Extreme ONE OS Switching v22.2.0.0 Layer 2 Switching Configuration Guide

Switching, LAG, MLAG, and Bridge Domain Setup

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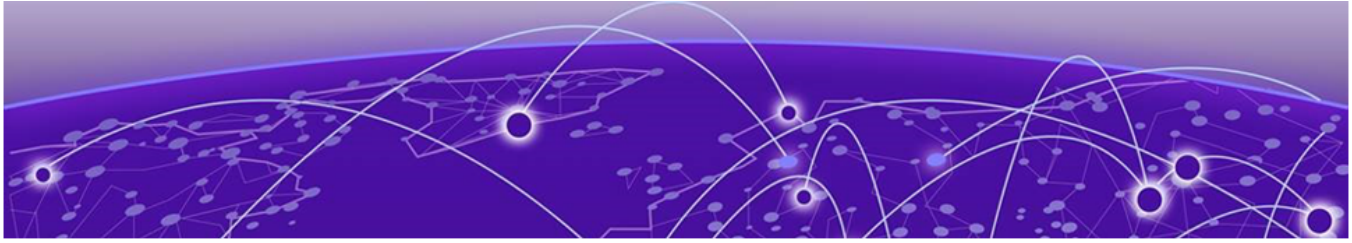

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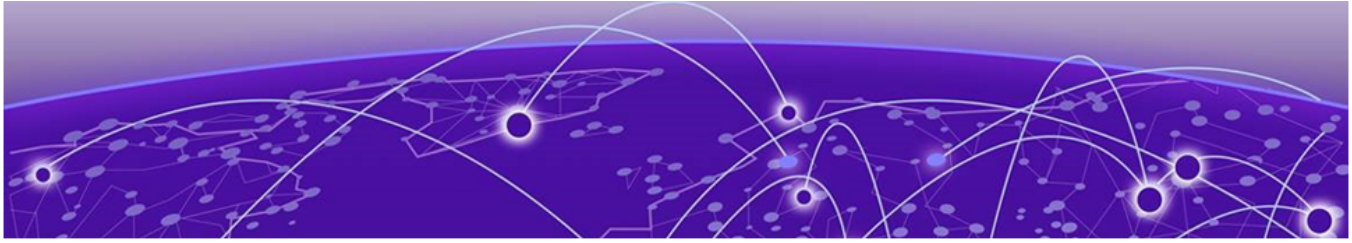

Abstract

The Extreme ONE OS Switching v22.2.0.0 Layer 2 Switching Configuration Guide provides CLI-based configuration procedures for deploying Layer 2 switching on Extreme ONE OS SR platforms with IEEE 802.1AX compliance. The documentation covers static and dynamic Link Aggregation Groups (LAGs) using LACP with configurable system priority (1-65535), PDU transmission rates (fast: 1s, normal: 30s), and validation through show interface port-channel and show counters commands. Multi-Chassis Link Aggregation (MLAG) implementation includes peer session establishment via gRPC (port 4012) and TCP (port 4000), role election based on keepalive source IPs, VxLAN-based inter-service links with VLAN-VNI mapping, and BFD health monitoring with 300-millisecond intervals on 8730-32D hardware platforms. Bridge domain configuration supports both VLAN and default modes with single-tagged, double-tagged, untagged, and untagged strict subinterface types, MAC learning procedures, and configurable MAC aging timers (60-38400 seconds). System fault detection handles out-of-memory conditions, FWD-HAL service restarts, and split-brain scenarios through interface-manager coordination and monitoring service integration via gRPC for high-availability data center operations.

Preface

Read the following topics to learn about:

- The meanings of text formats used in this document.
- Where you can find additional information and help.
- How to reach us with questions and comments.

Text Conventions

Unless otherwise noted, information in this document applies to all supported environments for the products in question. Exceptions, like command keywords associated with a specific software version, are identified in the text.

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Table 2: Text

Convention	Description
`screen displays`	This typeface indicates command syntax, or represents information as it is displayed on the screen.
The words *enter* and *type*	When you see the word *enter* in this guide, you must type something, and then press the Return or Enter key. Do not press the Return or Enter key when an instruction simply says *type*.
Key names	Key names are written in boldface, for example **Ctrl** or **Esc**. If you must press two or more keys simultaneously, the key names are linked with a plus sign (+). Example: Press **Ctrl**+**Alt**+**Del**
Words in italicized type	Italics emphasize a point or denote new terms at the place where they are defined in the text. Italics are also used when referring to publication titles.
NEW!	New information. In a PDF, this is searchable text.

Table 3: Command syntax

Convention	Description
bold text	Bold text indicates command names, keywords, and command options.
italic text	Italic text indicates variable content.
`[ ]`	Syntax components displayed within square brackets are optional. Default responses to system prompts are enclosed in square brackets.
`{ x | y | z }`	A choice of required parameters is enclosed in curly brackets separated by vertical bars. You must select one of the options.
x | **y**	A vertical bar separates mutually exclusive elements.
< >	Nonprinting characters, such as passwords, are enclosed in angle brackets.
...	Repeat the previous element, for example, *member*[*member*...].
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- A description of any actions already taken to resolve the problem
- A description of your network environment (such as layout, cable type, other relevant environmental information)
- Network load at the time of trouble (if known)
- The device history (for example, if you have returned the device before, or if this is a recurring problem)
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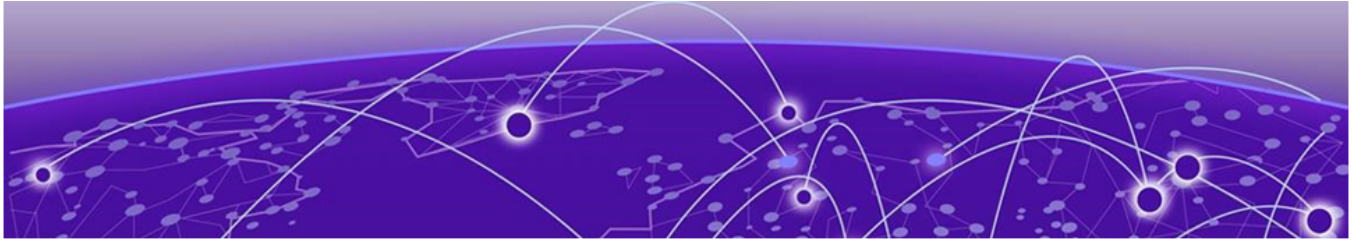
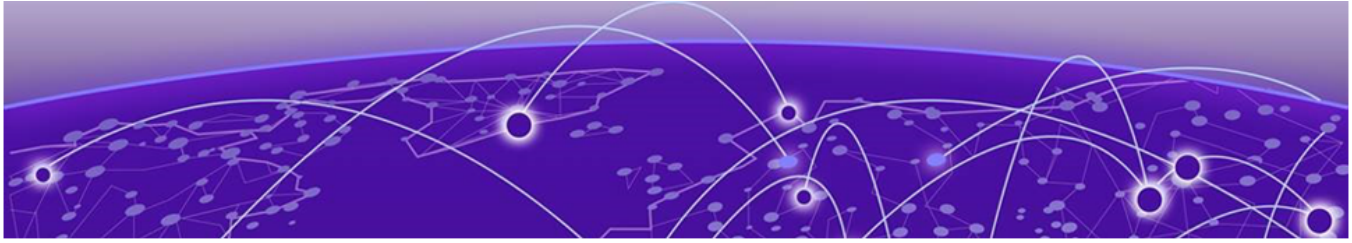


About This Document

This document provides comprehensive information on Extreme ONE OS SR, an application extending the capabilities of the base Extreme ONE OS to deliver advanced switching and routing (SR) functionalities. Extreme ONE OS SR offers flexible management options through both an enhanced command line interface (CLI) for traditional configuration and support for modern, model-driven configuration and management via gNMI and gNOI based on OpenConfig. This enables the configuration of Layer 2 switching features and Layer 3 routing protocols, including technologies such as EVPN for VXLAN and BGP, alongside essential network services such as Quality of Service (QoS) and security features.



Link Aggregation

Link Aggregation Overview

Link aggregation enables you to bundle multiple physical Ethernet links into a single port channel, providing enhanced performance, redundancy, and availability.

We also refer to port channels as link aggregation groups (LAGs). A LAG is considered a single link by connected devices, the Spanning Tree Protocol, IEEE 802.1Q VLANs, and so on. When one physical link in the LAG fails, the other links stay up. A small drop in traffic is experienced when one link fails.

When queuing traffic from multiple input sources to the same output port, all input sources are given the same weight, regardless of whether the input source is a single physical link or a port channel.

The benefits of link aggregation are as follows:

- Increased bandwidth (The logical bandwidth can be dynamically changed as the demand changes.)
- Increased availability
- Load sharing
- Rapid configuration and reconfiguration

Each LAG consists of the following components:

- Links of the same speed.
- A MAC address that is different from the MAC addresses of the LAG's individual member links.
- An interface index for each link to identify the link to the neighboring devices.
- An administrative key for each link. Only the links with the same administrative key value can be aggregated into a LAG. On each link configured to use Link Aggregation Control Protocol (LACP), LACP automatically configures an administrative key value equal to the port channel identification number.

Two LAG types are supported:

- Static LAGs—In static link aggregation, links are added into a LAG without exchanging control packets between the partner systems. The distribution and collection of frames on static links is determined by the operational status and administrative state of the link.
- Dynamic LAGs—Dynamic link aggregation uses Link Aggregation Control Protocol (LACP) to negotiate the links included in a LAG. Typically, two partner systems sharing multiple physical Ethernet links can aggregate a number of those physical links using LACP. LACP creates a LAG on both partner systems and identifies the LAG by the LAG ID. All links with the same administrative key, and all links that are connected to the same partner switch become members of the LAG. LACP continuously exchanges LACP protocol data units (PDUs) to monitor the health of each member link.

LAG Configuration Guidelines

When implementing port channels, consider the following:

- You can associate a link with only one port channel.

Basic LAG Configuration

The topics in this section configure both static and dynamic (LACP) LAG implementations.

Configure a Port Channel Interface

Follow this procedure to create a port channel interface at the global configuration mode.

1. Enter the **`configure terminal`** command to access global configuration mode.

```
device# configure terminal
```

2. Enter the **`interface port-channel`** command to create a new port channel interface.

```
device(config)# interface port-channel 1
```

Delete a Port Channel Interface

Follow this procedure to delete a port-channel interface and all member interfaces.

1. Enter the **`configure terminal`** command to access global configuration mode.

```
device# configure terminal
```

2. To delete a port-channel interface, enter the **`no interface port-channel`** command.

```
device(config)# no interface port-channel 1
```

Add a Member Port to a Port Channel

Follow this procedure to add a member port to a specific port channel interface. If the port channel does not already exist, this task creates the port channel and also adds a physical interface to it.

1. Access global configuration mode.

   ```
   device# configure terminal
   ```

2. Add a port channel.

   ```
   device(config)# interface port-channel 1
   ```

   The range is 1 to 255.

