Extreme OS ONE Switching and Routing v22.2.2.0 Layer 2 Configuration Guide

Switching, LAG, MLAG, and Bridge Domain Setup

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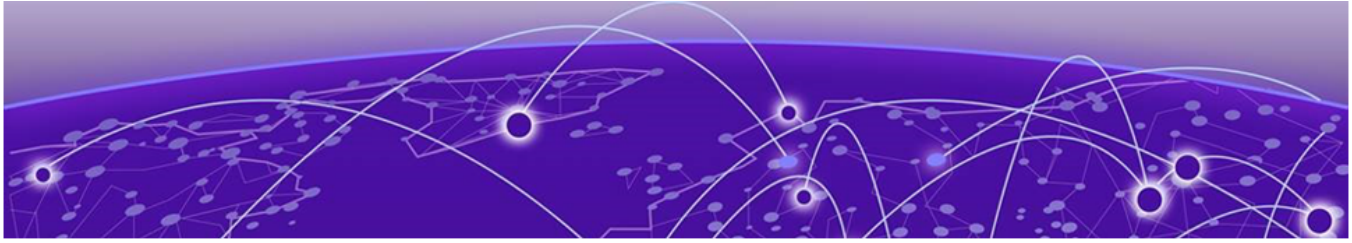

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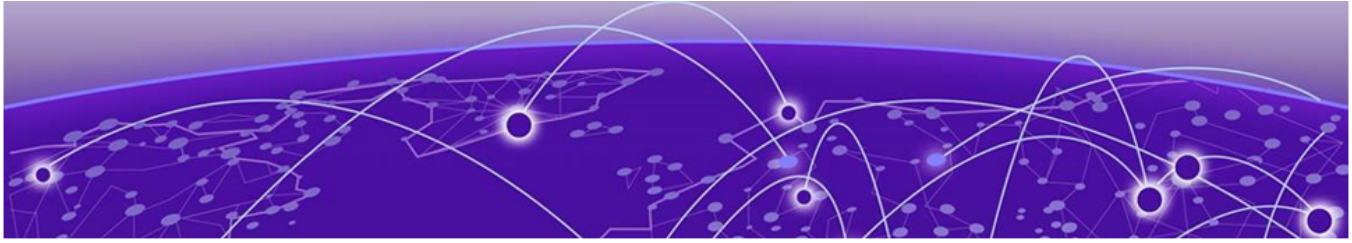

Abstract

The *Extreme OS ONE SR Layer 2 Configuration Guide* version 22.2.2.0 details Layer 2 features and procedures, including static and dynamic LAG (IEEE 802.1AX/LACP), MLAG control-plane design, and bridge domain configuration (VLAN and default modes) for tagged, double-tagged, untagged, and untagged-strict sub-interfaces. This guide is intended for intermediate-to-advanced IT professionals.

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.

When a feature, function, or operation pertains to a specific hardware product, the product name is used. When features, functions, and operations are the same across an entire product family, such as Extreme Networks switches, the product is referred to as *the switch*.

Table 1: Notes and warnings

Icon	Notice type	Alerts you to...
	Tip	Helpful tips and notices for using the product
	Note	Useful information or instructions
	Important	Important features or instructions
	Caution	Risk of personal injury, system damage, or loss of data
	Warning	Risk of severe personal injury

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*...].
\	In command examples, the backslash indicates a “soft” line break. When a backslash separates two lines of a command input, enter the entire command at the prompt without the backslash.

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- A description of the failure
- 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)
- Any related RMA (Return Material Authorization) numbers

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- Improvements that would help you find relevant information.
- Broken links or usability issues.

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Provide as much detail as possible including the publication title, topic heading, and page number (if applicable), along with your comments and suggestions for improvement.

About This Document

What's New in This Document

The following table describes the information added to this guide for Extreme OS ONE Switching and Routing, release 22.2.2.0:

Feature	Description	Link
Multichassis Link Aggregation Group (MLAG) Resiliency	Added the topic "MLAG Resiliency"	MLAG Resiliency on page 26

For additional information, see the *Extreme OS ONE SR Release Notes*.

Supported Platforms

Extreme OS ONE Switching and Routing 22.2.1.0 and later releases support Extreme 8520, Extreme 8720, Extreme 8730, and Extreme 8820 hardware platforms.

Note
Although this release uses many tested and supported software and hardware configurations, documenting all possible configurations and scenarios is beyond this document's scope.

For information about other releases, see the documentation for those releases.

Link Aggregation

Link Aggregation Overview

You can use link aggregation (LAG) to bundle multiple physical Ethernet links into a single port channel to provide enhanced performance, redundancy, and availability.

We also refer to port channels as link aggregation groups (LAGs). Connected devices, the Spanning Tree Protocol, IEEE 802.1Q VLANs, and so on consider a LAG to be a single link.

When one physical link in the LAG fails, the other links stay up. A failed link causes a small drop in traffic.

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

Link aggregation has the following benefits:

- Increased bandwidth (the system can change the logical bandwidth dynamically as the demand changes)
- Increased availability
- Load sharing
- Rapid configuration and reconfiguration

Each LAG has the following components:

- Links of the same speed
- A MAC address that differs 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 can belong to a LAG. Link Aggregation Control Protocol (LACP) automatically configures an administrative key value equal to the port channel identification number on each link that is configured to use LACP

Extreme OS ONE Switching and Routing supports two LAG types:

- Static—In static link aggregation, the system adds links into a LAG without exchanging control packets between the partner systems. The operational status and administrative state of the link determines the distribution and collection of frames on static links.
- Dynamic—In dynamic link aggregation, LACP negotiates the links included in a LAG. Typically, two partner systems that share 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 you 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.

Basic LAG Configuration

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

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

Configure a Port Channel Interface

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

1. Access global configuration mode.

```
device# configure terminal
```

2. 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 of its member interfaces.

1. Access global configuration mode.

```
device# configure terminal
```

2. Disable the port channel.

```
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 exist, this task creates the port channel and 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 for a port channel number.

3. Access global configuration mode again.

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

4. Access interface configuration mode for the physical interface where 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. You can specify one of the following modes:

   - (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 Link Aggregation Control Protocol (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. This example configures port channel number 1 and adds Ethernet interface 0/1 to the port channel in active mode:

```
device# show running-config lacp

interface port-channel 1
  no shutdown
  subinterface vlan 1
    ipv4 address 192.0.2.1/24
    ipv6 address 2001:db8:1:1::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 the 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 Link Aggregation Group (LAG) member links that the Link Aggregation Control Protocol (LACP) bundle can allow.

This configuration lets a port channel operate at a certain minimum bandwidth at all times. If the bandwidth of the port channel drops below the minimum number, then the device declares the port channel operationally DOWN even though it has operationally UP members.

1. Access Global configuration (config) mode.

```
device# configure terminal
```

2. Configure the interface.

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

3. Configure the minimum number of LAG member links.

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

The range is 1 to 64. The default is 1.

Note

Always configure **`min-links`** identically on both ends of the LAG. This prevents asymmetric forwarding and ensures clean failover behavior.

Dynamic (LACP) Configuration

Link Aggregation Control Protocol (LACP) is an IEEE 802.1AX standard that enables two partner systems to negotiate dynamically the attributes of physical links between them to form port channels.

If LACP determines that it can aggregate a link into a Link Aggregation Group (LAG), it puts the link into the LAG. All links in a LAG inherit the same administrative characteristics.

LACP operates in two modes:

- Active: LACP initiates protocol data unit (PDU) exchanges, regardless of whether the partner system sends LACP PDUs.

- Passive: 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 the following functionality:

- Inserting and capturing control LACP PDUs
- Restricting the traffic of a conversation to a specific link
- Load balancing links
- Handling dynamic changes in LAG membership

On each port, LACP performs the following tasks:

- 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. Access global configuration mode.

```
device# configure terminal
```

2. Enable Link Aggregation Control Protocol (LACP) globally.

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

3. (Optional) Disable LACP globally.

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

Configure LACP System Priority

You configure Link Aggregation Control Protocol (LACP) system priority on each device that runs LACP. LACP uses the system priority with the device MAC address to form the system ID and also during negotiation with other devices.

1. Access global configuration mode.

```
device# configure terminal
```

2. Specify the LACP system priority. The range is 1 to 65535. The higher the number, the lower the priority. The default is 32768.

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

3. (Optional) Reset the system priority to the default value.

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

Configure the LACP Interval

You can configure the protocol data unit (PDU) interval for a port that is a member of a link aggregation group (LAG). This is the interval at which the device sends Link Aggregation Control Protocol (LACP) control packets to an LACP supported interface.

You can choose a fast interval (one second) or a slow interval (30 seconds). The default is a slow interval.

The LACP timeout is triple the LACP interval. This means that for the **fast** setting, the LACP timeout is (1 second) x 3 = 3 seconds. For the **slow** setting, the LACP timeout is (30 seconds) x 3 = 90 seconds.

