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1 MLAG Configuration Guide

This document describes the Multi-Chassis Link Aggregation (MLAG) feature supported in Supermicro Layer 2 / Layer 3 switch products.

The availability of the MLAG feature depends on the switch model. The currently supported Top-of-Rack switch models are SSE-X24S/R, SSE-X3348S/R, and SSE-X3348T/R. It is also supported on the SBM-XEM-X10SM Supermicro Blade switch.

1.1 Overview

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

The Multi-Chassis Link Aggregation (MLAG) feature allow 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. As with LAG, MLAG also supports up to 8 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.

1.1.1 Terminologies

1.1.1.1 IPL – Inter Peer Link

The link connecting two MLAG peer switches is called 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.

1.1.1.2 Peer Switch

The two switches that form a single logical port channel interface are called “peer switches”. The peer switches are connected through the IPL interface. For example, in the topology diagrams shown in Section 1.2 - Topologies, switches “A” and “B” are peer switches.
1.1.1.3 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 both of the peer switches with the same port channel number.

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

1.1.1.5 Single Homed Device
The device connected to only one of the peer switch is called a “Single Homed Device”. This connection could be a regular single physical link connection or it could be made through a port channel interface.
1.2 Topologies

1.2.1 Topology 1 - Server to switch MLAG topology

In Figure 1 Switches A and 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 of the MLAG peer switches through a regular bonding or 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.
1.2.2 Topology 2 - Switch to switch MLAG topology

In Figure 2 Switches A and B are peer switches in the MLAG. Switches A and B are connected through an IPL port channel interface.

The Switch C is connected to both of the MLAG peer switches through a regular LACP port channel interface.

On Switches A and B the ports connected to Switch C are configured with the same MLAG enabled port channel number.
1.2.3 Topology 3 - Single uplink switch topology

In Figure 3 Switches A and 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 of the MLAG peer switches through a regular LACP port channel interface.

Uplink Switch 1 is connected to the MLAG peer switches A and B through a regular LACP port channel interface.

On Switches A and B the ports connected to Switch C 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 same packet (broadcast or multicast) to both the MLAG peer switches.
1.2.4 Topology 4 – Redundant uplink switch topology

In Figure 4 Switches A and 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 of the MLAG peer switches through a regular LACP port channel interface.

Uplink Switches 1 and 2 are connected to MLAG peer switches A and B through an MLAG port channel interface.

On Switches A and B the ports connected to Switch C are configured with the same MLAG enabled port channel number. Similarly the ports connected to Uplink Switches 1 and 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 same packet (broadcast or multicast) to both the MLAG peer switches.
1.2.5 Topology 5 - Server to switch Layer 3 MLAG topology

In Figure 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.

1.3 Default Configuration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>System ID</td>
<td>None</td>
</tr>
<tr>
<td>System priority</td>
<td>32768</td>
</tr>
<tr>
<td>Keep alive time</td>
<td>3 seconds</td>
</tr>
<tr>
<td>IPL interface</td>
<td>None</td>
</tr>
<tr>
<td>MLAG status</td>
<td>Disabled</td>
</tr>
</tbody>
</table>
1.4 MLAG Configurations

The mandatory configurations for an MLAG are:
1) System ID
2) Priority
3) IPL port channel interface
4) Enabling MLAG on a port channel interfaces

The “keep alive time” configuration is optional.

1.4.1 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 of the peer switches. If this condition is not met, the peer connection will not be established. All of 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 MLAG system ID and the MLAG system priority.

Follow the steps below to configure an MLAG System ID.

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>configure terminal</td>
<td>Enters the configuration mode</td>
</tr>
<tr>
<td>Step 2</td>
<td>mlag system-identifier <a href="">aa:aa:aa:aa:aa:aa</a></td>
<td>Configure the system ID&lt;br&gt; <a href="">aa:aa:aa:aa:aa:aa</a> - Specify any unicast MAC address to be used as the MLAG system ID</td>
</tr>
<tr>
<td>Step 3</td>
<td>end</td>
<td>Exits the configuration mode.</td>
</tr>
<tr>
<td>Step 4</td>
<td>show mlag detail</td>
<td>Displays the MLAG configuration details</td>
</tr>
</tbody>
</table>

The “no mlag system-identifier” command deletes the MLAG system ID.

