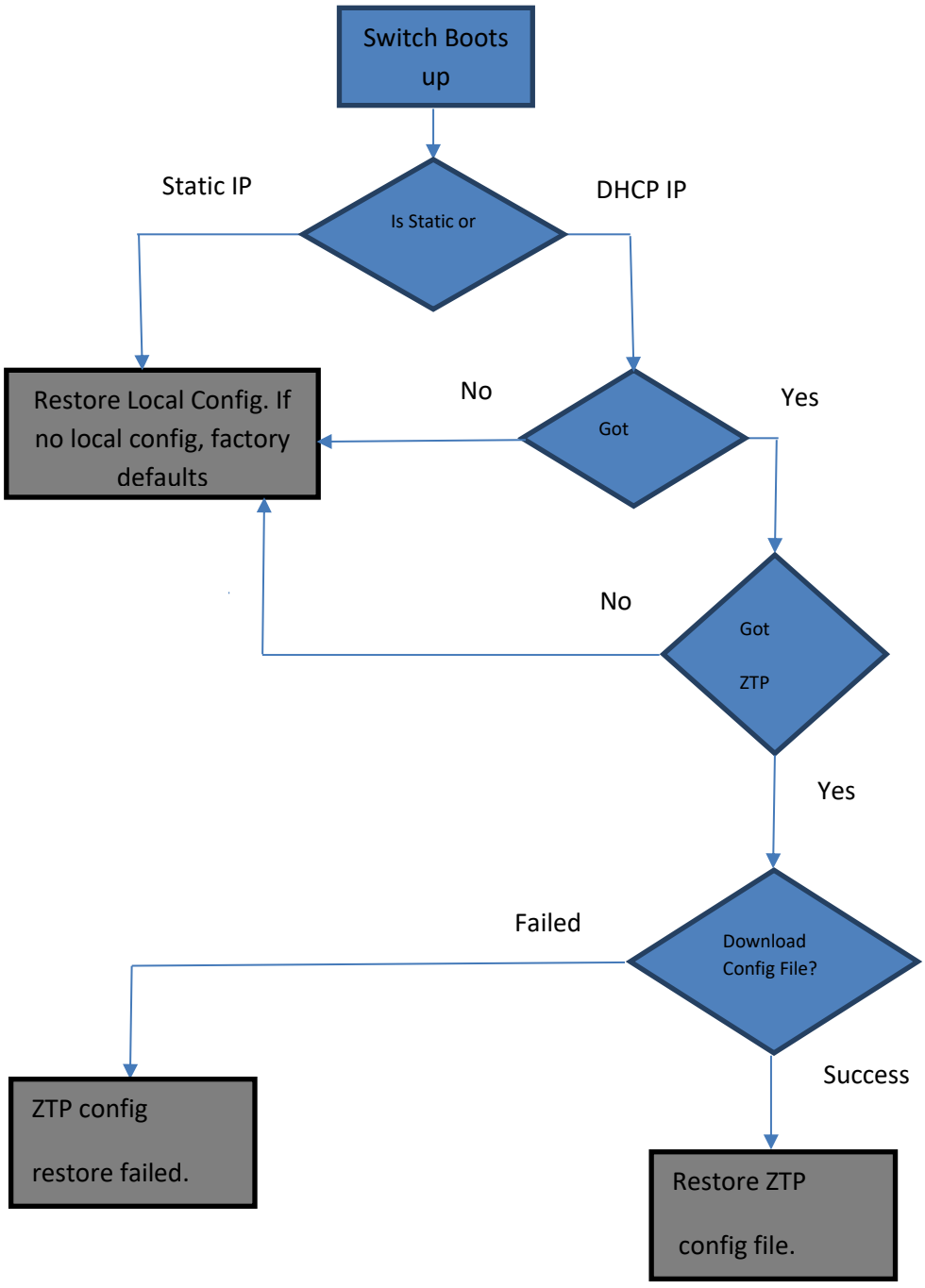
The lines in **bold** are newly required, other lines are shown for clarity.

Need to add the lines below to define option 43.1 for Supermicro switches.

2.8.1.2 Switch Configuration Restore

A ZTP configuration restore feature is enabled in Supermicro switches by default. The default management IP address configuration is DHCP mode. Hence, when switches boot up with DHCP, it gets the configuration file and applies the configuration.

The diagram below shows how a switch restores the configuration in ZTP and non-ZTP case.



2.8.2 ZTP Info

The “show system information” command in CLI displays the ZTP related information, including the following:

ZTP Config Restore Option - Default ZTP Enabled

Config Restore ZTP Filename - The name of the configuration file restored using ZTP. If ZTP restore is not applied, this field will be empty.

Config Restore ZTP TFTP IP Address – The IP address of the TFTP server from where the ZTP config file is downloaded. If ZTP restore is not applied, this field will be empty.

The “Config Restore Option” will also show “ZTP Restore” if a ZTP restore is attempted.

This information can be seen in the web interface on the “system settings” page in the “system management” group.

2.8.3 ZTP Firmware Upgrade

This section explains details on using ZTP to automatically upgrade firmware on Supermicro switches.

2.8.3.1 DHCP Server Configuration

Switches expect the following information from the DHCP server to upgrade the firmware supplied along with DHCP IP.

1. Firmware Image File Name
2. TFTP Server IP Address

Firmware Image File Name

The firmware image name is sent to switches from the DHCP server using vendor specific option 43 in sub option 04.

This simple text field carries the firmware image file name with the path in respect to the TFTP server root directory. If this file is kept in the TFTP root directory in a TFTP server, this field is a simple file name.

TFTP Server IP Address

The configuration file needs to be available on a TFTP server for the switch to download.

TFTP server IP address is sent to switches from the DHCP server using standard DHCP option 66, ***tftp-server-name***. This field needs to be configured in IP address format (e.g. xxx.xxx.xxx.xxx). Switches cannot accept server names, as domain name resolution is not supported.

These options can added to dhcpd.conf as shown in the below example.

```
option space smc-op;
option smc-op.config-file-name code 1 = text;
option smc-op.fw-img-file-name code 4 = text;
option smc-op-encapsulation code 43 = encapsulate smc-op;

# network for Supermicro switches
subnet 172.31.0.0 netmask 255.255.0.0 {
  range 172.31.30.10 172.31.30.79;
  # the below lines added for automatic restore of configuration
  option smc-op.config-file-name "smcSwitch.conf";
  option tftp-server-name "172.31.43.59";
  option smc-op.fw-img-file-name "SSE-3548-fw-1.2.0.3.swi";

}
```

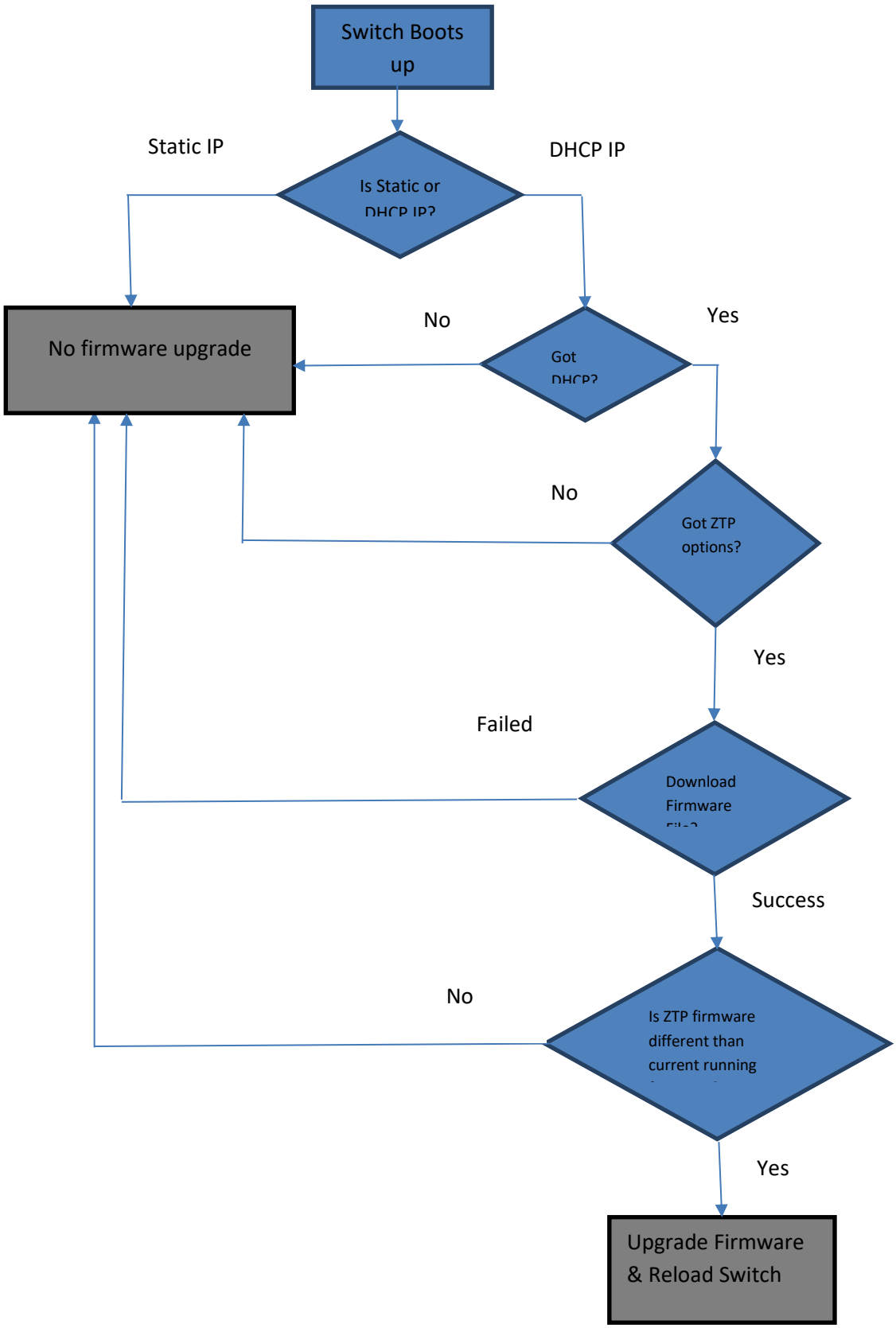
The lines in **bold** are newly required, other lines are shown for clarity.

Need to add the below lines to define option 43.1 for Supermicro switches.

2.8.3.2 Switch Firmware Upgrade

The ZTP firmware upgrade feature is enabled in Supermicro switches by default. The default management IP address configuration is DHCP mode. Hence, when switches boot up with DHCP, it gets the firmware image file and checks whether an upgrade is needed or not.

The diagram below shows how a switch upgrades the firmware in ZTP.



2.8.4 Disable ZTP

If a customer prefers not to use ZTP and wants to disable ZTP for any reason, it can be done. When ZTP is disabled, a switch always loads the local configuration file. If no local configuration file is available, a switch comes up with a default configuration. Similarly when ZTP is disabled, a switch does not upgrade firmware automatically.

To disable ZTP in CLI, please use the “ztp disable” command in config mode.

To enable ZTP back in CLI, please use the “ztp enable” command in config mode.

This option can be enabled or disabled in the web interface on “system settings” page in the “system management” group.

2.8.5 DHCP Vendor Class

Supermicro switches advertise its vendor class information on DHCP (discover and request) packets. The DHCP vendor class option 60 is used for this purpose.

The SSE-F3548S/R switch advertises the vendor class as “SSE-F3548S” and the SSE-X3548S/R switch advertises the vendor class as “SSE-X3548S”.

This vendor class information can be used in DHCP servers to send ZTP options only to the relevant switch models.

The example shows a DHCP server configuration that uses vendor class information to send ZTP options for Supermicro switch SSE-F3548S/R.

```
class "vendor-class" {
  match option vendor-class-identifier;
}
option space smc-op;
option smc-op.config-file-name code 1 = text;
option smc-op.fw-img-file-name code 4 = text;
option smc-op-encapsulation code 43 = encapsulate smc-op;
subnet 172.31.0.0 netmask 255.255.0.0 {
  range 172.31.30.10 172.31.30.79;
  subclass "vendor-class" "SSE-F3548S" {
    option smc-op.config-file-name "iss-11.conf";
    option smc-op.fw-img-file-name "SSE-3548-fw-1.2.0.3.swi";
    option tftp-server-name "172.31.33.5";
  }
}
```

2.9Tracking Uplink Failures

The Uplink Failure Tracking Feature (ULFT) is useful for Supermicro switches. This helps servers move to down stream Ethernet ports in case any switch uplink fails.

The user can configure one or more groups for ULFT. Each group can have one or more uplinks and one or more downstream ports.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	***link-status-tracking enable***	Enabling uplink failure tracking feature
Step 3	***link-status-tracking group <id>***	Creating group
Step 4	***link-status-tracking group <id> upstream***	Adding uplink to group
Step 5	***link-status-tracking group <id> downstream***	Adding downstream ports to group
Step 6	***link-status-tracking disable***	Disabling uplink failure tracking feature
Step 7	**End**	Exits the configuration mode.
Step 8	***show link-status-tracking***	Displays the link-status-tracking configuration.
Step 9	**write startup-config**	Optional step – saves this configuration to be part of startup configuration.

For example, if it is desired to bring down all fourteen ports from fx 0/1 to fx 0/14 when uplink interfaces Cx 0/1 and Cx 0/2 go down:

```
SMIS# configure terminal
SMIS(config)# link-status-tracking enable
SMIS(config)# link-status-tracking group 1
SMIS(config)# interface range Cx 0/1-2
SMIS(config-if)# link-status-tracking group 1 upstream
SMIS(config-if)# exit
SMIS(config)# interface range fx0/1-14
SMIS(config-if)# link-status-tracking group 1 downstream
SMIS(config-if)# exit
SMIS(config)# link-status-tracking disable
SMIS(config)# show link-status-tracking
```

If more than one uplink ports are configured, all downstream ports will be brought down only when all upstream ports are down.

2.10 Loop Protection

Loop protection feature helps to detect and prevent network loops. This loop protection feature is independent of the spanning tree protocol.

This feature can be used when the switches are connected to unmanaged devices where spanning tree cannot prevent network loops.

This feature detects networks loops by transmitting Ethernet control packets.

When the loop detected the switch discards all the packets from the loop detected port. When the loop disappears switch automatically move the port to forwarding without user administration.

2.10.1 Defaults

Loop Proteciton feature is disabled by default.

2.10.2 Enable Loop Protection

Loop Protection feature need to be enabled both globally and also on the interface level.

It can be enabled on all the interfaces or on selected interfaces.

Use the below commands to enable loop protection feature.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**loop-protect enable**	Enabling the loop protection feature globally
Step 3	***Interface <ifname> <ifid>***	Enter the interface configuration mode
Step 4	***loop-protect***	Enabling the loop protection feature on this interface
Step 5	**End**	Exits the configuration mode.
Step 6	***show loop protection***	Displays the loop protection configuration.
Step 7	**write startup-config**	Optional step – saves this configuration to be part of startup configuration.

2.10.3 Disable Loop Protection

Loop Protection feature need to be disabled both globally and also on the interface level.

To disable loop protection on particular interface, use the below commands.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	***interface <ifname> <ifid>***	Enter the interface configuration mode

Step 3	***no loop-protect***	Disabling the loop protection feature on this interface
Step 4	**End**	Exits the configuration mode.
Step 5	***show loop protection***	Displays the loop protection configuration.
Step 6	**write startup-config**	Optional step – saves this configuration to be part of startup configuration.

To disable loop protection on particular interface, use the below commands.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 3	**loop-protect disable**	Disabling the loop protection feature globally
Step 4	**End**	Exits the configuration mode.
Step 5	***show loop protection***	Displays the loop protection configuration.
Step 6	**write startup-config**	Optional step – saves this configuration to be part of startup configuration.

3 VLAN

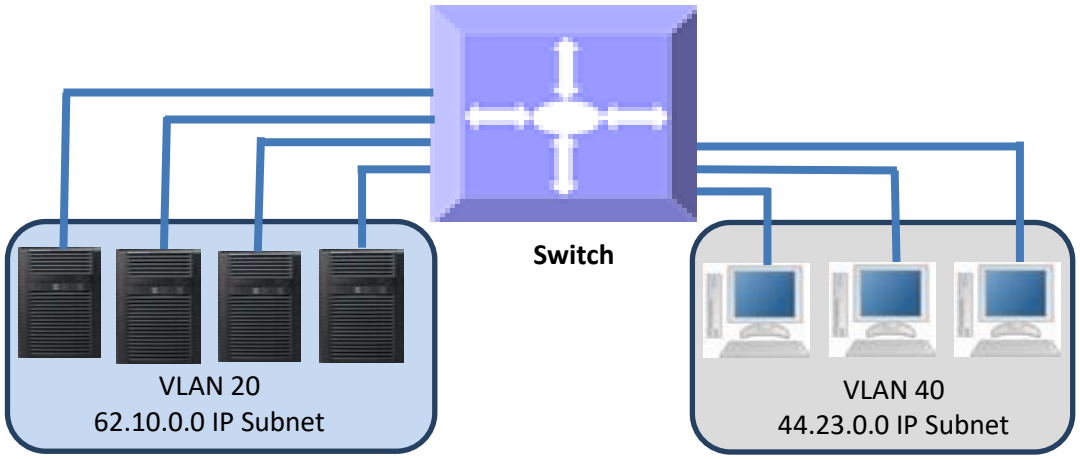
3.1VLAN Basics

A Virtual LAN (VLAN) is a logical switched LAN formed by segmenting physical Local Area Networks (LANs).

Segmenting a switched LAN as one or more VLANs provides the following advantages:

- ⇒ Limits multicast and broadcast floods only to the required segments of the LAN to save LAN bandwidth
- ⇒ Provides secured LAN access by limiting traffic to specific LAN segments
- ⇒ Eases management by logically grouping ports across multiple switches

Figure VLAN-1: VLANs on a Switched LAN

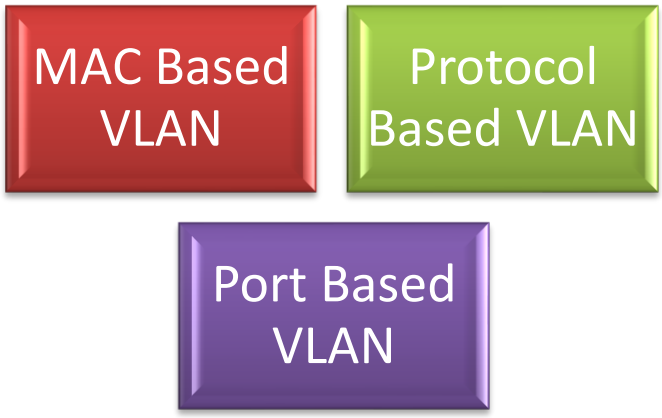


VLANs work in same way as physical LANs. The packets from the end stations of a VLAN are switched only to other end stations or network devices inside that VLAN. To reach devices in another VLAN, the packets have to be routed from one VLAN to another. Supermicro L2/L3 switches support such Inter VLAN routing to route packets across different VLANs. Inter VLAN routing is done by creating “Layer 3 Interface VLANs”.

3.2 VLAN Support

Supermicro switches support the three types of VLANs: MAC based VLANs, protocol based VLANs and port based VLANs.

Figure VLAN-2: Types of VLANs Supported



Once a packet is received, a switch tries to identify the VLAN for the received packet. This VLAN identification is done according to the procedure below.

If the incoming packet has a VLAN tag and the VLAN ID in the tag is not equal to zero, then this VLAN ID is used as the VLAN for this packet.

If the incoming packet does not have a VLAN tag (untagged packet) or if the VLAN ID in the VALN tag is equal to zero (priority tagged packet), the packet is considered as untagged/priority tagged and the below steps are used to identify the VLAN for this untagged/priority tagged packet.

Step 1: Use the source MAC of the incoming packet and check the MAC VLAN mapping. If the VLAN is found for this source MAC, that VLAN ID is used as the VLAN for this packet. If the MAC VLAN is not found, proceed to the next step.

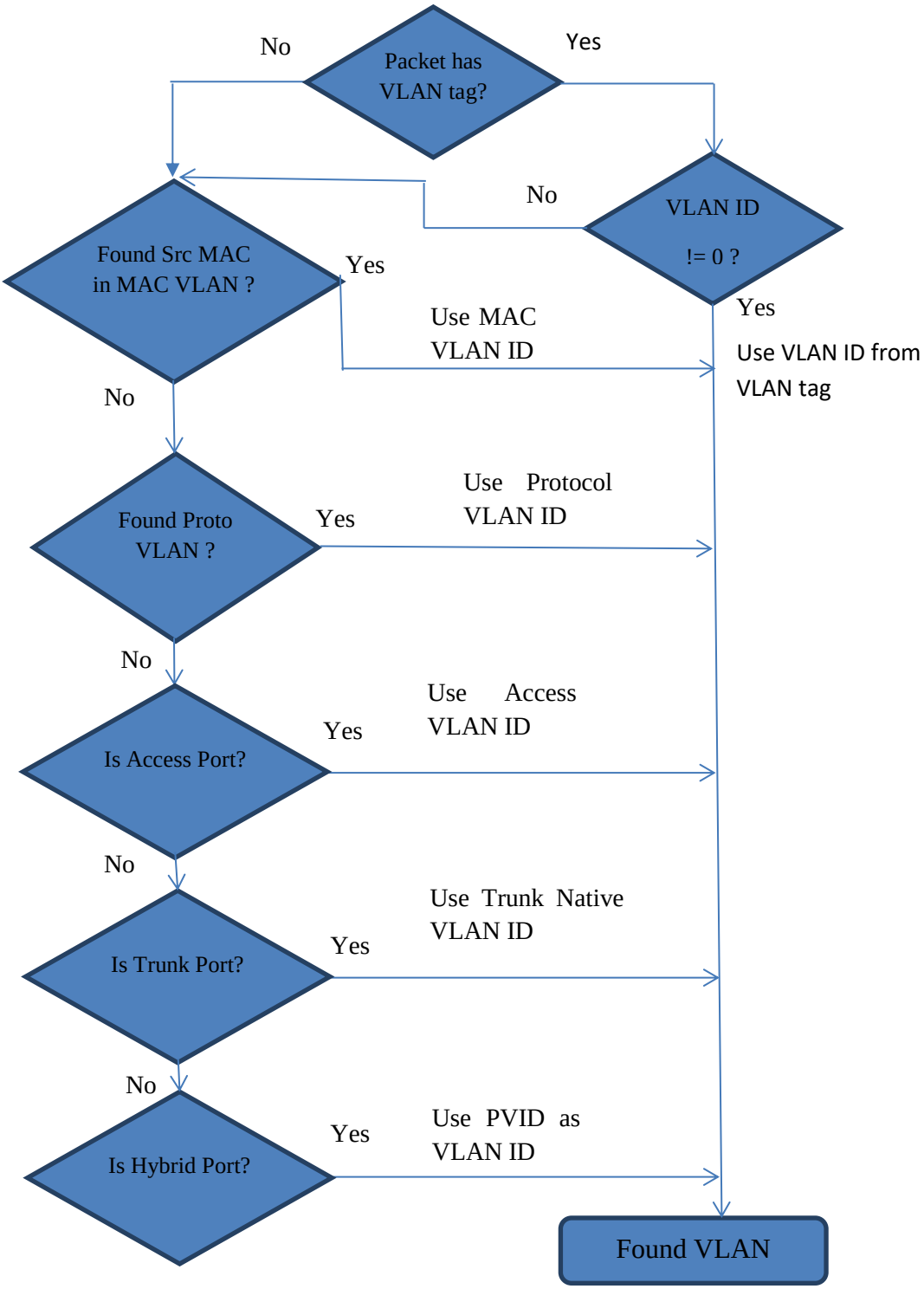
Step 2: Use the protocol field from the incoming packet layer 2 header and check the protocol VLAN table. If a protocol VLAN is found, that VLAN ID is used as the VLAN for this packet. If a protocol VLAN is not found, proceed to the next step.

Step 3: This step identifies the VLAN based on a port based VLAN configuration. If the received port is in access mode, the configured access VLAN (default is VLAN 1) is used as the VLAN for this packet. If the received port is in trunk mode, the configured trunk native VLAN (default is VLAN 1) is used as the VLAN for this packet. If the received port is in hybrid mode, the configured PVID (default is VLAN 1) is used as the VLAN for this packet.

This VLAN identification procedure is shown in Figure VLAN-3: VLAN Identification Procedure.

Once the VLAN is identified for the received packet, the switch checks if the received port is a member of this identifier VLAN. If the received is not member of the identified VLAN, the packet is dropped. If the received port is a member of the identified VLAN, then it will be forwarded to other member ports of this VLAN based on the forwarding logic. If there are no other member ports for this VLAN, the packet will most likely be dropped unless it was routed or sent to the CPU or redirected by an ACL rule.

Figure VLAN-3: VLAN Identification Procedure



3.3VLAN Numbers

SSE-F3548S/SR and SSE-X3548S/SR switches support 4K static VLANs.

SSE-F3548S/R and SSE-X3548S/SR switches support VLAN identifiers from 1 to 4069 for user created VLANs. VLAN identifiers 4070 to 4094 are reserved for internal use.

The command "**show vlan device info**" displays the maximum VLAN identifiers and total number of VLANs supported by the switch.

SSE-F3548S/SR and SSE-X3548S/SR switches support 1024 MAC based VLANs.

Supermicro switches support 16 protocol groups for protocol based VLANs. These 16 protocol groups can be mapped to different VLANs in every port. The same protocol group can be associated with different VLANs in different ports.

3.4 VLAN Defaults

Supermicro switches boot up with VLAN 1, which is a default Layer 2 VLAN. The switchable ports of all switches are added to this default VLAN 1 as hybrid ports. This default setup helps switch forwarding traffic across all the ports without the need of any user configuration.

Users can modify the port members of this VLAN 1 by adding or removing any ports to this VLAN 1 as either tagged or untagged ports. The easier way is to change the port modes to either "Access" or "Trunk" ports and configure the relevant VLANs. The "Access" and "Trunk" modes are described in detail in later sections.

VLAN 1 cannot be deleted by the user. If user wants to prohibit traffic from/to VLAN 1, then remove all the ports from VLAN 1 by using the "**no ports**" command available in the VLAN configuration mode. After removing all the ports, "show vlan id 1" command should display 'none' as shown below.

```
SMIS(config)# show vlan id 1

Vlan database
-------------
Vlan ID                : 1
Member Ports           : None
Hybrid Tagged Ports    : None
Hybrid Untagged Ports  : None
Hybrid Forbidden Ports : None
Access Ports           : None
Trunk Ports            : None
Name                   :
Status                 : Permanent
--------------------------------------------------
```

```
SMIS(config)#
```

The port based VLAN identifier (PVID) for all the switch ports is set to 1 by default. The PVID is used to associate incoming untagged packets to port based VLANs for the ports in “Hybrid” mode. Users can modify the PVID for switch ports to any VLAN identifier for “Hybrid” ports.

The switch port mode is set to “hybrid” for all switch ports by default. Users can change the port mode as explained in the Port Based VLAN section.

VLAN 1 is configured as the default native VLAN for all trunk interfaces. Users can change the native VLANs for trunk interfaces as explained in the Native VLAN on Trunk section.

Protocol based VLAN is enabled by default.

Supermicro switches do not create VLANs by default except for VLAN 1. Users need to create all the VLANs used on their network in Supermicro switches. Trunk ports will be able to carry only VLANs created in Supermicro switches.

3.5 Creating VLANs

Follow the steps below to create VLANs in Supermicro switches.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**vlan <***vlan-list***>**	Creates a VLAN using **vlan** command. *vlan-list* – may be any vlan number or list of vlan numbers. Multiple vlan numbers can be provided as comma-separated values. Consecutive vlan numbers can be provided as a range, such as 5-10. User can configure VLANs with identifiers 1 to 4069.
Step 3	**show vlan**	Displays the configured VLANs
Step 4	**write startup-config**	Optional step – Save these VLAN configuration to be part of startup configuration.

The examples below show various ways of creating VLANs.

Create a VLAN with identifier 10

SMIS# **configure terminal**
SMIS(config)# **vlan 10**
SMIS(config-vlan)# **exit**

Create VLANs with identifiers 20 to 30, 50 and 100

SMIS# **configure terminal**
SMIS(config)# **vlan 20-30,50,100**
SMIS(config-vlan)# **exit**

3.6 Removing VLANs

Follow the steps below to remove VLANs from Supermicro switches.

Step	Command	Description
Step 1	**configure terminal**	Enter the configuration mode
Step 2	**no vlan <***vlan-list***>**	Remove VLANs using the **no vlan** command. *vlan-list* – may be any vlan number or list of vlan numbers. Multiple vlan numbers can be provided as comma separated list. Consecutive vlan numbers can be provided as ranges like 5-10.
Step 3	**show vlan**	To display the configured VLANs
Step 4	**write startup-config**	Optional step – Save these VLAN configuration to be part of startup configuration.

The below examples show ways to remove VLANs.

Delete a VLAN with identifier 10

SMIS# **configure terminal**
SMIS(config)# **no vlan 10**

Delete VLANs with identifier 20 to 30, 50 and 100
SMIS# **configure terminal**
SMIS(config)# **no vlan 20-30,50,100**
SMIS(config-vlan)# **exit**

3.7 VLAN Name

VLANs can be associated with a label name string for easier configuration and identification.

Follow the steps below to add or modify a name string to any VLAN in Supermicro switches.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**vlan <***vlan-list***>**	Enters the VLAN configuration mode. *vlan-list* – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10. If multiple VLANs are provided, the same name string provided in next step will be associated with all these VLANs.
Step 3	**name <***vlan-name-string***>**	Associates a name string to this VLAN using the **name** command. *vlan-name-string* is any alphanumeric string up to 32 characters.
Step 4	**show vlan**	Displays the configured VLANs
Step 5	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The example below shows the steps necessary to associate a name string to a VLAN.

Associate name main_user_vlan to VLAN 50.

SMIS# **configure terminal**
SMIS(config)# **vlan 50**
SMIS(config-vlan)# **name main_user_vlan**
SMIS(config-vlan)# **exit**

Follow the steps below to remove a name string from any VLAN in a Supermicro switch.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**vlan <***vlan-list***>**	Enters the VLAN configuration mode. *vlan-list* – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10. If multiple VLANs are provided, the name string of all these VLANs will be removed by the next step.

Step 3	**no name**	Removes associated name string from this VLAN.
Step 4	**show vlan**	Displays the configured VLANs
Step 5	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The example below shows steps to remove name string from a VLAN.

Remove name from VLAN 50.

SMIS# **configure terminal**
SMIS(config)# **vlan 50**
SMIS(config-vlan)# **no name**
SMIS(config-vlan)# **exit**

3.8 Port Based VLANs

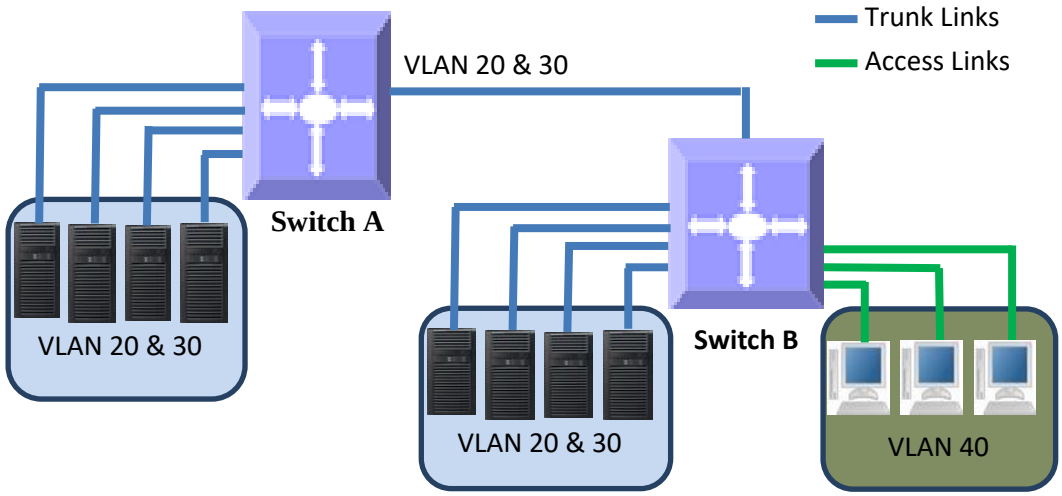
Port based VLANs are the simplest and most useful type of VLAN.

In port based VLAN deployment, switch ports are associated with one or more VLANs as member ports.

The traffic sent on the ports is decided by the VLAN membership and mode of the ports. Usually ports are associated with VLANs as either “access” port members or “trunk” port members. Supermicro switches support an additional port mode called “hybrid”.

Port Channel interfaces also can be configured as VLAN member ports.

Figure VLAN-4: Port Based VLANs



3.8.1 Access Ports

Access ports carry the traffic of only one VLAN. Any switch port can be configured as an access port. Usually switch ports connected to end stations (computers / servers) that have only one type of traffic are configured as access ports.

Access ports cannot be configured to be part of more than one VLAN.

Switches will not add VLAN tag headers to all the packets sent out on an access port. Switches expect to receive untagged or priority tagged (VLAN identifier 0) packets only at the access ports. If any tagged packets are received on an access port, the switch will drop them. Follow the below steps to configure any port as the access port of any VLAN.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po *interface-id* is in *slot/port* format for all physical interfaces. It may be the port channel identifier for port channel interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **int range fx 0/1-10** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **int range fx 0/1-10, fx 0/20**
Step 3	**switchport mode access**	Sets the port mode as the access port.
Step 4	**switchport access vlan** <*vlan-id*>	Configures the access VLAN for this interface. The VLAN identifiers may be any VLAN number from 1 to 4069. If the given VLAN does not exist, switch will provide a warning message. Only when the VLAN available, the port will operate as an access port for that VLAN.

Step 5	**show vlan port config port** <*iftype*> <*ifnum*>	Displays the configured mode and accesses the VLAN for this interface.
Step 6	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The "switchport access vlan" command will be accepted only if the port is in access mode.

The "**no switchport mode**" command will change the port mode to the default hybrid mode. For more details about hybrid mode, refer to the Hybrid Ports section.

The "**no switchport access vlan**" command will set the access VLAN as default VLAN 1. The port will continue to be the access port of VLAN 1.

The examples below show various ways to create VLANs with access ports.

Create a VLAN with identifier 50 and configure ports fx 0/2 to fx 0/10 as access ports to this VLAN.

SMIS# **configure terminal**
SMIS(config)# **vlan 50**
SMIS(config-vlan)# **exit**
SMIS(config)# **interface range fx 0/2-10**
SMIS(config-if)# **switchport mode access**
SMIS(config-if)# **switchport access vlan 50**
SMIS(config-if)# **exit**

Create a VLAN with identifier 10 and configure port channel 1 as access port to this VLAN.

SMIS# **configure terminal**
SMIS(config)# **vlan 10**
SMIS(config-vlan)# **exit**
SMIS(config)# **interface po 1**
SMIS(config-if)# **switchport mode access**
SMIS(config-if)# **switchport access vlan 10**
SMIS(config-if)# **exit**

3.8.2 Trunk Ports

Trunk ports carry the traffic of one or more VLANs. Any switch port can be configured as a trunk port. Usually switch ports connected between switches are configured as trunk ports to carry multiple VLAN traffic across switches. Switch ports connected to end stations (computers / servers) that have multiple VLANs are also configured as trunk ports.

When a switch port is configured as a trunk port, it will be added to all the VLANs in the switch as a tagged port by default. To restrict the VLANs carried in trunk ports, refer to the Allowed VLANs on a Trunk section.

Trunk ports will not carry traffic for VLANs that are not configured in a switch.
For example, if the user wants to carry traffic for all the VLANs from 1 to 1024 in a trunk port, VLANs 1 to 1024 need to be created in the switch using the "**vlan**" command.

A switch adds the VLAN tag header to all packets sent out on the trunk port except for native VLAN traffic. Supermicro switches support only IEEE 802.1Q encapsulation for VLAN tag headers.

When a packet is received on a trunk port, the switch identifies the VLAN for the received packet from the packet's VLAN tag header. If the received packet did not have a VLAN identifier and the packet did not match any MAC or protocol VLAN, the native VLAN is used to determine the VLAN for all untagged and priority tagged packets that are received.

If the user has not configured a native VLAN, the default VLAN 1 will be used as native VLAN for the trunk ports.

Follow the steps below to configure any port as a trunk port.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po *interface-id* is in *slot/port* format for all physical interfaces. It may be a port channel identifier for port channel interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range, use a hypen (-) between the start and end interface numbers. E.g.: **int range fx 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range fx 0/1-10, fx 0/20**
Step 3	**switchport mode trunk**	Sets the port mode as a trunk port.
Step 4	**show vlan port config port** <*iftype*> <*ifnum*> and **show running-config**	Displays the configured mode for this interface.
Step 5	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The "**no switchport mode**" command will change the port mode to the default hybrid mode. For more details about hybrid mode, refer to the Hybrid Ports section.

The examples below show various ways to configure trunk ports.

Configure port fx 0/1 and fx 0/2 as trunk ports.

SMIS# **configure terminal**
SMIS(config)# **interface range fx 0/1-2**
SMIS(config-if)# **switchport mode trunk**
SMIS(config-if)# **exit**

Configure port channel 1 as a trunk port.

SMIS# **configure terminal**
SMIS(config)# **interface po 1**
SMIS(config-if)# **switchport mode trunk**
SMIS(config-if)# **exit**

3.8.2.1 Allowed VLANs on a Trunk

By default, all the VLANs configured on a switch are allowed on the trunk interfaces. However, there may be some cases where users would like to limit the number of VLANs carried on the trunk ports. This can be configured by following the steps below.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po *interface-id* is in *slot/port* format for all physical interfaces. It may be a port channel identifier for port channel interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range, use a hypen (-) between the start and end interface numbers. E.g.: **int range fx 0/1-10**

		To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range fx 0/1-10, fx 0/20**
Step 3	**switchport mode trunk**	Sets the port mode as trunk port.
Step 4	Use any one of the below steps 4a to 4f based on the need.	The *vlan-list* parameter used in the below commands could be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10.
Step 4a	**switchport trunk allowed vlan** <*vlan-list*>	This command configures the list of allowed VLANs on this trunk. Only the VLANs provided on the *vlan-list* will be carried over the trunk.
Step 4b	**switchport trunk allowed vlan add** <*vlan-list*>	This command adds the given list of VLANS to the existing set of allowed VLANs on this trunk.
Step 4c	**switchport trunk allowed vlan remove** <*vlan-list*>	This command removes the given list of VLANS from the existing set of allowed VLANs on this trunk.
Step 4d	**switchport trunk allowed vlan except** <*vlan-list*>	This command makes all the configured VLANs allowed on this trunk except for the given list of VLANs.
Step 4e	**switchport trunk allowed vlan all**	This command sets the default behavior of allowing all VLANs configured in the switch as allowed VLANs on this trunk.
Step 4f	**switchport trunk allowed vlan none**	This command removes all the allowed VLANs from this trunk.
Step 5	**show vlan port config port** <*iftype*> <*ifnum*> and **show running-config**	Displays the configured, allowed VLANs for this trunk interface.
Step 6	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The "switchport trunk allowed vlan …" commands will be accepted only if the port is in trunk mode.

A trunk port will not carry traffic for any VLANs that are not configured in the switch. For example, if a user wants to allow traffic for VLANs 1 to 100, VLANs 1 to 100 need to be created in the switch using the "**vlan**" command.

The examples below show examples of configurations to allow VLANs on trunk ports.

Configure to allow only VLANs 2 to 20 on trunk interface fx 0/1.

SMIS# **configure terminal**
SMIS(config)# **vlan 2-20**
SMIS(config-vlan)# **exit**
SMIS(config)# **interface fx 0/1**
SMIS(config-if)# **switchport mode trunk**
SMIS(config-if)# **switchport trunk allowed vlan 2-20**
SMIS(config-if)# **exit**

Configure to not to allow VLANs 30 to 50 on trunk interface fx 0/1.

SMIS# **configure terminal**
SMIS(config)# **interface fx 0/1**
SMIS(config-if)# **switchport mode trunk**
SMIS(config-if)# **switchport trunk allowed vlan except 30-50**
SMIS(config-if)# **exit**

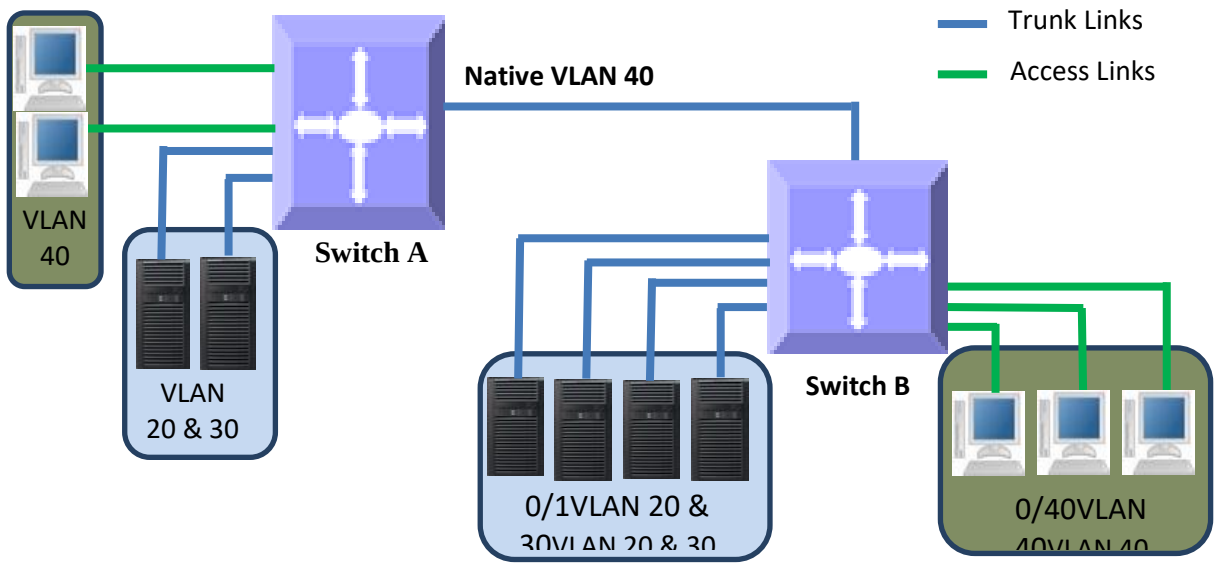
3.8.2.2 Native VLAN on Trunk

All packets sent out on a trunk interface carry the 802.1Q VLAN tag header. There may be cases in which untagged packets need to be carried over a trunk interface. This is achieved by using the native VLAN feature of the trunk interface.

Any VLAN can be configured on any trunk interface as a native VLAN. Trunk interfaces will send native VLAN packets as untagged packets without adding the 802.1Q VLAN tag header. Similarly, any untagged packets received on a trunk interface will be considered to be native VLAN packets.

VLAN 1 is the default native VLAN for all trunk interfaces.

Figure VLAN-5: Native VLANs



Users can configure a native VLAN for trunk interfaces by following the steps below.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po *interface-id* is in *slot/port* format for all physical interfaces. It may be a port channel identifier for port channel interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range, use a hypen (-) between the start and end interface numbers. E.g.: **int range fx 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range fx 0/1-10, fx 0/20**
Step 3	**switchport mode trunk**	Sets the port mode as a trunk port.
Step 4	**switchport trunk native vlan** <*vlan-id* >	*vlan-id* - The VLAN identifiers may be from 1 to 4069. If the given VLAN does not exist, switch will provide a warning message. In this case the native VLAN traffic will be dropped until the VLAN become available. Also, the given VLAN should be part of allowed VLANs in the trunk. If the native VLAN is not member of allowed VLAN list, the native VLAN packets will be dropped.
Step 5	**show vlan port config port** <*iftype*> <*ifnum*> and **show running-config**	Displays the configured native VLAN for this trunk interface.
Step 6	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The "switchport trunk native vlan" command will be accepted only if the port is in trunk mode.

The "**no switchport trunk native vlan**" command will reset the native VLAN as VLAN 1 for trunk interfaces.

The native VLAN needs to be part of allowed VLANs to pass native VLAN traffic.

The examples below show examples of configuring native VLANs for trunk ports.

Configure VLAN 20 as a native VLAN for trunk interface fx 0/1.

SMIS# **configure terminal**
SMIS(config)# **vlan 20**
SMIS(config-vlan)# **exit**
SMIS(config)# **interface fx 0/1**
SMIS(config-if)# **switchport mode trunk**
SMIS(config-if)# **switchport trunk native vlan 20**
SMIS(config-if)# **exit**

Remove a native VLAN from trunk interface fx 0/1.

SMIS# **configure terminal**
SMIS(config)# **interface fx 0/1**
SMIS(config-if)# **no switchport trunk native vlan**
SMIS(config-if)# **exit**

3.8.3 Hybrid Ports

Hybrid ports carry both untagged and 802.1Q tagged packets.

Hybrid ports carry the traffic of one or more VLANs. Any switch port can be configured as a hybrid port. In Supermicro switches, all switch ports by default come up in hybrid mode.

Users need to explicitly add the hybrid ports to all the required VLANs as either tagged or untagged interfaces. A hybrid port could be configured as a tagged or untagged port simultaneously on one or more VLANs.

Users need to configure the PVID for hybrid ports to correctly handle the incoming untagged packets.

It is recommended for users to use hybrid ports only when they thoroughly understand the PVID, tagged and untagged interfaces of their network.

Hybrid ports might cause VLAN packet forwarding drops if the ports are not correctly added to the required VLANs as untagged or tagged interfaces as needed.

Hybrid port functionality can be achieved through trunk ports with allowed VLANs and a native VLAN configuration.

When MAC based VLANs and protocol based VLANs are used, the ports need to be in "Hybrid" mode.

A switch adds the 802.1Q VLAN tag header for VLAN traffic in which the hybrid port is configured as a tagged interface. The switch sends out packets without a VLAN tag header for the VLAN on which the hybrid port is configured as an untagged interface.

When a packet is received on a hybrid port, a switch identifies the VLAN for the received packet from the packet's VLAN tag header. If the received packet did not have a VLAN identifier and the packet did not match any MAC or protocol VLAN, the port PVID is used as the VLAN for all the received untagged and priority tagged packets. If the user has not configured the PVID, VLAN 1 will be used as the default PVID for hybrid ports.

Follow the steps below to configure any port as a hybrid port.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**vlan <***vlan-list***>**	*vlan-list* – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10. If multiple VLANs are provided, the ports configuration provided in the next steps will be applied to all these VLANs.
Step 3	Use steps 3a to 3c below one or more times to configure the required port configurations for the VLANs provided in Step 2 above.	
Step 3a	**ports <***ports-list***> tagged** or **no ports [<***ports-list***>] tagged**	Adds the tagged ports list to this VLAN. *ports-list* – up to three ports or three ranges of ports separated by spaces. The range of ports is provided in the format fx 0/1-10, which specifies the ports from fx 0/1 to fx 0/10. Use the **no** form of this command to remove tagged ports from this VLAN. If *ports-list* is not provided to the **no** command, all the tagged ports are removed from this VLAN.
Step 3b	**ports <***ports-list***> untagged** or **no ports [<***ports-list***>] untagged**	Adds the untagged ports list to this VLAN.

		ports-list – up to three ports or three ranges of ports separated by spaces. The range of ports is provided in the format fx 0/1-10, which specifies the ports from fx 0/1 to fx 0/10. Use the **no** form of this command to remove untagged ports from this VLAN. If *ports-list* is not provided to the **no** command, all the untagged ports are removed from this VLAN.
Step 3c	**ports <***ports-list***> forbidden** or **no ports [<***ports-list***>] forbidden**	Denies traffic from ports given by *ports-list* to this VLAN. *ports-list* – up to three ports or ranges of ports separated by spaces. The range of ports is provided in the format fx 0/1-10, which specifies the ports from fx 0/1 to fx 0/10. Use the **no** form of this command to remove forbidden ports from this VLAN. If *ports-list* is not provided to the **no** command, all the forbidden ports are removed from this VLAN.
Step 4	**Exit**	Exits the VLAN configuration mode.
Step 5	**interface <***interface-type***> <***interface-id***>** or **interface range** <*interface-type*> <*interface-id*> ….	Enters the interface mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po *interface-id* is in *slot/port* format for all physical interfaces. It may be a port channel identifier for port channel interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range, use a hypen (-) between the start and end interface numbers. E.g.: **int range fx 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range fx 0/1-10, fx 0/20**
Step 6	**switchport mode hybrid**	Sets the port mode as a hybrid port.

Step 7	**switchport pvid** <*vlan-id*>	Configures the PVID for this interface. The VLANs identifiers could be any VLAN number from 1 to 4069. The VLAN provided in this command must exist in the switch. If the VLAN does not exist, create it first. This command accepted only when the port is “Hyrbrid” mode.
Step 8	**show vlan port config port** <*iftype*> <*ifnum*> **show running-config** **show vlan**	Displays the configured VLAN and ports information.
Step 9	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The “ports …” command can be used only for the ports in “hybrid” mode.

The “switchport pvid ...” command will be accepted only when a port is in “hybrid” mode.

A port can be configured as a tagged port for multiple VLANs.

A port can be configured as an untagged port for multiple VLANs. This is useful for MAC based VLANs. For a port based VLAN configuration, having a port as untagged in multiple VLANs is not a recommended configuration as all the received untagged packets can be associated with only one PVID of that port. In a MAC based VLAN, the received untagged packets will be matched to different VLANs based on the MAC address on the packet.

The examples below show various ways to configure hybrid ports.

Configure a VLAN 10 with ports fx 0/1 to fx 0/10 as untagged ports and add port cx 0/1 as a tagged port to this VLAN.

SMIS# **configure terminal**
SMIS(config)# **vlan 10**
SMIS(config-vlan)# **ports fx 0/1-10 untagged**
SMIS(config-vlan)# **ports cx 0/1 tagged**
SMIS(config-vlan)# **exit**
SMIS(config)# **interface range fx 0/1-10**
SMIS(config-if)# **switchport mode hybrid**
SMIS(config-if)# **switchport pvid 10**
SMIS(config-if**)# exit**

Configure a VLAN 100 with ports fx 0/1, fx 0/10, fx 0/20, fx 0/30, fx 0/40 and cx 0/1-2 as untagged ports and add port channel 1 as a tagged port to this VLAN.

SMIS# **configure terminal**
SMIS(config)# **vlan 100**
SMIS(config-vlan)# **ports fx 0/1 fx 0/10 fx 0/20 untagged**
SMIS(config-vlan)# **ports fx 0/30 fx 0/40 cx 0/1-2 untagged**
SMIS(config-vlan)# **ports po 1 tagged**
SMIS(config-vlan)# **exit**
SMIS(config)# **interface range fx 0/1,fx 0/10, fx 0/20, fx 0/30, fx 0/40, cx 0/1-2**
SMIS(config-if)# **switchport mode hybrid**
SMIS(config-if)# **switchport pvid 100**
SMIS(config-if**)# exit**

3.9 MAC Based VLANs

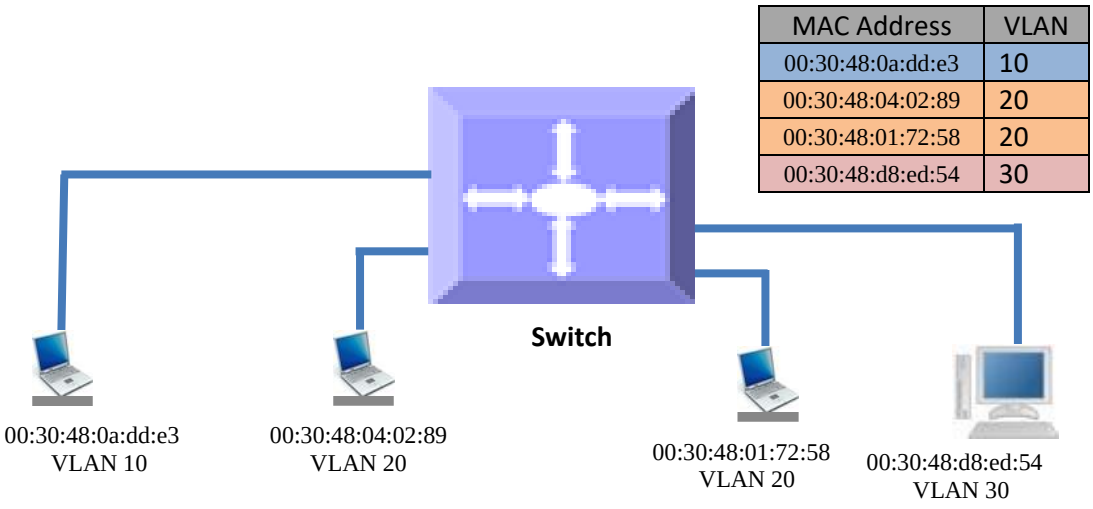
When end users move often from one place to another but remain inside the same LAN, it is difficult to maintain the same VLAN for an end user in a port based VLAN configuration.

MAC based VLAN features are used to provide the same VLAN to any end user irrespective of the switch port the end user is connecting to.

The switch administrator may configure MAC to VLAN mappings for unicast MAC addresses. When a switch receives any untagged packets, the source MAC address of the packet refers to this MAC VLAN mapping to identify the VLAN. If MAC VLAN mapping is not found for the received source MAC address, a protocol based VLAN or port based VLAN is used.

Supermicro switches support 1024 MAC based VLANs.

Figure VLAN-6: MAC Based VLANs



Follow the steps below to configure MAC based VLANs.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**vlan <***vlan-list***>**	Creates the required VLANs. *vlan-list* – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma separated values. Consecutive VLAN numbers can be provided as ranges such as 5-10.
Step 3	**ports <***ports-list***> untagged**	Adds the ports given by *ports-list* to this VLAN as untagged ports. *ports-list* – up to three ports or ranges of ports separated by spaces. The range of ports is provided in the format fx 0/1-10, which specifies the ports from fx 0/1 to fx 0/10.
Step 4	**Exit**	Exits the VLAN configuration mode.
Step 5	**mac-vlan** <ucast_mac> **vlan** <*vlan-id*>	Configures MAC VLAN mapping entry. *ucast_mac* – Unicast MAC address. This VLAN will be applied to all incoming untagged packets from this unicast MAC address. *vlan-id* - VLAN identifiers may be any VLAN number from 1 to 4069. The VLAN must have already been created in this switch.
Step 6	**show mac-vlan**	Displays the configured MAC based VLANs.
Step 7	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

User has to create the VLANs using the "**vlan** .." command prior to configuring MAC address VLAN mapping.

The ports required to support MAC VLAN have to be configured as untagged ports in the hybrid mode to those VLANs.

Follow the steps below to remove MAC based VLANs.

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

Step 2	**no mac-vlan** <ucast_mac>	Removes MAC VLAN mapping entry. *ucast_mac* – Unicast MAC address for which MAC VLAN mapping is to be removed.
Step 3	**show mac-vlan**	Displays the configured MAC based VLANs.
Step 4	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The examples below show various ways to configure MAC based VLANs.

Create a VLAN 10 and configure MAC address 00:30:40:10:10:10 to VLAN 10 for the ports fx 0/1 to 10

SMIS# **configure terminal**
SMIS(config)# **vlan 10**
SMIS(config-vlan)# ports fx 0/1-10 untagged
SMIS(config-vlan)# **exit**
SMIS(config)# **mac-vlan 00:30:40:10:10:10 vlan 10**

Remove MAC VLAN for MAC address 00:30:40:20:20:20.

SMIS# **configure terminal**
SMIS(config)# **no mac-vlan 00:30:40:20:20:20**

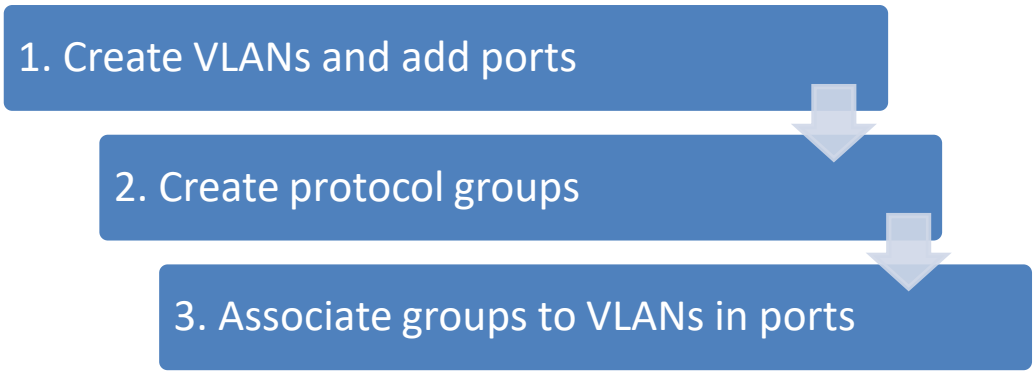
3.10 Protocol Based VLANs

Protocol based VLAN features help to classify incoming traffic to different VLANs based on the protocol. The protocol or ethertype field in the Layer 2 header is used to classify the packets to different VLANs.

Protocol VLAN features are enabled by default in Supermicro switches.

The protocol based VLAN features configuration is a three-step process, as shown in the diagram below.

Figure VLAN-7: Protocol Based VLAN Configuration Steps



Follow the steps below to configure protocol based VLANs.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**vlan <***vlan-list***>**	*vlan-list* – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10.
Step 3	**ports <***ports-list***> untagged**	Adds the required ports for this VLAN as untagged ports. *ports-list* – up to three ports or three ranges of ports separated by spaces. The range of ports is provided in a format like fx 0/1-10, which refers to ports from fx 0/1 to fx 0/10.
Step 4	**Exit**	Exits the VLAN configuration mode.
Step 5	**map protocol {arp | ip | rarp | ipx | novell | netbios | appletalk | other <***aa:aa or aa:aa:aa:aa:aa***>} {enet-v2 | RFC1042 | llcOther | snap8021H | snapOther} protocols-group <***Group id integer(0-2147483647***) >**	Creates a protocol group. Protocol group creation takes three parameters. First: protocol field as **arp, ip, rarp, ipx,novell, netbios** or **appletalk**. Users can enter any other two-byte protocol fields in hex format as aa:aa. Second: frame type as **enet-v2, llc** or **snap**. Third: protocol group identifier number.
Step 6	**interface <***interface-type***> <***interface-id***>** or **interface range** <*interface-type*> <*interface-id*> ….	Enters the interface mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po *interface-id* is in *slot/port* format for all physical interfaces. It could be the port channel identifier for port channel interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range, use a hypen (-) between the start and end interface numbers. E.g.: **int range fx 0/1-10**

		To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range fx 0/1-10, fx 0/20**
Step 7	**switchport map protocols-group <***Group id integer(0-2147483647***) > vlan <***vlan-id(1-4069***) >**	Associates the group to the VLAN on the above interface. *Group id* – Protocol Group Identifier *vlan-id* – VLAN identifier.
Step 8	**switchport pvid** <*vlan-id*>	Configures the PVID for the default port based VLAN behavior. This will be used for packets that did not match any protocol VLAN map. The VLAN identifiers may be any VLAN number from 1 to 4069. The VLAN provided in this command must exist in the switch. If the VLAN does not exist, create it first.
Step 9	**Exit**	Exits the interface configuration mode.
Step 10	**show vlan protocols-group** **show protocol-vlan**	Displays the configured protocol based VLANs.
Step 11	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

Follow the below steps to remove protocol based VLANs.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po *interface-id* is in *slot/port* format for all physical interfaces. It could be a port channel identifier for port channel interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range, use a hypen (-) between the start and end interface numbers.

		E.g.: **int range fx 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range fx 0/1-10, fx 0/20**
Step 3	**no switchport map protocols-group <***Group id integer(0-2147483647***) >**	Removes the protocol groups from interface mode. *Group id* – Protocol Group Identifier
Step 4	**Exit**	Exits VLAN configuration mode.
Step 5	**no map protocol {arp | ip | rarp | ipx | novell | netbios | appletalk | other <***aa:aa or aa:aa:aa:aa:aa***>} {enet-v2 | RFC1042 | llcOther | snap8021H | snapOther}**	Removes the protocol group. Before removing any protocol group, it must have been removed from all interfaces.
Step 6	**no vlan <***vlan-list***>** or **vlan <***vlan-list***>** **no ports <***ports-list***> untagged**	Removes the VLANs created for protocol based VLANs. If the VLAN is shared with a MAC or port based VLAN, then remove only the ports added during the protocol based VLAN configuration. To remove the ports use the "no ports" command in the VLAN configuration mode. *vlan-list* – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma separated values. Consecutive VLAN numbers may be provided as a range, such as 5-10.
Step 7	**show vlan protocols-group** **show protocol-vlan**	Displays the protocol based VLANs.
Step 8	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The examples below show various ways to configure protocol based VLANs.

Assign all IP traffic to VLAN 20 and all other traffic to VLAN 30 on ports fx 0/1 to fx 0/10.

SMIS# **configure terminal**
SMIS(config)# **vlan 20,30**
SMIS(config-vlan)# **po fx 0/1-10 untagged**
SMIS(config-vlan)# **exit**
SMIS(config)# **map protocol arp enet-v2 protocols-group 1**
SMIS(config)# **map protocol ip enet-v2 protocols-group 2**
SMIS(config)# **int range fx 0/1-10**
SMIS(config-if)# **switchport map protocols-group 1 vlan 20**
SMIS(config-if)# **switchport map protocols-group 2 vlan 20**

SMIS(config-if)# **switchport pvid 30**
SMIS(config-if)# **exit**

Remove protocol VLAN 20.

SMIS# **configure terminal**
SMIS(config)# **int range fx 0/1-10**
SMIS(config-if)# **no switchport map protocols-group 1**
SMIS(config-if)# **no switchport map protocols-group 2**
SMIS(config-if)# **exit**
SMIS(config)# **no map protocol arp enet-v2**
SMIS(config)#**no map protocol ip enet-v2**
SMIS(config)# **no vlan 20**

3.11 Acceptable Frame Types

By default, Supermicro switch ports accept all frames types – tagged, untagged and priority tagged.

Priority tagged packets have a VLAN tag header with a VLAN identifier of 0.

For access ports, the default acceptable frame type is untagged and priority tagged only.

Users can control this behavior to make switch ports accept either only tagged or untagged and priority tagged packets.

Follow the steps below to configure acceptable frame types for any port or port channel.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po *interface-id* is in *slot/port* format for all physical interfaces. It may be a port channel identifier for port channel interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range, use a hypen (-)

		between the start and end interface numbers. E.g. : **int range fx 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g. : **int range fx 0/1-10, fx 0/20**
Step 3	Use any of the below steps 3a to 3d to configure acceptable frame types for the ports provided in Step 2 above.	
Step 3a	**switchport acceptable-frame-type tagged**	This command makes only tagged frame types accepted on these ports. Any untagged or priority tagged packets received will be dropped.
Step 3b	**switchport acceptable-frame-type untaggedAndPrioritytagged**	This command makes only untagged and priority tagged frame types accepted on these ports. Any tagged packets received will be dropped.
Step 3c	**switchport acceptable-frame-type all**	This command makes accepting all frame types the default behavior.
Step 3d	**no switchport acceptable-frame-type**	This command makes accepting all frame types the default behavior.
Step 4	**show vlan port config port** <*iftype*> <*ifnum*>	Displays the configured mode and access VLAN for this interface.
Step 5	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The examples below show various ways to configure acceptable frame types on switch ports.

Configure fx 0/1 to fx 0/10 to accept only untagged and priority tagged packets.

SMIS# **configure terminal**
SMIS(config)# **interface range fx 0/1-10**
SMIS(config-if)# **switchport acceptable-frame-type untaggedAndPrioritytagged**
SMIS(config-if)# **exit**

Configure port channel interface 1 to accept only tagged packets.

SMIS# **configure terminal**
SMIS(config)# **interface po 1**
SMIS(config-if)# **switchport acceptable-frame-type tagged**
SMIS(config-if)# **exit**

3.12 Ingress Filter

By default, Supermicro switch has the ingress filter enabled. The ingress filter drops packets that do not match the configured VLAN membership.

For example, if the switch has two VLANs configured as 10 and 20, the ports configured with only VLAN 10 can accept packets with the VLAN header having VLAN identifier 20. This is called VLAN hoping. To prevent VLAN hoping, the ingress filter is enabled to drop those packets with a different VLAN identifier than the VLAN configured on the port.

The ingress filter can be disabled to allow VLAN hoping if needed.

Follow the steps below to enable/disable ingress filtering for any port or port channel.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po *interface-id* is in *slot/port* format for all physical interfaces. It may be a port channel identifier for port channel interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range, use a hypen (-) between the start and end interface numbers. E.g. : **int range fx 0/1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g. : **int range fx 0/1-10, fx 0/20**
Step 3	**switchport ingress-filter** **(or)** **no switchport ingress-filter**	This command enables ingress filtering function. This is the default behavior. The no form of this command disables ingress filtering.
Step 4	**show vlan port config port** <*iftype*> <*ifnum*>	Displays the configured ingress filter mode for this interface.
Step 5	**write startup-config**	Optional step – saves this VLAN configuration to be part of startup configuration.

The “no swithcport ingress-filter” command disables the ingress filter.

The examples below show how to enable ingress filter on switch ports.

Disable ingress filter for ports fx 0/1 to fx 0/10.

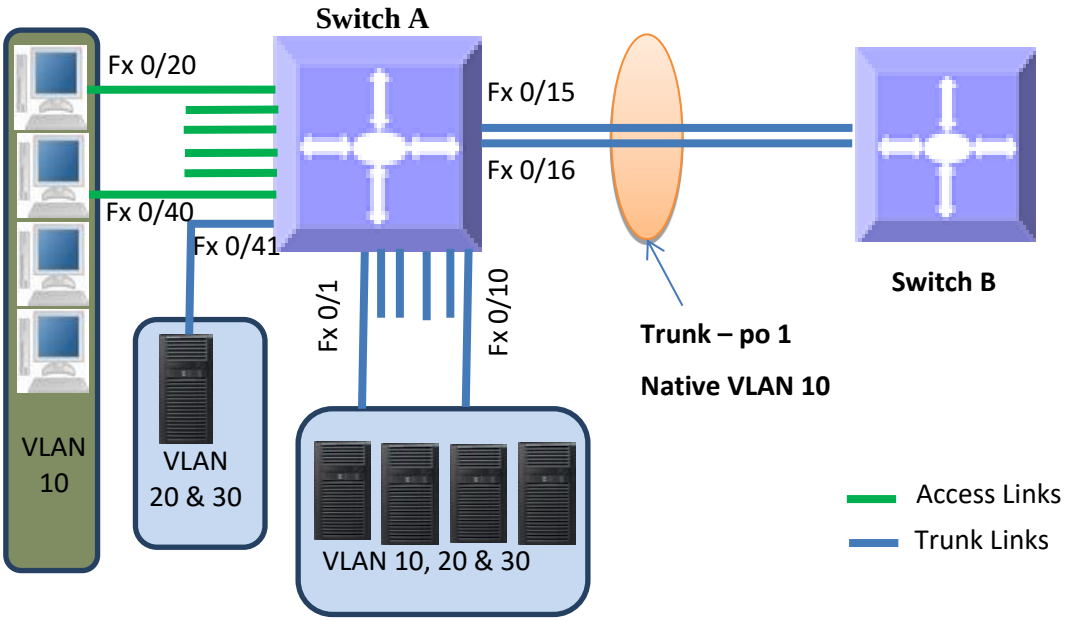
SMIS# **configure terminal**
SMIS(config)# **interface range fx 0/1-10**
SMIS(config-if)# **no switchport ingress-filter**
SMIS(config-if)# **exit**

3.13 VLAN Configuration Example

Configure the following requirements on switch A, as shown below in Figure VLAN-8.

1. Ports Fx 0/1 to Fx 0/10 are trunk ports connected to servers that have VLANs 10, 20 and 30. Here, VLAN 10 is untagged.
2. Port Fx 0/41 is a trunk port connected to storage, which carries VLAN 20 and 30.
3. Ports Fx 0/20 to Fx 0/40 are access ports for VLAN 10.
4. Ports Fx 0/15 and Fx 0/16 are part of a trunk port channel that carries all the VLANs to other switches with native VLAN 10.

Figure VLAN-8: VLAN Configuration Example



SMIS# **configure terminal**

Create all the VLANs first
SMIS(config)# vlan 10,20,30
SMIS(config-vlan)# exit

Configure VLANs for ports fx 0/1-10
SMIS(config)# **interface range fx 0/1-10**
SMIS(config-if)# **switchport mode trunk**
SMIS(config-if)# **switchport trunk native vlan 10**
SMIS(config-if)# **exit**

Configure VLANs for port fx 0/41
SMIS(config)# **int fx 0/41**
SMIS(config-if)# **switchport mode trunk**
SMIS(config-if)# **exit**

Configure the access VLAN for ports fx 0/20 to fx 0/40
SMIS(config)# **interface range fx 0/20-40**
SMIS(config-if)# **switchport mode access**
SMIS(config-if)# **switchport access vlan 10**
SMIS(config-if)# **exit**

Configure the port channel trunk interface on fx 0/15 and fx 0/16
SMIS(config)# **interface port-channel 1**
SMIS(config-if)# **exit**
SMIS(config)# **interface range fx 0/15-16**
SMIS(config-if)# **channel-group 1 mode on**
SMIS(config-if)# **exit**
SMIS(config)# **interface port-channel 1**
SMIS(config-if)# **switchport mode trunk**
SMIS(config-if)# **switchport trunk native vlan 10**
SMIS(config-if)# **end**

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

Building configuration...

ip address 172.31.30.120
interface port-channel 1
exit

Vlans and hybrid mode member ports configurations
vlan 1
 ports fx 0/11-14 untagged
 ports fx 0/17-19 untagged
 ports fx 0/41-48 untagged
 ports cx 0/1-6 untagged

```
exit
vlan 10,20,30
exit

interface Fx 0/1
 switchport mode trunk
 switchport trunk native vlan 10

interface Fx 0/2
 switchport mode trunk
 switchport trunk native vlan 10

interface Fx 0/3
 switchport mode trunk
 switchport trunk native vlan 10

interface Fx 0/4
 switchport mode trunk
 switchport trunk native vlan 10

interface Fx 0/5
 switchport mode trunk
 switchport trunk native vlan 10

interface Fx 0/6
 switchport mode trunk
 switchport trunk native vlan 10

interface Fx 0/7
 switchport mode trunk
 switchport trunk native vlan 10

interface Fx 0/8
 switchport mode trunk
 switchport trunk native vlan 10

interface Fx 0/9
 switchport mode trunk
 switchport trunk native vlan 10

interface Fx 0/10
 switchport mode trunk
 switchport trunk native vlan 10
```

```
interface Fx 0/15
 channel-group 1 mode on

interface Fx 0/16
 channel-group 1 mode on

interface Fx 0/20
 switchport mode access
 switchport access vlan 10

interface Fx 0/21
 switchport mode access
 switchport access vlan 10

interface Fx 0/22
 switchport mode access
 switchport access vlan 10

interface Fx 0/23
 switchport mode access
 switchport access vlan 10

interface Fx 0/24
 switchport mode access
 switchport access vlan 10

interface Fx 0/25
 switchport mode access
 switchport access vlan 10

interface Fx 0/26
 switchport mode access
 switchport access vlan 10

interface Fx 0/27
 switchport mode access
 switchport access vlan 10

interface Fx 0/28
 switchport mode access
 switchport access vlan 10

interface Fx 0/29
 switchport mode access
```

```
 switchport access vlan 10

interface Fx 0/30
 switchport mode access
 switchport access vlan 10

interface Fx 0/31
 switchport mode access
 switchport access vlan 10

interface Fx 0/32
 switchport mode access
 switchport access vlan 10

interface Fx 0/33
 switchport mode access
 switchport access vlan 10

interface Fx 0/34
 switchport mode access
 switchport access vlan 10

interface Fx 0/35
 switchport mode access
 switchport access vlan 10

interface Fx 0/36
 switchport mode access
 switchport access vlan 10

interface Fx 0/37
 switchport mode access
 switchport access vlan 10

interface Fx 0/38
 switchport mode access
 switchport access vlan 10

interface Fx 0/39
 switchport mode access
 switchport access vlan 10

interface Fx 0/40
 switchport mode access
```

```
 switchport access vlan 10

interface po 1
 switchport mode trunk
 switchport trunk native vlan 10

exit
SMIS# show vlan

Vlan database
-------------
Vlan ID: 1
Member Ports: fx 0/1-14 fx 0/17-19 fx 0/41-48 cx 0/1-6 po 1
Hybrid Tagged Ports: None
Hybrid Untagged Ports: fx 0/11-14 fx 0/17-19 fx 0/41-48 cx 0/1-6
Hybrid Forbidden Ports: None
Access Ports: None
Trunk Ports: fx 0/1-10 po 1
Name:
Status: Permanent
-----------------------------------------------------
Vlan ID: 10
Member Ports: fx 0/1-10 fx 0/20-40 po 1
Hybrid Tagged Ports: None
Hybrid Untagged Ports: None
Hybrid Forbidden Ports: None
Access Ports: fx 0/20-40
Trunk Ports: fx 0/1-10 po 1
Name:
Status: Permanent
-----------------------------------------------------
Vlan ID: 20
Member Ports: fx 0/1-10 po 1
Hybrid Tagged Ports: None
Hybrid Untagged Ports: None
Hybrid Forbidden Ports: None
Access Ports: None
Trunk Ports: fx 0/1-10 po 1
Name:
Status: Permanent
-----------------------------------------------------
Vlan ID: 30
Member Ports: fx 0/1-10 po 1
Hybrid Tagged Ports: None
```

Hybrid Untagged Ports: None
Hybrid Forbidden Ports: None
Access Ports: None
Trunk Ports: fx 0/1-10 po 1
Name:
Status: Permanent

SMIS#

3.14 Private Edge VLAN/Protected Ports

The private edge VLAN (also called the Protected Ports feature) helps to isolate traffic among the same VLAN ports. A protected port cannot forward any traffic to another protected port on the switch even if they are in the same VLAN.

Switch ports can be configured to operate in one of the following three modes.

3.14.1 Unprotected Port

By default all the ports in the switch are unprotected ports. Unprotected ports can send and receive traffic with all the other ports including other unprotected, protected and community ports based on the VLAN membership.

3.14.2 Protected Port

Protected ports can send and receive traffic only with unprotected ports in the same VLAN. A protected port cannot send or receive traffic with other protected ports or community ports. Protected ports are also called isolated ports.

3.14.3 Community Port

Community ports can send and receive traffic with unprotected ports and other ports in the same community.

Port Mode	Communicates with
Unprotected Ports	Unprotected Ports Protected Ports Community Ports
Protected Ports	Unprotected Ports
Community Ports	Unprotected Ports Other ports in the same community

3.15 Unprotected Ports Configuration

By default, all ports are unprotected ports. A protected port or community port can be configured as unprotected port with the below CLI command in interface configuration mode.

noswitchport protected

There is no limit on the number of unprotected ports that can be supported by the switch.

3.16 Protected Ports Configuration

Any port can be configured as a protected port with the below CLI command in interface configuration mode.

switchport protected

This can be done in the web interface by changing the port mode to "*Protected Port*" on the Protected Ports web configuration page in port manager.

There is no limit on the number of protected ports that can be supported by the switch.

3.17 Community Ports Configuration

Any port can be configured as a community port with the below CLI command in interface configuration mode.

switchport protected group <group number>

This can be done in the web interface by changing the port mode to "*Protected Port*" and entering the group number on the Protected Ports web configuration page in port manager.

Use the same group number for all the ports in same community. Here, community is identified with the configured group number.