3. Access global configuration mode again.

   ```
   device(config-if-po-1)# exit
   ```

4. Access interface configuration mode for the physical interface that you want to add to the port channel.

   ```
   device(config)# interface ethernet 0/1
   ```

5. Enable link aggregation on the physical interface and add it to the port channel.

   - (For *active* mode) Enable link aggregation on the physical interface and add it to the port channel to enable LACP unconditionally.

     ```
     device(config-if-eth-0/1)# channel-group 1 mode active
     ```

   - (For *passive* mode) Enable link aggregation on the physical interface and add it to the port channel to enable LACP when another LACP device is detected.

     ```
     device(config-if-eth-0/1)# channel-group 1 mode passive
     ```

   - (For *static* mode) Enable link aggregation on the physical interface and add it to the port channel to enable static link aggregation without LACP, which prevents channel formation with other ports that are in active or passive mode.

     ```
     device(config-if-eth-0/1)# channel-group 1 mode on
     ```

The following example displays the LAG configuration that is running currently on the device. In this example, port channel number 1 is configured, and Ethernet interface 0/1 is added to the port channel in active mode:

```
device# show running-config lacp

interface port-channel 1
  no shutdown
  subinterface vlan 1
    ipv4 address 10.x.x.x/24
    ipv6 address 1001:x:x:x::1/64
  !
!
interface ethernet 0/1
  no shutdown
  channel-group 1 mode active
!
device#
```

Delete a Member Port from a Port Channel

Follow this procedure to delete a member port from a port channel interface at the interface configuration level.

1. Access interface configuration mode for the physical interface that you want to delete from the port channel.

```
device(config)# interface ethernet 0/1
```

2. Delete a port from the port channel interface.

```
device(config-if-eth-0/1)# no channel-group
```

Configure the Minimum Number of LAG Member Links

Follow this procedure to configure the minimum number of LAG member links allowed in the LACP bundle.

This configuration allows a port-channel to operate at a certain minimum bandwidth at all times. If the bandwidth of the port-channel drops below the minimum number, then the port-channel is declared operationally DOWN even though it has operationally UP members.

1. Enter the **`configure terminal`** command to access global configuration mode.

```
device# configure terminal
device(config)#
```

2. Enter the **`interface port-channel`** command at the global configuration level.

```
device(config)# interface port-channel 30
device(config-if-po-30)#
```

3. Configure the minimum number of LAG member links at the port-channel interface configuration mode.

```
device(config-if-po-30)# lacp min-links 5
```

The number of links ranges from 1 to 64. The default minimum links is 1.

Dynamic (LACP) Configuration

Link Aggregation Control Protocol (LACP) is an IEEE 802.1AX standards-based protocol that allows two partner systems to dynamically negotiate attributes of physical links between them to form port-channels.

If LACP determines that a link can be aggregated into a LAG, LACP puts the link into the LAG. All links in a LAG inherit the same administrative characteristics.

LACP operates in two modes:

- *Active mode*—LACP initiates protocol data unit (PDU) exchanges, regardless of whether the partner system sends LACP PDUs.
- *Passive mode*—LACP responds to PDUs initiated by its partner system, but does not initiate the LACP PDU exchange.

The LACP process collects and distributes Ethernet frames. The collection and distribution process implements:

- Inserting and capturing control LACP protocol data units (PDUs).
- Restricting the traffic of a given conversation to a specific link.
- Load-balancing links.
- Handling dynamic changes in LAG membership.

On each port, link aggregation control:

- Maintains configuration information to control port aggregation.
- Exchanges configuration information with other devices to form LAGs.
- Attaches ports to and detaches ports from the aggregator when they join or leave a LAG.
- Enables or disables an aggregator's frame collection and distribution functions.

Configure LACP

1. Enter the **`configure terminal`** command to access global configuration mode.

```
device# configure terminal
```

2. Enable LACP globally.

```
device(config)# protocol lacp
```

3. Disable LACP globally.

```
device(config)# no protocol lacp
```

Configure LACP System Priority

You configure LACP system priority on each device running LACP. LACP uses the system priority with the device MAC address to form the system ID and also during negotiation with other devices. The system priority value must be a number in the range of 1 through 65535. The higher the number, the lower the priority. The default priority is 32768.

1. Enter the **`configure terminal`** command to access global configuration mode.

```
device# configure terminal
```

2. Specify the LACP system priority.

```
device(config)# lacp system-priority 25000
```

3. To reset the system priority to the default value.

```
device(config)# no lacp system-priority
```

Configure the LACP Rate

You can configure the protocol data unit (PDU) rate for a port that is a member of a link aggregation group (LAG). This is the rate at which LACP control packets are sent to an LACP supported interface. The default rate is 30 seconds.

The LACP timeout is calculated on the LACP rate (either fast or normal). For the fast setting, the timeout is 3 x 1 = 3 seconds. For the normal setting, the timeout is 30 x 3 = 90 seconds.

1. Access global configuration mode.

```
device# configure terminal
```

2. Specify the Ethernet interface for which you want to configure the rate.

```
device(config)# interface ethernet 0/1
```

3. Configure the rate on the interface.
   - To set a fast rate (one PDU per second):

```
device(config-if-eth-0/1)# lacp rate fast
```

   - To set a normal rate (one PDU per 30 seconds):

```
device(config-if-eth-0/1)# lacp rate normal
```

   - To restore the default rate (also one PDU per 30 seconds):

```
device(config-if-eth-0/1)# no lacp rate
```

The following example adds Ethernet interface 0/29 to a LAG that has port channel number 10, specifies active LACP mode on the interface, and sets the rate of the interface to one PDU per second:

```
device# configure terminal
device(config)# interface ethernet 0/29
(config-if-eth-0/29)# channel-group 10 mode active
(config-if-eth-0/29)# lacp rate fast
(config-if-eth-0/29)#
```

The following example displays the LAG configuration that is running currently on the device. In this example, Ethernet interface 0/29 is added to a LAG in active mode and with a fast rate (one PDU per second):

```
device# show running-config lacp

protocol lacp
lacp system-priority 32768
!
interface port-channel 10
lacp min-links 1
no shutdown
!
interface ethernet 0/29
channel-group 10 mode active
lacp rate fast
no shutdown
!
device#
```

Configure the LACP MAC Address

You can configure the MAC address of a link aggregation group (LAG).

1. Access global configuration mode.

```
device# configure terminal
```

2. Specify the port channel interface for which you want to configure the MAC address.

```
device(config)# interface port-channel 1
```

3. After configuring a port channel, validate the port channel health and statistics information.

```
device# show counters interface port-channel 101
Interface Statistics: port-channel 101
 Carrier Transitions: 1
           LastClear: 0s
Input:
              Total pkts: 1477460957
          Broadcast pkts: 87289588
            Discard pkts: 0
             Errors pkts: 0
              FCS Errors: 0
              MCast pkts: 87378080
                  Octets: 1126773024923
              UCast pkts: 1302793289
               Runt pkts: 0
              CRC Errors: 0
Input Distribution:
            64 byte pkts: 5868861
        65-127 byte pkts: 50932300
       128-255 byte pkts: 573604220
       256-511 byte pkts: 66253377
      512-1023 byte pkts: 347495781
     1024-1518 byte pkts: 211842668
              Jumbo pkts: 221463750
Out:
              Total pkts: 2416872288
          Broadcast pkts: 522284647
            Discard pkts: 0
             Errors pkts: 0
              MCast pkts: 272962830
                  Octets: 2360836407771
              UCast pkts: 1621624811
Rate Info:
                   Input: 116.925313 Mbits/sec, 20726 pkts/sec 0.29% of line-rate
                  Output: 288.130020 Mbits/sec, 35007 pkts/sec 0.72% of line-rate
```

4. Configure the LACP system MAC address.

```
device(config-if-po-1)# lacp system-mac 66:fc:1d:1f:5b:85
```

5. Reset the LACP system MAC address to the default value. This is a MAC address whose last octet is one more than that of the MAC address of the immediately previous interface.

```
device(config-if-po-1)# no lacp system-mac
```

The following example enables LACP globally on the device and configures a LAG with port channel number 10 and a system MAC address of 01:23:45:67:89:ab:

```
device# configure terminal
device(config)# protocol lacp
device(config)# interface port-channel 10
device(config-if-po-10)# lacp system-mac 01:23:45:67:89:ab
device(config-if-po-10)#
```

The following example displays the LAG configuration that is running currently on the device. In this example, LACP is enabled globally, a LAG with port channel number 10

and a system MAC address of 01:23:45:67:89:ab is configured, and Ethernet interface 0/29 is added to the LAG in active mode:

```
device# show running-config lacp

protocol lacp
interface port-channel 10
lacp system-mac 01:23:45:67:89:ab
no shutdown
!
interface ethernet 0/29
channel-group 10 mode active
no shutdown
!
device#
```

Configuring System Priority in LACP

In LACP, the system priority determines which switch or device takes the lead during link aggregation negotiations. You can set a value that influences which switch takes the lead in a multi-device setup.

The default is 32768, and it can range from 1 to 65535. Ensure that the value is the same across the switch.

To set or unset LACP system-priority, use the following command:

```
device(config-if-po-101)# lacp
  min-links        Set minimum number of links
  system-mac       Set LACP system-mac
  system-priority  Set LACP system priority


device(config-if-po-101)# lacp system-priority
  (1-65535)  Value from 1-65535
DUT5(config-if-po-101)# lacp system-priority
```

Supported Show Commands

- **`show interface port-channel`**: Displays details of port-channels.

```
device# show interface port-channel
  IFNAME  Po Value from 1-255
  brief   brief
device# show interface port-channel 101

device# show interface port-channel 101
port-channel 101 is up
    MTU 9216 Bytes
    IfIndex 0x4000065
    Mac address is 88:7e:25:d3:da:14
    Port mode is Full Duplex, 40G
    MinLinks is 1
    LagType is LACP
    Active Members in this channel: Eth 0/3
    Members in this channel: Eth 0/3
Statistics
 Carrier Transitions: 1
           LastClear: 0s
```

```
Input:
          Broadcast pkts: 87225518
            Discard pkts: 0
             Errors pkts: 0
              FCS Errors: 0
              MCast pkts: 87313943
                  Octets: 1126070215752
              UCast pkts: 1301896993
       Unknown Protocols: 0
Out:
          Broadcast pkts: 521900301
            Discard pkts: 0
             Errors pkts: 0
              MCast pkts: 272758354
                  Octets: 2359154212029
              UCast pkts: 1620447729


device# show interface port-channel brief
Flags:  M - Redundant Management  P - Performance-Path
Number of interfaces 21
Port     Mtu      Admin-State Oper-State Speed    Ifindex      Description
-------- -------- ----------- ---------- -------- ------------ -----------
Po 10    9216     UP          UP         75G      0x400000a    ISL_Underlay_PO
Po 53    9216     UP          UP         75G      0x4000035    TO-DUT3
Po 54    9216     UP          UP         75G      0x4000036    TO-DUT4
Po 101   9216     UP          UP         40G      0x4000065    Port-Channel 101
Po 102   9216     UP          UP         20G      0x4000066    Port-Channel 102
Po 127   9216     UP          DOWN       0G       0x400007f    Port-Channel 127
Po 151   9216     UP          UP         100G     0x4000097    Port-Channel 151
Po 152   9216     UP          UP         30G      0x4000098    Port-Channel 152
Po 153   9216     UP          UP         20G      0x4000099    Port-Channel 153
Po 154   9216     UP          UP         10G      0x400009a    Port-Channel 154
Po 155   9216     UP          UP         10G      0x400009b    Port-Channel 155
Po 156   9216     UP          UP         40G      0x400009c    Port-Channel 156
Po 157   9216     UP          UP         100G     0x400009d    Port-Channel 157
Po 158   9216     UP          UP         10G      0x400009e    Port-Channel 158
Po 159   9216     UP          UP         10G      0x400009f    Port-Channel 159
```