When the MLAG system ID is deleted, both the IPL and the 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

1.4.2 MLAG System Priority
MLAG switches use this MLAG system priority for LACP exchanges with partner devices.

An MLAG system priority must be configured the same in both of the peer switches. If this condition is not met, the peer connection will not be established. All of 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 MLAG System Priority.

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>configure terminal</td>
<td>Enters the configuration mode</td>
</tr>
<tr>
<td>Step 2</td>
<td>mlag system-priority &lt;0-65535&gt;</td>
<td>Configure the MLAG system priority</td>
</tr>
<tr>
<td>Step 3</td>
<td>End</td>
<td>Exits the configuration mode.</td>
</tr>
<tr>
<td>Step 4</td>
<td>show mlag detail</td>
<td>Displays the MLAG configuration details</td>
</tr>
</tbody>
</table>

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

1.4.3 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 a primary and other as a 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 the MLAG “keep alive” time.

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>configure terminal</td>
<td>Enters the configuration mode</td>
</tr>
<tr>
<td>Step 2</td>
<td>mlag keepalive-time &lt;3-90&gt;</td>
<td>Configure the MLAG keep alive time.</td>
</tr>
<tr>
<td>Step 3</td>
<td>End</td>
<td>Exits the configuration mode.</td>
</tr>
<tr>
<td>Step 4</td>
<td>show mlag detail</td>
<td>Displays the MLAG configuration details</td>
</tr>
</tbody>
</table>

The “no mlag keepalive-time” command resets the keep alive time to its default value.

Keepalive-time can be different on both the 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

1.4.4 IPL Interface
The link connecting two MLAG peer switches is called the Inter Peer Link (IPL). This link should be configured as an LACP port channel. It can have as many member ports as are supported by the switch model.

Note: Only the primary switch among the peers participates in Spanning Tree Protocol.
Follow the steps below to configure the IPL Interface.