1. Access global configuration mode.
   ```
   device# configure terminal
   ```
2. Specify the Ethernet interface for which you want to configure the interval.
   ```
   device(config)# interface ethernet 0/1
   ```
3. Configure the interval on the interface.
   - To set a fast interval (1 PDU per second):
     ```
     device(config-if-eth-0/1)# lacp interval fast
     ```
   - To set a slow interval (1 PDU per 30 seconds):
     ```
     device(config-if-eth-0/1)# lacp interval slow
     ```
   - To restore the default interval (also 1 PDU per 30 seconds):
     ```
     device(config-if-eth-0/1)# no lacp interval
     ```

The following example adds Ethernet interface 0/1 to a LAG that has port channel number 10, specifies active LACP mode on the interface, and sets the interval of the interface to 1 PDU per second:

```
device# configure terminal
device(config)# interface ethernet 0/1
device(config-if-eth-0/1)# channel-group 10 mode active
device(config-if-eth-0/1)# lacp interval fast
device(config-if-eth-0/1)#
```

The following example displays the LAG configuration that is running currently on the device. This example adds Ethernet interface 0/1 to a LAG in active mode with a fast interval (1 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 0/1
channel-group 10 mode active
lacp interval fast
no shutdown
!
device#
```

The following example adds Ethernet interface 0/2 to a LAG that has port channel number 20, specifies active LACP mode on the interface, and sets the interval of the interface to 1 PDU per 30 seconds:

```
device# configure terminal
device(config)# interface ethernet 0/2
device(config-if-eth-0/2)# channel-group 20 mode active
device(config-if-eth-0/2)# lacp interval slow
device(config-if-eth-0/2)#
```

The following example displays the LAG configuration that is running currently on the device. This example adds Ethernet interface 0/2 to a LAG in active mode with a show interval (1 PDU per 30 seconds):

```
device# show running-config lacp

protocol lacp
lacp system-priority 32768
!
interface port-channel 20
lacp min-links 1
no shutdown
!
interface ethernet 0/2
channel-group 20 mode active
lacp interval fast
no shutdown
!
device#
```

Configure the LACP MAC Address

You can configure the Link Aggregation Control Protocol (LACP) 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. (Optional) Validate the port channel health and statistics information.

   ```
   device(config)# do 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
device(config)#
```

4. Configure the system MAC address.

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

5. (Optional) 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 prior interface.

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

The following example enables LACP globally on the device and configures a Link Aggregation Group (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 the device is running currently. This example enables LACP globally, specifies a LAG with port channel number 10 and a system MAC address of 01:23:45:67:89:ab, and adds Ethernet interface 0/29 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 Link Aggregation Control Protocol (LACP), the system priority determines which device takes the lead during link aggregation negotiations. You can set a value that influences which device takes the lead in a multi-device setup.

The default is 32768, and the range is 1 to 65535. You must ensure that the value is the same across the device.

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

```
device(config-if-po-101)# lacp system-priority
```

Supported Show and Clear Commands

- **`show interface port-channel`**: Displays details for all 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
device#
```

- **show counters interface port-channel**: Displays statistics for a specific 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
device#
```

- **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
device#
```

Note
The LACP microservice fetches counter statistics for out-pkts from the kernel every 10 sec. This means that counters are refreshed every 10 seconds. In-Pkts are updated every second.

- **`show lacp system-identifier`**: Displays the unique identifier assigned to a LAG.

```
device# show lacp system-identifier

        System ID: 0x8000, 00:04:96:d6:83:e0
device#
```

- **`show lacp interface ethernet x/x`**: Displays statistics for specific member ports of dynamic 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}
device#
```

- **`clear counters lacp`**: Clears statistics for member ports of the dynamic LAGs that are configured on the device.

```
device# clear counters lacp
device# clear counters lacp interface port-channel 10-20
device#
```

Multi-Chassis Link Aggregation (MLAG)

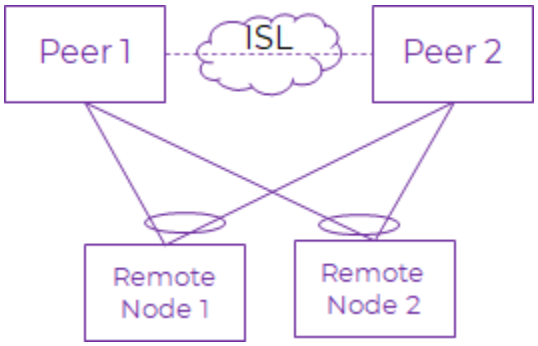
Overview

Multi-Chassis Link Aggregation (MLAG) lets one device (such as a server) connect to two switches at the same time, but it looks like just one connection to the server.

A LAG (link aggregation group) normally connects to one switch, so if that switch fails, the entire group goes down. MLAG splits the connections split across two switches that work together. The switches use an Inter-Switch Link (ISL) to communicate with each other to act like a single system. This means that if one switch fails, the other one keeps the connection alive to provide redundancy and more bandwidth.

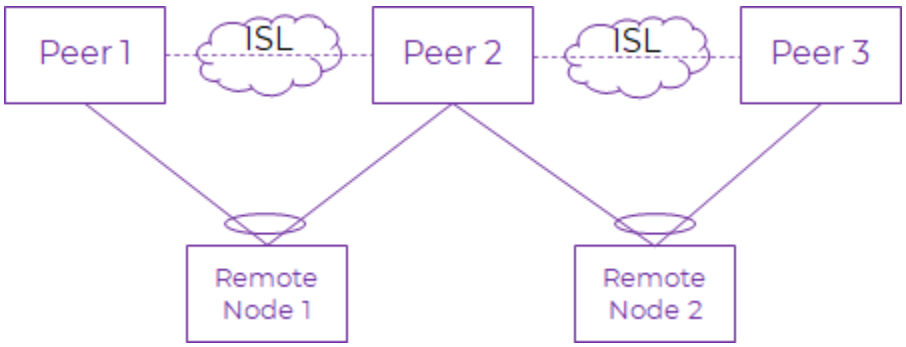
The Extreme OS ONE Switching and Routing Layer 2 MLAG control plane protocol (MCP) synchronizes MAC and ARP data between the MLAG peers for resiliency and faster convergence.

MLAG establishes the data plane using a Virtual eXtensible Local Area Network (VxLAN) tunnel between MLAG peers as in the following figure:



MLAG Limitations

Multichassis Link Aggregation Group (MLAG) supports only one peer device. It does *not* support the following topology, which contains multiple peers:



Other Limitations

- You cannot configure MLAG keep-alive source-interface as Virtual Ethernet (VE).
- Only the default VRF supports MLAG primary keep-alive.
- Ethernet MLAG interfaces do not support MLAG ID configuration as AUTO.
- Copper ports can remain operationally UP during a Forwarding Hardware Abstraction Layer (FWD-HAL) microservice crash.
- Recommendation: Physical interface or Port-channel used as underlay for VxLAN tunnel or ISL interface should not be part of any Bridge-domain or sub-interface configuration.

Supported Features

MLAG supports only system fault generation for the following features:

- Uncontrolled restart of the Forwarding Hardware Abstraction Layer (FWD-HAL) microservice
- Out of memory conditions

MLAG Terminology

MLAG	Multichassis Link Aggregation Group
ISL	Inter-Switch Link. This link connects the two physical devices that form an MLAG.The ISL is the dedicated, high-bandwidth connection between two MLAG peer devices. It synchronizes control traffic, such as MAC addresses and IGMP states, and carries data traffic if one switch loses its downstream link, ensuring high availability. An ISL allows two physically separate switches to act as a single logical entity to downstream devices, providing a unified control plane. The link transfers critical control information and to bridge data traffic between peers during failures or specific hash scenarios. You generally configure an ISL as a direct, high-speed, port-channel connection between the two switches, separate from traffic directed to servers.
VxLAN	Virtual eXtensible LAN
MCP	MLAG Control Protocol
MLAG VLANs	VLANs that the MLAG peers share. You configure these VLANs explicitly in the bridge domain configuration of the MLAG.
Member PO	A port channel (PO) that is a member of an MLAG group. These are the ports that belong to the port channel that forms the MLAG link. These links connect a device to both of the MLAG peer devices. For example, a server might have two NICs, with each connected to a different device, and the system bundles these NICs into a port channel that is a member of the MLAG. This makes the server connection appear as a single, highly available, and high bandwidth link.
Non-MLAG link	A standard network link that is not part of an MLAG. In contrast to MLAG, a non-MLAG link is a simple connection between two devices or a standard Link Aggregation Group (LAG) that combines only multiple links into a single logical one between two devices. A non MLAG link is any link that does not use this specific technology.
BD	Bridge Domain
VNI	Virtual Network Identifier
VE	Virtual Ethernet interface

MLAG Control Plane

Multichassis Link Aggregation Group (MLAG) establishes a primary keepalive session based on a gRPC Remote Procedure Call (gRPC) connection using port 4012 between the peers using the peer IP address of the configured primary keepalive and the IP of source interface. The primary keepalive session helps to establish an initial connection. If the Bidirectional Forwarding Detection (BFD) service is available, the system offloads the session to BFD for further management such as monitoring.

MLAG establishes a secondary keepalive session using a TCP connection using port 4000 between the peers using the IP address of the configured secondary keepalive and the IP of source interface if manually configured. By default, a secondary keepalive establishes a connection through the management interface automatically.

Inter-Switch Link (ISL)

ISL for is a Virtual eXtensible LAN (VxLAN) tunnel created between the Multi-Chassis Link Aggregation (MLAG) peers. The destination IP address of the ISL tunnel is the peer IP address of the MLAG peer. You configure the ISL source IP address on the source interface of the primary keepalive session.

The underlay interface carrying the traffic is any physical port or port channel Layer 3 interface between the MLAG peers. By default, the system extends all MLAG VLANs or bridge domains to the MLAG peer.

By default, the system configures VLAN to VxLAN Network Identifier (VLAN-VNI) mapping automatically for the ISL VxLAN tunnel. Because you can use a single VLAN-VNI mapping domain, any change to this mapping under the overlay gateway changes the mapping for the ISL and affects its traffic temporarily.

ISL does not support Virtual Ethernet (VE) interfaces.

MLAG Peer Role Selection in AUTO Role

The device elects the MLAG peer role based on the source IP address of the primary keepalive in the AUTO role. Otherwise, the device elects the peer with the highest primary keepalive source IP address as PRIMARY and uses the lowest as the BACKUP peer. You should configure the device so that if a peer has an AUTO role, the other peer also has an AUTO role.

MLAG Control Plane Protocol

MLAG peers send health check (HC) messages periodically. These messages travel over a gRPC Remote Procedure Call (gRPC) connection to 4012 port number of the peer. Peers send health check hellos every keepalive interval, where the keepalive interval is a configurable parameter with a range of 100 ms to 1000000 ms, defaulting to 300 ms.

You must configure the primary keepalive for peer liveness detection. MLAG declares the peer DOWN if both the primary and secondary keepalive statuses are DOWN.

In addition to keepalive messages, MLAG Control Plane Protocol (MCP) also synchronizes MAC and Address Resolution Protocol (ARP) messages and exchanges system parameters. These include the management IP address, configured bridge domains, and the system MAC address.

The primary keepalive service establishes the initial connection between peers and then offloads them to Bidirectional Forwarding Detection (BFD) for ongoing monitoring. BFD uses an MLAG 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 a Multichassis Link Aggregation Group (MLAG) by detecting and responding to critical system failures such as out of memory condition, uncontrolled restart of the Forwarding Hardware Abstraction Layer (FWD-HAL) service of the primary MLAG device or Quad Small Form-factor Pluggable (QSFP) Inter-Integrated Circuit (I2C) errors on 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 monitoring service contains the health monitoring logic, which acts as a gRPC Remote Procedure Call (gRPC) server. It listens for system fault events from various services including memory and CPU utilization issues. When it detects a fault, it publishes it on the message bus to make it available to all subscribed services (including MLAG).

Use the following command to check the local peer health.