- **show counters interface port-channel**: Displays statistics for the port channel.

```
device# show counters interface port-channel 101
Interface Statistics: port-channel 101
 Carrier Transitions: 1
           LastClear: 0s
Input:
              Total pkts: 1477460957
          Broadcast pkts: 87289588
            Discard pkts: 0
             Errors pkts: 0
              FCS Errors: 0
              MCast pkts: 87378080
                  Octets: 1126773024923
              UCast pkts: 1302793289
               Runt pkts: 0
              CRC Errors: 0
Input Distribution:
             64 byte pkts: 5868861
         65-127 byte pkts: 50932300
        128-255 byte pkts: 573604220
        256-511 byte pkts: 66253377
       512-1023 byte pkts: 347495781
      1024-1518 byte pkts: 211842668
              Jumbo pkts: 221463750
Out:
```

```
              Total pkts: 2416872288
          Broadcast pkts: 522284647
            Discard pkts: 0
             Errors pkts: 0
              MCast pkts: 272962830
                  Octets: 2360836407771
              UCast pkts: 1621624811
Rate Info:
                   Input: 116.925313 Mbits/sec, 20726 pkts/sec 0.29% of line-rate
                  Output: 288.130020 Mbits/sec, 35007 pkts/sec 0.72% of line-rate
```

- **show counters lacp**: Displays statistics for member ports of dynamic link aggregation groups (LAGs).

```
device# show counters lacp
Port                in-pkts   out-pkts   TxErr   RxErr   unknownErr   LacpErr
-------------------------------------------------------------------------------
Channel group: 10
ethernet 0/7:1       393        2724       0       0       0            0
ethernet 0/7:2       401        2723       0       0       0            0
ethernet 0/7:3       403        2723       0       0       0            0
ethernet 0/7:4       396        2723       0       0       0            0
```

- **show lacp system-identifier**: Displays the unique identifier assigned to a link aggregation group (LAG).

```
device# show lacp system-identifier
        System ID: 0x8000, 00:04:96:d6:83:e0
```

- **how lacp interface ethernet x/x**: Display statistics for specific member ports of dynamic link aggregation groups (LAGs).

```
device# show lacp interface ethernet 0/7:2
interface Eth 0/7:2 is up
     Channel group is 10 port channel is Po10
     PDUs sent: 2943
     PDUs rcvd: 614
     LACP Rx errors: 0
     LACP Tx errors: 0
     LACP unknown errors: 0
     LACP errors: 0
Local Port: Eth 0/7:2   MAC Address = 00:04:96:d6:83:e0
    System Identifier = 80:00:00:04:96:d6:83:e0
    Port Identifier = 0x8000, 0x207
    Operational key = 10
    LACP_Activity = active
    LACP_Timeout = short Timeout (1s)
    Synchronization = IN_SYNC
    Collecting = true
    Distributing = true

Partner information
    Partner-id = 80:00:00:04:96:d6:55:1c
    Partner-key = {10, 519}
```

Multi-Chassis Link Aggregation (MLAG)

Overview

Multi-Chassis Link Aggregation (MLAG) is trunking that initiates at a single MLAG-unaware server or switch and terminates at two MLAG-aware switches. MLAG allows the links to the two MLAG-aware switches to appear to a downstream device as if they are coming from a single device on a single Link Aggregation (LAG) trunk interface or physical port.

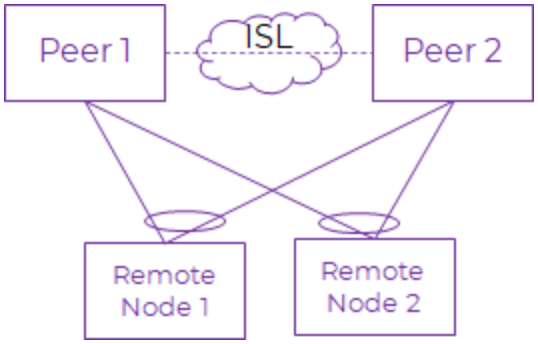
In a data center network environment, LAG trunks provide link level redundancy and increased capacity. However, they do not provide switch-level redundancy. If the switch connected to the LAG trunk fails, the entire trunk loses network connectivity.

With MLAG, member links of the LAG trunk are connected to two MLAG-aware devices. Logical Inter-Switch Link (ISL) configuration between the 2 MLAG devices enables data flow and control messages between them.

In this model, if one MLAG device fails, a data path remains through the other device.

Extreme ONE OS Layer 2 MLAG control plane protocol (MCP) synchronizes MAC and ARP data between the MLAG peers, for node resiliency and faster convergence.

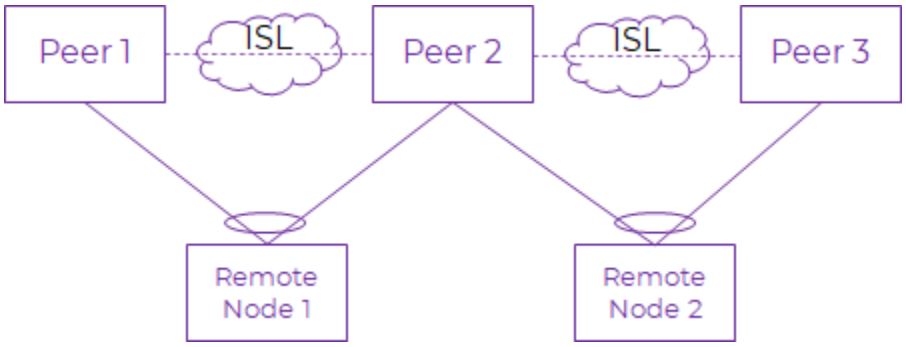
The data plane is established using a VxLAN tunnel between MLAG peers.



MLAG Limitations

Only a single MLAG peer switch will be allowed in the first release.

The following topology, which contains multiple peers, is not supported in the first release:



Other Limitations

- MLAG keep-alive source-interface as VE is not allowed.
- MLAG Primary keep-alive is supported only in the default-vrf.
- MLAG ID configuration as AUTO is not supported on Ethernet MLAG interface.
- Copper ports may remain operationally UP during a forward-hal crash.

Unsupported Features

MLAG only supports system fault generation for the following:

- Uncontrolled restart of services
- Out of memory conditions

Supported Platforms

- 8730-32D

MLAG Terminology

MLAG	Multi-Chassis Link Aggregation
ISL	Inter-Switch Link
VxLAN	Virtual Extensible LAN
MCP	MLAG Control Protocol
MLAG VLANs	VLANs that are shared by the MLAG peers. These VLANs are explicitly configured in the MLAG's Bridge-domain configuration.
BD	Bridge Domain
VNI	Virtual Network Identifier
VE	Virtual Ethernet interface

MLAG Control Plane

Primary keepalive session based on gRPC connection using port 4012 is established between the nodes using the configured primary keepalive's peer IP and the IP of source interface. The primary keepalive session helps in the establishment of an initial connection. If BFD (Bidirectional Forwarding Detection) service is available, the session will be offloaded to BFD for further management, for example, monitoring.

Secondary keepalive session using TCP connection using port 4000 is established between the nodes using the configured secondary keepalive's IP and the IP of source interface if manually configured. By default, secondary keepalive establishes connection through management interface automatically.

Inter-Switch Link for the Extreme ONE OS SR Devices

The Inter-Switch Link (ISL) for the devices is a VxLAN tunnel created between the MLAG nodes. The destination IP address of the ISL tunnel is the MLAG node's Peer IP. The ISL source IP is configured on the source-interface given in the primary keepalive session.

The underlay interface carrying the traffic can be any physical port or port-channel Layer 3 interface between the MLAG peers. VEs are not supported. By default, all MLAG VLANs or bridge domains (BDs) are extended to the MLAG peer.

By default, VLAN-VNI mapping is automatically configured for the ISL VxLAN tunnel. Since a single VLAN-VNI mapping domain is supported, any change to this mapping under the overlay gateway changes the mapping for the ISL and temporarily affects its traffic.

MLAG Node Role Selection in AUTO Role

MLAG node role elected based on Primary Keepalive's Source IP in the AUTO role, otherwise Node with highest primary keepalive Source IP will be elected as PRIMARY

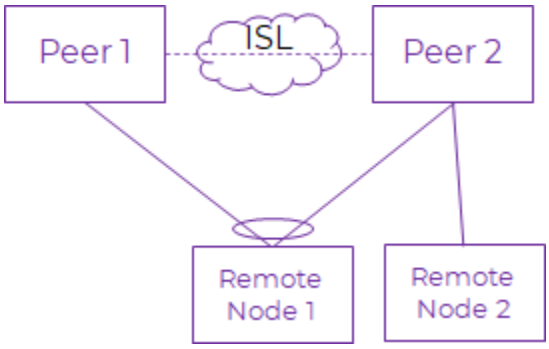
and lowest will be BACKUP node. It is recommended to configure such that if one peer is configured as AUTO role, other node also must be configured as AUTO role.

MLAG Control Plane Protocol (MLAG CCP)

MLAG peers periodically send health-check (HC) messages. These messages are sent over an gRPC connection to the peer's 4012 Port number. Peers send health-check hellos every keepalive-interval ms, where keepalive-interval is a configurable parameter with a range 100 ms -1000000 ms, defaulting to 300 ms. Primary Keepalive must be configured for peer liveness detection. Peer will be declared DOWN if both Primary and Secondary keepalive status are DOWN.

In addition to keepalive messages, MCP also synchronizes MAC and ARP messages and exchanges system parameters, including management IP. configured bridge domains (BDs), and System MAC address.

The Primary Keepalive service establishes the initial connection between peers, which is then offloaded to BFD (Bidirectional Forwarding Detection) for ongoing monitoring. BFD utilizes an MLAG (Multi-Chassis Link Aggregation) profile to configure transmission intervals and detection multipliers. By default, BFD operates with a 300-millisecond interval and a detection multiplier of 3.