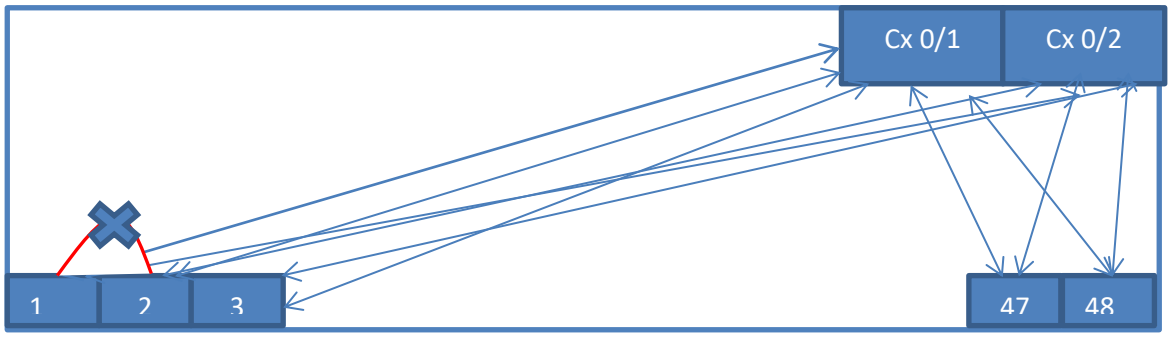
A maximum of 24 different communities can be configured in the switch.

Note:

This feature is not supported for port channel interface and port channel member ports.

3.17.1 Configuration Example 1

Configure all the 48 downlink Fx ports as isolated (or protected) ports. These 48 ports should not be able to communicate with each other. All these 48 ports should communicate only with the uplink ports cx 0/1 and cx 0/2.



The required configuration for this example is shown below. The uplink ports can be left with their default configuration as unprotected ports. All the downlink 25Gig ports need to be configured as protected ports.

```
SMIS# configure term

SMIS(config)# interface range fx 0/1-48

SMIS(config-if)# switchport protected

SMIS(config-if)# exit
```

3.17.2 Configuration Example 2

The Fx ports 1 to 24 should be able to communicate among themselves and also should be able to communicate with uplink ports Cx 0/1 and Cx 0/2.

The Fx ports 25 to 48 should be able to communicate among themselves and also should be able to communicate with uplink ports Cx 0/1 and Cx 0/2.

The ports 1 to 24 should not be able to communicate with the ports 25 to 48 and vice versa.

The required configuration for this example is given below. The uplink ports can be left with the default configuration as unprotected ports. The downlink ports 1 to 24 can be configured as one community (group) and ports 25 to 48 can be configured as another community (group).

```
SMIS# configure term

SMIS(config)# interface range fx 0/1-24

SMIS(config-if)# switchport protected group 1

SMIS(config-if)# exit

SMIS(config)# interface range fx 0/25-48

SMIS(config-if)# switchport protected group 2

SMIS(config-if)# exit
```

4 Link Aggregation

`

The Link Aggregation feature connects two or more physical links between two network devices without forming loops. Link aggregation can be used between switches, servers and routers.

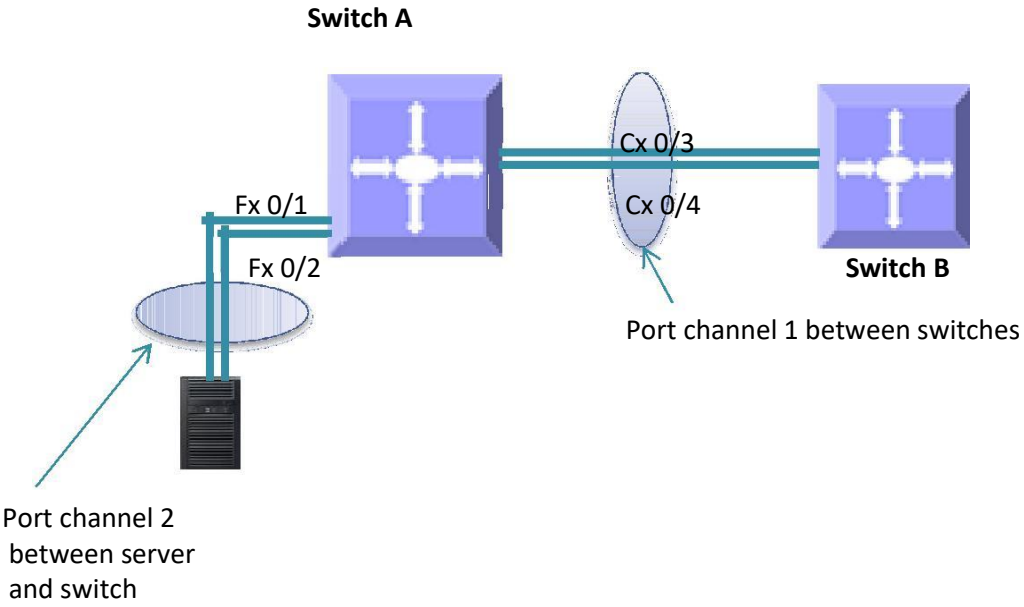
Link aggregation provides the following advantages:

Increased bandwidth – User can connect up to eight physical links between devices to increase the link bandwidth. When 25 Gbps links are aggregated, users can get an aggregated link with up to 200 Gbps bandwidth. When ports are set to 10Gig speed, users can aggregate eight 10Gig ports to get an aggregated uplink with up to 80 Gbps.

Incremental bandwidth – Users can start aggregation with a fewer number of ports and then increase the number of ports in aggregation (up to eight) incrementally based on the bandwidth requirements.

Redundancy - When one of the physical links fails, traffic will be distributed over the other remaining links in the aggregation.

Figure LA-1: Link Aggregation



The “port channel”, “channel group” and “ether channels” are used synonymously to refer to aggregate links

4.1 Link Aggregation Support

Supermicro switches support both static and dynamic link aggregations. Dynamic link aggregation support is based on the Link Aggregation Control Protocol (LACP).

Supermicro switches support only Layer 2 level link aggregation. Hence, only switching ports can be aggregated.

Supermicro switches do support the Multiple Chassis Link Aggregation (MLAG) feature.

4.2 Link Aggregation Numbers

Supermicro switches support up to 52 port channels.

Each port channel can have eight active links.

Users can configure more than eight ports to a LACP mode port channel. However, a maximum of eight ports only can be in an active bundle state in any port channel.

4.3 Link Aggregation Defaults

The Link Aggregation feature is enabled by default in Supermicro switches.

When a port channel interface is created, it will be added to VLAN 1 by default.

Port channels use the MAC address of the first physical link added to it.

The default LACP system priority is 32768.

The default LACP port priority is 128.

The default LACP timeout is long (30 seconds).

The default LACP wait time is 2 seconds.

4.4 Static Link Aggregation

Supermicro switches support static link aggregation.

User can add up to eight ports to a static port channel group. When the physical link status of one or more ports in a channel group is up, that port channel status will be up. The port channel status will be down when the ports physical link status of all members are down.

Switches do not exchange any port channel control information with other end devices in static link aggregation. Hence, users need to configure the port channel groups and member ports correctly on both end devices.

4.5 Dynamic Link Aggregation - LACP

Supermicro switches support dynamic link aggregation through IEEE 802.3ad Link Aggregation Control Protocol (LACP).

Users can add one or more ports to an LACP mode port channel. When more than eight member ports are configured, only the first eight member ports reaching the “bundle” state will be used for data traffic.

Ports in LACP mode exchange LACP packets with other end devices. The LACP system priority, switch MAC address, port LACP priority, port number and aggregation key are all exchanged between devices. Based on the exchanged information, both end devices agree on the status of the member ports. The member ports that successfully negotiated LACP parameters will be moved to the “bundle” state. The member ports that could not reach agreement on LACP parameters will stay in the “independent” state. Switches do not send traffic on member ports in “independent” state.

When one or more member ports reach the “bundle” state, the port channel status will be up. The port channel status will be down when all its member ports are either physically down or in the “independent” state.

Ports can be configured in either active or passive LACP mode. Ports in active LACP mode will initiate LACP negotiation by sending LACP messages to the other end devices. Ports in passive LACP mode will not initiate the LACP negotiation, but they will respond to LACP messages if received from other end.

Users should configure for an active LACP mode on at least one end of the LACP port channel connection. If LACP mode is configured as passive on both end devices, the port channel interface will not come up. Configuring LACP mode as active on both the end devices is allowed.

Figure LA-2: Dynamic Link Aggregation

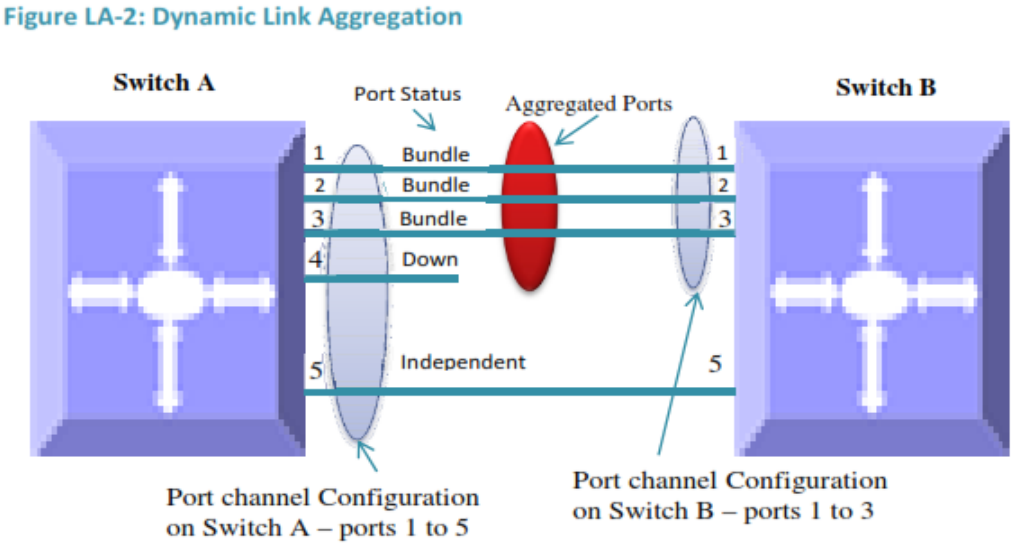


Figure LA-2: Dynamic Link Aggregation

The figure above shows an example of a port channel configuration with port status and aggregated ports. In this example, port 5 is not configured on LACP mode on switch B, and is therefore shown as being in the “independent” state and not part of the aggregated ports.

4.6 Link Aggregation Port Channel

4.6.1 Creating Port Channels

Port channel creation involves two steps: the first is to create the port channel interfaces and the second is to add member ports to the port channel interfaces.

4.6.1.1 Creating Port Channel Interfaces

Follow the steps below to create port channel interfaces in Supermicro switches.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	interface port-channel <*channel-group-number*> Or no interface range port-channel <*channel-group-number*> ….	Creates a port channel using “interface port—channel” command. *channel-group-number* – may be any number from 1 to 65535. To configure multiple port channel interfaces, use the “interface range …” command. To provide a range, use a hyphen (-) between the start and end interface numbers. E.g.: int range po 1-3 To provide multiple interfaces or ranges, separate with a comma (,). E.g. : int range po 1, 2
Step 3	description <*string*>	Optional step - adds any name string to the port channel interfaces using the description command. The *string* may be up to 64 characters

		in length. The port channel description strings will not affect the member ports description strings configurations.
Step 4	mtu <*framesize*>	Optional step. Configures the MTU for the port channel interfaces. *framesize* may be any number from Port channel MTU will be used on its all member ports.
Step 5	VLAN Configurations	Optional step – configures the VLAN parameters for port channel interfaces. Refer to the VLAN configuration guide for all VLAN configuration details.
Step 6	Spanning Tree Configurations	Optional step – configures the spanning tree parameters for port channel interfaces. Refer to the spanning Tree configuration guide for all spanning tree configuration details.
Step 7	End	Exits the configuration mode.
Step 8	show interface port-channel <*channel-group-number*>	Displays the configured port channel information.

	show etherchannel [[*channel-group-number*] { detail | load-balance | port | por t-channel | summary | protocol}]	
Step 9	write startup-config	Optional step – saves this port channel configuration to be part of startup configuration.

4.6.1.2 Adding Member Ports to Port Channels

Users can add up to eight member ports to static port channels. For LACP port channels, users can add more than eight ports, but only the first eight member ports reaching a bundle state will be part of the port channel for data transfer.

Only ports of same speed can be added to port channel interfaces.

Follow the steps below to add member ports to port channel interfaces.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx *interface-id* is in *slot/port* format for allphysical interfaces.To configure multiple interfaces, usethe “interface range …” command. Toprovide a range,

		use a hyphen (-).between the start and end interfacenumbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,).E.g.: int range fx 0/1-10, fx 0/20
Step 3	channel-group <channel-group-number> mode {active | passive | on}	Configures the interfaces as member ports for the given port channel. *channel-group-number* – The port channel to which these member ports are added. For LACP aggregation, use the active or passive mode. For static link aggregation, use mode on.
Step 4	End	Exits the interface configuration mode.
Step 5	show interface port-channel <*channel-group-number*> show etherchannel [[*channel-group-number*] { detail | load-balance | port | por t-channel | summary | protocol}]	Displays the configured port channel information.
Step 6	write startup-config	Optional step – saves this port channel configuration to be part of startup configuration.

The MTU, VLAN and spanning tree parameters of a port channel interface will be used on its member ports. After adding a port to any port channel, users should not configure MTU, VLAN and spanning tree parameters on that port. Instead users should configure MTU, VLAN and spanning tree parameters on the port channel interfaces.

The examples below show various ways to create port channels.

Create an LACP port channel with member ports cx 0/1 and cx 0/2.

```
SMIS# configure terminal
SMIS(config)# interface port-channel 10
SMIS(config-if)# exit
SMIS(config)# int range cx 0/1-2
SMIS(config-if)# channel-group 10 mode active
SMIS(config-if)# end
```

Create a static port channel having MTU 9000 with member ports cx 0/1 and cx 0/2. Also configure this port channel as a trunk interface to carry all the VLANs configured in the switch.

```
SMIS# configure terminal
SMIS(config)# interface port-channel 10
SMIS(config-if)# mtu 9000
SMIS(config-if)# switchport mode trunk
SMIS(config-if)# exit
SMIS(config)# int range cx 0/1-2
SMIS(config-if)# channel-group 10 mode on
SMIS(config-if)# end
```

4.6.2 Modifying Port Channels

4.6.2.1 Modifying Port Channel Parameters

After a port channel is created, users can modify the port channel configuration for description, MTU, VLAN, and spanning tree parameters. Users should not modify these parameters on port channel member ports directly. Instead, these parameters should be configured on port channel interfaces.

To modify port channel parameters, follow the same steps used to create the port channels as explained in the Creating Port Channel Interfaces section.

The example below shows the steps to modify the parameters of a port channel interface.

Modify port channel 10 as a trunk interface to allow VLANs 100 to 200 with a native VLAN 100.

```
SMIS# configure terminal
SMIS(config)# interface port-channel 10
SMIS(config-if)# switchport mode trunk
SMIS(config-if)# switchport trunk allowed vlan 100-200
SMIS(config-if)# switchport trunk native vlan 100
SMIS(config-if)# exit
```

4.6.2.2 Modifying Port Channel Member Ports

Users can add or remove member ports to the existing port channels. Users can also modify the port modes for member ports.

4.6.2.3 Adding New Member Ports

To add new member ports to an existing port channel, follow the same steps explained in the Adding Member Ports to Port Channels section.

The example below shows the steps necessary to add a new member port to an existing port channel interface.

Add port fx 0/3 to static port channel interface 10.

```
SMIS# configure terminal
SMIS(config)# int fx 0/3
SMIS(config-if)# channel-group 10 mode on
SMIS(config-if)# exit
```

4.6.2.4 Removing Member Ports

Follow the steps below to remove member ports from the port channel interfaces.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx *interface-id* is in *slot/port* format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	no channel-group	Removes the member ports from the port channel.
Step 4	End	Exits the configuration mode.
Step 5	show interface port-channel *<channel-group-number>* show etherchannel [[*channel-group-number*] { detail | load-balance | port | port-channel | summary |protocol }]	Displays the configured port channel information.
Step 6	write startup-config	Optional step – saves this port channel configuration to be part of startup configuration

When a port is removed from a port channel, that port will automatically be added to VLAN 1. The MTU and spanning tree configurations of that port will not be automatically changed to the default configurations. After removing any port from a port channel, users must verify and change the port VLAN, MTU and spanning tree configurations as needed.

The example below shows the steps necessary to remove a member port from a port channel interface.

Remove port cx 0/3 from port channel interface 10

```
SMIS# configure terminal
SMIS(config)# int cx 0/3
SMIS(config-if)# no channel-group
SMIS(config-if)# exit
```

To modify the port channel mode (active/passive/on) for any member port, users should first remove the

port from the port channel using the “no channel-group” command. After removing the port from the port channel interface, the channel-group command can be configuredwith the required port mode.

Step	Commands	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 mode. Interface-type - may be any of the following: fx-ethernet – fx cx-ethernet – cx Interface-id is in slot/port format for allphysical interfaces. To configure multiple interfaces,use the "interface range..." commnad. To provide a range, use a hyphen(-) between the start and end interface numbers. E.g.: int range fx0/1-10 To provide multiple interfaces or ranges, separate with a comma(,). E.g.: int range fx 0/1-10,fx 0/1-20
Step 3	no channel-group	Removes the member ports from the port channel.
Step 4	channel-group <channel-group-number> mode {active | passive | on}	Configures the interfaces as member ports with the given port mode. For LACP aggregation, use the active or passive mode. For static link aggregation, use the mode on.

		channel-group-number – The port channel to which these member ports are added.
Step 5	End	Exits the interface configuration mode.
Step 6	show interface port-channel <*channel-group-number*> show etherchannel [[*channel-group-number*] { detail | load-balance | port | por t-channel | summary | protocol}]	Displays the configured port channel information.
Step 7	write startup-config	Optional step – saves this port channel configuration to be part of startup configuration.

The example below shows the steps necessary to modify the member ports modes of a port channel interface.

Modify the member ports' modes to "active" for ports cx 0/2 and cx 0/3.

SMIS# configure terminal
SMIS(config)# int range cx 0/2-3
SMIS(config-if)# no channel-group
SMIS(config-if)# channel-group 10 mode active
SMIS(config-if)# exit

4.6.3 Removing Port Channels

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	no interface port-channel <*channel-group-number*> Or	Removes the port channel interface. *channel-group-number* – may be any

	no interface range port-channel <*channel-group-number*> ….	number from 1 to 65535. To remove multiple port channel interfaces, use the "no interface range …" command. To provide a range, use a hyphen (-) between the start and end interface numbers. E.g.: no int range po 1-3 To provide multiple interfaces or ranges, separate with a comma (,). E.g. : no int range po 1, 2
Step 3	show running-config show etherchannel	Displays the port channel information.
Step 4	write startup-config	Optional step – saves this port channel configuration to be part of startup configuration.

When a port channel is removed, all its member ports will be automatically added to VLAN 1. The MTU and spanning tree configurations of that port will not automatically be changed to their default configurations.

The example below shows the necessary steps to remove a port channel interface.

Remove port channel 10 and add all its member ports to VLAN 10 as access ports.

```
SMIS# configure terminal
SMIS(config)# no int port-channel 10
SMIS(config)# interface range cx 0/1-2
SMIS(config-if)# switchport mode access
SMIS(config-if)# switchport access vlan 10
```

SMIS(config-if)# exit

4.6.4 LACP Parameters

Users can configure the following LACP parameters on Supermicro switches.

LACP System
Priority LACP
Port Priority
LACP
Timeout

4.6.4.1 LACP System Priority

Every LACP device needs to have a globally unique system identifier. This globally unique system identifier is formed by combining a switch's MAC address and LACP system priority.

LACP system priority is also used to decide the active member ports of a port channel. When more than eight member ports are configured, the switch that has the lowest system priority value decides the active member ports. If both end devices have the same LACP system priority, the device with the numerically lower MAC address will get to decide the active member ports.

The default LACP system priority value is 32768.

Follow the steps below to modify the LACP system priority.

Step	**Command**	**Description**
Step 1	configure terminal	Enters the configuration mode.
Step 2	lacp system-priority <*system-priority*>	Configures the LACP system priority. *system-priority* – may be any value from 0 to 65535
Step 3	Exit	Exits the configuration mode.
Step 4	show running-config	Displays the configured LACP system priority value.
Step 5	write startup-config	Optional step – saves this LACP configuration to be part of startup configuration.

The “no lacp system-priority” command resets the LACP system priority to the default value 32768.

The example below shows the steps necessary to configure the LACP system priority value.

Set the LACP system priority as 1000.
SMIS# configure terminal
SMIS(config)# lacp system-priority 1000
SMIS(config-if)# exit

4.6.4.2 LACP Port Priority

If a LACP is configured with more than eight member ports then, switch selects the first eight ports that have the lowest port priority value as active member ports. If multiple ports have the same port priority value then, switch selects the first eight ports that have the numerically lower port ID as the active member ports.

The default LACP port priority is 128.

Follow the steps below to modify the LACP port priority.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx *interface-id* is in *slot/port* format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	lacp port-priority <*port-priority*>	Configures the LACP port priority. *port-priority* – may be any value from 0 to 65535
Step 4	End	Exits the configuration mode.
Step 5	show running-config show etherchannel	Displays the configured port priority information.
Step 6	write startup-config	Optional step – saves this port priority configuration to be part of startup configuration.

The “no lacp port-priority” command resets the LACP port priority to the default value of 128.

The example below shows the steps necessary to configure the port priority.

Configure the port priority as 10 for cx 0/1 and 20 for cx 0/2.

```
SMIS# configure terminal
SMIS(config)# interface cx 0/1
SMIS(config-if)# lacp port-priority 10
SMIS(config-if)# exit
SMIS(config)# interface cx 0/2
SMIS(config-if)# lacp port-priority 20
SMIS(config-if)# exit
```

4.6.4.3 LACP Timeout

Every LACP member port sends LACP messages periodically. The time period between LACP messages is configurable using the "lacp timeout" command.

Users can define the LACP timeout value either as "long" or "short". Every member port can have a different LACP timeout selection. Also, the LACP timeout selection does not need to match on both end devices. An LACP port with a "long" timeout can be connected to a port which has a "short" timeout.

When the "long" timeout value is chosen, LACP messages are expected to be received once every 30 seconds. When the "short" timeout value is chosen, LACP messages are expected to be received once every second.

The default LACP timeout is "long".

Follow the steps below to modify the LACP timeout value.

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx *interface-id* is in *slot/port* format for all

		physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	lacp timeout {long | short}	Configures the LACP port timeout. long – LACP messages are expected to be received once every 30 seconds. short – LACP messages are expected to be received once every second.
Step 4	End	Exits the configuration mode.
Step 5	show running-config show etherchannel	Displays the configured port priority information.
Step 6	write startup-config	Optional step – saves this port timeout configuration to be part of startup configuration.

The “no lacp timeout” command resets the LACP timeout to the default value of “long”.

The example below shows the steps necessary to configure the LACP timeout.

Configure the LACP timeout as short for ports cx 0/1 and cx 0/2.

SMIS# configure terminal

SMIS(config)# interface range cx 0/1-2

SMIS(config-if)# lacp timeout short

SMIS(config-if)# exit

4.6.4.4 LACP Wait Time

Switch waits for the “LACP wait time” period before adding any member port to aggregation.
The default LACP wait time period is two seconds.
Users can choose any time interval from 0 to 10 seconds as the LACP wait time. The LACP wait time is port specific and users can configure different LACP wait times on different member ports.
Follow the steps below to modify the LACP wait time

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 mode. *interface-type* – may be any of the following: fx-ethernet – fx cx-ethernet – cx
Step 4		Exits the configuration mode.

Step 5	show running-config show etherchannel	Displays the configured port priority information.
Step 6	write startup-config	Optional step – saves this LACP wait

The “no lacp wait-time” command resets the LACP wait time to the default value of “2”.

The example below shows the necessary steps to configure the LACP wait time.

Configure the LACP wait time as 0 for ports cx 0/1 and cx 0/2.

```
SMIS# configure terminal
SMIS(config)# interface range cx 0/1-2
SMIS(config-if)# lacp wait-time 0
SMIS(config-if)# exit
```

4.6.5 Load Balancing

Supermicro switches support load balancing on aggregated links.

Switches distribute outgoing traffic on all member ports that are in a bundle state. The distribution decision to transmit a packet on any particular member port is decided by a hash algorithm. Supermicro switches support the following hash algorithms:

- Packets will be distributed across the member ports based on the source MAC address of the packet.

Destination MAC Based

- Packets will be distributed across the member ports based on the source and destination MAC addresses of the packet.

source based IP

- Packets will be distributed across the member ports based on the source IP address of the packet.

Destination based IP

- Packets will be distributed across the member ports based on the destination IP address of the packet.

Source and Destination IP Based

- Packets will be distributed across the member ports based on the source and destination IP addresses of the packet.
- The hash algorithm provides the best distribution when the traffic has multiple streams. Users need to choose the right hash algorithm based on their common traffic scenarios.
- The load balance algorithm selection can be configured for individual port channel interfaces or it can be configured globally for all port channel interfaces. The load balancing algorithm on both ends of a port channel need not be the same.

The default load balancing algorithm is “Source and Destination MAC Based”.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	port-channel load-balance {src-mac | dest-mac | src-dest-mac| src-ip | dest-ip | src-dest-ip} [<*channel-group*>]	*channel-group* is the port channel identifier to which this load balancing algorithm is configured. *channel-group* number is an optional parameter for this configuration. When *channel-group* is not provided, the given port channel algorithm will be applied to all port channel interfaces.
Step 3	End	Exits the configuration mode.
Step 4	show running-config	Displays the configured load balancing information.

Step 5	write startup-config	Optional step – saves this load balancing configuration to be part of the startup configuration.

Follow the below steps to configure the load balancing algorithm.

The “no port-channel load-balance” command resets the load balancing algorithm to the default value of “src-dest-mac”.

The example below shows the steps necessary to configure the port channel load balancing algorithm. Configure the load balancing algorithm based upon source and destination IP addresses.
SMIS# configure terminal
SMIS(config)# port-channel load-balance src-dest-ip
SMIS(config-if)# exit
The link aggregation feature is enabled by default in Supermicro switches. Users can disable link aggregation if needed.

Follow the steps below to disable the link aggregation feature.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	set port-channel disable	Disables the link aggregation feature.
Step 3	End	Exits the configuration mode.
Step 4	show etherchannel	Displays link aggregation feature status.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

To enable the link aggregation feature, follow the steps below.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	set port-channel enable	Enables the link aggregation feature.
Step 3	End	Exits the configuration mode.
Step 4	show etherchannel	Displays link aggregation feature status
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

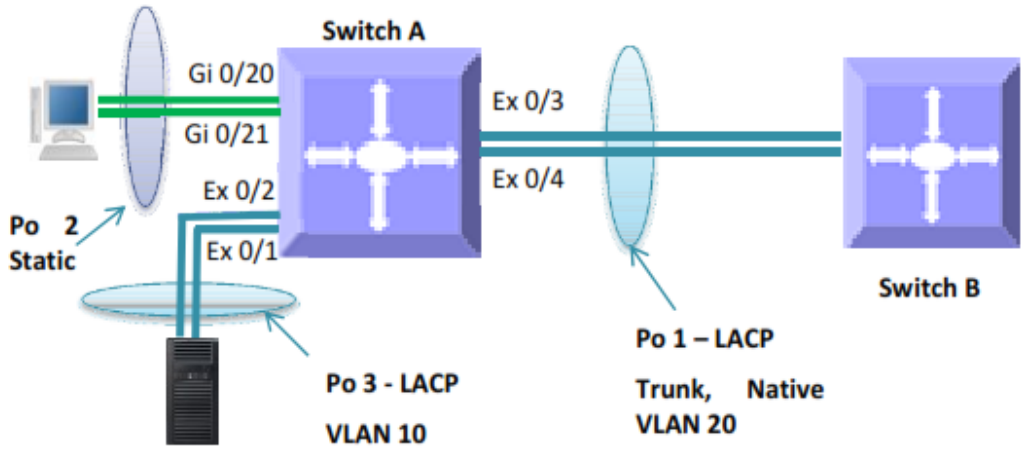
4.6.6 Link Aggregation Configuration Example

Configure switch A as shown below in Figure LA-3.

1. Aggregate ports Cx 0/3 and Cx 0/4 with LACP mode. Also configure this aggregation as a trunk interface with native VLAN 20.
2. Aggregate ports Cx 0/1 and Cx 0/2 with LACP mode. Configure this aggregation as an access port on VLAN 10.

3. Aggregate ports Fx 0/20 and Fx 0/21 statically.

Figure LA-3: Link Aggregation Configuration Example



SMIS# configure terminal

Create all the required VLANs first
SMIS(config)# vlan 10,20
SMIS(config-vlan)# exit

Create the port channel 1 interface
SMIS(config)# int port-channel 1
SMIS(config-if)# exit
Add member ports to the port channel 1 interface SMIS(config)# int range cx 0/3-4
SMIS(config-if)# channel-group 1 mode active
SMIS(config-if)# exit

Configure the VLAN requirements for the port channel 1 interface
SMIS(config)# int port-channel 1
SMIS(config-if)# switchport mode trunk
SMIS(config-if)# switchport trunk native vlan 20
SMIS(config-if)# exit

Create the port channel 2 interface
SMIS(config)# int port-channel 2
SMIS(config-if)# exit

Add member ports to the port channel 2 interface
SMIS(config)# int range fx 0/20-21
SMIS(config-if)# channel-group 2 mode on
SMIS(config-if)# exit

Create the port channel 3 interface
SMIS(config)# int port-channel 3

```
SMIS(config-if)# exit

# Add member ports to the port channel 3 interface
SMIS(config)# int range cx 0/1-2
SMIS(config-if)# channel-group 3 mode active
SMIS(config-if)# exit
# Configure the VLAN requirements for the port channel 3 interface
SMIS(config)# int port-channel 3
SMIS(config-if)# switchport mode access
SMIS(config-if)# switchport access vlan 10
SMIS(config-if)# end
# Check the running-configuration for accuracy
SMIS# show running-config

Building configuration...

ip address dhcp interface port-channel 1 exit
interface port-channel 2 exit
interface port-channel 3 exit
vlan 1

ports fx 0/1-19 untagged ports fx 0/22-48 untagged ports po 2 untagged
exit vlan 10
ports po 3 untagged exit
vlan 20
ports po 1 untagged
exit

interface Fx 0/20 channel-group 2 mode on
interface Fx 0/21 channel-group 2 mode on
interface Cx 0/1 channel-group 3 mode active
interface Cx 0/2 channel-group 3 mode active
interface Cx 0/3 channel-group 1 mode active
interface Cx 0/4 channel-group 1 mode active
interface po 1
switchport trunk native vlan 20
switchport mode trunk
interface po 3
switchport access vlan 10
switchport mode access
exit

SMIS#
# Check the port channels using the “show etherchannel” command
SMIS# show etherchannel detail
Port-channel Module Admin Status is enabled
Port-channel Module Oper Status is enabled
Port-channel System Identifier is 00:30:48:a1:11:01
LACP System Priority: 32768
```

Channel Group Listing

Group: 1
Protocol: LACP
Ports in the Group

Port: Cx0/3

Port State = Down, Not in Bundle
Channel Group: 1
Mode: Active
Pseudo port-channel = Po1
LACP port-priority = 128
LACP Wait-time = 2 secs
LACP Activity: Active
LACP Timeout: Long
Aggregation State: Aggregation, Defaulted
Port: Cx0/4

Port State = Down, Not in Bundle
Channel Group: 1
Mode: Active
Pseudo port-channel = Po1
LACP port-priority = 128
LACP Wait-time = 2 secs
LACP Activity: Active
LACP Timeout: Long
Aggregation State: Aggregation, Defaulted

LACP Port Admin Oper Port Port Port State Priority Key Key Number State
---

Cx0/3 Down 128 1 1 0x33 0x45
Cx0/4 Down 128 1 1 0x34 0x45
Port-channel: Po1

Number of Ports = 2 HotStandBy port = null
Port state = Port-channel Ag-Not-Inuse Protocol = LACP
Default Port = None
Channel Group Listing

Group: 2

Protocol: Manual
Ports in the Group

Port: Fx0/20

```
-------------
Port State = Down, Not in Bundle
Channel Group: 2
Mode: On
Pseudo port-channel = Po2
LACP port-priority = 128
LACP Wait-time = 2 secs
LACP Activity: Passive
LACP Timeout: Long
Aggregation State: Aggregation, Defaulted
Port: Fx0/21
-------------
Port State = Down, Not in Bundle
Channel Group: 2
Mode: On
Pseudo port-channel = Po2
LACP port-priority = 128
LACP Wait-time = 2 secs
LACP Activity: Passive
LACP Timeout: Long
Aggregation State: Aggregation, Defaulted
LACP Port Admin Oper Port Port Port State Priority Key Key Number State
------------------------------------------------------------------------
Fx0/20 Down   128     2      2     0x14    0x44
Fx0/21 Down   128     2      2     0x15    0x44
Port-channel: Po2
------------------
Number of Ports = 2
HotStandBy port = null
Port state = Port-channel Ag-Not-Inuse
Protocol = Manual
Default Port = None
Channel Group Listing
---------------------
Group: 3
----------
Protocol: LACP
Ports in the Group
------------------
Port: Fx0/1
-------------
Port State = Down, Not in Bundle
Channel Group: 3
Mode: Active
Pseudo port-channel = Po3
LACP port-priority = 128
LACP Wait-time = 2 secs
LACP Activity: Active
```

LACP Timeout: Long
Aggregation State: Aggregation, Defaulted
Port: Fx0/2

Port State = Down, Not in Bundle
Channel Group: 3
Mode: Active
Pseudo port-channel = Po3
LACP port-priority = 128
LACP Wait-time = 2 secs
LACP Activity: Active
LACP Timeout: Long
Aggregation State: Aggregation, Defaulted
LACP Port Admin Oper Port Port Port State Priority Key Key Number State
---
Fx0/1 Down 128 3 3 0x31 0x45
Fx0/2 Down 128 3 3 0x32 0x45
Port-channel: Po3

Number of Ports = 2
HotStandBy port = null
Port state = Port-channel Ag-Not-Inuse
Protocol = LACP
Default Port = None
SMIS#
Save this port channel configuration. SMIS# write startup-config
Building configuration, please wait. May take a few minutes . . .
[OK]
SMIS#

5 MLAG

5.1Overview

Typically data centers provide redundancy by means of oversubscription by connecting switches and servers to dual aggregation switches. In such cases, Spanning Tree Protocol (STP) prevents network loops by blocking half of the links to the aggregation switches. However this reduces the available bandwidth by 50%.

The Multi-Chassis Link Aggregation (MLAG) feature allows users to logically aggregate ports across two switches. This provides increased bandwidth and redundancy.

There can be multiple MLAG interfaces between two switches. The maximum number of MLAG interfaces is limited by the maximum number of LAGs supported in the switch models. Similar to the LAG, MLAG also supports up to eight member ports.

The two switches that logically aggregate are called *MLAG peer switches* and communicate through an interface called an *Inter peer link* (IPL). The IPL is primarily used to exchange MLAG control information between peer switches, however it also carries data traffic for devices that are attached to only one of the MLAG peers.

5.1.1 Terminologies

5.1.1.1 IPL – Inter Peer Link

The link connecting two MLAG peer switches is referred as an Inter Peer Link (IPL).

This link **should be configured as a LACP port channel**. It can have many member ports as supported by the switch model.

5.1.1.2 Peer Switch

The two switches that form a single logical port channel interface is referred to as peer switches. The peer switches are connected through the IPL interface. For example, in the topology diagrams shown in the “Topologies” section, the switches “Switch A” and “Switch B” are peer switches.

5.1.1.3 MLAG Port Channel

The link connecting MLAG peers to MLAG partner switches is called an MLAG port channel. MLAG port channel interfaces should be created on peer switches with the **same port channel number**.

5.1.1.4 Partner Device

The device connected to both the peer switches using a LACP aggregation link is referred as partner device. For example, in the topology diagrams shown in “Topologies” section, the switch “Switch C” and “Servers” are partner devices for MLAG switches.

5.1.1.5 Single Homed Device

A single homed device is a device connected to only one peer switch. This connection could be a regular single physical link connection or a connection through a port channel interface.

5.2 Topologies

5.2.1 Topology 1 - Server to Switch MLAG Topology

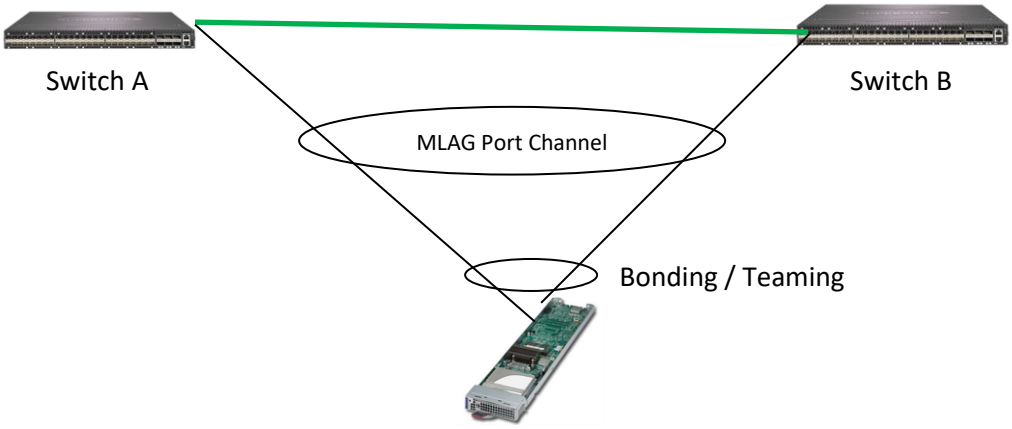


Figure MLAG1

In Figure MLAG-1, Switch A and Switch B are peer switches in the MLAG. Switches A and B are connected through an IPL port channel interface.

The server is connected to both MLAG peer switches either through regular bonding or by a teaming LACP interface on the server side.

On the switch side, the ports connected to the server are configured with the same MLAG enabled port channel number.

5.2.2 Topology 2 - Switch to Switch MLAG Topology

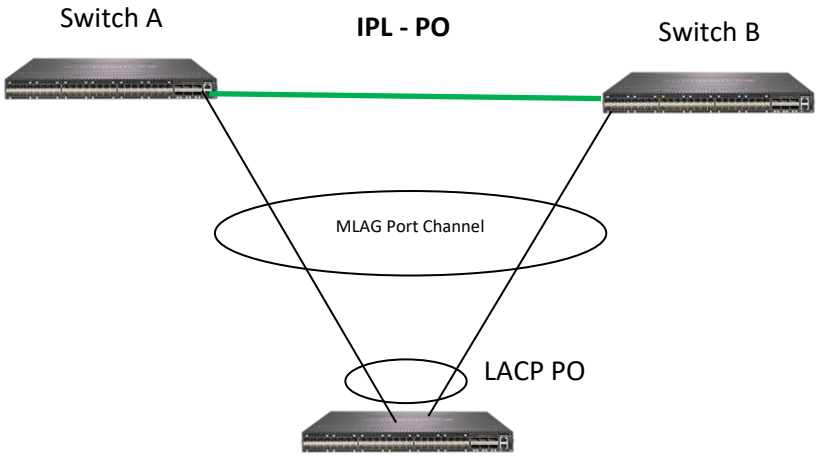


Figure MLAG-2

In Figure MLAG-2, Switch A and Switch B are peer switches in the MLAG. Switches A and B are connected through an IPL port channel interface.

Switch C is connected to both MLAG peer switches through a regular LACP port channel interface.

On the Switch A and Switch B sides, the ports connected to Switch C are configured with the same MLAG enabled port channel number.

5.2.3 Topology 3 - Single Uplink Switch Topology

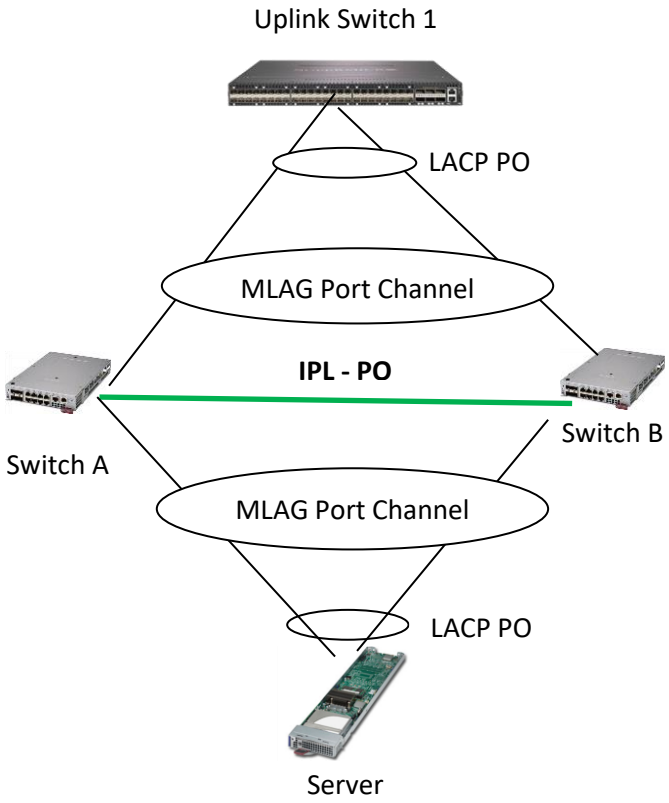


Figure MLAG-3

In Figure MLAG-3, Switch A and Switch B are peer switches in the MLAG. Switches A and B are connected through an IPL port channel interface.

The server is connected to both MLAG peer switches through a regular LACP port channel interface.

Uplink Switch 1 is connected to MLAG peer switches Switch A and Switch B through a regular LACP port channel interface.

On the Switch A and Switch B sides, the ports connected to the server are configured with the same MLAG enabled port channel number. Similarly, the ports connected to Uplink Switch 1 are configured with the same MLAG port channel number.

The reason for LAG in the uplink switch is to make sure the uplink switch does not send the same packet (broadcast or multicast) to both MLAG peer switches.

5.2.4 Topology 4 – Redundant Uplink Switch Topology

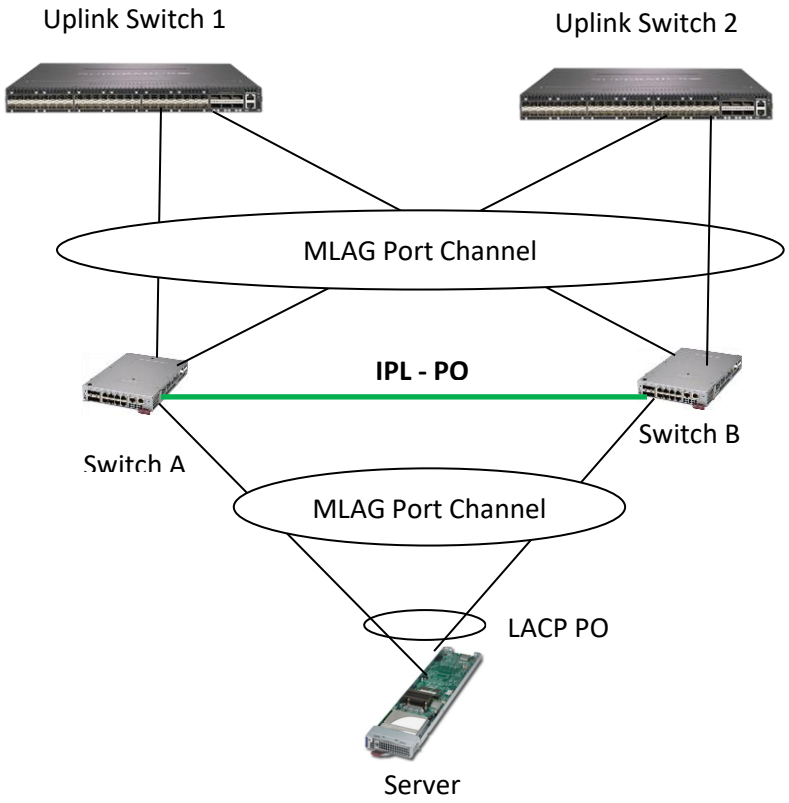


Figure MLAG-4

In Figure MLAG-4, Switch A and Switch B are peer switches in the MLAG. Switches A and B are connected through an IPL port channel interface.

The server is connected to both the MLAG peer switches through regular LACP port channel interface.

Uplink Switch 1 and Uplink Switch 2 are connected to MLAG peer switches Switch A and Switch B through the MLAG port channel interface.

On the Switch A and Switch B sides, the ports connected to the server are configured with the same MLAG enabled port channel number. Similarly, the ports connected to Uplink Switch 1 and Uplink Switch 2 are configured with the same MLAG port channel number.

The reason for MLAG in the uplink switches is to make sure the uplink switch does not send the same packet (broadcast or multicast) to both the MLAG peer switches.

5.2.5 Topology 5 - Server to switch Layer 3 MLAG topology

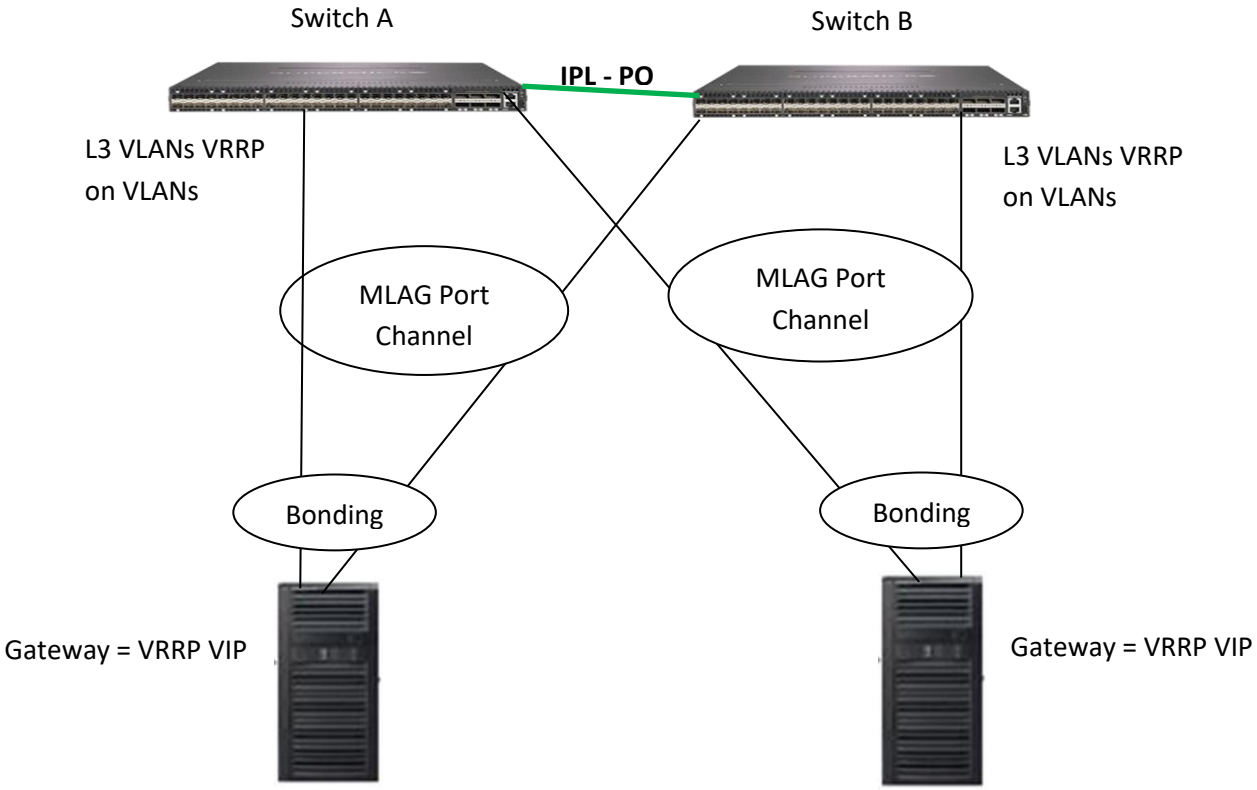


Figure MLAG-5

In Figure MLAG-5 Switches A and B are peer switches in the MLAG. Switches A and B are connected through an IPL port channel interface.

The servers are connected to both of the MLAG peer switches through a regular bonding or teaming LACP interface on the server side. The servers are configured with IP addresses in the L3 VLANs network (configured in MLAG peer switches). The VRRP virtual IP addresses configured in the MLAG peer switches are used as gateway IP addresses in the servers.

On the switch side the ports connected to server are configured with the same MLAG enabled port channel number. Layer 3 VLANs with required IP subnets are configured in the MLAG peer switches. VRRP is configured between the MLAG peer switches.

5.3 Default Configuration

Parameter	Default Value
System ID	None
System priority	32768
Keep alive time	3 seconds
IPL interface	None
MLAG status	Disabled

5.4 MLAG Configurations

The mandatory configurations for an MLAG are:

1) System ID
2) Priority
3) IPL port channel interface
4) Enabling MLAG on port channel interfaces

The keep alive time configuration is optional.

5.4.1 MLAG System ID

The MLAG system ID is a text string configured as a unique MAC address. MLAG switches use this MLAG system ID to identify their peers.

The MLAG system ID must be configured the same in both peer switches. If this condition is not met, the peer connection will not be established. All the MLAG links (connected to different partner devices) in the switch will use this globally configured MLAG system ID.

The LACP globally unique system identifier is formed by combining the MLAG system ID and the MLAG system priority.

Follow the steps below to configure the MLAG System ID.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**mlag system-identifier <aa:aa:aa:aa:aa:aa>**	Configure the system ID <aa:aa:aa:aa:aa:aa> - Specify any unicast MAC address to be used as the MLAG system ID
Step 3	**end**	Exits the configuration mode.
Step 4	show mlag detail	Displays the MLAG configuration details

The **"no mlag system-identifier"** command deletes the MLAG system ID.

When the MLAG system ID is deleted, both IPL and MLAG port channel connected to partner devices will go DOWN.

```
swA#configure terminal
swA(config)# mlag system-identifier 00:01:02:03:04:05
swA#end
```

```
swA#  show mlag detail
System Identifier: 00:01:02:03:04:05
System Priority: 32768
Keep Alive Time: 90
IPL Interface: po1
Peer System Identifier: 00:01:02:03:04:05
IPL Link Status: Up
Peer Connection State: ESTABLISHED
MLAG Role: PRIMARY
```

5.4.2 MLAG System Priority

MLAG switches use this MLAG system priority for LACP exchanges with partner devices.

MLAG system priority must be configured the same in both peer switches. If this condition is not met, the peer connection will not be established. All the MLAG links (connected to different partner devices) in the switch will use this globally configured MLAG system priority.

The LACP globally unique system identifier is formed by combining the MLAG system ID and the MLAG system priority.

Follow the steps below to configure the MLAG system priority.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**mlag system-priority <0-65535>**	Configure the MLAG system priority
Step 3	**End**	Exits the configuration mode.
Step 4	show mlag detail	Displays the MLAG configuration details

The **"no mlag system-priority"** command deletes the MLAG system priority.

When the MLAG system priority is deleted, both the IPL and the MLAG port channel connected to partner devices will go DOWN.

```
swA#configure terminal
swA(config)# mlag system-priority 1024
swA#end

swA#  show mlag detail
System Identifier: 00:01:02:03:04:05
System Priority: 1024
Keep Alive Time: 90
IPL Interface: po1
Peer System Identifier: 00:01:02:03:04:05
IPL Link Status: Up
Peer Connection State: ESTABLISHED
MLAG Role: PRIMARY
```

5.4.3 Keep Alive Time

MLAG peer switches periodically transmit keep alive packets to maintain the relationship between peer switches. The value of the keep alive transmit timer is user configurable.

The keep alive mechanism identifies one of the peer switches as the primary and another as the secondary switch based on the switch system MAC address. The switch with the lower MAC address will be the primary switch.

Follow the steps below to configure MLAG Keep alive time.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**mlag keepalive-time <3-90>**	Configure the MLAG keepalive time.
Step 3	**End**	Exits the configuration mode.
Step 4	show mlag detail	Displays the MLAG configuration details

The "**no mlag keepalive-time"** command resets the keep alive time to its default value.

Keep alive time can be different on both peers.

```
swA#configure terminal
swA(config)# mlag keepalive-time 30
swA#end

swA#  show mlag detail
System Identifier: 00:01:02:03:04:05
System Priority: 32768
Keep Alive Time: 30
IPL Interface: po1
Peer System Identifier: 00:01:02:03:04:05
IPL Link Status: Up
Peer Connection State: ESTABLISHED
MLAG Role: PRIMARY
```

5.4.4 IPL Interface

The link connecting between two MLAG peer switches is referred as the Inter Peer Link (IPL). This link should be configured as an LACP port channel. It can have as many member ports as supported by the switch model.

Only the primary switch among the peers participates in spanning tree protocol.

Follow the steps below to configure the IPL interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**mlag interface port-channel <port-channel-id (1-65535)>**	Configure the IPL interface used to establish the connection between the peers. Note: The given port channel should exist as a LACP port channel prior to this IPL interface configuration.
Step 3	**End**	Exits the configuration mode.
Step 4	show mlag detail	Displays the MLAG configuration details
Step 5	show mlag stp	Displays the MLAG Spanning Tree details

The "**no mlag interface"** command deletes the IPL interface.

The IPL interface cannot be deleted when IPL is in the established state.

```
swA#configure terminal
swA(config)# mlag interface port-channel 2
swA#end
```

```
swA#  show mlag detail
System Identifier: 00:01:02:03:04:05
System Priority: 32768
Keep Alive Time: 90
IPL Interface: po2
Peer System Identifier: 00:01:02:03:04:05
IPL Link Status: Up
Peer Connection State: ESTABLISHED
MLAG Role: PRIMARY
```

5.4.5 MLAG Port Channels

As the link connecting MLAG peers to MLAG partner switches, the MLAG port channel interfaces should be created on both peer switches with the same port channel number.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**interface port-channel <channel-group-number>**	Creates a port channel using "interface port-channel" command. *channel-group-number* – may be any number from 1 to 65535.
Step 3	**mlag enable**	Configure MLAG link from switch to the partner devices.
Step 4	**end**	Exits the configuration mode.
Step 5	show mlag interface	Displays the details of MLAG interface between peers and partner devices.

The "**mlag disable**" command disables the MLAG link between the switch and the partner device.

```
swA#configure terminal
swA(config)# interface port-channel 1
swA(config-if)# mlag enable
swA#end
```

```
swA# show mlag interface

MLAGId   Local Status   Peer Status
------   ------------   -----------
Po 1       UP           UP
```

The "show interface port channel" command also shows the basic port channel details for MLAG port channels.

5.4.6 Other Configurations

MLAG peer switches exchange only the dynamic learned specific information. The configurations across peer switches are not exchanged. Hence, users need to make sure MLAG peer switches are configured correctly. The following configurations have to be similar across MLAG peer switches for correct functionality.

Requirements	Comments
VLAN configurations for MLAG interfaces	
Spanning tree configurations for MLAG interfaces	
ACL configurations related to MLAG interfaces	

QoS configurations related to MLAG interfaces	
MAC aging time	
Static MAC entries	
MTU on MLAG and IPL interfaces	

6 Spanning Tree

Switches are interconnected to provide network access to a large number of end stations. In complex networks, it is possible to have multiple network paths between any two end devices. The multiple paths form network loops that lead to a flooding of packets by forwarding broadcast and multicast packets repeatedly over the looped connections. Flooding makes the network unusable until the looped connections are disconnected and the flooding stopped.

Spanning tree protocol helps to avoid flooding on network loops. Spanning tree protocols form a loop-free, tree structured logical network topology over physical network connections.

Spanning tree enabled switches exchange spanning tree protocol messages (BPDU) to form a loop-free topology. Based on the exchanged BPDU information,the spanning tree algorithm selects one of the switches on the network as the root switch for the tree topology. All other switches on the networks choose the best loop-free path to reach the root switch. The redundant paths to root switch are blocked to form a loop-free topology.

The spanning tree algorithm assigns one of the following roles to every port on the switch.

Root Port	•Port to reach the root switch with lowest path cost •Root ports forwards the traffic
Designated Port	•Loop-free connection to other switches on the LAN • Designated ports forward the traffic
Alternate Port	• Redundant path to the root switch •Alternate ports do not forward the traffic
Blocked Port	•Redundant path to other switches on the LAN •Blocked ports do not forward the traffic

When the network connections status changes, spanning tree recalculates the paths to form a loop-free topology. Spanning tree calculations are based on the following three key factors:

Bridge Identifier: Combination of switch MAC address and switch spanning tree priority

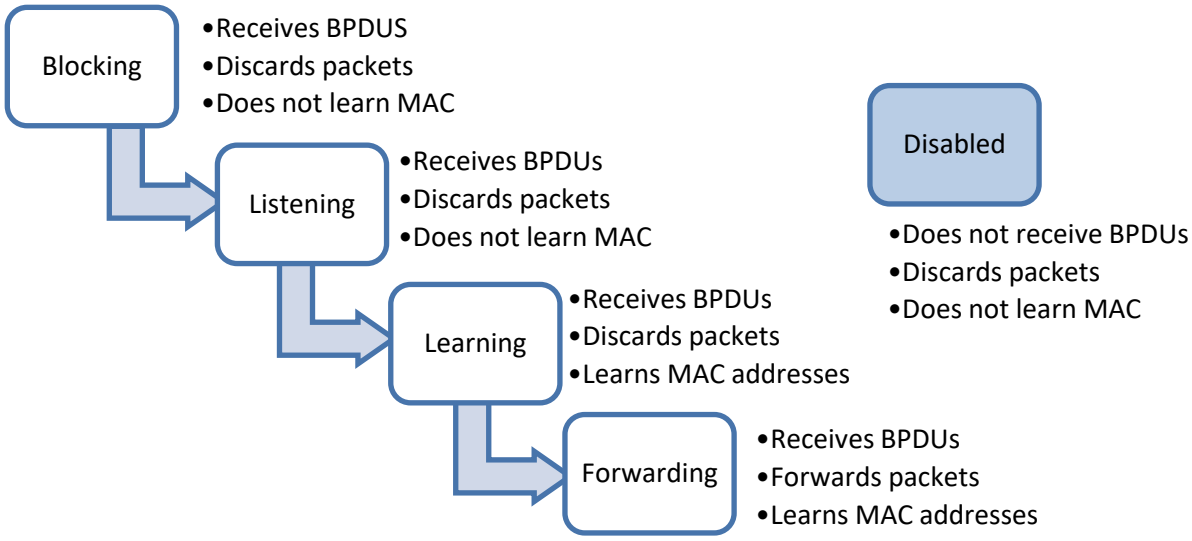
Path Cost: Spanning tree path cost to the root switch

Port Identifier: Combination of port number and port priority

When a switch boots up, it assumes its role as the root switch. It sends out spanning tree BPDUs with its bridge ID as the root bridge ID. When a switch receives spanning tree BPDUs, it compares the received BPDU information. If the received BPDU information is superior, the switch uses the received BPDU information to decide the root bridge and recalculates the spanning tree. If the received BPDU information is inferior, the switch ignores the received BPDU.

Spanning tree operates the switch ports in different states while calculating the loop-free topology. The BPDU exchange between switches takes a few seconds in large LANs. To avoid any temporary loops while

forming spanning tree topology, the switch ports are moved through different states to reach the forwarding state. Switch ports stay in one of the following spanning tree states:



Since spanning tree forms a logical loop-free topology, it helps to have physical loop connections on the network for redundancy purposes. When an active connection fails, spanning tree automatically enables the blocked redundant connection.

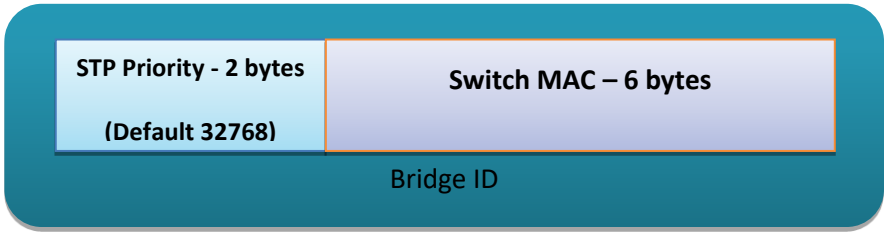
Rapid Spanning Tree Protocol (RSTP) provides faster topology convergence. Spanning tree (STP) takes more than 30 seconds to move a port to a forwarding state, but RSTP can move a port to the forwarding state within 3 times of the hello interval (default hello interval is 2 seconds). RSTP is compatible with STP.

Multiple Spanning Tree Protocol (MSTP) extends RSTP to provide separate spanning trees for different VLANs or VLAN groups. This helps to use alternate paths efficiently by blocking the ports only for the required VLANs. MSTP is compatible with RSTP.

6.1Root Switch Election Procedure

Spanning tree protocol selects one switch as the root switch for every switched LAN. This root switch is used as the reference point to decide the spanning tree topology. Based on the connections to this root switch, the redundant links on the LAN are identified and blocked. Spanning tree runs an election process to elect one switch as the root switch.

Spanning tree selects the switch with the lowest bridge ID as the root switch. Every switch on the LAN has a bridge ID.The bridge ID has two components: the priority and the MAC address of the switch. The spanning tree priority occupies the most significant two bytes of the bridge ID. The default spanning tree priority is 32768.



When a switch starts spanning tree it sends out BPDUs with its bridge ID as the root bridge ID. When a switch receives the BDPUs, it compares the received root bridge ID with its own bridge ID. If the received root bridge ID is lower than its own bridge ID, the received switch accepts the other switch as the root switch. In case the received root bridge ID is higher than its own bridge ID, the received switch ignores the received BPDU and continue to act as the root switch.

If the priorities of all switches are same, the switch MAC addresses decide the lowest bridge ID and hence the switch with the lowest MAC address will be elected as the root switch.

6.2 Spanning Tree Support

Supermicro switches support STP, RSTP and MSTP protocols based on standards IEEE 802.1D 2004 and 802.1s.

6.3 Spanning TreeDefaults

<table>
<tr><th>Parameter</th><th>Default Value</th></tr>
<tr><td>Spanning tree global status</td><td>Enabled</td></tr>
<tr><td>Spanning tree port status</td><td>Enabled</td></tr>
<tr><td>Spanning tree mode</td><td>MST</td></tr>
<tr><td>Switch priority</td><td>32768</td></tr>
<tr><td>Port priority</td><td>128</td></tr>
<tr><td>Port cost</td><td><table><tr><th>Port Speed</th><th>Default Path Cost</th></tr><tr><td>10 Mbps</td><td>2000000</td></tr><tr><td>100 Mbps</td><td>200000</td></tr><tr><td>1 Gbps</td><td>20000</td></tr><tr><td>10 Gbps</td><td>2000</td></tr></table></td></tr>
<tr><td>Hello time</td><td>2 seconds</td></tr>
<tr><td>Forwarding time</td><td>15 seconds</td></tr>
<tr><td>Maximum aging time</td><td>20 seconds</td></tr>
<tr><td>Transmit hold count</td><td>3</td></tr>
<tr><td>Max hops</td><td>20</td></tr>
<tr><td>Path cost method</td><td>Long</td></tr>
<tr><td>MST region name</td><td>Switch MAC address</td></tr>
<tr><td>MST region revision</td><td>0</td></tr>
<tr><td>Spanning tree compatibility</td><td>In MSTP mode, the default compatibility is MSTP and in RSTP mode the default compatibility is RSTP</td></tr>
<tr><td>Root guard</td><td>Disabled</td></tr>
<tr><td>Topology change guard</td><td>Disabled</td></tr>
<tr><td>Port fast</td><td>Disabled</td></tr>
<tr><td>Auto edge</td><td>Enabled</td></tr>
</table>

Link type	Full duplex ports – point to point links Half duplex ports – shared LAN links

6.4 Enabling/Disabling Spanning Tree

6.4.1 Enable/Disable Spanning Tree Globally

Spanning tree is enabled by default in Supermicro switches globally.

Follow the steps below to disable the spanning tree globally.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	no spanning-tree	Disables the spanning tree globally
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree	Displays the spanning tree information.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “spanning-tree” command enables the spanning tree globally**.**

The examples below show ways to disable/enable the spanning tree function on Supermicro switches.

Disable the spanning tree.

SMIS# configure terminal

SMIS(config)# no spanning-tree

SMIS(config)# end

Enable the spanning tree.

SMIS# configure terminal

SMIS(config)# spanning-tree

SMIS(config)# end

6.4.2 Enable/Disable Spanning Tree on Ports

Spanning tree is enabled by default on all the ports and port channels in Supermicro switches.

Follow the steps below to disable spanning tree on ports.

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 port interface mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po interface-id is in slot/port format for all physical interfaces. It may be the port channel identifier for port channel interfaces. To configure multiple interfaces, use the "interface range …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	To disable the spanning tree in RST mode: spanning-tree disable To disable the default MST instance spanning tree: spanning-tree disable To disable the particular MST instance spanning tree. spanning-tree mst<instance-id>disable	Disables the spanning tree on the port. instance-id – The MST instance identifier may be from 1 to 16.
Step 4	end	Exits the configuration mode.
Step 5	show spanning-tree interface <interface-type><interface-id> show running-config interface <interface-type><interface-id>	Displays the spanning tree port information.
Step 6	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree disable” command enables spanning tree on ports.

The examples below show various ways to disable/enable the spanning tree on ports.

Disable the spanning tree on ports cx 0/1 and cx 0/2.

SMIS# configure terminal

SMIS(config)# interface range cx 0/1-2

SMIS(config-if)# spanning-tree disable

SMIS(config)# end

Enable the spanning tree on port cx 0/1.

SMIS# configure terminal

SMIS(config)# interface cx 0/1

SMIS(config-if)# **no**spanning-tree disable

SMIS(config)# end

6.5 Configuring MST

Spanning tree is enabled by default in MST mode in Supermicro switches.

In case the switch was configured earlier in RST mode, follow the steps below to change to MST mode.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	spanning-tree mode mst	Configures the switch to operate in MST mode.
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree	Displays the spanning tree mode information.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

Changing the spanning tree mode will shut down the spanning tree currently running and restarts it in the new mode given.

6.6 Configuring MST Region and Instances

All the spanning tree switches in an MST region must have the same values configured for the following parameters.

- Region name
- Revision number
- Instance to VLAN mapping

Follow the steps below to configure the MST region parameters.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	spanning-tree mst configuration	Enters the MST configuration mode
Step 3	instance<instance-id(1-16)>vlan<vlan-range>	Creates a MST instance and maps it to the given VLAN range. instance-id – The MST instance identifier may be from 1 to 16. vlan-range – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10. User can configure VLANs with identifiers 1 to 4069.
Step 4	name<name-string>	Configures the MST region name. name-string–Alphanumeric case sensitive string with maximum length of 32 characters. The default name is system MAC address.
Step 5	revision<revision-number>	Configures the MST region revision number. revision-number – The MST revision number may be from 0 to 65535. The default revision-number is 0.
Step 6	end	Exits the configuration mode.
Step 7	show spanning-tree mst configuration	Displays the spanning tree MSTconfiguration parameters.
Step 8	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no name” command removes the configured MST region name.

The “no revision” command resets the configured MST region revision number to its default value of 0.

The examples below show various ways to configure MST region parameters.

Configure the MST region with name dc1_region, revision number 1 and map the VLANs 100 to 300 to MST instance 10.

SMIS# configure terminal

SMIS(config)# spanning-tree mst configuration

SMIS(config-mst)# name dc1_region

SMIS(config-mst)# revision 1

SMIS(config-mst)# instance 10 vlan 100-300

SMIS(config-mst)# end

Remove the VLANs 201 to 250 from MST instance 10.

SMIS# configure terminal

SMIS(config)# spanning-tree mst configuration

SMIS(config-mst)# noinstance 10 vlan 201-250

SMIS(config-mst)# end

Delete the MST instance 10.

SMIS# configure terminal

SMIS(config)# spanning-tree mst configuration

SMIS(config-mst)# noinstance 10

SMIS(config-mst)# end

6.7 Configuring RSTP

Spanning tree is enabled by default in MST mode in Supermicro switches.

Follow the steps below to change to RSTP.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode

Step 2	spanning-tree mode rst	Configures the switch to operate in RSTP mode.
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree	Displays the spanning tree mode information.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

Changing the spanning tree mode will shut down the spanning tree currently running and restart it in the new mode given.

6.8 Spanning Tree Compatibility

MSTP is backward compatible with RSTP and STP. Similarly, RSTP is backward compatible with STP.

When an MSTP operating switch detects an RSTP operating switch in any port, the MSTP switch will downgrade to RSTP operating mode on that port.

Similarly, when an MSTP or RSTP operating switch detects an STP operating switch in any port, the switch will downgrade to STP operating mode on that port.

Users can force the switch to operate in any particular compatibility mode. In user configured STP compatible mode, a switch will transmit and receive only STP BPDUs and will drop any received RSTP and MSTP BPDUS.

In MSTP mode the default compatibility is MSTP and in RSTP mode the default compatibility is RSTP.

Follow the steps below to configure the spanning tree compatibility.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	To force the spanning tree compatibility as STP spanning-tree compatibility stp To force the spanning tree compatibility as RSTP spanning-tree compatibility rst To force the spanning tree compatibility as MSTP spanning-tree compatibility mst	Configures the spanning tree compatibility.
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree	Displays the spanning tree mode information.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree compatibility” command resets the spanning tree compatibility mode to the default value.

The examples below show various ways to configure the spanning tree compatibility.

Configure the spanning tree compatibility as STP.

SMIS# configure terminal

SMIS(config)# spanning-tree compatibility stp

SMIS(config)# end

Configure the spanning tree compatibility as RSTP.

SMIS# configure terminal

SMIS(config)# spanning-tree compatibility rst

SMIS(config)# end

6.9 Configuring the Root Switch (or) Priority

The switch with the lowest priority value gets elected as the root switch. To make any particular switch the root switch, configure it with a lower numeric priority value. The default spanning tree priority is 32768.

When priorities of all switches are the same, the switch with the lowest MAC address gets elected as the root switch.

Follow the steps below to change spanning tree priority.

<table>
<tr><th>Step</th><th>Command</th><th>Description</th></tr>
<tr><td>Step 1</td><td>configure terminal</td><td>Enters the configuration mode</td></tr>
<tr><td>Step 2</td><td>To configure the switch priority in RST mode:
spanning-tree priority <priority-value>

To configure the switch priority for the default MST instance 0:
spanning-tree priority <priority-value>

To configure the switch priority for particular MST instance:
spanning-tree mst <instance-id> priority <priority-value></td><td>Configures the switch spanning tree priority.
priority-value – Spanning tree switch priority value in multiples of 4096 from 0 to 61440. In other words only the following priority values are valid.

<table><tr><td>0</td><td>4096</td><td>8192</td><td>12288</td></tr><tr><td>16384</td><td>20480</td><td>24576</td><td>28672</td></tr><tr><td>32768</td><td>36864</td><td>40960</td><td>45056</td></tr><tr><td>49152</td><td>53248</td><td>57344</td><td>61440</td></tr></table>
The default priority value is 32768.</td></tr>
</table>

		instance-id – The MST instance identifier may be from 1 to 16.
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree bridge priority show spanning-tree	Displays the spanning tree configuration parameters including the switch priority values.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree priority” command resets the spanning tree switch priority to the default value (32768). In MST mode, it resets the switch priority for the default MST instance 0.

The “no spanning-tree mst <instance-id>priority” command resets the spanning tree switch priority to the default value (32768) for the given MST instance.

The examples below show various ways to configure the spanning tree switch priority.

Configure the spanning tree switch priority as 4096 in RST mode.

SMIS# configure terminal

SMIS(config)# spanning-tree priority 4096

SMIS(config)# end

Configure the spanning tree switch priority as 4096 for the default MST instance 0.

SMIS# configure terminal

SMIS(config)# spanning-tree priority 4096

SMIS(config)# end

Configure the spanning tree switch priority as 4096 for the MST instance 10.

SMIS# configure terminal

SMIS(config)# spanning-tree mst 10 priority 4096

SMIS(config)# end

6.10 Port Priority

When spanning tree detects multiple paths to the root switch in a loop condition, it selects the port with the lowest path cost as the forwarding port.

In case of multiple ports having the same path cost to the root switch, spanning tree selects the port with the lowest numeric port priority value as the forwarding port.

When priorities of all the ports are the same, the port with the lowest port identifier gets selected as the forwarding port.

The port priority used in selection of the root port is the priority of the upstream switch port. Changing the port priority will affect the root port selection of the downstream switch connected to this port. It will not affect the root port selection of the switch on which the port priority is changed.

Follow the steps below to change the spanning tree port priority.

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 port interface mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po interface-id is in slot/port format for all physical interfaces. It may be the port channel identifier for port channel interfaces. To configure multiple interfaces, use the “interface range …” command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	To configure the port priority in RST mode: spanning-tree port-priority <priority-value> To configure the port priority for the default MST instance 0: spanning-tree port-priority <priority-value> To configure the port priority for particular MST instance:	Configures the port spanning tree priority. priority-value – Spanning tree port priority value may be from 0 to 240. Priority value must be multiple of 16. The default priority value is 128.

	spanning-tree mst <instance-id>port-priority <priority-value>	instance-id – The MST instance identifier may be from 1 to 16.
Step 4	end	Exits the configuration mode.
Step 5	show spanning-tree interface <interface-type><interface-id>	Displays the spanning tree port parameters including the port priority values.
Step 6	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree port-priority” command resets the spanning tree port priority to the default value (128). In MST mode, it resets the port priority for the default MST instance 0.

The “no spanning-tree mst <instance-id>port-priority” command resets the spanning tree port priority to the default value (128) for the given MST instance.

The examples below show various ways to configure the spanning tree port priority.

Configure the spanning tree port priority as 208 in RST mode on ports fx 0/1 and fx 0/2.

SMIS# configure terminal

SMIS(config)# interface range cx 0/1-2

SMIS(config-if)# spanning-tree port-priority 208

SMIS(config-if)# end

Configure the spanning tree port priority as 112 for the default MST instance 0 on port fx 0/1

SMIS# configure terminal

SMIS(config)# interface fx 0/1

SMIS(config-if)# spanning-tree port-priority 112

SMIS(config-if)# end

Configure the spanning tree port priority as 64 for the MST instance 10 on port cx 0/1

SMIS# configure terminal

SMIS(config)# interface cx 0/1

SMIS(config-if)# spanning-tree mst 10 port-priority 64

SMIS(config-if)# end

6.11 Path Cost

When spanning tree detects multiple paths to root switches in a loop condition, it selects the port with lowest path cost as the forwarding port. If multiple ports have the same path cost to the root switch, spanning tree selects the port with lowest numeric port priority value as the forwarding port.

The default path cost for the ports are calculated based on the port speed. The table below shows the default path costs for different speeds.

Port Speed	Default Path Cost
10 Mbps	2000000
100 Mbps	200000
1 Gbps	20000
10 Gbps	2000

Follow the steps below to change the spanning tree path cost for ports.

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 port interface mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po interface-id is in slot/port format for all physical interfaces. It may be the port channel identifier for port channel interfaces. To configure multiple interfaces, use the “interface range …” command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	To configure the port priority in RST mode: spanning-tree cost<cost-value> To configure the port priority for the default MST instance 0: spanning-tree cost<cost-value>	Configures the port spanning tree path cost. cost-value – Spanning tree port priority value may be from 1 to 200000000.

	To configure the port priority for particular MST instance: spanning-tree mst <instance-id>cost<cost-value>	The default path cost is calculated based on the port speed. instance-id – The MST instance identifier may be from 1 to 16.
Step 4	end	Exits the configuration mode.
Step 5	show spanning-tree interface <interface-type><interface-id>	Displays the spanning tree port parameters including the port path cost values.
Step 6	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “nospanning-tree cost” command resets the spanning tree port path cost to the default value. In MST mode, it resets the port path cost for the default MST instance 0.

