



## MC-LAG TCN Interworking

Multiple VLAN Registration Protocol (MVRP) is used for MAC Flushing during the Pseudowire (PW) redundancy process. However, not all Dual Homed Device (DHD) switches support MVRP for MAC flushing. MC-LAG TCN Interworking feature enables using the Multiple Spanning Tree Protocol with Topology Change Notification (MSTP TCN) scheme for MAC flushing towards the access network.

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## Prerequisites for MC-LAG TCN Interworking

- Ethernet Flow Points (EFPs) towards the core network as well as the access network must support the MSTP instance (creation and deletion) for sending and receiving Bridge Protocol Data Units (BPDUs).
- DHD access node(s) must support MSTP TCN.
- To enable the MAC mode for multichassis LACP (mLACP) or Pseudo mLACP (P- mLACP), mLACP sub-block must be created first.
- MSTP TCN enabled port channel interface must be compliant with High Availability (HA) synchronization (between HA Active and HA Hot Standby).

## Restrictions for MC-LAG TCN Interworking

- P-mLACP mode needs to be configured before enabling MSTP TCN.
- The port channel configuration on both Point of Attachments (PoAs) must be same, including EFP IDs.
- Port channel members need not be same on PoAs.
- Each PoA may be connected to the DHD with a different number of links for the Link Aggregation Group (LAG) (and hence configured with a different value for the max-links value) variable.

- Virtual Private Wire Service (VPWS) and Virtual Private LAN Service (VPLS) VC state (Active/Standby) are based on the Active VLAN list configuration on a PoA at any given time.

## Information About MC-LAG TCN Interworking

### MC-LAG TCN Interworking

Multiple Spanning Tree Protocol (MSTP) is an extension of the original STP specification. It is an IETF standard stack with a completed state machine (SM) for processing root path costs, topology change notification of the port or VLAN, and so on. MSTP uses Bridge Protocol Data Units (BPDU) to exchange information such as bridge IDs or root path costs. There are two types of BPDU in the MST stack.

- Configuration BPDU (CBPDU)
- Topology Change Notification BPDU (TCN BPDU)

Within the MST, BPDUs are exchanged regularly and enable devices to keep track of network changes and to start and stop forwarding at ports as required. MC-LAG TCN Interworking feature uses TCN BPDU to announce the changes in the network topology to access side DHD, requesting for MAC flushing. The DHD processes the MST TCN message and updates the forwarding table with appropriate outgoing interface for each destination MAC address.

MAC flushing is triggered during the following conditions:

- Pseudowire (PW) redundancy has taken place for switchover between VLANs or POAs.
- VLAN configuration has been changed by the administrator.

MSTP Topology Change Notification scheme can be configured per port-channel basis for MAC Flushing. MVRP Lite is used for MAC flushing during redundancy switchover as a default scheme.

## How to Configure MC-LAG TCN Interworking

### Enabling MSTP TCN Sequence

#### Before you begin

**Note**

Enable P-mLACP feature before enabling MSTP TCN sequence.

#### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `interface port-channel number`
4. `mlacp interchassis group group-id`

5. **mlacp mode active-active**
6. **mlacp mac mstp-tcn**
7. **mlacp load-balance primary vlan *vlan-id***
8. **mlacp load-balance secondary vlan *vlan-id***
9. **end**
10. Perform the same steps on standby POA.

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>interface port-channel <i>number</i></b> <b>Example:</b> Device(config)# interface port-channel 1	Configures the port channel and enters interface configuration mode.
<b>Step 4</b>	<b>mlacp interchassis group <i>group-id</i></b> <b>Example:</b> Device(config-if)# mlacp interchassis group 1	Specifies that the port channel is an mLACP port channel.
<b>Step 5</b>	<b>mlacp mode active-active</b> <b>Example:</b> Device(config-if)# mlacp mode active-active	Enables P-mLACP operations on a PoA and allows the PoA to form an LACP bundle even if the peer receives an LACP protocol data unit (PDU) from two different port channels on a dual-homed network (DHN) or DHD.
<b>Step 6</b>	<b>mlacp mac mstp-tcn</b> <b>Example:</b> Device(config-if)# mlacp mac mstp-tcn	Enables MAC mode on port channel base.
<b>Step 7</b>	<b>mlacp load-balance primary vlan <i>vlan-id</i></b> <b>Example:</b> Device(config-if)# mlacp load-balance primary vlan 10,20	Configures a list of primary VLANs that will be active on a given PoA.
<b>Step 8</b>	<b>mlacp load-balance secondary vlan <i>vlan-id</i></b> <b>Example:</b> Device(config-if)# mlacp load-balance secondary vlan 30,100	Configures a list of secondary VLANs that will be standby on a given PoA.
<b>Step 9</b>	<b>end</b> <b>Example:</b>	Exits interface configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
	Device(config-if)# end	
<b>Step 10</b>	Perform the same steps on standby POA.	—