MLAG Resiliency

MLAG Resiliency enhances the fault tolerance of MLAG by detecting and responding to critical system failures such as out of memory condition or uncontrolled restart of FWD-HAL service of the primary MLAG device. MLAG resiliency feature ensures continuous network availability.

The primary objective is to prevent split brain mode during system faults and maintain acceptable convergence times.

Health Monitoring

The health monitoring logic is embedded in the monitoring service, which acts as a gRPC server. It listens for system fault events from various services, including memory and CPU utilization issues. When a fault is detected, it is published on the message bus, making it available to all subscribed services—including MLAG.

Use the following debug command to check the local node health:

```
curl 0:9004/show-peerdb

[admin@leaf]# curl 0:9004/show-peerdb

Dumping MLAG Config Data Structures:
************************************

-----------------------------------------------------
Keepalive Interval     : ---
Keepalive Delay        : ---
Bringup  Delay         : 30
Multiplier             : ---
Role                   : ---
Mac                    :---
Mgmt IP                : 10.38.59.158 Idx: 22000001
System MAC             : 00:16:3e:54:e1:00
BringUpDelayTmrSt      : false
Local MaintenanceMode  : Disabled
Local Health : Healthy
```

Use the following debug command to check the remote node health:

```
device# show mlag peer
Peer dut3
=========
Peer State                 : UP
MCP State                  : UP
Role                       : BACKUP
Elected MAC                : 02:00:22:33:44:55
Extend Bridge Count        : 46
Peer Exception             : Peer Under Unhealthy State
```

Interface-Manager Responsibilities

The Interface-Manager is responsible for responding to Out-of-Memory (OOM) conditions by coordinating with platform scripts and MLAG services. It listens for OOM alerts from the monitoring service and, when triggered, brings down all physical interfaces and notifies MLAG to disable secondary keepalive to prevent split-brain scenarios. Once the system recovers, it helps restore network connectivity by bringing up interfaces and re-enabling MLAG functions.

```
Device# show int brief
Flags:  M - Redundant Management  P - Performance-Path
Number of interfaces 124
Port            Mtu      Admin-State Oper-State               Speed    Ifindex
Description
--------        -------- ----------- ----------              -------- ------------
-----------
Int 0(P)        9216     UP          UP                      10G      0x21000000
Internal 0
Eth 0/1         9216     UP          DOWN (SYSTEM_FAULT)     100G     0x1000020
towards-Leaf3
Eth 0/2         9216     UP          DOWN (SYSTEM_FAULT)     100G     0x1000040
towards-Leaf4
Eth 0/3         9216     DOWN        DOWN                    100G     0x1000060
Ethernet 0/3
Eth 0/4(M)      9216     UP          UP                      100G     0x1000080
Ethernet 0/4
Eth 0/5:1       9216     UP          DOWN (SYSTEM_FAULT)     25G      0x10000a1
Ethernet 0/5:1
Eth 0/5:2       9216     UP          DOWN (SYSTEM_FAULT)     25G      0x10000a2
```

```
Ethernet 0/5:2
Eth 0/5:3       9216     DOWN        DOWN                      25G      0x10000a3
Ethernet 0/5:3
Eth 0/5:4       9216     DOWN        DOWN                      25G      0x10000a4
Ethernet 0/5:4
Eth 0/6         9216     UP          DOWN (SYSTEM_FAULT)       100G     0x10000c0
Ethernet 0/6
Eth 0/7         9216     UP          DOWN (SYSTEM_FAULT)       100G     0x10000e0
Ethernet 0/7
Eth 0/8         9216     UP          DOWN (SYSTEM_FAULT)       100G     0x1000100
Ethernet 0/8
Eth 0/9         9216     UP          DOWN (SYSTEM_FAULT)       100G     0x1000120
Ethernet 0/9
Eth 0/10        9216     UP          DOWN (SYSTEM_FAULT)       100G     0x1000140
Ethernet 0/10
Eth 0/11        9216     UP          DOWN (SYSTEM_FAULT)       100G     0x1000160
Ethernet 0/11

:

:

:

Eth 0/31:1      9216     UP          DOWN (SYSTEM_FAULT)       25G      0x10003e1
member port of po 78
Eth 0/31:2      9216     UP          DOWN (SYSTEM_FAULT)       25G      0x10003e2
member port of po 78
Eth 0/31:3      9216     UP          DOWN (SYSTEM_FAULT)       25G      0x10003e3
member port of po 78
Eth 0/31:4      9216     UP          DOWN (SYSTEM_FAULT)       25G      0x10003e4
member port of po 78
Eth 0/32:1      9216     UP          DOWN (SYSTEM_FAULT)       25G      0x1000401
member port of po 78
Eth 0/32:2      9216     UP          DOWN (SYSTEM_FAULT)       25G      0x1000402
member port of po 78
Eth 0/32:3      9216     UP          DOWN (SYSTEM_FAULT)       25G      0x1000403
member port of po 78
Eth 0/32:4      9216     UP          DOWN (SYSTEM_FAULT)       25G      0x1000404
member port of po 78
Po 18           9216     UP            DOWN                      0G       0x4000012
Port-Channel 18
Po 28           9216     UP            DOWN                      0G       0x400001c
Port-Channel 28
Po 78           9216     DOWN     DOWN                      0G       0x400004e    Po b/w
9150-1, Leaf3, Leaf4
Po 101          9216     UP           DOWN                      0G       0x4000065    Port-
Channel 101
Po 102          9216     UP           DOWN                      0G       0x4000066    Port-
Channel 102
Tu ISL_10.7.8.7          UP           DOWN                               0x3100001
Tunnel ISL_10.7.8.7
Ve 101          9216     UP           DOWN (NO_ACTIVE_MEMBERS)          0x5000065    VE
101

Device# show system health

-------------------
DEGRADED-COMPONENTS
-------------------
Component: Memory
Reason: insuffiecient memory available (< 953.7 MiB)
Time: 2025-02-03 15:04:05
```

MLAG Responsibilities

FwdHAL Restarts

When FwdHAL restarts, the MLAG service relies on health monitoring updates from the State Database (SDB) published by the monitoring service. If the monitoring service marks a node as unhealthy, MLAG receives this notification and promptly informs its peer node using the keepalive service. Similarly, when the system is declared healthy again, MLAG communicates this recovery to the peer, ensuring both nodes remain synchronized in their health status.

Out-of-Memory (OOM) Handling

When OOM Condition is Detected:

1. Interface-Manager notifies MLAG MS about OOM condition.
2. MLAG MS communicates node unhealthy information to peer node using keepalive and system services

When OOM Condition is Cleared:

1. MLAG MS starts BringUp delay timer.
2. Once timer expires, MLAG MS sends Node Health notification to peer node.

Split-Brain Handling

A split-brain scenario occurs when the primary keepalive link is down but the secondary keepalive remains active. In this case, the MLAG backup node typically shuts down all its client ports to prevent network inconsistencies. However, if the backup node has already received a peer unhealthy notification, it will not shut down its client ports to avoid traffic blackholing.

Chassis Manager Responsibilities

- Manages platform hardware components (fans, PSU, thermal sensors, BMC)
- Reports hardware failures to monitoring service via gRPC
- MLAG MS attempts to send Node Health/Unhealth information to the peer node.
- In certain situations, such as kernel panic, fwd-hal restart, and broken communication between MLAG peers, the Node Health information may not be successfully delivered to the peer node.

FwdHAL Responsibilities

- Manages QSFP detection and BCM initialization
- Reports issues in ASIC bring-up or QSFP I2C lock-up to monitoring service
- Listens to SDB notification and shuts down front panel interface via BCM on I2C failures

Out-of-Memory (OOM) Condition

When system memory falls below a certain threshold, the kernel may reload the device. To prevent this, the `monitor-svc` service:

1. Monitors system memory: every 5 seconds
2. Calculates available memory: using `MemAvailable` field from `/proc/meminfo`
3. Generates system fault: if available memory falls below 1 GB
4. Clears fault: when available memory exceeds 1.5 GB

Fault Flapping Prevention

- Monitors the number of flaps
- If flaps exceed 5, the fault will not be cleared

OOM Event Update

Updates specific key paths with OOM event information. For example, OOM event will be updated on following key path:

```
key /components/component[name=degraded-component]
 {
  "name": "degraded-component",
  "subcomponents": {
   "subcomponent": [
    {
     "name": "Memory",
     "state": {
      "name": "Memory"
     }
    }
   ]
  }
 }


key /components/component[name=Memory]
 {
  "name": "Memory",
  "properties": {
   "property": [
    {
     "name": "reason",
     "state": {
      "configurable": false,
      "value": "insufficient memory available (less than 953.7 MiB)"
     }
    },
    {
     "name": "timestamp",
     "state": {
      "configurable": false,
      "value": "2025-02-03 06:59:36"
     }
    },
    {
     "name": "count",
     "state": {
      "configurable": false,
      "value": "0"
```

```
    }
   ]
  },
  "state": {
   "name": "Memory",
   "type": "health"
  }
 }
```

Show System Health CLI

Displays description of OOM event, including:

- Memory usage statistics
- Degraded components (Memory)
- Reason for degradation (insufficient memory available)

```
device# show system health
BIOS Vendor: SeaBIOS
BIOS Version: 1.13.0-1ubuntu1.1
BIOS Date: 04/01/2014
Kernel Version: 5.10.210-yocto-standard
Kernel Arch: x86_64
CPU Procs: 6
OS: linux
Platform: alpine
Platform Version: 3.20.3
Memory Total: 7.63GB
Memory Free: 0.91GB
Memory Used: 6.48GB
Memory Used (%): 84.00%
CPU Model: Intel Xeon Processor (Cascadelake)
Cpu Load: 37
Primary Rootfs Disk Total: 16.37GB
Primary Rootfs Disk Free: 11.70GB
Primary Rootfs Disk Used: 3.82GB
Secondary Rootfs Disk Total: 17.00GB
System Uptime: 4m31s
RAM Caches(kB): 911252

RAM Free(kB): 227316
Ram Used(kB): 6842488
RAM Buffers(kB): 23052
Cpu SoftIRQ time: 0
Cpu System time: 3
Cpu IOWait time: 7
Cpu User time: 26
USRDATA Partition Used: 22.00%
APPDATA Partition Used: 8.00%
Secondary Rootfs Disk Used: 3.90GB
Disk Written(kB): 0
Secondary Rootfs Disk Free: 12.00GB
CONFIG Partition Used: 1.00%
IAH Partition Used: 1.00%
Disk Read(kB): 4184

--------------------
DEGRADED-COMPONENTS
--------------------
Component: Memory
Reason: insufficient memory available (less than 953.7 MiB)
Time: 2025-02-03 06:59:36
```

Uncontrolled Restart of FWD-HAL

When FWD-HAL terminates ungracefully, the device reloads after a support save and graceful termination of services. To minimize traffic disruption:

1. Monitor-svc service detects crash: generates system fault and notifies services
2. Disables TX on QSFP interfaces: using host script to bring down front panel link
3. Copper ports not affected: only QSFP interfaces are disabled

For example, this event will be notified in following keypath:

```
key /components/component[name=degraded-component]
 {
  "name": "degraded-component",
  "subcomponents": {
   "subcomponent": [
    {
     "name": "Service",
     "state": {
      "name": "Service"
     }
    }
   ]
  }
 }

key /components/component[name=Service]
 {
  "name": "Service",
  "properties": {
   "property": [
    {
     "name": "reason",
     "state": {
      "configurable": false,
      "value": "service fwd-hal not healthy"
     }
    },
    {
     "name": "timestamp",
     "state": {
      "configurable": false,
      "value": "2025-02-03 07:06:27"
     }
    },
    {
     "name": "count",
     "state": {
      "configurable": false,
      "value": "0"
     }
    }
   ]
  },
  "state": {
   "name": "Service",
   "type": "health"
  }
 }
```

System Fault Notification

- Updates specific key paths with fault information
- The **show system health** CLI displays reason for degradation (service fwd-hal not healthy)

```
device# show system health

--------------------
DEGRADED-COMPONENTS
--------------------
Component: Service
Reason: service fwd-hal not healthy
Time: 2025-02-03 07:06:27
```

Uncontrolled Restart of Multiple Services

When two or more services terminate ungracefully within a 10 mins interval, the device automatically reboots. To aid traffic convergence and minimize disruption, generate a system fault.