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>configure terminal</td>
<td>Enters the configuration mode</td>
</tr>
</tbody>
</table>
| 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
```

### 1.4.5 MLAG Port Channels

The link connecting MLAG peers to MLAG partner switches is called an “MLAG Port Channel”.. MLAG port channel interfaces should be created on both of the peer switches with the same port channel number.

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>configure terminal</td>
<td>Enters the configuration mode</td>
</tr>
</tbody>
</table>
| Step 2 | interface port-channel <channel-group-number> | Creates a port channel using “interface
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<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td><code>mlag enable</code></td>
<td>Configure MLAG link from switch to the partner devices.</td>
</tr>
<tr>
<td>4</td>
<td><code>end</code></td>
<td>Exits the configuration mode.</td>
</tr>
<tr>
<td>5</td>
<td><code>show mlag interface</code></td>
<td>Displays the details of MLAG interface between peers and partner devices.</td>
</tr>
</tbody>
</table>

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

**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.

**1.4.6 Web configurations**

The following configurations can be done in the Web interface in the MLAG configuration page.

- MLAG system ID
- MLAG System Priority
- MLAG Keep Alive Time
- MLAG Interface

This page is available in the LA configurations page list in Layer 2 Mgmt section.
The LA interface page allows the user to enable or disable MLAG in the LACP port channel interfaces.

This page is also available in the LA configurations page list in the Layer 2 Mgmt section.
The following pages show how to check MLAG status:

**MLAG status page**

![MLAG status page screenshot]

**MLAG interface status page**

![MLAG interface status page screenshot]
MLAG counters page

These pages are available in the LA page group in the Statistics section.
MAC, IGS and ARP related MLAG information can be seen in the following pages:

MLAG MAC Table – This page is available in the VLAN page groups in the Statistics section.

MLAG ARP – This page is available in the IP page groups in the Statistics section.
1.4.7 Other Configurations

MLAG peer switches exchange only dynamically learned specific information. Information about the configurations shared across peer switches is not exchanged. Hence, the user needs to make sure that all individual MLAG peer switches are configured correctly. The following configurations must be the same across MLAG peer switches for correct functionality.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN configurations for MLAG interfaces</td>
<td></td>
</tr>
<tr>
<td>Spanning tree configurations for MLAG interfaces</td>
<td></td>
</tr>
<tr>
<td>Layer 3 subnets for MLAG interfaces related layer 3 interfaces</td>
<td>Only for Layer 3 switches.</td>
</tr>
<tr>
<td>ACL configurations related to MLAG interfaces</td>
<td></td>
</tr>
<tr>
<td>QoS configurations related to MLAG interfaces</td>
<td></td>
</tr>
<tr>
<td>MAC aging time</td>
<td></td>
</tr>
<tr>
<td>ARP aging time</td>
<td>Only for Layer 3 switches.</td>
</tr>
<tr>
<td>Static MAC entries</td>
<td></td>
</tr>
<tr>
<td>Static ARP entries</td>
<td>Only for Layer 3 switches.</td>
</tr>
<tr>
<td>Static IP routes</td>
<td>Only for Layer 3 switches.</td>
</tr>
<tr>
<td>MTU on MLAG and IPL interfaces</td>
<td></td>
</tr>
</tbody>
</table>
1.5 Sample MLAG Configurations

1.5.1 Switch Configurations

1.5.1.1 Switch A configuration

swA# show running-config

Building configuration...