The “no spanning-tree mst <instance-id>cost” command resets the spanning tree port path cost to the default value for the given MST instance.

The examples below show various ways to configure the spanning tree port path cost.

Configure the spanning tree port path cost as 200 in RST mode on ports cx 0/1 and cx 0/2.

SMIS# configure terminal

SMIS(config)# interface range cx 0/1-2

SMIS(config-if)# spanning-tree cost 200

SMIS(config-if)# end

Configure the spanning tree port priority as 200 for the default MST instance 0 on port fx 0/1

SMIS# configure terminal

SMIS(config)# interface fx 0/1

SMIS(config-if)# spanning-tree cost 200

SMIS(config-if)# end

Configure the spanning tree port priority as 20 for the MST instance 10 on port cx 0/1

SMIS# configure terminal

SMIS(config)# interface cx 0/1

SMIS(config-if)# spanning-tree mst 10 cost20

SMIS(config-if)# end

6.12 Hello Time

The root switch sends the BPDU messages on every port periodically for every hello time interval.

The default hello time is 2 seconds.

If switches do not receive BPDU messages for a period of 3 hello time intervals, spanning tree protocol assumes the root switch has failed.

In MSTP, the hello time is configurable on individual ports. In RSTP, the hello time is configured commonly for all ports.

Follow the steps below to change the hello time for RSTP.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	To configure the hello time in RST mode: spanning-tree hello-time<time-value>	Configures the hello time interval. time-value – Hello time value may be 1 or 2 seconds. The default hello time is 2 seconds.
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree interface <interface-type><interface-id>	Displays the spanning tree port parameters including the hello time values.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree hello-time” command resets the spanning tree port hello time to the default value of 2 seconds.

Follow the steps below to change the hello time for ports in MSTP.

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 port interface mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po

		interface-id is in slot/port format for all physical interfaces. It may be the port channel identifier for port channel interfaces. To configure multiple interfaces, use the “interface range …” command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	To configure the hello time in MST mode: spanning-tree mst hello-time<time-value>	Configures the hello time interval. time-value – Hello time value may be 1 or 2 seconds. The default hello time is 2 seconds.
Step 4	end	Exits the configuration mode.
Step 5	show spanning-tree bridge hello-time	Displays the spanning tree hello time.
Step 6	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree msthello-time” command resets the spanning tree port hello time to the default value of 2 seconds.

The examples below show various ways to configure the spanning tree port hello time.

Configure the spanning tree port hello time as 1 second in RST mode.

SMIS# configure terminal

SMIS(config)# spanning-tree hello-time 1

SMIS(config)# end

Configure the MSTP hello time as 1 second for the port fx 0/1

SMIS# configure terminal

SMIS(config)# interface fx 0/1

SMIS(config-if)# spanning-tree mst hello-time 1

SMIS(config-if)# end

6.13 Max Age

Switches maintain the BPDU information for every port for a period called the max age. If BPDU configuration messages are not received on any ports for the max age time, the switch will reconfigure those ports.

The max age time affects failure detection and reconfiguration. A smaller max age time will help detect failures quickly. It is advisable to choose a max age time based on the maximum number of switches on the network between any two hosts.

The default max age time is 20 seconds.

The max age value should be less than twice of (forward time – 1).

Follow the steps below to change the max age time.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	To configure the max age time: spanning-tree max-age<age-value>	Configures the switch spanning tree max age time. age-value – Spanning tree max age value may be from 6 to 40 seconds. The default max age is 20.
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree bridge max-age show spanning-tree	Displays the spanning tree configuration parameters including the switch priority values.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree max-age” command resets the spanning tree max age to the default value of 20.

The example below shows how to configure the spanning tree max age.

Configure the max age as 12.

SMIS# configure terminal

SMIS(config)# spanning-tree max-age12

SMIS(config)# end

6.14 Forwarding Time

The switch waits for the forwarding time interval of the listening and learning states before going to the forwarding state.

The default forwarding time is 15 seconds. Hence, the switch waits for 15 seconds in the listening state and waits for another 15 seconds in the learning state before going to the forwarding state.

The forwarding time value should maintain the following relation with max age:
2*(Forward Time -1)≥MaxAge

Follow the steps below to change the forwarding time.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	To configure the max age time: spanning-tree forward-time<time-value>	Configures the switch spanning tree max age time. time-value – Spanning tree forward time may be from 4 to 30 seconds. The default forwarding time is 15 seconds.
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree bridge forward-time	Displays the spanning tree forward time.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree forward-time” command resets the spanning tree forwarding time to the default value of 15.

The example below shows how to configure the spanning tree forward time.

Configure the forwarding time as 12 seconds.

SMIS# configure terminal

SMIS(config)# spanning-tree forward-time 12

SMIS(config)# end

6.15 Max Hops

MSTP uses a hop count to decide the validity of BPDU messages. The root switch sends a BPDU with a max hops count. Every switch decrements the hops count when forwarding the BPDU. When this hops count reaches zero, the switch discards the BPDU message.

The default max hops count is 20.

Follow the steps below to change the max hops.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	To configure the max age time: spanning-tree mst max-hops <maxhops-value>	Configures the switch MSTP max hops value. maxhops-value – MSTP max hops value may be from 6 to 40 seconds. The default max hops is 20.
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree mst	Displays the spanning tree max hops along with other MST information.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree mst max-hops” command resets the MST max hops to the default value of 20.

The example below shows how to configure the MSTP max hops.

Configure the MST max hops as 30.

SMIS# configure terminal

SMIS(config)# spanning-tree mst max-hops 30

SMIS(config)# end

6.16 Path Cost Long/Short

Spanning tree was originally designed with 16-bit path costs. This was good enough for fast Ethernet and Gigabit Ethernet speed links, but not for 10Gb and higher speed ports. Hence, spanning tree protocol introduced support for 32-bit path costs.

The 16-bit path costs method is referred to as the short path cost method and the 32-bit path cost method is referred to as the long path costs method.

In MSTP and RSTP modes, Supermicro switches support long path costs by default. In STP compatible RSTP mode, Supermicro switches uses short path costs by default.

Follow the steps below to change the path costs method.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	To configure the path cost method as short spanning-tree pathcost methodshort To configure the path cost method as long spanning-tree pathcost method long	Configures the path cost method. In MSTP and RSTP, the default path cost method is long. In STP compatible RSTP mode, the default path cost is short.
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree pathcost method	Displays the spanning tree path cost method information.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “nospanning-tree pathcost method” command resets the path cost method to default value.

The example below shows how to configure the path cost method.

Configure the path cost method as short**.**

SMIS# configure terminal

SMIS(config)# spanning-tree pathcost method short

SMIS(config)# end

6.17 Transmit Hold Count

Transmit hold count helps control the BPDU burst traffic. The switch limits the number of BPDUs sent in one second with the transmit hold count. A higher transmit hold count value of allows switches to send more number of BPDUs for faster convergence. But it might lead to high switch CPU utilization.

The default transmit hold count is 3.

Follow the steps below to change the transmit hold count value.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode

Step 2	spanning-tree transmit hold-count <count_value>	Configures the transmit hold count value. Count-value – Transmit hold count value may be from 1 to 10. The default transmit hold count value is 3.
Step 3	end	Exits the configuration mode.
Step 4	show spanning-tree detail	Displays the spanning tree hold count information.
Step 5	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree transmit hold-count” command resets the hold count to the default value of 3.

The example below shows how to configure the transmit hold count value.

Configure the transmit hold count as 8.

SMIS# configure terminal

SMIS(config)# spanning-tree transmit hold-count 8

SMIS(config)# end

6.18 Root Guard

In spanning tree networks, the position of the root switch is important to achieve optimized topology. According to spanning tree protocol, any switch can become a root switch based on the priority and switch MAC address. Networks managed by multiple administrators can lead to multiple switches with a lowest priority to compete for root switch status. There is no option to block any switch becoming the root switch to maintain the optimized topology.

The root guard feature helps prevent any unexpected switch from becoming the root switch. If the root guard feature is enabled on a port, it prevents any switches connected to that port from becoming the root switch. If any superior BPDU is received on the root guard enabled port, the switch moves that port from a forwarding state to a listening state.

The root guard feature is disabled on all ports by default.

Follow the steps below to enable the root guard feature on the ports.

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 port interface mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po interface-id is in slot/port format for all physical interfaces. It may be the port channel identifier for port channel interfaces. To configure multiple interfaces, use the “interface range …” command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	spanning-tree restricted-role	Enables the root guard feature. The default option is the root guard feature disabled.
Step 4	end	Exits the configuration mode.
Step 5	show spanning-tree detail	Displays the spanning tree root guard information.
Step 6	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree restricted-role” command resets the root guard feature to the default value of disabled.

The example below shows how to enable the root guard feature.

Enable the root guard feature on ports cx 0/1 and cx 0/2

SMIS# configure terminal

SMIS(config)# interface range cx 0/1-2

SMIS(config-if)# spanning-tree restricted-role

SMIS(config-if)# end

6.19 Topology Change Guard

The topology change guard helps prevent unexpected topology changes. Network administrators can configure the topology guard on ports that are not expected to receive topology change BPDUs.

Topology change BPDUs received on the topology change guard enabled ports will be dropped.

The topology guard feature is disabled on all ports by default.

Follow the steps below to enable the topology guard feature on the ports.

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 port interface mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po interface-id is in slot/port format for all physical interfaces. It may be the port channel identifier for port channel interfaces. To configure multiple interfaces, use the “interface range …” command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	spanning-tree restricted-tcn	Enables the topology guard feature. The default option is the topology guard feature disabled.
Step 4	end	Exits the configuration mode.
Step 5	show spanning-tree detail	Displays the spanning tree topology guard information.
Step 6	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The "no spanning-tree restricted-tcn" command resets the topology guard feature to the default value of disabled.

The example below shows how to enable the topology guard feature.

Enable the topology guard feature on ports cx 0/1 and cx 0/2

SMIS# configure terminal

SMIS(config)# interface range cx 0/1-2

SMIS(config-if)# spanning-tree restricted-tcn

SMIS(config-if)# end

6.20 Port Fast

When a port link is up, spanning tree does not allow the port to forward the packets immediately. Spanning tree moves the port through the listening and learning states before reaching the forwarding state. This state machine function helps achieve a loop-free topology, but delays the port operation of forwarding traffic.

Switch ports connected to computers and servers are not expected to cause any loops. Those ports can be configured with the port fast feature to start forwarding traffic immediately instead of waiting through the learning and listening states.

Configure the port fast feature only to ports that are connected to computers and servers. Configuring port fast on ports that are connected to other switches might cause network loops.

The port fast feature is disabled on all ports by default.

Follow the steps below to enable the port fast feature on the ports.

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 port interface mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po interface-id is in slot/port format for all physical interfaces. It may be the port

		channel identifier for port channel interfaces. To configure multiple interfaces, use the “interface range …” command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	spanning-tree portfast	Enables the port fast feature. The default setting is the port fast feature disabled.
Step 4	end	Exits the configuration mode.
Step 5	show spanning-tree detail	Displays the spanning tree port fast information.
Step 6	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree portfast” command resets the port fast feature to the default value of disabled.

The example below shows how to enable the port fast feature.

Enable the port fast feature on ports cx 0/1 and cx 0/2.

SMIS# configure terminal

SMIS(config)# interface range cx 0/1-2

SMIS(config-if)# spanning-tree portfast

SMIS(config-if)# end

6.21 Auto Edge

The auto edge feature is used to detect the other end of a device attached to a port. If no BPDU is received for a period of time on auto edge enabled ports, the switch marks them as edge ports assuming they are not connected to other switches. This helps quickly move the port to a forwarding state. Also, switches do not send topology change notifications when an edge port’s status changes.

The auto edge feature is enabled on all ports by default.

Follow the steps below to configure the auto edge feature on the ports.

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 port interface mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po interface-id is in slot/port format for all physical interfaces. It may be the port channel identifier for port channel interfaces. To configure multiple interfaces, use the "interface range …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	To enable the auto-edge spanning-tree auto-edge To disable the auto-edge no spanning-tree auto-edge	Enables or disabled the auto edge feature. The default setting is the auto edge feature enabled.
Step 4	end	Exits the configuration mode.
Step 5	show spanning-tree detail	Displays the spanning tree auto edge information.
Step 6	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The example below shows how to disable the auto edge feature.

Disable the auto edge feature on ports cx 0/1 and cx 0/2

SMIS# configure terminal

SMIS(config)# interface range cx 0/1-2

SMIS(config-if)# no spanning-tree auto-edge

SMIS(config-if)# end

6.22 Link Type

Spanning tree decides the link type based on the duplex mode of the ports. It detects full duplex ports as point-to-point links and half duplex ports as a shared LAN links.

Point-to-point links are assumed to be connected directly to another spanning tree switch, whereas shared LAN links are assumed to be connected with multiple switches through hubs.

In point-to-point links, spanning tree negotiates with other end switches to move the ports rapidly to the forwarding state.

Users can override the link type of ports as either point-to-point links or as shared links.

Follow the steps below to configure the link type of the ports.

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 port interface mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po interface-id is in slot/port format for all physical interfaces. It may be the port channel identifier for port channel interfaces. To configure multiple interfaces, use the “interface range …” command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20
Step 3	To configure the link type as point to point spanning-tree link-type point-to-point To configure the link type as shared spanning-tree link-type shared	Configures the link type.
Step 4	end	Exits the configuration mode.
Step 5	show spanning-tree detail	Displays the spanning tree auto edge information.

Step 6	write startup-config	Optional step – saves this spanning tree configuration to be part of startup configuration.

The “no spanning-tree link-type” command resets the user configured link type to let switches detect the link type based on the duplex mode.

The example below shows the way to configure the link type.

Configure the port fx 0/1 as a point-to-point link.

SMIS# configure terminal

SMIS(config)# interface fx 0/1

SMIS(config-if)# spanning-tree link-type point-to-point

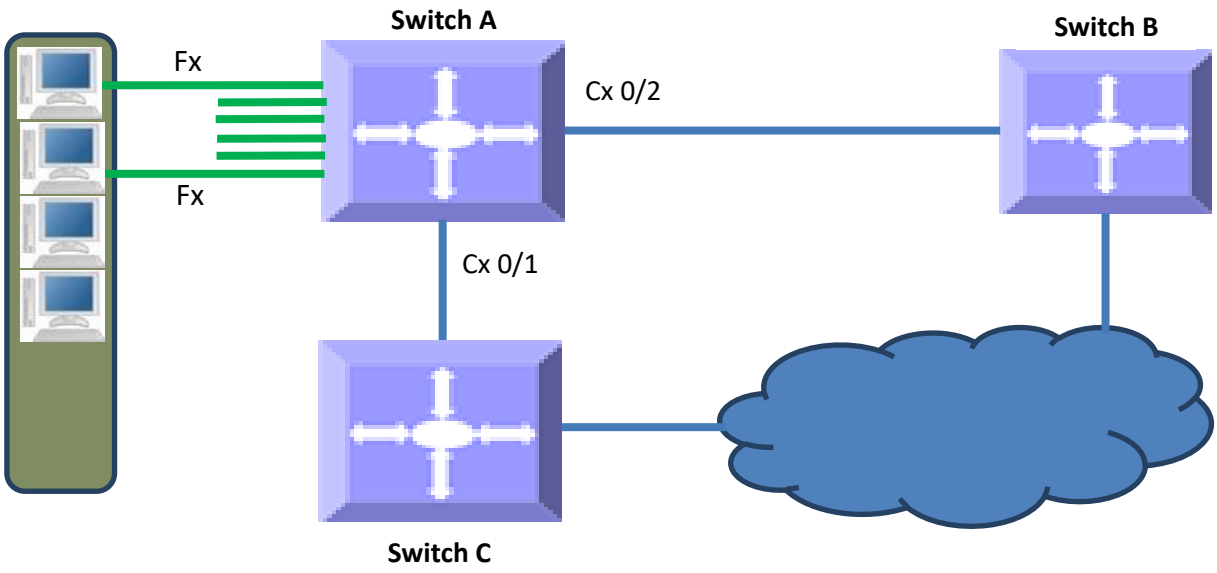
SMIS(config-if)# end

6.23 Spanning Tree Configuration Examples

Configure the following requirements on the switches as shown below in FigureMSTP-Eg.1.

1. Configure two MST instances separately for VLANs 100 and 200.
2. Configure switch B as the root switch for the VLAN 100 instance.
3. Configure switch C as the root switch for the VLAN 200 instance.
4. Configure port fx 0/1-40 in all switches as port fast.

Figure MSTP-Eg.1Spanning Tree MSTP Configuration Example



Configurations on switch A

SMIS# configure terminal

Create the VLANs 100 and 200

SMIS(config)# vlan 100,200

SMIS(config-vlan)# exit

Create MST instance for vlan 100 and 200

SMIS(config)# spanning-tree mst configuration

SMIS(config-mst)# instance 1 vlan 100

SMIS(config-mst)# instance 2 vlan 200

SMIS(config-mst)# exit

Configure the port fx 0/1-40 as port fast

SMIS(config)# interface range fx 0/1-40

SMIS(config-if)# spanning-tree portfast

Warning: portfast should only be enabled on ports connected to a single host.

Connecting hubs, concentrators, switches, bridges, etc. to this interface when portfast is enabled can cause temporary bridging loops.

Use with CAUTION

SMIS(config-if)#exit

Save this spanning tree configuration.

SMIS# write startup-config

Building configuration, Please wait. May take a few minutes ...

[OK]

SMIS#

Configurations on switch B

SMIS# configure terminal

Create the VLANs 100 and 200

SMIS(config)# vlan 100,200

SMIS(config-vlan)# exit

Create MST instance for vlan 100 and 200

SMIS(config)# spanning-tree mst configuration

SMIS(config-mst)# instance 1 vlan 100

SMIS(config-mst)# instance 2 vlan 200

SMIS(config-mst)# exit

Configure the port fx 0/1-40 as port fast

SMIS(config)# interface range fx 0/1-40

SMIS(config-if)# spanning-tree portfast

Warning: portfast should only be enabled on ports connected to a single host.

Connecting hubs, concentrators, switches, bridges, etc. to this interface when portfast is enabled can cause temporary bridging loops.

Use with CAUTION

SMIS(config-if)# exit

Configure switch B as the root switch for VLAN 100 instance

SMIS(config)# spanning-tree mst 1 priority 4096

SMIS(config)# end

Check the spanning tree MST configurations

```
SMIS# show spanning-tree mst 1 detail

 ## MST01

Vlans mapped:    100

Bridge     Address 00:30:48:a1:11:01    Priority 4096

Root       Address 00:30:48:a1:11:01    Priority 4096

Root       this switch for MST01

Fx0/47 of MST01 is Designated, Forwarding

Port info         port id 128.47           priority 128   cost 200000

Designated root   address 00:30:48:a1:11:01   priority 4096  cost 0

Designated bridge address 00:30:48:a1:11:01   priority 4096  port id 128.47

SMIS#
```

Save this spanning tree configuration.

```
SMIS# write startup-config

Building configuration, Please wait. May take a few minutes ...

[OK]

SMIS#Configurations on switch C

SMIS# configure terminal
```

Create the VLANs 100 and 200

```
SMIS(config)# vlan 100,200

SMIS(config-vlan)# exit
```

Create MST instance for vlan 100 and 200

```
SMIS(config)# spanning-tree mst configuration

SMIS(config-mst)# instance 1 vlan 100

SMIS(config-mst)# instance 2 vlan 200

SMIS(config-mst)# exit
```

Configure the port fx 0/1-40 as port fast

```
SMIS(config)# interface range fx 0/1-40

SMIS(config-if)# spanning-tree portfast
```

Warning: portfast should only be enabled on ports connected to a single host.

Connecting hubs, concentrators, switches, bridges, etc... to this interface

when portfast is enabled, can cause temporary bridging loops.

Use with CAUTION

SMIS(config-if)# exit

Configure switch C as the root switch for VLAN 200 instance

SMIS(config)# spanning-tree mst 2 priority 4096

SMIS(config)# end

Check the spanning tree MST configurations

SMIS# show spanning-tree mst 2 detail

MST02

Vlans mapped: 200

Bridge Address 00:30:48:e3:56:12 Priority 4096

Root Address 00:30:48:e3:56:12 Priority 4096

Root this switch for MST02

Fx0/47 of MST02 is Designated, Forwarding

Port info port id 128.47 priority 128 cost 200000

Designated root address 00:30:48:e3:56:12 priority 4096 cost 0

Designated bridge address 00:30:48:e3:56:12priority 4096 port id 128.47

SMIS#

Save this spanning tree configuration.

SMIS# write startup-config

Building configuration, Please wait. May take a few minutes ...

[OK]

SMIS#

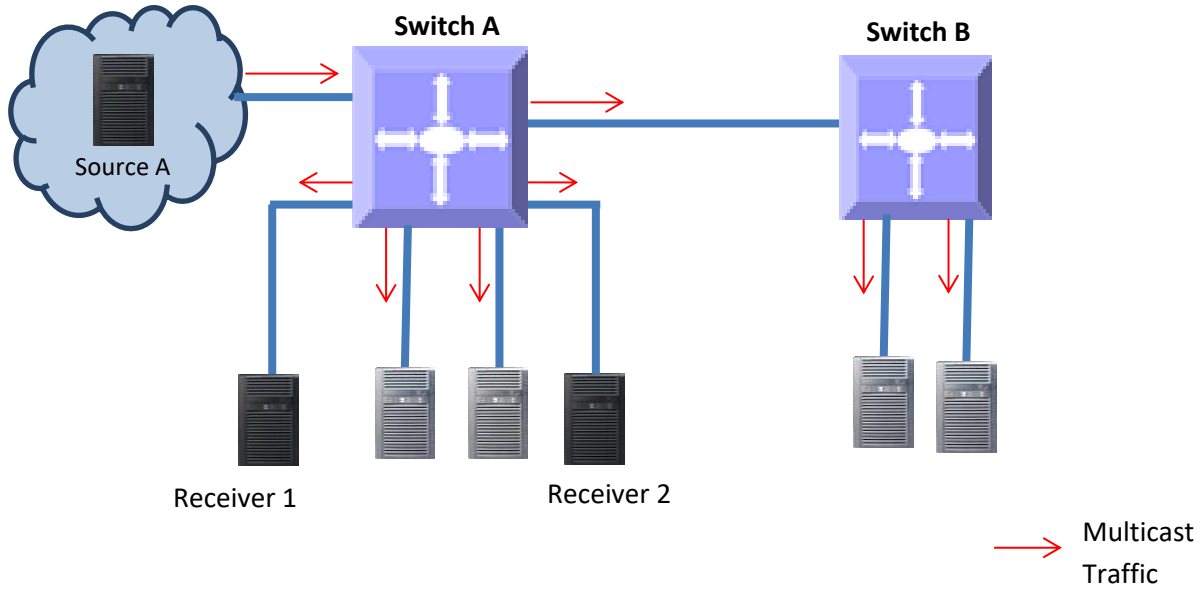
7 IGMP Snooping

Switches learn the source MAC addresses for unicast traffic and forward the unicast traffic only to the required ports. However for multicast and broadcast traffic, switches forward the traffic to all ports except for the port that received that traffic. This basic multicast switching function helps all hosts connected to the switch receive the multicast traffic.

In practical deployments, all hosts connected to a switch may not run the same multicast applications. The hosts that do not run multicast applications receive the multicast traffic unnecessarily. Similarly, the multicast traffic is forwarded to other switches unnecessarily when there are no hosts connected to the other switches expecting the multicast traffic.

Forwarding multicast traffic to unnecessary hosts and switches wastes network bandwidth and computing resources. In IP TV and other similar multicast intensive deployments, this problem leads to considerable underutilization of network and compute resources.

Figure IGS-1: Multicast Forwarding without IGMP Snooping

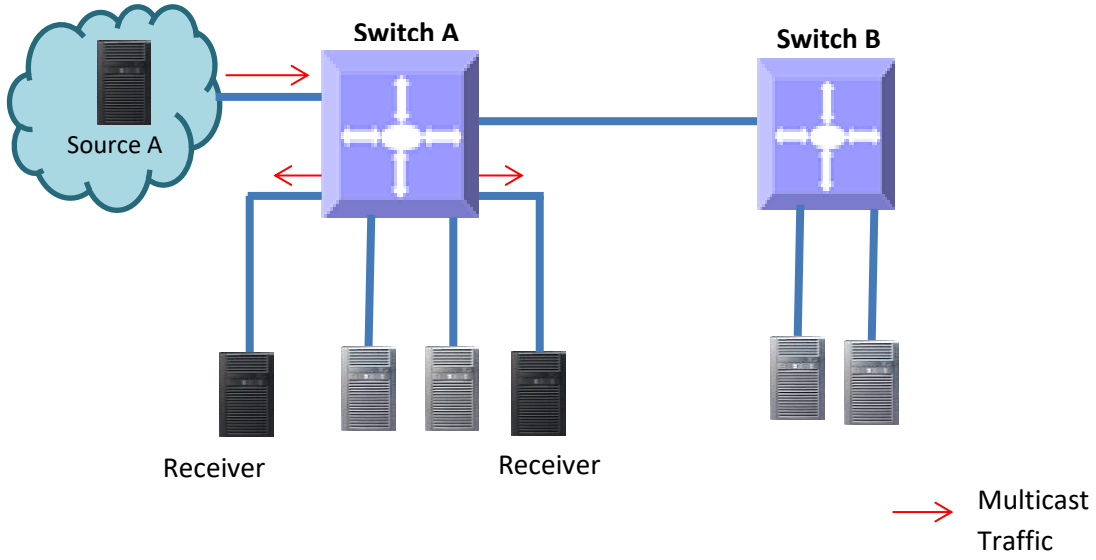


The IGMP snooping function helps switches to forward IPv4 multicast traffic to only the ports that require IPv4 multicast traffic. This function saves network bandwidth by preventing the unnecessary flooding of IPv4 multicast traffic.

A switch performs the IGMP snooping function by snooping Layer 3 IGMP packets and recognizes an IGMP host's connected ports by snooping the IGMP join messages sent from hosts. Similarly, a switch recognizes an IGMP router's connected ports by snooping the IGMP control messages sent by IGMP routers. The switch maintains a multicast forwarding table based on the hosts joined and router connected ports for every multicast group and updates the multicast forwarding table when hosts leave multicast groups.

A switch forwards the multicast traffic based on the information available on the multicast table. It sends the multicast traffic of any group to only the ports that have hosts joined for that multicast group. This mechanism prevents the unnecessary flooding of multicast traffic to all the ports.

Figure IGS-2: Multicast Forwarding with IGMP Snooping



7.1 IGMP Snooping Support

Supermicro switches support IGMP snooping for all three IGMP versions (1, 2 and 3).

Supermicro switches support the forwarding of multicast traffic based on MAC and IP addresses.

Supermicro switches support up to 255 multicast groups.

Parameter	Default Value
IGMP snooping global status	Disabled
IGMP snooping status in VLAN	Disabled
Multicast forwarding mode	MAC based
Send query on topology change	Disabled
Proxy report	Enabled
Router port purge interval	125 seconds
Port purge interval	260 seconds
Report forward interval	5 seconds
Group specific query interval	2 seconds
Forwarding reports	To only router ports
Group specific query retry count	2
IGMP version	3
Immediate leave (fast leave)	Disabled
Querier	Non-querier
Query interval	125 seconds
Unknown multicast filtering	Disabled

7.2 Enabling IGMP Snooping

IGMP snooping is disabled by default in Supermicro switches.

IGMP snooping needs to be enabled globally and also needs to be enabled in VLANs individually.

Follow the steps below to enable IGMP snooping.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	ip igmp snooping	Enables IGMP snooping globally.
Step 3	vlan<**vlan-list**>	Enters the VLAN configuration mode. vlan-list – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10. If multiple VLANs are provided, the next step will enable IGMP snooping on all these VLANs.
Step 4	ip igmp snooping	Enables IGMP snooping on VLAN.
Step 5	end	Exits the configuration mode.
Step 6	show ip igmp snooping globals show ip igmp snooping vlan<**vlan**>	Displays the IGMP snooping information.
Step 7	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The GMRP feature needs to be in the disabled state while enabling IGMP snooping. GMRP is disabled by default in Supermicro switches.
Use the “set gmrp disable” command to disable the GMRP feature if needed.

The example below shows the commands used to enable IGMP snooping.

Enable IGMP snooping for VLAN 1, 10 and 20.

SMIS# configure terminal

SMIS(config)# ip igmp snooping

SMIS(config)# vlan 1,10,20

SMIS(config-vlan)# ip igmp snooping

SMIS(config-vlan)# end

7.3 IGMP Version

The IGMP protocol standard has three versions: v1, v2 and v3.Supermicro switches support IGMP snooping for all three versions. Supermicro IGMP snooping support interoperates with different IGMP versions as defined in the IGMP protocol standard.

The default IGMP snooping version is v3, which is compatible with IGMP versions 1 and 2.

Supermicro switches provide flexibility for users to configure IGMP snooping versions for individual VLANs. User can configure different IGMP versions on different VLANs.

Follow the steps below to change the IGMP snooping version on any VLAN.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	vlan<vlan-list>	Enters the VLAN configuration mode. vlan-list – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10. If multiple VLANs are provided, the next step will be applied on all these VLANs.
Step 3	ip igmp snooping version {v1 | v2 | v3}	Configures IGMP snooping version.
Step 5	end	Exits the configuration mode.
Step 6	show ip igmp snooping vlan<vlan>	Displays the IGMP snooping version information for the given VLAN.
Step 7	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The example below shows the commands used to configure different versions of IGMP snooping.

Configure IGMP snooping version 3 for VLAN 10 and version 2 for VLAN 20.

SMIS# configure terminal

SMIS(config)# vlan 10

SMIS(config-vlan)# ip igmp snooping version v3

SMIS(config-vlan)# exit

SMIS(config)# vlan 20

SMIS(config-vlan)# ip igmp snooping version v2

SMIS(config-vlan)# end

7.4 Multicast Router Ports

Supermicro switches monitor the IGMP control messages sent by IGMP routers and recognize the ports that receive IGMP router messages as router ports.

A switch forwards the IGMP member reports from the host computers to only the router ports. If a switch does not recognize any router ports, it forwards the host computers' IGMP reports to all ports except the one that received the host report's message.

7.4.1 Router Port Timeouts

After finding the router ports, switches expect to periodically receive IGMP control messages from them. If IGMP receives no control messages for a period of time from any router port, a switch will stop considering those ports as router ports until IGMP control messages are received again. This period of time is called the router port timeout value.

By default, Supermicro switches have a router port timeout value of 125 seconds. This value can be changed by following the steps below.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	ip igmp snooping mrouter-time-out<timeout>	Configures the router port timeout value in seconds. timeout – may be any value from 60 to 600 seconds. The default value is 125 seconds.
Step 3	end	Exits the configuration mode.
Step 4	show ip igmp snooping globals	Displays the IGMP snooping router port timeoutinformation.
Step 5	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The "no ip igmp snooping mrouter-time-out" command resets the router timeout value to its default value of 125 seconds.

The example below shows the commands used to configure the router port timeout value.

Configure the router port timeout value as 90 seconds.

SMIS# configure terminal

SMIS(config)# ip igmp snooping mrouter-time-out 90

SMIS(config)# end

7.4.2 Static Router Ports

Router ports can also be configured statically. Router ports are configured per VLAN basis.

Follow the steps below to configure the static router portfor any VLAN.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	vlan<vlan-list>	Enters the VLAN configuration mode. vlan-list – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10. If multiple VLANs are provided, the next step will configurethe router ports for all these VLANs.
Step 3	ip igmp snooping mrouter<interface-type><interface-id>	Configures the router port. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx portchannel – po interface-id is in slot/port format for all physical interfaces. It may be the port channel identifier for port channel interfaces.
Step 5	end	Exits the configuration mode.
Step 6	show ip igmp snooping mrouter [vlan<vlan>]	Displays the IGMP snooping router port information. If a VLAN identifier is provided it displays the router port for the given VLAN. If a VLAN identifier is not provided it displays the router portsfor all the VLANs on the switch.
Step 7	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The “no ip igmp snooping mrouter<interface-type><interface-id>” command can be used to remove a statically configured router port from a VLAN.

The example below shows the commands used to configure the router ports.

Configure port fx 0/1 as the router port for VLAN 10.

SMIS# configure terminal

SMIS(config)# vlan 10

SMIS(config-vlan)# ip igmp snooping mrouter fx 0/1

SMIS(config-vlan)# end

7.5 Leaving a Multicast Group

Host computers leave multicast groups either silently or by sending IGMP leave messages. Switches monitor the IGMP leave messages sent by host computers. When a switch receives an IGMP leave message for any group on a port, it does not delete the port from the group entry on the multicast table immediately. Instead, the switch sends an IGMP group-specific query message on the port that received the IGMP leave message. If there is any other IGMP host on that port that joined the same multicast group, the switch will receive an IGMP member report as a response. If no hosts respond on that port, the switch will assume no other IGMP hosts are connected on that port for the same group and will delete the corresponding port from the group entry on the multicast table.

Switches follow the above process only for IGMP version 2 leave messages.

The following parameters are used to control the leave message handling procedure in Supermicro switches.

Group Query Interval – This configures the amount of time a switch will wait to get response for its group specific queries from IGMP hosts.

Retry Count – This configures the number of times a switch sends a group specific query to look for IGMP hosts on the port that received an IGMP leave message.

Immediate Leave – This configures the switch to consider the host leave immediately instead of sending group specific query messages to look for other IGMP hosts on the port that received an IGMP leave message.

These parameters can be configured as explained below.

7.5.1 Group Query Interval

Switches send a group specific query messages on the port that received an IGMP leave message. Switches wait for the group query interval time to get a response from the hosts for its group specific

query messages. If they receive any host member report as a response, they will drop the leave message received earlier on that port. If they do not receive any response from hosts for a group query interval time, the switches will resend a query specific message based on the retry count. When the number of times specified in the retry count is metwithoutaresponse from any of the hosts, the switches will remove the port from the group entry in the multicast forwarding table.

Users can configure this group query interval. The default group query interval is 2 seconds.

Follow the steps below to configure the group query interval.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	ip igmp snooping group-query-interval <timeout>	Configures the group query interval timeout. timeout – may be any value from 2 to 5 seconds. The default is 2 seconds.
Step 3	end	Exits the configuration mode.
Step 4	show ip igmp snooping globals	Displays the IGMP snooping group query interval information.
Step 5	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The “no ip igmp snooping group-query-interval” command resets the group query interval value to its default value of 2 seconds.

The example below shows the commands used to configure the group query interval time.

Configure the group query interval time as 5 seconds.

SMIS# configure terminal

SMIS(config)# ip igmp snooping group-query-interval 5

SMIS(config)# end

7.5.2 Group Query Retry Count

When no response is received from any host for the group specific query messages, switches will resend a group specific query message. The number of times a switch retries sending the group specific query message is configurable. The default retry count is 2.

Follow the steps below to configure the group specific query message retry count.

Step	Command	Description

Step 1	configure terminal	Enters the configuration mode.
Step 2	ip igmp snooping retry-count<**count**>	Configures the group specific query message retry count. count – may be any value from 1 to 5 seconds. The default is 2.
Step 3	end	Exits the configuration mode.
Step 4	show ip igmp snooping globals	Displays the IGMP snooping group specific query message retry count information.
Step 5	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The "no ip igmp snooping retry-count" command resets the group specific query retry count value to its default value of 2.

The example below shows the commands used to configure the retry count for group specific query messages.

Configure the group specific query message retry count as 3.

SMIS# configure terminal

SMIS(config)# ip igmp snooping retry-count 3

SMIS(config)# end

7.5.3 Immediate Leave

The switch can be configured to immediately remove a port from the group entry on the multicast table if it receives an IGMP leave message without sending out group specific query messages. This function is called immediate leave and it is configurable per a VLAN basis. Immediate leave is disabled by default in all VLANs.

Follow the steps below to enable the immediate leave for any VLAN.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	vlan<**vlan-list**>	Enters the VLAN configuration mode. vlan-list – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10.

		If multiple VLANs are provided, the next step will enable the immediate leave for all these VLANs.
Step 3	ip igmp snooping fast-leave	Enables the IGMP immediate leave.
Step 4	end	Exits the configuration mode.
Step 5	show ip igmp snooping vlan<**vlan**>	Displays the IGMP snooping immediate leave information for the given VLAN.
Step 6	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The "no ip igmp snooping fast-leave" command can be used to disable the immediate leave function for any VLAN.

The example below shows the commands used to enable the immediate leave function.

Enable the immediate leave for the VLANs 10 and 20.

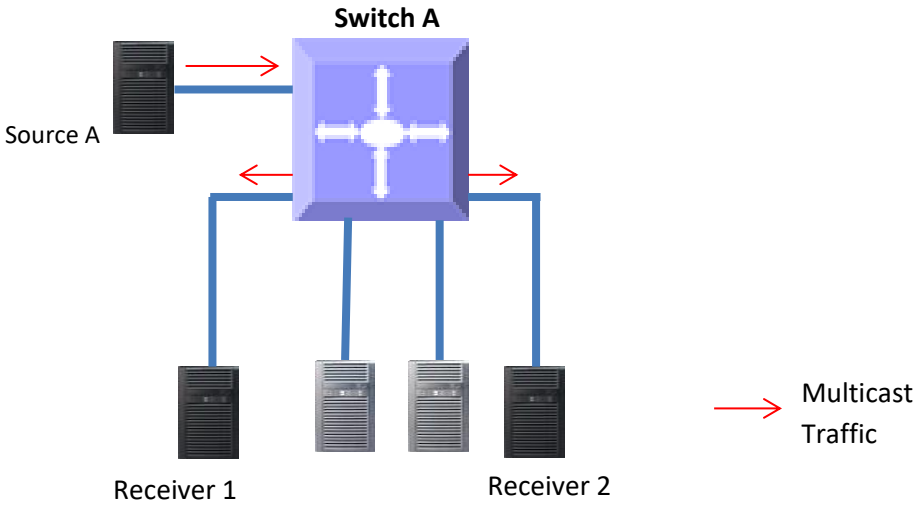
```
SMIS# configure terminal
SMIS(config)# vlan 10,20
SMIS(config-vlan)# ip igmp snooping fast-leave
```

SMIS(config-vlan)# end

7.6 IGMP Snooping Querier

The IGMP snooping function needs an IGMP router on the network. Simple multicast deployments in which multicast traffic is switched and not routed may not have IGMP routers on the network. In these cases, switches will have multicast hosts and sources on the same subnet as shown in the figure below.

Figure IGS-3: Multicast Deployment Without IGMP Routers



In simple multicast networks without IGMP routers, IGMP hosts will not send periodic membership reports since there is no IGMP router to respond. Without periodic membership reports from hosts, a switch will remove all multicast group entries on port purge timeouts. The removal of multicast group entries on a switch will cause flooding of multicast traffic on all ports. To avoid this flooding, a switch can be configured as an IGMP querier.

When a switch is configured as an IGMP querier, it will send periodic queries to hosts, similar to the action of an IGMP router. This will make hosts send periodic IGMP reports and hence the multicast group entries in switches will not time out.

Supermicro switches do not act as an IGMP querier by default. Users can configure the switch to act as an IGMP querier for any required VLANs.

When a Supermicro switch acts as an IGMP querier, it sends queries every 125 seconds. This periodic time interval can be configured for every VLAN.

Follow the steps below to configure a switch as an IGMP querier for any VLAN.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	vlan<**vlan-list**>	Enters the VLAN configuration mode. vlan-list – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10.

		If multiple VLANs are provided, the next step will configure the switch as an IGMP querier for all these VLANs.
Step 3	ip igmp snooping querier	Configures the switch to act as an IGMP querier.
Step 4	ip igmp snooping query-interval <**interval-value**>	Configures the periodic interval on the switch that will send IGMP queries. interval-value – may be any value from 60 to 600 seconds. The default value is 125 seconds.
Step 5	end	Exits the configuration mode.
Step 6	show ip igmp snooping vlan<**vlan**>	Displays the IGMP snooping querierconfiguration for the given VLAN.
Step 7	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The “no ip igmp snooping querier” command can be used to remove the IGMP querier configuration from a VLAN.
The “no ip igmp snooping query-interval” command can be used to set the querier periodic interval to the default value of 125 seconds.

The example below shows the commands used to configure the switch to act as an IGMP querier.

Configure the switch to act as an IGMP querier for VLAN 10 and set the querier periodic interval to 300 seconds.

SMIS# configure terminal

SMIS(config)# vlan 10

SMIS(config-vlan)# ip igmp snooping querier

SMIS(config-vlan)# ip igmp snooping query-interval 300

SMIS(config-vlan)# end

7.7 Report Forward

When IGMP snooping is enabled, Supermicro switches forward IGMP host member reports to IGMP routers. When a switch has not recognized any router ports, it forwards IGMP host member reports to all ports except the port on which the host member report was received. When a switch recognizes a router port, it forwards the IGMP host member reports to only the recognized router port.

The switch behavior can be changed to forward the IGMP host member reports to all the ports except the port on which the host member report was received irrespective of router port learning.

Follow the steps below to configure a switch to forward the IGMP host member reports to all the ports except the port on which the host member report was received.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	ip igmp snooping report-forward { all-ports | router-ports }	Configures the IGMP host member's report forwarding behavior. Use all-ports to configure a switch to forward IGMP host member reports to all ports. Use router-ports to configure the switch to forward the IGMP host member reports to the router ports only. The default behavior is router-ports.
Step 3	end	Exits the configuration mode.
Step 4	show ip igmp snooping globals	Displays the IGMP snooping information.
Step 5	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The "no ip igmp snooping report-forward" command configures the switch to the default behavior of forwarding the IGMP host member reports only to the router port.

The example below shows the commands used to configure IGMP member report forwarding.

Configure the switch to forward the IGMP member report to all ports.

SMIS# configure terminal

SMIS(config)# ip igmp snooping report-forward all-ports

SMIS(config)# end

7.8 Port Timeout (Port Purge Interval)

A switch recognizes an IGMP host's connected ports by snooping the IGMP join messages sent by the host and maintains a multicast forwarding table based on the host's joined ports for every multicast group.

After recognizing the host's member ports, a switch expects to receive IGMP member reports periodically on the host ports. If an IGMP member's reports are not received over a time period in any host member port, the switch will remove those ports from the corresponding group entry in the multicast forwarding

table. This time period is called the port purge interval value. Once a host port is removed from the multicast forwarding table for any group, it will no longer receive the multicast traffic for that group.

Supermicro switches have a port purge interval value of 260 seconds by default. Users can change this value by following the steps below.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	ip igmp snooping port-purge-interval<**timeout**>	Configures the port purge interval value in seconds. timeout – may be any value from 130 to 1225 seconds. The default value is 260 seconds.
Step 3	end	Exits the configuration mode.
Step 4	show ip igmp snooping globals	Displays the IGMP snooping port purge interval information.
Step 5	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The “no ip igmp snooping port-purge-interval” command resets the port purge interval value to its default value of 260 seconds.

The example below shows the commands used to configure the port purge interval value.

Configure the port purge interval value to 900 seconds.

SMIS# configure terminal

SMIS(config)# ip igmp snooping port-purge-interval 900

SMIS(config)# end

7.9 Report Suppression Interval

Supermicro switches forward the IGMP member reports sent by the hosts to IGMP multicast routers. To avoid forwarding duplicate reports, Supermicro switches suppress any reports received within a short time period for the same group. This time period is called the report suppression interval. Any reports received for the same group after this interval passes will be forwarded to multicast routers.

Supermicro switches suppress IGMP reports for IGMP versions 1 and 2 only. If an IGMP report contains IGMP version 3 reports, switches will forward these reports to multicast routers without suppressing.

Users can configure the report suppression time period. The default value is 5 seconds.

Follow the steps below to configure the report suppression interval.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	ip igmp snooping report-suppression-interval<**interval**>	Configures the port purge interval value in seconds. interval – may be any value from 1 to 25 seconds. The default value is 5 seconds.
Step 3	end	Exits the configuration mode.
Step 4	show ip igmp snooping globals	Displays the IGMP snooping report suppression interval information.
Step 5	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The “no ip igmp snooping report-suppression-interval” command resets the report suppression interval value to its default value of 5 seconds.

The example below shows the commands used to configure the report suppression interval value.

Configure the port report suppression interval value as 90 seconds.

SMIS# configure terminal

SMIS(config)# ip igmp snooping report-suppression-interval 90

SMIS(config)# end

7.10 Proxy Reporting

IGMP snooping switches maintain the states of IGMP host members. This information helps the switches send summarized IGMP reports to IGMP multicast routers. This function of IGMP snooping is called proxy reporting. This proxy reporting feature helps reduce IGMP control message traffic on the network by preventing the forwarding of every host report to the IGMP routers.

Proxy reporting is enabled by default in Supermicro switches. Users can disable or enable the proxy reporting feature by following the steps below.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	ip igmp snooping proxy-reporting	Enables the proxy reporting feature.
Step 3	end	Exits the configuration mode.
Step 4	show ip igmp snooping globals	Displays the IGMP snooping proxy reporting status information.

Step 5	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The “no ip igmp snooping proxy-reporting” command disables the proxy reporting feature.

The example below shows the commands used to enable the proxy reporting feature.

Enable IGMP snooping proxy reporting.

SMIS# configure terminal

SMIS(config)# ip igmp snooping proxy-reporting

SMIS(config)# end

7.11 Sending Queries WhenTopology Changes

When spanning tree topology changes, multicast traffic is often flooded. To quickly recover from flooding, switches can be configured to send general IGMP queries to all ports when spanning tree topology changes. This helps switches correctly recognize member ports based on the new spanning tree topology.

Supermicro switches do not send general IGMP queries by default when spanning tree topology changes. Users can enable the switch to send general IGMP queries when spanning tree topology change events occur. When enabled in RSTP mode, switches send general IGMP queries to all ports except for router ports. In MSTP mode, switches send general IGMP queries to all ports except for the router ports of the VLANs associated with topology changed MST instance.

Follow the steps below to enable the switch to send general IGMP queries when spanning tree topology changes.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	ip igmp snooping send-query enable	Enables the switch to send general IGMP queries when spanning tree topology changes.
Step 3	end	Exits the configuration mode.
Step 4	show ip igmp snooping globals	Displays the IGMP snooping information.
Step 5	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The “ip igmp snooping send-query disable” command configuresthe switch to not send general IGMP queries when spanning tree topology changes.

The example below shows the commands used to enable a switch to send general IGMP queries when spanning tree topology changes.

Enable the switch to send general IGMP queries when spanning tree topology changes.

SMIS# configure terminal

SMIS(config)# ip igmp snooping send-query enable

SMIS(config)# end

7.12 Disabling IGMP Snooping

IGMP snooping is disabled by default in Supermicro switches.

After enabling IGMP snooping, it must be disabled globally and also in VLANs individually.

Follow the steps below to disable IGMP snooping.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	no ip igmp snooping	Disables IGMP snooping globally.
Step 3	vlan<vlan-list>	Enters the VLAN configuration mode. vlan-list – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10. If multiple VLANs are provided, the next step will disable IGMP snooping on all these VLANs.
Step 4	no ip igmp snooping	Disables IGMP snooping in VLAN.
Step 5	end	Exits the configuration mode.
Step 6	show ip igmp snooping globals show ip igmp snooping vlan<**vlan**>	Displays the IGMP snooping information.
Step 7	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

The example below shows the commands used to disable IGMP snooping.

Disable the IGMP snooping function assuming the switch has VLANs 1, 10 and 20.

SMIS# configure terminal

SMIS(config)# no ip igmp snooping

SMIS(config)# vlan 1,10,20

SMIS(config-vlan)# no ip igmp snooping

SMIS(config-vlan)# end

7.13 Unknown Multicast Filtering

Unknown multicast packets are flooded to all the VLAN member ports by default. This functionality can be modified to drop all the unknown multicast packets.

This feature, unknown multicast filtering, can be configured per VLAN.

Follow the steps below to enable unknown multicast filtering for any VLAN.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	vlan<vlan-list>	Enters the VLAN configuration mode. vlan-list – may be any VLAN number or list of VLAN numbers. Multiple VLAN numbers can be provided as comma-separated values. Consecutive VLAN numbers can be provided as a range, such as 5-10. If multiple VLANs are provided, the next step will disable IGMP snooping on all these VLANs.
Step 3	ip igmp snooping multicast filtering enable	Disables IGMP snooping in VLAN.
Step 4	end	Exits the configuration mode.
Step 5	show ip igmp snooping vlan<**vlan**>	Displays the IGMP snooping information including Multicast Forwarding feature
Step 6	write startup-config	Optional step – saves this IGMP snooping configuration to be part of the startup configuration.

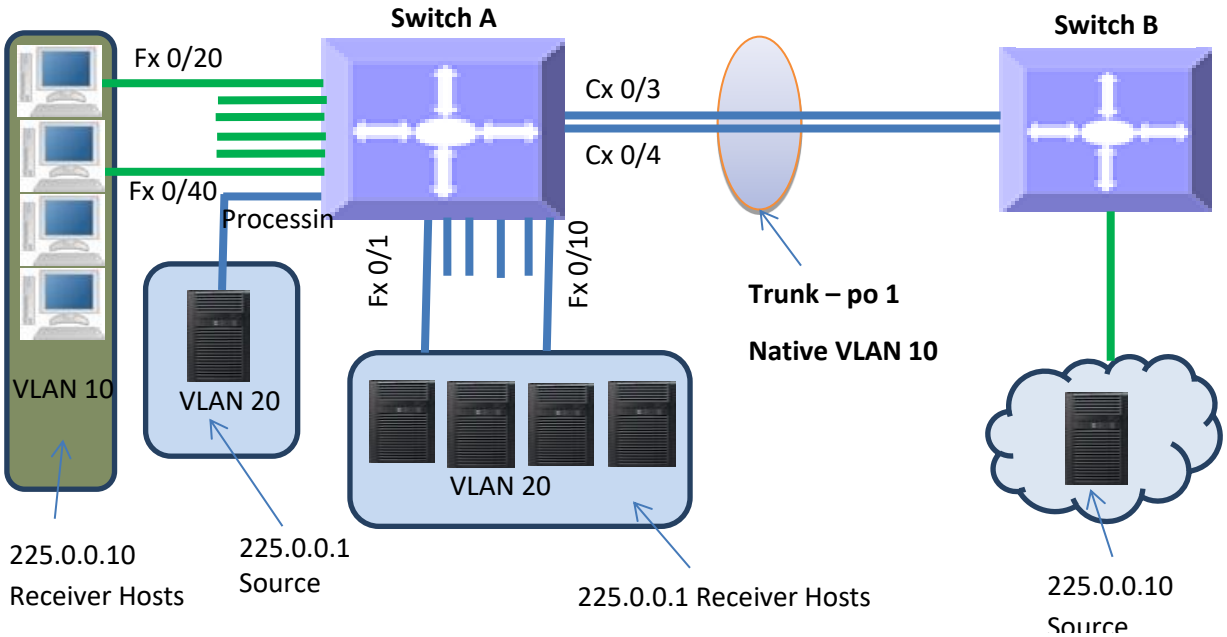
To disable unknown multicast filtering feature for any VLAN and flood all the unknown multicast packets to all the member ports of that VLAN, use the command “ip igmp snooping multicast filtering disable” in the VLAN configuration mode.

7.14 IGMP Snooping Configuration Example

Configure the following requirements on Switch A as shown below in Figure IGS-4.

1. Enable IGMP snooping.
2. There is no multicast router for group 225.0.0.1 so configure the switch as a querier for this group.
3. Use IGMP v2 for group 225.0.0.1 and also enable fast leave since hosts are directly connected to the switch.
4. Disable the proxy reporting.
5. Enable the switch to send general IGMP queries when spanning tree topology changes.

Figure IGS-4IGMP Snooping Configuration Example



SMIS# configure terminal

Create all the required VLANs first

SMIS(config)# vlan 10,20

SMIS(config-vlan)# exit

Add member ports to VLAN 10

SMIS(config)# int range fx 0/20-40

SMIS(config-if)#switchport mode access

SMIS(config-if)#switchport access vlan 10

SMIS(config-if)# exit

Add member ports to VLAN 20

SMIS(config)# int range cx 0/1 fx 0/1-10

SMIS(config-if)#switchport mode trunk

SMIS(config-if)#switchporttrunk allowed vlan 20

SMIS(config-if)# exit

Create the port channel 1 interface

SMIS(config)# int port-channel 1

SMIS(config-if)# exit

Add member ports to the port channel 1 interface

SMIS(config)# int range cx 0/3-4

SMIS(config-if)#channel-group 1 mode active

SMIS(config-if)# exit

Configure the VLAN requirements for the port channel 1 interface

SMIS(config)# int port-channel 1

SMIS(config-if)# switchport mode trunk

SMIS(config-if)# switchport trunk native vlan 10

SMIS(config-if)# exit

Req.1 Enable IGMP Snooping

SMIS(config)# ip igmp snooping

SMIS(config)# vlan 10,20

SMIS(config-vlan)# ip igmp snooping

SMIS(config-vlan)# exit

Req.2 Configure the switch as a querier for group 225.0.0.1

SMIS(config)# vlan 20

```
SMIS(config-vlan)# ip igmp snooping querier
SMIS(config-vlan)# exit
# Req.3 Configure IGMP v2 and fast leave for group 225.0.0.1
SMIS(config)# vlan 20
SMIS(config-vlan)# ip igmp snooping version v2
SMIS(config-vlan)# ip igmp snooping fast-leave
SMIS(config-vlan)# exit
# Req.4 Disable proxy reporting
SMIS(config)# no ip igmp snooping proxy reporting
# Req.5 Enable the switch to send general IGMP queries when spanning tree topology changes
SMIS(config)# ip igmp snooping send-query enable

# Check the running-configuration for accuracy
SMIS# show running-config
Building configuration...
interface port-channel 1
exit
vlan 1
ports fx 0/11-19 untagged
ports fx 0/41-48 untagged
ports cx 0/2 untagged
exit
vlan 10
ports fx 0/20-40 untagged
ports po 1 untagged
exit
vlan 20
exit
```

```
interface Fx 0/1
switchport trunk allowed vlan 20
switchport mode trunk
interface Fx 0/2
switchport trunk allowed vlan 20
switchport mode trunk
interface Fx 0/3
switchport trunk allowed vlan 20
switchport mode trunk
interface Fx 0/4
switchport trunk allowed vlan 20
switchport mode trunk
interface Fx 0/5
switchport trunk allowed vlan 20
switchport mode trunk
interface Fx 0/6
switchport trunk allowed vlan 20
switchport mode trunk
interface Fx 0/7
switchport trunk allowed vlan 20
switchport mode trunk
interface Fx 0/8
switchport trunk allowed vlan 20
switchport mode trunk
interface Fx 0/9
switchport trunk allowed vlan 20
switchport mode trunk
interface Fx 0/10
```

switchport trunk allowed vlan 20

switchport mode trunk

interface Fx 0/20

switchport access vlan 10

switchport mode access

interface Fx 0/21

switchport access vlan 10

switchport mode access

interface Fx 0/22

switchport access vlan 10

switchport mode access

interface Fx 0/23

switchport access vlan 10

switchport mode access

interface Fx 0/24

switchport access vlan 10

switchport mode access

interface Fx 0/25

switchport access vlan 10

switchport mode access

interface Fx 0/26

switchport access vlan 10

switchport mode access

interface Fx 0/27

switchport access vlan 10

switchport mode access

interface Fx 0/28

switchport access vlan 10

switchport mode access

interface Fx 0/29

switchport access vlan 10

switchport mode access

interface Fx 0/30

switchport access vlan 10

switchport mode access

interface Fx 0/31

switchport access vlan 10

switchport mode access

interface Fx 0/32

switchport access vlan 10

switchport mode access

interface Fx 0/33

switchport access vlan 10

switchport mode access

interface Fx 0/34

switchport access vlan 10

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interface Fx 0/35

switchport access vlan 10

switchport mode access

interface Fx 0/36

switchport access vlan 10

switchport mode access

interface Fx 0/37

switchport access vlan 10

switchport mode access

interface Fx 0/38

switchport access vlan 10

switchport mode access

interface Fx 0/39

switchport access vlan 10

switchport mode access

interface Fx 0/40

switchport access vlan 10

switchport mode access

interface Cx 0/1

switchport trunk allowed vlan 20

switchport mode trunk

interface Cx 0/3

channel-group 1 mode active

interface Cx 0/4

channel-group 1 mode active

interfacepo 1

switchport trunk native vlan 10

switchport mode trunk

exit

ip igmp snooping

noip igmp snooping proxy-reporting

vlan 20

ip igmp snooping fast-leave

ip igmp snooping version v2

ip igmp snooping querier

exit

SMIS#

SMIS# ship igmp snooping globals

Snooping Configuration

IGMP Snooping globally enabled

IGMP Snooping is operationally enabled

Transmit Query on Topology Change globally enabled

Multicast forwarding mode is MAC based

Proxy reporting globally disabled

Router port purge interval is 125 seconds

Port purge interval is 260 seconds

Report forward interval is 5 seconds

Group specific query interval is 2 seconds

Reports are forwarded on router ports

Group specific query retry count is 2

SMIS# show ip igmp snooping vlan 10

Snooping VLAN Configuration for the VLAN 10

IGMP Snooping enabled

IGMP Operating version is V3

Fast leave is disabled

Snooping switch is acting as Non-Querier

Query interval is 125 seconds

SMIS# show ip igmp snooping vlan 20

Snooping VLAN Configuration for the VLAN 20

IGMP Snooping enabled

IGMP configured version is V2

IGMP Operating version is V2

Fast leave is enabled

Snooping switch is configured as Querier

Snooping switch is acting as Querier

Query interval is 125 seconds

SMIS#

Save this port channel configuration.

SMIS# write startup-config

Building configuration, Please wait. May take a few minutes ...

[OK]

SMIS#

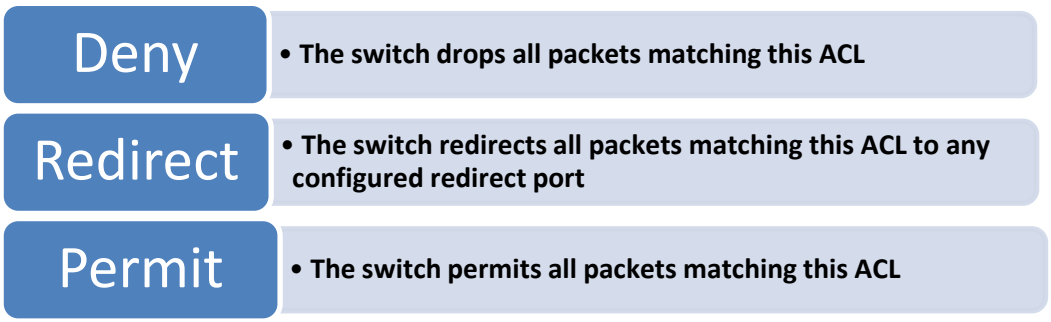
8 ACL

ACL is used to filter or redirect any particular traffic flow on the switch.

ACLs can be configured to match packets based on Layer 2 MAC or Layer3 or Layer 4 TCP/UDP parameters.

Every packet entering the switch is checked for the configured ACLs. If any packet contents match any of the configured ACLs, that packet will be handled according to the matched ACL configured action.

The ACL configuration provides the following actions that can be applied on matched traffic flow.



Supermicro switches implement ACL in hardware ASIC (Application Specific Integrated Circuit) to provide line rate ACL processing for all incoming traffic.

User configured ACL rules are programmed in an ACL table in ASIC. Layer 2 MAC extended ACLs and Layer 3 IP ACLs are implemented in two separate hardware tables, which are TCAM tables in ASIC.

ASIC analyzes the first 128 bytes of every received packet and extracts the packet contents for key fields in the Layer 2, Layer 3 and Layer 4 headers. ASIC then looks up the ACL tables to find a matching ACL rule for the extracted content of the packet. ASIC compares the values of the configured fields only and treats all other fields as “do not care”. Once a matching ACL is found, ASIC stops looking in that ACL table.

ASIC applies the configured action of the matching ACL rule to the matched packet. This could result in it dropping that packet, redirecting it to any particular port or simply allowing the packet to be forwarded through the switch.

A lookup on the Layer 2 and Layer 3 ACL tables happens simultaneously. If any packet matches the ACL rules of both Layer 2 and Layer 3 ACL tables, the actions configured on both ACL rules will be applied. In this case, conflicting actions configured on Layer 2 and Layer 3 ACL tables for the same traffic could lead to unpredictable behavior. Hence, it is suggested to avoid such ACL use cases.

8.1 Types of ACLs

Supermicro switches support the following three different types of ACLs.

Three types of ACL	MAC Extended ACL
	IP Standard ACL
	IP Extended ACL

8.1.1 MAC Extended ACL

A MAC Extended ACL allows users to control the traffic based on the fields in Ethernet MAC and VLAN headers.

Users can configure the traffic flow based on the source MAC address, destination MAC address or Ethernet type field value. Users can also use VLAN identifiers to configure the traffic flow.

Users can choose to deny, redirect or permit the configured traffic flow using a MAC Extended ACL.

8.1.2 IP Standard ACL

An IP Standard ACL allows users to control the traffic based on the fields in an IP header.

Users can configure the traffic flow based on the source IP address and destination IP address.

Users can choose to deny, redirect or permit the configured traffic flow using an IP Standard ACL.

8.1.3 IP Extended ACL

An IP Extended ACL allows users to control traffic based on fields in an IP header, ICMP header, TCP header and UDP header.

Users can configure the traffic flow based on source IP address, destination IP address,protocol field in IP header, TOS field in IP header or by using a DSCP priority in an IP header.

Users can also configure the traffic flow based on ICMP message type, ICMP message code, TCP port number or UDP port number.

Users can choose to deny, redirect or permit the configured traffic flow using an IP Extended ACL.

8.2 MAC Extended ACL

Supermicro switches support up to 128 MAC Extended ACLs.

Users can configure a MAC Extended ACL with a deny, permit or redirect action rule. A MAC Extended ACL can be configured only with one rule. To implement multiple rule ACLs, configure multiple MAC Extended ACLs.

There is no implied deny all rule in Supermicro switch ACLs. By default, all packets not matching a configured ACL rule will be forwarded automatically. For any traffic to be denied, it has to be configured with an explicit deny rule.

The permit rule is widely used for QoS applications. In some cases permit rules are useful when all traffic is denied by a rule and a few specific hosts are to be permitted. In this case, permit rules have to be created before deny rules to make sure switch hardware processes permit rules first.

MAC Extended ACLs allow users to configure the traffic flow with the following fields.

- Source MAC Address
- Destination MAC Address
- Non-IP Protocol
- Ethernet type field in an Ethernet Header
- VLAN Identifier

MAC Extended ACL rules can be created and identified either with an ACL number such as 1, 2 , 3 or with a name string. An ACL identifier number can be any number from 1 to 32768. An ACL identifier name can be any string length not exceeding 32 characters No special characters are allowed.

User can associate priority values to MAC extended ACL rules. Based on the configured priority, the rules will be orderly arranged in the hardware ACL table. The ACL rules are checked on the incoming packets based on the order of priority. Higher priority ACL rules take precedence over lower priority rules. In case of multiple rules with the same priority value, rules that were created earlier will take precedence over those created later.

If the user does not specify the priority, all rules will have a priority value of 1 by default.

8.2.1 Creating MAC Extended ACLs

Follow the steps below to create a MAC Extended ACL.

Step	Command	Description
Step 1	configure terminal	Enter the configuration mode
Step 2	mac access-list extended **{ <access-list-number>| <access-list-name> }**	Creates a MAC Extended ACL using the **mac-access-list extended** command. access-list-number–can be any number from 1 to 65535 access-list-name– any name string up to 32 characters.
Step 3	deny { any | host<src-mac-address>}{ any | host<dest-mac-address> }<value (1-65535)>] [Vlan<vlan-id (1-4069)>] [priority<value (1-255)>] or permit { any | host<src-mac-address>}{ any | host<dest-mac-address> } priority<value (1-65535)>][Vlan<vlan-id (1-4069)>] [priority<value (1-255)>] or	Configures a deny ACL rule, a permit ACL rule or a redirect ACL rule. The source and destination MAC addresses are provided with the keyword host. The keyword anyis used to refer any MAC addresses. If a source or destination MAC address is configured as any, the switch will not check that source or destination MAC address to match the packets for this ACL.

	redirect<interface-type><interface-id> { any | host<src-mac-address>} { any | host<dest-mac-address> } priority<value (1-65535)>] [Vlan<vlan-id (1-4069)>] [priority<value (1-255)>]	The protocol keyword can be used to configure the Ethernet header Encap Type field to be matched to apply this ACL rule. This protocol is an optional parameter. If not provided, switch will not check this field while matching packets for this ACL. If this ACL rule is to be applied only to a particular VLAN, user can configure VLAN number using Vlan keyword. This Vlan is an optional parameter. If not provided, the switch will not check VLAN while matching packets for this ACL. The priority keyword lets user assign a priority for this ACL rule. This priority is an optional parameter. It can be any value from 1 to 255. The default value is 1. Redirect ACL rule needs additional <interface-type><interface-id>parameters to definethe port to which the packets matching this ACL rule need to be redirected.
Step 4	show access-lists	Displays the configured ACL rules
Step 5	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

Every ACL is applied to all ports by default. Any ACL that needs to be applied only to particular ports needs to be configured as described in section Applying MAC Extended ACL to Interfaces.

The below examples show various ways of creatinga a MAC Extended ACL.

Create a deny MAC Extended ACL with ACL number 100 to deny all traffic from MAC 00:25:90:01:02:03

SMIS# configure terminal

SMIS(config)# mac access-list extended 100

SMIS(config-ext-macl)# deny host 00:25:90:01:02:03 any

Create a permit MAC Extended ACL with ACL name acl_cw3 to permit all traffic from MAC 00:25:30:01:02:03

SMIS# configure terminal

SMIS(config)# mac access-list extended acl_cw3

SMIS(config-ext-macl)# permit host 00:25:30:01:02:03 any

Create a redirect MAC Extended ACL to redirect all packets from MAC 00:25:90:01:02:03going to MAC 00:25:90:01:02:04 to interface fx 0/10.

SMIS# configure terminal

SMIS(config)# mac access-list extended 1

SMIS(config-ext-macl)# redirect fx 0/10 host 00:25:90:01:02:03 host 00:25:90:01:02:04

8.2.2 Modifying MAC Extended ACLs

To modify a configured MAC Extended ACL, follow the same steps used to create a MAC Extended ACL. When users modify an ACL with a deny, permit or redirect rule, the previously configured rule and its parameters for that ACL will be completely overwritten with the newly provided rules and parameters.

When an ACL rule is modified, it is removed from the hardware ACL table and added back based on the priority of the rule.

The below example shows a MAC Extended ACL rule 50 that is created and later modified with different parameters.

SMIS# configure terminal

SMIS(config)# mac access-list extended 50

SMIS(config-ext-macl)# deny host 00:25:90:01:02:03 any

SMIS(config-ext-macl)# end

Modify this ACL's rule 50 to deny traffic destined to a particular host MAC instead of any

SMIS# configure terminal

SMIS(config)# mac access-list extended 50

SMIS(config-ext-macl)# deny host 00:25:90:01:02:03 host 00:25:90:01:02:04

8.2.3 Removing MAC Extended ACLs

Follow the steps below to remove MAC Extended ACLs.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	no mac access-list extended **{ <access-list-number> | <access-list-name> }**	Deletes a MAC Extended ACL using **no mac-access-list extended** command. access-list-number – the ACL number that needs to be deleted access-list-name – the name of the ACL that needs to be deleted
Step 3	show access-lists	Displays the configured ACL rules to make sure the deleted ACL is removed properly
Step 4	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

The example below shows how to remove a MAC Extended ACL.

SMIS# configure terminal

SMIS(config)# no mac access-list extended 50

8.2.4 Applying MAC Extended ACLs to Interfaces

MAC Extended ACLs are applied to all physical interfaces by default. If users prefer to apply any MAC Extended ACL only to certain ports, the steps below need to be followed.

8.2.5 ACL Ingress Port Configuration

User can associate an ACL with multiple ingress ports. Follow the steps below to add ingress port(s) to an ACL.

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> ….**	The port or port lists on which this MAC Extended ACL needs to be applied.
Step 3	mac access-group { **<short (1-32768)> | <string(32)>** }	Adds the MAC Extended ACL to this port. access-list-number – the ACL number that needs to be added access-list-name – the name of the ACL that needs to be added
Step 4	show access-lists	Displays the configured ACL rules to make sure this port is added to the required ACL.

Step 5	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

The example below shows applying a MAC Extended ACL rule 100 to ingress ports fx 0/1 and fx 0/10.

SMIS#configure terminal

SMIS(config)# int fx 0/1

SMIS(config-if)# mac access-group 100

SMIS(config-if)# exit

SMIS(config)# int fx 0/10

SMIS(config-if)# mac access-group 100

Removing MAC Extended ACL from ingress port

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> ….	The port or port lists from which this MAC Extended ACL needs to be removed.
Step 3	no mac access-group { <short (1-32768)> | <string(32)>}	Removes the MAC Extended ACL from this port. access-list-number – the ACL number that needs to be removed from this interface. access-list-name – the name of the ACL which needs to be removed from this interface.
Step 4	show access-lists	Displays the configured ACL rules to make sure this port is removed from required ACL.
Step 5	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

1. When a MAC Extended ACL is removed from all the ports it was applied to, that ACL will become a switch-wide ACL (applied to all physical ports).
2. MAC Extended ACLs can be added only to physical ports like fx and cx ports. They cannot be added to Layer 3 vlan interfaces or port channel interfaces.

3. A MAC Extended ACL can be applied to many ports by following the above steps. In the same way, many MAC Extended ACLs can be applied to a single port.

The example below shows the commands for removing a MAC Extended ACL from a port.

SMIS#configure terminal

SMIS(config)# int fx 0/1

SMIS(config-if)# no mac access-group 100

8.2.6 Displaying MAC Extended ACLs

Step	Command	Description
Step 1	show access-lists or show access-lists mac { <access-list-number (1-32768)> | <access-list-name>]	Enters the configuration mode access-list-number – the ACL number that needs to be displayed access-list-name – the name of the ACL which needs to be displayed

The show command displays the following information for every MAC Extended ACL:

Filter Priority	ACL's configured or default priority
Protocol Type	Configured protocol. If not configured, it shall be displayed as zero.
Vlan Id	Configured VLAN identifier.
Destination MAC Address	Configured destination host MAC address. Displays 00:00:00:00:00:00 for any destination MAC address
Source MAC Address	Configured source host MAC address. Displays 00:00:00:00:00:00 for any source MAC address
In Port List	The list of ports this ACL is applied to. If it is applied to all ports, this will be ALL.
OutPort	The egress port configured for this ACL. If no egress port configured, this will be ALL.
Filter Action	Configured ACL action rule – deny, permit or redirect
Status	Current status of the ACL. The status should normally be ***active***. In the case of configuration errors, the ACL status may be inactive.

The below example displays a MAC Extended ACL.

SMIS#show access-lists mac 100

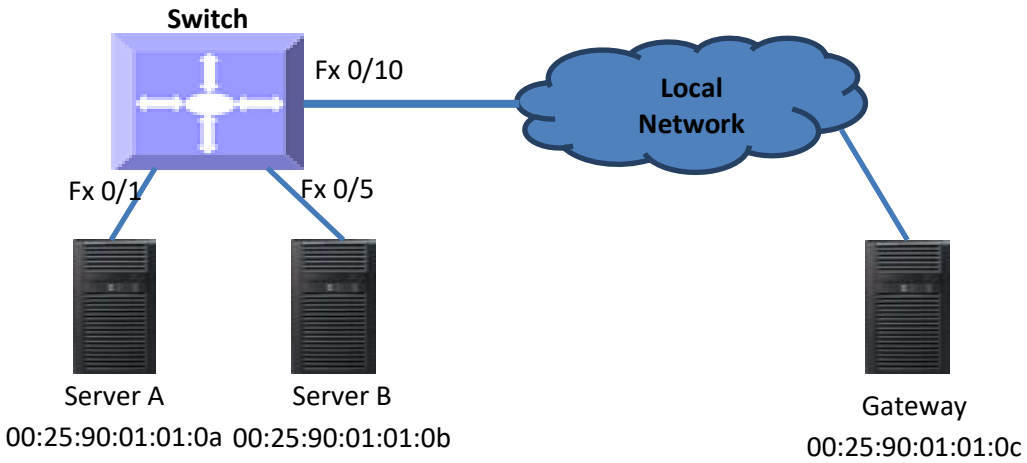
Extended MAC Access List 100

Filter Priority : 1
Protocol Type : 0
EncapType : 0
Vlan Id :
Destination MAC Address : 00:25:90:01:02:03
Source MAC Address : 00:00:00:00:00:00
In Port List : Fx0/2
Out Port : ALLFilter Action : Deny
Status : Active

8.2.7 MAC Extended ACL Configuration

This example describes the commands required to implement the following ACL requirements on the network setup shown in Figure ACL-1.
ACL 1 – Deny all traffic going from Server A to the gateway.
ACL 2 – Redirect all vlan 20 traffic coming from the gateway to Server B.

Figure ACL-1: MAC Extended ACL Example 1



ACL 1 Configuration
SMIS# configure terminal

SMIS(config)# mac access-list extended 1

SMIS(config-ext-macl)# deny host 00:25:90:01:01:0a host 00:25:90:01:01:0c

ACL 2 Configuration

SMIS# configure terminal

SMIS(config)# mac access-list extended 2

SMIS(config-ext-macl)# redirect fx 0/5 host 00:25:90:01:01:0c any vlan 20

8.3 IP Standard ACL

Supermicro switches support 128 IP ACLs, which includes both IP Standard and IP Extended ACLs.

Users can define IP Standard ACLs with deny, permit or redirect action rules. An IP Standard ACL can be defined with only one rule. To implement multiple rule ACLs, configure multiple IP Standard ACLs.

There is no implied deny all rule in Supermicro switch ACLs. By default, all packets not matching a configured ACL rule will be forwarded automatically. For any traffic to be denied, it has to be configured with an explicit deny rule.

The permit rule is widely used for QoS applications. In some cases permit rules are useful when all traffic is denied by a rule and a few specific hosts are to be permitted.

IP Standard ACLs allow users to configure the traffic flow with the following fields.

- Source IP Address
- Destination IP Address

IP Standard ACL rules can be created and identified either a with an ACL number as such as 1, 2 or 3 or with a name string. An ACL identifier number can be any number from 1 to 32768. An ACL identifier name can be any string length not exceeding 32 characters. No special characters are allowed in ACL name strings.

IP Standard ACLs and IP Extended ACLs share the same ACL numbers and names. Hence ACL numbers and names across all IP Standard and IP Extended ACLs have to be unique. In other words, the same ACL number or name cannot be used for both IP Standard ACLs and IP Extended ACLs.

Users can associate a priority value to IP standard ACL rules. Based on the configured priority, the rules will be orderly arranged on the hardware ACL table. The ACL rules are checked on the incoming packets based on the order of priority. Higher priority ACL rules take precedence over lower priority rules. In case of multiple rules with the same priority value, the rules that were created earlier will take precedence over those created later.

If the user does not specify the priority, all rules will have a priority value of 1 by default.

The priority for the IP standard ACL rule “deny any any” is fixed as 1. Users cannot configure the “deny any any” rule with different priority value. Since this rule will drop all the IP packets, this rule is added at the end of the IP ACL table on the hardware.

IP Standard ACLs and IP Extended ACLs share the same ACL table on the hardware. Hence priority values need to be configured while considering both IP standard and extended ACLs.