YANG Modules and CLI Commands

Yang Path

The monitor-svc service updates the SDB with system fault information in the following paths:

1. Degraded Component: lists all subcomponents in a degraded state - /components/component[name=degraded-component]
2. Subcomponent Details: provides reason, timestamp, and count for each subcomponent - /components/component[name=Memory]

Clearing Events

- Delete notification is sent on the subcomponent to clear the event
- /components/component[name=degraded-component] is updated with an empty subcomponent list

CLI Commands

For more information regarding MLAG CLI commands see the *Extreme ONE OS Switching Command Reference Guide*.

Show Command

When an Out-of-Memory (OOM) condition is detected:

- Front panel Ethernet ports become operationally down with reason code SYSTEM_FAULT (if admin UP)
- **show int brief** displays interface status, including OOM-affected ports
- **show system health** displays degraded components, including Memory, with the reason for degradation

Enhanced show mlag peer Command

- Displays peer node health state
- New leaf `/mlag/peers/peer[name=%v]/exception-state` updates peer exception information

The following example output shows Peer State (UP), Peer Exception (Peer Under Maintenance Mode, Unhealthy State):

```
device# show mlag peer
Peer dut3
=========
Peer State                : UP
MCP State                 : UP
Role                      : BACKUP
Elected MAC               : 02:00:22:33:44:55
Extend Bridge Count       : 46
Peer Exception            : Peer Under Unhealthy State
```

RASLog Messages

- MLAG Peer Unhealthy

```
LogID: 17014 - "MLAG Peer 10.2.5.5 is Unhealthy"
```

- MLAG Peer Healthy

```
LogID: 17014 - "MLAG Peer 10.2.5.5 is Healthy"
```

Configure MLAG Session on Peer Devices

You can configure MLAG session on peer devices.

Follow this procedure to configure MLAG session on peer devices at global configuration mode.

1. Enter the configure terminal command to access global configuration mode.

```
device# configure terminal
```

2. Run the **`mlag`** command to add an MLAG session at the global configuration level.

```
device# (config)# mlag
   device# (config-mlag)#
               peer           MLAG peer mode
   device# (config-mlag)# peer
               NAME□ (String: 1-64 character) example. peer (peer1)
  device# (config-mlag)# peer mlag-peer
  device(config-mlag-peer-mlag-peer)#
```

3. Verify the MLAG session configuration on the peer devices.

```
#show running-config mlag
  mlag
     peer mlag-peer

     #show running-state mlag
   mlag
     peer p1
```

4. Run the **`uplink-track interface`** command to configure uplink track ports between MLAG peers and external router.

```
uplink-track interface ( ethernet IFNAME | port-channel  PONUMBER )
EX:
(config-mlag)# uplink-track interface
```

```
  ethernet      Ethernet
  port-channel  Port-channel


device(config-mlag)# uplink-track interface ethernet
  IFNAME  Interface name in slot/port or slot/port:breakout format i.e slot/
port:<channel range>
device(config-mlag)# uplink-track interface ethernet 0/1:1


device(config-mlag)# uplink-track interface port-channel
  PORANGE  Value from 1-255, Example: 1. Range Example: 1-3,5,7-9
device(config-mlag)#  uplink-track interface port-channel 200
```

5. Run the **clear counters mlag** command to clear the counters of a multichassis link aggregation (MLAG) peer.

   ```
   clear counters mlag peer peer-name
   ```

   The following example clears the counters on an MLAG peer named m12345:

   ```
   device# clear counters mlag peer m12345
   device#
   ```

6. Run the **extend-bd** command to extend the bridge domains across the multichassis link aggregation (MLAG) peer.

   The following example configures the subset extend bridge domain mode with the range of bridge domains. In this example, the bridge domains with IDs 1,5,100-200 are extended to other MLAG peers:

   ```
   device# configure terminal
   device(config)# mlag
   device(config-mlag)# peer peer01
   device(config-mlag-peer-peer01)# extend-bd subset 1,5,100-200
   device(config-mlag-peer-peer01)#
   ```

   To specify all the bridge domains except the configured bridge domains:

   ```
   device(config-mlag-peer-mlag-peer)#extend-bd except
   BDRANGE  Value from 1-8192, Example: 1. Range Example: 1-3,5,7-9
   ```

7. Run the **interface (MLAG configuration)** command to configure a multichassis link aggregation (MLAG) interface.

   The following example configures an Ethernet interface on port 1 in slot 0 and specifies 234 as the MLAG identifier number:

   ```
   device# configure terminal
   device(config)# mlag
   device(config-mlag)# interface ethernet 0/1 id 234
   device#
   ```

   The following is an example command of adding port channels:

   ```
   device(config-mlag)# interface port-channel
     PORANGE  Value from 1-255, Example: 1.
   device(config-mlag)# interface port-channel 1 id auto


   device(config-mlag)# interface port-channel
     PORANGE  Value from 1-255, Example: 1.
   device(config-mlag)# interface port-channel 10 id 1020
   ```

8. Run the **keepalive** command to specify the delay, interval, and multiplier settings for multichassis link aggregation (MLAG) keepalive transmissions.

   The following example sets the interval to 1000 milliseconds, the delay to 100 milliseconds, and the multiplier to 4:

```
device# configure terminal
device(config)# mlag
device(config-mlag)# keepalive interval 1000 delay 100 multiplier 4
device(config-mlag)#
```

9. Run the **keepalive (MLAG peer configuration)** command to specify the MLAG peer keepalive name for multichassis link aggregation group (MLAG) keepalive transmissions and enter MLAG peer keepalive configuration mode.

   The following example configures an MLAG peer named peer01 and configure a keepalive named keepalive01:

```
device# configure terminal
device(config)# mlag
device(config-mlag)# peer peer01
device(config-mlag-peer-peer01)# keepalive keepalive01
device(config-mlag-peer-keepalive-keepalive01)#
```

10. Run the **destination (MLAG peer configuration)** command to specify the IP address for the keepalive destination of the multichassis link aggregation (MLAG) peer.

    The following example configures an MLAG peer named peer01 and also configures IPv4 address 12.1.1.1 as its keepalive destination:

```
device# configure terminal
device(config)# mlag
device(config-mlag)# peer peer01
device(config-mlag-peer-peer01)# keepalive keepalive01
device(config-mlag-peer-keepalive-keepalive01)# destination 12.1.1.1
device(config-mlag-peer-keepalive-keepalive01)#
```

11. Run the **mac (MLAG configuration)** command to specify the multichassis link aggregation (MLAG) MAC address.

    The following example configures the MLAG MAC address on the device:

```
device# configure terminal
device(config)# mlag
device(config-mlag)# mac a001.a002.a003
device(config-mlag)#
```

12. Run the **bringup-delay** command to set the multichassis link aggregation (MLAG) bringup delay.

```
device# configure terminal
device(config)# mlag
device(config-mlag)# bringup-delay 100
device(config-mlag)#
```

13. Run the **role (MLAG configuration)** command to specify the type of role for multichassis link aggregation (MLAG).

    The following example sets the MLAG role as primary:

```
device# configure terminal
device(config)# mlag
device(config-mlag)# role primary
device(config-mlag)#
```

14. Run the **show counters mlag** command to display statistics for multichassis link aggregation (MLAG).

    The following example displays statistics for the MLAG peer:

```
device# show counters mlag peer

Peer dut3
=========
Transitions     : 2
show counters mlag
No. of Restarts : 2
Last clear      : 0000-00-00 00:00:00

Keepalive kp-primary
--------------------
Transitions : 1
Receive     : 8 (BFD)
Transmit    : 8 (BFD)
Last clear  : 0000-00-00 00:00:00

Keepalive kp-secondary
----------------------
Transitions : 1
Receive     : 199603
Transmit    : 199603device#
Last clear  : 0000-00-00 00:00:00
```

15. Run the **source-interface** command to specify the source interface for the multichassis link aggregation (MLAG) peer keepalive.

    The following example configures an MLAG peer named peer01 and also configures an Ethernet port named 0/1 as its keepalive source interface:

```
device# configure terminal
device(config)# mlag
device(config-mlag)# peer peer01
device(config-mlag-peer-peer01)# keepalive keepalive01
device(config-mlag-peer-keepalive-keepalive01)# source-interface ethernet 0/1
device(config-mlag-peer-keepalive-keepalive01)#
```

16. Run the **type (MLAG peer keepalive configuration)** command to specify the multichassis link aggregation (MLAG) peer keepalive type.

    The following example configures an MLAG peer named peer01 and also configures it to use a primary keepalive type:

```
device# configure terminal
device(config)# mlag
device(config-mlag)# peer peer01
device(config-mlag-peer-peer01)# keepalive keepalive01
device(config-mlag-peer-keepalive-keepalive01)# type primary
device(config-mlag-peer-keepalive-keepalive01)#
```

17. Run the **show mlag interfaces** command to display details about the multichassis link aggregation (MLAG) interfaces

    The following example displays information about all MLAG interfaces that are configured on the device:

```
DUT4# sho mlag interfaces
Interface Identifier: 1010
  Interface: ethernet 0/13:1
Peer□   Lcl/Rmt State Rmt Cfg/Act Member Up Count  Exceptions
------ ------------- ------------------ --------- --------------
dut3               UP / UP       1 / 1               1
```

```
Interface Identifier: 4294967295
  Interface: ethernet 0/17:1
Peer□   Lcl/Rmt State Rmt Cfg/Act Member Up Count  Exceptions
------ ------------ ------------------ --------- --------------
dut3               UP / UP       1 / 1              1

Interface Identifier: 1103
  Interface: port-channel 103
Peer□   Lcl/Rmt State Rmt Cfg/Act Member Up Count  Exceptions
------ ------------ ------------------ --------- --------------
dut3               UP / UP       3 / 3               1

Interface Identifier: 2000
  Interface: port-channel 104
Peer   Lcl/Rmt State Rmt Cfg/Act Member Up Count  Exceptions
------ ------------ ------------------ --------- --------------
dut3               UP / UP       1 / 1              1
```

18. Run the **show mlag peer bfd** command to display Bidirectional Forwarding Detection (BFD) details about the multichassis link aggregation (MLAG) primary keepalive state on the device.