```
device# 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
device#
```

Use the following command to check the remote peer 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
device#
```

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 Multichassis Link Aggregation Group (MLAG) backup peer typically shuts down all its client ports to prevent network inconsistencies. However, if the backup peer has already received a peer unhealthy notification, it does not shut down its client ports to avoid traffic blackholing.

Chassis Manager Responsibilities

In certain situations, such as a kernel panic, Forwarding Hardware Abstraction Layer (FWD-HAL) service restart, or broken communication between MLAG peers, the peer health information might not arrive successfully at the peer.

FWD-HAL Responsibilities

The MLAG service communicates this information to the peer using its keepalive service when the monitoring services declare that the system is healthy.

Out-of-Memory Condition

When system memory falls below a certain threshold, the kernel might reload the device. To prevent this, the monitor-svc service takes the following actions:

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

Out of Memory Handling

A device under an Out of Memory (OOM) condition responds by coordinating with platform scripts and Multichassis Link Aggregation Group (MLAG) services. It listens for OOM alerts from the monitoring service and, when triggered, brings down all physical interfaces and notifies the MLAG peer devices of an unhealthy state to prevent a split brain scenario. Once the system recovers, it helps restore network connectivity by bringing up interfaces and re-enabling MLAG functions.

```
device# show interface 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: insufficient memory available (< 953.7 MiB)
Time: 2025-02-03 15:04:05
device#
```

With an OOM condition, MLAG communicates unhealthy peer information to the peer via the keepalive and system services.

When MLAG clears an OOM condition, it starts the bringup delay timer. Once the timer expires, MLAG brings up the interfaces and uplink track interfaces and sends a Node Health notification to the peer.

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 peer typically shuts down all its client ports to prevent network inconsistencies. However, if the backup peer has already received a peer unhealthy notification, it will not shut down its client ports to avoid traffic blackholing.

Fault Flapping Prevention

To avoid continuous flapping between low memory and sufficient memory, the system monitors the number of flaps. If this number exceeds 5 flaps, the fault is not cleared.

OOM Event Update

An OOM event updates specific key paths with OOM event information. For example, an OOM event updates the 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

Use the **show system health** command to display information about the OOM event. This includes the following details:

- 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
device#
```

Uncontrolled Restart of FWD-HAL

When the Forwarding Hardware Abstraction Layer (FWD-HAL) application microservice restarts, the Multichassis Link Aggregation Group (MLAG) service relies on health monitoring updates from the state database (SDB) that the monitoring service publishes. If the monitoring service marks a peer as unhealthy, MLAG receives this notification and promptly informs its peer using the keepalive service. When the system is healthy again, MLAG communicates this recovery to the peer to ensure that the health status of each peer remains synchronized.

When FWD-HAL terminates ungracefully, the device reloads after saving tech support information and gracefully terminating services. To minimize traffic disruption, the monitor-svc microservice detects the crash, generates a system fault, and notifies services. Also, the system disables TX on Quad Small Form-factor Pluggable (QSFP) interfaces by using a host script to bring down the front panel link. This does not affect copper ports (it disables only QSFP interfaces).

For example, the monitoring service notifies this event in the following key path:

```
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

System fault notification updates specific key paths with fault information.The **`show system health`** command displays the 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 10 minutes, the device reboots automatically. To aid traffic convergence and minimize disruption, Multichassis Link Aggregation Group (MLAG) generates a system fault.

I2C and EEPROM Errors on QSFP Modules

The system detects Quad Small Form-factor Pluggable (QSFP) presence, types, and capabilities via Inter-Integrated Circuit (I2C) requests to the Complex Programmable Logic Device (CPLD) via QSFP EEPROM. However, these transactions can fail due to hardware issues with the QSFP modules or the I2C signal path. In some cases, repeated errors might lock the I2C controller and cause broader failures in QSFP management.

The two types of I2C errors are EEPROM I2C and CPLD I2C errors. These errors affect QSFP management only, not the data plane or traffic flow.

EEPROM I2C Error

This error indicates a permanent hardware fault preventing communication with the port EEPROM, likely because of a failed EEPROM device or damaged I2C signal path. The port remains in an error state until you physically repair or replace it, because reloads or power cycles cannot not resolve the issue.

CPLD I2C Error

This error indicates a CPLD-managed I2C communication failure, usually because faulty QSFP modules disrupt the I2C bus. Recovery involves replacing the affected QSFP modules and reloading the device to reset the CPLD.

Solution

When the system detects an I2C error at the port, BCM APIs enforce port shutdown, which deactivates the laser and transmitter, which triggers the peer device to redirect traffic. The peer device then senses a loss-of-signal (LOS) and shifts traffic to standby links.

If this port is the sole remaining ISL member, all front-panel interfaces go operational-down state to enable traffic handover to the MLAG peer without ongoing redundancy.

If I2C errors exceed the threshold, all front-panel interfaces go operational down state, which triggers a controlled MLAG failover.

Operator Guidance

- EEPROM I2C Errors: Remove or replace the faulty QSFP module or port hardware to recover. Device reloads, power cycles, or admin state changes do not work.
- CPLD I2C Errors: Remove or replace the affected QSFP modules, then reload the device to recover. Admin state changes are not enough.

Interface Operational Down Reasons

Ports show specific reasons for being down:

- I2C_ERROR: When an Inter-Integrated Circuit (I2C) issue occurs on the port, it goes down until a device reload. Admin flaps do not bring it up.
- SYSTEM_FAULT:
  - I2C errors below threshold and Inter-Switch Link (ISL) tunnel are not impacted. Affected ports show an I2C_ERROR.

```
device# show int brief
Port               Mtu    Admin-State Oper-State       Speed   Ifindex
Description

Eth 0/1            9216   UP          DOWN (I2C_ERROR) 100G    0x1000020   Ethernet
0/1
Eth 0/2            9216   UP          UP               100G    0x1000040   Ethernet
0/2
Eth 0/3            9216   UP          UP               100G    0x1000060   Ethernet
0/3
Eth 0/4            9216   UP          DOWN (I2C_ERROR) 100G    0x1000080   Ethernet
0/4
Tu ISL_10.1.2.2           UP          UP                       0x3100001   Tunnel
```

```
ISL_10.1.2.2
device#
```

- I2C errors exceed threshold and ISL tunnel is impacted. The affected ports show a SYSTEM_FAULT error.

```
device# show int brief
Port               Mtu    Admin-State Oper-State            Speed  Ifindex
Description

Eth 0/1            9216   UP          DOWN (SYSTEM_FAULT)   100G   0x1000020
Ethernet 0/1
Eth 0/2            9216   UP          DOWN (SYSTEM_FAULT)   100G   0x1000040
Ethernet 0/2
Eth 0/3            9216   UP          DOWN (SYSTEM_FAULT)   100G   0x1000060
Ethernet 0/3
Eth 0/4            9216   UP          DOWN (SYSTEM_FAULT)   100G   0x1000080
Ethernet 0/4
Tu ISL_10.1.2.2           UP          DOWN                        0x3100001
Tunnel ISL_10.1.2.2
device#
```

- Out-of-memory condition: All front panel Ethernet ports (if admin UP) go down with a SYSTEM_FAULT error.

```
device# show int brief
Port      Mtu   Admin-State Oper-State           Speed  Ifindex    Description

Eth 0/1   9216  UP          DOWN (SYSTEM_FAULT)  100G   0x1000020  Ethernet 0/1
Eth 0/2   9216  UP          DOWN (SYSTEM_FAULT)  100G   0x1000040  Ethernet 0/2
Eth 0/3   9216  UP          DOWN (SYSTEM_FAULT)  100G   0x1000060  Ethernet 0/3
Eth 0/4   9216  UP          DOWN (SYSTEM_FAULT)  100G   0x1000080  Ethernet 0/4
device#
```

Post-Reload System Fault Behavior

If a switch reloads after a system fault, and Inter-Integrated Circuit (I2C) errors persist, the system remains in system fault state if any port has an I2C error, regardless of whether it is an Inter-Switch Link (ISL) port or not. This only applies if the reload happens after the initial system fault detection.