8.3.1 Creating IP Standard ACLs

Follow the steps below to create anIP Standard ACL.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ip access-list standard { <access-list-number(1-32768)> | <access-list-name> }	Creates an IP Standard ACL using ip-access-list standard command. access-list-number – can be any number from 1 to 32768 access-list-name – can be any name string up to 32 characters.
Step 3	deny { any | host<ucast_addr> | <ucast_addr><ip_mask> } [{any | host<ip_addr> | <ip_addr><ip_mask> }] [priority<value (1-255)>] or permit { any | host<src-ip-address> | <src-ip-address><mask> } [{ any | host<dest-ip-address> | <dest-ip-address><mask> }] [priority<value (1-255)>] or 1. redirect<interface-type><interface-id> { any | host<src-ip-address> | <src-ip-address><mask> } [{ any | host<dest-ip-address> | <dest-ip-address><mask> }] [priority<value (1-255)>]	Configure a deny ACL rule or permit ACL rule or redirect ACL rule. The source and destination IP addresses are provided with the keyword host. The keyword anyis used to refer to any IP addresses. To configure a network IP, address and mask should be provided. A redirect ACL rule needs additional <interface-type><interface-id>parameters to definethe port to which the packets matching this ACL rule need to be redirected. The priority keyword lets user assign a priority for this ACL rule. This priority is an optional parameter. It can be any value from 1 to 255. The default value is 1.
Step 4	show access-lists	Displays the configured ACL rule
Step 5	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

Every ACL is applied to all ports by default. If any ACL needs to be applied only to particular ports, it needs to be configured as described in section Applying IP ACL to Interfaces.

The examples below show different ways to create IP Standard ACLs.

Create a deny IP Standard ACL with ACL number 100 to deny all traffic from IP 172.10.10.10 to IP 172.10.10.1

SMIS# configure terminal

SMIS(config)# ip access-list standard 100

SMIS(config-std-nacl)# deny host 172.10.10.10 host 172.10.10.1

Create a permit IP Standard ACL with ACL name acl_cw3 to permit all traffic from IP 172.10.10.1

SMIS# configure terminal

SMIS(config)# ip access-list standard acl_cw3

SMIS(config-std-nacl)# permit host 172.10.10.1 any

Create a redirect IP Standard ACL to redirect all packets from subnet 172.20.20.X going to IP 172.20.0.1 to interface fx 0/10.

SMIS# configure terminal

SMIS(config)# ip access-list standard 1

SMIS(config-std-nacl)# redirect fx 0/10 172.20.20.0 255.255.255.0 host 172.20.0.1

8.3.2 Modifying IP Standard ACLs

To modify a configured IP Standard ACL, follow the same steps used to create aIP Standard ACL. When users modify an ACL with a deny, permit or redirect rule, the previously configured rule and its parameters for that ACL will be completely overwritten with the newly provided rules and parameters.

When an ACL rule is modified, it is removed from the hardware ACL table and added back based on the priority of the rule.

The example below shows anIP Standard ACL rule 50being created and then modified with different parameters.

SMIS# configure terminal

SMIS(config)# ip access-list standard 50

SMIS(config-std-nacl)# deny 172.10.0.0 255.255.0.0 any

Modify this ACL rule 50 to deny traffic destined to a particular host IP instead of to any.

SMIS# configure terminal

SMIS(config)# ip access-list standard 50

SMIS(config-std-nacl)# deny 172.10.0.0 255.255.0.0 host 172.50.0.1

8.3.3 Removing IPStandard ACLs

Follow the below steps to remove IP Standard ACLs.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	no ip access-list standard { <access-list-number(1-32768)r> | <access-list-name> }	Deletes an IP Standard ACL using no ip-access-list standard command. access-list-number – the ACL number that needs to be deleted access-list-name – the name of the ACL that needs to be deleted
Step 3	show access-lists	Displays the configured ACL rules to make sure the deleted ACL is removed properly
Step 4	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

The example below shows how to remove an IP StandardACL .

SMIS# configure terminal

SMIS(config)# no ip access-list standard 50

8.3.4 Applying IP ACLs to Interfaces

IP Standard and Extended ACLs are applied to all physical interfaces by default. If users prefer to apply any IP Standard or Extended ACL only to certain ports, the steps below need to be followed.

8.3.5 ACL Ingress Port Configuration

User can associate an ACL with multiple ingress ports. Follow the steps below to add ingress port(s) to an ACL.

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> ….	Defines the port or port lists on which this IP Standard / Extended ACL needs to be applied
Step 3	ip access-group { <access-list -number (1-32768)> | <access-list-name>	Adds the IP Standard / Extended ACL to this ingress port access-list-number – the ACL number that needs to be added access-list-name – the name of the ACL which needs to be added

Step 4	show access-lists	Displays the configured ACL rules to make sure this port has added the required ACL
Step 5	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration

The example below shows applying anIP Standard ACL rule 100 to ports fx 0/1 and fx 0/10.

SMIS# configure terminal

SMIS(config)# interface fx 0/1

SMIS(config-if)# ip access-group 100

SMIS(config-if)# exit

SMIS(config)# int fx 0/10

SMIS(config-if)# ip access-group 100

Removing anIPStandard / Extended ACL from a port

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> ….	The port or port lists from which this IP Standard or Extended ACL needs to be removed
Step 3	no ip access-group[{ <access-list-number (1-65535)> | <access-list-name> }]	Removes the IP Standard / Extended ACL from this ingress port access-list-number – the ACL number that needs to be removed from this interface access-list-name – the name of the ACL that needs to be removed from this interface
Step 4	show access-lists	Displays the configured ACL rules to make sure this port has been removed from the required ACL
Step 5	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

1. When an IP Standard/Extended ACL is removed from all the ports it was applied to, that ACL will become a switch wide ACL (applied to all physical ports).
2. IP Standard and Extended ACLs can be added only to physical ports like fx or cx ports. ACLs cannot be added to Layer 3 vlan interfaces or port channel interfaces
3. An IP Standard/Extended ACL can be applied to many ports by following the above steps. In the same way, many IP Standard/Extended ACLs can be applied on a single port.

The example below shows the commands used for removing an IP Extended ACL from a port.

SMIS# configure terminal

SMIS(config)# int fx 0/1

SMIS(config-if)# no ip access-group 100

8.3.6 Displaying IP Standard ACLs

Step	Command	Description
Step 1	show access-lists or show access-lists ip { <access-list-number (1-32768)> | <access-list-name>]	Enters the configuration mode access-list-number – the ACL number that needs to be displayed access-list-name – the name of the ACL that needs to be displayed

Theshow command displays the following information for every IP Standard ACL.

Source IP Address	Configured source host or subnet IP address. Displays 0.0.0.0 for any source IP.
Source IP Address Mask	Configured source subnet IP mask. For host IP address, the mask will be displayed as 255.255.255.255.
Destination IP Address	Configured destination host or subnet IP address. Displays 0.0.0.0 for any destination IP.
Destination IP Address Mask	Configured destination subnet IP mask. For host IP address, the mask will be displayed as 255.255.255.255.
In Port List	The list of ports this ACL is applied to. If it is applied to all ports, this will be ALL.
Out Port	The egress port configured for this ACL. If no egress port configured, this will be ALL.
Filter Action	Configured ACL action rule – deny,permit or redirect

Status	Current status of the ACL. The status should normally be *active*. In case of configuration errors, the ACL status may be inactive.

The example below displays an IPStandard ACL

SMIS# show access-lists ip 1

Standard IP Access List 1

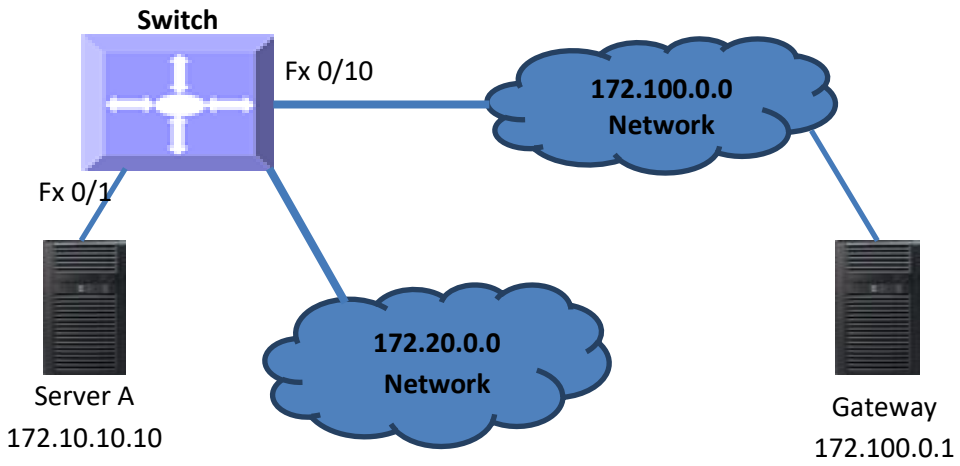
Source IP address : 172.20.20.0
Source IP address mask : 255.255.255.0
Destination IP address : 172.20.0.1
Destination IP address mask : 255.255.255.255
In Port List : ALL
Out Port : ALL
Filter Action : Redirect to Fx0/10
Status : Active

8.3.7 IP Standard ACL Configuration Example 1

This example describes the commands required to implement the following ACL requirements on the network setup shown in Figure ACL-2.

ACL 1 – Deny all traffic going from 172.20.0.0 network to 172.100.0.0 network, but allow only server 172.20.20.1 to access the 172.100.0.1 gateway.
ACL 2 – Redirect all traffic destined to IP 172.10.0.0 network to server 172.10.10.10.

Figure ACL-2: IP Standard ACL Example 1



ACL 1 Configuration

This ACL has two rules; one to allow traffic from 172.20.20.1 and the other to deny all traffic from the 172.20.0.0 network.

A permit rule needs to be created first.

SMIS# configure terminal

SMIS(config)# ip access-list standard acl_1a

SMIS(config-std-nacl)# permit host 172.20.20.1 host 172.100.0.1

Then create the deny rule for the subnet 172.20.0.0.

SMIS# configure terminal

SMIS(config)# ip access-list standard acl_1b

SMIS(config-std-nacl)# deny 172.20.0.0 255.255.0.0 172.100.0.0 255.255.0.0

ACL 2 Configuration

SMIS# configure terminal

SMIS(config)# ip access-list standard 2

SMIS(config-std-nacl)# redirect fx 0/1 any 172.10.0.0 255.255.0.0

8.3.8 IP Extended ACLs

Supermicro switches support 128 IP ACLs, which includes both IP Standard and IP Extended ACLs.

Users can define IP Extended ACLs with deny, permit or redirect action rules. An IP Extended ACL can be defined only with one rule.

There is no implied deny all rule in Supermicro switch ACLs. By default, all packets not matching a configured ACL rule will be forwarded automatically. For any traffic to be denied, it has to be configured with an explicit deny rule.

The permit rule is widely used for QoS applications. In some cases permit rules are useful when all traffic is denied by a rule and a few specific hosts are to be permitted. IP Extended ACLs allow users to configure traffic flow with the following fields.

- IP - Protocol, Source IP Address, Destination IP Address, Type Of Service (TOS), DSCP
- TCP – Source Port, Destination Port, TCP message type – acknowledgement / reset
- UDP – Source Port, Destination Port
- ICMP – Message Type, Message Code

IP Extended ACL rules can be created and identified either a with an ACL number such as 1,2 or 3 or with a name string. ACL identifier numberscan be any number from 1 to 65535. ACL identifier namescan be any string length not exceeding 32 characters.

IP Standard ACLs and IP Extended ACLs share the ACL numbers and names. Hence ACL numbers and names across all IP Standard and IP Extended ACLs have to be unique. In other words, the same ACL number or name cannot be used for both IP Standard ACLs and IP Extended ACLs.

User can associatepriority values to IP Extended ACL rules. Based on the configured priority, the rules will be orderly arranged on the hardware ACL table. The ACL rules are checked on the incoming packets based on the order of priority. The higher priority ACL rules takes precedence over the lower priority rules. In case of multiple rules with the same priority value, the rules that created earlier will take precedence over the later ones.

If the user does not specify the priority, by default all rules will have same priority value as 1.

IP Standard ACLs and IP Extended ACLs share the same ACL table on the hardware. Hence priority values need to be configured with the consideration of both IP standard and extended ACLs.

8.3.9 Creating IP Extended ACLs for IP Traffic

Follow the steps below to create an IP Extended ACL for IP, OSPF or PIM traffic.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ip access-list extended { <access-list-number(1-32768)> | <access-list-name> }	Creates an IP Extended ACL using ip-access-list extended command. access-list-number – can be any number from 1 to 32768 access-list-name – can be any name string up to 32 characters.
Step 3	deny { ip | ospf | pim | <protocol-type (1-255)>} { any | host<src-ip-address> | <src-ip-address><mask> } { any | host<dest-ip-address> | <dest-ip-address><mask> } [{tos<value (0-255)> | dscp<value (0-63)>}] [priority<value (1-255)>] or permit { ip | ospf | pim | <protocol-type (1-255)>} { any | host<src-ip-address> | <src-ip-address><mask> } { any | host<dest-ip-address> | <dest-ip-address><mask> } [{tos<value (0-255)>| dscp<value (0-63)>}] [priority<value (1-255)>] or	Configuresa deny, permitor redirect ACL rule. Use the keyword ip to apply this rule to all IP packets. To apply this rule to only OSPF or PIM packets, use the keywords ospf or pimas needed. The source and destination IP addresses can be provided with the keyword host. The keyword anymay be used to refer to any IP addresses. To configure a network IP, address and mask should be provided.

	redirect<interface-type><interface-id> { ip | ospf | pim | <protocol-type (1-255)>} { any | host<src-ip-address> | <src-ip-address><mask> } { any | host<dest-ip-address> | <dest-ip-address><mask> } [{tos<value (0-255)> | dscp<value (0-63)>}] [priority<value (1-255)>]	To apply this rule to packets with specific TOS values, use the keyword tos and specify the TOS value to be matched. User can specify any TOS values from 0 to 255. The user provided TOS value will be matched exactly against the type of service byte on the IPv4 header of the received packets.Hence users have to provide the TOS byte value combining the precedence and type of service fields of IP header. This TOS configuration is optional. To apply this rule to packets with specified DSCP values, use the keyword dscp and the specific DSCP values to be matched. Users can specify any DSCP values from 0 to 63. The DSCP configuration is optional. The priority keyword lets users assign a priority for this ACL rule. This priority is an optional parameter. It may be any value from 1 to 255. The default value is 1. Redirect ACL rules need additional <interface-type><interface-id>parameters to provide the port to which the packets matching this ACL rule should be redirected.
Step 4	show access-lists	Displays the configured ACL rule
Step 5	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

The examples below show various ways to create an IP Extended ACL for IP traffic.

Create a deny IP Extended ACL with ACL number 100 to deny all traffic from IP 172.10.10.10 with TOS8**.**

SMIS# configure terminal

SMIS(config)# ip access-list extended 100

SMIS(config-ext-nacl)# deny ip host 172.10.10.10 any tos 8

Create a deny IP ExtendedACL with ACL name acl_cw3 to deny all OSPF packets from network 172.20.1.0.

SMIS# configure terminal

SMIS(config)# ip access-list extended acl_cw3

SMIS(config-ext-nacl)# deny ospf 172.20.1.0 255.255.255.0 any

Create a redirect IP Extended ACL to redirect all packets from subnet 172.20.20.X going to IP 172.20.0.1with DSCP value 10 to interface fx 0/10.

SMIS# configure terminal

SMIS(config)# ip access-list extended 100

SMIS(config-ext-nacl)# redirect fx 0/10 ip 172.20.20.0 255.255.255.0 host 172.20.0.1 dscp 10

8.3.10 Creating IP Extended ACLs for TCP Traffic

Follow the below steps to create an IP Extended ACL for TCP traffic.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ip access-list extended { <access-list-number(1-32768)> | <access-list-name> }	Creates an IP Extended ACL using the ip-access-list extended command. access-list-number – can be any number from 1 to 32768 access-list-name – can be any name string up to 32 characters.
Step 3	denytcp {any | host<src-ip-address> | <src-ip-address><src-mask> } [{eq<port-number (0-65535)> }] { any | host<dest-ip-address> | <dest-ip-address><dest-mask> } [{eq<port-number (0-65535)> }] [{ ack | rst }] [{tos<value (0-255)>|dscp<value (0-63)>}] [priority<short(1-255)>] or permittcp {any | host<src-ip-address> | <src-ip-address><src-mask> } [{eq<port-number (0-65535)> }] { any | host<dest-ip-address> | <dest-ip-address><dest-mask> } [{eq<port-number (0-65535)> }] [{ ack | rst }] [{tos<value (0-255)>|dscp<value (0-63)>}] [priority<short(1-255)>] or	Configures a deny, permit or redirect ACL rule. The source and destination IP addresses are provided with the keyword host. The keyword anymay be used to refer to any IP addresses. To configure a network IP, address and mask should be provided. To apply this rule to packets with specific TCP ports, userscan configure either the source or destination TCP ports. The specific TCP port is provided with the keyword eq. To apply this ACL rule to only TCP ACK packets, the keyword ackcan be used. Similarly, to apply this ACL rule to only TCP RST packets, the keyword rst could be used.

	redirect<interface-type><interface-id>tcp {any | host<src-ip-address> | <src-ip-address><src-mask> } [{eq<port-number (0-65535)> }] { any | host<dest-ip-address> | <dest-ip-address><dest-mask> } [{eq<port-number (0-65535)> }] [{ ack | rst }] [{tos<value (0-255)>|dscp<value (0-63)>}] [priority<short(1-255)>]	To apply this rule to packets with specific TOS values, use the keyword tos and specify the TOS value to be matched. User can specify any TOS values from 0 to 255. The user provided TOS value will be matched exactly against the type of service byte on the IPv4 header of the received packets. Hence users have to provide the TOS byte value combining the precedence and type of service fields of IP header. This TOS configuration is optional. To apply this rule to packets with specified DSCP values, use the keyword dscp and specific DSCP values to be matched. Users can specific any DSCP values from 0 to 63. This DSCP configuration is optional. The priority keyword lets users assign a priority to this ACL rule. This priority is an optional parameter. It could be any value from 1 to 255. The default value is 1. Redirect ACL rules need additional <interface-type><interface-id>parameters to definethe port to which the packets matching this ACL rule need to be redirected.
Step 4	show access-lists	Displays the configured ACL rule
Step 5	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

The examples below show various ways to create IP Extended ACLs for TCP traffic.

Create a deny IP Extended ACL with ACL number 100 to deny all traffic toTCP port 23.

SMIS# configure terminal

SMIS(config)# ip access-list extended 100

SMIS(config-ext-nacl)# deny tcp any anyeq 23

Create a deny IP Extended ACL with ACL name acl_cw3 to deny all TCP traffic on 172.20.0.0 network.

SMIS# configure terminal

SMIS(config)# ip access-list extended acl_cw3

SMIS(config-ext-nacl)# deny tcp any 172.20.0.0 255.255.0.0

Create a redirect IP Extended ACL to redirect all packets from subnet 172.20.20.X going to IP 172.20.0.1with TCP ports equal to 1000 to interface fx 0/10.

SMIS# configure terminal

SMIS(config)# ip access-list extended 500

SMIS(config-ext-nacl)# redirect fx 0/10 udp 172.20.20.0 255.255.255.0 host 172.20.0.1 eq 1000

8.3.11 Creating IP Extended ACLs for UDP Traffic

Follow the steps below to create an IP Extended ACL for TCP traffic.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ip access-list extended{ <access-list-number(1-32768)> | <access-list-name> }	Creates an IP Extended ACL using the ip-access-list extended command. access-list-number – can be any number from 1 to 32768 access-list-name – can be any name string up to 32 characters.
Step 3	denyudp {any | host<src-ip-address> | <src-ip-address><src-mask> } [{eq<port-number (0-65535)> }] { any | host<dest-ip-address> | <dest-ip-address><dest-mask> } [{eq<port-number (0-65535)> }] [{tos<value (0-255)>|dscp<value (0-63)>}] [priority<short(1-255)>] or permitudp {any | host<src-ip-address> | <src-ip-address><src-mask> } [{eq<port-number (0-65535)> }] { any | host<dest-ip-address> | <dest-ip-address><dest-mask> } [{eq<port-number (0-65535)> }] [{tos<value (0-255)>|dscp<value (0-63)>}] [priority<short(1-255)>] or	Configuresa deny, permit or redirect ACL rule. The source and destination IP addresses can be provided with keyword host. The keyword anycan be used to refer to any IP addresses. To configure a network IP, address and mask should be provided. To apply this rule to packets with specific UDP ports, userscan configure either the source or destination UDP ports. The specific UDP port is provided with the keyword eq. To apply this rule to packets with specific TOS values, use the keyword tos and specify the TOS value to be matched. User can specify any TOS values from 0 to 255. The user

	redirect<interface-type><interface-id>tcp {any | host<src-ip-address> | <src-ip-address><src-mask> } [{eq<port-number (0-65535)> }] { any | host<dest-ip-address> | <dest-ip-address><dest-mask> } [{eq<port-number (0-65535)> }] [{tos<value (0-255)>|dscp<value (0-63)>}] [priority<short(1-255)>]	provided TOS value will be matched exactly against the type of service byte on the IPv4 header of the received packets. Hence users have to provide the TOS byte value combining the precedence and type of service fields of IP header. This TOS configuration is optional. To apply this rule to packets with specified DSCP values, use the keyword dscp and the specific DSCP values to be matched. Users can specify any DSCP value from 0 to 63. This DSCP configuration is optional. The priority keyword lets users assign a priority for this ACL rule. This priority is an optional parameter. It can be any value from 1 to 255. The default value is 1. A Redirect ACL rule needs additional <interface-type><interface-id>parameters to definethe port to which the packets matching this ACL rule need to be redirected.
Step 4	show access-lists	Displays the configured ACL rule
Step 5	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

The examples below show various ways to create IP Extended ACLs for TCP traffic.

Create a deny IP Extended ACL with ACL number 100 to deny all traffic toUDP port 1350.

SMIS# configure terminal

SMIS(config)# ip access-list extended 100

SMIS(config-ext-nacl)# deny udp any anyeq 1350

Create a deny IP Extended ACL with ACL name acl_cw3 to deny all UDP traffic on 172.20.0.0 network.

SMIS# configure terminal

SMIS(config)# ip access-list extended acl_cw3

SMIS(config-ext-nacl)# deny udp any 172.20.0.0 255.255.0.0

Create a redirect IP Extended ACL to redirect all packets from subnet 172.20.20.X going to IP 172.20.0.1with destination UDP ports equal to 1000 to interface fx 0/10.

SMIS# configure terminal

SMIS(config)# ip access-list extended 500

SMIS(config-ext-nacl)# redirect fx 0/10 udp 172.20.20.0 255.255.255.0 host 172.20.0.1 eq 1000

8.3.12 Creating IP Extended ACLs for ICMP Traffic

Follow the steps below to create an IP Extended ACL for TCP traffic.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ip access-list extended { <access-list-number(1-32768)> | <access-list-name> }	Creates an IP Extended ACL using theip-access-list extended command. access-list-number – can be any number from 1 to 32768 access-list-name – can be any name string up to 32 characters.
Step 3	denyicmp {any |host<src-ip-address>|<src-ip-address><mask>} {any | host<dest-ip-address> | <dest-ip-address><mask> } [<message-type (0-255)>] [<message-code (0-255)>] [priority<(1-255)>] or permiticmp {any |host<src-ip-address>|<src-ip-address><mask>} {any | host<dest-ip-address> | <dest-ip-address><mask> } [<message-type (0-255)>] [<message-code (0-255)>] [priority<(1-255)>] or redirect<interface-type><interface-id>icmp {any |host<src-ip-address>|<src-ip-address><mask>} {any | host<dest-ip-address> | <dest-ip-address><mask> } [<message-type (0-255)>] [<message-code (0-255)>] [priority<(1-255)>]	Configure a deny, permit or redirect ACL rule. The source and destination IP addresses can be provided with keyword host. The keyword anycan be used to refer to any IP addresses. To configure a network IP, the address and mask should be provided. To apply this rule to ICMP packets with specific message types or message codes, usersshould provide matching values for ICMP message types and ICMP message codes. The priority keyword lets users assign a priority for this ACL rule. This priority is an optional parameter. It can be any value from 1 to 255. The default value is 1. Redirect ACL rules need additional <interface-type><interface-id>parameters to definethe port to which the packets matching this ACL rule need to be redirected.

Step 4	show access-lists	To display the configured ACL rule
Step 5	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

The examples below show various ways to create IP Extended ACLs for ICMPpackets.

Create a deny IP Extended ACL with ACL number 100 to deny all ICMP “traceroute” messages.

SMIS# configure terminal

SMIS(config)# ip access-list extended 100

SMIS(config-ext-nacl)# deny icmp any any 30

Create a deny IP Extended ACL with ACL name acl_cw3 to deny all ICMP traffic on 172.20.0.0 network.

SMIS# configure terminal

SMIS(config)# ip access-list extended acl_cw3

SMIS(config-ext-nacl)# deny icmp any 172.20.0.0 255.255.0.0

Create a redirect IP Extended ACL to redirect all packets from subnet 172.20.20.X going to IP 172.20.0.1with ICMP message type “Destination Unreachable”to interface fx 0/10.

SMIS# configure terminal

SMIS(config)# ip access-list extended 500

SMIS(config-ext-nacl)# redirect fx 0/10 icmp 172.20.20.0 255.255.255.0 host 172.20.0.1 3

8.3.13 Modifying IP Extended ACLs

To modify a configured IP Extended ACL, follow the same steps used to create an IP Extended ACL. When users modify an ACL with a deny, permit or redirect rule, the previously configured rule and its parameters for that ACL will be completely overwritten with the newly provided rules and parameters.

When an ACL rule is modified, it is removed from the hardware ACL table and added back based on the priority of the rule.

The example below shows an IP Extended ACL rule 100 being created and then modified with different parameters.

SMIS# configure terminal

SMIS(config)# ip access-list extended 50

SMIS(config-ext-nacl)# deny icmp any 172.10.0.0 255.255.0.0

Modify this ACL rule 50 to deny ICMP redirect messages instead of all ICMP messages

SMIS# configure terminal

SMIS(config)# ip access-list extended 50

SMIS(config-ext-nacl)# deny icmp any 172.10.0.0 255.255.0.0 5

8.3.14 Removing IP Extended ACLs

Follow the steps below to remove IP Extended ACLs.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	no ip access-list extended { <access-list-number(1-32768)r> | <access-list-name> }	Deletes an IP Extended ACL using theip-access-list extended command. access-list-number – the ACL number that needs to be deleted access-list-name – the name of the ACL that needs to be deleted
Step 3	show access-lists	Displays the configured ACL rules to make sure the deleted ACL is removed properly
Step 4	write startup-config	Optional step – Saves this ACL configuration to be part of startup configuration.

The example below shows how to remove an IP Extended ACL .

SMIS# configure terminal

SMIS(config)# no ip access-list extended 50

8.3.15 Applying IP Extended ACLs to Interfaces

The procedure to apply IP Extended ACLs to an interface is the same as the procedure used for IP Standard ACLs. Hence, refer to the section Apply IP ACL to Interfaces.

8.3.16 Displaying IP Extended ACLs

Step	Command	Description
Step 1	show access-lists or show access-lists ext-ip { <access-list-number (1-32768)> | <access-list-name>]	Enters the configuration mode access-list-number – the ACL number that needs to be displayed access-list-name – the name of the ACL that needs to be displayed

This show command displays the following information for every IP Extended ACL.

Filter Priority	Configured or default priority of the ACL
Protocol Type	IP Protocol Type
Source IP Address	Configured source host or subnet IP address. Displays 0.0.0.0 for any source IP.
Source IP Address Mask	Configured source subnet IP mask. For host IP address, the mask will be displayed as 255.255.255.255.
Destination IP Address	Configured destination host or subnet IP address. Displays 0.0.0.0 for any destination IP.
Destination IP Address Mask	Configured destination subnet IP mask. For host IP address, the mask will be displayed as 255.255.255.255.
In Port List	The list of ports this ACL is applied to. If it is applied to all ports, this will be ALL.
Out Port	The egress port configured for this ACL. If no egress port configured, this will be ALL.
Filter Action	Configured ACL action rule – deny or permit or redirect
Status	Current status of the ACL. The status should normally be ***active*** always. In case of configuration errors, the ACL status may be inactive.
The following fields are displayed for TCP and UDP rules	
Source Ports From	Starting TCP/UDP source port. If the ACL needs to be applied to only one port, the “Ports From” will specify that port. If the ACL needs to be applied to all ports, “Ports From” will be 0.
Source Ports Till	Starting TCP/UDP source port. If the ACL needs to be applied to only one port, the “Ports Till” will specify that port. If this ACL needs to be applied to all ports, “Ports Till” will be 65535.
Destination Ports From	Starting TCP/UDP destination port. If the ACL needs to be applied to only one port, the “Ports From” will specify that port. If the ACL needs to be applied to all ports, “Ports From” will be 0.
Destination Ports Till	Starting TCP/UDP destination port. If the ACL needs to be applied to only one port, the “Ports Till” will specify that port. If the ACL needs to be applied to all ports, “Ports Till” will be 65535.
The following fields are displayed only for TCP rules	
RST bit	If the ACL is applied only to TCP Reset messages
ACK bit	If the ACL is applied only to TCP acknowledgement messages
The following fields are displayed only for ICMP rules	
ICMP type	Displays ICMP types if the ACL is applied only to particular ICMP messages.

	Displays “No ICMP types to be filtered” if the ACL is applied to all ICMP message types.
ICMP code	Displays ICMP message codes if the ACL is applied only to particular ICMP message codes. Displays “No ICMP codes to be filtered” if the ACL is applied to all ICMP message codes.

The examplesbelow display different IP Extended ACLs.

IP Extended ACLs with IP/OSPF/PIM rules display the following fields:

```
Filter Priority            : 1
Filter Protocol Type          : ANY
Source IP address             : 172.10.10.10
Source IP address mask     : 255.255.255.255
Destination IP address       : 0.0.0.0
 Destination IP address mask : 0.0.0.0
 In Port List                : ALL
Out Port                     : ALL Filter TOS                : 0 None
 Filter DSCP                 :
 Filter Action               : Deny
 Status               : Active
```

IP Extended ACLs with TCP rules display the following fields:

```
SMIS# show access-lists ext-ip 1
Extended IP Access List 1
------------------------------
 Filter Priority             : 1
 Filter Protocol Type         : TCP
 Source IP address           : 172.20.0.0
 Source IP address mask       : 255.255.0.0
 Destination IP address         : 0.0.0.0
 Destination IP address mask     : 0.0.0.0
 In Port List                : ALL
 Out Port                          : ALL
 Filter TOS                  :
 Filter DSCP                  :
 Filter Source Ports From        : 0
 Filter Source Ports Till       : 65535
 Filter Destination Ports From    : 25
 Filter Destination Ports Till    : 25
 Filter Action                : Permit
 Status                     : Active
```

IP Extended ACLs with ICMP rules display the following fields:

```
SMIS# show access-lists ext-ip 100
Extended IP Access List 100
```

```
------------------------------
 Filter Priority              : 1
 Filter Protocol Type         : ICMP
 ICMP type                    : No ICMP types to be filtered
 ICMP code                    : No ICMP codes to be filtered
 Source IP address            : 0.0.0.0
 Source IP address mask       : 0.0.0.0
 Destination IP address       : 172.10.0.0
 Destination IP address mask  : 255.255.0.0
 In Port List                 : ALL
 Out Port                     : ALL
 Filter Action                : Redirect to Fx0/1
 Status                       : Active
SMIS#
```

IP Extended ACLs with UDP rules display the following fields:

```
SMIS# show access-lists ext-ip 200
Extended IP Access List 200

------------------------------

 Filter Priority          : 1
 Filter Protocol Type     : UDP
 Source IP address        : 0.0.0.0
 Source IP address mask   : 0.0.0.0
 Destination IP address   : 172.100.0.0
 Destination IP address mask  : 255.255.0.0
 In Port List             : ALL
Out Port                  : ALL
 Filter TOS               :
 Filter DSCP              :
 Filter Source Ports From     : 0
 Filter Source Ports Till     : 65535
 Filter Destination Ports From  : 1001
 Filter Destination Ports Till  : 65535
 Filter Action            : Deny
 Status                   : Active
```

8.4IP Extended ACL Configuration Example 1

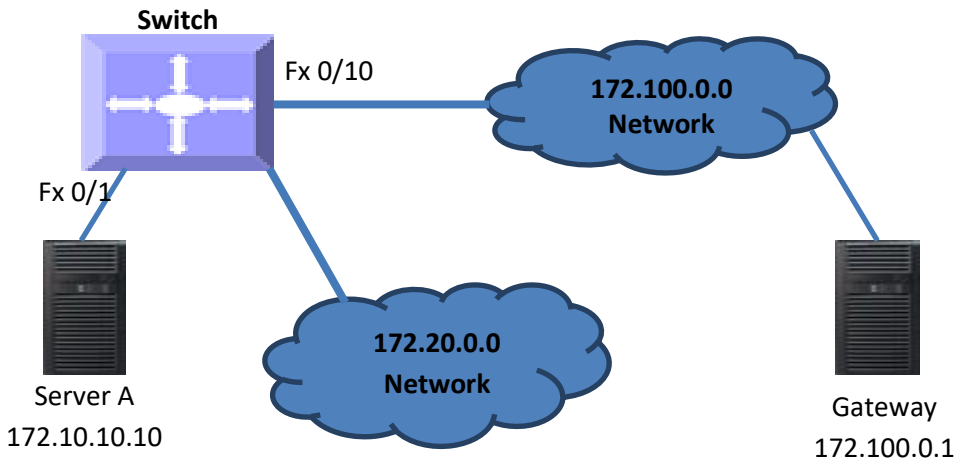
This example describes the commands required to implement the following ACL requirements on the network setup shown in Figure ACL-3.

ACL 1 – Allow SMTP TCP traffic fromthe 172.20.0.0 network and deny all other TCP traffic from this network.

ACL 2 – Redirect all ICMP traffic destined to the IP 172.10.0.0 network to server 172.10.10.10.

ACL 3 –Deny all UDP traffic going to 172.100.0.0 with a destination UDP port greater than 1000.

Figure ACL-3: IP Extended ACL Example 1



ACL 1 Configuration

This ACL has two rules: one to allow traffic from 172.20.20.1 and the other is to deny all traffic from the 172.20.0.0 network.

Create the permit rule first.

SMIS# configure terminal

SMIS(config)# ip access-list extended acl_1a

SMIS(config-ext-nacl)# permit tcp 172.20.0.0 255.255.0.0 any eq 25

Then create the deny rule for the subnet 172.20.0.0.

SMIS# configure terminal

SMIS(config)# ip access-list extended acl_1b

SMIS(config-ext-nacl)# deny tcp 172.20.0.0 255.255.0.0 any

ACL 2 Configuration

SMIS# configure terminal

SMIS(config)# ip access-list extended 100

SMIS(config-ext-nacl)# redirect fx 0/1 icmp any 172.10.0.0 255.255.0.0

ACL 3 Configuration

SMIS# configure terminal

SMIS(config)# ip access-list extended 200

SMIS(config-ext-nacl)# deny udp any 172.100.0.0 255.255.0.0 eq 1000

9 QoS

Typically, networks operate on a best-effort delivery basis providing all traffic equal priorityand an equal chance of being delivered in a timely manner. However, during congestion, all traffic has anequal chance of being dropped.The QoS featureallows one to select specific network traffic and prioritize it according toits relative importancetoprovide preferential treatment. Implementing QoS makes network performance morepredictable and bandwidth utilization more effective.

The QoS implementation in Supermicro switches is based on the Differentiated Services (DiffServ)architecture. DiffServarchitecture specifies that each packetis classified upon entry into the network.The classification is carried in the IP packet header using six bits from the deprecated IP type of service(ToS) field to carry the classification (class) information. Classification can also be carried in theLayer 2 frame.

• Classification bits in Layer 2 frames:
Layer 2 frame headers contain a class of service (CoS) value as a 3-bit field in the VLAN Header. Layer 2 CoS values range from 0 for low priority to 7 for high priority.

The sameforwarding treatment is provided to packets with the same class information and different treatment to packets withdifferent class information. The class information in the packet can be assigned by end hosts or byother switches or routers based on a configured policy, detailed examination of the packet, orboth.

Switches and routers use the class information to limit the amount of resourcesallocated per traffic class. The behavior of a switch/router when handling traffic in the DiffServarchitecture is called *per-hop behavior*. All devices along anetwork path must provide a consistent per-hop behavior in an end-to-end QoS solution.

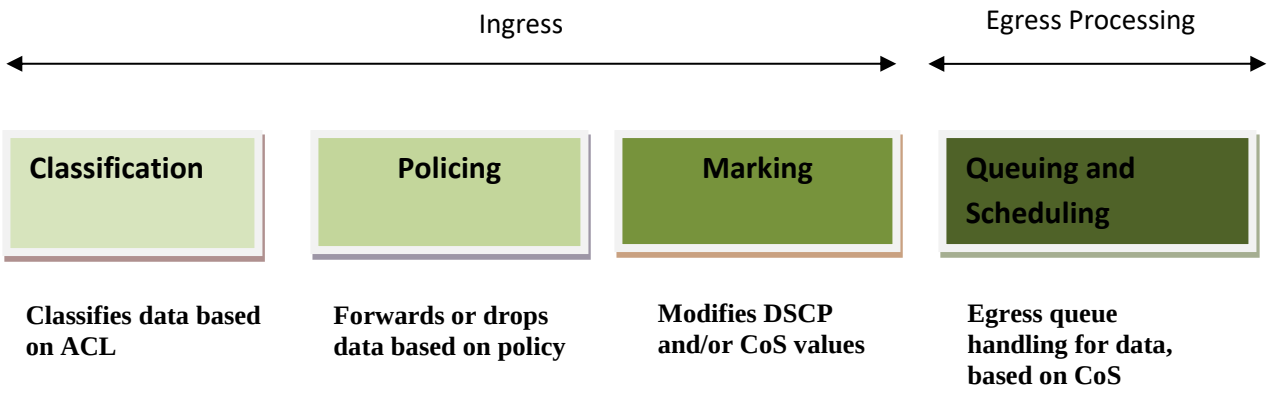


Figure QoS-1: QoS Model

The QoS Model can be divided into Ingress packet processing and Egress packet processing.

Actions at the ingress interface include classifying traffic, policing, and marking:

Classifying distinguishes one kind of traffic from another.

Policing determines whether a packet is in or out of profile according to the configured policer. The policeralso limits the bandwidth consumed by a flow of traffic.

Marking allows for the differentiation of packets by designating different identifying values, e.g. packets can be marked by setting the IP precedence bits or the IP differentiated services code point (DSCP) in the type of service (ToS) byte.

Actions at the egress interface include queuing and scheduling:

Queuing evaluates the CoS value and determines in which of the eight egress queues to placethe packet.

Scheduling services the eight egress queues based on a configured scheduling algorithm.

Parameter	Default Value
QoS Status	Disabled
Class Map	None
Policy Map	None
Default Priority	0
Minimum Bandwidth	0
Maximum Bandwidth	0
Weight	1
Scheduling Algorithm	Strict Queuing
Rate Limit	0
Burst Size	0
HOL	Enabled

The default priority to traffic classqueue mapping:

Priority	Traffic Class queue
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7

9.1Policy-Based QoS

Supermicro switch features based on QoS Policies are:

- QoS Classification
- Marking
- Policing

9.1.1 Classification and Marking

Classification is the process of distinguishing one kind of traffic from another by examining the fieldsin the packet. Supermicro switches use ACL's to specify the fields in the frame or packet based on which incoming IP traffic is classified.

Classification is enabled only if QoS is globally enabled on the switch. QoS isglobally disabledby default, so no classification occurs.In Supermicro switches, classification can be configured for all interfaces of the switch or for particular interfaces only.

After classification, the packet is sentfor policing, marking, queuing and scheduling.Marking is the process of setting or modifying values in the classified traffic. In Supermicro switches, marking can be configured using a policy map.

9.1.1.1 ClassMap and PolicyMap

IP standard, IP extended, and Layer 2 MAC access control lists (ACLs) can be used to define a group ofpackets with the same characteristics (class). Only the permit action of ACL's is permitted for use with QoS.

The Deny and Redirect ACL actions are not applicable for QoS.

Afteran ACL is associated with a class-map, it can be applied for QoS. When such a configured ACL has a match with a permit action, further classification can be doneusinga policymap.A policy map specifies the actions to perform for the traffic class of a class-map. Actions can include setting a specific DSCP value or the action to take when the traffic is out of profile.

An ACL must be created for each policy and class-map,If more thanone type of traffic needs to be classified, another ACL and class map can be created and associated. This relationship between the ACL, class map and policy map is depicted below.

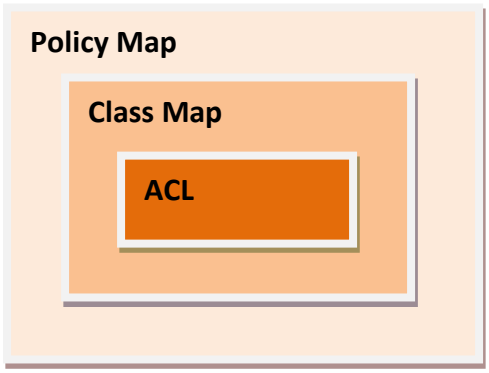


Figure QoS-2: Relationship: ACL, Policy Map & Class Map

9.1.1.2 Policing

Policing involves creating a policer that specifies the bandwidth limits for the traffic. Each policer specifies the action to take for packets thatare in or out of profile. Packets that exceedthe limits are out of profile and various actions are carried out by the marker on out of profile packets, which may includedropping the packet or markingdown the packet with a new user-defined value.

9.2 CoS-Based QoS

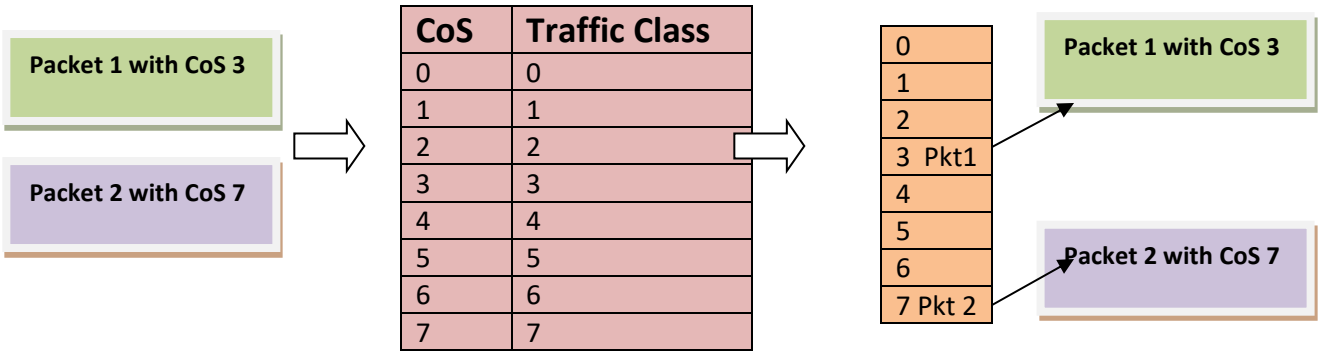
Supermicro switch features based on Class of Service (CoS) are:

- Queuing
- Scheduling
- Bandwidth Management
- Default Priority

9.2.1 Egress Queuing

The CoS priority of a packet is mapped to a traffic class.Supermicro switchesprovide support to configure the mapping of CoS priority to a traffic class.Each traffic class is mapped to eight egress queues in the switch.

The traffic class is taken from the CoS value of the ingress packet. If an ingress packet does not have a CoS (untagged packets), the port default priority will be used.



Ingress Packets CoS-to-Traffic-class mappingEgress QueueEgress Packets

Figure QoS-3: Egress Queuing

The above figure shows the egress queuing procedure. When a tagged packet with CoS value 3(packet1) arrives in the switch, the CoS to egress queuemapping for the particular destination port is lookedup. Based on CoS to egress queue mapping, packets with CoS value 3 are queued in Queue-3 and transmitted. Similarly, when a tagged packet with CoS value 7(packet2) arrives in switch, the CoS to egress queue mapping for the particular destination port is lookedup. Based on CoS to egress queue mapping, packets with CoS value 7 are queued in Queue-7 and transmitted.

9.2.2 Scheduling

Supermicro switches support eight CoS queues for each egress port. For each of the eightqueues, various typesof scheduling can be configured:

Strict Priority

Strict priority scheduling is based on the priority of queues. Packets in a high-priority queue are always sent first and packets in a low-priority queue are not sent until all the high-priority queuesareempty.

Round Robin(RR)

Using the round-robin (RR) scheduling algorithm, packets in queues are transmitted in a FIFO manner,i.e. one packet after the other. All queues havethe same priority and weight in an RR configuration.

Weighted RoundRobin (WRR)

In WRR scheduling, the user specifies a number to indicate the importance (weight) of thequeue relative to the other CoS queues. WRR scheduling prevents low-priority queues frombeing completely neglected during periods of high-priority traffic. The WRR scheduler sends somepackets from each queue in turn. The number of packets it sends corresponds to the relativeimportance of the queue. By using WRR,low-priority queues can send packets even when high-priority queues are not empty.

DeficitWRR

Bandwidth allocation can be unfair when the average packet sizes are different between the queues and their flows. This behavior can result in service degradation for queues with smaller average packet sizes. Deficit Weighted Round Robin (DWRR) is a modified weighted round-robin scheduling that can handle packets of variable size.

9.2.3 Default Priority

The Class of Service (CoS) priority field is taken from the VLAN header of a received packet. If the received packet does not have a VLAN header, the default port priority is used as the CoS value. Supermicro switches provide an option to configure the default priority.

Figure QoS-4: VLAN Tag and CoS Priority

In the above figures, CoS priority is a 3-bit field in a tagged frame that indicates the frame priority level, ranging from 0 (best effort) to 7 (highest) with 1 representing the lowest priority. These values can be used to prioritize different classes of traffic (voice, video, data, etc.).

For IEEE 802.1Q frames with tag information, the priority value from the header frame is used. For native frames, the default priority of the input port is used. Supermicro switches allow users to configure the default port priority.

Each ingress port on the switch has a single receive queue buffer for incoming traffic. When an untagged frame arrives, it is assigned the value of the port as its port default priority. Tagged frames use the assigned CoS value when it passes through the ingress port.

9.2.4 Bandwidth Management

Bandwidth limiting is configured at the level of traffic classes. Traffic classes can be assigned minimum bandwidths, maximum bandwidths, and weights. Weights are used to divide the bandwidth proportionally among all traffic classes within a QoS policy, in such a way that a traffic class does not receive more than its maximum bandwidth or less than its minimum bandwidth.

9.3 Port-Based Rate Limit

Rate limits define which packets conform to or exceed the defined rate based on the following two parameters:

Average rate determines the average transmission rate. Traffic that falls under this rate will always conform.

Burst size specifies in bits (or bytes) per burst how much traffic can be sent within a given unit of time without causing scheduling concerns. It determines how large a traffic burst can be before it exceeds the rate limit.

Traffic that exceeds the rate limit is dropped. Supermicro switches support output rate limits.

9.4 HOL Blocking Prevention

Supermicro switches provide eight egress queues per port. Each queue has a dynamic packet limit based on the availability of packet buffer memory. When a switch receives packets at a fast rate destined to a particular egress port, its egress port queuesbecome filled up. When the egress queue is full, all packets at ingress are dropped. This phenomenon of dropping ingress packets due to egress port/CoS queue over-subscriptionis called Head of Line (HOL) blocking.

Supermicro switches provide support to prevent HOL blocking. When HOL blocking prevention is enabled in the switch, itdropspackets newly arriving on the ingress if they aredestined to an oversubscribed egress port, based on the egress queue threshold. The switch stops dropping ingress packets once it determines the egress queue is not over-subscribed by using specific counters and thresholds. This mechanism ensures fair access to all port buffers.

HOL blocking prevention provides lossy buffer management, however it improves overall system throughput.

9.5 Enabling QoS

QoS is disabled by default in Supermicro switches. Follow the below steps to enable QoS.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	set qos enable	Enables QoS on all interfaces

Step 3	**End**	Exits the configuration mode

The “set qos disable” command disables QoS in the switch.

QoS must be enabled before configuring any of the QoS features.

The example below shows the commands used to enable QoS.

```
SMIS# configure terminal
SMIS(config)# set qos enable
SMIS(config)# end
SMIS(config)# show running-config

Building configuration...
ID   Hardware Version              Firmware    OS      Boot Loader

vlan 1
ports fx 0/1-24 untagged
ports cx 0/1-3 untagged
exit

setqos enable
```

9.6ConfiguringPolicy-Based QoS

Follow the steps below to configure Policy-Based QoS features such as classification, marking and policing.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step2	Create MAC Extended or IP Standard or IP Extended ACL. If required, apply ACL to specific Interface(s).	Refer to the ACL Configuration Guide at www.supermicro.com/products/nfo/networking.cfm.
Step 3	class-map <class-map-number(1-65535)>	Creates a class map and enters the class-map configuration mode. *class-map-number* - QoS class map number in range from 1-65535.
Step 4	match access-group { mac-access-list | ip-access-list } { <acl-index-num (1-65535) > | <acl-name> }	This command specifies the fields in the incoming packets that are to be examined toclassify the packets. The IP access group / MAC access group can be used as matchcriteria. mac-access-list - Accesses list created based on MAC addresses for non-IP traffic

		ip-access-list - Accesses list created based on IP addresses. The IP-access list can either bedefined as a standard IP-access list or an extended IP-access list. acl-index-num - Specifies the ACL index range. The ACL index range for an IP standard ACLis 1 to 1000 and 1001 to 65535for an IP extended ACL. The ACL index range for a MAC extendedACL is 1 to 65535. ACL-name – Specifies the configured ACL name as a string not exceeding 32 characters
Step 5	Exit	Exits theclassmap configuration mode.
Step 6	policy-map <policy-map-number(1-65535)>	Creates a policy map and enters the policy-map configuration mode. policy-map-number - QoS policy map number
Step 7	class <class-map-number(1-65535)>	This command defines a traffic classification for the policy to act upon. The class-map-number that isspecified in the policy map ties the characteristics for that class to the class map and its matchcriteria as configured with the class-map global configuration command. Uponexecution of theclass command, the switch enters the policy-map class configuration mode. *class-map-number* – The class map number to associate the policy, in range of 1-65535
Step 8	set {cos<new-cos(0-7)> | ipdscp<new-dscp(0-63)> | ip precedence <new-precedence(0-7)>}	(Optional) Configures the in-profile action by setting a class of service (CoS), differentiatedservices code point (DSCP), or IP-precedence value in the packet. *cos* - New COS value assigned to the classified traffic, in range of 0-7 *ipdscp* - New DSCP value assigned to the classified traffic, in range of 0-63 *ip precedence* - New IP-precedence value assigned to the classified traffic, in range of 0-7
Step 9	police <rate-Kbps(64-1048572)> exceed-action {drop | policed-dscp-transmit <new-dscp(0-63)>}	(Optional) Configures a policer for the classified traffic. This command also specifies the action to be taken if the specified rate is exceeded or if there is no match for the policy configured. rate-kbps- Average traffic rate in kilobitsper second (Kbps), in range 64-1048572

		exceed-action - Indicates the action of the switch whenthe specified rate is exceeded. drop - drops the packet policed-dscp-transmit - changes the differentiated services code point (DSCP) ofthe packet to that specified in the policed-DSCP map and then sends the packet. The DSCP range is 0-63.
Step 10	End	Exits theconfiguration mode.
Step 11	show class-map [<class-map-num(1-65535)>] show policy-map [<policy-map-num(1-65535)> [class <class-map-num(1-65535)>]	Displays the classmap configuration. Displays the policy map configuration.

ACL cannot be modified unless it is removed from the class-map.
For modifying an ACL associated with a classmap, follow the steps below:

1) Remove policy map
2) Remove classmap
3) Modify the ACL
4) Re-create the classmap
5) Re-create the policymap

If required, an ACL's association with an interface must be configured before the "class-map" configuration,i.e. after associating the ACL with a classmap using the "match"command, the ACL cannot be associated with an interface.
These commands either delete the particular configuration or reset it to its default value.
no class-map <class-map-number(1-65535)>
no policy-map <policy-map-number(1-65535)>
no class <class-map-number(1-65535)>
Before deleting a classmap, any policy map associated with it must first be deleted.

The example below shows the commands used to configure QoS classification, marking and policing.

Example 1: Classification and Marking

Create a Layer 2 MAC ACL with two permit statements and attach it to an ingress interface. The first permit statement allows traffic from the host with a MAC address of 00:30:48:14:c8:29to be sent to any host.

SMIS# configure terminal

SMIS(config)# mac access-list extended mac1

SMIS(config-ext-macl)# permit host 00:30:48:14:c8:29 any

SMIS(config-ext-macl)# exit

SMIS(config)# set qos enable

SMIS(config)# interface Fx 0/3

SMIS(config-if)# mac access-group mac1

SMIS(config-if)# exit

SMIS(config)# class-map 5

SMIS(config-cmap)# match access-group mac-access-list mac1

SMIS(config-cmap)# exit

SMIS(config)# policy-map 5

SMIS(config-pmap)# class 5

Existing Policymap configurations have been deleted. Please apply the policymap to make it active.

SMIS(config-pmap-c)# set cos 6

SMIS(config-pmap-c)# end

SMIS(config)# mac access-list extended mac2

SMIS(config-ext-macl)# permit host 00:b0:d0:86:bb:f7 any

SMIS(config-ext-macl)# exit

SMIS(config)# interface Fx 0/3

SMIS(config-if)# mac access-group mac2

SMIS(config-if)# exit

SMIS(config)# class-map 10

SMIS(config-cmap)# match access-group mac-access-list mac2

SMIS(config-cmap)# exit

SMIS(config)# policy-map 10

SMIS(config-pmap)# class 10

Existing policymap configurations have been deleted. Please apply the policymap to make it active.

SMIS(config-pmap-c)# set cos 7

SMIS(config-pmap-c)# end

SMIS# show policy-map

DiffServ Configurations:

Quality of Service has been enabled

Policy Map 5 is active

Class Map: 5

In Profile Entry

In profile action : policed-cos6

Policy Map 10 is active

Class Map: 10

In Profile Entry

In profile action : policed-cos7

SMIS# show class-map

DiffServ Configurations:

Class map 5

Filter ID : mac1

Filter Type : MAC-FILTER

DiffServ Configurations:

Class map 10

Filter ID : mac2

Filter Type : MAC-FILTER

SMIS# show running-config

Building configuration...

ID Hardware Version Firmware OS Boot Loader

vlan 1

ports fx 0/1-24 untagged

ports cx 0/1-3 untagged

exit

mac access-list extended mac1

permit host 00:30:48:14:c8:29 any

exit

mac access-list extended mac2

permit host 00:b0:d0:86:bb:f7 any

exit

interface Fx 0/3

mac access-group mac1

mac access-group mac2

exit

setqos enable

class-map 5

match access-group mac-access-list mac1

exit

class-map 10

match access-group mac-access-list mac2

exit

policy-map 5

class 5

setcos 6

exit

exit

policy-map 10

class 10

setcos 7

exit

exit

Example 2: Policing

Create a policy map for the switch without attaching it to an ingress interface. In the configuration, the IP standard ACL permits traffic from network 20.1.0.0. For traffic matching this classification, the DSCP value in the incoming packet is trusted. If the matched traffic exceeds an average traffic rate of 4800 bps, its DSCP is marked down to a value of 10 and transmitted.

SMIS# configure terminal

SMIS(config)# ip access-list standard 1

SMIS(config-std-nacl)# permit 20.1.0.0 255.255.0.0 any

SMIS(config-std-nacl)# exit

SMIS(config)# set qos enable

SMIS(config)# class-map 1

SMIS(config-cmap)# match access-group ip-access-list 1

SMIS(config-cmap)# exit

SMIS(config)# policy-map 1

SMIS(config-pmap)# class 1

Existing policymap configurations have been deleted. Please apply the policymap to make it active.

SMIS(config-pmap-c)# police 500000 exceed-action policed-dscp-transmit 10

SMIS(config-pmap-c)# end

SMIS# show policy-map

DiffServ Configurations:

Quality of Service has been enabled

Policy Map 1 is active

Class Map: 1

Out Profile Entry

Metering on

burst bytes/token size : 6

Refresh count : 500000

Out profile action : policed-dscp 10

SMIS# show class-map

DiffServ Configurations:

Class map 1

Filter ID : 1

Filter Type : IP-FILTER

SMIS# show running-config

Building configuration...

ID Hardware Version Firmware OS Boot Loader

vlan 1

ports fx 0/1-24 untagged

ports cx 0/1-3 untagged

exit

ip access-list standard 1

permit 20.1.0.0 255.255.0.0 any

exit

setqos enable

class-map 1

match access-group ip-access-list 1

exit

policy-map 1

class 1

police 500000 exceed-action policed-dscp-transmit 10

exit

exit

9.7 Configuring CoS-Based QoS

Follow the steps below to configure CoS-Based features such as default priority, scheduling and bandwidth.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	vlan map-priority <priority value(0-7)> traffic-class <Traffic class value(0-7)>	Maps a priority to a traffic class in the switch. The frame received with the configured priority will be processed in the configured traffic class. Priority- Priority of the packet, in range of 0-7. Class –Traffic class in range of 0-7.
Step 3	interface <*interface-type*><*interface-id*> or interface range <*interface-type*><*interface-id*> ….	(Optional) Enters the interface configuration mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 4	switchport priority default <priority value(0-7)>	(Optional) Configures the default priority for the interface in range of 0-7.
Step 5	cosq scheduling algorithm { strict | rr | wrr | deficit }	(Optional) Configures the QoS Egress queue scheduling algorithm. strict - strict rr - round robin wrr - weighted round robin (WRR) deficit – deficit WRR
Step 6	traffic-class <integer(0-7)> weight <integer(0-15)> [minbandwidth<integer(64-16777152)>] [maxbandwidth<integer(64-16777152)>]	(Optional) Configures the egress queue minimum and maximum bandwidth. weight - Configures the queue weights in range of 0-15 minbandwidth - Configures the minimum bandwidth for the queue in range of 64-16777152 maxbandwidth - Configures the maximum bandwidth for the queue in range of 64-16777152
Step 7	End	Exits the configuration mode.
Step 8	show vlan port config port [<interface-type><interface-id>] show vlan traffic-classes	Displays the port default priority configuration. Display the traffic class and egress queue mapping.

The “no cosq scheduling algorithm” resets the CoS queue scheduling algorithm configuration to its default value of*strict*.
The “no traffic-class [<integer(0-7)>] [weight] [minbandwidth] [maxbandwidth]” command resets the minimum/maximum bandwidth configuration to its default valueof 0 and weight to 1.

The “no switchport priority default” command resets the default priority configuration to its default valueof 0.
The “no vlan map-priority <priority value (0-7)>” command resets the egress CoS queue mapping to its default value.

The example below shows the commands used to configure QoS default priority, scheduling and bandwidth.

Example 1: Default Priority

SMIS# configure terminal

SMIS(config)# interface Fx 0/10

SMIS(config-if)# switchport priority default 5

SMIS(config-if)# end

SMIS# show vlan port config port Fx 0/10

Vlan Port configuration table

Port Fx0/10

Port Vlan ID : 1

Port Access Vlan ID : 1

Port Acceptable Frame Type : Admit All

Port Ingress Filtering : Disabled

Port Mode : Hybrid

Port Gvrp Status : Disabled

Port Gmrp Status : Disabled

Port Gvrp Failed Registrations : 0

Gvrp last pdu origin : 00:00:00:00:00:00

Port Restricted Vlan Registration : Disabled

Port Restricted Group Registration : Disabled

Mac Based Support : Disabled

Port-and-Protocol Based Support : Enabled

Default Priority : 5

Filtering Utility Criteria : Default

Allowed Vlans on Trunk : 1-4069

Trunk Native Vlan Id : 0

Example 2: Scheduling

The example below shows the commands used to configure the QoS scheduling algorithm.

SMIS# configure terminal

SMIS(config)# set qos enable

SMIS(config)# interface Fx 0/8

SMIS(config-if)# cosq scheduling algorithm wrr

SMIS(config-if)# end

SMIS# show cosq algorithm

CoSq Algorithm

Interface Algorithm

--- ---

Fx0/1 StrictPriority

Fx0/2 StrictPriority

Fx0/3 StrictPriority

Fx0/4 StrictPriority

Fx0/5 StrictPriority

Fx0/6 StrictPriority

Fx0/7 StrictPriority

Fx0/8 WeightedRoundRobin

Fx0/9 StrictPriority

Fx0/10 StrictPriority

Fx0/11 StrictPriority

Fx0/12 StrictPriority

Fx0/13 StrictPriority

Fx0/14 StrictPriority

Fx0/15 StrictPriority

Fx0/16 StrictPriority

Fx0/17 StrictPriority

Fx0/18 StrictPriority

Fx0/19 StrictPriority

Fx0/20 StrictPriority

Fx0/21 StrictPriority

Fx0/22 StrictPriority

Fx0/23 StrictPriority

Fx0/24 StrictPriority

Cx0/1 StrictPriority

Cx0/2 StrictPriority

Cx0/3 StrictPriority

Cx0/3 StrictPriority

Example 3: Egress Bandwidth

SMIS# configure terminal

SMIS(config)# set qos enable

SMIS(config)# interface Fx 0/15

SMIS(config-if)# traffic-class 6 weight 7 minbandwidth 6400 maxbandwidth 6400000

SMIS(config-if)# end

SMIS# show cosq weights-bw interface Fx 0/15

CoSq Weights and Bandwidths

Interface CoSqIdCoSqWeightMinBwMaxBw

--- --- --- --- ---

Fx0/15 0 1 0 0

Fx0/15 1 1 0 0

Fx0/15 2 1 0 0

Fx0/15 3 1 0 0

Fx0/15 4 1 0 0

Fx0/15 5 1 0 0

Fx0/15 6 7 6400 6400000

Fx0/15 7 1 0 0

Example 4: Egress Queue

SMIS# configure terminal

SMIS(config)# vlan map-priority 2 traffic-class 7

SMIS(config)# end

SMIS# show vlan traffic-classes

Priority to Traffic Class Queue Mapping

Priority Traffic Class Queue

--- ---

0 0

1 1

2 7

3 3

4 4

5 5

10 Port Mirroring

Supermicro switches support Port Mirroring function. Users can configure the Port mirroring session(s) to provide a method to monitor networking traffic flow on another port.

Port mirroring feature allow user to configure up to 4 independent sessions. Each session will have one destination port and as many source ports as available in the Switch. Networking traffic flowing in any direction for the source ports(s), being transmit only, receive only or both transmit and receive, will be monitored, or mirroring at the destination port.

10.1 Port Mirroring Defaults

Parameter	Default Value
Port mirroring	Disabled
Port mirroring direction	Both

10.2 Configure Port Mirroring in CLI

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**Monitor session <session number: 1-4> destination interface <interface-type> <interface-id>**	Configure Port Mirroring. *session_number* – 1, indicates only one session is supported. *Destination* – Monitoring Port. *interface-type* –may be any of the following: fx-ethernet – fx cx-ethernet – cx *interface-id* –is in *slot/port* format for all physical interfaces. NOTE: Source and Destination port cannot be same.
Step 3	**Monitor session <session number: 1-4>source interface <interface-type> <interface-id> {rx } tx | both}**	Configure Port Mirroring. *session_number* – 1, indicates only one session is supported.

		Source – Monitored Port. *interface-type* –may be any of the following: fx-ethernet – fx cx-ethernet – cx *interface-id –i*s in *slot/port* format for all physical interfaces. *rx* – Packets received on source port are monitored (Ingress). *tx* – Packets transmitted on source port are monitored (Egress). *both* – Packets received and transmitted on source port are monitored. NOTE: Source and Destination port cannot be same.
Step 3	**End**	Exits the configuration mode.
Step 4	**show port-monitoring**	Displays the port monitoring configuration.
Step 5	**write startup-config**	Optional step – saves this configuration to be part of startup configuration.

The following command in Switch configuration mode is used to configure a session of mirroring for one unique source port to one destination port. The source port has to be unique, because once the source port is used in one session, it can not be used in another session, unless the port is removed first. Destination port does not have this restriction.

The mirroring action is carried out only when both destination port and source port(s) are in place for the same session. Hence, the execution to carry out a mirroring action generally is composed of these commands.

The first command will establish the mirroring session with the destination port. The interface-id is the port that user wanted to be mirrored to, with format of example like cx 0/1, fx 0/1, fx 0/23 …

The second command will establish the other half of the mirroring action, in which the session, if it is the same as the session of the previous destination port command, will mirror traffic from the source port <interface-id>, with direction of ingress (Rx), egress (Tx) or both. If direction is not given, then both is the default direction.

In CLI, user can only add one source port at a time to any session.

In the same session, user's new command for direction of same port, will overwrite the previous configuration of the same source port.

Once the source port is used in a session, to use it in another session, user needs to remove the source port first. If not, the recently input source port will overwrite the previous source port.

The **"no monitor session [session_number:1-4] destination interface <interface-type> <interface id> "** command delete the destination port mirroring**.**

The **"no monitor session [session_number:1-4] source interface <interface-type> <interface-id>"** command deletes the source port mirroring.

Note that in the command to remove the source port, there is no provision for the direction field **{rx ,tx, both}.**

The example below shows the commands used to configure Port Mirroring.

SMIS# configure terminal
SMIS(config)# **monitor session destination interface fx 0/48**
SMIS(config)# **monitor session source interface fx 0/22**
SMIS(config)# **monitor session source interface fx 0/23**
SMIS(config)# **monitor session source interface fx 0/24**
SMIS(config)# **monitor session source interface fx 0/25**
SMIS(config)# end

SMIS# **show port-monitoring**

Port Monitoring is enabled
Monitor Port : Fx0/48

Port	Ingress-Monitoring	Egress-Monitoring
Fx0/1	Disabled	Disabled
Fx0/2	Disabled	Disabled
Fx0/3	Disabled	Disabled
Fx0/4	Disabled	Disabled
Fx0/5	Disabled	Disabled
Fx0/6	Disabled	Disabled
Fx0/7	Disabled	Disabled
Fx0/8	Disabled	Disabled
Fx0/9	Disabled	Disabled
Fx0/10	Disabled	Disabled
Fx0/11	Disabled	Disabled
Fx0/12	Disabled	Disabled
Fx0/13	Disabled	Disabled
Fx0/14	Disabled	Disabled
Fx0/15	Disabled	Disabled
Fx0/16	Disabled	Disabled

Fx0/17	Disabled	Disabled
Fx0/18	Disabled	Disabled
Fx0/19	Disabled	Disabled
Fx0/20	Disabled	Disabled
Fx0/21	Disabled	Disabled
Fx0/22	Enabled	Enabled
Fx0/23	Enabled	Enabled
Fx0/24	Enabled	Enabled
FX0/25	Enabled	Enabled
Fx0/26	Disabled	Disabled
Fx0/27	Disabled	Disabled
Fx0/28	Disabled	Disabled
Fx0/29	Disabled	Disabled
Fx0/30	Disabled	Disabled
Fx0/31	Disabled	Disabled
Fx0/32	Disabled	Disabled
Fx0/33	Disabled	Disabled
Fx0/34	Disabled	Disabled
Fx0/35	Disabled	Disabled
Fx0/36	Disabled	Disabled
Fx0/37	Disabled	Disabled
Fx0/38	Disabled	Disabled
Fx0/39	Disabled	Disabled
Fx0/40	Disabled	Disabled
Fx0/41	Disabled	Disabled
Fx0/42	Disabled	Disabled
Fx0/43	Disabled	Disabled
Fx0/44	Disabled	Disabled
Fx0/45	Disabled	Disabled
Fx0/46	Disabled	Disabled
Fx0/47	Disabled	Disabled
Fx0/48	Disabled	Disabled
Cx0/1	Disabled	Disabled
Cx0/2	Disabled	Disabled
Cx0/3	Disabled	Disabled
Cx0/4	Disabled	Disabled
Cx0/5	Disabled	Disabled
Cx0/6	Disabled	Disabled

11 SNMP

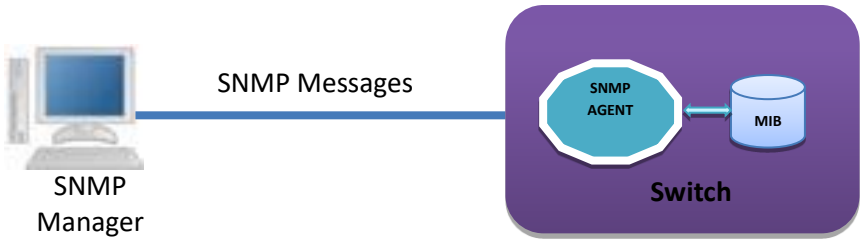
SNMP helps to monitor and manage the switches from network management systems (NMS). SNMP solutions contain three major components – SNMP manager, SNMP agent and MIB (Management Information Base) as shown in Figure – SNMP-1.

The SNMP MIB contains all the configuration and status information of the switch. MIB is organized in a tree structure with branches and leaf nodes. Each node contains an object of information and is identified with an object identifier (OID). SNMP MIB is stored and maintained in the switch.

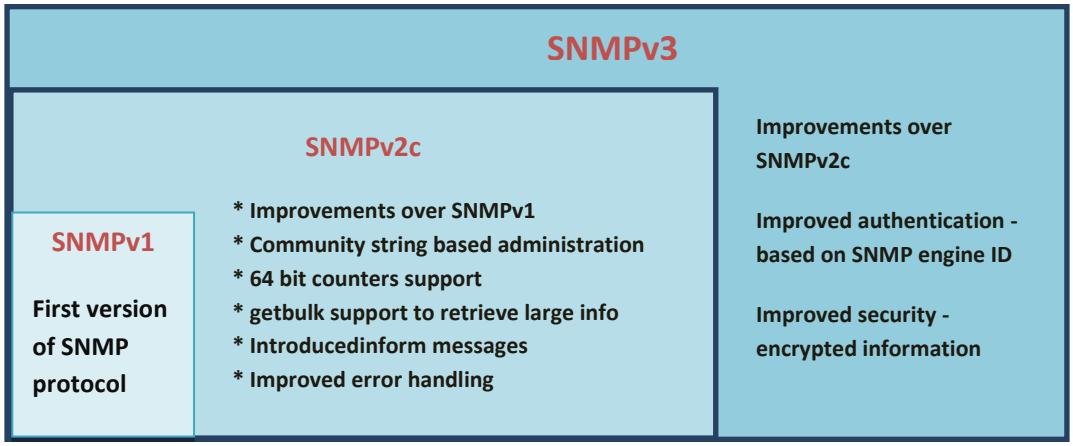
The SNMP agent also resides on the switch. It processes the SNMP requests received from the SNMP manager. It sends responses to SNMP managers by retrieving required information from the MIB. It also updates the MIB based on SNMP messages sent by the SNMP managers. SNMP agents also send voluntary traps to SNMP managers. Traps are sent to alert the SNMP managers on events happening on the switch.

The SNMP manager is an NMS application. It monitors and manages switches by communicating to the SNMP agents running on the switch. The SNMP manager application provides command or graphical interfaces to the network administrators to help them manage the networks.

Figure SNMP-1: SNMP Systems



There are three versions of SNMP protocols available.



USM (User based Security Model) and VACM (View based Access Control Model) are the main features in SNMPv3. USM provides user authentication and message encryption. VACM provides MIB access control by associating views and users.

SNMPv3 uses a combination of *security model* and *security level* to define switch access. *Security model* specifies the authentication mechanism for the user and the group to which the user belongs. The security models in the Supermicro switch are v1, v2c and v3.

Security level specifies the permitted security within the particular security model. The security levels in Supermicro switches are

- NoAuthNoPriv
- AuthNoPriv
- AuthPriv

The security model and level combinations possible in Supermicro switch are listed in the table below.

Security Model	Security Level	Authentication	Encryption	Purpose
V1	noAuthNoPriv	Community string	None	Community string and community user are used to authenticate user login.
V2c	noAuthNoPriv	Community string	None	Community string and community user are used to authenticate user login.
V3	noAuthNoPriv	User name	None	User configuration is used to authenticate user login.
V3	Auth	MD5 or SHA	None	MD5 or SHA algorithm is used to verify user login.
V3	Priv	None	DES	DES is used to encrypt all SNMP messages.

SNMP uses multiple messages between managers and agents. The below table describes the SNMP messages.

Message Type	Originator	Receiver	Purpose
get-request	Manager	Agent	To get the value of a particular MIB object
get-next-request	Manager	Agent	To get the value of the next object in a table
get-bulk-request	Manager	Agent	To get the values of multiple MIB objects in one transaction
get-response	Agent	Master	Response for get-request, get-next-request and get-bulk-request messages.
set-request	Manager	Agent	To set the value of a particular MIB object
Trap	Agent	Master	To notify the events occurring on agents
Inform	Agent	Master	To guarantee delivery of traps to Manager

11.1 SNMP Support

Supermicro switches support three versions of SNMP:SNMPv1, SNMPv2c and SNMPv3.

A switch supports 50 users, 50 groups, 50 views and 50 views.

11.2 Interface Numbers

IF-MIB contains information about all the interfaces on the switch. Users can access the interface specific MIB object values using interface index (ifIndex) numbers. The ifIndex numbers are assigned by switch software for every physical and logical interface. The table below shows ifIndex to interface mapping method.

Interface Type	ifIndex
25 Gig physical interfaces	Starts from 1 and goes up to the maximum number of 25 Gig interfaces available on the switch. 1 to 48
100 Gig physical interfaces	Starts after 1Gig ifIndexes and goes up to the maximum number of 100 Gig interfaces available on the switch. 49 to 54
Port channel interfaces	Starts after 10Gig ifIndexes and goes up to the maximum number of port channel interfaces supported on the switch. 53 to 108
Management IP interfaces	109

11.3 SNMP Configuration

SNMP Configuration involves configuring user, group, access, view, community etc.

SNMP Users: SNMP users have a specified username, authentication password, privacy password, (if required) and authentication and privacy algorithms to use.

SNMP Groups: When a user is created, it is associated with an SNMP group. SNMPv3 groups are the means by which users are assigned their views and access control policy.

SNMP View: An SNMP MIB view is a defined list of objects within the MIB that can be used to control what parts of the MIB can be accessed by users belonging to the SNMP group that is associated with that particular view. When you want to permit a user to access a MIB view, you include a particular view. When you want to deny a user access to a MIB view, you exclude a particular view.

SNMP Group access: An SNMP group access is essentially an access control policy to which users can be added. Each SNMP group is configured with a security level, and is associated with an SNMP view

There are three possible types of access that can be configured for the users in that SNMP group to have access to an SNMP view.

- ReadView - Specifies Read access for an SNMP view
- WriteView - Specifies Write access for an SNMP view
- NotifyView - Specifies SNMP view for which the group will receive notifications.

The figure below shows the relationship between the various SNMP tables: User, group, access and view.

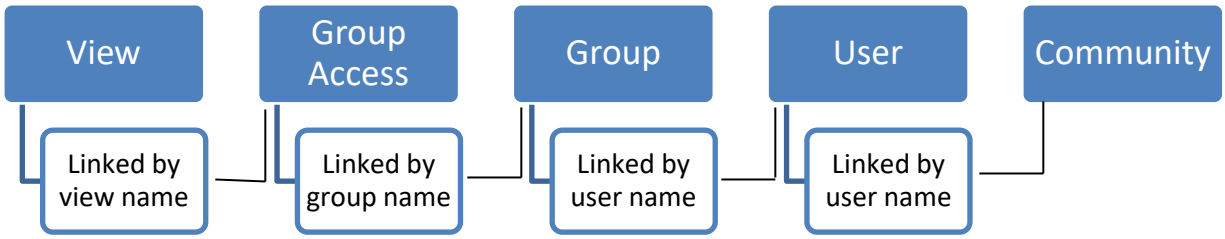


Figure SNMP-2: SNMP - Relationships

The following mapping can exist between the SNMP tables user, group, access and view:

- Multiple users can belong to one group
- An user can belong to multiple groups.
- Multiple groups can be associated with a view.
- Multiple views can be created.
- More than one group can be associated with a particular view.
- More than one view can be associated with a group. For instance, a group can have read access to the entire MIB, but write access only for certain MIB objects.