    The following example displays BFD details on the MLAG peer that is configured on the device:

```
device# show mlag peer bfd
Peer mlag-peer
==============
Keepalive one
-------------
Profile        : default
Session ID     : 1
Session Status : Up
Device
```

19. Run the **show mlag peer** command to display details about the multichassis link aggregation (MLAG) peers that are configured on the device.

    The following example displays information about the MLAG peer that is configured on the device:

```
DUT3# sho mlag peer
Peer dut4
=========
Peer State                : UP
MCP State                 : UP
Role                      : PRIMARY
Elected MAC               : 02:00:22:33:44:55
Extend Bridge Count       : 72
Peer Exception            : None
   Keepalive kp-primary
   --------------------
   Destination Address: 11.x.x.x
   State              : UP
   Type               : PRIMARY
   Address Type       : MANUAL
   Source Interface   : port-channel 20 ( 11.x.x.x )
   First Rx           : 2025-06-24 15:34:32
   Last Rx            : 2025-06-24 15:34:33
   Keepalive kp-secondary
   ----------------------
   Destination Address: 10.x.x.x
   State              : UP
   Type               : SECONDARY
   Address Type       : AUTO
   Source Interface   : management 0 ( 10.x.x.x )
```

```
   First Rx           : 2025-06-24 15:34:40
   Last Rx            : 2025-06-25 15:20:42
```

20. Run the **show mlag peer extended-bridges** command to display information about the MLAG peer extended bridges that are configured on the device.

```
device# show mlag peer extended-bridges
Peer dut3
=========
No. of Extend Bridge: 34
Extend Bridges :
1,100,200-202,205,209,215-216,300-302,400,402,500-506,1001,2001,2500-2501,3001-3002,300
5-3
006,4000-4003,8192
device#
```

21. Run the **show mlag** command to display information about the multichassis link aggregation (MLAG) configuration.

    The following example displays information about the MLAG configuration on the device:

```
DUT4# show mlag
Role                 : BACKUP
MAC                  : none
Bring up delay       : 100 seconds
Keepalive Delay      : 1000 ms
Tx Interval          : 300 ms
Multiplier           : 3
Uplink Track Intf    :  ethernet 0/4,0/6
             port-channel 54,64
No. of Peers         :1
No. of Interfaces    : 17
Peer Info:
==========
  Peer                State
  ---------           -----
  dut3                UP
Interfaces Info:
================
Id           Interface            Peer      Local/Remote State  Exceptions
--------    -------------------   ------    ------------------ ----------
1010         ethernet 0/13:1      dut3        UP / UP
4294967295   ethernet 0/17:1      dut3        UP / UP
1103         port-channel 103     dut3        UP / UP
2000         port-channel 104     dut3        UP / UP
1181         port-channel 181     dut3        UP / UP
1182         port-channel 182     dut3        UP / UP
183183       port-channel 183     dut3        UP / UP
184184       port-channel 184     dut3        UP / UP
1185         port-channel 185     dut3        UP / UP
186186       port-channel 186     dut3        UP / UP
1187         port-channel 187     dut3        UP / UP
1188         port-channel 188     dut3        UP / UP
189          port-channel 189     dut3        UP / UP
1190         port-channel 190     dut3        UP / UP
191919       port-channel 191     dut3        UP / UP
1192         port-channel 192     dut3        UP / UP
1193         port-channel 193     dut3        UP / UP
DUT4# sho mlag peer
Peer dut3
=========
Peer State               : UP
MCP State                : UP
Role                     : BACKUP
Elected MAC              : 02:00:22:33:44:55
```

```
Extend Bridge Count      : 72
Peer Exception           : None
  Keepalive kp-primary
  --------------------
  Destination Address : 11.1.2.1
  State               : UP
  Type                : PRIMARY
  Address Type        : MANUAL
  source Interface    : port-channel 20 ( 11.1.2.2 )
  First Rx            : 2025-05-20 19:09:49
  Last Rx             : 2025-05-20 19:42:03
  Keepalive kp-secondary
  ----------------------
  Destination Address : 10.x.x.x
  State               : UP
  Type                : SECONDARY
  Address Type        : AUTO
  Source Interface    : management 0 ( 10.3x.x.x )
  First Rx            : 2025-05-20 19:09:51
  Last Rx             : 2025-05-20 20:13:28
```

22. Run the **`show running-config mlag`** command to display the MLAG configuration that is running currently on a device.

```
device# show running-config mlag
mlag
  role backup
  bringup-delay 100
  uplink-track interface ethernet 0/4,0/6,0/11:2
  uplink-track interface port-channel 12,54,64
  interface port-channel 183 id 183183
  interface ethernet 0/17:1 id 4294967295
  interface port-channel 190 id auto
  interface port-channel 182 id auto
  interface port-channel 193 id auto
  interface port-channel 191 id 191919
  interface ethernet 0/13:1 id 1010
  interface port-channel 188 id auto
  interface port-channel 181 id auto
  interface port-channel 184 id 184184
  interface port-channel 189 id 189
  interface port-channel 104 id 2000
  interface port-channel 187 id auto
  interface port-channel 192 id auto
  interface port-channel 103 id auto
  interface port-channel 185 id auto
  interface port-channel 186 id 186186
  peer dut3
    extend-bd except 1001,1301
    keepalive kp-primary
      type primary
      address-type manual
      destination 11.1.2.1
      source-interface port-channel 20
   !
     keepalive kp-secondary
       type secondary
     !
   !
  !
```

MLAG Cluster Event Monitoring and Notification

Multi-Chassis Link Aggregation (MLAG) is trunking that initiates at a single MLAGunaware server or switch and terminates at two MLAG-aware switches. MLAG allows the links to the two MLAG-aware switches to appear to a downstream device as if they are coming from a single device on a single Link Aggregation (LAG) trunk interface or physical port.

In a data center network environment, LAG trunks provide link level redundancy and increased capacity. However, they do not provide switch-level redundancy. If the switch connected to the LAG trunk fails, the entire trunk loses network connectivity.

With MLAG, member links of the LAG trunk are connected to two MLAG-aware devices. Logical Inter-Switch Link (ISL) configuration between the 2 MLAG devices enables data flow and control messages between them.

In this model, if one MLAG device fails, a data path remains through the other device.

Extreme ONE OS Layer 2 MLAG control plane protocol (MCP) synchronizes MAC and ARP data between the MLAG peers, for node resiliency and faster convergence.

The data plane is established using a VxLAN tunnel between MLAG peers.

Supported Notifications

The following traps are generated when the peer is Up or Down:

Table 4: Extreme ONE MLAG MIB

Trap Names and OIDs	Varbinds	Description
extremeMlagPeerDownTrap 1.3.6.1.4.1.1916.1.63.0.1	extremeMlagPeerAddrType extremeMlagPeerAddr	Generated when MLAG peer goes down extremeMlagPeerAddrType: peer IP address type extremeMlagPeerAddr: peer IP address
extremeMlagPeerUpTrap 1.3.6.1.4.1.1916.1.63.0.2	extremeMlagPeerAddrType extremeMlagPeerAddr	Generated when MLAG peer comes up

EXTREME ONE MLAG MIB Definitions

- MIB Module: defines objects and notifications for MLAG
- Objects:
  - extremeMlagPeerAddrType: specifies peer IP address type
  - extremeMlagPeerAddr: specifies peer IP address
- Notifications:
  - extremeMlagPeerDownTrap: MLAG peer is down
  - extremeMlagPeerUpTrap: MLAG peer is up

The following is an sample of Extreme ONE MLAG MIB:

```
EXTREME-ONE-MLAG-MIB DEFINITIONS ::= BEGIN

 IMPORTS
     MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
         Integer32, Unsigned32, Counter32, Counter64
         FROM SNMPv2-SMI                       -- RFC 2578

     MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
         FROM SNMPv2-CONF                      -- RFC 2580

     InetAddress, InetAddressType
         FROM INET-ADDRESS-MIB

     sysName
        FROM SNMPv2-MIB

     extremeAgent
            FROM EXTREME-BASE-MIB;

extremeOneMlagMIB MODULE-IDENTITY
     LAST-UPDATED "202503110000Z" -- 11 March 2025 00:00:00 GMT
     ORGANIZATION "Extreme Networks, Inc."
             CONTACT-INFO
              "Postal: Extreme Networks, Inc.
                      6480 Via Del Oro
                      San Jose, CA 95119 USA
             Phone:   +1 408 579-2800
             E-mail:  support@extremenetworks.com
             WWW:     http://www.extremenetworks.com"
             DESCRIPTION
                     "initial version"
     ::= { extremeAgent  63 }

-- Top-level components of this MIB module.

 extremeMlagNotifications OBJECT IDENTIFIER ::= { extremeOneMlagMIB 0  }

 extremeMlagPeerAddrType OBJECT-TYPE
        SYNTAX InetAddressType
        MAX-ACCESS accessible-for-notify
        STATUS current
        DESCRIPTION
                "This object specifies the IP address type of the peer."
 ::= { extremeOneMlagMIB 1 }

 extremeMlagPeerAddr OBJECT-TYPE
        SYNTAX InetAddress
        MAX-ACCESS accessible-for-notify
        STATUS current
        DESCRIPTION
                "This object specifies the peer IP address."
 ::= { extremeOneMlagMIB 2 }

 extremeMlagPeerDownTrap NOTIFICATION-TYPE
        OBJECTS {
                extremeMlagPeerAddr, -- peer address
                extremeMlagPeerAddrType, -- peer address type
                sysName  -- The local host name assigned for this switch
        }
        STATUS current
        DESCRIPTION
                "MLAG peer is down"
 ::= { extremeMlagNotifications 1 }
```

```
 extremeMlagPeerUpTrap NOTIFICATION-TYPE
        OBJECTS {
                extremeMlagPeerAddrType, -- peer address type
                extremeMlagPeerAddr, -- peer address
                sysName  -- The local host name assigned for this switch
        }
        STATUS current
        DESCRIPTION
                "MLAG peer is up"
 ::= { extremeMlagNotifications 2 }

END
```

YANG Module for MLAG Status Retrieval

Peer Status

- Retrieved from YANG leaf object: /mlag/peers/peer/state/peer-state
- Module: extreme-mlag
- Peer state values:
  - UP: peer is up
  - DOWN: peer is down
  - UNKNOWN: peer state is unknown

```
module: extreme-mlag
  +--rw mlag
     +--rw peers
     |  +--rw peer* [name]
     |     +--rw name          -> ../config/name
     |     +--ro state
     |     |  +--ro name?                  string
     |     |  +--ro peer-state?            mlag-entity-state
```

Keepalive Status

- Retrieved from YANG leaf object: `/mlag/peer/keepalives/keepalive/state/keepalive-state`
- Module: extreme-mlag
- Keepalive state values:
  - UP: keepalive is up
  - DOWN: keepalive is down
  - UNKNOWN: keepalive state is unknown

```
module: extreme-mlag
  +--rw mlag
     +--rw peers
     |  +--rw peer* [name]
     |     +--rw keepalives
     |        +--rw keepalive* [name]
     |           +--rw name      -> ../config/name
     |           +--ro state
     |              +--ro name?              string
     |              +--ro keepalive-state?   mlag-entity-state


typedef mlag-entity-state {
```

```
    type enumeration {
      enum UP {
        description
          "The entity is perceived to be up by the system.";
      }
      enum DOWN {
        description
          "The entity is perceived to be down by the system.";
      }
      enum UNKNOWN {
        description
          "The current state of the entity is not known to the system.";
      }
    }
    description
      "Type for state of MLAG entities";
}
```

CLI Commands for MLAG Cluster

For details on syntax and command parameters, see *Extreme ONE OS Switching v22.2.0.0 Command Reference Guide*.