Interface Manager Restart

If the interface manager restarts, ports in Inter-Integrated Circuit (I2C) error or the system in the fault state retain their state after restart.

YANG Modules and CLI Commands for MLAG Resiliency

YANG Path

The monitor-svc microservice updates the state database (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 the reason, timestamp, and count for each subcomponent (Memory, Service and Inter-Integrated Circuit (I2C)): /components/component[name=Memory]

Multichassis Link Aggregation Group (MLAG) sends a notification on the subcomponent to clear the event. MLAG updates /components/component[name=degraded-component] with an empty subcomponent list.

Yang Path Updates for Monitor-SVC

- Memory issues: Updates degraded-component with Memory subcomponent and reason

```
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": "insuffiecient memory available (less than 953.7 MiB)"
     }
    },
    {
     "name": "timestamp",
     "state": {
      "configurable": false,
      "value": ""
     }
    },
    {
     "name": "count",
     "state": {
      "configurable": false,
      "value": "0"
     }
}}


To clear the event delete notification will be sent on the subcomponent.

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

- Service restarts: Updates degraded-component with Service subcomponent and reason

```
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"
  }
 }
```

- I2C errors:
  - Updates degraded-component with I2C subcomponent
  - Tracks count, affected interfaces, and timestamp

```
module extreme-i2c-fault {

  yang-version "1";

  namespace "http://extremenetworks.com/yang/i2c-fault";

  prefix "extr-i2c-fault";
```

```
  // import some basic types
  import openconfig-system { prefix oc-sys; }
  import openconfig-extensions { prefix oc-ext; }
  import openconfig-types { prefix oc-types; }
  import openconfig-interfaces { prefix oc-if; }

  organization
    "Extreme Networks, Inc.";

  contact
    "Extreme Networks, Inc.
    http://www.extremenetworks.com ";

  description
    "This module defines configuration and operational state data
    for I2C/EEPROM fault handling. It provides a configurable threshold
    to trigger system-wide interface shutdown when a specified number
    of interfaces experience I2C/EEPROM hardware errors, preventing
    traffic blackholing.";

  oc-ext:openconfig-version "0.1.0";

  revision "2025-11-24" {
    description
      "Initial revision for I2C fault handling feature";
    reference
      "0.1.0";
  }

  // grouping statements

  grouping i2c-fault-config {
    description
      "Configuration data for I2C fault handling";



leaf threshold {
  type uint16 {
    range "0..80";
  }
  description
    "Number of interfaces with I2C/EEPROM faults required to
     trigger shutdown of all front-panel ports. When the number
     of faulted interfaces reaches or exceeds this threshold, the
     system will disable TX on all ports to prevent traffic
     blackholing.";
}
  }
  grouping i2c-fault-state {
    description
      "Operational state data for I2C fault handling";



leaf count {
  type uint16;
  description
    "Current number of interfaces experiencing I2C/EEPROM faults.
    This counter includes all interfaces where persistent I2C
    read errors have been detected, regardless of interface type.";
}
leaf  system-fault-triggered {
  type boolean;
```

```
  description
    "Indicates whether the threshold has been exceeded and global
    interface shutdown has been triggered. Once set to true, this
    flag remains true until system reboot, even if individual
    interface faults are cleared.";
}
leaf timestamp {
  type oc-types:timeticks64;
  description
    "Timestamp of when the threshold was last exceeded and global
    shutdown was triggered. Format: YYYY-MM-DD HH:MM:SS";
}
leaf-list interfaces {
  type oc-if:base-interface-ref;
  description
    "List of interface names currently experiencing I2C/EEPROM
    faults. Format: interface names as shown in 'show interface
    brief' (e.g., 'ethernet 0/1', 'ethernet 0/5').";
}
  }
  grouping i2c-fault-top {
    description
      "Top-level grouping for I2C fault configuration
      and state";



container i2c-fault {
  description
    "Configuration and state for I2C/EEPROM fault handling.
    This feature monitors I2C/EEPROM hardware errors on interfaces
    and triggers a protective shutdown of all ports when a
    configurable threshold is exceeded, preventing traffic loss.";
  container config {
    description
      "Configuration parameters for I2C fault handling";
    uses i2c-fault-config;
  }
  container state {
    config false;
    description
      "Operational state for I2C fault handling";
    uses i2c-fault-config;
    uses i2c-fault-state;
  }
  }
  }

  // augment statements

  augment "/oc-sys:system" {
    description
      "Adds I2C fault configuration to the openconfig-system
      model";

      uses i2c-fault-top;

  }
}

FWD-HAL will notify using following keypaths -

key /components/component[name=degraded-component]
 {
```

```
  "name": "degraded-component",
  "subcomponents": {
   "subcomponent": [
    {
     "name": "I2C",
     "state": {
      "name": "I2C"
     }
    }
   ]
  }
 }

/components/component[name=I2C]
  /properties/property[name=reason]/state/value = "I2C errors on 3 interfaces"
  /properties/property[name=timestamp]/state/value = "2025-02-15 10:23:45"
  /properties/property[name=count]/state/value = 3
  /properties/property[name=interfaces]/state/value = "ethernet 0/1,ethernet
0/2,ethernet 0/6"
```

CLI Commands

For details about MLAG commands, see the *Extreme OS ONE SR Command Reference Guide*.

`show` Command

When an Out of Memory (OOM) condition occurs:

- Front panel Ethernet ports become operationally down with the reason code SYSTEM_FAULT (if administratively UP).
- **`show int brief`** displays the interface status, including OOM affected ports.
- **`show system health`** displays the degraded components, including memory, service restart, and I2C errors, with the reason for the degradation.

Enhanced `show mlag peer` Command

- Displays peer health state.
- A new leaf `/mlag/peers/peer[name=%v]/exception-state` updates peer exception information.

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

```
device# show mlag peer

Peer towards-leaf
=========
Peer State                : UP
MCP State                 : UP
Role                      : BACKUP
Elected MAC               : 02:00:22:33:44:55
Extend Bridge Count       : 46
Peer Exception            : Peer Under Maintenance Mode, Unhealthy State
device#
```

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`

MLAG Resiliency Event Log Messages

Event Type	Log ID	Full Message	Condition Triggered
MLAG peer unhealthy	17014	LogID:17014 Msg:MLAG Peer 10.2.5.5 is Unhealthy	Peer health state changes
MLAG peer healthy	17014	LogID:17014 Msg:MLAG Peer 10.2.5.5 is Healthy	Peer health state changes
I2C CPLD error	5004	2025-12-05 04:15:57.2860 fwd-hal[99]: Level:error LogID:5004 Topic:1 Msg:I2C errors found during accessing CPLD for the port and it may shutdown, Reboot the device to recover. slot:0 port:14	CPLD I2C error detected
I2C EEPROM error	5005	2025-12-05 04:10:06.9816 fwd-hal[99]: Level:error LogID:5005 Topic:1 Msg:I2C errors found during accessing EEPROM for the port and it may shutdown, Remove and/or replace the pluggable media on this port and reboot the device to recover. port:13 slot:0	EEPROM I2C error detected
System fault (I2C error)	25039	2025-12-09 20:15:11.8566 interface-mgr[7]: Level:error LogID:25039 Msg:System fault detected due to I2C error	System fault triggered by I2C error

Using MLAG CLI Commands

This task uses the Multichassis Link Aggregation Group (MLAG) CLI commands to configure MLAG interfaces, keepalive behavior, and peer attributes, and then

verify MLAG status and learned MAC addresses.For details on syntax and command parameters, see the *Extreme OS ONE SR Command Reference Guide*.

1. Clear existing MLAG peer statistics so that new counters reflect only the current session.

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

   Replace *m12345* with the name of the MLAG peer.
2. Configure MLAG interfaces and their identifiers.
   a. In MLAG configuration mode, add an Ethernet interface and assign an MLAG ID.

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

      The ID value can be in the range 0 to 4294967295 or set to **auto**.
   b. Add one or more port channel interfaces as MLAG interfaces.

      ```
      device(config-mlag)# interface port-channel 10 id 1020
      ```

      Note
      MLAG port channels do not support minimum links configuration. Configuring minimum links on MLAG port channels can disrupt traffic during failure events such as link down or port channel related triggers.
3. Set MLAG keepalive timers.

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

   The keepalive command supports the following parameters:
   - **interval** (0 to 1000000 ms)
   - **delay** (100 to 1000000 ms)
   - **multiplier** (1 to 50)

   Use the **no** form of this command to restore the default values.
4. Configure the global MLAG MAC address and device role.
   a. Specify the MLAG MAC address.

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

      Use 48-bit dotted notation (`xxxx.xxxx.xxxx`).
   b. Set the MLAG role for the device.

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

      You can specify **auto**, **primary**, or **backup**. The **auto** keyword chooses the role based on the keepalive behavior.
5. Configure the MLAG peer and the extended bridge domain behavior.
   a. Enter MLAG peer configuration mode and specify a peer name.

      ```
      device(config-mlag)# peer peer01
      device(config-mlag-peer-peer01)#
      ```
   b. Extend a subset of bridge domains to the peer.

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

      The range for the subset is 1 to 8192.

c. Optionally, extend all bridge domains except those specified.