11.3.1 Configuration Steps

The sequence of steps for SNMP Configuration in Supermicro switches are:

1. Create a **User** Name
2. Create a **community** name and associate user with the community (Optional).
3. Create a **group** and associate the user name with the group name.
4. The **view** is then defined to include or exclude whole/part MIB sub trees.
5. Define type of **access** for each group for a view.
6. Finally, **traps** can be defined based on the User Name (Optional).

11.4 SNMP Defaults

Function	Default Value
SNMP Agent Status	Enabled
SNMP Sub-Agent Status	Disabled
Version	3
Engine Id	80.00.08.1c.04.46.53

Communities	PUBLIC, NETMAN
Users	initial, TemplateMD5, TemplateSHA
Authentication (for default users)	initial : none TemplateMD5: MD5 TemplateSHA: SHA
Privacy (for default users)	initial : none TemplateMD5: none TemplateSHA: DES
Groups	iso, initial
Access	iso, initial
View (for default groups)	iso: iso, initial: restricted
Notify View Name	iss, iss1
Read, Write, Notify	Iso
Target Parameters	Internet, test1
Storage Type	Volatile
Context	None
SNMP Port	161
SNMP Trap Port	162
Trap Status	Enabled
Authentication Trap	Disabled
Link-State Trap	Enabled
Switch Name	SMIS
System Contact	http://www.supermicro.com
System Location	Supermicro

11.5 Enable/Disablethe SNMP Agent

The SNMP Agent is enabled by default in Supermicro switches.

Follow the steps below to **disable** the SNMP agent.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**disable snmpagent**	Disables the SNMP agent
Step 3	**end**	Exits the configuration mode.

Step 4	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The**"enablesnmpagent"** command enables the SNMP agent.

To enable the SNMP agent, it must be in the disabled state.

The examples below show ways to disable/enable the SNMP agent function on Supermicro switches.

Disable the SNMP agent.

SMIS# **configure terminal**
SMIS(config)# **disable snmpagent**
SMIS(config)# **end**

Enable the SNMP agent.

SMIS# **configure terminal**
SMIS(config)# **enable snmpagent**
SMIS(config)# **end**

11.5.1 Switch Name

Supermicro switches can be assigned a name for identification purposes. The default switch name isSMIS. The switch name is also used as a prompt.

Follow the steps below to configure the switch name.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**device name <devname(15)>**	Configures switch name and prompt. Devname – Switch name specified with 1-15 alphanumeric characters.
Step 3	**End**	Exits the configuration mode.
Step 4	**show system information**	Displays the system information configuration.
Step 5	**write startup-config**	Optional step – saves thisconfiguration to be part of the startup configuration.

The device name configuration is automatically stored as part of the startup configuration file.

The example below shows the commands used to configure the switch name.

SMIS# configure terminal
SMIS(config)# **device name switch1**
switch1(config)# end

switch1# **show system information**
Switch Name: switch1
Switch Base MAC Address: 00:30:48:e3:70:bc
SNMP EngineID: 80.00.08.1c.04.46.53
System Contact: http://www.supermicro.com/support
System Location: Supermicro
Logging Option: Console Logging
Login Authentication Mode: Local
Snoop Forward Mode: MAC based
Config Restore Status: Not Initiated
Config Restore Option: No restore
Config Restore Filename: iss.conf
Config Save IP Address: 0.0.0.0
Device Up Time: 0 days 0 hrs 1 mins 11 secs
Boot-up Flash Area: Normal
NTP Broadcast Mode: No
[NTP] ntp is disabled
Server Key Prefer
=============== ===== ======
Key # Key
======= ==================================
Time zone offset not set

11.5.2 Switch Contact

Supermicro switches provide an option to configure the switch in charge Contact details, usually anemail ID.

Follow the steps below to configure the switch contact.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**system contact <string - to use more than one word, provide the string within double quotes>**	Configures the switch contact. String – Contact information entered as a String of maximum length 256.
Step 3	**End**	Exits the configuration mode.
Step 4	**show system information**	Displays the system information configuration.
Step 5	**write startup-config**	Optional step – saves this configuration to be part of the startup configuration.

The Switch contact configuration is automatically stored as part of the startup configuration file.

The example below shows the commands used to configure a switch contact.

SMIS# configure terminal
SMIS(config)# **system contact "User1 at CA”**
SMIS(config)# end

SMIS# **show system information**
Switch Name: SMIS
Switch Base MAC Address: 00:30:48:e3:70:bc
SNMP EngineID: 80.00.08.1c.04.46.53
System Contact: User1 at CA
System Location: Supermicro
Logging Option: Console Logging
Login Authentication Mode: Local
Snoop Forward Mode: MAC based
Config Restore Status: Not Initiated
Config Restore Option: No restore
Config Restore Filename: iss.conf
Config Save IP Address: 0.0.0.0
Device Up Time: 0 days 0 hrs 50 mins 51 secs
Boot-up Flash Area: Normal
NTP Broadcast Mode: No
[NTP] ntp is disabled
Server Key Prefer
============== ===== ======
Key # Key
======= ==================================
Time zone offset not set

11.5.3 System Location

Supermicro switches provide an option to configure the switch location details.

Follow the steps below to configure system location.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**system location <location name>**	Configures the system location.

		location name – Location of the switch specified as a string with a maximum size of 256.
Step 3	**End**	Exits the configuration mode.
Step 4	**show system information**	Displays the system information configuration.
Step 5	**write startup-config**	Optional step – saves this configuration to be part of the startup configuration.

The System Location configuration is automatically stored as part of the startup configuration file.

The example below shows the commands used to configure system location.

SMIS# configure terminal
SMIS(config)# **system location "Santa Clara"**
SMIS(config)# end

SMIS# **show system information**
Switch Name: SMIS
Switch Base MAC Address: 00:30:48:e3:70:bc
SNMP EngineID: 80.00.08.1c.04.46.53
System Contact: http://www.supermicro.com
System Location: Santa Clara
Logging Option: Console Logging
Login Authentication Mode: Local
Snoop Forward Mode: MAC based
Config Restore Status: Not Initiated
Config Restore Option: No restore
Config Restore Filename: iss.conf
Config Save IP Address: 0.0.0.0
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Device Up Time: 0 days 0 hrs 51 mins 39 secs
Boot-up Flash Area: Normal
NTP Broadcast Mode: No
[NTP] ntp is disabled
Server Key Prefer
=============== ===== ======
Key # Key
======= ===================================
Time zone offset not set

11.6 Access Control

There are various parameters that control access to the SNMP Agent.

- Engine ID
- Community String
- User
- Group
- Group Access

11.6.1 Engine Identifier

The SNMP Engine Identifieris a unique identifier for the SNMP agent in a switch. It is used with a hashing function in the agent to generate keys for authentication and encryption. Hence after any change in theEngine Identifier,the following must be re-configured:

- SNMPv3 authentication
- SNMPv3 encryption/privacy
- Community

Follow the steps below to configure the SNMP Engine Identifier.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmpengineid<EngineIdentifier>**	Configures the SNMP Engine Identifier. *EngineIdentifier*-Hexadecimal number, with length between 5 and 32 octets. Each octet should be separated by a period.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmpengineID**	Displays the SNMP engine Identifier information.
Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The example below shows the commands used to configure the SNMP Engine Identifier.

SMIS# configure terminal
SMIS(config)# **snmpengineid 80.00.08.1c.44.44**
SMIS(config)# end

SMIS# **show snmpengineid**

EngineId: 80.00.08.1c.44.44

The **"no snmpengineid"** command resets the SNMP engineid to its default value of 80.00.08.1c.04.46.53.

11.6.2 Community

An SNMP community defines a group of devices and management systems. Only devices and management systems that are members of the same community can exchange SNMP messages. A device or management system can be a member of multiple communities.

The SNMP v1/v2 community is also used as a form of security. The community of SNMP managers that can access the agent MIB in the switch is defined by a community string.

Follow the steps below to configure an SNMP community.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmp community index <CommunityIndex> name <CommunityName> security <SecurityName> [context <name>] [{volatile | nonvolatile}] [transporttag<TransportTagIdentifier | none>]**	Configures the SNMP community. *CommunityIndex*–Alphanumericvalue with a maximum of 32 characters. *CommunityName*–Alphanumeric value with a maximum of 64 characters. *SecurityName* – This is the user name associated with the community. Alphanumeric value with a maximum of 32 characters. *Name* –Alphanumeric value with a maximum of 32 characters. *TransportTagIdentifier* –Identifies the transport end points between agent and manager. Alphanumeric value with a maximum of 64 characters.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmp community**	Displays the SNMP community information.
Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The **"no snmp community index <CommunityIndex> "**command deletes the specified community index.

SNMP *User Name* is also referred to as SNMP *Security Name* in Supermicro switches.

The example below shows the commands used to configure the SNMP community.

SMIS(config)# **snmp community index test1 name test1 security user1 nonvolatile**

SMIS(config)# **show snmp community**

Community Index: NETMAN
Community Name: NETMAN
Security Name: none
Context Name:
Transport Tag:
Storage Type: Volatile
Row Status: Active

Community Index: PUBLIC
Community Name : PUBLIC
Security Name: none
Context Name :
Transport Tag:
Storage Type: Volatile
Row Status: Active

Community Index: test1
Community Name: test1
Security Name: user1
Context Name:
Transport Tag:
Storage Type: Non-volatile
Row Status: Active

11.6.3 User

SNMP user configuration is used only for SNMPv3. An SNMP user requests and receives information about switch status and traps.

Follow the steps below to configure an SNMP user.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmp user <UserName> [auth {md5 | sha} <passwd>[priv DES <passwd>]] [{volatile | nonvolatile}]**	Configures the SNMP user, authentication and encryption. *UserName* - Alphanumeric value with a maximum of 32 characters. Use **auth**to enable authentication for the user.

		Passwd–Password used for user Authentication. Alphanumeric value with a maximum of 32 characters. Use **priv**toenableencryption of packets. *Passwd*–Password used to generate keys for encryption of messages. Alphanumeric value with a maximum of 40 characters. Use **volatile**if the value need not be stored in NVRAM. Use **nonvolatile** if the value must be stored in NVRAM and available after restart.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmp user**	Displays the SNMP user information.
Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The **"no snmp user <UserName> "**command deletes the specified user.

The example below shows the commands used to configure the SNMP user.

SMIS# configure terminal
SMIS(config)# **snmp user user5 auth md5 abc123 priv DES xyz123**
SMIS# end

SMIS# **show snmp user**

Engine ID: 80.00.08.1c.04.46.53
User: user5
Authentication Protocol: MD5
Privacy Protocol: DES_CBC
Storage Type: Volatile
Row Status: Active

Engine ID: 80.00.08.1c.04.46.53

User: initial
Authentication Protocol: None
Privacy Protocol: None
Storage Type: Volatile
Row Status: Active

Engine ID: 80.00.08.1c.04.46.53
User: templateMD5
Authentication Protocol: MD5
Privacy Protocol: None
Storage Type: Volatile
Row Status: Active

Engine ID: 80.00.08.1c.04.46.53
User: templateSHA
Authentication Protocol: SHA
Privacy Protocol: DES_CBC
Storage Type: Volatile
Row Status: Active

11.6.4 Group

A group identifies a set of users in SNMPv3.

Follow the steps below to configure an SNMP group.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmp group <GroupName> user <UserName> security-model {v1 | v2c | v3 } [{volatile | nonvolatile}]**	Configures the SNMP group. *GroupName* – Alphanumeric value with a maximum of 32 characters. *Security-model* – Use v1 or v2c or v3. *UserName* - Alphanumeric value with a maximum of 32 characters. Use **volatile**if the value need not be stored in NVRAM. Use **nonvolatile** if the value must be stored in NVRAM and available after restart.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmp group**	Displays the SNMP group information.

Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The "**no snmp group <GroupName> user <UserName>security-model {v1 | v2c | v3}**" command deletes the specified group.

The example below shows the commands used to configure the SNMP group.

SMIS# configure terminal
SMIS(config)# **snmp group group5 user user5 security-model v3**
SMIS# end

SMIS# **show snmp group**

Security Model: v1
Security Name: none
Group Name: iso
Storage Type: Volatile
Row Status: Active

Security Model: v2c
Security Name: none
Group Name: iso
Storage Type: Volatile
Row Status: Active

Security Model: v3
Security Name: user5
Group Name: group5
Storage Type: Volatile
Row Status: Active

Security Model: v3
Security Name: initial
Group Name: initial
Storage Type: Non-volatile
Row Status: Active

Security Model: v3
Security Name: templateMD5
Group Name: initial
Storage Type: Non-volatile
Row Status: Active

Security Model: v3
Security Name: templateSHA
Group Name: initial
Storage Type: Non-volatile
Row Status: Active

11.6.5 View

A view specifies limited access to MIBs. A view can be associated with one or many groups.

In an SNMP, parameters are arranged in a tree format. SNMP uses an Object Identifier (OID) to identify the exact parameter in the tree. An OID is a list of numbers separated by periods.

Follow the steps below to configure the SNMP view.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmpview <ViewName><OIDTree> [mask <OIDMask>] {included | excluded}[{volatile | nonvolatile}]**	Configures the SNMP view. *ViewName*- Alphanumeric value with a maximum of 32 characters. *OIDTree*–OID number, with a maximum of 32 numbers. *OIDMask*– OID number, with a maximum of 32 numbers. Use **included**to specifythat the MIB sub-tree is included in the view. Use **excluded**to specify that the MIB sub-tree is excluded from the view. Use **volatile**if the value need not be stored in NVRAM. Use **nonvolatile** if the value must be stored in NVRAM and available after restart.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmpviewtree**	Displays the SNMP view information.
Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The **"**no snmp view <ViewName><OIDTree> **"**command deletes the specified SNMP view.

The example below shows the commands used to configure the SNMP view.

SMIS(config)# **snmp view view1 1.3.6.1 included**

SMIS(config)# **show snmpviewtree**

View Name: iso
Subtree OID: 1
Subtree Mask: 1
View Type: Included
Storage Type: Non-volatile
Row Status: Active

View Name: view1
Subtree OID: 1.3.6.1
Subtree Mask: 1.1.1.1
View Type: Included
Storage Type: Volatile
Row Status: Active

View Name: Restricted
Subtree OID: 1
Subtree Mask: 1
View Type: Excluded
Storage Type: Non-volatile
Row Status: Active

11.6.6 Group Access

Group access defines the access policy for a set of users belonging to a particular group. Group access is used only for SNMPv3.

Follow the steps below to configure SNMP group access.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmp access <GroupName> {v1 | v2c | v3 {auth | noauth | priv}}[read <ReadView | none>] [write <WriteView | none>] [notify <NotifyView | none>] [{volatile | nonvolatile}]**	Configures the SNMP group access. *GroupName* - Alphanumeric value with a maximum of 40 characters. Security model – Mention one of v1, v2c or v3.

		Use **auth**to enable authentication for the user. Use **priv**toenableencryption of packets. *ReadView*- View name that specifies read access to particular MIB sub-tree.Alphanumeric value with a maximum of 40 characters. *WriteView*View name that specifies write access to particular MIB sub-tree. Alphanumeric value with a maximum of 40 characters. *NotifyView*View name that specifies a particular MIB sub-tree used in notification. Alphanumeric value with a maximum of 40 characters. Use **volatile**if the value need not be stored in NVRAM. Use **nonvolatile** if the value must be stored in NVRAM and available after restart.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmp group access**	Displays the SNMP group access information.
Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of startup configuration.

Group, user and view should be created before configuring group access.

The**"no snmp access <GroupName> {v1 | v2c | v3 {auth | noauth | priv}}**" commanddeletes the specified SNMP group access.

The sequence of steps to delete a group that is associated with a group access and view:

1. Delete the view
2. Delete the group access.
3. Delete the group.

The example below shows the commands used to configure the SNMP group access.

SMIS# configure terminal
SMIS(config)# **snmp access group5 v3 auth read view1 write view2 notify none nonvolatile**
SMIS(config)# end

SMIS# **show snmp group access**

Group Name: iso
Read View: iso
Write View: iso
Notify View: iso
Storage Type: Volatile
Row Status: Active

Group Name: iso
Read View: iso
Write View: iso
Notify View: iso
Storage Type: Volatile
Row Status: Active

Group Name: group5
Read View: view1
Write View: view2
Notify View:
Storage Type: Non-volatile
Row Status: Active

Group Name: Initial
Read View: Restricted
Write View: Rrestricted
Notify View: Restricted
Storage Type: Non-volatile
Row Status: Active

Group Name: Initial
Read View: iso
Write View: iso
Notify View: iso
Storage Type: Non-volatile
Row Status: Active

Group Name: initial
Read View: iso
Write View: iso
Notify View: iso
Storage Type: Non-volatile
Row Status: Active

11.7 Trap

11.7.1 Target Address

A target is a receiver of SNMP notification(s), which are usually SNMP Managers. The target address defines the transport parameters of the receivers.

Follow the steps below to configure the SNMP Target address.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmptargetaddr<TargetAddressName>param<ParamName> {<IPAddress> | <IP6Address>} [timeout <Seconds(1-1500)] [retries <RetryCount(1-3)] [taglist<TagIdentifier | none>] [{volatile | nonvolatile}]**	Configures the SNMP target address information. *TargetAddressName* - Alphanumeric value with a maximum of 32 characters. *ParamName* – The parameter to be notified to the specific target. Alphanumeric value with a maximum of 32 characters. IPAddress– IPv4 address of the target. *IP6Address* – IPv6 address of the target. *Seconds* – Specifies the timeout within which the target should be reachable. *RetryCount* – Specifies the number of retries to reach the target. *TagIdentifier*- A set of targets can be grouped under a tag Identifier. Use **volatile**if the value need not be stored in NVRAM.

		Use **nonvolatile** if the value must be stored in NVRAM and available after restart.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmptargetaddr**	Displays the SNMP target address information.
Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The **"**no snmptargetaddr<TargetAddressName> **"**command deletes the specified SNMP target address information.

The example below shows the commands used to configure the SNMP target address.

SMIS# configure terminal
SMIS(config)# **snmptargetaddr host1 param param1 192.168.1.10 taglist tg1**
SMIS# end

SMIS# **show snmptargetaddr**

Target Address Name: host1
IP Address: 192.168.1.10
Tag List: tg1
Parameters: param1
Storage Type: Volatile
Row Status: Active

11.7.2 Target Parameters

Target parameters define the MIB objects that should be notified to an SNMP target, usually an SNMP manager.

Follow the steps below to configure SNMP target parameters.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmptargetparams<ParamName> user <UserName>security-model {v1 | v2c | v3 {auth |**	Configures the SNMP target parameters.

	noauth | priv}}message-processing {v1 | v2c | v3} [{volatile | nonvolatile}]	*ParamName*The parameter to be notified. Alphanumeric value with a maximum of 32 characters. *UserName* - Alphanumeric value with a maximum of 32 characters. Security model – Use one of v1, v2c, v3. Use **auth**to enable authentication for the user. Use **priv**toenableencryption of packets. Message processing- Specifies the SNMP version for sending/receiving the parameter via a notification message. Use **volatile**if the value need not be stored in NVRAM. Use **nonvolatile** if the value must be stored in NVRAM and available after restart.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmptargetparam**	Displays the SNMP target parameters information.
Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The**"no snmptargetparams<ParamName> "**command deletes the specified SNMP target parameters information.

The example below shows the commands used to configure the SNMP target parameters.

SMIS# configure terminal
SMIS(config)# **snmptargetparams param4 user user4 security-model v2c message-processing v2c**
SMIS# end

SMIS# **show snmptargetparam**

Target Parameter Name: Internet

Message Processing Model: v2c
Security Model: v2c
Security Name: None
Security Level: No Authenitcation, No Privacy
Storage Type: Volatile
Row Status: Active

Target Parameter Name: param4
Message Processing Model: v2c
Security Model: v2c
Security Name: user4
Security Level: No Authenitcation, No Privacy
Storage Type: Volatile
Row Status: Active

Target Parameter Name: test1
Message Processing Model: v2c
Security Model: v1
Security Name: None
Security Level: No Authenitcation, No Privacy
Storage Type: Volatile
Row Status: Active

11.7.3 SNMP Notify

Notify is used to specify the type of notifications to be sent to particular targets that are grouped under a particular tag.

Follow the steps below to configure the SNMP Notification.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmp notify <NotifyName> tag <TagName> type {Trap | Inform}[{volatile | nonvolatile}]**	Configures the SNMP Notify information. *NotifyName*- Alphanumeric value with a maximum of 32 characters. *TagName* –Specifies a group of targets identified by this name. Alphanumeric value with a maximum of 32 characters. Type – Notification can be Trap or Inform.

		Use **volatile**if the value need not be stored in NVRAM. Use **nonvolatile** if the value must be stored in NVRAM and available after restart.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmp notify** **show snmp inform statistics**	Displays the SNMP notification information and Inform statistics.
Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The **"**no snmp notify <NotifyName>**"** command deletes the specified SNMP notification.

The example below shows the commands used to configure the SNMP notification.

SMIS# configure terminal
SMIS(config)# **snmp notify PUBLIC tag tag1 type trap nonvolatile**
SMIS(config)# end

SMIS# **show snmpnotif**

Notify Name: PUBLIC
Notify Tag: tag1
Notify Type: trap
Storage Type: Non-volatile
Row Status: Active

Notify Name: iss
Notify Tag: iss
Notify Type: trap
Storage Type: Volatile
Row Status: Active

Notify Name: iss1
Notify Tag: iss1
Notify Type: trap
Storage Type: Volatile
Row Status: Active

11.7.4 Trap UDP Port

The default UDP port for traps is 162. Supermicro switches providean option for users to change this trap UDP port.

Follow the steps below to configure the SNMP UDP port for traps.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmp-server trap udp-port <port>**	Configures the SNMP UDP port for traps. *Port*–UDP port for traps in the range 1 – 65535.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmp-server traps**	Displays the SNMP traps information.
Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The **"no snmp-server trap udp-port"** command resets the SNMP UDP port to its default value of 162.

The example below shows the commands used to configure the SNMP UDP port for traps.

SMIS# configure terminal
SMIS(config)# **snmp-server trap udp-port 170**
SMIS(config)# end

SMIS(config)# **show snmp-server traps**

SNMP Trap Listen Port is 170
Currently enabled traps:
---
linkup,linkdown,
Login Authentication Traps DISABLED.

11.7.5 Authentication Traps

Traps can be generated when a user login authentication fails at the SNMP agent. In Supermicro switches, authentication traps are disabled by default.

Follow the steps below to enable an SNMP authentication trap.

Step	Command	Description

Step 1	**configure terminal**	Enters the configuration mode
Step 2	**snmp-server enable traps snmp authentication**	Enables the SNMP authentication traps.
Step 3	**end**	Exits the configuration mode.
Step 4	**show snmp**	Displays the SNMP information.
Step 5	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The **"no snmp-server enable traps snmp authentication"** command disables SNMP authentication traps.

The example below shows the commands used to enable the SNMP authentication traps.

SMIS# configure terminal
SMIS(config)# **snmp-server enable traps snmp authentication**
SMIS# end

SMIS(config)# **show snmp-server traps**

SNMP Trap Listen Port is 162
Currently enabled traps:
---
linkup,linkdown,
Login Authentication Traps ENABLED.

11.7.6 Link-State Trap

Link-state traps are enabled for all interfaces by default in Supermicro switches. Traps are generated when an interface toggles its state from Up to down or vice-versa.

Follow the steps below to disable SNMP Link-state trap.

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: fx-ethernet – fx cx-ethernet – cx port-channel - po interface-id is in slot/port format for all physical interfaces. To configure multiple interfaces, use the “interface range …” command. Toprovide a range, use a hyphen (-) between the start and end interface numbers. E.g.: int range fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	**no snmp trap link-status**	Disables the SNMP link-state trap on the particular interface.
Step 4	**end**	Exits the configuration mode.
Step 5	**show snmp**	Displays the SNMP information.
Step 6	**write startup-config**	Optional step – saves this SNMP configuration to be part of the startup configuration.

The **“snmp trap link-status”** command enables SNMP link-state traps.

The example below shows the commands used to disable the SNMP Link-state trap.

SMIS# configure terminal
SMIS(config)# interface Fx 0/21
SMIS(config-if)# **no snmp trap link-status**
SMIS(config-if)# end

SMIS# **show interface Fx 0/21**

Fx0/21 up, line protocol is up (connected)
Bridge Port Type: Customer Bridge Port

Hardware Address is 00:30:48:e3:04:89
MTU 1500 bytes, Full duplex, 1 Gbps, Auto-Negotiation
HOL Block Prevention enabled.
Input flow-control is off,output flow-control is off

Link Up/Down Trap is disabled

Reception Counters
  Octets : 753
  Unicast Packets : 0
  Broadcast Packets : 0
  Multicast Packets : 9
  Pause Frames : 0
  Undersize Frames : 0
  Oversize Frames : 0
  CRC Error Frames : 0
  Discarded Packets : 0
  Error Packets : 0
  Unknown Protocol : 0
  Received Rate : 114 bps

Transmission Counters
  Octets : 9043
  Unicast Packets : 0
  Non-Unicast Packets : 74
  Pause Frames : 0
  Discarded Packets : 0
  Error Packets : 0
  Transmit Rate : 740 bps

11.8 SNMPConfigurationExample

PC – SNMP Manager **Switch - SNMP Agent**

Figure SNMP-2 – SNMP Configuration Example

Configure the following requirements on a switch acting as an SNMP agent as shown above in Figure SNMP-2.

1) Creates SNMP users
    a. Create an SNMP user '*user1*' Specify the authentication and privacy protocol and the authentication and privacy passwords.
    b. Creates an SNMP user '*user2*'. Specify the authentication protocol and password.
2) Creates SNMP groups
    a. Create groupcalled *superusers*and associateuser1 with this group.
    b. Create groupcalled *generalusers* and associate user1 with this group.
3) Create views
    a. Creates an SNMP view '*full'*which will allow access to everything from the specified Object Identifier
    b. Creates an SNMP view '*restricted'*which will allow access to everything from the specified OID onwards, and also adds a restriction to anything on a particular sub-tree.
4) Create group access
    a. Access for *superusers- fullread/write* and notify privilege to the '*full*' view
    b. Access for *generalusers- full* read,notify privilege to the 'full' view and , retricted write
5) Display all configuration

SMIS# configure terminal

SMIS(config)# **snmp user user1 auth md5 pwd1**

SMIS(config)# **snmp user user2 auth sha abcd priv deS 1b12**

SMIS(config)# **snmp group superuser user user1 security-model v3 volatile**

SMIS(config)# **snmp group generalusers user user2 security-model v3 volatile**

SMIS(config)# **snmp view full 1.3.6.1 included volatile**

SMIS(config)# **snmp view restricted 1.3.6.1 included volatile**

SMIS(config)# **snmp view restricted 1.3.6.3.10.2.1 excluded volatile**

SMIS(config)# **snmp access superuser v3 auth read full write full notify full**

SMIS(config)# **snmp access generalusers v3 noauth read full write restricted notify full**

SMIS(config)# end

SMIS# **show snmp user**

Engine ID : 80.00.08.1c.04.46.53

User : user1

Authentication Protocol : MD5

Privacy Protocol : None

Storage Type : Volatile

Row Status : Active

Engine ID : 80.00.08.1c.04.46.53

User : user2

Authentication Protocol : SHA

Privacy Protocol : DES_CBC

Storage Type : Volatile

Row Status : Active

Engine ID : 80.00.08.1c.04.46.53

User : initial

Authentication Protocol : None

Privacy Protocol : None

Storage Type : Volatile

Row Status : Active

Engine ID : 80.00.08.1c.04.46.53

User : templateMD5

Authentication Protocol : MD5

Privacy Protocol : None

Storage Type : Volatile

Row Status : Active

Engine ID : 80.00.08.1c.04.46.53

User : templateSHA

Authentication Protocol : SHA

Privacy Protocol : DES_CBC

Storage Type : Volatile

Row Status : Active

SMIS# **show snmp group**

Security Model : v1

Security Name : none

Group Name : iso

Storage Type : Volatile

Row Status : Active

Security Model : v2c

Security Name : none

Group Name : iso

Storage Type : Volatile

Row Status : Active

Security Model : v3

Security Name : user1

Group Name   : superuser

Storage Type   : Volatile

Row Status   : Active

Security Model : v3

Security Name : user2

Group Name   : generalusers

Storage Type   : Volatile

Row Status   : Active

Security Model : v3

Security Name : initial

Group Name   : initial

Storage Type   : Non-volatile

Row Status   : Active

Security Model : v3

Security Name : templateMD5

Group Name   : initial

Storage Type   : Non-volatile

Row Status   : Active

Security Model : v3

Security Name : templateSHA

Group Name   : initial

Storage Type   : Non-volatile

Row Status : Active

SMIS# **show snmp group access**

Group Name : iso

Read View : iso

Write View : iso

Notify View : iso

Storage Type : Volatile

Row Status : Active

Group Name : iso

Read View : iso

Write View : iso

Notify View : iso

Storage Type : Volatile

Row Status : Active

Group Name : initial

Read View : restricted

Write View : restricted

Notify View : restricted

Storage Type : Non-volatile

Row Status : Active

Group Name : initial

Read View : iso

Write View : iso

Notify View : iso

Storage Type : Non-volatile

Row Status : Active

Group Name : initial

Read View : iso

Write View : iso

Notify View : iso

Storage Type : Non-volatile

Row Status : Active

Group Name : superuser

Read View : full

Write View : full

Notify View : full

Storage Type : Volatile

Row Status : Active

Group Name : generalusers

Read View : full

Write View :

Notify View : full

Storage Type : Volatile

Row Status : Active

SMIS# **show snmp viewtree**

View Name : iso

Subtree OID : 1

Subtree Mask : 1

View Type : Included

Storage Type : Non-volatile

Row Status : Active

View Name : full

Subtree OID : 1.3.6.1

Subtree Mask : 1.1.1.1

View Type : Included

Storage Type : Volatile

Row Status : Active

View Name : restricted

Subtree OID : 1

Subtree Mask : 1

View Type : Excluded

Storage Type : Non-volatile

Row Status : Active

View Name : restricted

Subtree OID : 1.3.6.1

Subtree Mask : 1.1.1.1

View Type : Included

Storage Type : Volatile

Row Status : Active

View Name   : restricted

Subtree OID : 1.3.6.3.10.2.1

Subtree Mask : 1.1.1.1.1.1.1

View Type   : Excluded

Storage Type : Volatile

Row Status   : Active

SMIS# **show running-config**

Building configuration...

vlan 1

 ports fx 0/1-24 untagged

 ports cx 0/1-3 untagged

exit

snmp user user1 auth md5 AUTH_PASSWD volatile

snmp user user2 auth sha AUTH_PASSWD priv DES DES_CBC volatile

snmp group superuser user user1 security-model v3 volatile

snmp group generalusers user user2 security-model v3 volatile

snmp access superuser v3 auth read full write full notify full volatile

snmp access generalusers v3 noauth read full notify full volatile

snmp view full 1.3.6.1 included volatile

snmp view restricted 1.3.6.1 included volatile

snmp view restricted 1.3.6.3.10.2.1 excluded volatile

12 RMON

Remote monitoring (RMON) is a method similar to Simple Network Management Protocol (SNMP) and uses a client-server model to monitor/manageremote devices on the network. RMON and SNMP differ in the approach used:

- RMON is used for "flow-based" monitoring, while SNMP is often used for "device-based" management. The data collected in RMON deals mainly with traffic patterns rather than the status of individual devices as in SNMP.
- RMON is implemented basedon SNMP. RMON sends traps to the management device to notify the abnormality of the alarm variables by using the SNMP trap mechanism. Traps in RMON and those in SNMP have different monitored targets, triggering conditions, and report contents.
- RMON provides an efficient means of monitoring subnets. The managed device sends a trap to the management device automatically once an alarm has reached a certain threshold value.
- Unlike SNMP, the management device need not get the values of MIB variables multiple times for comparison. Hence the communication traffic between the management device and the managed device is reduced.

RMON provides statistics and alarm functionality to monitor managed devices.

- The statistics function tracks traffic information on the network segments connecting to its ports. For e.g. number of oversize packets received.
- The alarm function aids in monitoring the value of a specified MIB variable. Italso handleevents such as trap or log to be sent to the management device when its value reaches a particular threshold. For e.g. rate of packets received reaches a certain value.

RMON protocol allows multiple monitors or management devices. A monitor provides two ways of data gathering:

- Using RMON probesfrom which Management devices can get data directly and control network resources. In this approach, management devices can obtain all RMON MIB information.
- RMON agents in routers and switches. Management devices exchange data with RMON agents using SNMP operations, which, due to system resources limitation, may not cover all MIB information but four groups of information, alarm, event, history, and statistics, in most cases.

Supermicro supports minimal RMON agent implementation for Ethernet interfaces.

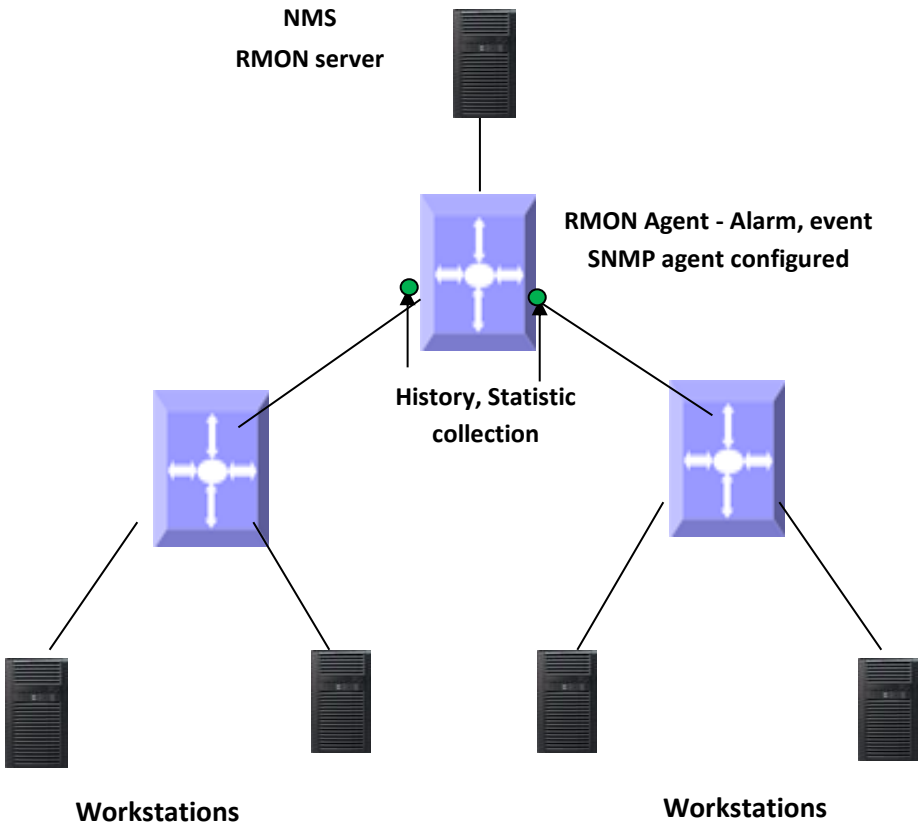


Figure RMON-1: RMON Operation

12.1 RMON Groups

Supermicro supports four groups from RMON MIB1 defined by RMON specifications: event group, alarm group, history group and statistics group.

12.1.1 Alarm group

The RMON alarm group monitors specified alarm variables, such as total number of received packets on an interface. Once an alarm entry is defined, the switch checks the value of the monitored alarm variable at the specified interval. When the value of the monitored variable is greater than or equal to the upper threshold, an upper event is triggered; when the value of the monitored variable is smaller than or equal to the lower threshold, a lower event is triggered. The event is then handledas specified in the event group.

If the value of a specified alarm MIB variable fluctuates, then the rising alarm and falling alarm alternate i.e. only the first one triggers an alarm event.

12.1.2 Event Group

The event group defines event indexes and controls the generation and notifications of the events triggered by the alarms defined in the alarm group. The events can be handled by either of the following ways:

- Logging event related information in the event log table of the RMON MIB of the switch.
- Trap: Sending a trap to notify the occurrence of this event to the management device.

12.1.3 Statistics

RMON statistics function is implemented by either the Ethernet statistics group or the history group. The objects of the statistics are different for both these groups;however both groups record statistics on the interfaceas a cumulative sum for a particular period.

12.1.3.1 History group

The history group specifies periodic collection of traffic information statistics on an interface and saves the statistics in the history record table. The statistics data includes bandwidth utilization, number of error packets, and total number of packets.

12.1.3.2 Ethernet statistics group

The statistics group specifies collection of various traffic statistics information on an Ethernet interface and saves it in the Ethernet statistics table. The statistics data includes network collisions, CRC alignment errors, undersize/oversize packets, broadcasts, multicasts, bytes received, and packets received etc.

12.2 RMON Configuration

This section describes RMON configuration for Supermicro switches.

Parameter	Default Value
RMON status	Disabled
Collection statistics	None
Collection history	None
Alarms	None
Events	None

12.2.1 EnablingRMON

RMON is disabled by default in Supermicro switches. Follow the below steps to enable RMON.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	set rmon enable	Enable RMON in the switch.
Step 3	End	Exit from Configuration mode.
Step 4	Show rmon	Display RMON status.

The “set rmon disable” command disables RMON in the switch.

RMON must be enabled before any other RMON configuration.

The example below shows the commands used to enable RMON.

SMIS# configure terminal

SMIS(config)# **set rmon enable**
SMIS(config)# end
SMIS# show rmon

RMON is enabled

12.2.2 Configuring Alarms and Events

The alarm group periodically takes statistical samples from variables and compares them with the configured thresholds. When a threshold is crossed, an event is generated using the alarm mechanism.

The event group generates events whenever an alarm condition takes place in the device. The alarm group calls the event group, so an event must already be createdfor the alarm to call.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	rmon alarm <alarm-number><mib-object-id (255)><sample-interval-time (1-65535)>{absolute | delta } rising-threshold <value (0-2147483647)><rising-event-number (1-65535)> falling-threshold <value (0-2147483647)><falling-event-number (1-65535)> [owner <ownername (127)>]	(Optional) Set an alarm on a MIB object. alarm-number - Alarm Number. This value ranges between 1 and 65535. mib-object-id - The mib object identifier. sample-interval-time - Time in seconds during which the alarm monitors the MIB variable. This value ranges between 1 and 65535 seconds. absolute - Used to test each mib variable directly. delta - Used to test the change between samples of a variable. rising-threshold - A number at which the alarm is triggered. This value ranges between 0 and 2147483647.

		falling-threshold*value* - A number at which the alarm is reset. This value ranges between 0 and 2147483647. NOTE: Falling threshold must be less than rising threshold. rising-event-number - The event number to trigger when the rising threshold exceeds its limit. This value ranges between 1 and 65535. falling-event-number - The event number to trigger when the falling threshold exceeds its limit. This value ranges between 1 and 65535. Owner – Owner of the alarm, string of length 127.
Step 3	rmon event <number (1-65535)> [description <event-description (127)>] [log] [owner <ownername (127)>] [trap <community (127)>]	(Optional) Add an event in the RMON event table that is associated with an RMON event number. Number - Event number Description - Description of the event Log - Used to generate a log entry Owner - Owner of the event, , in range 1- 127 characters Trap - Used to generate a trap. The SNMP community string is to be passed for the specifiedtrap. NOTE : When RMON event trap is enabled, SNMP agent must be configured prior to configuring the RMON alarm function as described in SNMP Configuration guide (www.supermicro.com).
Step 4	end	Exit from Configuration mode.
Step 5	show rmon [statistics [<stats-index (1-65535)>]] [alarms] [events] [history [history-index (1-65535)] [overview]]	Display RMON statistics, alarms, events history and overview.

The “no rmon alarm <number (1-65535)>” and“no rmon event <number (1-65535)>” commandsdelete the RMON alarm configuration and RMON event configuration respectively.

When the alarm variable is the MIB variable defined in the history group or the Ethernet statistics group, RMON Ethernet statistics function or RMON history statistics function should be configured on the particular Ethernet interface, elsethe creation of the alarm entry fails, and no alarm event is triggered.

12.2.3 Configuring Statistics

The RMON Ethernet statistics group collects statistics for each monitored interface on the switch and stores them in the Ethernet statistics table. Only one statistics entry can be createdper interface.

The RMON Ethernet history group collects a periodic statistical sampling of the data collected by the Ethernet statistics group and stores them in the Ethernet history table. Multiple history entries can be configured on one interface, however all should have different values.

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*> ….**	(Optional) Enters the interface configuration mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	rmon collection stats <index (1-65535)> [owner <ownername (127)>]	(Optional) Enable RMON statistic collection on the interface index - Statistics table index, in range 1-65535

		owner - Optional field that allows you to enter the name of the owner of the RMON group of statistics with a string length of 127
Step 4	rmon collection history <index (1-65535)> [buckets <bucket-number (1-65535)>] [interval <seconds (1-3600)>] [owner <ownername (127)>]	(Optional) Enable history collection for the specified number of buckets and time period index - History table index, in range 1-65535 buckets - The maximum number of buckets desired for the RMON collection history group of statistics. interval - The number of seconds in each polling cycle, in range 1-3600 owner - Optional field - allows the user to enter the name of the owner of the RMON group of statistics, string of length 127.
Step 5	show rmon [statistics [<stats-index (1-65535)>]] [alarms] [events] [history [history-index (1-65535)] [overview]]	Display RMON statistics, history and overview.

The “no rmon collection stats <index (1-65535)>” and “no rmon collection history <index (1-65535)>” commands delete the RMON collection configuration.

12.2.4 RMON Configuration Example

A sample RMON configuration of alarms, events and collection statistics and History in a Supermicro switch is specified below.

1) Enable RMON
2) Create events for Rising and falling threshold.
3) Create the alarm for the MIB object in 1 1.3.6.1.6.3.16.1.2.1.4 table.
4) Create statistics collection on an interface.
5) Display all RMON configurations.

SMIS# configure terminal

SMIS(config)# set rmon enable

SMIS(config)# rmon event 1 description rise log owner smicro1 trap PUBLIC

SMIS(config)# rmon event 2description fall log owner smicro1 trap NETMAN

SMIS(config)# rmon alarm 1 1.3.6.1.6.3.16.1.2.1.4.1.4.110.111.110.1012 absolute rising-threshold 2 1 falling-threshold 1 2 owner smicro1

SMIS(config)# interface Fx 0/5

SMIS(config-if)# rmon collection history 1 buckets 2 interval 20

SMIS(config-if)# rmon collection stats 1

SMIS(config-if)# end

SMIS# show rmon statistics

RMON is enabled

Collection 1 on Fx0/5 is active, and owned by monitor,

Monitors ifEntry.1.5 which has

Received 0 octets, 0 packets,

0 broadcast and 0 multicast packets,

0 undersized and 0 oversized packets,

0 fragments and 0 jabbers,

0 CRC alignment errors and 0 collisions.

# of packets received of length (in octets):

64: 0, 65-127: 0, 128-255: 0,
256-511: 0, 512-1023: 0, 1024-1518: 0

SMIS# show rmon events

RMON is enabled

Event 1 is active, owned by smicro1

Description is rise

Event firing causes log and trap to community PUBLIC,

Time last sent is Apr 29 10:12:20 2013

Logging Event With Description : rise

Event 2 is active, owned by smicro1

Description is fall

Event firing causes log and trap to community NETMAN,

Time last sent is Apr 29 10:11:01 2013

SMIS# show rmon history

RMON is enabled

Entry 1 is active, and owned by

Monitors ifEntry.1.5 every 20 second(s)

Requested # of time intervals, ie buckets, is 2,

Granted # of time intervals, ie buckets, is 2,

Sample 2 began measuring at Apr 29 10:13:52 2013

Received 0 octets, 0 packets,

0 broadcast and 0 multicast packets,

0 undersized and 0 oversized packets,

0 fragments and 0 jabbers,

0 CRC alignment errors and 0 collisions,

# of dropped packet events is 0

Network utilization is estimated at 0

Sample 3 began measuring at Apr 29 10:14:12 2013

Received 0 octets, 0 packets,

0 broadcast and 0 multicast packets,

0 undersized and 0 oversized packets,

0 fragments and 0 jabbers,

0 CRC alignment errors and 0 collisions,

# of dropped packet events is 0

Network utilization is estimated at 0

SMIS# show rmon alarms

RMON is enabled

Alarm 1 is active, owned by smicro1

Monitors 1.3.6.1.6.3.16.1.2.1.4.1.4.110.111.110.101 every 2 second(s)

Taking absolute samples, last value was 2

Rising threshold is 2, assigned to event 1

Falling threshold is 1, assigned to event 2

On startup enable rising or falling alarm

SMIS# show rmon history overview

RMON is enabled

Entry 1 is active, and owned by

Monitors ifEntry.1.5 every 20 second(s)

Requested # of time intervals, ie buckets, is 2,

Granted # of time intervals, ie buckets, is 2,

SMIS# show rmon statistics 1 alarms events history 1

RMON is enabled

Collection 1 on Fx0/5 is active, and owned by monitor,

Monitors ifEntry.1.5 which has

Received 0 octets, 0 packets,

0 broadcast and 0 multicast packets,

0 undersized and 0 oversized packets,

0 fragments and 0 jabbers,

0 CRC alignment errors and 0 collisions.

# of packets received of length (in octets):

64: 0, 65-127: 0, 128-255: 0,

256-511: 0, 512-1023: 0, 1024-1518: 0

Alarm 1 is active, owned by smicro1

Monitors 1.3.6.1.6.3.16.1.2.1.4.1.4.110.111.110.101 every 2 second(s)

Taking absolute samples, last value was 2

Rising threshold is 2, assigned to event 1

Falling threshold is 1, assigned to event 2

On startup enable rising or falling alarm

Event 1 is active, owned by smicro1

Description is rise

Event firing causes log and trap to community PUBLIC,

Time last sent is Apr 29 10:12:20 2013

Logging Event With Description : rise

Event 2 is active, owned by smicro1

Description is fall

Event firing causes log and trap to community NETMAN,

Time last sent is Apr 29 10:11:01 2013

Entry 1 is active, and owned by

Monitors ifEntry.1.5 every 20 second(s)

Requested # of time intervals, ie buckets, is 2,

Granted # of time intervals, ie buckets, is 2,

Sample 4 began measuring at Apr 29 10:14:32 2013

Received 0 octets, 0 packets,

0 broadcast and 0 multicast packets,

0 undersized and 0 oversized packets,

0 fragments and 0 jabbers,

0 CRC alignment errors and 0 collisions,

# of dropped packet events is 0

Network utilization is estimated at 0

Sample 5 began measuring at Apr 29 10:14:52 2013

Received 0 octets, 0 packets,

0 broadcast and 0 multicast packets,

0 undersized and 0 oversized packets,

0 fragments and 0 jabbers,

0 CRC alignment errors and 0 collisions,

# of dropped packet events is 0

Network utilization is estimated at 0

SMIS# write startup-config

Building configuration, Please wait. May take a few minutes ...

[OK]

SMIS# show running-config

Building configuration...

vlan 1

ports fx 0/1-24 untagged

ports cx 0/1-3 untagged

exit

set rmon enable

rmon event 1 description rise log owner smicro1 trap PUBLIC

rmon event 2 description fall log owner smicro1 trap NETMAN

rmon alarm 1 1.3.6.1.6.3.16.1.2.1.4.1.4.110.111.110.101 2 absolute rising-thresh

old 2 1 falling-threshold 1 2 owner smicro1

interface Fx 0/5

rmon collection stats 1 owner monitor

rmon collection history 1 buckets 2 interval 20

exit

12.2.5 Configuring Port Rate Limit

Rate limit is disabled by default in Supermicro switches. Follow the below steps to enable the port rate limit.

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*> ….	(Optional) Enters the interface configuration mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	rate-limit output <rate-value-kbps (1-10000000)><burst-value-kbits (1-10000000)>	Enables the egress rate limit for the interface(s), set to the closest rate (kbps) and burst size (kbits) as the hardware capabilities. Rate limiting is applied to packets sent out on a particular interface. Rate limit and burst size in range of1-10000000.
Step 4	End	Exits the configuration mode.
Step 5	show interface [{ [<interface-type><interface-id>] rate-limit	Displays the rate limit configuration on an interface

The “no rate-limit output” command disablesthe ratelimit on a particular interface**.**

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

SMIS# configure terminal
SMIS(config)# interface Fx 0/20
SMIS(config-if)# rate-limit output 500000 4800
SMIS(config-if)# end

SMIS# show interface Fx 0/20 rate-limit

Fx0/20

Rate Limit : 500000 Kbps
Burst Size : 4800 Kbps

12.2.6 Configuring HOL Blocking Prevention

HOL is enabled by default in Supermicro switches. Follow the steps below to disable HOL blocking.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	no hol blocking prevention	Disables HOL blocking
Step 3	End	Exits the configuration mode.
Step 4	show interfaces [{ [<interface-type><interface-id>]	Displays theinterface configuration.

The “hol blocking prevention” command enables HOLblocking.

The example below shows the commands used to disable HOL blocking.

SMIS# configure terminal
SMIS(config)# interface Fx 0/4
SMIS(config-if)# no hol blocking prevention
SMIS(config-if)# end
SMIS# show interface Fx 0/4

Fx0/4 up, line protocol is down (not connect)
Bridge Port Type: Customer Bridge Port
Hardware Address is 00:30:48:e3:04:78

MTU 1500 bytes, Full duplex, 25 Gbps, Auto-Negotiation
HOL Block Prevention disabled.
Input flow-control is off, output flow-control is off

Link Up/Down Trap is enabled

Reception Counters

Octets : 0
Unicast Packets : 0
Broadcast Packets : 0

Multicast Packets : 0
Pause Frames : 0
Undersize Frames : 0
Oversize Frames : 0
CRC Error Frames : 0
Discarded Packets : 0
Error Packets : 0
Unknown Protocol : 0
Received Rate : 114 bps

Transmission Counters

Octets : 0
Unicast Packets : 0
Non-Unicast Packets : 0
Pause Frames : 0
Discarded Packets : 0
Error Packets : 0
Transmit Rate : 740 bps

13 Security

Supermicro switches support four methods of user authentication:

- RADIUS – Remote Authentication Dial-In User Service (RADIUS) uses AAA service for ID verification, granting access and tracking actions of remote users.
- TACACS – *Terminal Access Controller Access Control System (TACACS)* provides accounting information and administrative control for authentication and authorization. RADIUS encrypts only password, whereas TACACS encrypts username as well, hence it is more secure.
- SSH - *Secure Shell (SSH)* is a protocol for secure remote connection to a device. SSH provides more security than telnet by encryption of messages during authentication.
- SSL –*Secure Socket Layer (SSL)* provides server authentication, encryption and message integrity as well as HTTP client authentication.

13.1 Login Authentication Mode

Supermicro switches allow login authentication against users in local configuration or users in RADIUS or TACACS. Switch can also be configured to fallback to local authentication if authentication with RADIUS or TACACS fails.

Follow the steps below to configure Login Authentication Mechanism.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	login authentication {local | RADIUS [local]| TACACS [local]}	Configure the login authentication mechanism to be used for switch access. Local – Use the local database in switch to authenticate users. Radius – Use RADUIS server to authenticate users. Radius local – Use RADIUS server to authenticate users and in case of failure fallback to local authentication. Tacacs – Use TACACS server to authenticate users. Tacacs local – Use TACACS server to authenticate users and in case of failure fallback to local authentication.
Step 3	End	Exits the configuration mode.
Step 4	show system information	Displays the Login Authentication mechanism.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no login authentication” command resets the login authentication to its default of ‘local’.

The example below shows the commands used to configure Login Authentication with RADIUS.

```
SMIS# configure terminal
SMIS(config)# login authentication radius
SMIS(config)# end
SMIS# show system information

Switch Name                    : SMIS
Switch Base MAC Address        : 00:30:48:e3:70:bc
SNMP EngineID                  : 80.00.08.1c.04.46.53
System Contact                 : http://www.supermicro.com/support
System Location                : Supermicro
Logging Option                 : Console Logging
Login Authentication Mode      : RADIUS

Snoop Forward Mode             : MAC based
Config Restore Status          : Not Initiated
Config Restore Option          : No restore
Config Restore Filename        : iss.conf
Config Save IP Address         : 0.0.0.0
Device Up Time                 : 0 days 0 hrs 15 mins 43 secs
Boot-up Flash Area             : Normal
NTP Broadcast Mode             : No

[NTP] ntp is disabled

    Server      Key   Prefer
================ =====  ======
 Key #    Key
=======  ==================================
 Time zone offset not set
```

The example below shows the commands to configure RADIUS authentication with fallback to local.

```
SMIS# configure terminal
SMIS(config)# login authentication radius local
SMIS(config)# end
```

13.2 RADIUS

A sequence of events occurs during RADIUS client-server communication at the time of user login.

- The username and password are encrypted by the client and sent to RADIUS server.
- The client receives a response from the RADIUS server:
  - ACCEPT—User authentication is successful.
  - REJECT—User authentication failed. User is prompted to re-enter username/password, or access is denied.
  - CHALLENGE—Additional data is requested from the user.
  - CHALLENGE PASSWORD—User is prompted to select a new password.

Along with ACCEPT or REJECT packets, service options (Telnet, SSH, rlogin, or privileged EXEC services) and connection parameters like user timeouts are sent by RADIUS server.

Defaults – RADIUS

Parameter	Default Value
Server	None
Timeout	3 seconds
Re-transmit	3
Key	None

13.2.1 RADIUS Server

Supermicro switches function as a RADIUS client. The RADIUS server to be contacted for authentication can be configured in the switch.

Follow the steps below to configure RADIUSserver Parameters.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	radius-server host <ip-address> [timeout <1-120>] [retransmit <1-254>] key <secret-key-string> [type {authenticating | accounting | both}]	Configure RADIUS server for purpose of authenticating or accounting or both. *ip-address* – serverIP address. *timeout* – Specify RADIUS server timeout in range 1-120 *retransmit* – Specify number of retries to attempt to connect to RADIUS server in range 1-254 *key* –Specify authentication key
Step 3	End	Exits the configuration mode.
Step 4	show radius server show radius statistics	Displays the RADIUS configuration.

Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no radius-server host <ip-address>” command deletes the RADIUS client.

The example below shows the commands used to configure RADIUS server.

SMIS# configure terminal
SMIS(config)#radius-server host 200.200.200.1 timeout 50 retransmit 250 key key1

SMIS(config)# end

SMIS# show radius server

Radius Server Host Information

Index : 1

Server address : 200.200.200.1

Shared secret : key1

Radius Server Status : Enabled

Response Time : 50

Maximum Retransmission : 250

SMIS# show radius statistics

Radius Server Statistics

Index : 1
Radius Server Address : 200.200.200.1

UDP port number : 1812
Round trip time : 0
No of request packets : 0
No of retransmitted packets : 0
No of access-accept packets : 0
No of access-reject packets : 0
No of access-challenge packets : 0
No of malformed access responses : 0
No of bad authenticators : 0

No of pending requests : 0
No of time outs : 0
No of unknown types : 0

13.3 TACACS

TACACS provides access control to switch through a client-server model, similar to RADIUS except that it provides enhanced security by encryption of all messages and reliability via TCP.

Defaults – TACACS

Parameter	Default Value
TACACS server	None
TACACS server re-tries	2
TACACS TCP port	49
TACACS Authentication Mode	PAP
TACACS Authorization status	Diabled
Privilege	1

13.3.1 TACACS Server

Supermicro switches allow configuration of multiple TACACS servers. One of these servers provides the authentication support.

Follow the steps below to configure TACACS server.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	tacacs-server host <ip-address> [single-connection] [port <tcp port (1-65535)>] [timeout <time out in seconds>] key <secret key>	Configure TACACS server. *ip-address* – TACACS Server IP-address *single-connection* – When this option is specified,only one connection to one of the configured TACACS servers is permitted. *port* – Specify TCP port in range 1-65535 *timeout* - Specify TACACS server timeout in range 0 – 255 seconds *key* – Authentication key of maximum length 64 characters.
Step 3	End	Exits the configuration mode.
Step 4	show tacacs	Displays the TACACS configuration.

Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no tacacs-server host <ip-address>” command deletes the TACACS server.

The example below shows the commands used to configure TACACS server.

SMIS# configure terminal
SMIS(config)# tacacs-server host 10.10.10.1 port 500 timeout 200 key key123

SMIS(config)# end

SMIS# show tacacs

Server : 1
Address : 10.10.10.1

Single Connection : no

TCP port : 500

Timeout : 200

Secret Key : key123

Client uses server: 0.0.0.0
Authen. Starts sent : 0
Authen. Continues sent : 0
Authen. Enables sent : 0
Authen. Aborts sent : 0
Authen. Pass rvcd. : 0
Authen. Fails rcvd. : 0
Authen. Get User rcvd. : 0
Authen. Get Pass rcvd. : 0
Authen. Get Data rcvd. : 0
Authen. Errors rcvd. : 0
Authen. Follows rcvd. : 0
Authen. Restart rcvd. : 0
Authen. Sess. timeouts : 0
Author. Requests sent : 0
Author. Pass Add rcvd. : 0
Author. Pass Repl rcvd : 0
Author. Fails rcvd. : 0
Author. Errors rcvd. : 0
Author Follows rcvd. : 0
Author. Sess. timeouts : 0

Acct. start reqs. sent : 0
Acct. WD reqs. sent : 0
Acct. Stop reqs. sent : 0
Acct. Success rcvd. : 0
Acct. Errors rcvd. : 0
Acct. Follows rcvd. : 0
Acct. Sess. timeouts : 0
Malformed Pkts. rcvd. : 0
Socket failures : 0
Connection failures : 0

13.3.2 TACACS Re-tries

Supermicro switches retry transmission of messages to the TACACS server, if there is no response from the server. This retry count can be configured by user.

Follow the steps below to configure TACACS server re-tries.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	tacacs-server retransmit <1-100>	Configure TACACS server re-tries in the range 1-100.
Step 3	End	Exits the configuration mode.
Step 4	show tacacs	Displays the TACACS configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no tacacs-server retransmit” command resets the TACACS server re-tries to its default value.

The example below shows the commands used to configure TACACS server re-tries.

SMIS# configure terminal
SMIS(config)# tacacs-server retransmit 5
SMIS(config)# end

13.3.3 TACACS use-server

Supermicro switches provide option to configure multiple TACACS servers. User can specify one of these available servers to be used at a time.

Follow the steps below to configure TACACS server to be used.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	tacacs use-server address<ip-address>	Configure TACACS server to be used.
Step 3	End	Exits the configuration mode.
Step 4	show tacacs	Displays the TACACS configuration.

Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no tacacs use-server address<ip-address>” command deletes the TACACS client.

The example below shows the commands used to configure TACACS server to be used.

```
SMIS# configure terminal
SMIS(config)# tacacs use-server address 10.10.10.1

SMIS(config)# end

SMIS# show tacacs

Server : 1
    Address         : 10.10.10.1
    Single Connection : no
    TCP port        : 49
    Timeout         : 200
    Secret Key      : key123
Server : 2
    Address         : 50.50.50.1
    Single Connection : no
    TCP port        : 49
    Timeout         : 5
    Secret Key      : key789
Client uses server: 10.10.10.1

Authen. Starts sent    : 0
Authen. Continues sent : 0
Authen. Enables sent   : 0
Authen. Aborts sent    : 0
Authen. Pass rvcd.     : 0
Authen. Fails rcvd.    : 0
Authen. Get User rcvd. : 0
Authen. Get Pass rcvd. : 0
Authen. Get Data rcvd. : 0
Authen. Errors rcvd.   : 0
Authen. Follows rcvd.  : 0
Authen. Restart rcvd.  : 0
Authen. Sess. timeouts : 0
Author. Requests sent  : 0
Author. Pass Add rcvd. : 0
Author. Pass Repl rcvd : 0
Author. Fails rcvd.    : 0
```

Author. Errors rcvd. : 0
Author Follows rcvd. : 0
Author. Sess. timeouts : 0
Acct. start reqs. sent : 0
Acct. WD reqs. sent : 0
Acct. Stop reqs. sent : 0
Acct. Success rcvd. : 0
Acct. Errors rcvd. : 0
Acct. Follows rcvd. : 0
Acct. Sess. timeouts : 0
Malformed Pkts. rcvd. : 0
Socket failures : 0
Connection failures : 0

13.3.4 TACACS Login Authentication Mode

Supermicro switches provide an option to configure TACACS login authentication mode. Users can specify one of the mode PAP or CHAP .

In TACACS+ mode, authentication request is sent to the configured TACACS+ server. The user name and passwords are authenticated using TACACS+ server.

Follow the steps below to configure the TACACS login authentication mode to be used.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	aaa authentication tacacs { chap | pap }	Configures TACACS authentication mode to be used.
Step 3	End	Exits the configuration mode.
Step 4	show Tacacs	Displays the TACACS configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of the startup configuration.

The “no aaa authentication tacacs” command deletes the TACACS login mode.

The example below shows the commands used to configure the TACACS login mode to be used.

SMIS# configure terminal

SMIS(config)# aaa authentication tacacs chap

```
SMIS(config)# end

SMIS# show tacacs
Server : 1
      Address          : 192.168.2.11
      Single Connection : no
      TCP port         : 49
      Timeout          : 5
      Key Type         : 0
      Secret Key       : testing123
      Mode             : Chap
Client uses server: 192.168.2.11

Authen. Starts sent       : 14
Authen. Continues sent : 0
Authen. Enables sent      : 0
Authen. Aborts sent       : 0
Authen. Pass rvcd.        : 11
Authen. Fails rcvd.       : 3
Authen. Get User rcvd. : 0
Authen. Get Pass rcvd. : 0
Authen. Sess. timeouts    : 0
Author. Requests sent     : 0
Author. Pass Add rcvd.  : 0
Author. Pass Repl rcvd :    0
Author. Fails rcvd.       :  0
Author. Errors rcvd.      : 0
Author Follows rcvd.      : 0
Author. Sess. timeouts    : 0
Acct. start reqs. sent    : 0
Acct. WD reqs. sent       : 0
Acct. Stop reqs. sent     : 0
Acct. Success rcvd.  : 0
Acct. Errors rcvd.        : 0
Acct. Follows rcvd.       : 0
Acct. Sess. timeouts      : 0
Malformed Pkts. rcvd. : 0
Socket failures           : 0
Connection failures       : 0
```

13.3.5 TACACS Authorization Status

Supermicro switches provide an option to configure TACACS authorization status. Users can specify one of the option Enable or Disable.

If authorization status is enabled, during TACACS+ authentication switch will also send out the authorization request to TACACS+ server. The authorization requests are used to get privilege levels for TACACS+ users. When authorization status is disabled, all TACACS+ authenticated users will be logged in with default privilege level 1. When authorization status is enabled, the TACACS+ authentication users will be logged in with privilege levels configured in TACACS+ server.

Follow the steps below to configure the TACACS authorization to be used.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode.
Step 2	aaa authorization group Tacacs	Configures TACACS authorization to be used.
Step 3	End	Exits the configuration mode.
Step 4	show tacacs	Displays the TACACS configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of the startup configuration.

The “no aaa authorization group tacacs” command disables the TACACS authorization status.

The example below shows the commands used to configure the TACACS authorization status to be used.

```
SMIS# configure terminal

SMIS(config)# aaa authorization group tacacs

SMIS(config)# end

SMIS(config)# show tacacs
Server : 1
      Address          : 192.168.2.11
      Single Connection : no
      TCP port          : 49
      Timeout           : 5
      Key Type          : 0
      Secret Key        : test123
      Mode              : Pap
```

Client uses server: 192.168.2.11
Authorization Enable
Authen. Starts sent : 8
Authen. Continues sent : 0
Authen. Enables sent : 0
Authen. Aborts sent : 0
Authen. Pass rvcd. : 5
Authen. Fails rcvd. : 3
Authen. Get User rcvd. : 0
Authen. Get Pass rcvd. : 0
Authen. Sess. timeouts : 0
Author. Requests sent : 4
Author. Pass Add rcvd. : 0
Author. Pass Repl rcvd : 0
Author. Fails rcvd. : 0
Author. Errors rcvd. : 0
Author Follows rcvd. : 0
Author. Sess. timeouts : 0
Acct. start reqs. sent : 0
Acct. WD reqs. sent : 0
Acct. Stop reqs. sent : 0
Acct. Success rcvd. : 0
Acct. Errors rcvd. : 0
Acct. Follows rcvd. : 0
Acct. Sess. timeouts : 0
Malformed Pkts. rcvd. : 0
Socket failures : 0
Connection failures : 0

13.3.6 TACACS Privilege

Req. #	Description	Comments

1.0	The privilege configured in TACACS+ server should be used while logging in to Supermicro switch using TACACS+ authentication.
	
	There are many types of service used by different vendors on the market. For Supermicro switches the supported service type is 'config'.
	
	E.g. user configuration in TACACS+ server:
	user = test15 {
	name = "Test15 User"
	pap = cleartext "test15"
	service=**config** {
	priv-lvl = 15
	}
	}
		This is an umbrella requirement to cover the functionality.

1.1	TACACS+ users without privilege configured also should be able to login to switch with the default privilege level 1.	

	E.g. user configuration in TACACS+ server:
	user = test1 {
	name = "Test1 User"
	pap = cleartext "test1"
	}	

1.2	This privilege function should be enabled only when user enables it in CLI, Web, and SNMP. Proposed new CLI command to enable: aaa authorization group tacacs In Web, it should be enabled in "Management Security" page. In SNMP, the following OID can be used: 1.3.6.1.4.1.2076.77.1.6.0	For e.g. the new command "aaa authorization
1.3	If this function is not enabled (using the command in Req. 2), switch should behave as before. It means the irrespective of the privilege configured on the TACACS+ server, it will login the users with the default privilege 1.	
1.4	The TACACS+ privilege function should work in telnet, ssh and Web login.	
1.5	The new authorization status configuration (Req. 2) should be saved and restored.	

13.4 SSH

Supermicro switches act as a SSH client and support both SSH version 1 and SSH version 2.

Parameter	Default Value
SSH status	Enabled
SSH version compatibility	Off
SSH port	22
SSH Key	RSA
Cipher Algorithm	3DES-CBC
SSH Version	2
Authentication	HMAC-SHA1

Follow the steps below to configure SSH.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ip ssh {version compatibility | auth ([hmac-md5] [hmac-sha1]) | port <(1024-65 535)>}	*versioncompatibility*- Specify whether switch should process both version 1 and version 2 SSL messages. *auth* –Specify the authentication algorithm.

		port - Specify SSH port in range 1024-65535
Step 3	End	Exits the configuration mode.
Step 4	show ip ssh	Displays the SSH configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no ip ssh {version compatibility | auth ([hmac-md5] [hmac-sha1]) | port <(1024-65535)>}” command disables SSH.

The example below shows the commands used to configure SSH.

SMIS# configure terminal
SMIS(config)# ip ssh version compatibility
SMIS(config)# end
SMIS# show ip ssh

Version : Both

Cipher Algorithm : 3DES-CBC
Authentication : HMAC-SHA1
Trace Level : None

SMIS# configure terminal

SMIS(config)# ip ssh auth hmac-md5

SMIS(config)# end

SMIS# show ip ssh

Version : 2
Cipher Algorithm : 3DES-CBC
Authentication : HMAC-MD5

Trace Level : None

13.5 SSL

SSL provides server authentication, encryption, and message integrity, as well asHTTP client authentication, to allow secure HTTP communications.To use this feature, thecryptographic (encrypted) software image must be installed on the switch.

Parameter	Default Value
HTTP Secure server status	Enabled
HTTP Secure server encryption	rsa-null-md5
HTTP Secure server keys	None
SSL Server certificate	None
SSL Server certificate request	None

13.5.1 Secure HTTP (https)

On a secure HTTP connection, data to and from an HTTP server is encrypted before being sent over theInternet. *HTTP with SSL encryption (HTTPS)*provides a secure connection to allow such functions as configuringa switch from a Web browser.

Follow the steps below to configure Secure HTTP.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	ip http secure { server | ciphersuite [rsa-null-md5] [rsa-null-sha] [rsa-des-sha] [rsa-3des-sha] [dh-rsa-des-sha][dh-rsa-3des-sha][rsa-exp1024-des-sha] | crypto key rsa [usage-keys (512|1024)] }	Configure Secure HTTP. *server* – Enables HTTPS server *ciphersuite* – Specify one or many of the supported encryption algorithm to be used. *crypto key rsa*–Encryption Key, either 512 or 1024.
Step 3	End	Exits the configuration mode.
Step 4	show ip http secure server status	Displays the SSL configuration.
Step 5	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The “no ip http secure { server | ciphersuite [rsa-null-md5] [rsa-null-sha] [rsa-des-sha] [rsa-3des-sha] [dh-rsa-des-sha][dh-rsa-3des-sha][rsa-exp1024-des-sha] | crypto key rsa [usage-keys (512|1024)] }” command enables the agent.

The example below shows the commands used to configure Secure HTTP.

```
SMIS# configure terminal
SMIS(config)# no ip http secure server
SMIS(config)# end
SMIS# show ip http secure server status

HTTP secure server status      : Disabled
HTTP secure server ciphersuite  : RSA-DES-SHA:RSA-3DES-SHA:RSA-EXP1024-DES-SHA:
HTTP crypto key rsa 1024
```

13.5.2 Certificate Signing Request (CSR)

An SSL certificate provides security for online communications. Before requesting an SSL certificate, a Certificate Signing Request (CSR) must be generated and submitted to the Certification Authority (CA).Certificate authorities (CAs) manage certificate requests and issue certificates to participating network devices. These services provide centralized security key and certificate management for the participating devices. CA servers are called as trustpoints, e.g. thawte.com.

Supermicro switches create a Certificate Signing Request (CSR) using RSA key pair and Switch Identification.

Follow the steps below to configure Certificate Signing Request (CSR).

Step	Command	Description
Step 1	ssl gen cert-req algo rsa sn <SubjectName>	Configure Certificate Signing Request (CSR). *SubjectName* – Switch ID or IP-address.
Step 2	show ssl server-cert	Displays the SSL configuration.
Step 3	write startup-config	Optional step – saves this configuration to be part of startup configuration.

The example below shows the commands used to configure Certificate Signing Request (CSR).

```
SMIS# ssl gen cert-req algo rsa sn SMIS

-----BEGIN CERTIFICATE REQUEST-----

MIIBTjCBuAIBADAPMQ0wCwYDVQQDEwRTTUlTMIGfMA0GCSqGSIb3DQEBAQUAA4GN

ADCBiQKBgQChj0JzVX1/gZ4SMGekRdrsAnftWnKHG3VypWTtySqkvTwhnZ206Q2o

cBYJNKY4ZCykOXG81mfUhqPfVLyO8sbK+RYzEeTMX9lw9iq9yOySOlvxY6IoYNsg

O++JS02khz0SAbpRkhtGuwmBiZQtSj+8Ea3dG8ReoixpcYDVVdIrDQIDAQABoAAw

DQYJKoZIhvcNAQEEBQADgYEAXR8Nz40QeC8wqwzqy+iozT5iUMKOkelXTE8mDydt

AvRyc7a3EPraGjyOL5W1H94z+wW2wkxXTRzKuLzAEYRH9f84XB2uCAdL+jkuSBJc

5qd3j4yBtOIu/pxOsdKKwuq6LWbi44DCXg97SkE+pOYa7nWojVkjc2SbjvK5CTgG

89s=

-----END CERTIFICATE REQUEST-----

SMIS# show ssl server-cert

Certificate:
   Data:
      Version: 1 (0x0)
      Serial Number: 10 (0xa)
      Signature Algorithm: md5WithRSAEncryption
      Issuer: C=US, ST=CA, L=SanJose, O=Supermicro, OU=Switch, CN=Switch/Email
=support@supermicro.com

      Validity
         Not Before: Aug 11 22:18:10 2011 GMT
         Not After : Sep 10 22:18:10 2011 GMT
      Subject: CN=SMIS
      Subject Public Key Info:
         Public Key Algorithm: rsaEncryption
         RSA Public Key: (1024 bit)
            Modulus (1024 bit):
               00:a1:8f:42:73:55:7d:7f:81:9e:12:30:67:a4:45:
```

da:ec:02:77:ed:5a:72:87:1b:75:72:a5:64:ed:c9:

2a:a4:bd:3c:21:9d:9d:b4:e9:0d:a8:70:16:09:34:

a6:38:64:2c:a4:39:71:bc:d6:67:d4:86:a3:df:54:

bc:8e:f2:c6:ca:f9:16:33:11:e4:cc:5f:d9:70:f6:

2a:bd:c8:ec:92:3a:5b:f1:63:a2:28:60:db:20:3b:

ef:89:4b:4d:a4:87:3d:12:01:ba:51:92:1b:46:bb:

09:81:89:94:2d:4a:3f:bc:11:ad:dd:1b:c4:5e:a2:

2c:69:71:80:d5:55:d2:2b:0d

Exponent: 65537 (0x10001)

Signature Algorithm: md5WithRSAEncryption

21:bd:73:5e:96:82:89:13:12:a6:69:e8:9c:e6:fb:a5:0f:bc:

0b:8d:fd:03:25:68:d9:09:73:58:7f:e1:30:64:d9:3a:99:63:

6b:d2:ec:37:ea:33:1e:28:11:48:26:94:13:36:aa:08:14:5a:

7a:c4:f2:14:26:54:9e:d4:b5:2d:a2:c1:ab:fe:7a:2f:b8:f6:
23:08:93:fb:6b:7e:d9:14:da:09:90:50:b4:76:b0:17:e1:5f:
53:75:ee:7a:5f:85:dd:90:3c:d4:28:18:ee:5c:64:f5:09:52:
03:25:3e:f1:ed:5d:80:37:4b:ff:ad:fb:54:d0:24:11:a1:cd:
32:6c

13.5.3 SSL Certificate

Each SSL Certificate contains

- A public/private key pair: a private key with the code and a public key used to decode it. The private key is installed on the server and is not shared with anyone. The public key is incorporated into the SSL certificate and shared with web browsers.
- Identification information. E.g. When you request an SSL certificate, a third party (such as Thawte) verifies your organization's information and issues a unique certificate to you with that information.

SSL Certificate can be configured in Supermicro switches. The certificate should be specified in PEM format.

Follow the steps below to configure SSL server certificate.

Step	Command	Description
Step 1	ip http secure	Configure Cipher Suite and Crypto Key RSA of your choice using "ip http secure" command.
Step 2	ssl gen cert-req algo rsa sn	Enter the subject name and create certificate request by using the "ssl gen cert-req algo rsa sn" command.
Step 3	show ssl server-cert	The "show ssl server-cert" command will display certificate request. Copy

		paste these contents to a text file, say a.csr.
Step 4	Linux commands	To generate SSL certificate openssl application can be used. The following steps can be executed in any linux machine to generate SSL certificates. For other openssl implementation refer the openssl documentation to find the equivalent steps. Execute the below commands in linux shell. 1. openssl req -x509 -newkey rsa:1024 -keyout cakey.pem -out cacert.pem 2. openssl x509 -req -in a.csr -out cert.pem -CA cacert.pem -CAkey cakey.pem –Cacreateserial This would generate certificate file cert.pem.
Step 5	ssl server-cert	Open the generate certificate file cert.pem. Delete first line (---BEGIN CERTIFICATE ---) and last line (----END CERTIFICATE--). Join all the remaining lines as single line to avoid line breaks processed. Copy paste these joined texts in “Enter Certificate” prompt– This prompt appears after entering the “ssl serv-cert” command in CLI. This step would configure the certificate and save it to flash.
Step 6	show ssl server-cert	Displays the SSL configuration.

14 LLDP

LLDP is a neighbor discovery protocol that is used for network devices to advertise information about themselves to other devices on the network. This protocol runs over the data-link layer, which allows two systems running different network layer protocols to learn about each other.