Switch ID  Hardware Version             Firmware Version  OS Version
0          SSE-X24S Rev. C   (P3-01)    1.0.9-1           111

ip address 172.31.31.26
device name swA
interface port-channel 1
    exit
interface port-channel 10
    exit
interface port-channel 20
    exit
mlag system-identifier 00:01:02:03:04:05
mlag keepalive-time 90
mlag interface port-channel 1

vlan 1
    ports ex 0/10 tagged
    ports gi 0/1 untagged
    ports ex 0/7-9 untagged
    ports ex 0/11-24 untagged
    ports po 1 untagged
    exit
vlan 10
  ports po 10 untagged
exit
vlan 20
  ports po 20 untagged
exit

interface Ex 0/1
  mtu 9216
  channel-group 1 mode active

interface Ex 0/2
  mtu 9216
  channel-group 1 mode active

interface Ex 0/3
  channel-group 10 mode active

interface Ex 0/4
  channel-group 10 mode active

interface Ex 0/5
  channel-group 20 mode active

interface Ex 0/6
  channel-group 20 mode active

interface po 1
  mtu 9216
  switchport mode trunk
  spanning-tree disable

interface po 10
  switchport access vlan 10
  switchport mode access
  mlag enable

interface po 20
  switchport access vlan 20
  switchport mode access
  mlag enable

interface vlan 1
  ip address  172.31.31.26 255.255.0.0

interface vlan 10
  ip address  10.1.1.1 255.255.255.0

interface vlan 20
  ip address  20.1.1.1 255.255.255.0
exit
ip igmp snooping
vlan 1
ip igmp snooping
ip igmp snooping mrouter port-channel 1
exit
vlan 10
ip igmp snooping
ip igmp snooping mrouter port-channel 1
exit
vlan 20
ip igmp snooping
ip igmp snooping mrouter port-channel 1
exit

router vrrp
    interface vlan 10
        vrrp 10 ipv4 10.1.1.3 ping-able
exit
    interface vlan 20
        vrrp 20 ipv4 20.1.1.3 ping-able
exit

interface vlan 1
    ipv6 address fe80::230:48ff:fee3:7542 link-local
exit

swA#

swA# show mlag details
System Identifier : 00:01:02:03:04:05
System Priority : 32768
KeepAlive Time : 90
IPL Interface : po1
Peer System Identifier : 00:01:02:03:04:05
IPL Link Status : Up
Peer Connection State : ESTABLISHED
MLAG Role : SECONDARY
swA# show mlag interface

<table>
<thead>
<tr>
<th>MLAG Id</th>
<th>Local Status</th>
<th>Peer Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Po 10</td>
<td>UP</td>
<td>UP</td>
</tr>
<tr>
<td>Po 20</td>
<td>UP</td>
<td>UP</td>
</tr>
</tbody>
</table>

swA# show mlag stp

Local Interface   STP State

Po 10 SECONDARY
Po 20 SECONDARY

swA# show spanning-tree

We are the root of the Spanning Tree
Root Id  Priority  32768
Address  00:30:48:e3:75:42
Cost  0
Port  0
Max age 20 Sec, forward delay 15 Sec

MST00
Spanning tree Protocol has been enabled
MST00 is executing the mstp compatible Multiple Spanning Tree Protocol
Bridge Id  Priority  32768
Address  00:30:48:e3:75:42
Max age is 20 sec, forward delay is 15 sec
Dynamic Path Cost is Disabled

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>po1</td>
<td>Disabled</td>
<td>Forwarding</td>
<td>1000</td>
<td>128</td>
<td>P2P</td>
</tr>
<tr>
<td>po10</td>
<td>Disabled</td>
<td>Forwarding</td>
<td>1000</td>
<td>128</td>
<td>P2P</td>
</tr>
<tr>
<td>po20</td>
<td>Disabled</td>
<td>Forwarding</td>
<td>1000</td>
<td>128</td>
<td>P2P</td>
</tr>
</tbody>
</table>

swA# show int po 10

po10 up, line protocol is up (connected)
Bridge Port Type: Customer Bridge Port

Hardware Address is 00:30:48:e3:75:45
MTU  1500 bytes,

<table>
<thead>
<tr>
<th>Port</th>
<th>State</th>
<th>LACP Port</th>
<th>Admin Key</th>
<th>Oper Key</th>
<th>Port Number</th>
<th>Port State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex0/3</td>
<td>Bundle</td>
<td>128</td>
<td>10</td>
<td>10</td>
<td>0x4</td>
<td>0x3d</td>
</tr>
<tr>
<td>Ex0/4</td>
<td>Bundle</td>
<td>128</td>
<td>10</td>
<td>10</td>
<td>0x5</td>