```
device(config-mlag-peer-peer01)# extend-bd except 1001,1301
```

6. Configure the MLAG peer keepalive address type, destination, source interface, and keepalive type.
   a. Create or select a keepalive instance for the peer.

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

   b. Specify the address type for the keepalive destination.

```
device(config-mlag-peer-keepalive-keepalive01)# address-type manual
```

   Use **auto** to derive the management based keepalive automatically or **manual** to specify explicit addresses.

   c. Configure the keepalive destination address.

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

   You can specify an IPv4 or an IPv6 destination.

   d. Select the source interface for the keepalive traffic.

```
device(config-mlag-peer-keepalive-keepalive01)# source-interface port-channel 10
```

   You can specify an Ethernet, loopback, management, or port channel interface.

   e. Set the keepalive type.

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

   You can specify **primary** or **secondary**. Typically, the primary keepalive uses the ISL path, and the secondary uses the management network.

7. (Optional) Verify the MLAG peer status, interfaces, MAC learning, and counters.
   a. Display MLAG counters for the peer and keepalive sessions.

```
device(config-mlag-peer-keepalive-keepalive01)# do show counters mlag peer

Peer peer01
=========
Transitions     : 2
No. of Restarts : 2
Last clear      : 0000-00-00 00:00:00

   Keepalive keepalive01
   ---------------------
   Transitions    : 1
   Receive        : 8  (BFD)
   Transmit       : 8  (BFD)
   Last clear     : 0000-00-00 00:00:00
device(config-mlag-peer-keepalive-keepalive01)#
```

   b. Display MAC addresses that the system learned via MLAG for a specific bridge domain.

```
device(config-mlag-peer-keepalive-keepalive01)# do show mac-address-table bridge-
domain 100 mlag

Total number of Mac Entries: 2
Hardware Status Codes - #:Failed
Mac-Address              Type             Interface
------------------------ ---------------- ------------------------
00:10:94:10:01:01        MLAG             ethernet 0/1
device(config-mlag-peer-keepalive-keepalive01)#
```

c. Check the overall MLAG configuration.

```
device(config-mlag-peer-keepalive-keepalive01)# do show mlag

Role              : PRIMARY
MAC               : 00:10:94:10:01:01
Bring up delay    : 1000 seconds
Keepalive Delay   : 100 ms
Tx Interval       : 1000 ms
Multiplier        : 4
No. of Peers      : 1
No. of Interfaces : 2
Uplink-track Interfaces : ethernet 0/1, port-channel 10

Peer Info:
==========
  Peer                            State
  ---------                       -----
  peer01                          UP
Interfaces Info:
================
Id      Interface            Peer               Local/Remote State   Exceptions
------- -------------------- ------------------ -------------------- ---------------
234     ethernet 0/1         peer01             UP
  peer01                           UP
Interfaces Info:
================
Id      Interface            Peer               Local/Remote State   Exceptions
------- -------------------- ------------------ -------------------- ---------------
1020     port-channel 10      peer01             UP
device(config-mlag-peer-keepalive-keepalive01)#
```

d. Check the MLAG interface summary.

```
device(config-mlag-peer-keepalive-keepalive01)# do show mlag interfaces

Interface Identifier: 234
  Interface: ethernet 0/1
Peer               Lcl/Rmt State Rmt Cfg/Act Member Up Count  Exceptions
------------------ ------------- ------------------ --------- --------------------
peer01             UP / UP       1 / 1              11

Interface Identifier: 1020
  Interface: port-channel 10
Peer               Lcl/Rmt State Rmt Cfg/Act Member Up Count  Exceptions
------------------ ------------- ------------------ --------- --------------------
peer01              UP / UP       2 / 2              16
device(config-mlag-peer-keepalive-keepalive01)#
```

e. Display detailed information about MLAG peers and their keepalives.

```
device(config-mlag-peer-keepalive-keepalive01)# do show mlag peer

Peer peer01
================
Peer State                 : UP
MCP State                  : UP
Role                       : PRIMARY
Elected MAC                : 50:0a:9c:97:90:00
Extend Bridge Count        : 1614
Peer Exception             : None

   Keepalive keepalive01
   ---------------
   Destination Address: 12.1.1.1
   State              : UP
   Type               : PRIMARY
```

```
   Address Type       : MANUAL
   Source Interface   : port-channel 10 ( 10.1.1.0 )
   First Rx           : 0000-00-00 00:00:00
   Last Rx            : 0000-00-00 00:00:00
device(config-mlag-peer-keepalive-keepalive01)#
```

Configure an MLAG Session on Peer Devices

You can configure Multichassis Link Aggregation Group (MLAG) sessions on peer devices.

Follow this procedure to configure an MLAG session on peer devices.

1. Access global configuration mode.

```
device# configure terminal
```

2. Add an MLAG session.

```
device# (config)# mlag
device# (config-mlag)# peer mlag-peer
```

3. (Optional) Verify the MLAG session configuration on the peer devices.

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

4. Configure uplink track ports between MLAG peers and an external router.

```
device(config-mlag)# 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
```

   You configure uplink track ports between MLAG peers and an external router. This command helps reduce convergence for reload cases by diverting traffic to alternate paths. After reload, the device puts uplink track interfaces in the Oper down (MLAG_SHUT) state until the Bring Up delay timer expires.

   A split brain scenario makes uplink track interfaces Oper down (MLAG_SHUT) on a secondary MLAG peer along with MLAG interfaces.

5. Clear the counters of an MLAG peer.

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

6. Extend the bridge domains across the MLAG peer.

   The following example configures the subset in extended bridge domain mode with the range of bridge domains. This example extends the bridge domains with IDs 1, 5, and 100 to 200 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
   ```

   The following example configures all the bridge domains except the configured bridge domains.

   ```
   device(config-mlag-peer-mlag-peer)# extend-bd except 1-3,5,7-9
   ```

7. Configure an MLAG interface.

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

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

   The following is an example command of adding port channels.

   ```
   device(config-mlag)# interface port-channel 1 id auto
   device(config-mlag)# interface port-channel 10 id 1020
   ```

8. Specify the delay, interval, and multiplier settings for 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
   ```

9. Specify the MLAG peer keepalive name for MLAG keepalive transmissions and enter MLAG peer keepalive configuration mode.

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

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

10. Specify the IP address for the keepalive destination of the MLAG peer.

    The following example configures an MLAG peer named peer01 and 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
    ```

11. Specify the 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
    ```

12. Set the MLAG bringup delay.

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

13. Specify the type of role for MLAG.

    The following example sets the MLAG role as primary.

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

14. Display statistics for 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. Specify the source interface for the MLAG peer keepalive.

    The following example configures an MLAG peer named peer01 and 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
```

16. Specify the MLAG peer keepalive type.

    The following example configures an MLAG peer named peer01 and 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
```

17. Display details about the MLAG interfaces

    The following example displays information about all configured MLAG interfaces on the device.

```
device(config-mlag-peer-keepalive-keepalive01)# do show 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. Display Bidirectional Forwarding Detection (BFD) details about the MLAG primary keepalive state on the device.

    The following example displays BFD details on the configured MLAG peer on the device.

```
device(config-mlag-peer-keepalive-keepalive01)# do show mlag peer bfd

Peer mlag-peer
==============
Keepalive one
-------------
Profile        : default
Session ID     : 1
Session Status : Up
```

19. Display details about the MLAG peers that are configured on the device.

    The following example displays information about the configured MLAG peer on the device.

```
device(config-mlag-peer-keepalive-keepalive01)# do show 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: 12.1.1.1
   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
```

20. Display information about the configured MLAG peer extended bridges on the device.

```
device(config-mlag-peer-keepalive-keepalive01)# do 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
```

21. Display information about the MLAG configuration.

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

```
device(config-mlag-peer-keepalive-keepalive01)# do 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

device(config-mlag-peer-keepalive-keepalive01)# do show 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. Display the currently running MLAG configuration on a device.

```
device(config-mlag-peer-keepalive-keepalive01)# do 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
     !
   !
  !
```

Monitor MLAG Events and Notifications

Multichassis Link Aggregation Group (MLAG) event monitoring and notification involves tracking the operational status, health, and specific events of an MLAG deployment to ensure network redundancy and stability. Extreme OS ONE Switching and Routing offers several ways to monitor these events and provide notifications:

- Command line interface (CLI): You can use specific commands (such as **`show counters mlag peer`**, **`show mlag`**, **`show mac-address-table bridge-domain`**, or

show mlag interfaces) to check the current status and statistics on the devices directly.

- Event notifications and alarms:
  - SNMP traps: You can configure events to send SNMP notifications (traps) to a central event monitor.
  - Reliability, Availability and Serviceability Log (RASLog) logging: MLAG typically logs events in the system log file and can forward them to a remote logging server.

Supported Notifications

The device generates the following traps when the peer is up or down:

Table 4: Extreme ONE MLAG MIB

Trap Name and OID	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

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 example shows an Extreme OS ONE Switching and Routing 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 the 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 the 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";
}
```

Displaying MLAG Addresses in the MAC Address Table for a Bridge Domain

You can use the **show mac-address-table bridge-domain** *ID* **mlag** command to display the MAC addresses that the system learns from Multichassis Link Aggregation Group (MLAG) clients. This command differentiates the addresses that it learns locally and remotely from the MLAG peers.

The following example displays the MLAG addresses in the MAC address table for bridge domain 100 on the device.