Devices in a LAN maintain operations-related configuration information in management information bases (MIBs). LLDP helps avoid misconfiguration problems in LANs by enabling LAN devices to be aware of other devices' configuration information.

LLDP supports a set of attributes that it uses to discover neighbor devices. These attributes contain type, length, and value descriptions and are referred to as TLVs. LLDP supported devices can use TLVs to receive and send information to their neighbors. Details such as configuration information, device capabilities, and device identity can be advertised using LLDP.

Supermicroswitches provides the following LLDP features:

- Support all mandatory TLVs (chassis identifier, port identifier and time-to-live).
- Support optional TLVs - port description, system name, system description, system capabilities and management address.
- Support organizationally specific optional TLVs - port VLAN identifier, port and protocol VLAN identifier, VLAN name, MAC or PHY configuration or status, link aggregation and maximum frame size.
- Provide support for notifications through traps.

An LLDP agent operates in any one of the following three modes:

1. Transmit-only mode: The agent can only transmit the information about the capabilities and the status of the local system.
2. Receive-only mode: The agent can only receive information about the capabilities and the status of the remote systems.
3. Transmit and receive mode: The agent can transmit the local system capabilities and status information and receive the capabilities and status informationof remote systems.

The LLDP transmit only modesends the local device's information at regular intervals in LLDP TLV’s. Whenever the transmit mode is disabled, the device transmits an LLDP PDU with a time-to-live (TTL) TLV containing "0" in the information field. Upon reception of a PDU with TLV 0, remote devices are then enabled to remove the information associated with this local device fromtheir databases.

The LLDP receive only mode receivesaremote device's information and updates the remote system's LLDP MIB database. When new or updated information is received, the receive module initiates a timer for avalid duration indicated by the TTL TLV in the received LLDP PDU. The remote system's information is removed from the database when an LLDP PDU is received with TTL TLV containing "0" in its information field.

Parameter	Default Value
LLDP Status (global)	Disabled
LLDP Status (interface level)	Transmit and receive
TLV	None

HoldtimeMultiplier	4
Message Transmit Interval	30
ReinitializationDelay	2
Transmit Delay	2
Trap Notification Interval	5
Chassis ID	Switch MAC address
Chasis ID Subtype	MAC address
Port ID Subtype	Interface name
System Capabilities	None
Notification	Disabled
Notification Type	Mis-configuration

14.1.1 EnablingLLDP

LLDP is disabled by default in Supermicro switches. Follow the steps below to enable LLDP.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	set lldp enable	Enables LLDP in the switch.
Step 3	**End**	Exits the configuration mode.
Step 4	**show lldp**	Displays the LLDP global configuration details

The “set lldp disable” command disables LLDP in the switch.

14.1.2 Configuring LLDP Parameters

Once LLDP is enabled globally, it is enabled on all supported interfaces by default. Supermicro switches provide a user configuration to place an interface in only send or only receive mode.

Other LLDP parameters that can be configured in Supermicro switches are Notification type, Chassis-ID Sub-type and Port-ID Sub-type.

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*> ….	(Optional) Enters the interface configuration mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx

		port-channel – po interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20 If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	lldp {transmit | receive}	(Optional) Sets LLDP admin status on an interface to Transmit or Receive
Step 4	lldp notification [remote-table-chg][mis-configuration]	(Optional) Enables LLDP trap notification on an interface. remote-table-chg - Trap notification for change in neighbor’s table. mis-configuration - Trap notification for mis-configuration.
Step 5	lldp port-id-subtype { if-alias | port-comp <string(255)> | mac-addr | if-name | local <string(255)> }	(Optional) Configures LLDPport IDsubtype and port IDvalue if-alias - interface alias port-comp - port component mac-addr - MAC address if-name - interface name local - locally assigned The default value for port-id-subtype is if-name. Note: The if-alias option can be used only for the interfaces which havevalid description configured.

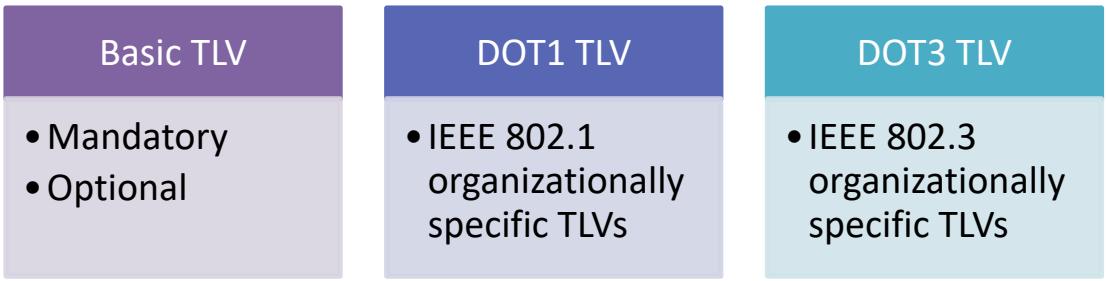
Step 6	Exit	Exitsinterface configuration mode.
Step 7	lldp chassis-id-subtype { chassis-comp <string(255)> | if-alias | port-comp <string(255)> | mac-addr | nw-addr | if-name | local <string(255)> }	(Optional) Configures LLDPchassis IDsubtype and chassis IDvalue. The chassis identifier value can only be set for the chassis-component and local system subtypes. For all other subtypes, the value is taken from the system automatically. chassis-comp - chassis component if-alias - management interface alias port-comp - port component mac-addr - MAC address nw-addr - network address if-name - interface name local - locally assigned The default value for chassi-id-subtype is mac-addr. Note: To use the if-alias option, the management interface must have been configured with valid description.
Step 8	End	Exits the configuration mode.
Step 9	show lldp interface [<interface-type><interface-id>] show lldp neighbors [chassis-id <string(255)> port-id <string(255)>] [<interface-type><interface-id>][detail] show lldp traffic [<iftype><ifnum>] show lldp errors show lldp statistics	Displays LLDP configuration details on a particular interface or all interfaces Displays information about neighbors learned on an interface or all interfaces Displays LLDP counters, including the number of frames sent, received, discarded, etc. Displays information about errors such as memory allocation failures, queue overflows, table overflows, etc.

		Displays the LLDP remote table statistics information
Step 10	clear lldp counters	Clears LLDP transmit and receive statistics
Step 11	clear lldp table	Clears LLDP neighbors information

These commands reset the particular configuration to its default value.
lldp {transmit | receive}
no lldp notification
no lldp tlv-select basic-tlv { [port-descr] [sys-name] [sys-descr] [sys-capab] [mgmt-addr {all | ipv4 <ucast_addr> | ipv6 <ip6_addr>}]}
no lldp tlv-select dot1tlv {[port-vlan-id] [protocol-vlan-id {all |<vlan-id>}] [vlan-name {all | <vlan-id>}]}
no lldp tlv-select dot3TLV { [macphy-config] [link-aggregation] [max-framesize] }

14.1.2.1 Configuring LLDP TLV

Supermicro switches provide support for user configuration of LLDP TLV's. The TLV types supported by Supermicro switches are: Basic TLV, DOT1 TLV and DOT3 TLV. The figure below displays the TLV types and



their content.

Figure LLDP-1: LLDP TLV Types

The content ofthe various TLVs supported by Supermicro switches are specified in the figurebelow.

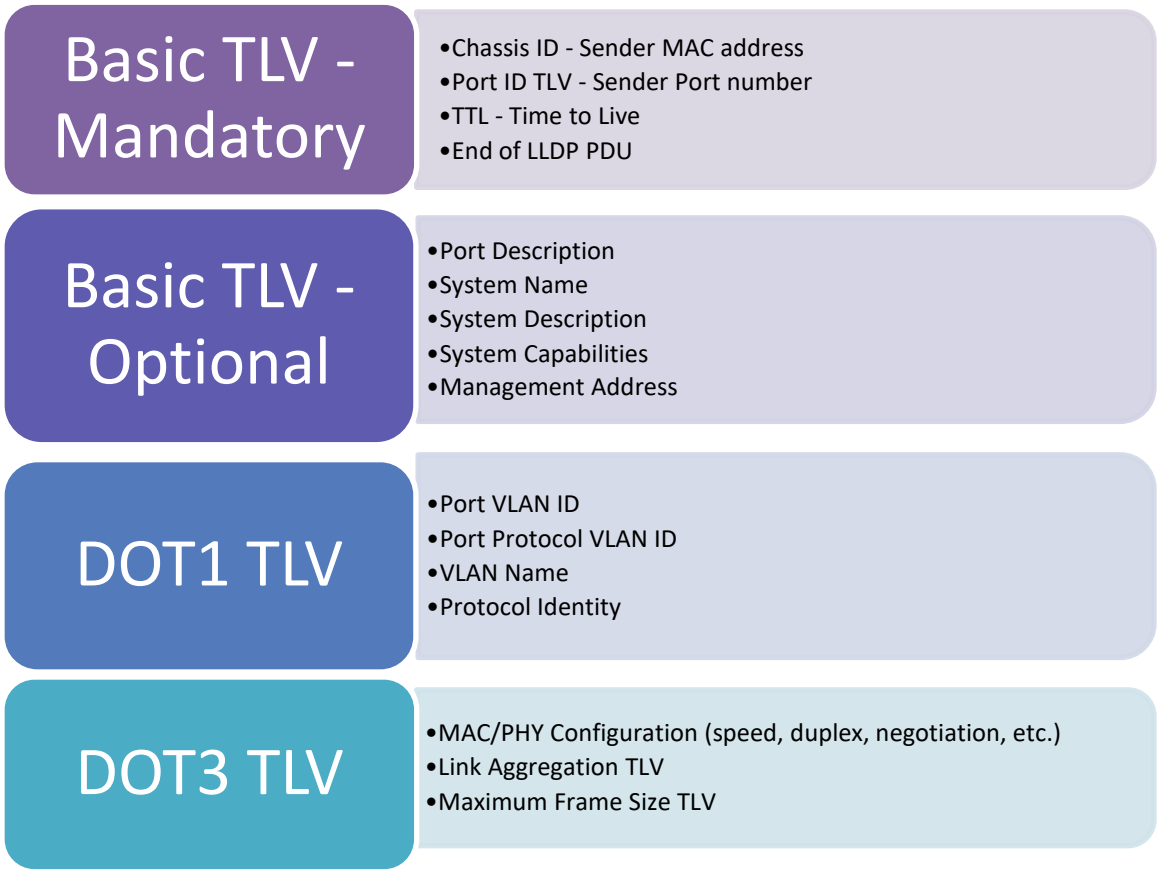


Figure LLDP-2: LLDP TLV Content

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	interface <*interface-type*><*interface-id*> or interfacerange <*interface-type*><*interface-id*> ….	(Optional) Enters the interface configuration mode. interface-type – may be any of the following: fx-ethernet – fx cx-ethernet – cx port-channel – po interface-id is in slot/port format for all physical 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 fx 0/1-10 To provide multiple interfaces or ranges, separate with a comma (,). E.g.: int range fx 0/1-10, fx 0/20

		If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 3	lldp tlv-select basic-tlv { [port-descr] [sys-name] [sys-descr] [sys-capab] [mgmt-addr {all | ipv4 <ucast_addr> | ipv6 <ip6_addr>}]}	(Optional) Enables the basic TLV transmission on a given port port-descr - Port description TLV sys-name - System name TLV sys-descr- System description TLV sys-capab - System capabilities TLV mgmt-addr all- Enables the transmission of the management address on the current interface. If no management address is present or configured in the system, the switch'sMAC address will be usedfor transmission. mgmt-addr ipv4 *ucast-addr* - Enables the transmission of a particular ipv4 address on the current interface. mgmt-addr ipv6 *ipv6-addr* - Enables the transmission of a particular ipv6 address on the current interface.
Step 4	lldp tlv-select dot1tlv {[port-vlan-id] [protocol-vlan-id {all |<vlan-id>}] [vlan-name {all | <vlan-id>}]}	(Optional) Configure dot1 TLV types to be transmitted on a port port-vlan-id - Port VLAN identifier TLV. The keyword port-vlan-id keyword is not supported. protocol-vlan-id - Protocol VLAN identifier TLV. The keyword protocol-vlan-id is not supported. vlan-name – VLAN name TLV NOTE: VLANname must be configured prior to this LLDP configuration.
Step 5	lldp tlv-select dot3tlv { [macphy-config] [link-aggregation] [max-framesize] }	(Optional) Configure dot3 TLV types to be transmitted on a port

		macphy-config - MAC or PHY TLV. link-aggregation - Link aggregation TLV. max-framesize - Maximum frame size TLV.
Step 6	End	Exits the configuration mode.
Step 7	show lldp interface [<interface-type><interface-id>]	Displays LLDP configuration details on a particular interface or all interfaces
	show lldp local {[<interface-type><interface-id>] | [mgmt-addr]}	Displays the current switch information that will be used to populate outbound LLDP advertisements for a specific interface or all interfaces

14.1.3 Configuring LLDP Timers

Supermicro switches allow for user configuration of LLDP timers:

- Transmit Interval
- Holdtime Multiplier
- ReinitializationDelay
- Transmit Delay
- Notification Delay

14.1.3.1 Message Transmit Interval

The message transmit interval is the period between transmission of the periodic LLDP advertisements.The default message transmit interval is 30 seconds.

Supermicro switches allow for user configuration of the message transmit interval. Follow the below steps to change the message transmit interval.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	lldp transmit-interval <seconds(5-32768)>	(Optional) Configuresthe message transmit interval, range of 5-32768.
Step 3	End	Exits the configuration mode.
Step 4	show lldp	Displays the LLDP global information

The “no lldp transmit-interval” command resets the message transmit intervalto its default value.

14.1.3.2 Message Transmit Holdtime Multiplier

The Message Transmit Holdtime Multiplier is used to calculate the time-to-live (TTL) value sent in LLDP advertisements. The time-to-live informsthe receiving LLDP agent of the timeto retain remote LLDP informationif LLDP advertisements are not received periodically.

The TTL is calculated as:the minimum of ((Transmission Interval * Holdtime Multiplier), or 65536)

The default holdtime multiplier is 4 seconds. The default TTL is: 4*30 = 120 seconds. Supermicro switches allow for the user configuration of the message transmit holdtimemultiplier. Follow the steps below to change the message transmit holdtimemultiplier.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	lldpholdtime-multiplier <value(2-10)>	(Optional) Configures the message transmit holdtimemultiplier, range of 2-10.
Step 3	End	Exits the configuration mode.
Step 4	show lldp	Displays the LLDP global information

The “no lldpholdtime-multiplier” command resets the message transmit holdtimemultiplierto its default value.

14.1.3.3 ReinitializationDelay

When LLDP ports are disabled or the link goes down, LLDP is reinitialized on a port. The delay between the port going down and the reinitialization is called the reinitialization delay. When LLDP is reinitialized on a port, all information in the remote systems LLDP MIB associated with this port is deleted.

Supermicro switches allow user configuration of the reinitialization delay. Follow the steps below to change the reinitialization delay.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step2	lldpreinitialization-delay <seconds(1-10)>	(Optional) Configures the reinitialization delay, range of 1-10.
Step 3	End	Exits the configuration mode.
Step 4	show lldp	Displays the LLDP global information

The “no lldpreinitialization-delay” commandresets the reinitialization delayto its default value.

14.1.3.4 Transmit Delay

Any change in local LLDP MIB variables initiates the transmission of LLDP advertisements. The delay between the successive transmissions of such advertisements is called the Transmit Delay. The transmit delay helps prevent unnecessary LLDP transmissions when rapid changes occur in local LLDP MIB objects.

Supermicro switches allow for user configuration of the message transmit delay. Follow the steps below to change the message transmit delay.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	lldptx-delay <seconds(1-8192)>	(Optional) Configures themessage transmit delay, range of 1-8192. NOTE: The Txdelay should be less than 0.25 * message Txinterval
Step 3	End	Exits the configuration mode.
Step 4	show lldp	Displays the LLDP global information

The “no lldptx-delay” commandresets the message transmit delayto its default value.

14.1.3.5 Notification Interval

The Notification Interval is the time interval between successive periodic SNMP notifications about LLDP MIB changes. Any change in LLDP neighbors that occurs between SNMP notifications is not transmitted; only state changes that exist at the expiry of the notification interval are included in the transmission.

Supermicro switches allow for user configuration of the notification interval. Follow the steps below to change the the notification interval.

Step	Command	Description
Step 1	configure terminal	Enters the configuration mode
Step 2	lldp notification-interval <seconds(5-3600)>	(Optional) Configures the notification interval, range of 5-3600.
Step 3	End	Exits the configuration mode.
Step 4	show lldp	Displays the LLDP global information

The “no lldp notification-interval” command resets the notification interval to its default value.

14.1.4 LLDPConfiguration

The example below shows the commands used to configure LLDP by connecting two switches: Switch A and Switch B.

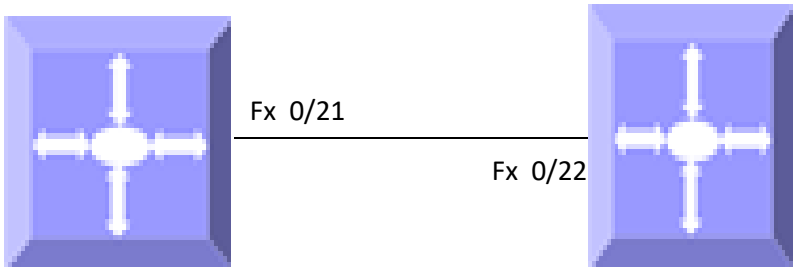


Figure LLDP-3: LLDP Configuration Example

Switch A

SMIS# configure terminal

SMIS(config)# set lldp enable

SMIS(config)# end

SMIS# show lldp

LLDP is enabled

Transmit Interval : 30

Holdtime Multiplier : 4

Reinitialization Delay : 2

Tx Delay : 2

Notification Interval : 5

Chassis Id SubType : Mac Address

Chassis Id : 00:30:48:e3:04:75

SMIS# show lldp neighbors

Capability Codes :

(R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device,

(W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Chassis ID	Local Intf	Hold-time	Capability	Port Id
00:30:48:e3:70:bc	Fx0/21	120		Fx0/22

Total Entries Displayed : 1

SMIS(config)# lldp chassis-id-subtype if-name

SMIS(config)# lldpholdtime-multiplier 7

SMIS(config)# lldp notification-interval 100

SMIS(config)# lldpreinitialization-delay 5

SMIS(config)# lldpreinitialization-delay 9

SMIS(config)# lldpreinitialization-delay 10

SMIS(config)# lldp transmit-interval 100

SMIS(config)# lldp transmit-interval 10

SMIS(config)# end

SMIS(config)# interface Fx 0/21

SMIS(config-if)# lldp notification remote-table-chg

SMIS(config-if)# lldp port-id-subtype if-name

SMIS(config-if)# lldp tlv-select basic-tlv port-descrmgmt-addr all

SMIS(config-if)# exit

SMIS(config)# vlan 1

SMIS(config-vlan)# name vlan1

SMIS(config-vlan)# exit

SMIS(config)# interface Fx 0/21

SMIS(config-if)# lldp tlv-select dot1tlv vlan-name 1

SMIS(config-if)# lldp tlv-select dot3tlv macphy-config

SMIS(config-if)# end

SMIS# show lldp

LLDP is enabled

Transmit Interval : 10

Holdtime Multiplier : 7

Reinitialization Delay : 10

Tx Delay : 2

Notification Interval : 100

Chassis Id SubType : Interface Name

Chassis Id : eth0

SMIS# show lldp neighbors

Capability Codes :

(R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device,

(W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Chassis ID	Local Intf	Hold-time	Capability	Port Id
00:30:48:e3:70:bc	Fx0/21	120		Fx0/22

Total Entries Displayed : 1

SMIS# show lldp errors

Total Memory Allocation Failures : 0

Total Input Queue Overflows : 0

Total Table Overflows : 0

SMIS# show lldp traffic

Total Frames Out : 71

Total Entries Aged : 0

Total Frames In : 28

Total Frames Received In Error : 0

Total Frames Discarded : 0

Total TLVS Unrecognized : 0

Total TLVs Discarded : 0

SMIS# show lldp interface Fx 0/21

Fx0/21:

Tx State : Enabled

Rx State : Enabled

Tx SEM State : IDLE

Rx SEM State : WAIT FOR FRAME

Notification Status : Enabled

Notification Type : Remote Table Change

SMIS# show lld statistics

Remote Table Last Change Time : 217700

Remote Table Inserts : 1

Remote Table Deletes : 0

Remote Table Drops : 0

Remote Table Ageouts : 0

Remote Table Updates : 0

SMIS# show lldp local Fx 0/21

Port Id SubType : Interface Name

Port Id : Slot0/21

Port Description :

Enabled TxTlvs : Port Description, Management Address, Mac Phy

Extended 802.3 TLV Info

-MAC PHY Configuration & Status

Auto-Neg Support & Status : Supported, Enabled

Advertised Capability Bits : 6c11

10base-T(HD)

10base-T(FD)

100base-TX(HD)

100base-TX(FD)

Asym and SymmPAUSE(FD)

1000base-T(FD)

Operational MAU Type : 30

-Link Aggregation

Capability & Status : Not Capable, Not In Aggregation

Aggregated Port Id : 21

-Maximum Frame Size : 1500

Extended 802.1 TLV Info

-Port VLAN Id : 1

-Port & Protocol VLAN Id

Protocol VLAN Id Support Protocol VLAN Status TxStatus

---------- ------- ---------- --------

0 Supported DisabledDisabled

-Vlan Name

Vlan Id Vlan Name TxStatus

------- --------- --------

1 vlan1 Enabled

SMIS# show running-config

Building configuration...

vlan 1

ports fx 0/1-24 untagged

ports cx 0/1-3 untagged

name vlan1

exit

setlldp enable

lldp transmit-interval 10

lldpholdtime-multiplier 7

lldpreinitialization-delay 10

lldp notification-interval 100

lldp chassis-id-subtype if-name

interface Fx 0/21

lldp notification remote-table-chg

lldp tlv-select basic-tlv port-descrmgmt-addr all

lldp tlv-select dot3tlv macphy-config

lldp tlv-select dot1tlv vlan-name 1

exit

Switch B

SMIS# configure terminal

SMIS(config)# set lldp enable

SMIS(config)# end

SMIS# show lldp

LLDP is enabled

Transmit Interval : 30

Holdtime Multiplier : 4

Reinitialization Delay : 2

Tx Delay : 2

Notification Interval : 5

Chassis Id SubType : Mac Address

Chassis Id : 00:30:48:e3:70:bc

SMIS# **show lldp neighbors**

Capability Codes :

(R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device,

(W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

```
Chassis ID          Local Intf    Hold-time   Capability      Port Id
----------          ----------    ---------   ----------      -------
00:30:48:e3:04:75   Fx0/22        120                         Fx0/21

Total Entries Displayed : 1
```

SMIS# **show lldp statistics**

```
Remote Table Last Change Time : 80900
Remote Table Inserts          : 4
Remote Table Deletes          : 3
Remote Table Drops            : 0
Remote Table Ageouts          : 3
Remote Table Updates          : 7
SMIS(config)# show lldp traffic
Total Frames Out              : 52
Total Entries Aged            : 3
Total Frames In               : 144
Total Frames Received In Error : 0
Total Frames Discarded        : 0
Total TLVS Unrecognized       : 0
Total TLVs Discarded          : 0
SMIS(config)# show lldp errors
Total Memory Allocation Failures  : 0
Total Input Queue Overflows       : 0
Total Table Overflows             : 0
SMIS(config)# show lldp interface Fx 0/22
Fx0/22:
Tx State            : Enabled
```

Rx State : Enabled

Tx SEM State : IDLE

Rx SEM State : WAIT FOR FRAME

Notification Status : Disabled

Notification Type : Mis-configuration

SMIS# show lldp local Fx 0/22

Port Id SubType : Interface Alias

Port Id : Fx0/22

Port Description :

Enabled TxTlvs :

Extended 802.3 TLV Info

-MAC PHY Configuration & Status

Auto-Neg Support & Status : Supported, Enabled

Advertised Capability Bits : 6c11

10base-T(HD)

10base-T(FD)

100base-TX(HD)

100base-TX(FD)

Asym and SymmPAUSE(FD)

1000base-T(FD)

Operational MAU Type : 30

-Link Aggregation

Capability & Status : Not Capable, Not In Aggregation

Aggregated Port Id : 22

-Maximum Frame Size : 1500

Extended 802.1 TLV Info

-Port VLAN Id : 1

-Port & Protocol VLAN Id

Protocol VLAN Id Support Protocol VLAN Status TxStatus

---------- ------- ---------- --------

0 Supported Enabled Disabled

-Vlan Name

Vlan Id Vlan Name TxStatus

------- --------- --------

1 Disabled

SMIS# show running-config

Building configuration...

vlan 1

ports fx 0/1-24 untagged

ports cx 0/1-3 untagged

exit

setlldp enable

15 Data Centre Bridging Exchange

DCBX is a discovery & capability exchange protocol that is capable of discoveing DCB compliant devices and exchange DCBX configuration information with them. Supermicro switches SSE-F3548S/SR and SSE-X3548S/SR support DCBX (Data centre Bridging Exchange) feature.

15.1 Overview

DCBX runs on the Physical Ethernet link between Supermicro switch (e.g SSE-F3548S) and Host Server's Network Card adapter (e.g. AOC-MH25G-m2S2T,AOC-S100G-m2C) that has DCBX capabilities.

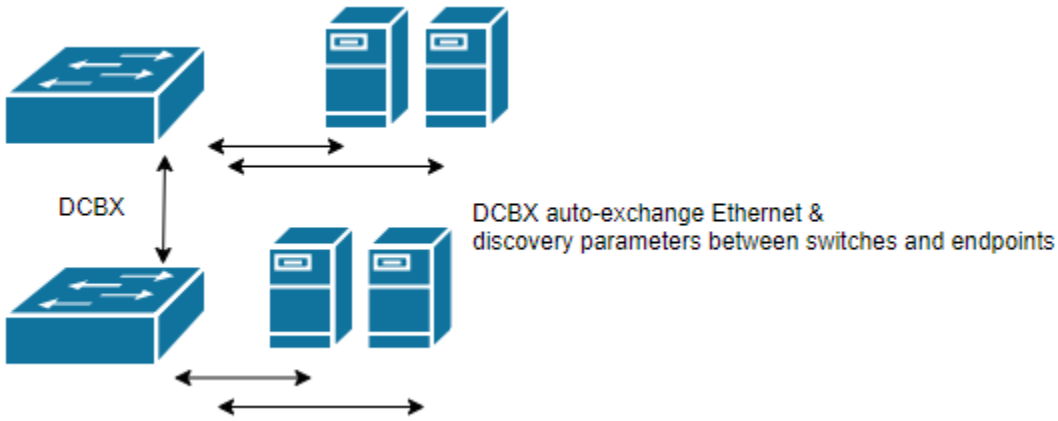
DCBX protocol relies on the Link Layer Discovery Protocol (LLDP) to exchange DCBX information with its DCBX peer. DCBX peers (switch and the host adapter) negotiate the capabilities between them to send configuration values to the adapter. Auto PFC configuration from the switch to the host can be achieved with DCBX TLVs.

- DCBX capability on the switch remain disabled if the host network adapter does not support the DCBX.
- Please make sure that the DCBX feature is enabled on the host network adapter if it is not turned on by default.

15.2 DCB Feature Benefits

Feature	Benefit Properties
Data Center Bridging Exchange (DCBX) Protocol	It Allows exchange of Ethernet parameters between switches and Host Adapters.
Congestion notification	Provides end to end congestion management for protocols that are capable of transmission rate limiting to avoid frame loss.
Enhanced transmission selection	Provides bandwidth management between traffic types.
Priority Based Flow Control (PFC)	Provides a link level flow control mechanism that can be controlled independently for each frame priority.

Data Center Bridging Exchange (DCBX) Protocol

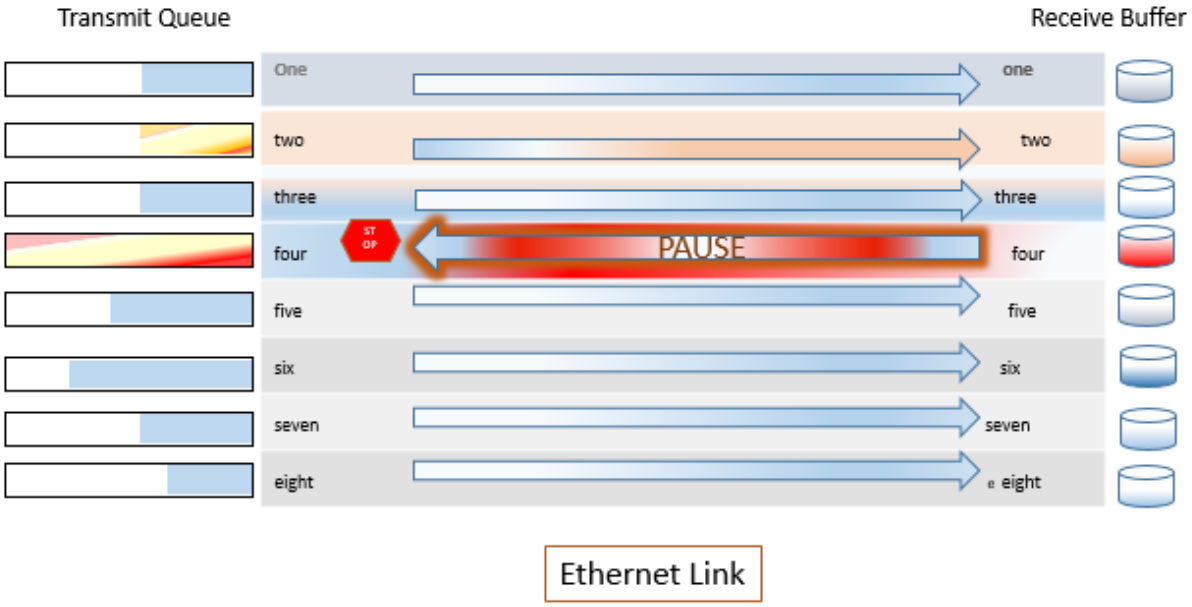


Congestion Notification, IEEE 802.1Qau is A congestion management mechanism that sends a congestion notification message to the source of the congestion. It tries to stop congestion at its source - where the "end host" originates the congestion and causing flow.

Enhanced Transmission Selection (ETS) IEEE 802.1Qaz is a bandwidth management mechanism which enables us to allocate port bandwidth in such a way that maximizes bandwidth utilization for all flows on a link. ETS allows a port to share and re-allocate BW dynamically among its flows while guaranteeing a minimum amount of bandwidth to each flow.

Priority-based flow control (PFC), IEEE standard 802.1Qbb, is a link-level flow control mechanism. Which is an enhancement to the Ethernet pause mechanism, operates on single priority rather than pausing all traffic on a link.

PFC creates eight logically divided virtual links from A physical link and provides the capability to use pause on a single virtual link without affecting traffic on the other virtual links. PFC allows us to pause traffic selectively according to its class.



PFC Priority based Flow Control (Figure A)

15.3 DCBX configuration steps

Configuring DCBX involves the steps listed below.

1. Enable LLDP.
2. Create cee-map.
    a. Create a name for Priority (optional).
    b. Mark the application-protocol packets with required priority.
    c. Create a name for Priority-group (optional).
    d. Map priority to priority-group.
    e. Allocate bandwidth to the priority-group.
3. Apply cee-map to the interface.
4. Configure TLVs (optional).

Commands to configure the above steps on Super Micro Switch are given below in detail.

15.3.1 Enable LLDP feature on the switch

DCBX protocol relies on Link Layer Discovery Protocol (LLDP) to exchange information with peer. So LLDP must be enabled for DCBX feature to work.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**Set lldp enable**	Enable and Configure LLDP
Step 3	**Exit**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# set lldp enable
SMIS(config)# exit
```

15.3.2 Create cee-map

Converged Enhanced Ethernet map creates an association among application-protocol, priority, priority-group, and group-bandwidth. Four cee-maps can be created.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**Exit**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# exit
```

```
SMIS(config)# exit

SMIS# show cee-map 1
```

15.3.2.1 Create a description for Priority (optional)

There are 8 priorities available and they are identified by number 0 - 7. Creating a description for the priority helps to easily identify the traffic assigned to that priority. This step is optional and doesn't affect the functionality. Description has to be created before assigning the cee-map to the interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**priority <pri(0-7)> description {<string(63)>}**	Creates a description for priority, which can be viewed in the show commands.
Step 4	**Exit**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# priority 1 description "FTP traffic"
SMIS(config-cee-map)# exit
SMIS(config)# exit

SMIS# show cee-map 1
```

15.3.2.2 Mark the application-protocol packets with required priority

The application-protocol of interest can be assigned to required priority. There are 8 priorities available and they are identified by number 0 - 7. More than one application-protocol can be assigned to the same priority. The default application-protocol configuration after creating a cee-map is shown below.

Application-Protocol-ID	Type	Protocol-ID	Priority
1	ether-type	0x8906	3
2	ether-type	0x8914	3
3	tcp-udp	3260	4
4	ether-type	0x8915	3
5	tcp-udp	445	4

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**application-protocol <id(1-5)> type {ether-type|tcp-udp|sf2|sf3} protocol-id <proto-id> priority <prio(0-7)>**	Marks the packets based on the application-protocol with the configured priority.

Step 4	**Exit**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# application-protocol 5 type tcp-udp protocol-id 22
priority 2
SMIS(config-cee-map)# exit
SMIS(config)# exit

SMIS# show cee-map 1
```

15.3.2.3 Create a name for Priority-group (optional)

CEE supports 9 priority-groups and they are identified by PGID number 0 – 7 and 15. Creating a description for the priority-group helps to easily identify the traffic assigned to that priority-group. This step is optional and doesn't affect the functionality. Description has to be created before assigning the cee-map to the interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**group <id(0-7,15)> description {<string(63)>}**	Creates a description for priority-group, which can be viewed in the show commands.
Step 4	**Exit**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# group 0 description "Download Traffic"
SMIS(config-cee-map)# exit
SMIS(config)# exit

SMIS# show cee-map 1
```

15.3.2.4 Map priority to priority-group

Multiple priorities can be bundled together to form a priority-group. In other words, the traffic will be assigned to priority-group based on their priority. The priority-groups are identified by PGID number 0 – 7 and 15. There are 8 priorities available and they are identified by number 0 - 7. More than one priority can be assigned to a priority-group.

A default priority-to-priority-group mapping will be created when a cee-map is created. The default mapping is shown below.

```
Priority    Group PFC   Description
-----------------------------------------------
       0    0     No    LAN
```

```
1    0      No
2    0      No
3    1      Yes   FCoE/FIP
4    0      No
5    0      No
6    0      No
7    0      No
```

Priority-group 15 is a special group; traffic shall be assigned to this group with no bandwidth limit, group-level PFC and members of this group are scheduled in strict priority order.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**pri2pg <group(0-7, 15)> <> <> <> <> <> <> <>**	Maps the priority 0-7 respectively to the priority-groups.
Step 4	**end**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# pri2pg 1 1 1 2 2 7 1 15
SMIS(config-cee-map)# end

SMIS# show cee-map 1
```

15.3.2.5 Allocate bandwidth to the priority-group

The 100% of bandwidth has to be divided as required and allocated among the 8 priority-groups. The total bandwidth allocated to 7 groups has to be 100.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**group-bandwidth <bandwidth(0-100)> <> <> <> <> <> <> <>**	Allocates the bandwidth respectively to the priority-groups 0 - 7.
Step 4	**end**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# group-bandwidth 10 10 10 20 10 10 10 20
SMIS(config-cee-map)# end

SMIS# show cee-map 1
```

15.3.2.6 Enable PFC

Priority Flow Control (PFC) can be enabled for traffics based on priorities or priority-groups. PFC can be enabled/disabled in a cee-map before applying it to an interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**cee-map <CEE-map-id(1-4))>**	Creates a cee-map.
Step 3	**PFC priority <pri(0-7)> {enable|disable}**	Enable/disable PFC for priority.
	PFC group <id(0-7)> {enable|disable}	Enable/disable PFC for priority-group.
Step 4	**end**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# pfc priority 1 enable
SMIS(config-cee-map)# pfc group 2 enable
SMIS(config-cee-map)# end

SMIS# show cee-map 1

Use disable option to disable the PFC.
SMIS# configure terminal
SMIS(config)# cee-map 1
SMIS(config-cee-map)# pfc priority 1 disable
SMIS(config-cee-map)# pfc group 2 disable
SMIS(config-cee-map)# end
```

15.3.3 Apply cee-map to the interface

After the cee-map configuration is complete, it has to be applied to the physical interface for it to take effect. Same cee-map can be applied to multiple interfaces.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**interface <interface-type> <interface-id>**	Enters the interface configuration mode. *Interface-type* –may be any of the following: fx-ethernet – fx cx-ethernet – cx
Step 3	**CEE <CEE-map-id(1-4))>**	Applies the cee-map.
Step 4	**dcbx cee**	Enables DCBX.
Step 5	**end**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# interface fx-ethernet 0/1
SMIS(config-if)# cee 1
```

```
SMIS(config-if)# dcbx cee
SMIS(config-if)# end

SMIS# show interface fx-ethernet 0/1
```

15.3.4 Configure TLVs (optional)

Information such as DCBX control state, configuration, etc are exchanged between DCBX peers using Type Length Value (TLV) over LLDP protocol. Local operational configuration of each DCBX parameter is handled by DCBX state machine by comparing and synchronizing with the settings of its DCBX peer. TLV configuration are setup specific or NIC specific. The example show below are only for illustration purpose.

Apply CEE-map and enable DCBX before configuring TLVs.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**interface <interface-type> <interface-id>**	Enters the interface configuration mode. *Interface-type* –may be any of the following: fx-ethernet – fx cx-ethernet – cx
Step 3	**CEE <CEE-map-id(1-4))>**	Applies the cee-map.
Step 4	**dcbx cee**	Enables DCBX.
Step 5	**LLDP TLV-select DCBX-CEE-PFC [advertise {on|off}] [willing {0|1}] [enable {0|1 }]**	Configures DCBX-CEE-PFC TLV.
Step 6	**LLDP TLV-select DCBX-CEE-pg [advertise {on|off}] [willing {0|1}] [enable {0|1}]**	Configures DCBX-CEE-pg TLV.
Step 7	**LLDP TLV-select basic-TLV { [port-descr] [sys-name] [sys-descr] [sys-capab] [m gmt-addr {all | IPV4 <ucast_addr> | IPV6 <ip6_addr>}]}**	Configures basic-TLV.
Step 8	**LLDP TLV-select dot1tlv {[port-VLAN-id] [protocol-VLAN-id {all |<VLAN-id>}] [V LAN-name {all | <VLAN-id>}]}**	Configures dot1tlv.
Step 9	**LLDP TLV-select dot3tlv {[MACphy-config] [link-aggregation] [max-framesize]}**	Configures dot3tlv.
Step 10	**end**	Exit from configuration mode.

Example:

```
SMIS# configure terminal
SMIS(config)# interface fx-ethernet 0/1
SMIS(config-if)# cee 1
SMIS(config-if)# dcbx cee
```

```
SMIS(config-if)# lldp tlv-select dcbx-cee-pfc advertise on willing 1
enable 0
SMIS(config-if)# lldp tlv-select dcbx-cee-pg  advertise on willing 1
enable 0
SMIS(config-if)# end
```

Use the no form of the command to remove the configuration; shown below are some example.

```
SMIS(config-if)# no lldp tlv-select dcbx-cee-pfc
SMIS(config-if)# no lldp tlv-select dcbx-cee-pg
SMIS(config-if)# no lldp tlv-select basic-tlv port-descr
SMIS(config-if)# no lldp tlv-select basic-tlv sys-name
SMIS(config-if)# no lldp tlv-select basic-tlv sys-capab
SMIS(config-if)# no lldp tlv-select basic-tlv mgmt-addr all
SMIS(config-if)# no lldp tlv-select basic-tlv
```

15.4 Show commands for CEE-MAP and DCBX

Use ‘show interface’ command to check whether DCBX is enabled/disabled for the intrerface.

show cee-map [<cee-map-id(1-4)>]

Example:

```
SMIS# show interface cx-ethernet 0/1
```

Cx0/1 up, line protocol is up (connected)
Bridge Port Type: Customer Bridge Port

Hardware Address is 0c:c4:7a:2c:19:63
MTU 1500 bytes, Full duplex, 100 Gbps, FEC is on, No-Negotiation
HOL Block Prevention enabled.
Input flow-control is off,output flow-control is off
DCBX is Enable
PFC is controlled by DCBX protocol

Link Up/Down Trap is enabled

Reception Counters
Octets : 1028282
Unicast Packets : 7
Unicast Packets Rate : 0/Sec
Broadcast Packets : 0
Broadcast Packets Rate : 0/Sec
Multicast Packets : 13741
Multicast Packets Rate : 0/Sec
Pause Frames : 0
Undersize Frames : 0
Oversize Frames : 0
CRC Error Frames : 0
Discarded Packets : 0
Error Packets : 0
Unknown Protocol : 0
Received Rate : 114 bps
Transmission Counters
Octets : 219288
Unicast Packets : 9
Unicast Packets Rate : 0/Sec
Broadcast Packets : 1
Broadcast Packets Rate : 0/Sec

```
Multicast Packets              : 2539
Multicast Packets Rate         : 0/Sec
Pause Frames                   : 0
Discarded Packets              : 0
Error Packets                  : 0
Transmit Rate                  : 740 bps
```

Use ‘show cee-map’ to check the CEE-MAP configuration. This command displays the application-protocol to priority mapping, priority to priority-group mapping, and bandwidth allocation for the priority-groups.

show cee-map [<cee-map-id(1-4)>]

Example:

```
SMIS# show cee-map 1

CEE-Map 1

Ports : fx 0/1
Priority  Group  PFC  Description
-----------------------------------
       0      1   No  LAN
       1      1  Yes
       2      1   No
       3      2  Yes  FCoE/FIP
       4      2   No
       5      7   No
       6      1   No
       7     15   No

Group  Bandwidht(%)  PFC  Description
---------------------------------------
    0            10   No  LAN
    1            10  Yes  SAN
    2            10   No
    3            20   No
    4            10   No
    5            10   No
    6            10   No
    7            20   No
    15          MAX   No

Application-Protocol-ID   Type       Protocol-ID    Priority
-------------------------------------------------------------
```

```
1    ether-type 0x8906         3
2    ether-type 0x8914         3
3    tcp-udp    3260           4
```

Use ‘show lldp dcbx’ command to check the current status/result of DCBX (CEE) use the below show command.

show lldp dcbx interface [<interface-type> <interface-id>]

Example:

```
SMIS# show lldp dcbx interface fx-ethernet 0/1
Fx0/1:
DCBX Control Message Exchange Information
-----------------------------------------
Status: Non-synchronized

Peer message seq#: 16777216 (acknowledged: 0)
Local message seq#: 2 (acknowledged: 16777216)

DCBX Feature Information
-----------------------------------------
Feature: PG, Priority Groups
Type/subtype: 2/0
Enabled: Yes
Advertisement: Yes
Willing: No
Error: No
Operation status: Operational
Config (operation/desired/peer):
         PG0...10 / 10 / 10
         PG1...10 / 10 / 10
         PG2...10 / 10 / 10
         PG3...20 / 20 / 20
         PG4...10 / 10 / 10
         PG5...10 / 10 / 10
         PG6...10 / 10 / 10
         PG7...20 / 20 / 20
         PG15...MAX / MAX / MAX
         #TCs...8 / 8 / 8

Feature: PFC, Priority-based Flow Control
Type/subtype: 3/0
Enabled: Yes
Advertisement: Yes
Willing: No
Error: No
Operation status: Operational
Config (operation/desired.pg/peer):
         Pri0...1 / 0.1 / 1
         Pri1...0 / 0.0 / 0
         Pri2...0 / 0.0 / 0
         Pri3...1 / 1.0 / 1
```

```
         Pri4...0 / 0.0 / 0
         Pri5...0 / 0.0 / 0
         Pri6...0 / 0.0 / 0
         Pri7...1 / 0.1 / 1
         #TCs...8 / 8 / 8

Feature: Application Protocol
Type/subtype: 4/0
Enabled: Yes
Advertisement: Yes
Willing: No
Error: No
Operation status: Operational
Config (operation/desired/peer):
         Operation Config
         Type       Protocol-ID    Priority
         ---------------------------------
         ether-type 0x8906         3
         ether-type 0x8914         3
         tcp-udp    3260           4

         Desired Config
         Type       Protocol-ID    Priority
         ---------------------------------
         ether-type 0x8906         3
         ether-type 0x8914         3
         tcp-udp    3260
```

Other related show commands:

```
SMIS# show lldp neighbors
SMIS# show lldp neighbors detail
SMIS# show lldp traffic
SMIS# show lldp traffic [<iftype> <ifnum>]
```

15.5 Sample DCBX configuration

The sample configuration shown below is only for illustration purpose. As the DCBX configurations are setup specific, the configuration below doesn't guarantee any function.

```
SMIS # show running-config

ip address dhcp

vlan 1
 ports fx 0/1-48 untagged
 ports cx 0/1-6 untagged
exit

set lldp enable

cee-map 2
  pri2pg 1 2 4 2 2 4 4 1
  pfc priority 1 enable
  group-bandwidth 10 10 10 20 10 10 10 20
  pfc group 2 enable
exit
cee-map 4
  pri2pg 0 1 2 3 4 5 6 7
  pfc priority 1 enable
  pfc priority 3 disable
  group-bandwidth 25 75 0 0 0 0 0 0
  pfc group 0 enable
exit

interface Fx 0/6
 cee 2
 dcbx cee

interface Cx 0/1
 cee 4
 dcbx cee
 exit

SMIS#
```

16 IP Overview

Internet Protocol (IP), the foundation of the IP Protocol suite, is a packet-based protocol used for exchange of data over computer networks. IP is a network layer that contains addressing and control information to allow routing of data packets. IP handles addressing, fragmentation, reassembly, and protocol de-multiplexing.

Supermicro switches supports both TCP and UDP at the transport layer, for maximum flexibility in services.

- Transmission Control Protocol (TCP) is a connection-oriented protocol built upon the IP layer. TCP specifies the format of data and acknowledgments used in the transfer of data and also the procedures used to ensure that the data arrives in correct order. With TCP multiple applications on a system can communicate concurrently as it handles all demultiplexing of the incoming traffic among the application programs.

- With UDP, applications can send messages, also called datagrams to other hosts on an IP network without prior setup of transmission channels or data paths. UDP is suitable when error checking and correction is either not necessary or performed in the application, avoiding the overhead of such processing at the network interface level.

The following features of IP implementation in Supermicro switches are covered in this document.

- Layer3 Interface
- Inter-VLAN routing
- Static Route
- ARP
- DHCP
- VRRP

16.1 Layer 3 Interface

The network layer or Layer 3 handles the routing of data in packets across logical internetwork paths. The data link layer or Layer 2 contains protocols that control the physical layer/Layer 1 and data framing for transmission on the physical medium. The Layer 2 function of filtering and forwarding data in frames between two segments on a LAN is known as *bridging*.

Supermicro switches support two types of Layer 3 interfaces.

- The *Layer 3 VLAN Interface* combines the functionality of routing and bridging.
- The *Loopback Interface* is a logical interface that is “always up”. It is not tied to any physical interface therefore it does not go down unless it is administratively shut down.

The uses of Layer3 interface are:

- Allow traffic to be routed between VLANs.
- Provide Layer 3 IP connectivity to the switch.

16.1.1 Layer 3 VLAN Interface

VLANs typically operate at Layer 2. When a layer2 VLAN is configured with an IP address, it behaves as a logical Layer 3 VLAN interface. L3 VLAN interface provides logical routing interfaces to VLANs on Layer 2 switches. It is also called *Switch Virtual Interfaces (SVI)* and handles processing for all the packets associated with that VLAN.

Follow the steps below to configure Logical Layer3 Interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**Create a Layer 2 VLAN and add all required ports.**	For details on configuring Layer 2 VLAN, refer 'VLAN Config. guide' from www.supermicro.com
Step 3	**interface vlan <vlan-id (1-4069)>**	Enters interface configuration mode to specify the interface to be configured as a Layer 3 interface.
Step 4	**ip address [<ip-address> | <ip-address>/prefix-length] [<subnet-mask>] [secondary]**	Configure IP address. *ip-address* – A valid IPv4 Address. *ip-address/prefix-length* - A valid IPv4 Address with a prefix length of value 1-32. *subnet-mask* – A valid IP subnet mask. *Secondary* - Assigns multiple IP addresses to network interfaces.
Step 5	**end**	Exits the configuration mode.
Step 6	show ip interface	Displays the Layer 3 interface information.

The "**no ip address [<ip_addr>]"** command deletes the layer 3 VLAN interface and resets it as a Layer2 VLAN.

The example below shows the commands used to configure Logical Layer3 Interface.

SMIS# configure terminal
SMIS(config)# vlan 10
SMIS(config-vlan)# ports fx 0/22 untagged
SMIS(config-vlan)# exit

SMIS(config)# interface vlan 10
SMIS(config-if)# **ip address 10.10.10.1 255.255.255.0**
SMIS(config-if)# end

SMIS# **show ip interface**

mgmt is up, line protocol is down
Internet Address is 192.168.100.102/24
Broadcast Address 192.168.100.255
Gateway 0.0.0.0

vlan10 is up, line protocol is up
Internet Address is 10.10.10.1/24
Broadcast Address 10.10.10.255

16.1.2 Loopback Interface

Supermicro switches support loopback interface which is a virtual interface and is not connected to any other device. Loopback interfaces are very useful since they will never go down, unless the entire router goes down. This is useful for managing routers because there will always be at least one active interface on the routers, the loopback interface.

Follow the steps below to configure Loopback Interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**interface loopback <interface-id (1-100)>**	Enters interface configuration mode to specify the interface to be configured as a Layer 3 interface.
Step 3	**ip address [<ip-address> | <ip-address>/prefix-length] [<subnet-mask>]**	Configure IP address. *ip-address* – A valid IPv4 Address. *ip-address/prefix-length* - A valid IPv4 Address with a prefix length of value 1-32. *subnet-mask* – A valid IP subnet mask. *NOTE:* Subnet mask should be 32 bit for loopback interface.
Step 4	**no shutdown**	Enable the Loopback interface
Step 5	**end**	Exits the configuration mode.
Step 6	show ip interface show interface loopback <1-100>	Displays the Layer 3 interface configuration. Display Loopback interface configuration.

IP Routing is not supported on Loopback Interfaces.

The "**no interface loopback <interface-id (1-100)>"** command deletes the Loopback interface.

SMIS# configure terminal
SMIS(config)# **interface loopback 1**
SMIS(config-if)# **ip address 100.1.1.1/32**
SMIS(config-if)# **no shutdown**
SMIS(config-if)# end

SMIS# **show interface loopback 1**

Interface Status Protocol Description
--------- ------ -------- -----------
loopback1 up up

SMIS# **show ip interface**

mgmt is up, line protocol is down
Internet Address is 192.168.100.102/24
Broadcast Address 192.168.100.255
Gateway 0.0.0.0

loopback1 is up, line protocol is up
Internet Address is 100.1.1.1/32
Broadcast Address 100.1.1.1

16.2 Inter-VLAN Routing

VLANs enable splitting traffic across several manageable broadcast domains. Devices within a VLAN can communicate with one another without requiring routing. Whenever hosts in one VLAN need to communicate with hosts in another VLAN, the traffic must be routed between them. This is known as *Inter-VLAN Routing*.

Supermicro switches use application-specific integrated circuits (ASICs), which are hardware chips that can route traffic at *very high speeds*. These ASICs are installed on the switching engine of a Layer 3 switch, which traditionally switches frames at Layer 2. The ASICs allow the switching engine to also switch frames that contain packets sent between different VLANs. Each ASIC is programmed with the information required to route traffic from one VLAN to another, *without having to pass the traffic through the CPU* of the routing engine.

Advantages of *Inter-VLAN routing in L3 switches:*

- Layer 3 switches are much more cost effective than routers for delivering high-speed inter-VLAN routing.
- Layer 3 switches are enhanced Layer 2 switches and, hence, have the same high port densities that Layer 2 switches have. Routers on the other hand typically have a much lower port density.
- Layer 3 switches can be configured to operate as a normal Layer 2 switch or Layer 3 switch as required.

Application of Inter-VLAN routing:
The network can be divided based on the group or function the device. For example, the engineering department VLAN would only have devices associated with the engineering department, while the HR VLAN would only have HR related devices. With Inter-VLAN routing, the devices in each VLAN can talk to one another without all the devices being in the same broadcast domain.

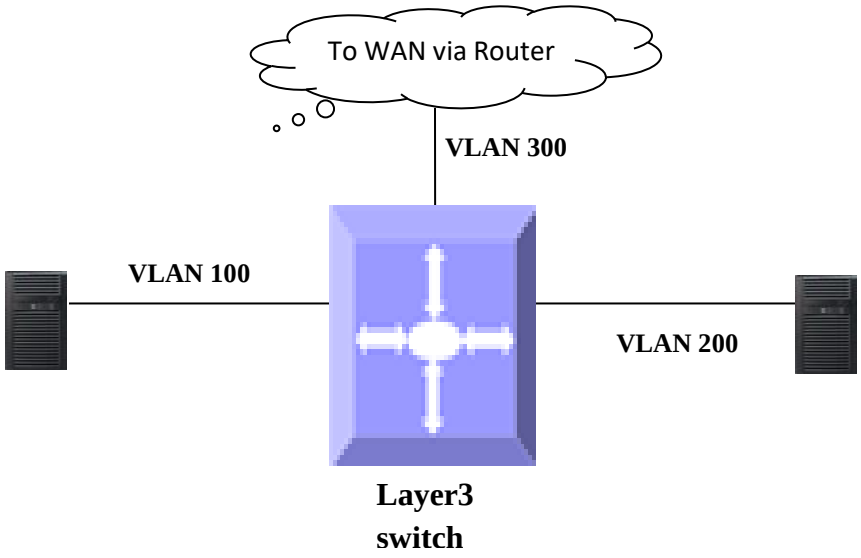


Figure IP-1: Inter-VLAN routing

Follow the steps below to configure Inter-VLAN Routing.

1. Create 2 Layer 3 interface VLAN's.
2. Configure an IP address for both these Layer 3 VLAN interfaces.
3. Execute show ip route to check if the VLAN routes specified by VLAN IP address are displayed as connected routes. The routing table has an entry for each VLAN interface subnet, hence devices in VLAN 10 can communicate with devices in VLAN 20 and vice versa.

The example below shows the commands used to configure Inter-VLAN Routing.

SMIS# configure terminal
SMIS(config)# vlan 10
SMIS(config-vlan)# ports fx 0/21 untagged
SMIS(config-vlan)# exit
SMIS(config)# **interface vlan 10**
SMIS(config-if)# **ip address 10.10.10.1 255.255.255.0**
SMIS(config-if)# exit

SMIS(config)# vlan 20
SMIS(config-vlan)# ports fx 0/22 untagged
SMIS(config-vlan)# exit
SMIS(config)# **interface vlan 20**
SMIS(config-if)# **ip address 20.20.20.1 255.255.255.0**
SMIS(config-if)# end

SMIS# **show ip interface**

mgmt is up, line protocol is down

Internet Address is 192.168.100.102/24
Broadcast Address 192.168.100.255
Gateway 0.0.0.0

vlan10 is up, line protocol is up
Internet Address is 10.10.10.1/24
Broadcast Address 10.10.10.255

vlan20 is up, line protocol is up
Internet Address is 20.20.20.1/8
Broadcast Address 20.255.255.255

SMIS# **show ip route**

C 10.10.10.0/24 is directly connected, vlan10
C 20.0.0.0/8 is directly connected, vlan20
C 192.168.100.0/24 is directly connected, mgmt

16.3 Static Route

Static route define explicit paths between two routers. Manual reconfiguration of static rotutes is required when network changes occur. Static routes use less bandwidth than dynamic routes. No CPU cycles are used to calculate and analyze routing updates.

Routers forward packets using either route information from manually configured route table entries or the route information calculated using dynamic routing algorithms.

Use of Static route:

- Static routes can be used in environments where network traffic is predictable and where the network design is simple.
- Static routes are also useful for specifying a gateway of last resort (a default router to which all non-routable packets are sent).

Follow the steps below to configure Static Route.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**ip route <prefix> <mask> {<next-hop> | Vlan <vlan-id (1-4069)> | <interface-type> <interface-id> | null0 } [<distance (1-255)>] [private]**	Configure static route. The VLAN id and interface for this static route. *Prefix* – The destination network IP address the route leads to. *Mask* – A valid IP subnet mask *Next-hop* – specify next-hop IP address. *Null* - Specifies a null interface

		Distance – specifies the administrative distance in the range 1 to 255. The default is 1. *Private* - Specify whether this route can be shared with other routes when RIP is enabled.
Step 3	**end**	Exits the configuration mode.
Step 4	show ip route [{ <ip-address> [<mask>] | bgp | connected | ospf | rip | static | summary }]	Displays the route information

When an interface goes down, static routes through that interface are removed from the IP routing table.

When the next hop for the address is unreachable, the static route is removed from the IP routing table.

The **"no ip route <prefix> <mask> { <next-hop> | Vlan <vlan-id(1-4069)> | <interface -type> <interface-id> | null0 } [private]"** command deletes the static route.

The example below shows the commands used to configure Static Route.

SMIS# configure terminal
SMIS(config)# vlan 10
SMIS(config-vlan)# ports fx 0/21 untagged
SMIS(config-vlan)# exit
SMIS(config)# interface vlan 10
SMIS(config-if)# ip address 10.10.10.1
SMIS(config-if)# exit
SMIS(config)# **ip route 200.200.200.0 255.255.255.0 10.10.10.2**
SMIS(config)# end

SMIS# **show ip route static**

S 200.200.200.0/24 [1] via 10.10.10.2

16.4 ARP

The Address Resolution Protocol (ARP) feature finds the hardware address, also known as Media Access Control (MAC) address, of a host from its known IP address. This mapping of MAC addresses to IP addresses is stored in a table called *ARP cache*.

ARP is part of all Supermicro switches systems that run IP. Though Supermicro switches are layer 3 switches that forward packets based on IP address, ARP is required for certain cases like default gateway or for ping within same subnet.

16.4.1.1 Cache Timeout

The ARP cache can contain dynamic (learned) entries and static (user-configured) entries. Dynamic ARP entry is created in the ARP cache when the Layer 3 Switch learns a device's MAC address from an ARP request or ARP reply from a device. ARP entries are refreshed periodically otherwise these entries are timed out and deleted from ARP cache.

16.4.1.2 ARP request retry

ARP requests can be re-sent by a device before confirming the host as unreachable. The number of times ARP request can be re-transmitted is user configurable in Supermicro switches.

16.4.1.3 Static ARP

For hosts that do not support dynamic Address Resolution Protocol (ARP), static entries can be added by defining static mapping between an IP address (32-bit address) and a Media Access Control (MAC) address (48-bit address). Static ARP entry in the ARP cache never times out. The entries remain in the ARP table until they are removed by user configuration.

Defaults

Parameter	Default Value
ARP request retry	3
ARP cache timeout	300
Static ARP entries	None

Follow the steps below to configure ARP.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**arp timeout <seconds (30-86400)>**	(Optional) Sets the length of time, in seconds, an Address Resolution Protocol (ARP) cache entry stays in the cache. The range is 30-86400 seconds. Note: If there is frequent change in cache entries in network, suggest to ARP timeout to a shorter value.
Step 3	**arp <ip address> <hardware address> {Vlan <vlan-id(1-4069)> | <interface-type> <interface-id> | Linuxvlan <interface-name>| Cpu0}**	(Optional) Globally associates an IP address with a MAC address in the ARP cache. *ip-address* —IP address in four-part dotted decimal format corresponding to the local data-link address. *hardware-address*—Local data-link address (a 48-bit address). *Linuxvlan* - Interface name of Linux VLAN interface.

		Cpu0 - Out-of-band management interface
Step 4	**ip arp max-retries <value (2-10)>**	(Optional) To set the maximum number of ARP request retries in the range 2-10.
Step 5	**end**	Exits the configuration mode.
Step 6	show ip arp **show ip arp summary** **show ip arp information**	Displays the ARP table entries. Displays summary of the ARP table, including dynamic and static entries. Displays the ARP configuration details.

These commands delete values or reset to default values, as applicable:

no arp timeout
no arp <ip address>
no ip arp max-retries

The example below shows the commands used to configure ARP.

SMIS# configure terminal
SMIS(config)# arp timeout 800
SMIS(config)# i**p arp max-retries 10**
SMIS(config)# **arp 10.0.0.0 48:2C:6A:1E:59:3D vlan 1**
SMIS(config)# end

SMIS# **show ip arp**

Address Hardware Address Type Interface Mapping
------- ---------- ---- --------- -------
10.0.0.0 48:2c:6a:1e:59:3d ARPA vlan1 Static

SMIS# **show ip arp summary**

1 IP ARP entries, with 0 of them incomplete

SMIS# **show ip arp information**

ARP Configurations:

Maximum number of ARP request retries is 10
ARP cache timeout is 800 seconds

16.5 DHCP

The Dynamic Host Configuration Protocol (DHCP) is based on the Bootstrap Protocol (BOOTP), which can automatically allocate reusable network addresses and configuration options to Internet hosts. DHCP is built on a client/server model, where designated DHCP servers allocate network addresses and deliver configuration parameters to DHCP clients.

When a DHCP client requests an IP address from a DHCP server, the client sends a DHCPDISCOVER broadcast message to locate a DHCP server. A relay agent forwards the packets between the DHCP client and server. A DHCP server offers configuration parameters (such as an IP address, a MAC address, a domain name, and a lease for the IP address) to the client in a DHCPOFFER unicast message.

Supermicro switches support Dynamic Host Configuration Protocol (DHCP) server, DHCP client and DHCP relay agent functionality.

16.5.1 DHCP Server

Supermicro switches DHCP server implementation assigns and manages IP addresses from specified address pools to DHCP clients. The DHCP server can also be configured to assign additional parameters like default router, IP address of the Domain Name System (DNS) server etc. The DHCP server can accept broadcasts from locally attached LAN segments or from DHCP requests that have been forwarded by other DHCP relay agents within the network.

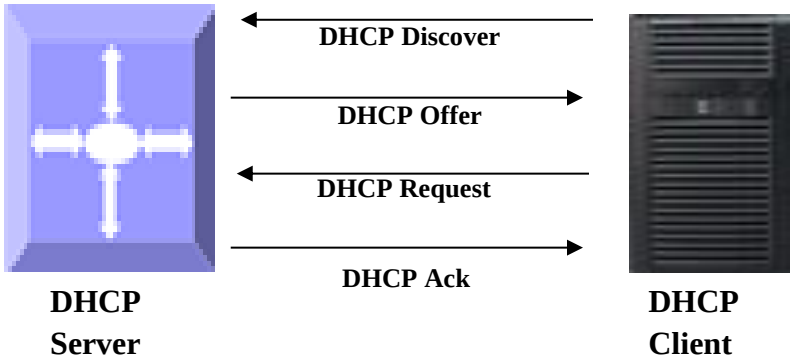


Figure IP-2: DHCP Server

16.5.1.1 DHCP Address Pool

Supermicro switches DHCP server accepts address assignment requests and renewals and assigns the addresses from predefined groups of addresses contained within *DHCP address pools*. These address pools can also be configured to supply additional information to the requesting client such as the IP address of the DNS server, the default router, and other configuration parameters.

16.5.1.2 Additional Parameter - Default Router & DNS

The DHCP server can be configured to assign additional parameters such as the IP address of the Domain Name System (DNS) server and the default router to the DHCP clients.

Default route IP address should be on the same subnet as the client. When a DHCP client requests an IP address, the DHCP server accesses the default router list to select another router that the DHCP client is to use as the first hop for forwarding messages.

16.5.1.3 Excluding IP address

By default, the DHCP Server assumes all IP addresses in the configured DHCP address pool are available for assigning to DHCP clients. If a particular address or range of addresses should not be assigned to DHCP clients, users can configure these excluded IP addresses.

16.5.1.4 Utilization Threshold

A DHCP address pool has a threshold associated with it. If a pool's outstanding addresses exceed the high utilization threshold and the SNMP trap signaling is enabled, SNMP is notified.

16.5.1.5 Lease

DHCP supports three mechanisms for IP address allocation:

- Automatic allocation--DHCP server assigns a permanent IP address to a client.
- Dynamic allocation--DHCP server assigns an IP address to a client from the address pool for a limited period of time called a lease or until the client relinquishes the address.
- Manual allocation--The network administrator assigns an IP address to a client and DHCP is used simply to convey the assigned address to the client.

16.5.1.6 Options and Sub-options

Configuration parameters and control information are available in the options field of the DHCP message. This can be used when additional information need not be stored in DHCP client, rather it can be transmitted by the DHCP server to the client.

Some DHCP clients send a client identifier (DHCP option 61) in the DHCP packet to DHCP server. To configure manual bindings for such clients, configure the client-identifier DHCP pool configuration. To configure manual bindings for clients who do not send a client identifier option, configure the hardware-address DHCP pool configuration.

16.5.1.7 Bootfile

The boot file is used to store the boot image for the client. The boot image is generally the operating system the Dynamic Host Configuration Protocol (DHCP) client uses to load.

16.5.1.8 DHCP Ping

The DHCP server pings a pool address twice before assigning a particular address to a requesting client. If the ping is unanswered, the DHCP server assumes that the address is not in use and assigns the address to the requesting client.

16.5.1.9 DHCP Server Configuration

Defaults

Parameter	Default Value
DHCP server status	Disabled
DHCP Server IP address	None
DHCP pool index	None
DHCP network IP	None
Excluded Address	None
Domain Name	None
DNS server	None
NetBIOS name server	None
NetBIOS node type	None
DHCP option	None
Lease	3600
Utilization Threshold	75
Default router	None
Hardware Address	None
Client ID	None
Bootfile	None
Next-server	None
DHCP ping	None
Offer reuse	5

16.5.1.9.1 Enabling DHCP server

DHCP server is disabled by default in Supermicro switches. Follow the steps below to enable DHCP Server.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**service dhcp-server**	Enable DHCP server.
Step 3	**end**	Exits the configuration mode.
Step 4	**show ip dhcp server information**	Displays the DHCP server configuration details.

DHCP Relay must be disabled before enabling DHCP Server.

The '**no service dhcp-server'** command disables the DHCP server.

16.5.1.9.2 Configuring DHCP pool

Follow the steps below to configure DHCP Server pool.

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

Step 2	**ip dhcp pool <index (1-2147483647)>**	Creates a name for the DHCP server address pool and enters DHCP pool configuration mode.
Step 3	**network <network-IP> [{ <mask> | / <prefix-length (1-31)> }] [<start-ip> [<end-ip>]]**	Specifies the subnet network number and mask of the DHCP address pool. *Network-ip* – A valid IPv4 Address. *prefix-length* - A valid IPv4 Address with a prefix length of value 1-32. *mask* – A valid IP subnet mask. *start-ip* and *end-ip* specify the address pool range
Step 4	**excluded-address <low-address> < high-address >**	(Optional) Specify the range of IP addresses that the DHCP server must not assign to DHCP clients in the range *low-address to high-address.*
Step 5	**domain-name <domain (63)>**	(Optional) Specifies the domain name for the client.
Step 6	**dns-server <ip address>**	(Optional) Specifies the IP address of a DNS server that is available to a DHCP client.
Step 7	**netbios-name-server <ip address>**	(Optional) Specifies the NetBIOS WINS server that is available to a Microsoft DHCP client.
Step 8	**netbios-node-type { <0-FF> | b-node | h-node | m-node | p-node }**	(Optional) Specifies the NetBIOS node type for a Microsoft DHCP client. *b-node* – Broadcast node *h-node* – Hybrid node *m-node* – Mixed node *p-node* – Peer to peer node
Step 9	**option <code (1-2147483647)> { ascii <string> | hex <Hex String> | ip <address> }**	(Optional) Configures DHCP server options. Configurable DHCP options with corresponding option length values are: - Options 19, 20, 27, 29, 30, 31, 34, 36, 39, 46 must have length 1 - Options 12, 14, 15, 17, 18, 40, 43, 47, 64, 66, 67 must have length >=1 - Option 16 must have minimum length 4 and the value for this option must be an IP address and Option 25 can have a length of 2 and 2*n

		- Option 68 must have length 4 and the value for this option must be an IP address - Options 1-11, 41, 42, 44, 45, 48, 49, 65, 69, 70-76 must have a length of 4 . Value for these options must be an IP address - Options 21, 33 must have minimum length as 8 and 8*n - Options 0, 255, 50-60 are non-configurable options
Step 10	**lease { <days (0-365)> [<hours (0-23)> [<minutes (0-59)>]] | infinite }**	(Optional) Specifies the duration of the lease. The infinite keyword specifies that the duration of the lease is unlimited.
Step 11	**utilization threshold { <integer (0-100)> }**	(Optional) Configures the utilization mark of the current address pool size.
Step 12	**default-router <ip address>**	(Optional) Specifies the IP address of the default router for a DHCP client.
Step 13	**host hardware-type <type (1-2147483647)> client-identifier <mac-address> option <code (1-2147483647)> { ascii <string> | hex <Hex String> | ip <address> }**	(Optional) To specify the hardware MAC address of DHCP client. *mac-address* - Specifies MAC address of a DHCP client in dotted hexadecimal notation. *string* - ASCII-format representation of a MAC address *address* - Specifies the IP address and network mask for a manual binding to a DHCP client.
Step 14	**end**	Exits the configuration mode.
Step 15	**show ip dhcp server pools**	Displays the DHCP pool configuration.

The "**no ip dhcp pool <index (1-2147483647)>"** command deletes the DHCP pool configuration.

These commands delete values or reset to default values, as applicable:

no network
no excluded-address <low-address> [<high-address>]
no domain-name
no dns-server
no netbios-name-server
no netbios-node-type
no default-router
no option <code (1-2147483647)>
no lease

no utilization threshold
no host hardware-type <host-hardware-type (1-2147483647)> client-identifier <client-mac-address> option <code (1-2147483647)>

16.5.1.9.3 Configuring other parameters

Follow the steps below to configure DHCP Server parameters.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**ip dhcp bootfile <bootfile (63)>**	(Optional) Specifies the name of the default boot image for a DHCP client.
Step 3	**ip dhcp next-server <ip address>**	(Optional) Configures the next server in the boot process of a DHCP client.
Step 4	**ip dhcp option <code (1-2147483647)> { ascii <string> | hex <Hex String> | ip <address> }**	This option can be used to configure DHCP option for all pools.
Step 5	**ip dhcp { ping packets | server offer-reuse <timeout (1-120)> }**	(Optional) Specify DHCP Server should ping a pool address before assigning it. *Server offer-reuse* - Specify the maximum timeframe after which an offered IP address can be returned to the pool of free addresses.
Step 6	**end**	Exits the configuration mode.
Step 7	**show ip dhcp server information** **show ip dhcp server statistics**	Displays the DHCP server configuration details. Displays DHCP packet statistics.

These commands delete values or reset to default values, as applicable:

no ip dhcp bootfile
no ip dhcp next-server
no ip dhcp option <code (1-2147483647)>
no ip dhcp { ping packets | server offer-reuse | binding <ip address> }

The example below shows the commands used to configure DHCP Server.

SMIS# configure terminal
SMIS(config)# **service dhcp-server**
SMIS(config)# **ip dhcp server 100.100.100.1**
SMIS(config)# **ip dhcp pool 1**

SMIS(dhcp-config)# **network 200.200.0.0 255.255.0.0**

SMIS(dhcp-config)# **excluded-address 200.200.20.20 200.200.20.30**
SMIS(dhcp-config)# **dns-server 10.10.10.1**
SMIS(dhcp-config)# **domain-name supermicro.com**
SMIS(dhcp-config)# **netbios-name-server 172.16.1.3**
SMIS(dhcp-config)# **netbios-node-type h-node**
SMIS(dhcp-config)# **option 19 hex 1**
SMIS(dhcp-config)# **lease infinite**
SMIS(dhcp-config)# **utilization threshold 50**
SMIS(dhcp-config)# **host hardware-type 1 client-identifier 00:A0:23:C9:12:FF option 10 IP 10.10.10.1**
SMIS(dhcp-config)# **default-router 192.168.1.10**
SMIS(dhcp-config)# exit

SMIS(config)# **ip dhcp bootfile abcboot**
SMIS(config)# **ip dhcp next-server 172.17.10.3**
SMIS(config)# **ip dhcp ping packets**
SMIS(config)# end

SMIS# show ip dhcp server information

DHCP server status : Enable
Send Ping Packets : Enable
Debug level : None
Server Address Reuse Timeout : 5 secs
Next Server Adress : 172.17.10.3
Boot file name : abcboot

SMIS# show ip dhcp server pools

Pool Id : 1

Subnet : 200.200.0.0
Subnet Mask : 255.255.0.0
Lease time : 2147483647 secs
Utilization threshold : 50%
Start Ip : 200.200.0.1
End Ip : 200.200.255.255
Exclude Address Start IP : 200.200.20.20
Exclude Address End IP : 200.200.20.30

Subnet Options

Code : 1, Value : 255.255.0.0
Code : 3, Value : 192.168.1.10
Code : 6, Value : 10.10.10.1
Code : 15, Value : supermicro.com
Code : 19, Value : 1
Code : 44, Value : 172.16.1.3
Code : 46, Value : 8

Host Options

Hardware type : 1
Client Identifier : 00:a0:23:c9:12:ff
Code : 10, Value : 10.10.10.1

SMIS# show ip dhcp server statistics

Address pools : 1

Message	Received
DHCPDISCOVER	0
DHCPREQUEST	0
DHCPDECLINE	0
DHCPRELEASE	0
DHCPINFORM	0

Message	Sent
DHCPOFFER	0
DHCPACK	0
DHCPNAK	0

16.5.2 DHCP Client

Supermicro switches can function as Dynamic Host Configuration Protocol (DHCP) client to obtain configuration parameters such as an IP address from the DHCP server.

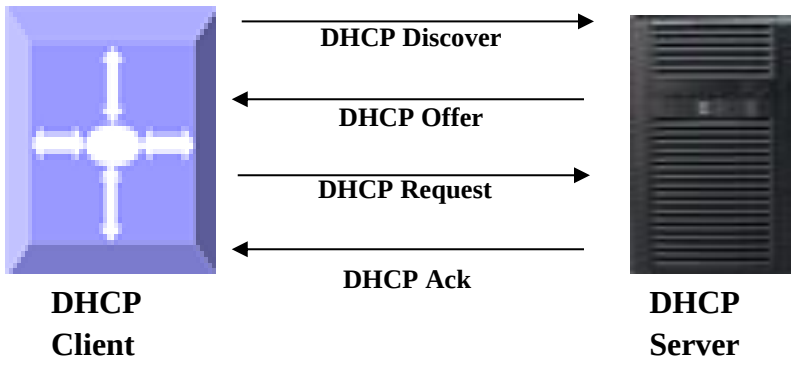


Figure IP-3: DHCP Client

16.5.2.1 Release Client

The release dhcp command starts the process to immediately release a DHCP lease for the specified interface. After the lease is released, the interface address is deconfigured.

16.5.2.2 Renew Client

The DHCP client lease can be renewed by user configuration. The renew dhcp command advances the DHCP lease timer to the next stage, after which a DHCP REQUEST packet is sent to renew or rebind the lease.

• If the lease is currently in a BOUND state, the lease is advanced to the RENEW state and a DHCP RENEW request is sent. If there is no response to the RENEW request, the interface remains in the RENEW state and the lease timer will advance to the REBIND state, and then sends a REBIND request. If a NAK response is sent in response to the RENEW request, the interface IP address is deconfigured. The original IP address for the interface must be assigned by the DHCP server.

• If the lease is currently in a RENEW state, the timer is advanced to the REBIND state and a DHCP REBIND request is sent.

Follow the steps below to configure DHCP Client.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**interface vlan <vlan-id (1-4069)> | interface loopback <interface-id (1-100)>**	Enters interface configuration mode to specify the interface to be configured as a Layer 3 interface or loopback.
Step 3	**ip address dhcp**	Specify DHCP client to obtain IP address from DHCP server.
Step 4	**exit**	Exit from Interface configuration mode
Step 5	**renew dhcp [{ vlan <vlan-id (1-4069)> | <interface-type> <interface-id> }]**	(Optional) Configure DHCP client lease renew procedure.
Step 6	**release dhcp [{ vlan <vlan-id (1-4069)> | <interface-type> <interface-id> }]**	(Optional) Configure DHCP client release procedure.
Step 7	**end**	Exits the configuration mode.
Step 8	**show ip interface**	Display Layer 3 interface configuration.

VLAN should be created before configuring VLAN client on that particular VLAN.

The "**no ip address dhcp"** command deletes the DHCP client configuration.

The example below shows the commands used to configure DHCP Client.

SMIS(config)# interface vlan 200
SMIS(config-if)# **ip address dhcp**
SMIS(config-if)# end

SMIS# **show ip interface**

mgmt is up, line protocol is up
Internet Address is 172.18.0.84/24
Broadcast Address 172.18.0.255
Gateway 172.18.0.254
IP address allocation method is dynamic
IP address allocation protocol is dhcp

vlan200 is up, line protocol is down
Internet Address is 10.10.10.2/8
Broadcast Address 10.255.255.255

IP address allocation method is dynamic
IP address allocation protocol is dhcp

16.5.3 DHCP Relay Agent

In small networks with only one IP subnet DHCP clients can communicate directly with DHCP servers. In large networks DHCP servers provide IP addresses for multiple subnets. In such cases, a DHCP client that has not yet obtained an IP address from the DHCP server cannot communicate with the DHCP server using IP routing. A DHCP relay agent forwards DHCP packets between clients and servers when they are not on the same physical subnet.

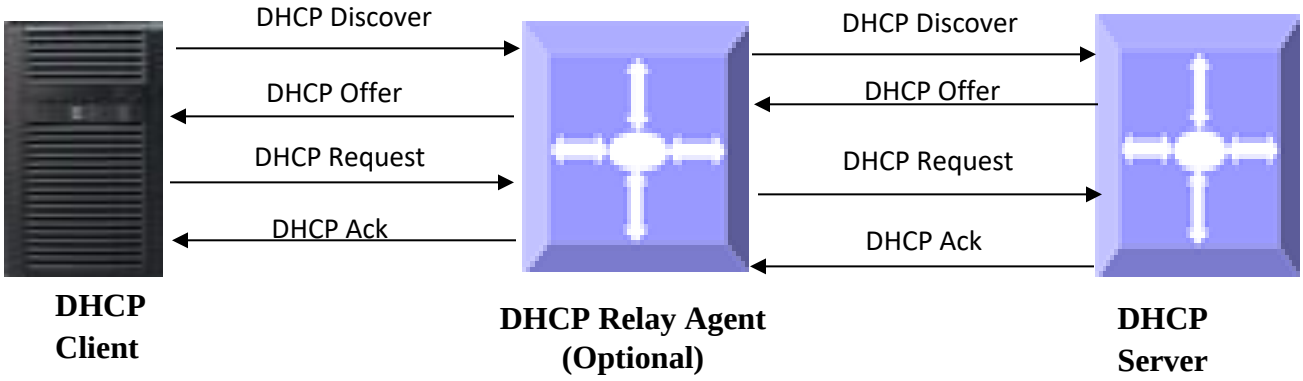


Figure IP-4: DHCP Relay Agent

The relay agent receives the broadcast from the DHCP client and unicasts it to one or more DHCP servers. The relay agent stores its own IP address in the GIADDR field of the DHCP packet. The DHCP server uses the GIADDR to determine the subnet on which the relay agent received the broadcast, and allocates an IP address on that subnet. When the DHCP server replies to the client, it unicasts the reply to the GIADDR address. The relay agent then retransmits the response on the local network.

16.5.3.1 Relay Agent Information option

The relay agent information option (option 82) includes additional information about DHCP relay agent when forwarding client-originated DHCP packets to a DHCP server. The relay agent will automatically add the circuit identifier sub-option and the remote ID suboption to the relay agent information option and forward it to the DHCP server.

16.5.3.2 Circuit-ID Sub-option

Agent Circuit ID, suboption 1 is an ASCII string that identifies the interface on which a client DHCP packet is received.

16.5.3.3 Remote-ID Sub-option

Agent Remote ID, suboption 2 is an ASCII string assigned by the relay agent that securely identifies the client.

Defaults

Parameter	Default Value
DHCP Relay status	Disabled

Relay Information Option	Disabled
Circuit ID	None
Remote ID	None

Follow the steps below to configure DHCP Relay.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**service dhcp-relay**	Enable DHCP relay.
Step 3	**ip dhcp server <ucast_addr>**	Configure the DHCP server IP address.
Step 4	**ip dhcp relay information option**	(Optional) Enables DHCP relay agent information option to be sent by DHCP relay agent.
Step 5	**ip dhcp relay circuit-id <circuit-id>**	(Optional) Specify Circuit ID sub-option
Step 6	**ip dhcp relay remote-id <remote-id name>**	(Optional) Specify Remote ID sub-option
Step 7	**end**	Exits the configuration mode.
Step 8	**show ip dhcp relay information**	Displays the DHCP relay configuration

DHCP Server must be disabled before enabling DHCP Relay.

These commands delete values or reset to default values, as applicable:

no service dhcp-relay
no ip dhcp server <ip address>
no ip dhcp relay information option
no ip dhcp relay circuit-id
no ip dhcp relay remote-id

The example below shows the commands used to configure DHCP Relay.

SMIS# configure terminal
SMIS(config)# **service dhcp-relay**
SMIS(config)# **ip dhcp server 172.1.3.15**
SMIS(config)# **ip dhcp relay information option**
SMIS(config)# end
SMIS# **show ip dhcp relay information**

Dhcp Relay : Enabled
Dhcp Relay Servers only : Enabled

DHCP server 1 : 172.1.3.15

Dhcp Relay RAI option : Enabled
Debug Level : 0x0

No of Packets inserted RAI option : 0
No of Packets inserted circuit ID suboption : 0

No of Packets inserted remote ID suboption : 0
No of Packets inserted subnet mask suboption : 0
No of Packets dropped : 0
No of Packets which did not inserted RAI option : 0

16.6 Routing Context

The switch management application modules include tftp-client, syslog-client, snmp-trap, sntp-client, tacacs-client, and radius-client. The packets originating from these switch management application modules can be routed via management interface or data-plane. Routing context setting determines the path to route the packets from management modules. By default, routing context is set to route all application modules via management interface.

Application	Context	
tftp-client	mgmt	Routing context for tftp client.
syslog-client	mgmt	Routing context for syslog client.
snmp-trap	mgmt	Routing context for snmp-trap.
sntp-client	mgmt	Routing context for sntp client.
tacacs-client	mgmt	Routing context for tacacs client.
radius-client	mgmt	Routing context for radius client.

If switch is used as a layer 2 only switch with management interface connected, then the default routing context (i.e mgmt) should work fine. If switch is configured with layer 3 VLAN interface and management interface is not connected, then all the routing context should be set to data-plane. If the switch has management interface connection as well as VLAN interface configuration, then choose the path where the services are reachable.

Follow the steps below to configure routing context.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**routing-context {tftp | syslog-client | snmp-trap | sntp-client | tacacs-client | radius-client} {mgmt | data-plane}**	Sets the routing context of the module.
Step 9	**end**	Exits the configuration mode.
Step 10	**show routing-context**	Displays the routing context settings.

The example below shows the commands used to configure VRRP.