<td>0x3d</td>
</tr>
</tbody>
</table>

Reception Counters
Octets  : 8020
Unicast Packets : 0
Broadcast Packets : 2
Multicast Packets : 66
Pause Frames : 0
Undersize Frames : 0
Oversize Frames : 0
CRC Error Frames : 0
Discarded Packets : 0
Error Packets : 0
Unknown Protocol : 0

Transmission Counters
Octets : 8217
Unicast Packets : 0
Non-Unicast Packets : 67
Pause Frames : 0
Discarded Packets : 0
Error Packets : 0

swA#

swA# show int po 20

po20 up, line protocol is up (connected)
Bridge Port Type: Customer Bridge Port

Hardware Address is 00:30:48:e3:75:47
MTU 1500 bytes,

<table>
<thead>
<tr>
<th>Port</th>
<th>LACP</th>
<th>Admin</th>
<th>Oper</th>
<th>Port</th>
<th>Port</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>State</td>
<td>Priority</td>
<td>Key</td>
<td>Key</td>
<td>Number</td>
</tr>
<tr>
<td>Ex0/5</td>
<td>Bundle</td>
<td>128</td>
<td>20</td>
<td>20</td>
<td>0x6</td>
</tr>
<tr>
<td>Ex0/6</td>
<td>Bundle</td>
<td>128</td>
<td>20</td>
<td>20</td>
<td>0x7</td>
</tr>
</tbody>
</table>

Reception Counters
Octets : 7872
Unicast Packets : 2
Broadcast Packets : 2
Multicast Packets : 64
Pause Frames : 0
Undersize Frames : 0
Oversize Frames : 0
CRC Error Frames : 0
Discarded Packets : 2
Error Packets : 0
Unknown Protocol : 0

Transmission Counters
Octets : 4003216
Unicast Packets : 5810
Non-Unicast Packets : 72
Pause Frames : 0
Discarded Packets : 0
Error Packets : 0
swA#

swA# show mlag counters
KeepAlive sent : 8
MLAG Status change sent : 1
STP packet sent : 0
STP PortState packet sent : 0
MAC Sync packet sent : 6
ARP Sync packet sent : 5
IGS packet sent : 1
KeepAlive received : 10
MLAG Status change received : 0
STP packet received : 0
STP PortState packet received : 0
MAC Sync packet received : 5
ARP Sync packet received : 1
IGS packet received : 2
swA#

swA# show mlag mac

<table>
<thead>
<tr>
<th>Vlan</th>
<th>Mac Address</th>
<th>Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>00:25:90:40:19:de</td>
<td>po1</td>
</tr>
<tr>
<td>10</td>
<td>00:25:90:40:05:f2</td>
<td>po10</td>
</tr>
<tr>
<td>10</td>
<td>00:25:90:40:05:f4</td>
<td>po10</td>
</tr>
<tr>
<td>10</td>
<td>00:25:90:40:05:f5</td>
<td>po10</td>
</tr>
<tr>
<td>10</td>
<td>00:25:90:40:19:de</td>
<td>po1</td>
</tr>
<tr>
<td>20</td>
<td>00:25:90:40:46:9c</td>
<td>po20</td>
</tr>
<tr>
<td>20</td>
<td>00:25:90:40:46:9d</td>
<td>po20</td>
</tr>
</tbody>
</table>

Total Mac Addresses displayed: 8

1.5.1.2 Switch B Configurations

swB# show running-config

Building configuration...

Switch ID  Hardware Version  Firmware Version  OS Version
0          SSE-X24S Rev. A   (P3-01)       1.0.9-1       1.1.5

ip address 172.31.31.25
ip gateway 172.31.0.1
device name swB
interface port-channel 1
exit
interface port-channel 10
exit
interface port-channel 20
exit
interface port-channel 100
exit
mlag system-identifier 00:01:02:03:04:05
mlag keepalive-time 90
mlag interface port-channel 1

vlan 1
  ports po 100 tagged
  ports ex 0/7-9 untagged
  ports ex 0/11-24 untagged
  ports po 1 untagged
exit
vlan 10
  ports po 10 untagged
exit
vlan 20
  ports po 20 untagged
exit

interface Ex 0/1
  mtu 9216
  channel-group 1 mode active

interface Ex 0/2
  mtu 9216
  channel-group 1 mode active

interface Ex 0/3
  channel-group 20 mode active

interface Ex 0/4
  channel-group 20 mode active

interface Ex 0/5
  channel-group 10 mode active

interface Ex 0/6
  channel-group 10 mode active

interface Ex 0/10
  channel-group 100 mode active

interface po 1
  mtu 9216
  switchport mode trunk
  spanning-tree disable
interface po 10
    switchport access vlan 10
    switchport mode access
    mlag enable

interface po 20
    switchport access vlan 20