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

Total number of Mac Entries: 2
Hardware Status Codes - #:Failed
Mac-Address              Type             Interface
------------------------ ---------------- ------------------------
00:10:94:10:01:01        MLAG             ethernet 0/1:1.10
device#
```

MLAG Event Log Messages

Peer Up or Down Events

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

Log messages indicate the MLAG keepalive state changes (UP or 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 or unhealthy). For example, MLAG peer 10.2.5.5 is unhealthy or 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 the MLAG peer maintenance mode state changes (enabled or disabled). For example, the system enables or disables maintenance mode on MLAG peer 10.38.59.158.

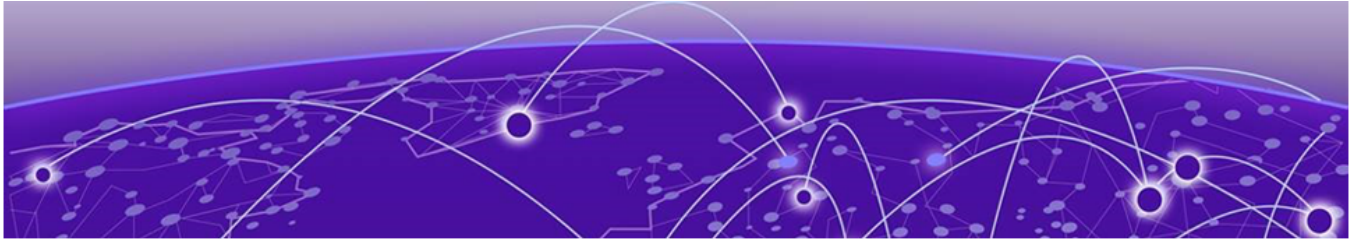
```
LogID:17013 Msg:Maintenance Mode is Enabled on MLAG Peer 10.38.59.158
LogID:17013 Msg:Maintenance Mode is Disabled on MLAG Peer 10.38.59.158
```

RASlogs

The following table describes the Reliability, Availability and Serviceability Log (RASLog) IDs.

RASlog ID	Description	Sample log	Trigger
17009	Mlag Keepalive UP event	MLAG Keepalives with Peer 1.1.1.1 Primary: UP Secondary: UP	MLAG starts using primary and secondary keepalives.
17009	Mlag Keepalive DOWN event	MLAG Keepalives with Peer 1.1.1.1 Primary: DOWN Secondary: DOWN	The Inter-Switch Link (ISL) interface shuts down.
17011	Mlag Peer UP event	MLAG Peer 1.1.1.1 is operationally UP	One of the keepalives comes up.
17011	Mlag Peer DOWN event	MLAG Peer 1.1.1.1 is operationally DOWN	Both keepalives go down.
17012	Mlag MLAG Control Plane Protocol (MCP) UP event	MLAG Peer 10.2.5.5 MCP State operationally UP	MCP state depends on the primary keepalive. So the trigger is the same as the 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 the trigger is the same as the primary keepalive.
17013	Maintenance Mode Enable event	Maintenance Mode is Enabled on MLAG Peer 10.38.59.158	Enable maintenance mode on a peer MLAG device.
17013	Maintenance Mode Disable event	Maintenance Mode is Disabled on MLAG Peer 10.38.59.158	Disable maintenance mode on a peer MLAG device.
17014	Unhealthy event	MLAG Peer 10.2.5.5 is Unhealthy	Trigger a fault in the peer.
17013	Healthy event	MLAG Peer 10.2.5.5 is Healthy	Clear the fault in the peer.

Note
The MCP state depends on the primary keepalive state. The MCP state is UP if the primary keepalive is UP and DOWN if the primary keepalive is DOWN.



Bridge Domains

Bridge Domain Overview

A 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 it shares among all of its members. This means that the bridge domain propagates the traffic that is flooded within the bridge domain to all associated members.

Bridge Domain Limitations

Extreme 8730 Platform Limitations

When double tagged traffic enters a single tagged logical interface (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.

By default, the **bridge-domain** command uses VLAN mode when creating a bridge domain with an ID of 1 through 4094 (mapping each one to a VLAN with the same ID) and uses default mode when creating a bridge domain with an ID of 4095 through 8192. The system displays one of the following messages to indicate this implicit behavior:

```
%Info: bridge domain IDs IDs created in vlan mode with VID VID.

%Info: bridge domain IDs IDs created in default mode.
```

To override this default (implicit) behavior and force the type of mode to use, use the **mode** keyword.

For information about commands and supported parameters to configure bridge domains, see the *Extreme OS ONE SR Command Reference Guide*.

Note
When you configure a bridge domain member by using the **member** command in the CLI, it establishes the association only between the subinterface and the bridge domain. You must create the subinterfaces explicitly under the interfaces. Using the **no** form of the **member** command in the bridge domain removes only the association of the subinterface with the bridge domain. The subinterfaces themselves remain intact under the interface.

Configure a Subinterface

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

Use the following procedure to configure a subinterface.

1. Configure a tagged subinterface.

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

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

2. Configure an untagged strict subinterface.

   Note
   The Extreme 8730 platform does not support untagged strict subinterfaces.

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

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

3. Configure an untagged subinterface.

   Note
   The system supports this only with VLAN-mode bridge domains (not with default-mode bridge domains).

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

   ```
   device# configure terminal
   device(config)# interface ethernet 0/3
   device(config-eth-0/3)# subinterface untagged vlan 400
   ```

Configure a Bridge Domain in VLAN Mode

VLAN mode bridge domain: A bridge domain in VLAN mode determines VLAN switching behavior. You associate it with a specific VLAN ID (1 to 4094). This mode supports the following key features:

- Tagged and untagged configurations.
- Member ports that you add to the bridge domain create a subinterface linked to that bridge domain.

Untagged member behavior: An untagged member in a VLAN mode bridge domain accepts the following packets:

- Untagged packets
- Tagged packets with the configured VLAN ID

Use the following procedure to configure the bridge domain in VLAN mode.

1. Access global configuration mode.

```
device# configure terminal
```

2. (Implicit mode) Specify one or more bridge domains without specifying the mode explicitly. Eligible IDs are 1 to 4094. Use one or more comma separated integers or a range of integers. For example, 1 or 1,2,3 or 1-10.

```
device(config)# bridge-domain 100-101
%Info: bridge domain IDs 100-101 created in vlan mode with VID 100-101
device(config-bd-100-101)# do show running-config bridge-domain
bridge-domain 100 mode vlan
vlan-id 100
bridge-domain 101 mode vlan
vlan-id 101
!
```

3. (Explicit mode) Specify one or more bridge domains while specifying the mode explicitly. Eligible IDs are 1 to 8192. For example, 4095 or 4095,4096,4097 or 4095-5004.

```
device(config)# bridge-domain 100-101 mode vlan
device(config-bd-100-101)# do show running-config bridge-domain
bridge-domain 100 mode vlan
bridge-domain 101 mode vlan
```

4. Configure the tagged members.

   You can add the physical ports or port channel as tagged member of the VLAN mode bridge domain.

```
device(config)# bridge-domain 200 mode vlan
device(config-vlan-bd-200)# vlan-Id 200
device(config-vlan-bd-200)# member ethernet 0/1

device(config)# bridge-domain 100-101
%Info: bridge domain IDs 100-101 created in vlan mode with VID 100-101
device(config-vlan-bd-100-101)# member ethernet 0/1
```

5. Configure the untagged members.

   You can add a physical port or port channel as an untagged member. It accepts packets with no VLAN tags and tagged traffic of the VLAN of this bridge domain. You cannot use untagged configuration in the bridge domain range mode.

   ```
   device(config)# bridge-domain 200 mode vlan
   device(config-bd-200)# vlan-Id 200
   device(config-bd-200)# member ethernet 0/1 untagged
   device(config-bd-100)# member ethernet 0/1 untagged
   ```

6. Configure the untagged strict members.

   You can add a physical port or port channel as an untagged strict member. It accepts packets with no VLAN tags. You must create the untagged strict subinterface and then add it to the bridge domain to get the untagged strict behavior.

   ```
   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
   ```

7. Configure Virtual eXtensible LAN (VxLAN) tunnel members.

   You 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

   device(config)# bridge-domain 200-210
   device(config-vlan-bd-200-210)# member tunnel vxlan-tunnel-1
   ```

The following example displays all bridge domain configurations that are running currently on the device. This example configures bridge domain 200 explicitly in VLAN mode:

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

bridge-domain 200 mode vlan
  description This is bridge domain 200 in VLAN mode.
  vlan-id 11
  member port-channel 190
  member port-channel 191
  member port-channel 192
  member port-channel 193
  member port-channel 194 untagged
  member port-channel 196 untagged
  member port-channel 197 untagged
  member port-channel 200 untagged
  member tunnel vxlan-tunnel-1
  arp-proxy
    suppress-arp
    arp-snooping
  !
  nd-proxy
    suppress-nd
    nd-snooping
  !
!
device#
```

Configure a Bridge Domain in Default Mode

Bridge domain default mode: In default mode, a bridge domain enables extended bridging functionality to support various subinterface configurations:

- Single-tagged
- Double-tagged
- Untagged strict

Untagged traffic handling: An untagged member in the default mode bridge domain accepts untagged traffic exclusively via an untagged strict subinterface.

Use the following procedure to configure a bridge domain in default mode.

1. Enter global configuration mode.

```
device# configure terminal
```

2. (Implicit mode) Specify one or more bridge domains without specifying the mode explicitly. Eligible IDs are 4095 to 8192. Use one or more comma-separated integers or a range of integers. For example, 4095 or 4095,4096,4097 or 4095-5004.

```
device(config)# bridge-domain 5000-5001
%Info: bridge domain IDs 5000-5001 created in default mode
device(config-def-bd-5000-5001)# do show running-config bridge-domain
bridge-domain 5000 mode default
bridge-domain 5001 mode default
```

3. (Explicit mode) Specify one or more bridge domains while specifying the mode explicitly. Eligible IDs are 1 to 8192. Use one or more comma-separated integers or a range of integers. For example, 1 or 1,2,3 or 1-10.