- clear counters mlag peer <peerName>
- interface { ethernet | port-channel} id <(0-4294967295) | auto>
- [no] keepalive {interval (100-1000000) | delay (0-1000000) | multiplier (1-50) }
- mac <XXXX.XXXX.XXXX>
- role {auto | primary| backup}
- peer <peer-name>
- [no] extend-bd {all | none | subset BDRANGE | except BDRANGE }
- address-type {auto | manual}
- destination {<IPv4 Address> | <IPv6 Address>}
- source-interface { ethernet | loopback | management | port-channel}
- type {primary | secondary}
- show counters mlag peer
- show mlag
- show mlag interfaces
- show mlag peer

MLAG Event Log Messages

Peer Up/Down Events

Log messages indicate MLAG peer operational state changes (UP/DOWN). For example, MLAG Peer 7.7.7.2 is operationally UP or MLAG Peer 7.7.7.2 is operationally DOWN.

```
{"Level":"info","Service":"mlag","LogID":17011,"Time":"2025-01-13 06:25:09.969 UTC
+0000","Msg":"MLAG Peer 7.7.7.2 is operationally UP"}
{"Level":"info","Service":"mlag","LogID":17011,"Time":"2025-01-13 06:28:49.735 UTC
+0000","Msg":"MLAG Peer 7.7.7.2 is operationally DOWN"}
```

Keepalive Up/Down Events

Log messages indicate MLAG keepalive state changes (UP/DOWN) for primary and secondary keepalives. For example, MLAG Keepalives with Peer 7.7.7.2 Primary:DOWN Secondary:UP.

```
{"Level":"info","Service":"mlag","LogID":17009,"Time":"2025-01-13 06:28:49.224 UTC
+0000","Msg":"MLAG Keepalives with Peer 7.7.7.2 Primary:DOWN Secondary:UP"}
{"Level":"info","Service":"mlag","LogID":17009,"Time":"2025-01-13 06:28:49.735 UTC
+0000","Msg":"MLAG Keepalives with Peer 7.7.7.2 Primary:DOWN Secondary:DOWN"}
```

Peer Health Events

Log messages indicate MLAG peer health state changes (Healthy/Unhealthy). For example, MLAG Peer 10.2.5.5 is Unhealthy or MLAG Peer 10.2.5.5 is Healthy.

```
LogID:17014 Msg:MLAG Peer 10.2.5.5 is Unhealthy
LogID:17014 Msg:MLAG Peer 10.2.5.5 is Healthy
```

Maintenance Mode Events

Log messages indicate MLAG peer maintenance mode state changes (Enabled/Disabled). For example, Maintenance Mode is Enabled on MLAG Peer 10.38.59.158 or Maintenance Mode is Disabled on MLAG Peer 10.38.59.158.

```
LogID:17013 Msg:Maintenance Mode is Enabled on MLAG Peer 10.38.59.158
LogID:17013 Msg:Maintenance Mode is Disabled on MLAG Peer 10.38.59.158
```

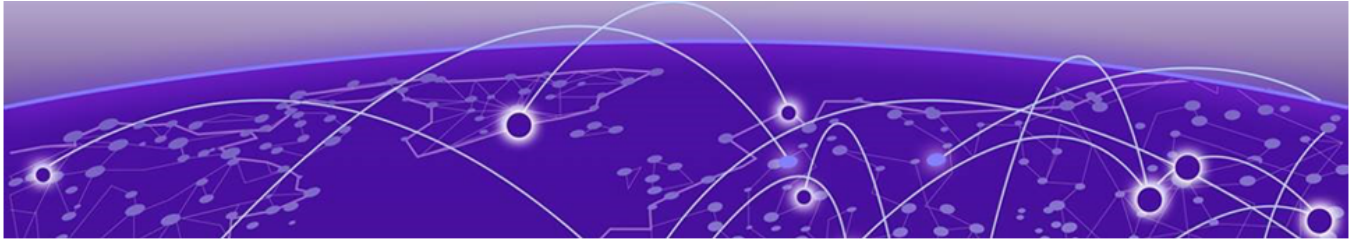
RASLogs

The following table describes RASLog IDs:

Raslog ID	Description	Sample log	Trigger
Raslog id	Description	Sample log	Trigger
17009	Mlag Keepalive UP event	MLAG Keepalives with Peer 1.1.1.1 Primary: UP Secondary: UP	MLAG is configured with primary and secondary keepalive.
17009	Mlag Keepalive DOWN event	MLAG Keepalives with Peer 1.1.1.1 Primary: DOWN Secondary: DOWN	Shut down the ISL interface
17011	Mlag Peer UP event	MLAG Peer 1.1.1.1 is operationally UP	This event will come if one of the keepalives is up. So, to simulate this event, bring up either of the keepalives.
17011	Mlag Peer DOWN event	MLAG Peer 1.1.1.1 is operationally DOWN	This event will come if both keepalives are down. So, to simulate this event, bring down both the keepalives.
17012	Mlag MCP UP event	MLAG Peer 10.2.5.5 MCP State operationally UP	MCP state depends on the primary keepalive. so, trigger is the same as primary keepalive.
17012	Mlag MCP DOWN event	MLAG Peer 10.2.5.5 MCP State operationally DOWN	MCP state depends on the primary keepalive. so, trigger is the same as primary keepalive.

Raslog ID	Description	Sample log	Trigger
17013	Maintenance Mode Enable event	Maintenance Mode is Enabled on MLAG Peer 10.38.59.158	Enable Maintenance Mode on peer MLAG device
17013	Maintenance Mode Disable event	Maintenance Mode is Disabled on MLAG Peer 10.38.59.158	Disable Maintenance Mode on peer MLAG device
17014	Unhealthy event	MLAG Peer 10.2.5.5 is Unhealthy	Trigger a fault in the peer node
17013	Healthy event	MLAG Peer 10.2.5.5 is Healthy	Clear the fault in the peer node

Note
MCP state depends on the primary keepalive state. MCP state will be UP if primary keepalive is UP, and DOWN if primary keepalive is DOWN.



Bridge Domains

Bridge Domain Overview

Bridge domain is an infrastructure that supports the implementation of different switching technologies.

A bridge domain is a generic broadcast domain that is not tied to a specific transport technology. Bridge domains support a wide range of service endpoints including regular Layer 2 endpoints and Layer 2 endpoints over Layer 3 technologies.

A bridge domain determines the flooding domain, which is shared among all members attached to that bridge domain. This means that traffic flooded within the bridge domain will be propagated to all associated members.

Bridge Domain Limitations

TD4 Limitations

1. **Exiting a double-tagged LIF:** When double-tagged traffic enters a single-tagged LIF and exits through a double-tagged LIF, only the outer VLAN is updated. The inner VLAN remains unchanged due to limitations in egress VLAN translation.
2. **Exiting an untagged-strict LIF:** When double-tagged traffic enters a single-tagged LIF and exits an untagged strict LIF, the inner VLAN remains unchanged, and only the outer VLAN is removed.

Bridge Domain Configuration

Use this topic to learn about configuring a bridge domain.

Note

- When a bridge domain member is configured using the "member" command in the CLI, it establishes the association only between the subinterface and the bridge domain. The subinterfaces must be created explicitly under the interfaces.
- Using the "no" form of the member command in the bridge domain will only remove the association of the subinterface with the BD; the subinterfaces themselves will remain intact under the interface.
- For information about commands and supported parameters to configure bridge domains, see *Extreme ONE OS SR Command Reference Guide*.

Configure Subinterface

You can configure subinterfaces under Ethernet and port channel interfaces to define specific packet-matching criteria. To manage packet flooding effectively, these subinterfaces must be linked to bridge domains, enabling proper packet forwarding and processing.

Follow the procedure to configure a subinterface.

1. Configure a tagged subinterface.

   A tagged subinterface matches single-tagged packets with a specific VLAN ID and sends packets with the designated VLAN tag.

   ```
   device(config)# interface ethernet 0/1
   device(config-eth-0/1) # subinterface vlan 100
   ```

2. Configure double-tagged subinterface.

   A double-tagged subinterface matches double-tagged packets with specific inner and outer VLAN IDs and sends packets with both VLAN tags.

   ```
   device(config)# interface ethernet 0/1
   device(config-eth-0/1)# subinterface vlan 100 inner-vlan 200
   ```

3. Configure untagged strict subinterface.

   An untagged strict subinterface matches only untagged packets received on the port and sends packets without a VLAN tag.

   ```
   device(config)# interface ethernet 0/2
   device(config-eth-0/1)# subinterface untagged
   ```

4. Configure untagged subinterface.

   An untagged subinterface matches untagged packets, associates them with a specified VLAN, and sends packets without a VLAN tag. This configuration also allows packets tagged with the VLAN ID associated with the VLAN-mode BD.

   ```
   device(config)# interface ethernet 0/2
   device(config-eth-0/1)# subinterface untagged vlan 400
   ```

Configure Bridge Domain in VLAN Mode

VLAN Mode Bridge Domain: A bridge domain in VLAN mode determines VLAN switching behavior and is associated with a specific VLAN ID (1-4094). This mode supports the following key features:

- Tagged and untagged configurations
- Member ports added to the bridge domain create a subinterface linked to the bridge domain

Untagged Member Behavior: An untagged member in a VLAN mode bridge domain accepts both:

- Untagged packets
- Tagged packets with the configured VLAN ID

Follow the procedure to configure the bridge domain in VLAN mode.