## Enabling MST for VLANs

### SUMMARY STEPS

1. **configure terminal**
2. **spanning-tree mode mst**
3. **spanning-tree extend system-id**
4. **spanning-tree mst configuration**
5. **name *name***
6. **revision *version***
7. **instance *instance-id* vlan *vlan-range***
8. **exit**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 2</b>	<b>spanning-tree mode mst</b> <b>Example:</b> Device(config)# spanning-tree mode mst	Enables MST on the device.
<b>Step 3</b>	<b>spanning-tree extend system-id</b> <b>Example:</b> Device(config)# spanning-tree extend system-id	Enables the extended-system ID.
<b>Step 4</b>	<b>spanning-tree mst configuration</b> <b>Example:</b> Device(config)# spanning-tree mst configuration	Enters MST configuration submode on the system.
<b>Step 5</b>	<b>name <i>name</i></b> <b>Example:</b> Device(config-mst)# name test	Specifies the name of an MST region
<b>Step 6</b>	<b>revision <i>version</i></b> <b>Example:</b> Device(config-mst)# revision 1	Specifies the revision number for the MST configuration

	Command or Action	Purpose
Step 7	<b>instance</b> <i>instance-id</i> <b>vlan</b> <i>vlan-range</i> <b>Example:</b> <pre>Device(config-mst)# instance 1 vlan 1-63 Device(config-mst)# instance 1 vlan 20, 40</pre>	Maps VLANs to an MST instance. <ul style="list-style-type: none"> <li>• <i>instance-id</i>—Range is 0 to 4094.</li> <li>• <i>vlan-range</i>—Range is 1 to 4094.</li> </ul> To specify a VLAN range, use a hyphen; for example, <b>instance 1 vlan 1-63</b> maps VLANs 1 through 63 to MST instance 1. To specify a VLAN series, use a comma; for example, <b>instance 1 vlan 20, 40</b> maps VLANs 20 and 40 to MST instance 1.
Step 8	<b>exit</b> <b>Example:</b> <pre>Device(config-mst)# exit</pre>	Exits MST configuration mode and returns to global configuration mode.

## Verifying MC-LAG TCN Interworking

All steps are optional and can be performed in any order.

### SUMMARY STEPS

1. **enable**
2. **show ethernet service interface** [*type number*] [**detail**]
3. **show spanning-tree detail**

### DETAILED STEPS

#### Step 1 **enable**

**Example:**

```
Device> enable
```

Enables the privileged EXEC mode. Enter your password if prompted.

#### Step 2 **show ethernet service interface** [*type number*] [**detail**]

**Example:**

```
Device(config)# show ethernet service interface port 1 detail
```

```
Interface: Port-channel1, Type: UNI
ID:
EVC Distribution State: Ready
EVC Map Type: Bundling-Multiplexing
Bridge-domains:
Associated Service Instances:
  Service-Instance-ID CE-VLAN
  20
```

```

40
L2protocol pass

mLACP state: Active

```

Displays the information about mLACP enabled Ethernet interface port.