```
device(config)# bridge-domain 100-101 mode default
device(config-def-bd-100-101)# do show running-config bridge-domain
bridge-domain 100 mode default
bridge-domain 101 mode default
```

4. Configure bridge domain members.

```
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
```

The following example displays all bridge domain configurations that are running currently on the device. This example configures bridge domain 100 explicitly in default mode:

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

bridge-domain 100 mode default
 description This is bridge domain 100 in default mode.
  member port-channel 201 vlan 1-102
  member port-channel 202 vlan 1-102
  member port-channel 203 vlan 1-102
  member port-channel 204 vlan 1-102
  member port-channel 205 untagged
  member port-channel 206 untagged
  member port-channel 208 untagged
  member port-channel 209 untagged
  member tunnel vxlan-tunnel-1
  arp-proxy
```

```
    suppress-arp
    arp-snooping
  !
  nd-proxy
    suppress-nd
    nd-snooping
  !
!
device#
```

Configure a Static MAC Address

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

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

Note

The **bridge-domain** command uses VLAN mode when creating a bridge domain with an ID of 1 through 4094 (mapping each one to a VLAN with the same ID) and uses default mode when creating a bridge domain with an ID of 4095 through 8192. To override this default (implicit) behavior and force the type of mode, use **bridge-domain** *bridge-domain-range* [**mode** { **vlan** | **default** }].

```
device# configure terminal
device(config)# bridge-domain 1
%Info: bridge domain IDs 1 created in vlan mode with VID 1
device(config-bd-1)# static-mac-address 40:88:2f:f9:c0:03 ethernet 0/1
device(config-bd-1)# static-mac-address 02:e0:52:11:11:11 ethernet 0/2 untagged
device(config-bd-1)# static-mac-address f0:64:26:f5:c8:05 port-channel 2
device(config-bd-1)# static-mac-address f0:64:26:f5:c8:03 port-channel 2 untagged
```

   You can configure only one static MAC address per port.

2. (Optional) Enter the following command to verify the bridge domain configuration on the device.

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

bridge-domain 1 mode vlan
  vlan-id 1
  static-mac-address 02:e0:52:11:11:11 ethernet 0/2 untagged
  static-mac-address 40:88:2f:f9:c0:03 ethernet 0/1
  static-mac-address f0:64:26:f5:c8:03 port-channel 2 untagged
  static-mac-address f0:64:26:f5:c8:04 ethernet 0/5 untagged
  static-mac-address f0:64:26:f5:c8:05 port-channel 2
!
```

3. (Optional) Enter 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
```

Configure MAC Learning

The device always enables MAC learning on the bridge domains.

1. Enter 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
```

2. Enter 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
```

   The following example shows how to clear the MAC address table.

```
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
```

3. Enter one of the following commands to display bridge domain information.
   - To display information for all bridge domains on the device:

```
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
```

- 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
```

- To display the MAC address table for a specific bridge domain and a 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
```

- To display details of an Ethernet interface or a range of interfaces (such as 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
```

- To display details of a port channel:

```
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
```

- To display global aging time for the MAC address table:

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

Mac Aging Time: 1500
```

Configure MAC Address Aging

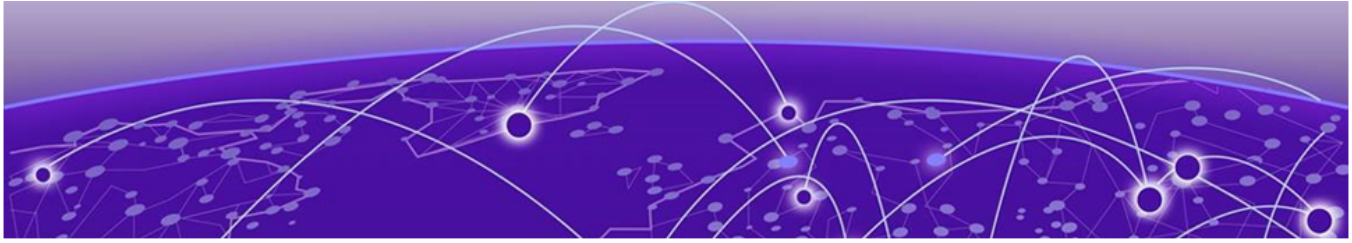
The device stores dynamically learned MAC addresses in the MAC address table. The MAC address aging feature flushes out the dynamic MAC addresses that are inactive for a specified period.

You can configure the aging time of dynamic MAC address entries by using the **mac-address-table aging-time** command. You can disable the MAC address aging by specifying the aging time as 0 (zero).The range is 60 to 38400 seconds. The default is 1800 seconds. The MAC aging time applies to all MAC addresses in the system.

Note
The MAC address aging configuration per bridge domain is not supported.

Following is an example configuration of MAC address aging (MAC forwarding table aging time):

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



MAC Movement Detection and Resolution

MAC movement detection and resolution prevents loop detection in networks. This feature fixes network malfunctions by detecting frequent MAC learnings between different logical interfaces (also called detection of MAC mobility), then detecting the network loop that causes the MAC mobility, and then shutting down the necessary ports or logging them so that you can take action manually.

Repeated MAC movement detection and resolution works for switch ports.

Loop detection using MAC movement detection is mutually exclusive of Spanning Tree Protocol (STP) and Error Limiting Device (ELD) protocol operations.

The system does not consider MAC movement detection for a port where you have enabled port security and the device triggers a restrict violation action.

MAC Movement Overview

A MAC address is defined as moved when the same MAC address arrives on a different interface in the same VLAN. Multichassis Link Aggregation Group (MLAG) enables MAC movement on local and remote nodes. However, a high MAC move rate might indicate a loop in the network or an issue with the server side interface, which causes flapping. A high rate causes the control plane to process a very high rate of MAC learning events and might exhaust the control plane resources.

MAC move definitions

- Rapid MAC movement: The system tracks a MAC that moves across multiple logical interfaces (LIF), ports, and VLANs for each second it moves. If the number of moves crosses the defined threshold, then the system treats it a MAC move violation.
- Slow MAC movement: In the first second that the system detects MAC movement, it monitors the movement. In that first second, if the number of moves does not cross the threshold, then it tracks the MAC for a maximum of 10 seconds. If after 10 seconds the total number of moves is within the threshold, then no action occurs. If it exceeds the threshold limit, then the system triggers an action.

MAC Movement Detection

This feature uses Reliability, Availability and Serviceability (RAS) traces to log MAC movement rules violations.

After you enable and configure MAC movement detection, it tracks the movement of each MAC address between all interfaces that learned them. If the number of MAC moves in one second exceeds the user defined threshold limit, then the feature records 3 values (the old logical interface (LIF), the current LIF, and the number of MAC moves).

The system parses this list of recorded values automatically. If a port has many LIFs with MAC moves, then MAC movement detection records those LIFs in the RASlog by default or shuts them down (if configured).

For example, MAC A moves between port 1, VLAN 10 and port 2, VLAN 10. MAC B moves between port 1, VLAN 20 and port 3, VLAN 20. MAC C moves between port 4, VLAN 10 and port 5, VLAN 10. All MACs have crossed the user defined threshold. The following list shows these moves:

- MAC A: port 1,VLAN 10; and port 2, VLAN 10
- MAC B: port 1, VLAN 20; and port 3, VLAN 20
- MAC C: port 4, VLAN 10; and port 5, VLAN 10

MAC Movement Resolution

Based on the previous example, the system selects port 1 for the MAC movement action (**shutdown** | **raslog**) because it has more logical interfaces (LIFs) in the list. The system either shuts down LIFs port 1,VLAN 10 and port 1, VLAN 20 with the actions logged or logs the movement details (without a shutdown).

The default MAC movement action is **raslog**. The system saves all MAC movement information to the Reliability, Availability and Serviceability Log (RASlog). When the auto recovery time limit expires, the LIF becomes operational, and the tracking process restarts.

Note

The system ignores all LIFs that are part of a tunnel, an Inter-Switch link (ISL), or a pseudowire (PW) and takes no resolution action on them.

MAC Movement Resolution enables automatic recovery by default. The LIF remains shut down for 5 minutes by default. The range is 3 through 30 minutes. You can disable automatic recovery from the command line.