1. Configure a bridge domain with VLAN mode BD.

```
bridge-domain <ID> [mode vlan]

DUT(config)# bridge-domain
  (1-8192)  Bridge domain Id(1-8192)
DUT(config)# bridge-domain 100 mode
  vlan         Vlan mode
```

2. Configure VLAN-ID if the BD is a VLAN mode BD.

```
device(config)# bridge-domain 100 mode vlan
device(config-vlan-bd-100)# vlan-id
<1-4094>  Vlan ID range <1-4094>
```

3. Configure the tagged members.

   Add physical ports or port channels as tagged members to a VLAN mode bridge domain.

```
device(config)# bridge-domain 100 mode vlan
device(config-bd-100)# vlan-id 100
device(config-bd-100)# member ethernet 0/1
```

4. Configure the untagged members.

   Add physical ports or port channels as untagged members, accepting both untagged packets and tagged traffic from the VLAN.

```
device(config)# bridge-domain 100 mode vlan
device(config-bd-100)# vlan-id 100
device(config-bd-100)# member ethernet 0/1 untagged
```

5. Configure the untagged strict members.

   Add physical ports or port channels as untagged strict members, which only accept untagged packets. Requires creating an untagged strict subinterface and adding it to the bridge domain.

```
device(config)# interface ethernet 0/2
device(config-eth-0/1)# subinterface untagged

device(config)# bridge-domain 100 mode vlan
device(config-bd-100)# vlan-id 100
device(config-bd-100)# member ethernet 0/2 untagged
```

6. Configure VXLAN tunnel members.

   Include VXLAN tunnels in a bridge domain for extended network connectivity.

```
device(config)# bridge-domain 100 mode vlan
device(config-bd-100)# member tunnel vxlan-tunnel-1
```

Configure Bridge Domain in Default Mode

Bridge Domain Default Mode: In default mode, a bridge domain enables extended bridging functionality, supporting various subinterface configurations:

- Single-tagged
- Double-tagged
- Untagged strict subinterfaces

Untagged Traffic Handling: An untagged member within the default mode bridge domain exclusively accepts untagged traffic via an untagged strict subinterface.

Follow the procedure to configure a bridge domain in default mode.

1. Run the following commands

```
device(config)# bridge-domain 100
device(config-bd-100)# member ethernet 0/1 vlan 100
device(config-bd-100)# member ethernet 0/1 vlan 200 inner-vlan 300
device(config-bd-100)# member ethernet 0/1 untagged
device(config-bd-100)# member tunnel vxlan-tunnel-1
```

2. Run the **`member (tagged)`** command to create a tagged subinterface and assign the specified bridge domain membership.

   The following example creates a tagged subinterface and assigns the specified bridge domain membership:

```
device# configure terminal
device(config)# bridge-domain 200 mode vlan
device(config-vlan-bd-200)# vlan-id 200
device(config-vlan-bd-200)# member ethernet 0/2
device(config-vlan-bd-200)# member port-channel 1
device(config-vlan-bd-200)#
device# show running-config bridge-domain 200
bridge-domain 200 mode vlan
vlan-id 200
member ethernet 0/2
member port-channel 1
device#
```

3. Run the **`member (untagged)`** command to create an untagged subinterface and assign the specified bridge domain untagged membership:

   The following example creates a tagged subinterface and assigns the specified bridge domain membership:

```
device(config)# bridge-domain 200 mode vlan
device(config-vlan-bd-200)# member ethernet 0/2 untagged
device# show running-config
bridge-domain 200 mode vlan
vlan-id 200
member ethernet 0/2 untagged
device(config)#
```

4. (Optional) Create a VNI domain, which defines the VNI name space used by tunnels.

```
device(config-vlan-bd-200)# vni-domain

device(config-vlan-bd-200)# vni-domain base vni
  <1-16777215>  Vni value for bridge domain
```

The following example configures the VNI mapping bridge domain:

```
device# configure terminal
device(config)# bridge-domain 200
device(config-bd-200)# vni-domain base vni 64000
device(config-bd-200)#

device# show running-config bridge-domain 200

bridge-domain 200 mode vlan
   vlan-id 200
   member ethernet 0/21
   vni-domain base vni 64000
device#
```

Configure a Static MAC Address

Perform the following steps to configure static MAC address entries in a bridge domain on the device.

1. Run the following commands to configure static MAC address entries.

```
device# configure terminal
device(config)# bridge-domain 1
device(config-bd-1)# static-mac-address 40:88:2f:f9:c0:03 ethernet 0/1 vlan 1
device(config-bd-1)# static-mac-address f0:64:26:f5:c8:03 ethernet 0/2 vlan 401
device(config-bd-1)# static-mac-address f0:64:26:f5:c8:03 port-channel 2 untagged
device(config-bd-1)# static-mac-address f0:64:26:f5:c8:05 port-channel 2 vlan 10
device(config-bd-1)# static-mac-address 02:e0:52:11:11:11 ethernet 0/2 untagged
device(config-bd-1)# static-mac-address 02:e0:52:11:11:11 ethernet 0/4 vlan 10
device(config-bd-1)#
```

2. Run the following command to verify the bridge domain configuration on the device.

```
device# show running-config bridge-domain

bridge-domain 10 mode vlan
  vlan-id 1
  static-mac-address 40:88:2f:f9:c0:03 ethernet 0/1 untagged

bridge-domain 1
  static-mac-address 40:88:2f:f9:c0:03 ethernet 0/1 vlan 1
  static-mac-address f0:64:26:f5:c8:03 ethernet 0/2 vlan 401
  static-mac-address f0:64:26:f5:c8:03 port-channel 2 untagged
  static-mac-address f0:64:26:f5:c8:05 port-channel 2 vlan 10
  static-mac-address 02:e0:52:11:11:11 ethernet 0/2 untagged
  static-mac-address 02:e0:52:11:11:11 ethernet 0/4 vlan 10
device#
```

3. Run the following command to show the MAC address table for all bridge domains on a device:

```
device# show mac-address-table bridge-domain all

Bridge-Domain:1
------------------
Total number of Mac Entries: 1
Hardware Status Codes - #:Failed
```

```
Mac-Address              Type             Interface
------------------------ ---------------- ------------------------
00:10:00:00:00:01        Static           ethernet 0/3

Bridge-Domain:10
------------------
Total number of Mac Entries: 1
Hardware Status Codes - #:Failed
Mac-Address              Type             Interface
------------------------ ---------------- ------------------------
00:10:00:00:00:02        Static           ethernet 0/4.10

vm1# show mac-address-table bridge-domain 10 static
Total number of Mac Entries: 1
Hardware Status Codes - #:Failed
Mac-Address              Type             Interface
------------------------ ---------------- ------------------------
00:10:00:00:00:02        Static           ethernet 0/4.10

vm1# show mac-address-table bridge-domain 10 00:10:00:00:00:02
'*' denotes best route-source
Mac-Address              Type             Interface                Last
Change              Seq No   Hardware Status
------------------------ ---------------- ------------------------
------------------------ -------- ----------------
*00:10:00:00:00:02       Static           ethernet 0/4.10
48s                      0
device#
```

Configure MAC Learning

MAC learning is always enabled on the bridge domains.

1. Run the following command to view the MAC learning information:

```
device# show mac-address-table bridge-domain all

Bridge-Domain:100
------------------
Total number of Mac Entries: 6
Hardware Status Codes - #:Failed
Mac-Address              Type             Interface
------------------------ ---------------- ------------------------
00:10:00:00:00:00        Dynamic          ethernet 0/1:1.100
00:10:00:00:00:06        Dynamic          ethernet 0/1:1.102
00:10:94:00:00:02        Dynamic          ethernet 0/1:1.100
device#
```

2. Run the following commands to clear the MAC address table:

```
device# clear mac-address-table bridge-domain ID static
device# clear mac-address-table bridge-domain ID dynamic
device# clear mac-address-table bridge-domain ID mlag
device# clear mac-address-table bridge-domain ID evpn
device# clear mac-address-table bridge-domain ID X:X:X:X:X:X
device#
```

The following is an example:

```
device# clear mac-address-table bridge-domain 100 static
device# clear mac-address-table bridge-domain 100 dynamic
device# clear mac-address-table bridge-domain 100 mlag
device# clear mac-address-table bridge-domain 100 evpn
device# clear mac-address-table bridge-domain 100 01:01:01:01:01:01
device#
```

3. Run the following command to configure MAC aging:

```
device# config
device(config)# system
device(config-system)# global
device(config-system-global)# mac-address-table aging-time
  (60-38400)  Aging time in seconds (default = 1800)
  0           Disable aging
device(config-system-global)# mac-address-table aging-time 1000
device(config-system-global)#
```

4. Run the following command to display bridge domain information.
   - To display the Bridge domain information:

```
device# show bridge-domain all

*untag-s --accepts untagged only  *untag --accepts untagged+tagged

Bridge Domain 1    Mode L2VSI_VLAN Vlan 100
Total number of member ports  2
If Name   Vlan     Inner Vlan Admin Status Oper Status
========  ======== ========== ============ ===========
Eth 0/1:1 --       --         UP           UP
Po 100    untag-s  --         UP           UP

Bridge Domain 100    Mode L2VSI_P2MP
Vni Domain base Vni 64000
Total number of member ports  1
Member ports:
If Name  Vlan     Inner Vlan Admin Status Oper Status
======== ======== ========== ============ ===========
Eth 0/7  100                UP           DOWN
device#
```

   - To display the mac-address-table for a specific bridge domain.

```
device# show mac-address-table bridge-domain 100

Total number of Mac Entries: 3
Hardware Status Codes - #:Failed
Mac-Address              Type             Interface
------------------------ ---------------- -------------------------
00:10:94:00:00:02        Dynamic          ethernet 0/13.100
00:10:94:00:00:10        Static           ethernet 0/13.100
00:16:3e:1e:b6:03        Local            Local
device#
```

   - To display the mac-address-table for a specific bridge domain and specific source.

```
device# show mac-address-table bridge-domain 100 dynamic

Total number of Mac Entries: 3
Hardware Status Codes - #:Failed
Mac-Address              Type             Interface
------------------------ ---------------- -------------------------
00:10:94:00:00:02        Dynamic          ethernet 0/13.100
device#
```

   - To display details of ethernet interface or range of interfaces 1/1-2,2/1-2,3/2:1-4:

```
device# show interface ethernet 0/1 subinterface

Interface ethernet 0/1
Vlan      Inner Vlan Admin Status Oper Status If Mode
========  ========== ============ =========== ========
untag(100) -          UP          DOWN         IF_MODE_L2
100        200        UP          DOWN         IF_MODE_L2
device#
```

- To display details of port-channels:

```
device# show interface port-channel 103 subinterface

Vlan        Inner Vlan Admin Status Oper Status If Mode
========    ========== ============ =========== ========
untag(1000) -          UP           UP          IF_MODE_L2
1           0          UP           UP          IF_MODE_L2
2           0          UP           UP          IF_MODE_L2
device#
```

- To display global aging time for mac-address-table:

```
device# show system mac-address-table aging-time

Mac Aging Time: 1500
device#
```

Configure MAC Aging

Run the following commands to configure MAC aging:

```
device# config
device(config)# system
device(config-system)# global
device(config-system-global)# mac-address-table aging-time 1000
device(config-system-global)#
```