```
SMIS# configure terminal
SMIS(config)# routing-context tacacs-client data-plane
SMIS(config)# routing-context snmp-trap data-plane
SMIS(config)# routing-context tftp-client data-plane
SMIS(config)# end
SMIS# write startup-config
```

Use the show routing-context command to display the current routing context settings.

```
SMIS# show routing-context
  Application      Context
  -------------    ----------
  tftp-client      data-plane Routing context for tftp client.
  syslog-client    mgmt       Routing context for syslog client.
  snmp-trap        data-plane Routing context for snmp-trap.
  sntp-client      mgmt       Routing context for sntp client.
  tacacs-client    data-plane Routing context for tacacs client.
  radius-client    mgmt       Routing context for radius client.
SMIS#
```

16.7 VRRP

There are several ways a LAN client can determine which router should be the first hop to a particular remote destination. The client can use a dynamic process or static configuration.

Examples of dynamic router discovery are Proxy ARP, Routing protocol(s), ICMP Router Discovery Protocol (IRDP) client. The drawback to dynamic discovery protocols is that they incur some configuration and processing overhead on the LAN client. Also, in the event of a router failure, the process of switching to another router can be slow.

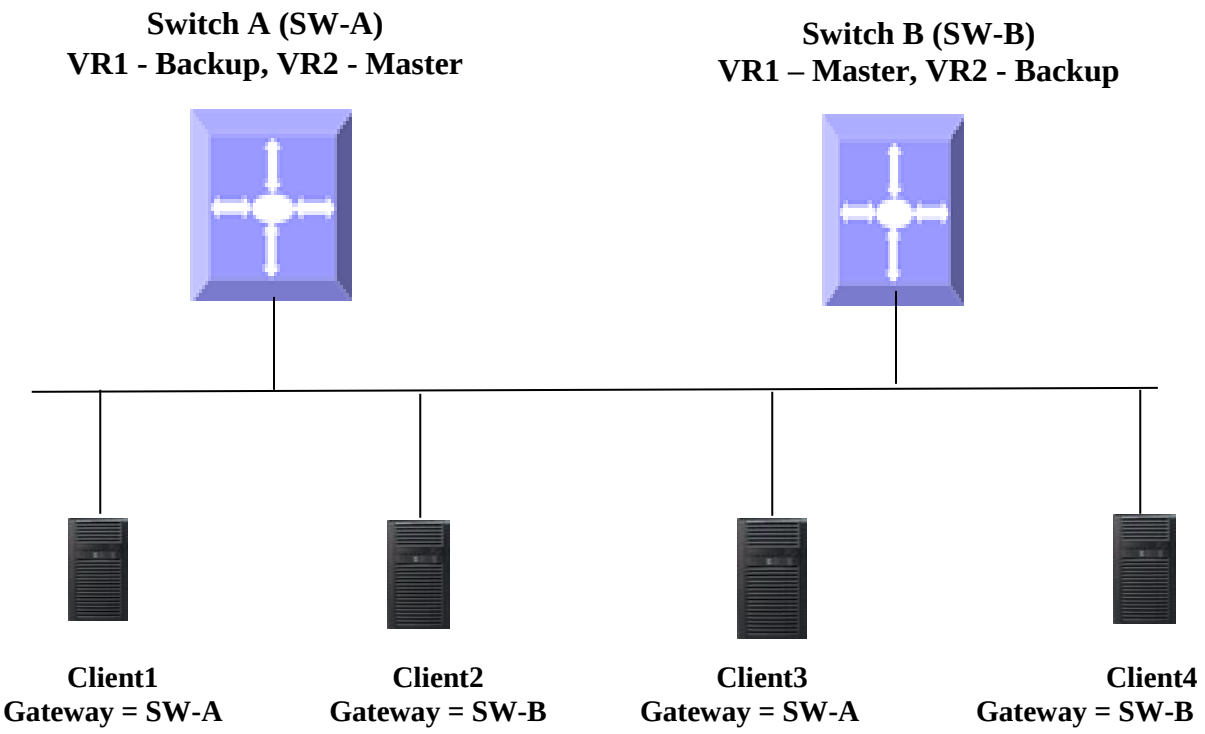


Figure IP-4: VRRP

An alternative to dynamic discovery protocols is to statically configure a default router on the client. This approach simplifies client configuration and processing, but creates a single point of failure. If the default gateway fails, the LAN client is limited to communicating only on the local IP network segment and is cut off from the rest of the network.

VRRP can solve the static configuration problem. VRRP enables a group of routers to form a single virtual router. The LAN clients can then be configured with the virtual router as their default gateway.

Virtual Router Redundancy Protocol (VRRP) is an election protocol that dynamically assigns responsibility for one or more virtual routers to the VRRP routers on a LAN, allowing several routers on a multi-access link to utilize the same virtual IP address. In a VRRP configuration, one router is elected as the virtual router master, with the other routers acting as backups in case the virtual router master fails.

16.7.1.1 Priority

The VRRP priority determines the role of each VRRP router. If a VRRP router owns the virtual IP address and the IP address of the physical interface, this router functions as the master. The priority of the master is 255. Priority also determines the backup router in case of failure of master – The backup router with next highest priority is elected as master.

For example, if Router A, the master in a LAN topology, fails, VRRP must determine if backups B or C should take over. If Router B has priority 101 and Router C has default priority of 100, VRRP selects Router B to become the master because it has the higher priority. If routers B and C have default priority of 100, VRRP selects the backup with the higher IP address to become the master.

16.7.1.2 Preemption

VRRP uses preemption to determine what happens after a VRRP backup router becomes the master. With preemption enabled by default, VRRP switches to a backup if that backup comes online with a priority higher than the new master.

For example, if Router A is the master and fails, VRRP selects Router B (next in order of priority). If Router C comes online with a higher priority than Router B, VRRP selects Router C as the new master, even though Router B has not failed. If preemption is disabled, VRRP switches only if the original master recovers or the new master fails.

16.7.1.3 Periodic Advertisement

The VRRP master sends VRRP advertisements to other VRRP routers in the same group to communicate the priority and state of the master. Supermicro switches encapsulate the VRRP advertisements in IP packets and send them to the IP multicast address assigned to the VRRP group. Supermicro switches send the advertisements once every second by default, but you can configure a different advertisement interval.

16.7.1.4 Authentication

VRRP supports the following authentication functions:
- No authentication
- Plain text authentication

VRRP rejects packets in any of the following cases:
- The authentication schemes differ on the router and in the incoming packet.
- Text authentication strings differ on the router and in the incoming packet.

VRRP is not a replacement for existing dynamic protocols.

Defaults

Parameter	Default Value
VRRP Status	Disabled
VRID	0
Priority	100

Authentication	None
Pre-empt	Disabled
Advertisement interval	1

Follow the steps below to configure VRRP.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router vrrp**	Enables VRRP in the switch
Step 3	**interface [{ vlan <vlan-id (1-4069)> | <interface-type> <interface-id> }]**	Specify interface on which VRRP is to be configured.
Step 4	**vrrp <vrid(1-255)> ipv4 <ucast_addr> [secondary]**	Configures the virtual IPv4 address for the specified VRRP group. This address should be in the same subnet as the IPv4 address of the interface. *Secondary* –Specify VRRP routers accept the packets sent to the virtual router's IP address
Step 5	**vrrp <vrid(1-255)> priority <priority(1-254)>**	Sets the priority level used to select the active router in an VRRP group. The default is 100 for backups and 255 for a master that has an interface IP address equal to the virtual IP address.
Step 6	**vrrp <vrid(1-255)> preempt**	(Optional) Enable preemption.
Step 7	**vrrp <vrid(1-255)> text-authentication <password>**	(Optional) Assigns the simple text authentication option and specifies the keyname password. The keyname range is from 1 to 255 characters. We recommend that you use at least 16 characters. The text password is up to eight alphanumeric characters.
Step 8	**vrrp <vrid(1-255)> timer <interval(1-255)secs>**	(Optional) Sets the VRRP advertisement interval time.
Step 9	**end**	Exits the configuration mode.
Step 10	**show vrrp** **show vrrp detail**	Displays the VRRP configuration. Displays the VRRP configuration with additional details like advertisement timer, authentication details etc.

These commands delete values or reset to default values, as applicable:

no router vrrp
no interface [{ Vlan <vlan-id (1-4069)> | <interface-type> <interface-id> }]
no vrrp <vrid(1-255)> ipv4 [<ucast_addr> [secondary]]
no vrrp <vrid(1-255)> priority

no vrrp <vrid(1-255)> preempt
no vrrp <vrid(1-255)> text-authentication
no vrrp <vrid(1-255)> timer

The example below shows the commands used to configure VRRP.

```
SMIS# configure terminal
SMIS(config)# vlan 10
SMIS(config-vlan)# ports fx 0/15 untagged
SMIS(config-vlan)# exit
SMIS(config)# interface vlan 10
SMIS(config-if)# ip address 172.1.10.1
SMIS(config-if)# end

SMIS# configure terminal
SMIS(config)# router vrrp
SMIS(config-vrrp)# interface vlan 10
SMIS(config-vrrp-if)# vrrp 200 ipv4 10.10.10.1
SMIS(config-vrrp-if)# vrrp 200 preempt
SMIS(config-vrrp-if)# vrrp 200 priority 100
SMIS(config-vrrp-if)# vrrp 200 text-authentication pwd1
SMIS(config-vrrp-if)# vrrp 200 timer 255
SMIS(config-vrrp-if)# vrrp 100 ipv4 100.100.100.1
SMIS(config-vrrp-if)# vrrp 100 priority 254
SMIS(config-vrrp-if)# vrrp 100 text-authentication pwd2
SMIS(config-vrrp-if)# vrrp 100 timer 100
SMIS(config-vrrp-if)# end


SMIS# show vrrp

P indicates configured to preempt

Interface   vrID Priority  P  State    Master Addr     VRouter Addr
---------   ---- --------  -  -----    -----------     ------------
vlan10      100  254       P  Init     0.0.0.0         100.100.100.1
vlan10      200  100       P  Init     0.0.0.0         10.10.10.1

SMIS# show vrrp detail

vlan10  - vrID 100
---------------
  State is Init
  Virtual IP address is 100.100.100.1
  Virtual MAC address is 00:00:5e:00:01:64
  Master router is 0.0.0.0
 Associated IpAddresses :
 ----------------------
100.100.100.1
```

```
  Advertise time is 100 secs
  Current priority is 254
  Configured priority is 254, may preempt
  Configured Authentication
  Authentication key is pwd2
vlan10  - vrID 200
---------------
  State is Init
  Virtual IP address is 10.10.10.1
  Virtual MAC address is 00:00:5e:00:01:c8
  Master router is 0.0.0.0
 Associated IpAddresses :
 ----------------------
10.10.10.1
  Advertise time is 255 secs
  Current priority is 100
  Configured priority is 100, may preempt
  Configured Authentication
  Authentication key is pwd1
```

17 IP Multicast Overview

IP communication is 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 usage 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 range 224.0.0.0 to 239.0.0.0 is selected for 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 of a particular group must join the group by signaling a router/switch on their subnet. IGMP is used as the signaling protocol for conveying *group membership*. Network devices along the path from Source to Receivers forward data only on ports leading to the receivers, rather than flooding on all ports.

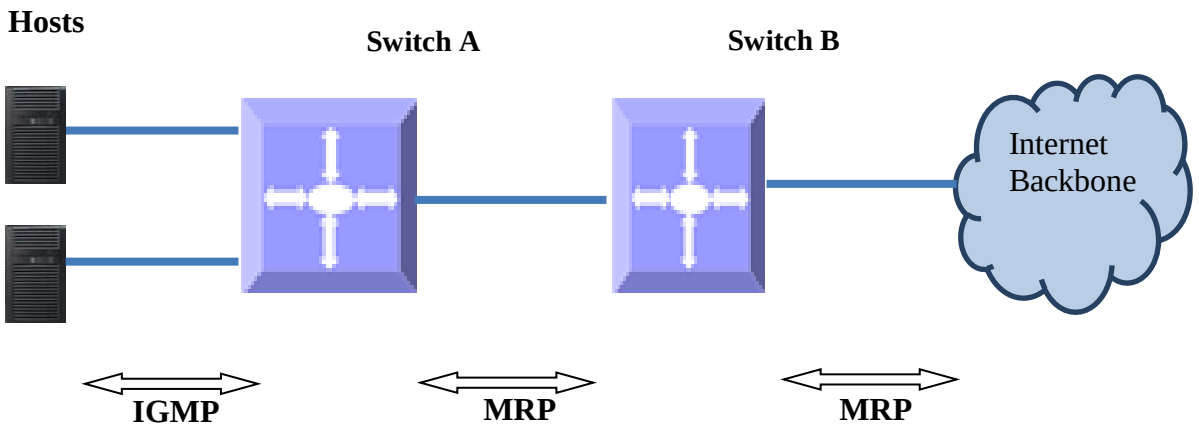
Membership in a multicast group is dynamic as hosts can join and leave at any time. There is no restriction on the location or number of members in a multicast group. A host can be a member of more than one multicast group at a time.

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 Protocol's (MRP's)** at the enterprise and core of the network for maintaining the senders/receivers database and forwarding data from Senders to Receivers.

Figure IGMP-1: IP Multicast Routing



17.1 IGMP Basics

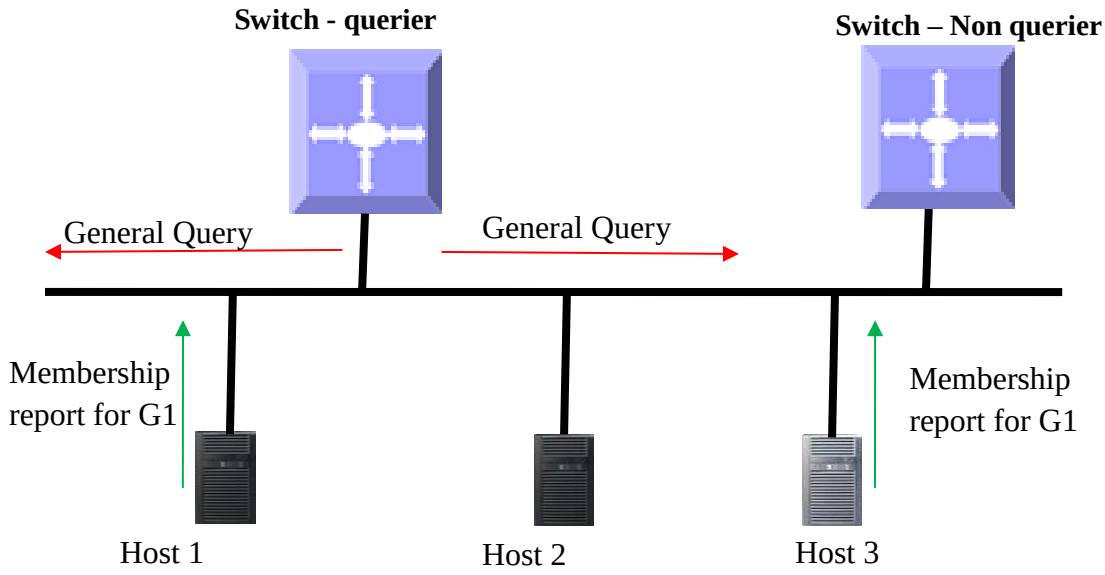
IGMP is an IPv4 protocol used by hosts to request Multicast data for a particular group. A switch performs the IGMP function by

- Sending IGMP query messages to identify receivers interested in particular Multicast group(s). IGMP query is sent only by a querier.
- Processing IGMP report messages from hosts in response to the query message from the querier.

Switch maintains a multicast forwarding table based on the hosts joined for every multicast group and updates the multicast forwarding table when hosts leave multicast groups.

In figure IGMP-2, the querier switch sends an *IGMP General Query* message on the LAN. Host1 and Host2 respond to the query with the *IGMP report* for G1 Group membership.

Figure IGMP-2: Multicast Forwarding with IGMP



IGMP has 3 versions. The basic difference between the versions is:

IGMP v1: Supports basic query-response mechanism to identify active Multicast group(s).

IGMP v2: Extends v1 with features like querier election, IGMP Leave, group-specific query and maximum response time field.

IGMP v3: Provides support for source-specific query and report in addition to IGMP v1 and IGMPv2 features.

Supermicro switch acts as a querier by default as long as it is the Multicast router with lower IP address on the subnet.

17.2 IGMP Support

Supermicro switches support IGMP for all three IGMP versions (1, 2 and 3).

Supermicro switches support up to 255 multicast groups.

17.3 IGMP Defaults

Parameter	Default Value
IGMP global status	Disabled
IGMP status in VLAN	Disabled
IGMP version	2
Query interval	125

Query Max response time	100
Robustness value	2
Last member query interval	10
Immediate leave (fast leave)	Disabled
Static Multicast Group Membership	None

17.4 Enabling IGMP

IGMP is disabled by default in Supermicro switches.

IGMP needs to be enabled globally and also needs to be enabled in interfaces individually.

Follow the steps below to enable IGMP.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**set ip igmp enable**	Enables IGMP globally.
Step 3	**interface <*interface-type*> <*interface-id*>** or **interface vlan <id>** **interface range <*interface-type*> <*interface-id*> ….**	Enters the interface configuration mode. *interface-type* – may be any of the following: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: ***interface range vlan 10-20*** If multiple interfaces are provided, the next step will enable IGMP on all these interfaces.
Step 4	**set ip igmp enable**	Enables IGMP on interface.
Step 5	**end**	Exits the configuration mode.
Step 6	**show ip igmp global-config** **show ip igmp interface <*interface-type*> <*interface-id*>**	Displays the IGMP information.
Step 7	**write startup-config**	Optional step – saves this IGMP configuration to be part of the startup configuration.

The example below shows the commands to enable IGMP.

Enable IGMP for layer3 VLAN 10

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

SMIS# **show ip igmp global-config**
IGMP is globally enabled

SMIS(config)#**configure terminal**
SMIS(config)#**interface vlan 10**
SMIS(config-if)# **set ip igmp enable**
SMIS(config-if)#**end**

SMIS# **show ip igmp interface**
vlan10, line protocol is up
Internet Address is 2.2.2.2/8
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 2.2.2.2 (this system)
Fast leave is disabled on this interface
No multicast groups joined

17.5 IGMP Version

The IGMP protocol standard has three versions: v1, v2 and v3. Supermicro switches support IGMP for all three versions. Supermicro IGMP support interoperates with different IGMP versions as defined in IGMP protocol standard.

The default IGMP version is v2, which works compatible with IGMP versions 1 and 3.

Supermicro switches provide flexibility for user to configure IGMP versions for individual interfaces. User can configure different IGMP version on different interfaces.

Follow the steps below to change IGMP version 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **interface range vlan 10,20** If multiple interfaces are provided, the next step will enable IGMP on all these interfaces.
Step 3	**ip igmp version { 1 | 2 | 3}**	Configures IGMP version.
Step 5	**end**	Exits the configuration mode.
Step 6	**show ip igmp interface <***interface-type***> <***interface-id***>**	Displays the IGMP version information for the given interface.
Step 7	**write startup-config**	Optional step – saves this IGMP configuration to be part of the startup configuration.

The **"no ip igmp version"** command resets the IGMP version to its default value of 2.

The example below shows the commands to configure different versions of IGMP.

Configure IGMP version 3 for layer3 VLAN 10.

SMIS# **configure terminal**
SMIS(config)# **interface vlan 10**
SMIS(config-if)# **ip igmp version 3**
SMIS(config-if)# **end**

SMIS# **show ip igmp interface**
vlan10, line protocol is up

Internet Address is 2.2.2.2/8
IGMP is enabled on interface
Current IGMP router version is 3
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 2.2.2.2 (this system)
Fast leave is disabled on this interface
No multicast groups joined

17.6 IGMP query and report

When IGMP is enabled in Supermicro switch, it assumes itself as querier. As long as switch does not receive an IGMP query from another Multicast router in the subnet, with IP address lower than itself, it continues to be the IGMP querier on the subnet. If Supermicro switch acting as querier receives a query from another Multicast router on the subnet with an IP address lower than itself, then the switch transitions to a non-querier role and resets a timer that is based on value of its querier timeout. Upon expiry of the querier timer, Supermicro switch transitions to querier again, if there are no queries from the router with lower IP address, otherwise it continues to remain the non-querier on the subnet.

The querier switch is in charge of sending periodic query messages on the network to determine the presence of any new hosts. In response to query message from the querier, hosts respond with IGMP report messages indicating inclusion or exclusion of a particular Multicast Group address. The querier consolidates the reports from all hosts and maintains it in an IGMP group table.

There are various parameters that control the query messages and report messages:

Query Interval: This configures the time interval between transmissions of query messages by querier.

Max Response Time: This configures the maximum time interval until which the querier will wait for receiving reports from the hosts

Robustness Value: This parameter tunes certain intervals used in IGMP protocol and also determines the retransmissions of IGMPv3 report messages to prevent loss in network.

17.6.1 Query Interval

IGMP querier sends IGMP queries periodically to determine if there are any new hosts. This periodic time interval is called the *query interval*.

The default query interval is 125 seconds.

Supermicro switches provide flexibility for user to configure query interval for individual interfaces. User can configure different query interval on different interfaces.

Follow the steps below to change query 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **interface range vlan 10,20** If multiple interfaces are provided, the next step will enable IGMP on all these interfaces.
Step 3	**ip igmp query-interval <value>**	Configures IGMP query interval. The query interval value can be 1-65535 seconds. Default is 125 seconds.
Step 5	**end**	Exits the configuration mode.
Step 6	**show ip igmp interface *<interface-type> <interface-id>***	Displays the IGMP query interval information for the given interface.
Step 7	**write startup-config**	Optional step – saves this IGMP configuration to be part of the startup configuration.

The **"no ip igmp query-interval"** command resets the IGMP query interval to its default value of 125.

The example below shows the commands to configure IGMP query interval.

Configure IGMP query interval for layer3 VLAN 10

SMIS(config)#**configure terminal**
SMIS(config)#**interface vlan 10**

SMIS(config-if)# **ip igmp query-interval 500**
SMIS(config-if)# **end**

SMIS# **show ip igmp interface**
vlan10, line protocol is up
 Internet Address is 2.2.2.2/8
 IGMP is enabled on interface
 Current IGMP router version is 2
 IGMP query interval is 500 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 2.2.2.2 (this system)
 Fast leave is disabled on this interface
 No multicast groups joined

SMIS# **show ip igmp statistics**
IGMP Statistics for vlan10
Number of General queries received 0
Number of Group Specific queries received 0
Number of Group and Source Specific queries received 0
Number of v1/v2 reports received 0
Number of v3 reports received 0
Number of v2 leaves received 0
Number of General queries transmitted 32
Number of Group Specific queries transmitted 0
Number of Group and Source Specific queries transmitted 0

17.6.2 Maximum query response time

For every inclusion report received by the querier, the particular interface entry is added in the IGMP group table for that particular group. A timer of value *Group membership timeout* is started for each group/interface entry in the IGMP group table. The *query response interval* is used to calculate the group membership timeout.

Group membership timeout = (robustness value * query interval) + *max query response interval*

Once a query is received by the hosts, the hosts should respond with IGMP reports within *Max query response time.* The querier deletes the hosts' interface entry from the IGMP group table if no reports are received from the host until expiry of Group membership timeout.

The default query-max-response time is 100 seconds.

Supermicro switches provide flexibility for user to configure query-max-response time for individual interfaces. User can configure different query-max-response time on different interfaces.

Follow the steps below to change query-max-response 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **interface range vlan 10,20** If multiple interfaces are provided, the next step will enable IGMP on all these interfaces.
Step 3	i**p igmp query-max-response-time <value>**	Configures IGMP query-max-response time. The value of query-max-response time is 1-255 seconds. Default is 100 seconds.
Step 5	**end**	Exits the configuration mode.
Step 6	**show ip igmp interface <***interface-type***> <***interface-id***>**	Displays the IGMP query-max-response time information for the given interface.
Step 7	**write startup-config**	Optional step – saves this IGMP configuration to be part of the startup configuration.

The **"no ip igmp query-max-response-time"** command resets the query-max-response-time to its default 100.

Configure query-max-response time only on IGMPv2 interface.

The example below shows the commands to configure IGMP query maximum response time.

Configure IGMP query maximum response time for layer3 VLAN 10

SMIS(config)#**configure terminal**
SMIS(config)#**interface vlan 10**
SMIS(config-if)# **ip igmp query-max-response-time 255**
SMIS(config-if)# **end**

SMIS# **show ip igmp interface**
vlan10, line protocol is up
Internet Address is 2.2.2.2/8
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 255 seconds
Robustness value is 2
IGMP querying router is 2.2.2.2 (this system)
Fast leave is disabled on this interface
No multicast groups joined

17.6.3 Robustness Value

The robustness value can be fine-tuned to allow for expected packet loss on a subnet. The value of this variable affects certain IGMP message intervals for IGMPv2 and IGMPv3 as below:

- *Group membership interval*: Amount of time that must pass before a multicast router determines that there are no more members of a group on a network.
  Group membership interval = (Robustness value * query interval) + query response interval

- *Other querier present interval*: The robustness value is used to calculate the amount of time that must pass before a multicast router determines that there is no longer another multicast router that is the querier.
  Other querier present interval = (Robustness value * query interval) + (0.5 * query response interval)

- *Last-member query count*: Number of group-specific queries sent before the router assumes there are no local members of a group. The number of queries is equal to the value of the robustness value.

In IGMPv3, devices send a state-change report in case of change of interface state. The number of times state-change report is retransmitted is the robustness value minus one.

The default robustness value is 2. Suggest increasing this value if the subnet is expected to lose packets.

Supermicro switches provide flexibility for user to configure robustness value for individual interfaces. User can configure different robustness value on different interfaces.

Follow the steps below to change robustness value on any interface.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**interface <*interface-type*> <*interface-id*>** or	Enters the interface configuration mode.

	interface range *<**interface-type**> <**interface-id**> ….*	*interface-type* – may be any of the following: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **interface range vlan 10,20** If multiple interfaces are provided, the next step will enable IGMP on all these interfaces.
Step 3	**ip igmp robustness <value>**	Configures IGMP robustness value. The robustness value can be any number from 1-255 seconds. Default is 2 seconds.
Step 5	**end**	Exits the configuration mode.
Step 6	**show ip igmp interface** *<**interface-type**> <**interface-id**>*	Displays the IGMP robustness information for the given interface.
Step 7	**write startup-config**	Optional step – saves this IGMP configuration to be part of the startup configuration.

The **"no ip igmp robustness"** command resets the robustness value to its default 2.

Configure Robustness value only on IGMPv2 and IGMPv3 interfaces.

The example below shows the commands to configure IGMP query maximum response time.

Configure IGMP robustness value for layer3 VLAN 10

SMIS(config)#**configure terminal**
SMIS(config)#**interface vlan 10**
SMIS(config-if)# **ip igmp robustness 10**

SMIS(config-if)# **end**

SMIS# **show ip igmp interface**
vlan10, line protocol is up
Internet Address is 2.2.2.2/8
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 10
IGMP querying router is 2.2.2.2 (this system)
Fast leave is disabled on this interface
No multicast groups joined

17.7 Leaving a Multicast Group

Host computers leave multicast groups either silently or by sending IGMP leave messages. Switches monitor the IGMP leave messages sent by host computers. When a switch receives an IGMP leave message for any group on an interface, it does not delete the interface from the group entry on the multicast table immediately. Instead, the switch sends an IGMP group-specific query message on the interface that received the IGMP leave message. If there is any other IGMP host on that interface that joined the same multicast group, the switch will receive an IGMP member report as a response. If no hosts respond on that interface, the switch will assume no other IGMP hosts are connected on that interface for the same group and will delete the corresponding interface from the group entry on the multicast table.

Switches follow the above process only for IGMP version 2 leave messages.

The following parameters are used to control the leave message handling procedure in Supermicro switches.

Group Query Interval – This configures the amount of time a switch will wait to get response for its group specific queries from IGMP hosts.

Immediate Leave – This configures the switch to consider the host leave immediately instead of sending group specific query messages to look for other IGMP hosts on the interface that received an IGMP leave message.

These parameters can be configured as explained below.

17.7.1 Last member Query Interval

Switches send a group specific query messages on the interface that received an IGMP leave message. Switches wait for the group query interval time to get a response from the hosts for its group specific query messages. If they receive any host member report as a response, they will drop the leave message

received earlier on that interface. If they do not receive any response from hosts for a group query interval time, the switches will remove the interface from the group entry in the multicast forwarding table.

Users can configure this last member query interval. The default last member query interval is 10 seconds.

Follow the steps below to configure the last member query 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **interface range vlan 10,20** If multiple interfaces are provided, the next step will enable IGMP on all these interfaces.
Step 3	**ip igmp last-member-query-interval <value>**	Configures the last member query interval. The last member query interval value can be any number from 1-255 seconds. Default is 2 seconds.
Step 4	**end**	Exits the configuration mode.
Step 5	**show ip igmp interface <***interface-type***> <***interface-id***>**	Displays the IGMP last member query interval information for the given interface(s).
Step 6	**write startup-config**	Optional step – saves this IGMP configuration to be part of the startup configuration.

The **"no ip igmp last-member-query-interval"** command resets the last member query interval value to its default value of 10 seconds.

Last member query interval should be configured only on an IGMPv2 or IGMPv3 interface.

The example below shows the commands used to configure the last member query interval time.

Configure the last member query interval time as 250 seconds for layer3 VLAN10.

SMIS(config)#**configure terminal**
SMIS(config)#**interface vlan 10**
SMIS(config-if)# **ip igmp last-member-query-interval 250**
SMIS(config-if)#**end**

SMIS# **show ip igmp interface**
vlan10, line protocol is up
Internet Address is 2.2.2.2/8
IGMP is enabled on interface
Current IGMP router version is 2
IGMP query interval is 125 seconds
Last member query response interval is 250 seconds
IGMP max query response time is 100 seconds
Robustness value is 2
IGMP querying router is 2.2.2.2 (this system)
Fast leave is disabled on this interface
No multicast groups joined

17.7.2 Immediate Leave

The switch can be configured to immediately remove the interface from the group entry on the multicast table when any interface receives an IGMP leave message without sending out group specific query messages. This function is called immediate leave and it is configurable per interface basis.

Immediate leave is disabled by default in all interfaces.

Follow the steps below to enable the immediate leave for 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces.

		To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **interface range vlan 10,20** If multiple interfaces are provided, the next step will enable IGMP on all these interfaces.
Step 3	**ip igmp immediate leave**	Enables the IGMP immediate leave.
Step 4	**end**	Exits the configuration mode.
Step 5	**show ip igmp interface** *<interface-type> <interface-id>*	Displays the IGMP immediate leave information for the given interface.
Step 6	**write startup-config**	Optional step – saves this IGMP configuration to be part of the startup configuration.

The **"no ip igmp immediate leave"** command can be used to disable the immediate leave function for any VLAN.

Immediate leave should be configured only on an IGMPv2 interface.

The example below shows the commands used to enable the immediate leave function.

Enable the immediate leave for Layer3 VLAN 10.

SMIS(config)#**configure terminal**
SMIS(config)#**interface vlan 10**
SMIS(config-if)# **ip igmp immediate-leave**
SMIS(config-if)# **end**

SMIS# **show ip igmp interface**
vlan10, line protocol is up
Internet Address is 2.2.2.2/8
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 2.2.2.2 (this system)

Fast leave is enabled on this interface
No multicast groups joined

17.8 Static Multicast Group Membership

IGMP Group membership can be configured statically on an interface. The static IGMP group entries are used to statically forward Multicast data on the particular interface. The entries in the static group membership table exist without any timeout, until they are explicitly deleted.

By default there are no static Multicast memberships.

Follow the steps below to configure static group and source membership.

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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **interface range vlan 10,20** If multiple interfaces are provided, the next step will enable IGMP on all these interfaces.
Step 3	**ip igmp static-group <Group Address> [source <Source Address>]**	Enables the IGMP static group membership. **Group:** Mention the IP address of the Multicast group in dotted decimal notation**.**

		Source (optional): Mention the IP address of the Source in dotted decimal notation**.**
Step 4	**end**	Exits the configuration mode.
Step 5	**show ip igmp groups** **show ip igmp sources**	Displays the IGMP group membership information.
Step 6	**write startup-config**	Optional step – saves this IGMP configuration to be part of the startup configuration.

The **"no ip igmp static-group <Group Address> [source <Source Address>]"** command can be used to remove a statically configured group and source from an interface.

The 'source' option should be used only on an IGMPv3 interface.

The example below shows the commands to configure IGMP Static group membership.

Configure IGMP Static group membership for layer3 VLAN 10

SMIS(config)#**configure terminal**
SMIS(config)#**interface vlan 10**
SMIS(config-if)# **ip igmp static-group 225.5.5.5**
SMIS(config-if)# **ip igmp static-group 235.1.1.1**
SMIS(config-if)# **end**

SMIS# **show ip igmp groups**

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

```
GroupAddress    Flg Iface   UpTime          ExpiryTime      LastReporter
--------------- --- ------- --------------- --------------- ---------------
225.5.5.5       S   vlan10  [0d 00:00:06.17] [0d 00:00:00.00] 0.0.0.0
235.1.1.1       S   vlan10  [0d 01:20:01.36] [0d 00:00:00.00] 0.0.0.0
```

SMIS# **show ip igmp interface**
vlan10, line protocol is up
Internet Address is 2.2.2.2/8
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 2.2.2.2 (this system)
Fast leave is disabled on this interface

Number of multicast groups joined 2

17.9 Disabling IGMP

IGMP is disabled by default in Supermicro switches.

After enabling IGMP, if user needs to disable it, it has to be disabled globally and also in interfaces individually.

Follow the steps below to disable IGMP.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode.
Step 2	**set ip igmp disable**	Disables IGMP globally.
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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **interface range vlan 10,20** If multiple interfaces are provided, the next step will enable IGMP on all these interfaces.
Step 4	**set ip igmp disable**	Disables IGMP in VLAN.
Step 5	**end**	Exits the configuration mode.
Step 6	**show ip igmp global-config** **show ip igmp interface** <*interface-type*> <*interface-id*>	Displays the IGMP information.

Step 7	**write startup-config**	Optional step – saves this IGMP configuration to be part of the startup configuration.

The example below shows the commands used to disable IGMP.

Disable the IGMP function assuming the switch has layer3 VLAN 10

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

SMIS# **show ip igmp global-config**
IGMP is globally disabled

SMIS(config)#**configure terminal**
SMIS(config)#**interface vlan 10**
SMIS(config-if)# **set ip igmp disable**
SMIS(config-if)#**end**

SMIS# **show ip igmp interface**
vlan10, line protocol is up
Internet Address is 2.2.2.2/8
IGMP is disabled 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 2.2.2.2 (this system)
Fast leave is disabled on this interface
No multicast groups joined

17.10 IGMP Configuration example

Configure the following requirements as shown below in Figure IGMP-3.

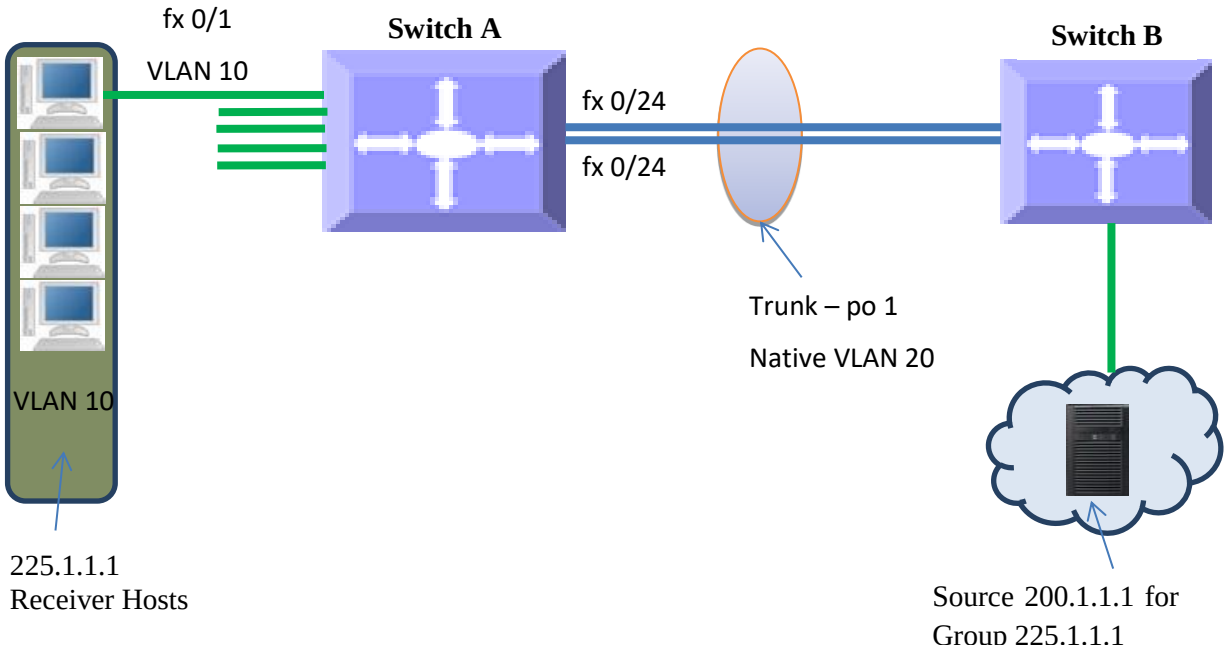
Switch A:

5. Enable IGMP.
6. Configure static Multicast group and source on VLAN10.
7. Configure immediate leave and query interval
8. Verify the IGMP group table

Switch B:

1. Enable IGMP.
2. Verify the IGMP group table
3. Configure robustness value

Figure IGMP-3: IGMP Configuration example



When an MRP like PIM is enabled on interfaces between Switch A and Switch B, traffic flows from Source 200.1.1.1 to receivers for Group 225.1.1.1

IGMP Configuration on Switch A

```
#Create Layer3 VLAN interface
SMIS(config)# vlan 10
SMIS(config-vlan)# ports fx 0/1 untagged
SMIS(config-vlan)# exit
SMIS(config)# interface vlan 10
SMIS(config-if)# ip address 10.10.10.10 255.0.0.0
SMIS(config-if)# exit

SMIS(config)# vlan 20
SMIS(config-vlan)# ports fx 0/24 untagged
SMIS(config-vlan)# exit
SMIS(config)# interface vlan 20
SMIS(config-if)# ip address 20.20.20.1 255.0.0.0
SMIS(config-if)# exit

#Enable IGMP on interface
SMIS(config)# interface vlan 10
SMIS(config-if)# set ip igmp enable
SMIS(config-if)# ip igmp version 3
SMIS(config-if)# ip igmp immediate leave
SMIS(config-if)# ip igmp query-interval 60
SMIS(config-if)# ip igmp static-group 225.1.1.1 source 200.1.1.1
SMIS(config-if)# exit

SMIS(config)# interface vlan 20
SMIS(config-if)# set ip igmp enable
SMIS(config-if)# exit

#Enable IGMP globally
SMIS(config)# set ip igmp enable

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

Building configuration...
Switch ID      Hardware Version            Firmware Version

ip address dhcp
vlan 1
  ports fx 0/2-23 untagged
 ports fx 0/25-48 untagged
 ports fx 0/1-4 untagged
exit
vlan 10
  ports fx 0/1 untagged
exit
vlan 20
 ports fx 0/24 untagged
exit
```

```
interface vlan 1
 ip address dhcp

interface vlan 10
 ip address  10.10.10.10 255.0.0.0
 set ip igmp enable
 ip igmp immediate-leave
 ip igmp version 3
 ip igmp query-interval  60
 ip igmp static-group 225.1.1.1 source 200.1.1.1

interface vlan 20
 ip address  20.20.20.1 255.0.0.0
 set ip igmp enable

exit
set ip igmp enable

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

#Display IGMP Global Configuration
SMIS(config)# show ip igmp global-config
IGMP is globally enabled

#Display IGMP interface information
SMIS(config)# 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 3
 IGMP query interval is 60 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 enabled on this interface
 Number of multicast groups joined 1

vlan20, line protocol is up
 Internet Address is 20.20.20.1/8
 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 20.20.20.1 (this system)
Fast leave is disabled on this interface
No multicast groups joined

#Display IGMP Group information
SMIS(config)# show ip igmp groups

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

GroupAddress Flg Iface UpTime ExpiryTime LastReporter
225.1.1.1 IS vlan10 [0d 00:35:06.25] [0d 00:00:00.00] 10.10.10.10

#Display IGMP Source information
SMIS(config)# show ip igmp sources

I - Include Mode, E - Exclude Mode
S - Static Mbr, D - Dynamic Mbr
F - Forward List, N - Non-Forward List

GroupAddress Iface SrcAddress Flg ExpiryTime LastReporter
225.1.1.1 vlan10 200.1.1.1 ISF [0d 00:00:00.00] 10.10.10.10

IGMP Configuration on Switch B

#Create Layer3 VLAN interface
SMIS(config)# vlan 20
SMIS(config-vlan)# ports fx 0/24 untagged
SMIS(config-vlan)# exit

SMIS(config)# interface vlan 20
SMIS(config-if)# ip address 20.20.20.5

#Enable IGMP on Layer3 VLAN interface
SMIS(config-if)# set ip igmp enable
SMIS(config-if)# ip igmp robustness 5
SMIS(config-if)# exit

#Enable IGMP globally
SMIS(config)# set ip igmp enable

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

Building configuration...
Switch ID Hardware Version Firmware Version

ip address dhcp
vlan 1
ports fx 0/1-23 untagged

```
 ports fx 0/1-3 untagged
exit
vlan 20
 ports fx 0/24 untagged
exit

interface vlan 20
 ip address  20.20.20.5 255.0.0.0
 set ip igmp enable
 ip igmp robustness  5

exit
set ip igmp enable

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

#Display IGMP Global Configuration
SMIS(config)# show ip igmp global-config
IGMP is globally enabled

#Display IGMP interface information
SMIS(config)# show ip igmp interface
vlan20, line protocol is up
 Internet Address is 20.20.20.5/8
 IGMP is enabled on interface
 Current IGMP router version is 2
 IGMP query interval is 125 seconds
 Last member query response interval is 10 (1/10 seconds)
 IGMP max query response time is 100 (1/10 seconds)
 Robustness value is 5
 IGMP querying router is 20.20.20.1
 Fast leave is disabled on this interface
 No multicast groups joined
```

18 IP Unicast Routing Overview

Layer 3 switches can route packets in three different ways:

• Default routing: Traffic with an unknown destination is sent to a default destination, usually specified by a default route configuration.

• Static routes: Static unicast routing forwards packets from predetermined ports through a single path into and out of a network. Static routing is secure and uses little bandwidth, but does not automatically respond to changes in the network, such as link failures, and hence may result in unreachable destinations. As networks grow, static routing configuration becomes labor-intensive.

• Dynamically Routing protocol: Dynamic routing protocols are used by routers to dynamically calculate the best route for forwarding traffic. There are two types of dynamic routing protocols:

- Distance-vector protocols create/maintain routing tables with distance values of network resources, and periodically update these tables to the neighbor routers. Distance-vector protocols use one or a series of metrics for calculating the best routes. These protocols are easy to configure and use. Distance-vector protocols supported by Supermicro switches are Routing Information Protocol (RIP), which uses a single distance metric (cost) to determine the best path and Border Gateway Protocol (BGP), which adds a path vector mechanism.
- Link-state protocols create/maintain a complex database of network topology, based on the exchange of link-state advertisements (LSAs) between routers. LSAs are triggered by an event in the network, which speeds up the convergence time due to topology changes. Link-state protocols require greater bandwidth and more resources than distance-vector protocols. Supermicro switches support Open Shortest Path First (OSPF) link-state protocol.

Routing in the Internet is divided into two parts – fine-grained topological detail of connected segments of the Internet is managed with *interior routing protocols* (such as RIP or OSPF), while the interconnection of these segments, or "autonomous systems" is managed by an *inter-domain routing* protocol (such as Border Gateway Protocol, or BGP).

Administrative distance is a rating of the trustworthiness of a routing information source, an integer between 0 and 255, with a higher value meaning a lower trust rating. An administrative distance of 255 indicates the routing information should be ignored.

Redistribution is a process of passing the routing information from one routing domain to another. The purpose of redistribution is to provide full IP connectivity between different routing domains and to provide redundant connectivity, i.e. backup paths between routing domains. Routing domain is a set of routers running the same routing protocol. Redistribution process is performed by border routers – i.e. routers belonging to more than one routing domain. Supermicro switches allow redistribution of routes from/to RIP

to/from other Unicast Routing Protocols, like OSPF. Differences in routing protocol characteristics, such as metrics, administrative distance, classful and classless capabilities can effect redistribution.

18.1 RIP

Routing Information Protocol (RIP) is a distance-vector routing protocol that uses hop count (the number of routers) to determine the best way to a remote network. RIP sends the complete routing table out to all active interfaces every 30 seconds.

Supermicro switches support both RIPv1 and RIPv2. RIPv1 is a classful routing protocol that does not include the subnet mask with the network address in routing updates, which causes problems in discontiguous subnets or networks that use Variable-Length Subnet Masking (VLSM). RIPv2 is a classless routing protocol so subnet masks are included in the routing updates, making RIPv2 more compatible with modern routing environments.

RIP (Routing Information Protocol) is a widely-used protocol for managing router information within a self-contained network such as a corporate local area network (LAN) or an interconnected group of such LANs. RIP is considered an effective solution for small homogeneous networks. RIP is not suited for larger, more complicated networks since the transmission of the entire routing table every 30 seconds increases network traffic.

18.1.1 Network

Supermicro switches provide user configuration of the network IP address that run RIP. The network number specified must not contain any subnet information. RIP routing updates are sent and received only through interfaces on this network.

18.1.2 Neighbor

By default RIPv2 will send multicast updates out all interfaces specified within the range of the network command. Supermicro switches allow neighbor configuration that enables the switch to send unicast updates to that neighbor out the respected link. Multicast updates are also sent through the same link.

18.1.3 Metric

RIP uses a single routing metric (hop count) to measure the distance between the source and a destination network. Each hop in a path from source to destination is assigned a hop count value, which is typically 1. When a router receives a routing update that contains a new or changed destination network entry, the router adds 1 to the metric value indicated in the update and enters the network in the routing table. RIP routing is limited to 15 hops. A metric of 16 hops identifies unreachable network.

18.1.4 Route tag

Route tags are supported in RIP version 2. This functionality allows for routes to be distinguished from internal routes to external redistributed routes from EGP protocols.

18.1.5 Split Horizon

Routers connected to broadcast-type IP networks use the split-horizon mechanism to reduce routing loops, especially when links are broken. Split horizon blocks information about routes from being advertised by a router on any interface from which that information originated.

Supermicro switches support the following two mechanisms that help ensure the reachability of routes:

- Split horizon -- This mechanism omits routes learned from one neighbor in updates sent to that neighbor. Split horizon minimizes routing overhead, but may cause slower convergence.
- Split horizon with poison reverse -- This mechanism includes routes learned from one neighbor in updates sent to that neighbor. However, it sets the metric to 16, which avoids loop. Poison reverse speeds up convergence, but it increases routing overhead.

18.1.6 Summarization

In large internetworks, hundreds, or even thousands, of network addresses can exist. It is often problematic for routers to maintain this volume of routes in their routing tables. Route summarization also called route aggregation or supernetting helps reduce the number of routes that a router must maintain as a series of network numbers are represented by a single summary address.

Route summarization is most effective within a subnetted environment when the network addresses are in contiguous blocks in powers of 2. Summarization results in less CPU, memory, and bandwidth usage.

Routing protocols summarize or aggregate routes based on shared network numbers within the network. RIPv2 supports route summarization based on subnet addresses, including VLSM addressing. RIPv1 automatically summarize routes on the classful network boundary only.

If more than one entry in the route summary matches a particular destination, the longest prefix match in the routing table is used.

NOTE: If split horizon is enabled, neither autosummary nor interface IP summary addresses is advertised.

18.1.7 Authentication

RIP Version 1 does not support authentication. RIP Version 2 packets supports RIP authentication on an interface. The key chain and the set of keys that can be used on the interface should be specified for authentication.

18.1.8 Security

RIP supports the following two security mechanisms that prevent unauthorized routers from forming adjacencies:

- Simple text password: This method transmits simple passwords in clear text.
- MD5 authentication (For RIPv2 only): This mechanism provides more protection than a simple password and has a greater probability of detecting hostile messages.

18.1.9 Passive Interface

Passive interfaces are used to suppress routing updates. These interfaces can be used to allow an interface to receive updates but prevent the interface from sending advertisements.

18.1.10 Inter-packet delay

By default, RIP implementation in Supermicro switches does not add delay between packets during a multiple-packet RIP update transmission. If a high-end router is sending packets to a low-speed router, inter-packet delay of RIP updates must be configured, in the range of 8 to 50 milliseconds.

18.1.11 Re-transmission

Supermicro switches support retransmission of Update Request packet or unacknowledged Update response packet. User can specify the timeout interval and the maximum number of retransmissions of the update request and update response packets. During retries, if no response is received then the routes through the next hop router are marked unreachable.

18.1.12 Timers

RIP uses the following timers to maintain routing tables:

Update timer: Routers within an autonomous system exchange routing information through periodic RIP updates. The update timer controls the frequency of these updates.

Expiration timer: RIP expects an update every 30 seconds from its neighbors. If it does not receive an update in that time, RIP waits for a specified expiration time before declaring a route invalid.

Triggered update timer: When routes change, Supermicro switch sends a RIP update almost immediately instead of waiting for its regular update message. This helps to speed up network convergence. The triggered update timer is set to wait for 5 seconds to avoid a storm of triggered updates.

18.1.13 Default route

RIP has a built in feature in which allows it to advertise a default route to its direct neighbors which will propagate throughout the entire RIP routing domain. The default route can be configured by the user. Utilizing this type of configuration reduces the effort required to configure a static default route on each and every router and/or switch in the network.

18.1.14 RIP Configuration

18.1.14.1 Default RIP Configuration

Parameter	Default Value
RIP Status	Disabled
UDP Port	521
Update Interval	30 seconds
Space Interval	2
Route Age/Expiry	180 seconds
Maximum paths	16
Garbage collection Interval	120 seconds
Split Horizon Status	Enabled with Poison Reverse
Version	2
Default Metric	10
Retransmission count	36
Retransmission time	5
Redistribution	Enabled
Neighbor	None
Subscription time	180
Spacing Status	Disabled
Automatic Summarization	Enabled
Triggered Updates	Disabled
Trigger timer	0
Security	Maximum
Authentication	Disabled

18.1.14.2 Enabling RIP

RIP is disabled by default in Supermicro switches. Follow the below steps to enable RIP.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router rip**	Enables RIP on all interfaces and enters the Router configuration mode
Step 3	**end**	Exit from Configuration mode.

The "**no router rip**" command disables RIP in the switch.

18.1.14.3 RIP Neighbor

Supermicro switches allow configuration of RIP Neighbor. Follow the below steps to configure a RIP neighbor.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router rip**	Enables RIP on all interfaces and enters the Router configuration mode
Step 3	**neighbor <ip address>**	Add a neighbor router
Step 4	**End**	Exit from Configuration mode.

The "**no neighbor <ip address>"** command deletes the RIP neighbor.

18.1.14.4 Interface Parameters

Supermicro switches provide configuration of Interface parameters for RIP. Follow the below steps to configure a RIP interface parameters.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router rip**	Enables RIP on all interfaces and enters the Router configuration mode
Step 3	**neighbor <ip address>**	Add a neighbor router
Step 4	**Exit**	Exit from RIP router configuration mode
Step 5	**interface <*interface-type*><*interface-id*>** or **interface range** <***interface-type*><*interface-id*> ….**	(Optional) Enters the interface configuration mode. *interface-type* – may be any of the following: 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 vlan 1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range vlan 1-10,20** If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 6	**ip rip send version { 1 | 2 | 1 2 | none }**	(Optional) Configure IP RIP version number for transmitting advertisements

Step 7	**ip rip receive version { 1 | 2 | 1 2 | none }**	(Optional) Configure IP RIP version number for receiving advertisements
Step 8	**ip rip authentication mode { text | md5 } key-chain <key-chain-name (16)>**	(Optional) Configures authentication mode and key
Step 9	**timers basic <update-value (10-3600)> <routeage-value (30-500)> <garbage-value (120-180)>**	(Optional) Configure update, route age and garbage collection timers
Step 10	**ip split-horizon [poison]**	(Optional) Configure the split horizon status
Step 11	**ip rip default route originate <metric(1-15)>**	(Optional) Configure the metric to be used for default route propagated over the interface
Step 12	**ip rip summary-address <ip-address> <mask>**	(Optional) Configure route aggregation for all subnet routes that falls under the specified ip address and mask.
Step 13	**ip rip default route install**	(Optional) Install default route received in updates to the rip database.
Step 14	**end**	Exit from Configuration mode.
Step 15	show ip rip { database [<ip-address> <ip-mask>] | statistics }	Display IP RIP protocol database or statistics

These commands either delete the particular configuration or reset it to its default value.

no ip rip send version
no ip rip receive version
no ip rip authentication
no timers basic
no ip split-horizon
no ip rip default route originate
no ip rip summary-address <ip-address> <mask>
no ip rip default route install

18.1.14.5 Additional Parameters

Supermicro switches provide configuration of certain additional RIP parameters. Follow the below steps to configure additional RIP parameters.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router rip**	Enables RIP on all interfaces and enters the Router configuration mode
Step 3	**neighbor <ip address>**	Add a neighbor router
Step 4	**network <ip-address>[unnum {vlan <integer(1-4069)> | <iftype> <ifnum>}]**	Enable RIP on an IP network or an unnumbered interface
Step 5	**ip rip retransmission { interval <timeout-value (5-10)> | retries <value (10-40)> }**	(Optional) Configure the timeout interval and number of retries to retransmit the update request packet or an unacknowledged update response packet. During retries, if no response is

		received the routes through the next hop router are marked unreachable. *interval* - The timeout interval to be used to retransmit the update request packet or an unacknowledged update response packet *retries* - The maximum number of retransmissions of the update request and update response packets.
Step 6	**redistribute { all | bgp | connected | ospf | static } [route-map <name(1-20)>]**	(Optional) Enables redistribution of corresponding protocol routes into RIP. *all* - Advertises all routes learned in the RIP process. *connected* - Connected routes redistribution. *ospf* - Advertises routes learned by OSPF in the RIP process. *static* - Statically configured routes to advertise in the RIP process. *route-map* - Name of the Route Map to be applied during redistribution of routes from Route Table Manager to RIP. If this is not specified, all routes are redistributed.
Step 7	**default-metric <value>**	(Optional) Configure the metric to be used for redistributed routes. The default-metric command is used in conjunction with the redistribute router configuration command to cause the current routing protocol to use the same metric value for all redistributed routes. NOTE: This command can be configured only if RIP redistribution is enabled in Interface mode.
Step 8	**route-tag <1-65535>**	(Optional) Configure the route tag to be used for redistributed routes.
Step 9	**auto-summary {enable | disable}**	(Optional) Enable/Disable auto summarization feature in RIP
Step 10	**ip rip security { minimum | maximum }**	(Optional) Accept/ignore RIP1 packets when authentication is in use

		minimum - Denotes that the RIP1 packets will be accepted even when authentication is in use **maximum** - Denotes that the RIP1 packets will be ignored when authentication is in use.
Step 11	**passive-interface {vlan <vlan-id(1-4069)> | <interface-type> <interface-id>}**	(Optional) Suppress routing updates on an interface
Step 12	**output-delay**	(Optional) Enable inter-packet delay for RIP updates
Step 13	**end**	Exit from Configuration mode.
Step 14	show ip rip { database [<ip-address> <ip-mask>] | statistics }	Display IP RIP protocol database or statistics

These commands either delete the particular configuration or reset it to its default value.

no network <ip-address> [unnum {vlan <integer(1-4069)> | <iftype> <ifnum>}]
no ip rip security
no ip rip retransmission { interval | retries }
no passive-interface {vlan <vlan-id(1-4069)> | <interface-type> <interface-id>}
no output-delay
no redistribute { all | bgp | connected | ospf | static } [route-map <name(1-20)>]
no default-metric
no route-tag

18.1.14.6 RIP Configuration Example

The example below shows the commands used to configure RIP by using 2 switches: Switch A and switch B.

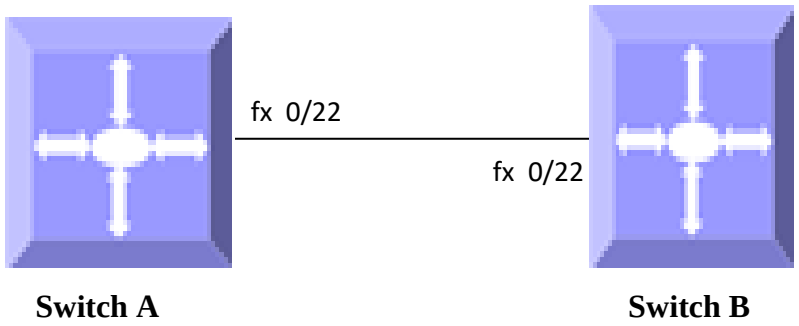


Figure IP-Unicast-Routing-1: RIP Configuration Example

On switch A

SMIS# configure terminal
SMIS(config)# vlan 200
SMIS(config-vlan)# exit

```
SMIS(config)# interface fx 0/22
SMIS(config-if)# switchport mode access
SMIS(config-if)# switchport access vlan 200
SMIS(config)# interface vlan 200
SMIS(config-if)# ip address 10.10.10.2
SMIS(config-if)# exit
SMIS(config)# router rip
SMIS(config-router)# network 10.10.10.2
SMIS(config-router)# neighbor 10.10.10.1
SMIS(config-router)# end
```

SMIS# **show ip rip database**

```
10.0.0.0/8  [1]       auto-summary
10.0.0.0/8  [1]       directly connected, vlan200
```

SMIS# **show ip rip statistics**

```
RIP Global Statistics:
----------------------
 Total number of route changes is 0
 Total number of queries responded is 0
 Total number of dropped packets is 0

RIP Interface Statistics:
-------------------------
Interface        Periodic      BadRoutes   Triggered     BadPackets   Admin
IP Address       Updates Sent   Received    Updates Sent   Received     Status
-----------      ------------   ---------   ------------   ----------   ------
10.10.10.2          3           0         1           0        Enabled
```

SMIS# **show running-config**

```
Building configuration...
Switch ID      Hardware Version              Firmware Version

vlan 1
 ports fx 0/1-20 untagged
 ports fx 0/22-48 untagged
 ports cx 0/1-6 untagged
exit
vlan 200
exit

interface Fx 0/22
 switchport mode access
 switchport access vlan 200

exit

interface vlan 200
```

```
 ip address  10.10.10.2 255.0.0.0

exit
router rip
 neighbor 10.10.10.1
 network 10.10.10.2
exit
```

On switch B

```
SMIS# configure terminal
SMIS(config)# vlan 200
SMIS(config-vlan)# exit
SMIS(config)# interface fx 0/22
SMIS(config-if)# switchport mode access
SMIS(config-if)# switchport access vlan 200
SMIS(config)# interface vlan 200
SMIS(config-if)# ip address 10.10.10.1
SMIS(config-if)# exit
SMIS(config)# router rip
SMIS(config-router)# network 10.10.10.1
SMIS(config-router)# neighbor 10.10.10.2
SMIS(config-router)# end
```

SMIS# **show ip rip database**

```
10.0.0.0/8  [1]       auto-summary
10.0.0.0/8  [1]       directly connected, vlan200
```

SMIS# **show ip rip statistics**

```
RIP Global Statistics:
----------------------
 Total number of route changes is 0
 Total number of queries responded is 1
 Total number of dropped packets is 0

RIP Interface Statistics:
-------------------------
Interface        Periodic      BadRoutes   Triggered     BadPackets   Admin
IP Address       Updates Sent   Received    Updates Sent   Received    Status
-----------      ------------   ---------   ------------   ----------   ------
10.10.10.1          4           0         1           0        Enabled
```

SMIS# **show running-config**

```
Building configuration...
Switch ID      Hardware Version             Firmware Version

vlan 1
```

```
 ports fx 0/1-20 untagged
 ports fx 0/22-48 untagged
 ports cx 0/1-6 untagged
exit
vlan 200
exit

interface Fx 0/22
 switchport mode access
 switchport access vlan 200

exit
interface vlan 200
 ip address  10.10.10.1 255.0.0.0

exit
router rip
 neighbor 10.10.10.2
 network 10.10.10.1
exit
interface vlan 200
exit
```

18.2 OSPF

OSPF is an Interior Gateway routing protocol that can scale well in large environments. OSPF supports the following features:

- Variable Length Subnet masks (VLSM)
- The use of areas to minimize Central Processing Unit (CPU) and memory requirements.
- A simple cost metric that can be manipulated to support up to six equal cost paths.
- The use of authentication to ensure OSPF updates are secure and the use of multicast updates to conserve bandwidth.
- Faster convergence times ensuring updates and changes are propagated across the network.
- No limitation of network diameter or hop count. Limiting factors include only CPU and memory resources.
- The ability to tag OSPF information injected from any autonomous systems.

OSPF enabled switch multicasts Link State Advertisements (LSAs) to inform all other routers in the area of its neighbors and costs. Based on OSPF LSAs, each router constructs a topology table which contains every connection link within the network. Then, the Dijkstra algorithm runs over the topology table to find the shortest path to every other router, and hence creates the routing table. This algorithm, which is also known as the SPF algorithm, runs on every OSPF enabled router on the network, and routers within a particular area all have the same topology tree of the specific area.

18.2.1 Neighbor & DR

OSPF routers exchange hellos with neighboring routers and in the process learn their neighbor's Router ID (RID) and cost, these values are stored to the adjacency table.

Supermicro switch establishes OSPF adjacencies between all neighbors on a multi-access network (such as Ethernet). This ensures all routers do not need to maintain full adjacencies with each other.

The Designated Router (DR) is selected based on the router priority. In a tie, the router with the highest router ID is selected. Backup DR is a router designed to perform the same functions in case the DR fails.

18.2.2 LSA

Once a router has exchanged hellos with its neighbors and captured Router IDs and cost information, it begins sending LSAs, or Link State Advertisements. Link state is the information shared between directly connected routers. This information propagates throughout the network unchanged and is also used to create a shortest path first (SPF) tree.

The OSPF standard defines a number of LSAs types. Unlike distance vector protocols (for example, RIP), OSPF does not actually send its routing table to other routers. Instead, OSPF sends the LSA database and derives the IP routing table from LSAs.

In order to avoid LSA storm, each LSA has a sequence number which is incremented only if LSA has changed. Each LSA also has an age value that is set to zero by the originating switch and increased by every switch during flooding.

The common types of LSA are

Type 1 – Router LSA, containing router ID and link information

Type 2 – Network LSA contains DR and broadcast segment details

Type 3 – Network Summary LSA originated by ABR only and contains metric and subnet information

Type 4 – ASBR Summary LSA originated by ABR only and advertised to ASBR contains router ID, mask and metric

Type 5 – AS external LSA originated by ASBR contains external route and default route information

18.2.3 Area

An OSPF area is defined as a logical grouping of routers by a network administrator. OSPF routers in any area contain same topological view, also known as the OSPF database of the network. OSPF is configured in multiple areas in order to reduce routing table sizes, which in turn reduces the topological database and switch CPU/memory requirements.

OSPF is not just configured in one large area, so all routers share the same topological database. The use of multiple areas ensures that the flooding and database management required in large OSPF networks is reduced within each area so that the process of flooding the full database and maintaining full network connectivity does not consume a large portion of the CPU processing power and network bandwidth. Every time a network change occurs, the CPU on a router is interrupted and a new OSPF tree is calculated. Running the shortest path first (SPF) algorithm itself is not CPU intensive, but sending and flooding the network with new topological information is extremely CPU intensive.

Areas are identified through a 32-bit Area ID expressed in dotted decimal notation. All OSPF areas must be connected to the backbone in case of network failure. When an area cannot reside physically or logically on the backbone, a *virtual link* is required. There are four types of Areas used in OSPF:

- *Backbone Area*: Alternate Name for Area 0. This includes all ABRs and internal routers of the backbone area. The backbone is a hub for inter-area transit traffic and the distribution of routing information between areas. Inter-area traffic is routed to the backbone, then routed to the destination area, and finally routed to the destination host within the destination area Routers on the backbone also advertise the summarized routes within their areas to the other routers on the backbone. Backbone area helps avoid routing loops as it is the trunk of the network.

- *Regular Area*: Non-backbone area, with both internal and external routes

- *Stub area*: An area that contains a single exit point from the area. Areas that reside on the edge of the network with no exit point except one path can be termed a stub area.
- *Not-So-Stubby-Area (NSSA)*: This area is used to connect to an ISP. All advertised routes can be flooded through the NSSA but are blocked by the ABR.

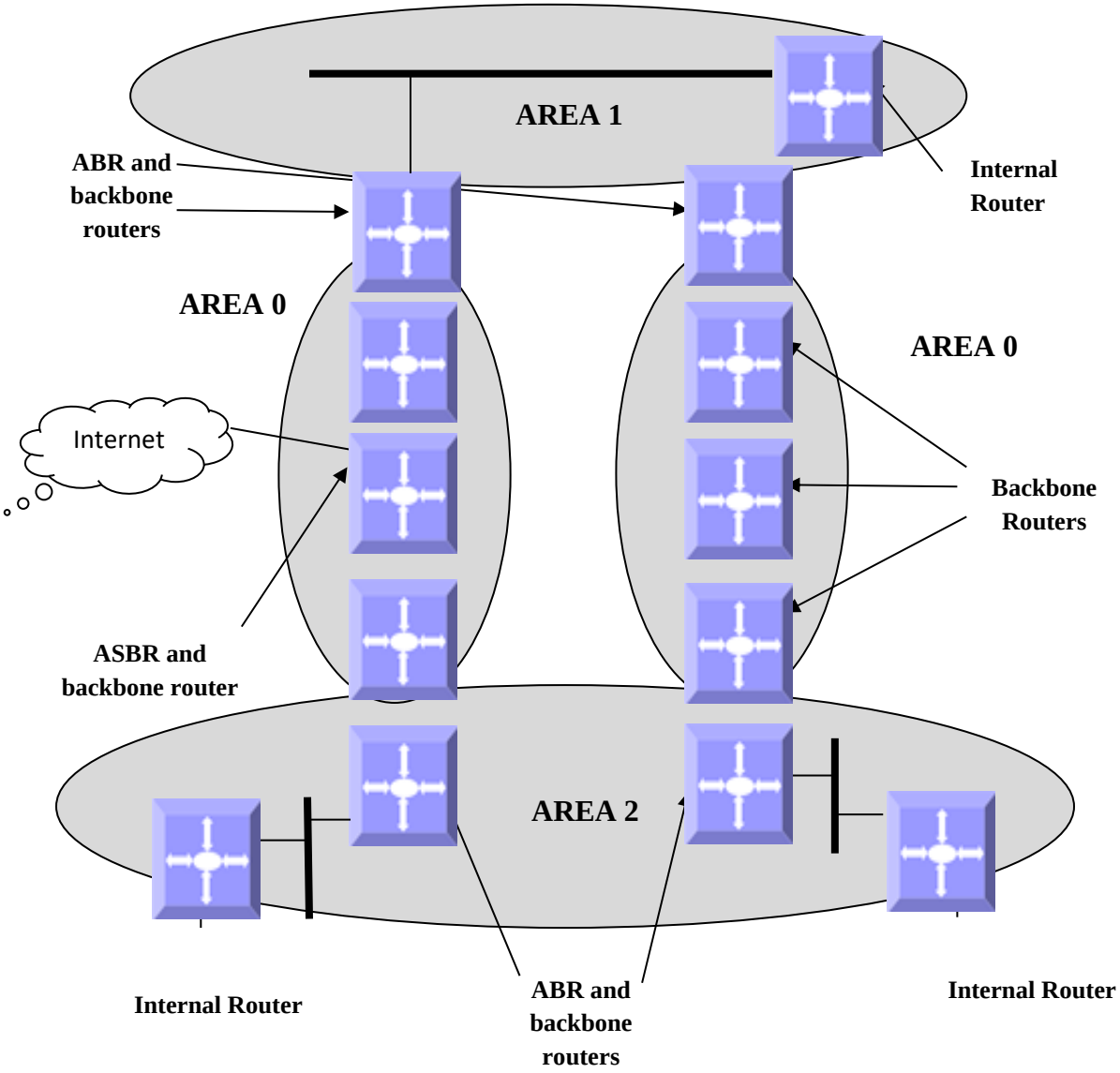


Figure IP-Unicast-Routing-2: OSPF Area

18.2.4 OSPF Router Types

There are different types of OSPF Routers classified based on functionality.