### Step 3 show spanning-tree detail

#### Example:

```

Device# show spanning-tree detail

MST0 is executing the mstp compatible Spanning Tree protocol
Bridge Identifier has priority 32768, sysid 0, address f866.f2eb.7ebb
Configured hello time 2, max age 20, forward delay 15, transmit hold-count 6
Current root has priority 32768, address 2834.a252.7380
Root port is 14 (Port-channell), cost of root path is 0
Topology change flag not set, detected flag not set
Number of topology changes 2 last change occurred 00:15:24 ago
    from Port-channell
Times: hold 1, topology change 35, notification 2
    hello 2, max age 20, forward delay 15
Timers: hello 0, topology change 0, notification 0

Port 14 (Port-channell) of MST0 is root forwarding
Port path cost 20000, Port priority 128, Port Identifier 128.14.
Designated root has priority 32768, address 2834.a252.7380
Designated bridge has priority 32768, address 2834.a252.7380
Designated port id is 128.456, designated path cost 0
Timers: message age 4, forward delay 0, hold 0
Number of transitions to forwarding state: 1
Link type is point-to-point by default, Internal
BPDU: sent 8, received 774

MST1 is executing the mstp compatible Spanning Tree protocol
Bridge Identifier has priority 32768, sysid 1, address f866.f2eb.7ebb
Configured hello time 2, max age 20, forward delay 15, transmit hold-count 6
Current root has priority 32769, address 2834.a252.7380
Root port is 14 (Port-channell), cost of root path is 20000
Topology change flag not set, detected flag not set
Number of topology changes 3 last change occurred 00:12:04 ago
    from Port-channell
Times: hold 1, topology change 35, notification 2
    hello 2, max age 20, forward delay 15
Timers: hello 0, topology change 0, notification 0

Port 14 (Port-channell) of MST1 is root forwarding
Port path cost 20000, Port priority 128, Port Identifier 128.14.
Designated root has priority 32769, address 2834.a252.7380
Designated bridge has priority 32769, address 2834.a252.7380
Designated port id is 128.456, designated path cost 0
Timers: message age 5, forward delay 0, hold 0
Number of transitions to forwarding state: 1
Link type is point-to-point by default, Internal
BPDU: sent 8, received 775

```

Displays the STP details including TCN information.

# Configuration Examples for MC-LAG TCN Interworking

## Example: Enabling MSTP TCN Sequence

The following example shows how to enable the MSTP TCN sequence.

### Active PoA-POA1

```
Device# configure terminal
Device(config)# interface port-channel1
Device(config-if)# mlacp interchassis group 1
Device(config-if)# mlacp mode active-active
Device(config-if)# mlacp mac mstp-tcn
Device(config-if)# mlacp load-balance primary vlan 10,20
Device(config-if)# mlacp load-balance secondary vlan 30,100
Device(config-if)# end
```

### Standby PoA-POA2

```
Device# configure terminal
Device(config)# interface port-channel1
Device(config-if)# mlacp interchassis group 1
Device(config-if)# mlacp mode active-active
Device(config-if)# mlacp mac mstp-tcn
Device(config-if)# mlacp load-balance primary vlan 30,100
Device(config-if)# mlacp load-balance secondary vlan 10,20
Device(config-if)# end
```

## Example: Enabling MST for VLANs

The following example shows the STP configuration for VLANs 20 and 40.

```
Device# configure terminal
Device(config)# spanning-tree mode mst
Device(config)# spanning-tree extend system-id
Device(config)# spanning-tree mst configuration
Device(config-mst)# name test
Device(config-mst)# revision 1
Device(config-mst)# instance 1 vlan 20, 40
```

## Example: Configuring Redundancy and P-mLACP on Active POA

The following example shows how to configure redundancy and P-mLACP on an active POA.

```
redundancy
mode sso
interchassis group 4294967295
```

## Example: Configuring Redundancy and P-mLACP on Active POA

```

monitor peer bfd
member ip 88.1.1.2
backbone interface GigabitEthernet0/0/2
backbone interface GigabitEthernet0/0/1
mlacp system-mac 0001.0001.0001
mlacp system-priority 100
mlacp node-id 1
!
!
interface Port-channell1
no ip address
no negotiation auto
mlacp interchassis group 4294967295
mlacp mode active-active
mlacp mac mstp-tcn
mlacp load-balance primary vlan 40
mlacp load-balance secondary vlan 20
service instance 20 ethernet
encapsulation dot1q 20
rewrite ingress tag pop 1 symmetric
xconnect 88.1.1.3 20 encapsulation mpls pw-class poa
backup peer 88.1.1.4 20 pw-class poa
!
service instance 40 ethernet
encapsulation dot1q 40
rewrite ingress tag pop 1 symmetric
xconnect 88.1.1.3 40 encapsulation mpls pw-class poa
backup peer 88.1.1.4 40 pw-class poa
!
interface Port-channell10
description to-DHD
no ip address
mlacp interchassis group 100
mlacp mode active-active
mlacp mac mstp-tcn
mlacp load-balance primary vlan 100-109
mlacp load-balance secondary vlan 110-120
service instance 10 ethernet
encapsulation dot1q 100
rewrite ingress tag pop 1 symmetric
xconnect 3.3.3.3 90 encapsulation mpls
!
service instance 11 ethernet evcl1_bd_201
encapsulation dot1q 101
rewrite ingress tag pop 1 symmetric
bridge-domain 201
!
service instance 12 ethernet
encapsulation dot1q 102
rewrite ingress tag pop 1 symmetric
bridge-domain 202 split-horizon
!
service instance 20 ethernet
encapsulation dot1q 110
rewrite ingress tag pop 1 symmetric
xconnect 3.3.3.3 91 encapsulation mpls
!
service instance 21 ethernet
encapsulation dot1q 111
rewrite ingress tag pop 1 symmetric
bridge-domain 211
!
service instance 22 ethernet
encapsulation dot1q 112