    switchport mode access
    mlag enable

interface po 100
    mlag enable

interface vlan 10
    ip address 10.1.1.2 255.255.255.0

interface vlan 20
    ip address 20.1.1.2 255.255.255.0

exit
ip igmp snooping
vlan 1
ip igmp snooping
ip igmp snooping mrouter port-channel 1
exit
vlan 10
ip igmp snooping
ip igmp snooping mrouter port-channel 1
exit
vlan 20
ip igmp snooping
ip igmp snooping mrouter port-channel 1
exit

logging trap debugging

router vrrp
    interface vlan 10
        vrrp 10 ipv4 10.1.1.3 ping-able
exit
    interface vlan 20
        vrrp 20 ipv4 20.1.1.3 ping-able
exit
exit

swB#

swB# show mlag details
System Identifier          : 00:01:02:03:04:05
System Priority            : 32768
KeepAlive 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

swB# show mlag interface

MLAG Id  Local Status   Peer Status
------  --------        --------
Po 10   UP              UP
Po 20   UP              UP
Po 100  Down            Unknown

swB# show mlag stp

Local Interface   STP State
------------------- ------------
Po 10             PRIMARY
Po 20             PRIMARY

swB# show spanning-tree

Root Id          Priority 32768
Address    00:25:90:40:05:ee
Cost       1000
Port       po10
Max age 20 Sec, forward delay 15 Sec

MST00

Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree Protocol

Bridge Id         Priority 32768
Address    00:25:90:40:19:de
Max age is 20 sec, forward delay is 15 sec
Dynamic Path Cost is Disabled

Name   Role       State   Cost Prio   Type
-----  ----        -----   ---- ----   ----
p01    Disabled    Forwarding 1000 128    P2P
p010   Root       Forwarding 1000 128    P2P
p020   Designated Forwarding 1000 128    P2P

swB#

swB# show int po 10

po10 up, line protocol is up (connected)
Bridge Port Type: Customer Bridge Port

Hardware Address is 00:25:90:40:19:e2
MTU 1500 bytes,

<table>
<thead>
<tr>
<th>Port</th>
<th>State</th>
<th>LACP Port</th>
<th>Admin Key</th>
<th>Oper Key</th>
<th>Port Number</th>
<th>Port State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex0/5</td>
<td>Bundle</td>
<td>128</td>
<td>10</td>
<td>10</td>
<td>0x5</td>
<td>0x3d</td>
</tr>
<tr>
<td>Ex0/6</td>
<td>Bundle</td>
<td>128</td>
<td>10</td>
<td>10</td>
<td>0x6</td>
<td>0x3d</td>
</tr>
</tbody>
</table>

Reception Counters
- Octets: 58871
- Unicast Packets: 0
- Broadcast Packets: 0
- Multicast Packets: 479
- Pause Frames: 0
- Undersize Frames: 0
- Oversize Frames: 0
- CRC Error Frames: 0
- Discarded Packets: 0
- Error Packets: 0
- Unknown Protocol: 0

Transmission Counters
- Octets: 61788
- Unicast Packets: 0
- Non-Unicast Packets: 888
- Pause Frames: 0
- Discarded Packets: 0
- Error Packets: 0

swB# show int po 20

po20 up, line protocol is up (connected)
Bridge Port Type: Customer Bridge Port

Hardware Address is 00:25:90:40:19:e0
MTU 1500 bytes,

<table>
<thead>
<tr>
<th>Port</th>
<th>State</th>
<th>LACP Port</th>
<th>Admin Key</th>
<th>Oper Key</th>
<th>Port Number</th>
<th>Port State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex0/3</td>
<td>Bundle</td>
<td>128</td>
<td>20</td>
<td>20</td>
<td>0x3</td>
<td>0x3d</td>
</tr>
<tr>
<td>Ex0/4</td>
<td>Bundle</td>
<td>128</td>
<td>20</td>
<td>20</td>
<td>0x4</td>
<td>0x3d</td>
</tr>
</tbody>
</table>

Reception Counters
- Octets: 924706
- Unicast Packets: 7433
- Broadcast Packets: 1
Multicast Packets : 78
Pause Frames : 0
Undersize Frames : 0
Oversize Frames : 0
CRC Error Frames : 0
Discarded Packets : 0
Error Packets : 0
Unknown Protocol : 0

Transmission Counters
Octets : 1090675
Unicast Packets : 1178
Non-Unicast Packets : 1314
Pause Frames : 0
Discarded Packets : 0
Error Packets : 0

swB# show mlag counters
KeepAlive sent : 13