- *Internal Router:* This router is within a specific area only. Internal router functions include maintaining the OSPF database and forwarding data to other networks. All interfaces on internal routers are in the same area.

- *Backbone Router:* Backbone routers are connected to area 0, which is also represented as area 0.0.0.0. A backbone router can perform ASBR functions as well as ABR functions.

- *Area Border Router (ABR):* ABRs are responsible for connecting two or more areas. An ABR contains the full topological database for each area it is connected to and sends this information to other areas. ABRs contain a separate Link State Database, separating LSA flooding between areas, optionally summarizing routes, and optionally sourcing default routes.

- *Autonomous System Boundary Router (ASBR):* Router that has at least one interface in an OSPF area and at least one interface outside of an OSPF area. Routers that connect to, for example, the Internet and redistribute external IP routing tables from such protocols as Border Gateway Protocol (BGP) are termed autonomous system boundary routers (ASBRs).

18.2.5 Types of routes

OSPF supports two types of routes: Internal routers and External OSPF. External routes are routing entries in OSPF route tables injected by an external routing protocol, such as BGP. When calculating the cost to a remote network, internal routes add the total cost to destination; whereas External routes include only the cost to the external network.

18.2.6 Default route

When redistribution of routes into an OSPF routing domain is configured, the route becomes an autonomous system boundary router (ASBR). The ASBR can generate a default route into the OSPF routing domain by user configuration.

18.2.7 Metric

The OSPF process assigns cost values to interfaces based on the inverse of the bandwidth parameter assigned to the interface with the bandwidth command. For calculating the SPF to a given destination, the router takes into consideration the costs of the links along various paths. The path with the lower cost is selected as the shortest path. The SPF algorithm only runs within a single area, so routers only compute paths within their own area. Inter-area routes are passed using border routers.

18.2.8 Router Id

The source of Link-state Advertisements in a given area is identified by the Router ID. This ID has the form of an IP address and can be automatically or manually defined.

18.2.9 Priority

In multi-access networks the router with the highest priority value is chosen as the DR which acts as the central point of LSAs exchange. Supermicro switches provide OSPF DR priority configuration.

18.2.10 Route Summarization

Route summarization is the consolidation of advertised addresses into a single summary route to be advertised by other areas. Summarization occurs using the LSA type 4 packet or by the ASBR. OSPF can be configured in two ways to summarize networks:

- Inter-area summarization creating type 3 or 4 LSAs
- External summarization with type 5 LSAs

18.2.11 Authentication

OSPF does not authenticate its protocol's messages or route updates. OSPF does, however, support two message authentication options:

- Simple Authentication- using plaintext keys
- MD5 Authentication - Matching authentication methods and keys must be configured on each interface on a segment. Theoretically, different passwords could be applied to different router interfaces – the routers on the other ends of those links would just be required to have matching information.

18.2.12 Timers

Supermicro switches provide configuration of the delay time between when OSPF receives a topology change and when it starts the shortest path first (SPF) calculation and the hold time between two SPF calculations.

18.2.13 Virtual Link

In OSPF, all areas must be connected to a backbone area. A virtual link can be configured in case of a backbone-continuity break by configuring two Area Border Routers as endpoints of a virtual link. Configuration information includes the identity of the other virtual endpoint (the other ABR) and the non-backbone link that the two routers have in common (the transit area). Virtual links cannot be configured through a stub area.

18.2.14 Passive Interface

The passive-interface interface command disables OSPF hellos from being sent out, thus disabling the interface from forming adjacencies out that interface.

18.2.15 Demand Circuit

A demand circuit is a point-to-point connection between two neighboring interfaces configured for OSPF. Demand circuits increase the efficiency of OSPF on the configured interfaces by stopping the periodic transmission of OSPF packets, like Hello and LSA. OSPF can establish a demand link to form an adjacency and perform initial database synchronization; the adjacency remains active even after Layer 2 of the demand circuit goes down.

18.2.16 Network Type

Internet network types are dependent on the layer 2 technology used such as Ethernet, point-to-point T1 circuit, and frame relay. The various OSPF network types and their compatibility with one another are specified below.

Non-Broadcast: This is the default for OSPF enabled frame relay physical interfaces. Non-Broadcast networks require static neighbor configuration and OSPF hellos are sent via unicast. The Non-Broadcast network type has a 30 second hello and 120 second dead timer. An OSPF Non-Broadcast network type requires the use of a DR/BDR.

Broadcast: This is the default for an OSPF enabled ethernet interface. The Broadcast network type requires link support Layer 2 Broadcast capabilities. The Broadcast network type has a 10 second hello and 40 second dead timer. An OSPF Broadcast network type requires the use of a DR/BDR.

Point-to-Point: A Point-to-Point OSPF network type does not maintain a DR/BDR relationship. The Point-to-Point network type has a 10 second hello and 40 second dead timer. Point-to-Point network types are intended to be used between 2 directly connected routers.

Point-to-Multipoint: This is viewed as a collection of point-to-point links. Point-to-Multipoint networks do not maintain a DR/BDR and advertise a hot route for all the frame-relay endpoints. The Point-to-Multipoint network type has a 30 second hello and 120 second dead timer.

18.2.17 OSPF Configuration

18.2.17.1 OSPF Default Configuration

Parameter	Default Value
Status	Disabled
Router Id	None
Area	None
Hello Interval	10 seconds
Router Dead Interval	40
Trans Delay	1
Router priority	1
Retransmission Interval	5
Polling Interval	120
Passive Interface Status	Disabled
Secondary IP	Disabled

ASBR Status	Disabled
NSSA ASBR Status	Disabled
RPF 1583 Compatibility	Enabled
LSA Interval	5
SPF Hold time	10 milliseconds
SPF Interval	1 milliseconds
ABR	Standard ABR

18.2.17.2 Enabling OSPF

OSPF is disabled by default in Supermicro switches. Follow the steps below to enable OSPF and configure an OSPF router ID.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router ospf**	Enable OSPF routing process
Step 3	router-id <router ip address>	Configure the Router ID
Step 4	**End**	Exits the configuration mode.
Step 5	**show ip ospf info**	Display general information about OSPF routing process.

The "**no router ospf"** command disables OSPF in the switch.

18.2.17.3 OSPF Neighbor

Supermicro switches provide option to configure OSPF neighbors. Follow the steps below to configure OSPF neighbor.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router ospf**	Enable OSPF routing process
Step 3	router-id <router ip address>	Configure the Router ID
Step 4	neighbor <neighbor-id> [priority <priority value (0-255)>]	Specify a neighbor router and its priority
Step 5	**End**	Exits the configuration mode.
Step 6	**show ip ospf neighbor [{ vlan <vlan-id (1-4069)> | <interface-type> <interface-id> }] [Neighbor ID] [detail]**	Display OSPF neighbor information list

The "**no neighbor <neighbor-id> [priority]"** command deletes the OSPF neighbor.

18.2.17.4 Area Parameters

Supermicro switches provide configuration options for OSPF area. Follow the steps below to configure OSPF area and its parameters.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router ospf**	Enable OSPF routing process
Step 3	router-id <router ip address>	Configure the Router ID
Step 4	neighbor <neighbor-id> [priority <priority value (0-255)>]	Specify a neighbor router and its priority
Step 5	network <Network number> area <area-id> [unnum Vlan <PortNumber>]	(Optional) Define the interfaces on which OSPF runs and to define the area ID for those interfaces
Step 6	area <area-id> stability-interval <Interval-Value (0 - 0x7fffffff)>	(Optional) Configure the Stability interval for NSSA area
Step 7	area <area-id> translation-role { always | candidate }	(Optional) Configure the translation role for the NSSA area
Step 8	no area <area-id> translation-role	(Optional) Configure the default translation role for the NSSA area
Step 9	compatible rfc1583	(Optional) Configure OSPF compatibility list compatible with RFC 1583
Step 10	abr-type { standard | cisco | ibm }	(Optional) Configure the Alternative ABR Type
Step 11	area <area-id> nssa [{ no-summary | default-information-originate [metric <value>] [metric-type <Type(1-3)>] [tos <tos value (0-30)>] }]	(Optional)Configure an area as a NSSA area and other parameters related to that area
Step 12	area <area-id> stub [no-summary]	(Optional)Specify an area as a stub area
Step 13	default-information originate always [metric <metric-value (0-0xffffff)>] [metric-type <type (1-2)>]	(Optional) Enable generation of a default external route into an OSPF routing domain
Step 14	area <area-id> virtual-link <router-id> [authentication { simple |message-digest | null}] [hello-interval <value (1-65535)>] [retransmit-interval <value (0-3600)>] [transmit-delay <value (0-3600)>] [dead-interval <value>] [{authentication-key <key (8)> | message-digest-key <Key-id (0-255)> md5 <key (16)>}]	(Optional) Define an OSPF virtual link and its related parameters
Step 15	ASBR Router	(Optional) Specify this router as ASBR
Step 16	area <AreaId> range <Network> <Mask> {summary | Type7} [{advertise | not-advertise}] [tag <value>]	(Optional)Consolidates and Summarizes routes at an area boundary
Step 17	summary-address <Network> <Mask> <AreaId> [{allowAll | denyAll | advertise | not-advertise}] [Translation {enabled | disabled}]	(Optional) Creates aggregate addresses for OSPF
Step 18	redistribute {static | connected | rip | bgp | all}	(Optional) Configures the protocol from which the routes has to be redistributed into OSPF

Step 19	redist-config <Network> <Mask> [metric-value <metric (1 - 16777215)>] [metric-type {asExttype1 | asExttype2}] [tag <tag-value>}	(Optional) Configure the information to be applied to routes learnt from RTM
Step 20	set nssa asbr-default-route translator { enable | disable }	(Optional) Enable/Disable setting of P bit in the default Type 7 Lsa generated by NSSA internal ASBR
Step 21	passive-interface {vlan <vlan-id(1-4069)> | <interface-type> <interface-id>}	(Optional) Suppress routing updates on an interface
Step 22	passive-interface default	(Optional) Suppress routing updates on all interfaces
Step 23	**End**	Exits the configuration mode.
Step 24	**show ip ospf request-list [<neighbor-id>] [{ vlan <vlan-id (1-4069)> | <interface-type> <interface-id> }]**	Display OSPF Link state request list information
	show ip ospf border-routers	Display OSPF Border and Boundary Router Information
	show ip ospf {area-range | summary-address}	Display OSPF Summary-address redistribution Information
	show ip ospf info	Display general information about OSPF routing process
	show ip ospf [area-id] database [{database-summary | self-originate | adv-router <ip-address>}]	Display routes learned by OSPF process Display OSPF LSA Database summary
	show ip ospf [area-id] database { asbr-summary | external | network | nssa-external | opaque-area | opaque-as | opaque-link | router | summary } [link-state-id] [{adv-router <ip-address> | self-originate}]	Display OSPF Database summary for the LSA type
	show ip ospf request-list [<ip_addr>] [{ vlan <integer(1-4069)> | <iftype> <ifnum> }]	Display OSPF Link state request list information
	show ip ospf virtual-links	Display OSPF Virtual link information
	show ip ospf border-routers	Display OSPF Border and Boundary Router Information
	show ip ospf {area-range | summary-address}	Display OSPF Summary-address redistribution Information
	show ip ospf	Display general information about OSPF routing process
	show ip ospf route	Display routes learned by OSPF process
		Display OSPF LSA Database summary

	show ip ospf [area-id] database [{database-summary | self-originate | adv-router <ip-address>}] **show ip ospf [area-id] database { asbr-summary | external | network | nssa-external | opaque-area | opaque-as | opaque-link | router | summary } [link-state-id] [{adv-router <ip-address> | self-originate}]**	Display OSPF Database summary for the LSA type

These commands delete the particular configuration or reset it to its default value.

no area <area-id> stability-interval
no compatible rfc1583
no area <area-id> default-cost [tos <tos value (0-30)>]
no area <area-id> [{ stub | nssa }]
no default-information originate always [metric <metric-value (0-0xffffff)>] [metric-type <type (1-2)>]
no area <area-id> virtual-link <router-id> [authentication] [hello-interval] [retransmit-interval] [transmit-delay] [dead-interval] [{authentication-key | message-digest-key <Key-id (0-255)>}]
no ASBR Router
no area <AreaId> range <Network> <Mask>
no summary-address <Network> <Mask> <AreaId>
no redistribute {static | connected | rip | bgp | all}
no redist-config <Network> <Mask>
no network <Network number> area <area-id> [unnum Vlan <PortNumber>]
no passive-interface {vlan <vlan-id(1-4069)> | <interface-type> <interface-id>}
no passive-interface default

18.2.17.5 Interface Parameters

All OSPF Interface level configurations are all optional and must be consistent/compatible across all routers in an attached network. Follow the steps below to configure OSPF parameters in Supermicro switch.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router ospf**	Enable OSPF routing process
Step 3	router-id <router ip address>	Configure the Router ID
Step 4	neighbor <neighbor-id> [priority <priority value (0-255)>]	Specify a neighbor router and its priority
Step 5	**Exit**	Exit the Router Configuration mode.
Step 6	**interface <*interface-type*><*interface-id*>** or **interface range <*interface-type*><*interface-id*> ….**	(Optional) Enters the interface configuration mode. *interface-type* – may be any of the following: vlan

		interface-id is 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 vlan 1-10** To provide multiple interfaces or ranges, separate with a comma (,). E.g.: **int range vlan 1-10, 20** If multiple interfaces are provided, the next step will perform the particular configuration on all these interfaces.
Step 7	**ip ospf demand-circuit**	Configure OSPF to treat the interface as an OSPF demand circuit
Step 8	**ip ospf retransmit-interval <seconds (0 - 3600)>**	Specify the time between link-state advertisement (LSA) retransmissions for adjacencies belonging to the interface
Step 9	**ip ospf transmit-delay <seconds (0 - 3600)>**	(Optional) Configure the estimated time it takes to transmit a link state update packet on the interface
Step 10	**ip ospf priority <value (0 - 255)>**	(Optional) Configure the router priority
Step 11	**ip ospf hello-interval <seconds (1 - 65535)>**	(Optional) Specify the interval between hello packets sent on the interface
Step 12	**ip ospf dead-interval <seconds (0-0x7fffffff)>**	(Optional) Configure the interval at which hello packets must not be seen before neighbors declare the router down
Step 13	**ip ospf cost <cost (1-65535)> [tos <tos value (0-30)>]**	(Optional) Explicitly specify the cost of sending a packet on an interface Type of Service (TOS) is defined as a mapping to the IP Type of Service Flags as defined in the IP Forwarding Table MIB. The condition to select next-hop for a destination from a multipath route (set of next hops for a given destination) is referred to as 'policy', which is specified by the TOS Field. However, TOS field is no longer in use.
Step 14	**ip ospf network {broadcast | non-broadcast | point-to-multipoint | point-to-point}**	(Optional) Configure the OSPF network type to a type other than the default for a given media
Step 15	**ip ospf authentication-key <password (8)>**	(Optional) Specify a password to be used by neighboring routers that are using

		the OSPF simple password authentication
Step 16	**ip ospf authentication [{message-digest | null}]**	(Optional) Specify the authentication type for an interface
Step 17	**ip ospf message-digest-key <Key-ID (0-255)> md5 <md5-Key (16)>**	(Optional) Enable OSPF MD5 authentication
Step 18	**End**	Exits the configuration mode.
Step 19	**show ip ospf interface [{ vlan <vlan-id (1-4069)> | <interface-type> <interface-id> }]** **show ip ospf retransmission-list [<neighbor-id>] [{ vlan <vlan-id (1-4069)> | <interface-type> <interface-id> }]** **show ip ospf info**	Display OSPF interface information Display OSPF Link state retransmission list information Display general information about OSPF routing process

These commands delete the particular configuration or reset it to its default value.

no ip ospf demand-circuit
no ip ospf retransmit-interval
no ip ospf transmit-delay
no ip ospf priority
no ip ospf hello-interval
no ip ospf dead-interval
no ip ospf cost [tos <tos value (0-30)>]
no ip ospf network
no ip ospf authentication-key
no ip ospf authentication
no ip ospf message-digest-key <Key-ID (0-255)>

18.2.17.6 OSPF Configuration Example

The example below shows the commands used to configure OSPF by connecting 2 switches: Switch A and Switch B.

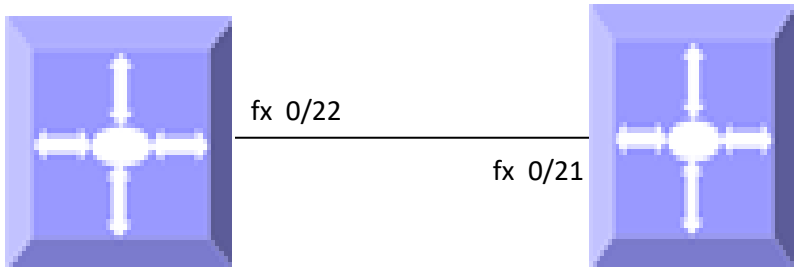


Figure IP-Unicast-Routing-3: OSPF Configuration Example

.**On Switch A**

```
SMIS# configure terminal
SMIS(config)# vlan 10
SMIS(config-vlan)# ports fx 0/21 untagged
SMIS(config-vlan)# exit
SMIS(config)# interface fx 0/21
SMIS(config-if)# switchport pvid 10
SMIS(config-if)# exit
SMIS(config)# interface vlan 10
SMIS(config-if)# ip address 10.10.10.1
SMIS(config-if)# exit
SMIS(config)# router ospf
SMIS(config-router)# router-id 10.10.10.1
SMIS(config-router)# network 10.10.10.1 area 0.0.0.0
SMIS(config-router)# end
```

SMIS# **show ip ospf neighbor**

```
 Vrf  default
Neighbor-ID  Pri   State           DeadTime   Address         Interface
-----------  ---   -----          --------   -------         ---------
10.10.10.2   100   FULL/DR_OTHER     30        10.10.10.2       vlan10
```

SMIS# **show ip ospf info**

```
 OSPF Router with ID (10.10.10.1) (Vrf  default)
  Supports only single TOS(TOS0) route
  ABR Type supported is Standard ABR
  Number of Areas in this router is 1
  Area is 0.0.0.0
  Number of interfaces in this area is 1
  SPF algorithm executed 15 times
```

SMIS# **show ip ospf route**

```
 Vrf  default

OSPF Routing Table

Dest/Mask                TOS NextHop/Interface Cost Rt.Type   Area

---------                --- -------/--------- ---- -------   ----

10.0.0.0/255.0.0.0          0   0.0.0.0/vlan10    100  IntraArea 0.0.0.0
```

SMIS# **show ip ospf interface**

```
vlan10 is line protocol is up
```

Internet Address 10.10.10.1, Mask 255.0.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.10.1, Network Type BROADCAST, Cost 100
Transmit Delay is 500 sec, State 4, Priority 200
Designated RouterId 10.10.10.1, Interface address 10.10.10.1
Backup Designated RouterId 10.10.10.2, Interface address 10.10.10.2
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 500
Hello due in 4 sec
Neighbor Count is 1, Adjacent neighbor count is 1
Adjacent with the neighbor 10.10.10.2
Connected to VRF default

SMIS# **show running-config**

Building configuration...
Switch ID Hardware Version Firmware Version

vlan 1
ports fx 0/1-48 untagged
ports cx 0/1-6 untagged
exit
vlan 10
ports fx 0/21 untagged
exit

interface Fx 0/21
switchport pvid 10

exit
interface vlan 10
ip address 10.10.10.1 255.0.0.0

exit
router ospf
router-id 10.10.10.1
network 10.10.10.1 area 0.0.0.0
exit

On Switch B

SMIS# configure terminal
SMIS(config)# vlan 10
SMIS(config-vlan)# ports fx 0/22 untagged
SMIS(config-vlan)# exit
SMIS(config)# interface fx 0/22
SMIS(config-if)# switchport pvid 10
SMIS(config-if)# exit
SMIS(config)# interface vlan 10
SMIS(config-if)# ip address 10.10.10.2
SMIS(config-if)# exit
SMIS(config)# router ospf
SMIS(config-router)# router-id 10.10.10.2

```
SMIS(config-router)# network 10.10.10.2 area 0.0.0.0
SMIS(config-router)# end
```

SMIS# **show ip ospf neighbor**

```
 Vrf  default
Neighbor-ID  Pri   State           DeadTime   Address         Interface
-----------  ---   -----          --------   -------         ---------
10.10.10.1   200   FULL/DR          36       10.10.10.1       vlan10
```

SMIS# **show ip ospf info**

```
 OSPF Router with ID (10.10.10.2) (Vrf  default)
  Supports only single TOS(TOS0) route
  ABR Type supported is Standard ABR
  Number of Areas in this router is 1
  Area is 0.0.0.0
  Number of interfaces in this area is 1
  SPF algorithm executed 17 times
```

SMIS# **show ip ospf interface**

```
vlan10 is line protocol is up
  Internet Address 10.10.10.2, Mask 255.0.0.0, Area 0.0.0.0
  AS 1, Router ID 10.10.10.2, Network Type BROADCAST, Cost 100
  Transmit Delay is 500 sec, State 5, Priority 100
  Designated RouterId 10.10.10.1, Interface address 10.10.10.1
  Backup Designated RouterId 10.10.10.2, Interface address 10.10.10.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40,  Retransmit 500
  Hello due in 2 sec
  Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with the neighbor 10.10.10.1
 Connected to VRF   default
```

SMIS# **show ip ospf route**

```
 Vrf  default

OSPF Routing Table

Dest/Mask                TOS NextHop/Interface Cost Rt.Type   Area

---------                --- -------/--------- ---- -------   ----

10.0.0.0/255.0.0.0         0   0.0.0.0/vlan10    100  IntraArea 0.0.0.0
```

SMIS# **show running-config**

```
Building configuration...
Switch ID      Hardware Version            Firmware Version

vlan 1
```

```
 ports fx 0/1-48 untagged
 ports cx 0/1-6 untagged
exit
vlan 10
 ports fx 0/22 untagged
exit

interface Fx 0/22
 switchport pvid 10

exit
interface vlan 10
 ip address  10.10.10.2 255.0.0.0

exit
router ospf
router-id 10.10.10.2
network 10.10.10.2 area 0.0.0.0
exit
```

18.3 BGP

Border Gateway Protocol (BGP) is an inter-domain routing protocol designed to provide loop-free routing links between organizations. BGP is designed to run over a reliable transport protocol using Port 179. BGP is used to connect a local network to an external network in order to access the Internet or to connect to other organizations. When connecting to an external organization, external BGP (eBGP) peering sessions are created. BGP peers within the same organization exchange routing information through internal BGP (iBGP) peering sessions. Supermicro switches support BGP version 4.

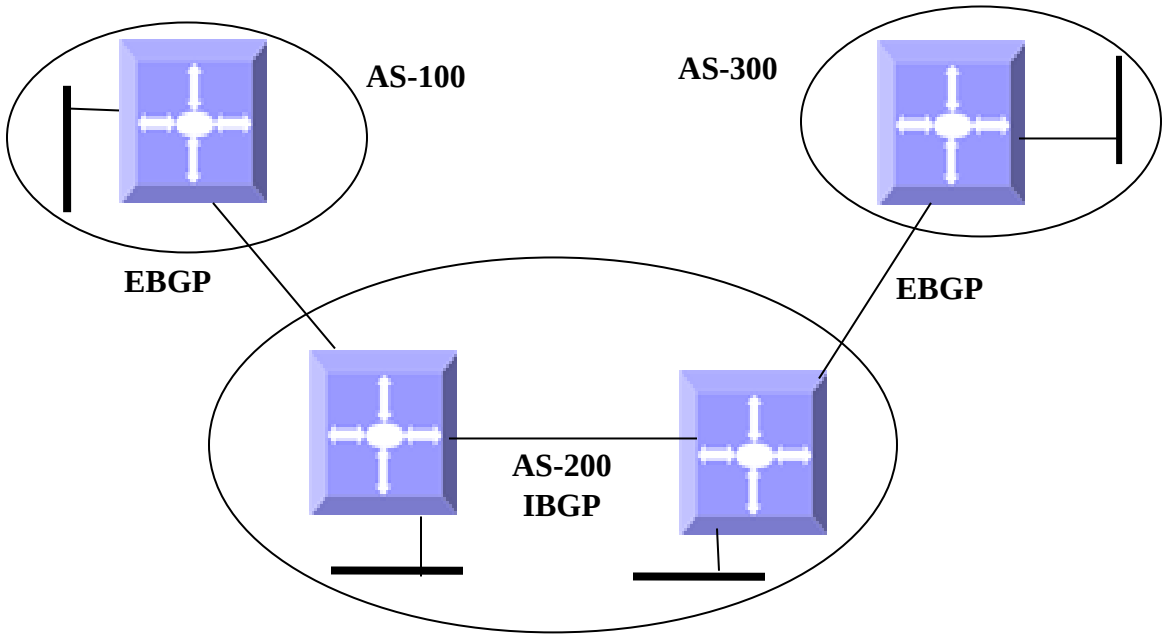


Figure IP-Unicast-Routing-1: BGP

BGP uses a path-vector routing algorithm to exchange network reachability information with other BGP speaking networking devices. Network reachability information is exchanged between BGP peers in routing updates. Network reachability information contains the network number, path specific attributes, and the list of autonomous system numbers that a route must transit through to reach a destination network. BGP then selects a single path, by default, as the best path to a destination host or network. The best path selection algorithm utilizes *path attributes* to determine the route to be installed in the BGP routing table.

18.3.1 Router ID

BGP uses router ID to identify BGP-speaking peers. The BGP router ID is represented by an IPv4 address. The BGP router ID must be unique to the BGP peers in a network.

18.3.2 Speaker and Peer

A peer device is a BGP-speaking router that has an active TCP connection to another BGP-speaking device. BGP devices need not be necessarily directly connected. A BGP speaker is the local router and a peer is any other BGP speaking network device.

When a TCP connection is established between peers, each BGP peer initially exchanges all its routes—the complete BGP routing table with the other peer. After this only incremental updates are sent after a change in network topology or routing policy. Peers exchange special messages called keep alive messages.

18.3.3 Autonomous System (AS)

An autonomous system is a network controlled by a single technical administration entity. In BGP autonomous systems are used in individual routing domains with local routing policies.

Each routing domain can support multiple routing protocols. However, each routing protocol is administrated separately. Other routing protocols can dynamically exchange routing information with BGP through redistribution.

18.3.4 Aggregate Addresses

Classless inter-domain routing (CIDR) enables creation of aggregate routes (or supernets) to minimize the size of routing tables. Aggregate routes can be configured in BGP either by redistributing an aggregate route into BGP or by creating an aggregate entry in the BGP routing table.

18.3.5 Route Reflection

Typical BGP requires all IBGP speakers to be fully meshed i.e. when a router receives a route from an external neighbor, it must advertise it to all internal neighbors. To prevent a routing information loop, all IBPG speakers must be connected and the internal neighbors do not share routes among themselves.

With route reflectors, all IBGP speakers need not be fully meshed because another method is used to pass learned routes to neighbors. When an internal BGP peer is configured to be a route reflector, it is responsible for passing IBGP learned routes to a set of IBGP neighbors. The internal peers of the route reflector are divided into two groups: *client peers and non-client peers* (all the other routers in the autonomous system). A route reflector reflects routes between these two groups. The route reflector and its client peers form a

cluster. The non-client peers must be fully meshed with each other, but the client peers need not be fully meshed. The clients in the cluster do not communicate with IBGP speakers outside their cluster.

When the route reflector receives an advertised route, it takes one of these actions, depending on the neighbor:

• A route from an external BGP speaker is advertised to all clients and non-client peers.
• A route from a non-client peer is advertised to all clients.
• A route from a client is advertised to all clients and non-client peers. Hence, the clients need not be fully meshed.

To increase redundancy and to avoid a single point of failure, a cluster might have more than one route reflector. In this case, all route reflectors in the cluster must be configured with the same *cluster ID* so that a route reflector can recognize updates from route reflectors in the same cluster. All the route reflectors serving a cluster should be fully meshed and should have identical sets of client and non-client peers.

18.3.6 Confederation

Another way to reduce the IBGP mesh is to divide an autonomous system into multiple sub-autonomous systems and group them into a single confederation to make it appear as a single autonomous system. Each autonomous system is fully meshed within itself and has a few connections to other autonomous systems in the same confederation. Even though the peers in different autonomous systems have EBGP sessions, they exchange routing information as if they were IBGP peers.

Specifically, the next hop, MED and local preference information is preserved. A *confederation identifier* must be configured to act as the autonomous system number for the group of autonomous systems.

18.3.7 Attributes

BGP has a number of complex attributes used to determine a path to a remote network. These attributes allow greater flexibility and enable a complex routing decision to ensure that the path to a remote network is the best possible path. BGP always propagates the best path to any peers. BGP attributes are carried in update packets.

18.3.7.1 Multi-Exit Discriminator (MED) Attribute

The multi-exit discriminator (MED) or metric attribute is used as a suggestion to an external AS regarding the preferred route into the AS that is advertising the metric. A lower MED is always preferred.

18.3.7.2 Local Preference Attribute

If there are multiple exit points from the AS, the local preference attribute is used to select the exit point for a specific route. A higher local preference is always preferred.

18.3.7.3 Next-Hop Attribute

The EBGP next-hop attribute is the IP address that is used to reach the advertising router. For EBGP peers, the next-hop address is the IP address of the connection between the peers. For IBGP, the EBGP next-hop address is carried into the local AS

18.3.7.4 Community Attribute

Communities allow routes to be tagged for use with a group of routers sharing the same characteristics. The community attribute provides a way of grouping destinations, called communities, to which routing decisions (such as acceptance, preference, and redistribution) can be applied. Some of the predefined community attributes are:

- *no-export* - Do not advertise this route to EBGP peers.
- *no-advertise* - Do not advertise this route to any peer.
- *internet* - Advertise this route to the Internet community; all routers in the network belong to it.
-

The BGP community attribute is an optional transitive attribute of variable length. The attribute consists of a set of four octet values that specify a community. The community attribute values are encoded with an Autonomous System (AS) number in the first two octets, with the remaining two octets defined by the AS. A router can add or modify a community attribute before it passes the attribute to other peers.

The BGP *Extended Community Attribute* provides a community attribute structuring by means of a type field.

18.3.7.5 Cluster ID

This attribute is used in route-reflector environments and is not used for router selection.

A router reflector cluster normally has a single route reflector. To avoid a single point of failure, a cluster can be configured with more than one route reflector. In case of more than one Route Reflector in the group, a cluster of Route reflectors is established. All Router Reflectors in the cluster are in the same cluster -ID.

Route-Reflector algorithm will not accept the update that has the same Cluster-ID as itself in order to prevent looping.

18.3.8 Filters

A number of different filter methods control the send and receive of BGP updates. BGP updates can be filtered with route information as a basis, or with communities as a basis. Packets that do not match the configured filters are dropped.

18.3.9 Overlapping Routes

Overlapping routes are non-identical routes that point to the same destination, e.g. 10.10.128.0/17 and 10.10.192.0/18, in which the second route is actually included in the first route.

A BGP speaker can be configured to make the following choices:

a) Install both the less and the more specific routes

b) Install the more specific route only

e) Install the less specific route only

18.3.10 Synchronization

When a BGP router receives information about a network from an IBGP neighbor, it does not use that information until a matching route is learned via an IGP or static route. This is called Synchronization. It also does not advertise that route to an EBGP neighbor unless a matching route is in the routing table. It is recommended to turn off synchronization when all routers in the autonomous system run BGP.

18.3.11 BGP Path selection

When a BGP speaker receives updates from multiple autonomous systems that describe different paths to the same destination, it must choose the single best path for reaching that destination. When chosen, the selected path is entered into the BGP routing table and propagated to its neighbors. The decision is based on the value of attributes that the update contains and other BGP-configurable factors.

1. If the next hop address is reachable, consider it.
2. Prefer the largest local preference attribute.
3. If the local preference is the same, prefer the route this local router originated.
4. Prefer the route with the shortest AS path.
5. If this is equal, prefer the route with the origin set to originated (through BGP); IGP is preferred to EGP followed by incomplete.
6. If the origin codes are the same, prefer the route with the lowest MED.
7. If the MED is the same, prefer EBGP over IBGP.
8. Prefer the closest path.
9. Finally, if all paths are equal, prefer the path with lowest BGP router ID.

18.3.12 Timers

BGP implementation in Supermicro switches maintains different timers for Peers and Route updates.

- The *keep alive interval* is the time within which keep alive messages are sent to peers.
- The *hold time* is the interval after which a peer is declared inactive after not receiving a keep alive message from it.
- *Route advertisement interval* is the interval between sending BGP routing updates.
- *Connection Retry timer* is the amount of time to wait before re-opening a TCP connection.
- *AS Originate Interval* is the interval between two subsequent update messages for internal peers.

18.3.13 Route dampening

Route flap dampening minimizes the propagation of flapping routes across an internetwork. A route is considered to flap when it is repeatedly available and unavailable. When route dampening is enabled, a

numeric penalty value is assigned to a route when it flaps. When a route's accumulated penalties reach a configurable limit, BGP suppresses advertisements of the route, even if the route is running.

The reuse limit is a configurable value that is compared with the penalty. If the penalty is less than the reuse limit, a suppressed route that is up is advertised again.

Dampening is not applied to routes learned by IBGP as it prevents IBGP peers from having a higher penalty for routes external to the AS.

18.3.14 BGP Configuration

18.3.14.1 BGP Default Configuration

Parameter	Default Value
BGP Status	Disabled
Synchronization	Disabled
Port	179
Preference	100
Metric	0
MED Comparison	Disabled
Peer	None
Overlap policy	Both
Connection retry time	30 seconds
Hold time	120 seconds
Keep alive	30 seconds
AS Originate Interval	15 seconds
Route Advertisement Interval	30 seconds
Authentication	None
EBGP Multihop	Disable
Next-hop self	Disable
Aggregation	Disabled
Metric	0
Route dampening	Enabled
Redistribution	Enabled
AS Number	None
Router ID	None
Community Peer	None
Community Filter	None
Extended Community Peer	None
Extended Community Filter	None

Pre-requisite: Autonomous System (AS) Number "**as-num <value (1-65535)>**" and Router-ID "**router-id <addr>**" must be configured in Supermicro switch prior to BGP Configuration.

18.3.14.2 Enabling BGP

BGP is disabled by default in Supermicro switches. Follow the steps below to enable BGP.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router bgp <AS no(1-65535)>**	Enable BGP and configure the AS number of the BGP Speaker
Step 3	**End**	Exits Configuration mode.
Step 4	**show bgp-version** **show ip bgp info**	Displays the BGP Version information. Displays the general info about bgp protocol.

The "**no router bgp"** command disables BGP in the switch**.**

18.3.14.3 BGP Peer

Supermicro switches provide option to configure BGP Peer. Follow the steps below to configure BGP Peer.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router bgp <AS no(1-65535)>**	Enable BGP and configure the AS number of the BGP Speaker
Step 3	bgp router-id <bgp router id (ip-address)>	Configures the BGP Identifier of the BGP Speaker.
Step 4	neighbor <ip-address> remote-as <AS no(1-65535)>	Creates a Peer and initiates the connection to the peer.
Step 5	neighbor <ip-address> {advertisement-interval <seconds> | as-origination-interval <seconds> | connect-retry-interval <seconds>}	(Optional) Configures neighbor interval.
Step 6	neighbor <ip-address> timers {keepalive <seconds> | holdtime <seconds>}	(Optional) Configures neighbor KeepAlive Time and Hold Time Intervals
Step 7	neighbor <ip-address> shutdown	(Optional) Disables the Peer session.
Step 8	neighbor <ip-address> send-community {both | standard | extended}	(Optional) Enables advertisement of community attributes to (standard/extended) to peer.
Step 9	**neighbor <ip-address> password password-string**	(Optional) Configure the password for TCP-MD5 authentication with peer.
Step 10	**Exit**	Exits BGP Router Mode
Step 11	**shutdown ip bgp**	(Optional) Configure the BGP Speaker Global Admin status DOWN.
Step 12	**End**	Exits Configuration mode.
Step 13	**show ip bgp {[neighbor [<peer-addr>]]| [rib]}**	Displays the status of all BGP4 connections.

	show ip bgp timers **show ip bgp info**	Displays the value of bgp timers. Displays the general info about bgp protocol.

no shutdown ip bgp
no neighbor <ip-address>
no neighbor <ip-address> {advertisement-interval | as-origination-interval | connect-retry-interval}
no neighbor <ip-address> timers {keepalive | holdtime}
no neighbor <ip-address> shutdown
no neighbor <ip-address> password

18.3.14.4 Confederation

Supermicro switches allow configuration of BGP Confederation. Follow the steps below to configure BGP Confederation.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router bgp <AS no(1-65535)>**	Enable BGP and configure the AS number of the BGP Speaker
Step 3	bgp router-id <bgp router id (ip-address)>	Configures the BGP Identifier of the BGP Speaker.
Step 4	neighbor <ip-address> remote-as <AS no(1-65535)>	Creates a Peer and initiates the connection to the peer.
Step 5	**bgp confederation identifier <AS no(1-65535)>**	(Optional) Specify BGP confederation identifier.
Step 6	**bgp confederation peers <AS no(1-65535)>**	(Optional) Configure the AS that belongs to the confederation
Step 7	**End**	Exits Configuration mode.
Step 8	**show ip bgp info** **show ip bgp confed info**	Displays the BGP related information. Displays info about confederation feature.

The commands "**no bgp confederation identifier"** and "**no bgp confederation peers <AS no(1-65535))"** delete the Confederation ID and peers.

18.3.14.5 Attributes

Supermicro switches provide user configuration of BGP attributes. Follow the steps below to configure BGP Attributes.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router bgp <AS no(1-65535)>**	Enable BGP and configure the AS number of the BGP Speaker
Step 3	bgp router-id <bgp router id (ip-address)>	Configures the BGP Identifier of the BGP Speaker.
Step 4	neighbor <ip-address> remote-as <AS no(1-65535)>	Creates a Peer and initiates the (Optional) connection to the peer.
Step 5	bgp default local-preference <Local Pref Value>	(Optional) Configures the Default Local Preference value.
Step 6	**neighbor <ip-address> ebgp-multihop**	(Optional) Enables BGP to establish connection with external peers that are not directly connected
Step 7	neighbor <ip-address> next-hop-self	(Optional) Enables BGP to send itself as the next hop for advertised routes.
Step 8	neighbor <ip-address> send-community {both | standard | extended}	(Optional) Enables advertisement of community attributes to (standard/extended) to peer.
Step 9	bgp always-compare-med	(Optional) Enables the comparison of med for routes received from different autonomous system.
Step 11	bgp med <1-100> remote-as <0-65535> <ip-address> <ip_mask> [intermediate-as <AS-no list-AS1,AS2,...>] value <value> direction <in|out> [override]	(Optional) Configures an entry in MED Table.
Step 12	bgp local-preference <1-100> remote-as <0-65535> <ip-address> <ip_mask> [intermediate-as <AS-no list- AS1,AS2,...>] value <value> direction <in|out> [override]	(Optional) Configures an entry in Local Preference Table.
Step 13	bgp update-filter <1-100> <permit|deny> remote-as <0-65535> <ip-address> <ip_mask> [intermediate-as <AS-no list-AS1,AS2,...>] direction <in|out>	(Optional) Configures an entry in Update Filter Table.
Step 14	bgp cluster-id <cluster id value(ip_address)>	(Optional) Configures the Cluster ID for Route Reflector.
Step 15	bgp comm-route {additive|delete} <ip-address> <ip_mask> comm-value <4294967041-4294967043,65536-4294901759>	(Optional) Configures an entry in additive or delete community table.
Step 16	bgp comm-peer <ip-address> <permit|deny>	(Optional) Enables/Disable advertisement of community attributes to peer
Step 17	**bgp comm-filter <comm-value(4294967041-4294967043,65536-4294901759)> <permit|deny> <in|out>**	(Optional) Allows/Filters the community attribute while receiving or advertising.

Step 18	**bgp comm-policy <ip-address> <ip_mask> <set-add|set-none|modify>**	(Optional) Configures the community attribute advertisement policy for specific destination.
Step 19	**bgp ecomm-route {additive|delete} <ip-address> <ip_mask> ecomm-value <value(xx:xx:xx:xx:xx:xx:xx:xx)>**	(Optional) Configures an entry in additive or delete ext community table.
Step 20	**bgp ecomm-peer <ip-address> <permit|deny>**	(Optional) Enables/Disable advertisement of ext community attributes to peer.
Step 21	**bgp ecomm-filter <ecomm-value(xx:xx:..:xx)> <permit|deny> <in|out>**	(Optional) Allows/Filters the ext community attribute while receiving or advertising
Step 22	**bgp ecomm-policy <ip-address> <ip_mask> <set-add|set-none|modify>**	(Optional) Configures the ext community attribute advertisement policy for specific destination
Step 23	**bgp bestpath med confed**	(Optional) Enables MED comparison among paths learned from confed peers
Step 24	**Exit**	Exits BGP Router Mode
Step 25	**clear ip bgp {* | <ip-address>} [soft {in|out}]**	(Optional) Resets the bgp connection dynamically for inbound and outbound route policy
Step 26	**End**	Exits Configuration mode.
Step 27	**show ip bgp community community-number(4294967041-4294967043,65536-4294901759) [exact]**	Displays routes that belong to specified BGP communities.
	show ip bgp extcommunity <value(xx:xx:xx:xx:xx:xx:xx:xx)> [exact]	Displays routes that belong to specified BGP extended-communities.
	show ip bgp filters	Displays the contents of filter table.
	show ip bgp med	Displays the contents of MED table.
	show ip bgp local-pref	Displays the contents of local preference table.
	show ip bgp info	Displays the general info about bgp protocol.
	show ip bgp community {route|peer|policy|filter}	Displays the contents of community tables.
	show ip bgp extcommunity {route|peer|policy|filter}	Displays the contents of ext-community tables.

no bgp default local-preference
no neighbor <ip-address> ebgp-multihop
no neighbor <ip-address> next-hop-self

no neighbor <ip-address> send-community {both | standard |extended}
no bgp always-compare-med
no bgp med <1-100>
no bgp local-preference <1-100>
no bgp update-filter <1-100>
no bgp cluster-id
no bgp comm-route {additive|delete} <ip-address> <ip_mask> comm-value <4294967041-4294967043,65536-4294901759>
no bgp comm-peer <ip-address>
no bgp comm-filter <comm-value(4294967041-4294967043,65536-4294901759)> <permit|deny> <in|out>
no bgp comm-policy <ip-address> <ip_mask>
no bgp ecomm-route {additive|delete} <ip-address> <ip_mask> ecomm-value <value(xx:xx:xx:xx:xx:xx:xx:xx)>
no bgp ecomm-peer <ip-address>
no bgp ecomm-filter <ecomm-value(xx:xx:..:xx)> <permit|deny> <in|out>
no bgp ecomm-policy <ip-address> <ip_mask>
no bgp bestpath med confed

18.3.14.6 Route Reflection

Supermicro switches allow users to configure Route Reflection. Follow the steps below to configure BGP Route Reflection.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router bgp <AS no(1-65535)>**	Enable BGP and configure the AS number of the BGP Speaker
Step 3	bgp router-id <bgp router id (ip-address)>	Configures the BGP Identifier of the BGP Speaker.
Step 4	neighbor <ip-address> remote-as <AS no(1-65535)>	Creates a Peer and initiates the connection to the peer.
Step 5	bgp client-to-client reflection	(Optional) Configures the Route Reflector to support route reflection to Client Peers.
Step 6	**neighbor <ip-address> route-reflector-client**	(Optional) Configures the Peer as Client of the Route Reflector.
Step 7	**End**	Exits Configuration mode.
Step 8	**show ip bgp {[neighbor [<peer-addr>]]| [rib]}** **show ip bgp info** **show ip bgp rfl info**	Displays the status of all BGP4 connections. Displays the BGP related information. Displays info about Route Reflection feature.

Cluster ID must be configured before configuring Route Reflection.

The "**no bgp client-to-client reflection"** command disables Route Reflection. The "**no neighbor <ip-address> route-reflector-client"** commands delete the Route reflection client.

18.3.14.7 Route Dampening

Supermicro switches provide option to configure Route Dampening. Follow the steps below to configure BGP Route Dampening.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router bgp <AS no(1-65535)>**	Enable BGP and configure the AS number of the BGP Speaker
Step 3	bgp router-id <bgp router id (ip-address)>	Configures the BGP Identifier of the BGP Speaker.
Step 4	neighbor <ip-address> remote-as <AS no(1-65535)>	Creates a Peer and initiates the connection to the peer.
Step 5	**Exit**	Exits BGP Router Mode
Step 6	**ip bgp dampening [<HalfLife-Time> [<Reuse Value> [<Suppress Value> [<Max-Suppress Time>]]]] [-s <Decay Granularity> [<Reuse Granularity> [<Reuse Array Size>]]]**	(Optional) Configures the Dampening Parameters
Step 7	**clear ip bgp <ip-address> flap-statistics**	(Optional) Clear flap-statistics counters for all paths from the neighbor at the IP address.
Step 8	**End**	Exits Configuration mode.
Step 9	**show ip bgp dampening** **show ip bgp info** **show ip bgp dampened-paths** **show ip bgp flap-statistics [<ip-address><Mask>]**	Displays the contents of dampening table. Displays the BGP related information. Displays the dampened routes. Displays the statistics of flapped routes.

The "**no ip bgp dampening [HalfLife-Time [Reuse-Value [Suppress-Value [Max-Suppress-Time]]]] [-s [Decay-Granularity [Reuse-Granularity [Reuse-Array-Size]]]"** command deletes the BGP Dampening Parameters.

18.3.14.8 Other Parameters

Supermicro switches provide configuration of several BGP parameters, like Synchronization, redistribution etc. Follow the steps below to configure BGP parameters.

Step	Command	Description
Step 1	**configure terminal**	Enters the configuration mode
Step 2	**router bgp <AS no(1-65535)>**	Enable BGP and configure the AS number of the BGP Speaker
Step 3	bgp router-id <bgp router id (ip-address)>	Configures the BGP Identifier of the BGP Speaker.
Step 4	bgp nonbgproute-advt <external|both>	(Optional) Controls the advertisement of Non-BGP routes either to the external peer (1) or both to internal & external peer (2)
Step 5	default-metric <Default Metric Value>	(Optional) Configures the Default IGP Metric value.
Step 6	redistribute <static|connected|rip|ospf|all>	(Optional) Configures the protocol from which the routes have to be redistributed into BGP.
Step 7	aggregate-address index <1-100> <ip-address> <ip_mask> [summary-only]	(Optional) Configures an entry in Aggregate Table.
Step 8	**Exit**	Exits BGP Router Mode
Step 9	ip bgp overlap-policy <more-specific|less-specific|both>	(Optional) Configures the Overlap Route policy for the Bgp Speaker.
Step 10	ip bgp synchronization	(Optional) Enables synchronization between BGP and IGP.
Step 11	**clear ip bgp {* | <ip-address>} [soft {in|out}]**	(Optional) sResets the bgp connection dynamically for inbound and outbound route policy
Step 12	**End**	Exits Configuration mode.
Step 13	**show ip bgp info** **show ip bgp aggregate**	Displays the BGP related information. Displays the contents of aggregate table.

These commands reset the particular configuration to its default value.

no ip bgp overlap-policy
no ip bgp synchronization
no bgp nonbgproute-advt
no redistribute <static|connected|rip|ospf|all>
no default-metric

18.3.14.9 BGP Configuration Example

The example below shows the commands used to configure BGP by connecting 2 switches: Switch A and Switch B.

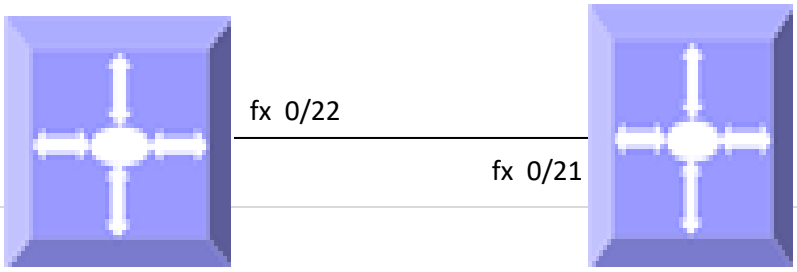


Figure IP-Unicast-Routing-4: BGP Configuration Example

On Switch A

```
SMIS# configure terminal
SMIS(config)# interface Fx 0/21
SMIS(config-if)#  switchport mode access
SMIS(config-if)#  switchport access vlan 200
SMIS(config-if)# exit
SMIS(config)# interface vlan 200
SMIS(config-if)# ip address 10.10.10.2
SMIS(config-if)# exit
SMIS(config)# as-num 1
SMIS(config)# router-id 10.10.10.2
SMIS(config)# router bgp 1
SMIS(config-router)# neighbor 10.10.10.1 remote-as 1
SMIS(config-router)# bgp default local-preference 50
SMIS(config-router)# default-metric 50
SMIS(config-router)# neighbor 10.10.10.1 ebgp-multihop
SMIS(config-router)# neighbor 10.10.10.1 timers keepalive 10
SMIS(config-router)# neighbor 10.10.10.1 advertisement-interval 5
SMIS(config-router)# end

SMIS# show ip bgp neighbor

BGP neighbor is 10.10.10.1, remote AS 1, internal link
  BGP version 4, remote router ID 10.10.10.1
  BGP state = Established, up for 11 minutes 31 seconds
  Rcvd update before 0 secs, hold time is 120, keepalive interval is 30 secs
  Neighbors Capability:
    Route-Refresh: Advertised and received
    Address family IPv4 Unicast: Advertised and received
  Received 24 messages, 0 Updates
  Sent 24 messages, 0 Updates
  Route refresh: Received 0, sent 0.
  Minimum time between advertisement runs is 5 seconds
  Connections established 1 time(s)
  Local host: 10.10.10.2, Local port: 179
  Foreign host: 10.10.10.1, Foreign port: 32768
  Last Error: Code 0, SubCode 0.

SMIS# show ip bgp info

Routing Protocol is "bgp 1"
IGP synchronization is disabled
```

Both more-specific and less-specific overlap route policy is set
Local Preference is 50
Non-bgp routes are advertised to both external and internal peers
MED Comparision is disabled
Metric is 50

Peer Table
Peer Address RemoteAS NextHop MultiHop
---- ------- -------- ------- --------
10.10.10.1 1 automatic enable

TCPMD5 Auth Table
Peer Address Password
---- ------- --------

SMIS# **show ip bgp summary**

BGP router identifier is 10.10.10.2, local AS number 1

BGP table version is 0
Neighbor Version AS MsgRcvd MsgSent Up/Down State/PfxRcd
--------- ------- -- ------- ------- ------- ------------

10.10.10.1 4 1 24 24 00:00:11:41 Established

SMIS# **show ip bgp dampening**
Half Life Time is 900
Reuse value is 500
Suppress value is 3500
Max Suppress time is 3600
Decay timer granularity is 1
Reuse timer granularity is 15
Reuse index array size is 1024

SMIS# **show running-config**

Building configuration...
Switch ID Hardware Version Firmware Version

vlan 1
ports fx 0/1-20 untagged
ports fx 0/22-48 untagged
ports cx 0/1-6 untagged
exit
vlan 200
exit

interface Fx 0/21
switchport mode access

switchport access vlan 200
exit

interface vlan 200
ip address 10.10.10.2 255.0.0.0
exit

as-num 1
router-id 192.168.100.102

router bgp 1
bgp router-id 192.168.100.102
bgp default local-preference 50
default-metric 50
neighbor 10.10.10.1 remote-as 1
neighbor 10.10.10.1 ebgp-multihop
neighbor 10.10.10.1 timers keepalive 10
neighbor 10.10.10.1 advertisement-interval 5
exit

On switch B

SMIS# configure terminal
SMIS(config)# interface Fx 0/21
SMIS(config-if)# switchport mode access
SMIS(config-if)# switchport access vlan 200
SMIS(config-if)# exit
SMIS(config)# interface vlan 200
SMIS(config-if)# ip address 10.10.10.1
SMIS(config-if)# exit
SMIS(config)# **as-num 1**
SMIS(config)# **router-id 10.10.10.1**
SMIS(config)# **router bgp 1**
SMIS(config-router)# **neighbor 10.10.10.2 remote-as 1**
SMIS(config-router)# **bgp always-compare-med**
SMIS(config-router)# **bgp bestpath med confed**
SMIS(config-router)# **bgp client-to-client reflection**
SMIS(config-router)# **bgp comm-peer 10.10.10.2 permit**
SMIS(config-router)# **bgp default local-preference 80**
SMIS(config-router)# **default-metric 100**
SMIS(config-router)# **neighbor 10.10.10.2 timers keepalive 10**
SMIS(config-router)# **neighbor 10.10.10.2 advertisement-interval 5**
SMIS(config-router)# end

SMIS# **show ip bgp summary**

BGP router identifier is 10.10.10.1, local AS number 1

BGP table version is 0

Neighbor	Version	AS	MsgRcvd	MsgSent	Up/Down	State/PfxRcd

```
10.10.10.2    4          1        20    20     00:00:9:43  Established
```

SMIS# **show ip bgp info**

```
Routing Protocol is "bgp 1"
IGP synchronization is disabled
Both more-specific and less-specific overlap route policy is set
Local Preference is 80
Non-bgp routes are advertised to both external and internal peers
MED Comparision is enabled
Metric is 100

 Peer Table
 Peer Address RemoteAS NextHop   MultiHop
 ---- ------- -------- -------   --------
10.10.10.2        1     automatic   disable

 TCPMD5 Auth Table
 Peer Address Password
 ---- ------- --------
```

SMIS# **show ip bgp neighbor**

```
BGP neighbor is 10.10.10.2, remote AS 1, internal link
  BGP version 4, remote router ID 192.168.100.102
  BGP state = Established, up for 10 minutes 4 seconds
  Rcvd update before 0 secs, hold time is 120, keepalive interval is 30 secs
  Neighbors Capability:
    Route-Refresh: Advertised and received
    Address family IPv4 Unicast: Advertised and received
  Received 21 messages, 0 Updates
  Sent 21 messages, 0 Updates
  Route refresh: Received 0, sent 0.
  Minimum time between advertisement runs is 5 seconds
  Connections established 1 time(s)
  Local host: 10.10.10.1, Local port: 32768
  Foreign host: 10.10.10.2, Foreign port: 179
  Last Error: Code 0, SubCode 0.
```

SMIS# **show ip bgp community peer**

```
Community Peer Table
 IpAddress SendStatus
 --------- ----------

10.10.10.2      send
```

SMIS# show ip bgp dampened-paths

```
   Status codes: d dampened, h history,* valid
```

```
  Network    From      LastUpdt   Path
  -------    ----      --------   ----
```

```
SMIS# show ip bgp dampening
Half Life Time is 900
Reuse value is 500
Suppress value is 3500
Max Suppress time is 3600
Decay timer granularity is 1
Reuse timer granularity is 15
Reuse index array size is 1024
```

```
SMIS# show ip bgp timers
 Peer Timers
 Peer Address Holdtime KeepAliveTime ConnectRetry ASOrig RouteAdvt
 ---- ------- -------- ------------- ------------ ------ ---------
   10.10.10.2      120       10           30      15     5
SMIS# show ip bgp local-pref
   Index Admin  Remote-AS Prefix PrefixLen Inter-AS Direction Value Preference
         Status
   ----- ------ --------- ------ --------- -------- --------- ----- ----------
```

```
SMIS# show running-config

Building configuration...
Switch ID       Hardware Version              Firmware Version

vlan 1
 ports fx 0/1-20 untagged
 ports fx 0/22-48 untagged
 ports cx 0/1-6 untagged
exit
vlan 200
exit

interface Fx 0/21
 switchport mode access
 switchport access vlan 200
exit

interface vlan 200
 ip address  10.10.10.1 255.0.0.0
exit

as-num 1
router-id 10.10.10.1

router bgp 1
bgp router-id 10.10.10.1
bgp default local-preference 80
bgp always-compare-med
```

```
default-metric 100
bgp bestpath med confed
neighbor 10.10.10.2 remote-as 1
neighbor 10.10.10.2 send-community standard
bgp comm-peer 10.10.10.2 permit
neighbor 10.10.10.2 timers keepalive 10
neighbor 10.10.10.2 advertisement-interval 5
exit
```

19 PIM Configuration

IP Multicast Overview

IP communication is 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 usage 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 range 224.0.0.0 to 239.0.0.0 is selected for 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 of a particular group must join the group by signaling a router/switch on their subnet. IGMP is used as the signaling protocol for conveying *group membership*. Network devices along the path from Source to Receivers forward data only on ports leading to the receivers, rather than flooding on all ports.

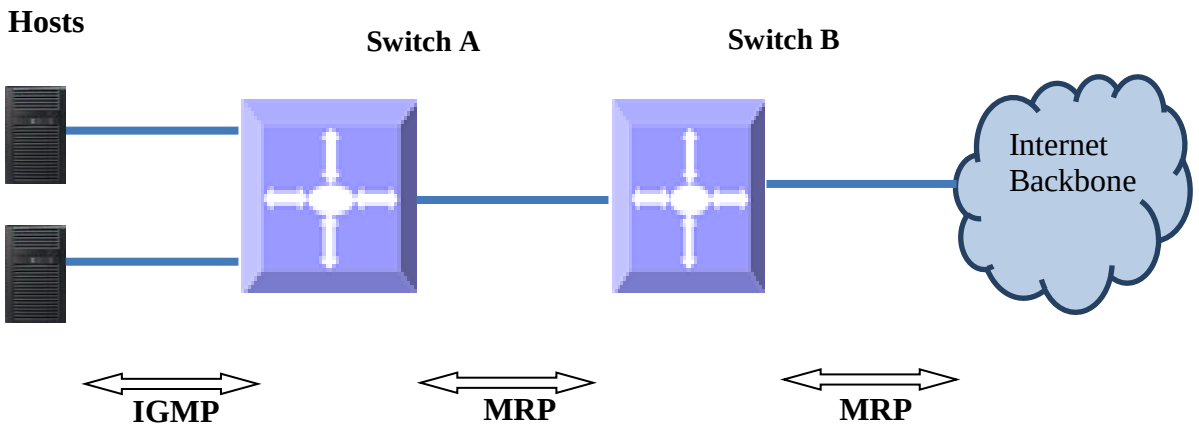
Membership in a multicast group is dynamic as hosts can join and leave at any time. There is no restriction on the location or number of members in a multicast group. A host can be a member of more than one multicast group at a time.

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 Protocol's (MRP's)** 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



19.1 PIM

Protocol Independent Multicast (PIM) is a Multicast Routing Protocol (MRP) to maintain the Multicast distribution tree and 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*.

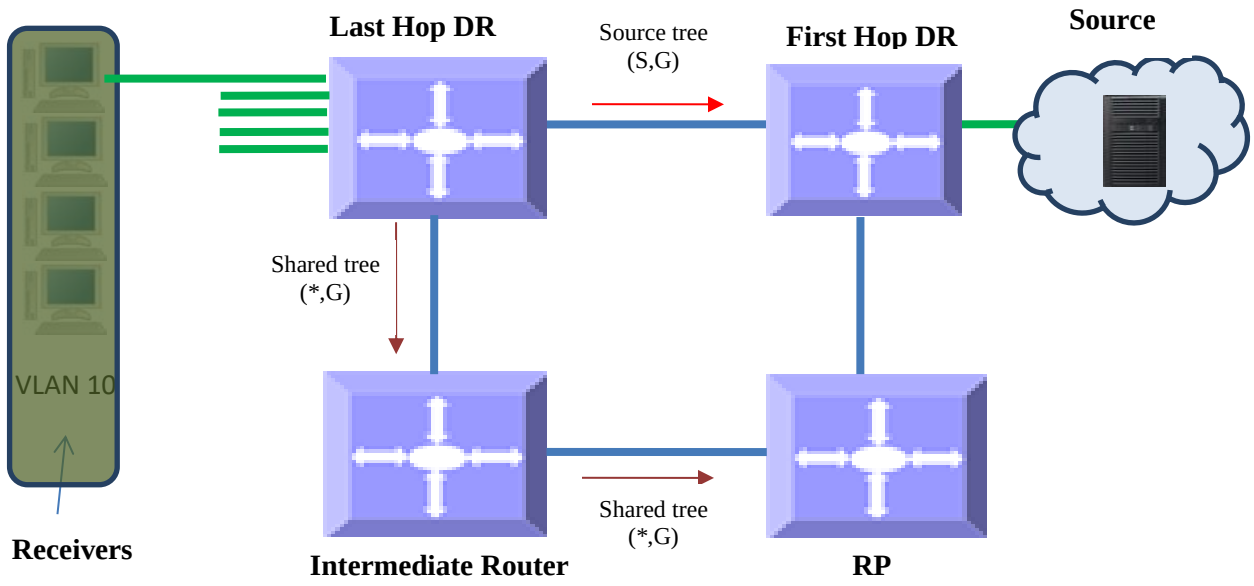
The path from receivers to Source or RP is called *upstream.* The path from Source or RP towards receivers is called *downstream*-.

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

19.1.1 PIM-SM Basics

PIM Sparse mode operates on 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 *reverse-path forwarding (RPF) check* to determine upstream neighbor to source and/or RP. RPF check helps to eliminate loops in Multicast tree formation wherein the forwarding decision for a received packet is done based on the source address in the packet rather than destination address – If router has a route entry to the source address in the packet i.e. upstream router, the packet is forwarded, as RPF check passes; otherwise packet is dropped as RPF check failure.

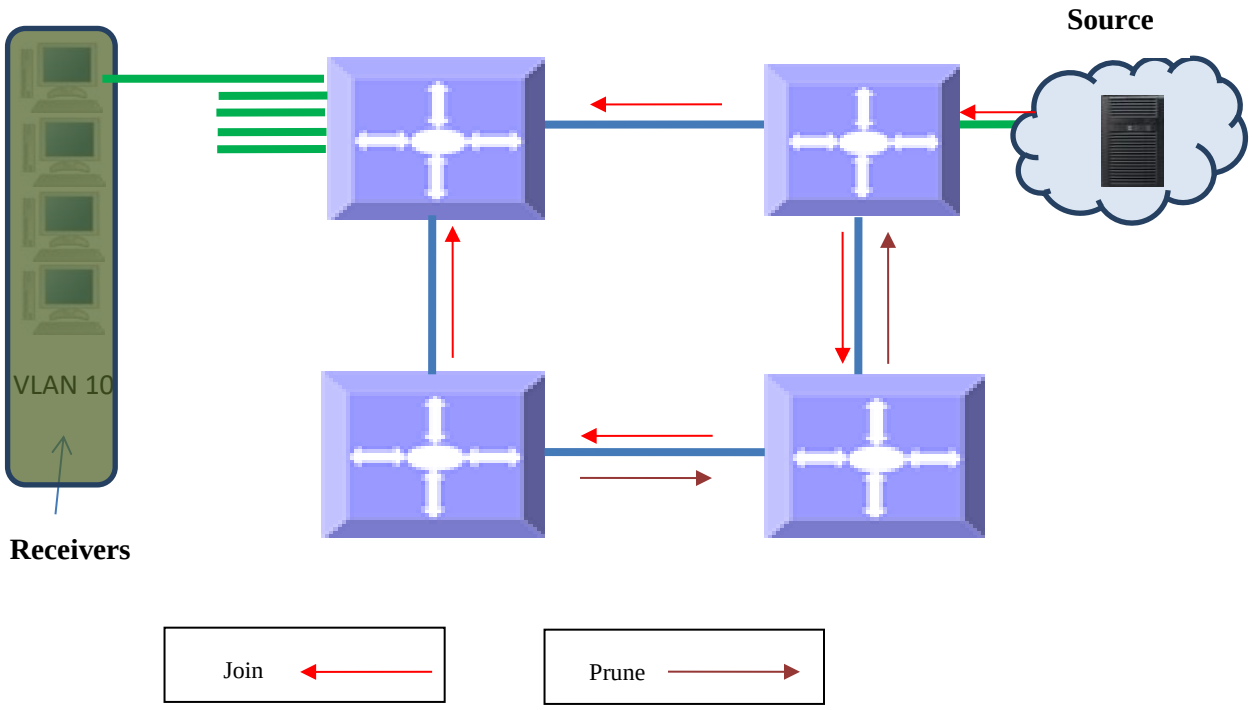
PIM Sparse mode builds a *shared tree or RPT* with a root called as *Rendezvous Point (RP).* A *Candidate RP (CRP)* is configured for every group, then by using *Bootstrap router (BSR)* mechanism CRP is populated as a *RP-set* across the domain. After receiving RP set, every router performs a uniform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

Receivers interested in particular Multicast group data from any source send a (*, G) join to upstream neighbor towards the router elected as 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 source and this is called *Source-specific tree or Shortest Path Tree (SPT)*. PIM-SM is typically used in WAN environment.

19.1.2 PIM-DM Basics

PIM Dense mode operates on 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 pruned when branches do not want Multicast data from a particular Group and/or source. PIM-DM is typically used in LAN environment.

Figure PIM-3: Multicast Forwarding with PIM-DM



19.2 PIM Support

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

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 Source, CRP, and CBSR. PIM uses this information for RPF check.

19.3 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 interval	30 seconds
DR priority	1
Override interval	0
LAN Prune Delay status	Enabled
LAN Prune Delay	0
Hello hold time	3.5 x Hello interval
CBSR preference	-1

19.4 Enabling PIM

PIM is disabled by default in Supermicro switches.

PIM needs to be enabled globally for IP Multicast operation. 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 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

19.5 PIM Component and Interface

Supermicro switch provides multiple instances of PIM in a router. The PIM instances are referred as *PIM component*. 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 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **Int vlan range 1-10** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **int range vlan 1-10, 20** If multiple interfaces are provided, the next step will perform the particular

		PIM configuration on all these interfaces.
Step 4	**ip pim componentId <value(1-255)>**	Configures 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.

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

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

The example below shows the commands to configure 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 fx 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

19.6 PIM Mode

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

19.7 PIM neighbor

PIM routers exchange periodic Hello message with directly connected routers. These directly connected routers are the PIM neighbors. PIM Hello message contains different configurable options.

19.7.1 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 upstream. As a first-hop router, the DR is responsible for forwarding data to downstream.

The default DR priority is 1.

Supermicro switches provide flexibility for user to configure DR priority for individual interfaces. User can configure different DR priority on different interfaces.

Follow the steps below to change 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces.

		To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** OR **interface range vlan 1,5,10** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **int range vlan 1-10, 20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces.
Step 3	**ip pim dr-priority <priority(1-65535)>**	Configures 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 to configure 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

19.7.2 Hello interval

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 user to configure Hello interval for individual interfaces. User can configure different Hello interval on different interfaces.

Follow the steps below to change 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **int range vlan 1-10, 20** If multiple interfaces are provided, the next step will perform the particular

		PIM configuration on all these interfaces.
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 30seconds.
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 to configure PIM query-interval.

Configure PIM query-interval for layer3 VLAN 100

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

19.7.3 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 3.5 x Hello Interval (i.e. 3.5 * 30 = 105 seconds).

The show command in example shows PIM Hello hold time.

SMIS# show ip pim interface detail

vlan100 146 is up

Internet Address is 10.1.2.2
Muticast Switching : Enabled
PIM : Enabled
PIMv6 : Disabled
PIM version : 2, mode: Sparse
PIM DR : 10.1.2.2
PIM DR Priority : 1
PIM Neighbour Count : 1
PIM Hello/Query Interval : 30
Hello-Holdtime : 105
PIM Message Interval : 60
PIM Override Interval : 0
PIM Lan Delay : 0
PIM Lan-Prune-Delay : Disabled
PIM Component Id : 1
PIM domain border : disabled

19.8 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 flowing 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's). The entry can be (*.G) or (S,G). (*,G) entries have W and R bit set, while (S,G) entries have Shortest Path Tree (SPT) bit set. The RP and RPF neighbor are also listed.

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

Below example shows the 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/---
```

19.9 PMBR

PIM multicast border routers (PMBR) is the border between two or more PIM domains running different MRP's like 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 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

19.10 Disabling PIM

PIM is disabled by default in Supermicro switches.

After enabling PIM, if user needs to disable it, it has to be disabled 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**

19.11 PIM-SM Specific Configuration

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

19.11.1 PIM Join/Prune

19.11.1.1 Join-Prune Interval

PIM router sends Join messages periodically to upstream router 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 user to configure Join-Prune interval for individual interfaces. User can configure different Join-Prune interval on different interfaces.

Follow the steps below to change 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **int range vlan 1-10, 20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces.
Step 3	**ip pim message-interval <Interval(1-65535)>**	Configures PIM Join prune interval value. The Join prune interval value can be any number from 1-65535. 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 to configure PIM Join-Prune interval.

Configure 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

19.11.1.2 LAN Prune delay

LAN Prune Delay option is used in Multi-Access network to delay processing of prune messages received at upstream routers. This ensures in a multi-access LAN there is no flapping of Multicast data due to Join by some routers and prune by some 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, instead maintains the tree for 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 'LAN Prune Delay interval'.

The default 'LAN delay' flag is 'Disabled' state. Default value of LAN prune delay is 0 seconds.

Supermicro switches provide flexibility for user to configure LAN Prune Delay for individual interfaces. User can configure different LAN Prune Delay on different interfaces.

Follow the steps below to change 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **int range vlan 1-10,20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces.
Step 3	**set ip pim lan-prune-delay { enable | disable }** **ip pim lan-delay <value(0-65535)>**	Configures LAN prune delay value. LAN prune-delay is disabled 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 to configure PIM LAN delay.

Configure 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

19.11.1.3 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 a period of *override interval* 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.

Override interval ensures in a multi-access LAN, Multicast data is forwarded only if there is at least one router with receivers interested in a particular group and 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 Join/prune override interval for individual interfaces. User can configure different Join/prune override interval on different interfaces.

Follow the steps below to configure 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:

		vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **int range vlan 1-10,20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces.
Step 3	**ip pim override-interval <interval(0-65535)>**	Configures 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 to configure PIM override interval.

Configure 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

19.11.2 Shared Tree (RPT)

An RP is used as the central information exchange point in PIM domain as it reduces the amount of state in non-RP routers. No network flooding is required to provide non-RP routers information about active sources. All routers in a PIM domain must have same RP information for a particular group.

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

19.11.2.1 Bootstrap Router (BSR)

BSR distributes PIM RP information for all groups within the domain. Each PIM domain can have only 1 elected BSR. Several routers are configured as candidate BSRs, the BSR is elected as the router with highest preference. The elected RP's send their information to the BSR and BSR maintains RP-to-group mapping as the RP-set.

Supermicro switches provide flexibility for user to configure BSR for individual interface.

Follow the steps below to configure 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: vlan *interface-id* is the VLAN identifier for VLAN interfaces. To configure multiple interfaces, use the "**interface range** …" command. To provide a range use a hypen (-) between the start and end interface

		numbers. E.g.: **interface range vlan 10-20** To provide multiple interfaces or ranges, use separate with a comma (,). E.g.: **int range vlan 1-10,20** If multiple interfaces are provided, the next step will perform the particular PIM configuration on all these interfaces.
Step 3	**ip pim bsr-candidate <value (0-255)>**	Configures 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 to configure 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

19.11.2.2 Candidate RP (CRP)

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

Supermicro switches provide flexibility for user to configure CRP for individual components. User can configure different CRP on different component.

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 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 to configure PIM Candidate RP.

Configure 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
```

19.11.2.3 Static RP

An RP for a group range can be configured statically on a router, instead of using 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 user to configure Static RP for individual components. User can configure different Static RP on different component.

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 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

19.11.2.4 Register- Stop Rate-limit

When first-hop DR receives 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 downstream members on the RPT. If there are no receivers on RP, it then sends Register stop to First-hop DR as long as there are no receivers. Register-Stop rate limit is used at 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 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 to configure 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

19.11.3 Shortest Path Tree (SPT)

19.11.3.1 SPT at RP

When first-hop DR receives 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 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

19.11.3.1.1 RP switch period

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

RP switch period is disabled by default in Supermicro switches i.e. RP's switch to SPT immediately upon receipt of 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 to configure 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

19.11.3.1.2 RP threshold

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

RP threshold is disabled by default in Supermicro switches i.e. RP's switch to SPT immediately upon receipt of Multicast data packet.

Follow the steps below to configure 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 to configure 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

19.11.3.2 SPT at Last-hop DR

When last-hop DR receives multicast packet from *Shared tree or RP tree*, it 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 last-hop DR building a SPT is called *SPT switchover at Last-hop DR*. Once SPT is established at 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

19.11.3.2.1 SPT switch period

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

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 Multicast data packet.

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

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 to configure 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

19.11.3.2.2 SPT threshold

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

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

Follow the steps below to configure 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

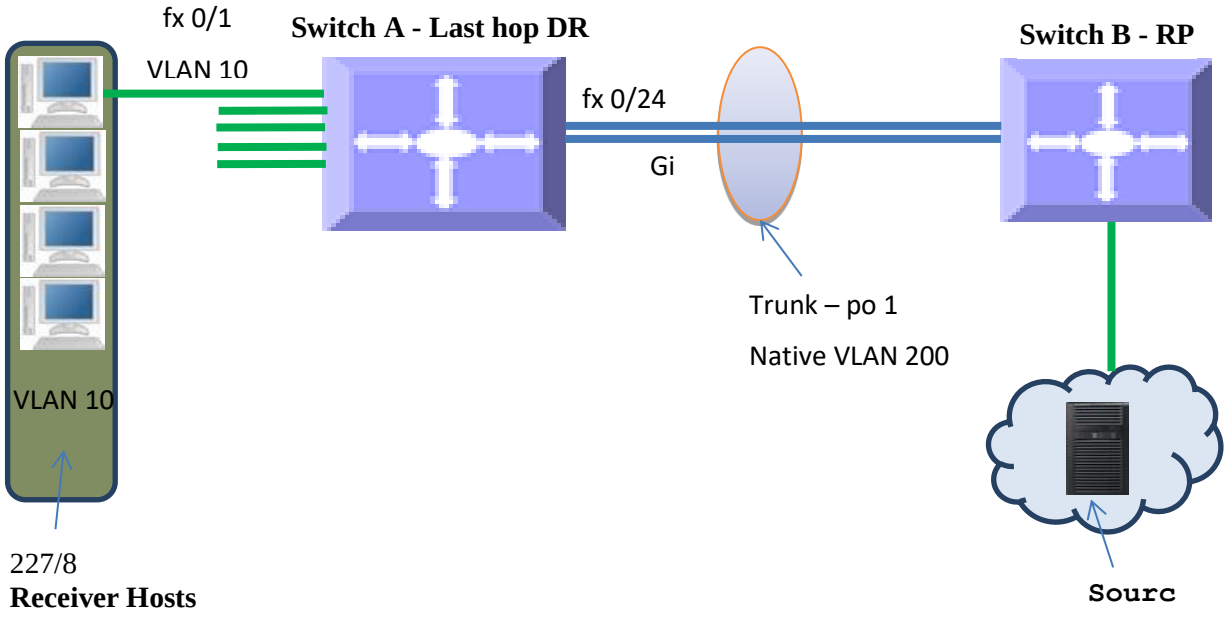
Group Threshold : 100
Source Threshold : 200
Switching Period : 0

PIM SPT-RP Threshold Information

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

19.12 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 fx 0/1 untagged
SMIS(config-vlan)# exit
SMIS(config)# vlan 200
SMIS(config-vlan)# ports fx 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

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

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