```



```

rewrite ingress tag pop 1 symmetric
bridge-domain 212 split-horizon
!

```

## Example: Configuring Redundancy and P-mLACP on Standby POA

The following example shows how to configure redundancy and P-mLACP on a standby POA.

```

redundancy
mode sso
interchassis group 100
monitor peer bfd
member ip 1.1.1.1
backbone interface GigabitEthernet8/0/10
mlacp system-priority 100
mlacp node-id 2

interface Port-channel1
no ip address
no negotiation auto
mlacp interchassis group 4294967295
mlacp mode active-active
mlacp mac mstp-tcn
mlacp load-balance primary vlan 20
mlacp load-balance secondary vlan 40
service instance 40 ethernet
encapsulation dot1q 40
rewrite ingress tag pop 1 symmetric
xconnect 88.1.1.3 20 encapsulation mpls pw-class poa
backup peer 88.1.1.4 20 pw-class poa
!
service instance 20 ethernet
encapsulation dot1q 20
rewrite ingress tag pop 1 symmetric
xconnect 88.1.1.3 20 encapsulation mpls pw-class poa
backup peer 88.1.1.4 20 pw-class poa
!
interface Port-channel10
description to-DHD
no ip address
mlacp interchassis group 100
mlacp mode active-active
mlacp mac mstp-tcn
mlacp load-balance primary vlan 110-120
mlacp load-balance secondary vlan 100-109
service instance 10 ethernet
encapsulation dot1q 100
rewrite ingress tag pop 1 symmetric
xconnect 3.3.3.3 90 encapsulation mpls
!
service instance 11 ethernet
encapsulation dot1q 101
rewrite ingress tag pop 1 symmetric
bridge-domain 201
!
service instance 12 ethernet
encapsulation dot1q 102
rewrite ingress tag pop 1 symmetric

```

```

    bridge-domain 202 split-horizon
    !
    service instance 20 ethernet
    encapsulation dot1q 110
    rewrite ingress tag pop 1 symmetric
    xconnect 3.3.3.3 91 encapsulation mpls
    !
    service instance 21 ethernet
    encapsulation dot1q 111
    rewrite ingress tag pop 1 symmetric
    bridge-domain 211
    !
    service instance 22 ethernet
    encapsulation dot1q 112
    rewrite ingress tag pop 1 symmetric
    bridge-domain 212 split-horizon
    !
End

```

## Additional References for MC-LAG TCN Interworking

### Related Documents

Related Topic	Document Title
Cisco IOS commands	<a href="#">Cisco IOS Master Command List, All Releases</a>
Carrier Ethernet Commands	<a href="#">Cisco IOS Carrier Ethernet Command Reference</a>
Multichassis LACP	<a href="#">Multichassis LACP</a>
ICCP Multichassis VLAN Redundancy	<a href="#">ICCP Multichassis VLAN Redundancy</a>

### Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	<a href="http://www.cisco.com/c/en/us/support/index.html">http://www.cisco.com/c/en/us/support/index.html</a>

## Feature Information for MC-LAG TCN Interworking

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 1: Feature Information for MC-LAG TCN Interworking**

Feature Name	Releases	Feature Information
MC-LAG TCN Interworking	Cisco IOS XE Release 3.17S	Multiple VLAN Registration Protocol (MVRP) is used for MAC Flushing during the Pseudowire (PW) redundancy process. However, not all Dual Homed Device (DHD) switches support MVRP for MAC flushing. MC-LAG TCN Interworking feature enables using the Multiple Spanning Tree Protocol with Topology Change Notification (MSTP TCN) scheme for MAC Flushing towards the access network.  The following commands were introduced or modified: <b>mlacp mac mstp-tcn</b> , <b>show ethernet service</b> , <b>show spanning-tree detail</b>