MLAG Staus change sent : 0
STP packet sent : 0
STP PortState packet sent : 0
MAC Sync packet sent : 5
ARP Sync packet sent : 1
IGS packet sent : 2
KeepAlive received : 11
MLAG Staus change received : 1
STP packet received : 0
STP PortState packet received : 0
MAC Sync packet received : 6
ARP Sync packet received : 5
IGS packet received : 1

swB# show mlag mac

<table>
<thead>
<tr>
<th>Vlan</th>
<th>Mac Address</th>
<th>Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>00:30:48:e3:75:42</td>
<td>po1</td>
</tr>
<tr>
<td>10</td>
<td>00:25:90:40:05:f3</td>
<td>po10</td>
</tr>
<tr>
<td>10</td>
<td>00:30:48:e3:75:42</td>
<td>po1</td>
</tr>
<tr>
<td>20</td>
<td>00:25:90:40:46:9e</td>
<td>po20</td>
</tr>
<tr>
<td>20</td>
<td>00:25:90:40:46:9f</td>
<td>po20</td>
</tr>
<tr>
<td>20</td>
<td>00:30:48:e3:75:42</td>
<td>po1</td>
</tr>
</tbody>
</table>

Total Mac Addresses displayed: 6

1.5.1.3 Switch C Configuration

swC(config)# show running-config
Building configuration...
Switch ID       Hardware Version                Firmware Version
OS Version
0               SSE-X3348SR Rev.B (P4-01)      1.0.5.7
2

device name swC
interface port-channel 10
exit

vlan 1
  ports gi 0/1-2 untagged
  ports ex 0/1-2 untagged
  ports ex 0/7-48 untagged
  ports qx 0/1-4 untagged
  ports po 10 untagged
exit
vlan 10
exit

interface Ex 0/3
  channel-group 10 mode active

interface Ex 0/4
  channel-group 10 mode active

interface Ex 0/5
  channel-group 10 mode active

interface Ex 0/6
  channel-group 10 mode active

interface vlan 1
exit
ip igmp snooping
vlan 10
ip igmp snooping
exit

logging console
logging trap debugging

interface vlan 1
ipv6 address fe80::225:90ff:fe40:5ee link-local
exit

swC(config)#
swC(config)# show int po 10

po10 up, line protocol is up (connected)
Bridge Port Type: Customer Bridge Port

Hardware Address is 00:25:90:40:05:f2
MTU 1500 bytes,

<table>
<thead>
<tr>
<th>Port</th>
<th>LACP Port</th>
<th>Admin Priority</th>
<th>Oper Priority</th>
<th>Port Key</th>
<th>Oper Key</th>
<th>Number</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex0/3</td>
<td>Bundle</td>
<td>128</td>
<td>10</td>
<td>0x5</td>
<td>0x3d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex0/4</td>
<td>Bundle</td>
<td>128</td>
<td>10</td>
<td>0x6</td>
<td>0x3d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex0/5</td>
<td>Bundle</td>
<td>128</td>
<td>10</td>
<td>0x7</td>
<td>0x3d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex0/6</td>
<td>Bundle</td>
<td>128</td>
<td>10</td>
<td>0x8</td>
<td>0x3d</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reception Counters
Octets : 99277
Unicast Packets : 0
Unicast Packets Rate : 0/Sec
Broadcast Packets : 3
Broadcast Packets Rate : 0/Sec
Multicast Packets : 1345
Multicast Packets Rate : 1/Sec
Overall Packets Rate : 1/Sec
Pause Frames : 0
Undersize Frames : 0
Oversize Frames : 0
CRC Error Frames : 0
Discarded Packets : 1320
Error Packets : 0
Unknown Protocol : 0

Transmission Counters
Octets : 95442
Unicast Packets : 0
Unicast Packets Rate : 0/Sec
Broadcast Packets : 2
Broadcast Packets Rate : 0/Sec
Multicast Packets : 776
Multicast Packets Rate : 0/Sec
Overall Packets Rate : 0/Sec
Pause Frames : 0
Discarded Packets : 0
Error Packets : 0

swC(config)#

swC# show spanning-tree
We are the root of the Spanning Tree

Root Id       Priority   32768
Address       00:25:90:40:05:ee
Cost          0
Port          0
Max age 20 Sec, forward delay 15 Sec

MST00

Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree Protocol

Bridge Id       Priority   32768
Address 00:25:90:40:05:ee
Max age is 20 sec, forward delay is 15 sec
Dynamic Path Cost is Disabled