You can disable shutdown from the command line. You can also enable logging as the only action when the number of MAC moves exceeds the threshold. The MAC movement details appear in the RASlog as in the following example.

```
device# 2025-06-03 21:45:18.6698 uftm[7]: Level:warn LogID:0 Topic:4 Msg:MAC-MOVE
DETECTION: MAC 00:11:22:33:44:55/48 exceeded the number of moves between ports!
Interface: port-channel 101.4088 Bridge Domain: 1
2025-06-03 21:45:20.6714 uftm[7]: Level:warn LogID:0 Topic:4 Msg:MAC-MOVE DETECTION: MAC
00:11:22:33:44:55/48 exceeded the number of moves between ports! Interface: port-channel
101.4088 Bridge Domain: 1
```

```
2025-06-03 21:45:35.6821 uftm[7]: Level:warn LogID:0 Topic:4 Msg:MAC-MOVE DETECTION: MAC
00:11:22:33:44:55/48 exceeded the number of moves between ports! Interface: port-channel
102.409610 Bridge Domain: 1
```

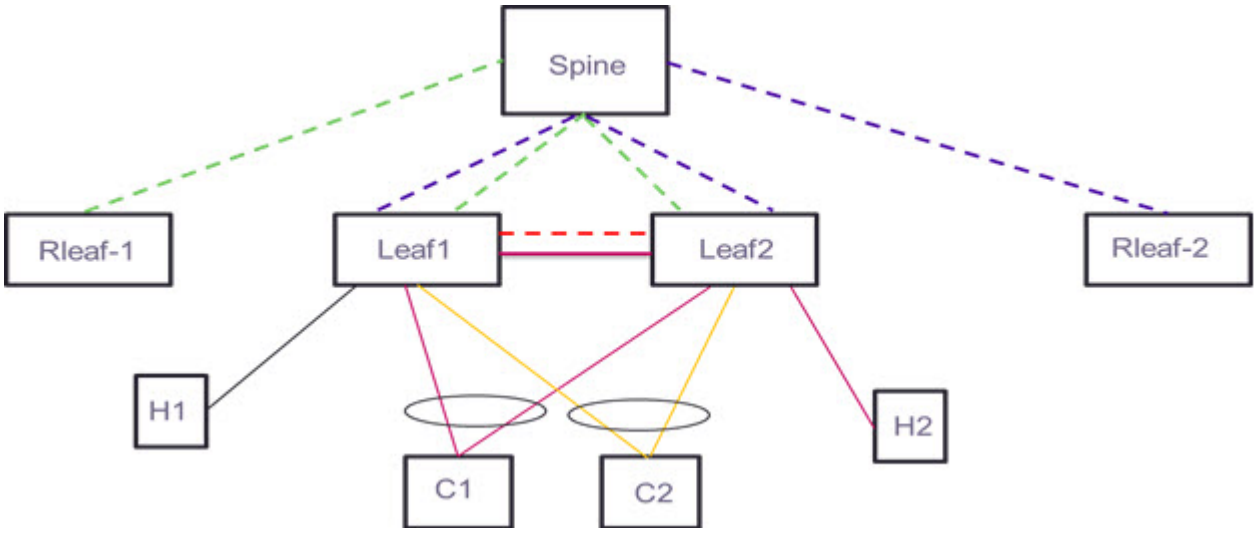


Figure 1: MAC movement detection scenario

Multichassis Link Aggregation Group (MLAG) Use Case: MAC loop between MLAG Interfaces

If MAC movement between C1 and C2 crosses the MAC move threshold, the cluster node with the higher IP address shuts down the LIF. For example: Leaf1 has the higher cluster IP configured. Leaf1 takes the decision to shut down the LIF connecting to C1 and communicates to Leaf2 to shut down the corresponding LIF connecting to C1.

MLAG Use Case: MAC loop between an MLAG Interface and a Non MLAG interface

If MAC movement between C1 and H1 crosses the threshold MAC move limit, the MLAG node with the higher IP address shuts down the LIF. For example, Leaf1 has the higher cluster IP configured. Leaf1 takes the decision to shut down the LIF on C1 and communicates to Leaf2 to shut down the corresponding LIF on C1. If the MAC movement occurs between the MLAG Interface and Non-MLAG interface, the system always takes the action on the MLAG Interface.

MLAG Use Case: MAC loop between Non MLAG interfaces

If MAC movement between H1 and H2 crosses the threshold MAC move limit, each leaf independently takes the action. Leaf1 and Leaf2 run MAC move detection separately.

Note
In an IP fabric configuration, you must enable this feature on all leaf nodes.

Note
This feature supports only bridge domains.

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MAC Movement Detection and Resolution Commands

The following commands support MAC movement detection and resolution. You run these commands under Global configuration (config) mode.

Table 5: MAC movement detection and resolution commands

Command	Details
l2 mac-move-detection enable	Enables MAC movement detection. MAC movement detection and resolution enables this feature by default. Use the **no** form of this command to disable the feature.
l2 mac-move-detection threshold *moves*	Event count (maximum number of moves) before the system shuts down the port or triggers a Reliability, Availability and Serviceability log (RASlog). Use an integer from 3 to 500. The default is 20.
l2 mac-move-detection action shutdown	Shuts down the port or interface when MAC movement exceeds the specified threshold. This is in addition to a RASlog entry (which always occurs). MAC movement detection and resolution enables shutdown by default when you use the **l2 mac-move-detection enable** command. Use the **no** form of this command to disable shutdown. Details about every shutdown appear in the RASlog.
l2 mac-move-detection auto-recovery-time *minutes*	Time (in seconds) until MAC movement detection and resolution resets the port state to up. Use an integer from 0 to 1800. 0 disables auto-recovery. The default is 300 (5 minutes). Details about every recovery appear in the RASlog.
l2 mac-move-detection interval *seconds*	Interval (in seconds) before the system deletes the MAC movement events. The default is 10 seconds. The range is 10 through 120 seconds.
clear l2 mac-move-detection shut-list [**interface** { **ethernet** *interface-name* | **port-channel** *port* | **ve** *interface-name* | **loopback** *interface-name* }]	Clears entries from the shutdown list and sets the port state to up for all ports in a list or for a specified port.

Table 5: MAC movement detection and resolution commands (continued)

Command	Details

show bridge-domain all	Shows when the logical interface (LIF) is down because of MAC movement as in the following example:
	`device# show bridge-domain 105`
	`*untag-s --accepts untagged only`
	`*untag --accepts untagged+tagged`
	`Bridge Domain 105 Mode`
	`L2VSI_VLAN Vlan 105`
	`Total number of member ports 3`
	`If Name Vlan Inner`
	`Vlan Admin Status Oper Status`
	`======== ========`
	`========== ============ ===========`
	`Tu ISL_10.20.20.7 -`
	`- UP UP`
	`Po 101 --`
	`- UP DOWN`
	`(MAC_MOVE_SHUT)`
	`Po 201 --`
	`- UP UP`
	
	`device# show bridge-domain 115`
	`*untag-s --accepts untagged only`
	`*untag --accepts untagged+tagged`
	`Bridge Domain 115 Mode`
	`L2VSI_VLAN Vlan 115`
	`Total number of member ports 3`
	`If Name Vlan Inner`
	`Vlan Admin Status Oper Status`
	`======== ========`
	`========== ============ ===========`
	`Po 102 --`
	`- UP DOWN`
	`(MAC_MOVE_SHUT)`
	`Po 202 --`
	`- UP UP`
	`Tu ISL_10.20.20.7 -`
	`- UP UP`
	`device#`

show l2 mac-move-detection	Displays the MAC move settings as in the following example:
	`device# show l2 mac-move-detection`
	
	`MAC-move detection is enabled and configured:`
	`Tracking interval: 17 seconds`
	`Threshold for triggering action: 10 moves`
	`Action taken when threshold is reached: shutdown`
	`Auto-recovery is done after 60 seconds.`
	`device#`

Table 5: MAC movement detection and resolution commands (continued)

Command	Details

show l2 mac-move-detection shut-list	Displays the MAC move detection port shutdown list for a device as in the following example:
	`device# show l2 mac-move-detection shutlist`
	
	`MAC-move detection shut port list`
	`Interface BD ID Time remaining (s)`
	`---------- ---------- ----------`
	`ethernet 0/1:3.100 500 2`
	`ethernet 0/1:2.100 500 34`
	`device#`

show interface ethernet *interface-name* **subinterface**	Displays when the LIF or port subinterface is down because of MAC movement.

Table 5: MAC movement detection and resolution commands (continued)

Command	Details

system internal service uftm command mac-move-detection [**args** *arguments*]	Displays the internal state of MAC move detection. It lists the following details:
	• The MAC move globals
	• The current window index that captures MAC moves
	• The event map, which is the list of pairs between LIFs and the number of moves per second for each bridge domain-MAC pair
	• The detailed shut list, which comprises the output of the **show l2 mac-move-detection shut-list** command plus the the LIF information
	For example:
	`device# system internal service uftm command mac-move-detection`
	
	`MAC-move detection debug information`
	
	`Dumping macMove globals:`
	` enabled = true`
	` interval = 60`
	` threshold = 18`
	` action = shutdown`
	` shutInterval = 65`
	
	`Current macMoveData.windowIndex = 52`
	
	`Dumping macMoveData.eventMap:`
	
	`BD: 1, MAC: 00:a9:09:11:0a:01/48, moves: 2 = {0,[]},{0,[]},{2,[0x2000036,0x3100002,]},{0,[]},{0,[]},{0,[]},{0,[]},{0,[]},`
	
	`Dumping macMoveData.shutPortList:`
	`Interface LIF BD ID Time remaining (s)`
	`----------`
	`---------- ----------`
	`----------`
	`ethernet 0/1:1.30 0x200002c 1 63`
	`device#`

show system internal cdb path /system/global/l2/mac-move-detection/config	Displays the internal state database (SDB) records or the timestamp, user, and IP address of the last update for the /system/global/l2/mac-move-detection/config data path.

Table 5: MAC movement detection and resolution commands (continued)

Command	Details
show system internal sdb path /system/global/l2/mac-move-detection/state	Displays the internal configuration database (CDB) records or the timestamp, user, and IP address of the last update for the /system/global/l2/mac-move-detection/state data path.
show running-config system global	Displays whether the MAC movement detection feature is enabled.
system global l2 mac-move-detection enable l2 mac-move-detection action shutdown	Shuts down the port or interface when MAC movement exceeds the specified threshold. This is in addition to a RASlog entry (which always occurs). The system enables this by default when you use **l2 mac-move-detection enable**. Use the **no** form of this command to disable shutdown. Details about every shutdown appear in the RASlog.

For details about these commands, see the *Extreme OS ONE SR Command Reference Guide*.