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>po10</td>
<td>Designated</td>
<td>Forwarding</td>
<td>500</td>
<td>128</td>
<td>P2P</td>
</tr>
</tbody>
</table>

swC#

1.5.1.4 Switch D Configuration

swD(config)# show running-config

Building configuration...

Switch ID       Hardware Version                Firmware Version
OS Version
0               SSE-X3348S Rev.1  (P4-01)       1.0.5.12
2.6.23.0.11

Ip address 20.1.1.105
device name swD
interface port-channel 20
exit
port-channel load-balance src-mac 20

Vlan 1
  ports gi 0/1-2 untagged
  ports ex 0/1-2 untagged
  ports ex 0/7-48 untagged
  ports qx 0/1-4 untagged
  ports po 20 untagged
exit
vlan 20
exit

interface Ex 0/3
  channel-group 20 mode active
interface Ex 0/4
  channel-group 20 mode active

interface Ex 0/5
  channel-group 20 mode active

interface Ex 0/6
  channel-group 20 mode active

interface vlan 1
  ip address 20.1.1.105 255.255.255.0

exit
vlan 1
ip igmp snooping mrouter gigabitethernet 0/1
exit
logging trap debugging

interface vlan 1
  ipv6 address fe80::225:90ff:fe40:4698 link-local
exit

swD(config)#

swD(config)# show int po 20

po20 up, line protocol is up (connected)
Bridge Port Type: Customer Bridge Port

Hardware Address is 00:25:90:40:46:9c
MTU 1500 bytes,

<table>
<thead>
<tr>
<th>Port</th>
<th>LACP Port</th>
<th>Admin Key</th>
<th>Oper Key</th>
<th>Port Number</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex0/3</td>
<td>Bundle 128</td>
<td>20</td>
<td>20</td>
<td>0x5</td>
<td>0x3d</td>
</tr>
<tr>
<td>Ex0/4</td>
<td>Bundle 128</td>
<td>20</td>
<td>20</td>
<td>0x6</td>
<td>0x3d</td>
</tr>
<tr>
<td>Ex0/5</td>
<td>Bundle 128</td>
<td>20</td>
<td>20</td>
<td>0x7</td>
<td>0x3d</td>
</tr>
<tr>
<td>Ex0/6</td>
<td>Bundle 128</td>
<td>20</td>
<td>20</td>
<td>0x8</td>
<td>0x3d</td>
</tr>
</tbody>
</table>

Reception Counters
Octets: 7045429
Unicast Packets: 11072
Unicast Packets Rate: 5/Sec
Broadcast Packets: 6
Broadcast Packets Rate: 0/Sec
Multicast Packets: 2129
Multicast Packets Rate: 1/Sec
Overall Packets Rate: 6/Sec
Pause Frames : 0
Undersize Frames : 0
Oversize Frames : 0
CRC Error Frames : 0
Discarded Packets : 203
Error Packets : 0
Unknown Protocol : 0

Transmission Counters
Octets : 1323069
Unicast Packets : 10353
Unicast Packets Rate : 5/Sec
Broadcast Packets : 3
Broadcast Packets Rate : 0/Sec
Multicast Packets : 228
Multicast Packets Rate : 0/Sec
Overall Packets Rate : 5/Sec
Pause Frames : 0
Discarded Packets : 0
Error Packets : 0

swD(config)#

swD# show spanning-tree

Root Id   Priority   32768
Address    00:25:90:40:05:ee
Cost       1500
Port        po20
Max age 20 Sec, forward delay 15 Sec

MST00

Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree Protocol
Bridge Id   Priority   32768
Address    00:25:90:40:46:98
Max age is 20 sec, forward delay is 15 sec
Dynamic Path Cost is Disabled

Name      Role       State    Cost    Prio  Type
   ----  ----      -----    -----    ----  ----
   Gi0/1  Designated Forwarding 20000  128   P2P
   po20   Root       Forwarding  500    128   P2P

swD#
## 1.6 Troubleshooting

<table>
<thead>
<tr>
<th>#</th>
<th>Issue</th>
<th>Cause(s)</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Peer not established</td>
<td>1) System ID does not match on both peers.</td>
<td>Configure same value of System ID on both switches.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Priority does not match in both peers.</td>
<td>Configure same value of priority on both switches.</td>
</tr>
<tr>
<td>2</td>
<td>MLAG is not UP</td>
<td>Port channel ID’s used in both peers are different.</td>
<td>Configure same port channel ID’s on both switches for MLAG link.</td>
</tr>
</tbody>
</table>