



ZebOS-XP®

Network Platform

Version 1.4

Extended Performance

Carrier Ethernet
Configuration Guide
December 2015

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IP Infusion Inc.
3965 Freedom Circle, Suite 200
Santa Clara, CA 95054
+1 408-400-1900
<http://www.ipinfusion.com/>

For support, questions, or comments via E-mail, contact:
support@ipinfusion.com

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Preface

This guide describes how to configure Carrier Ethernet in ZebOS-XP.

Audience

This guide is intended for network administrators and other engineering professionals who configure Carrier Ethernet.

Conventions

Table P-1 shows the conventions used in this guide.

Table P-1: Conventions

Convention	Description
<i>Italics</i>	Emphasized terms; titles of books
Note:	Special instructions, suggestions, or warnings
<code>monospaced type</code>	Code elements such as commands, functions, parameters, files, and directories

Contents

This document contains these chapters and appendices:

- [Chapter 1, Ethernet CFM Configurations](#)
- [Chapter 2, CFM Over PBB Configurations](#)
- [Chapter 3, Ethernet to the First Mile OAM Configuration](#)
- [Chapter 4, Link Layer Discovery Protocol Configuration](#)
- [Chapter 5, Provider Bridging Configuration](#)
- [Chapter 6, MEF UNI Configuration](#)
- [Chapter 7, MEF ENNI Configuration](#)
- [Chapter 8, User Network Interface Configuration](#)
- [Chapter 9, Provider Backbone Bridging Configuration](#)
- [Chapter 10, Ethernet Protection Switching Configuration](#)
- [Chapter 11, PBB-TE Configurations](#)
- [Chapter 12, PBB-TE Ethernet Switched Path Configuration](#)
- [Chapter 13, PBB-TE APS Configuration](#)
- [Chapter 14, Service OAM Configuration](#)

- [Chapter 15, G.8032 ERPS Version 1](#)
- [Chapter 16, G.8032 ERPS Version 2](#)
- [Chapter 17, Dual-Ended LMM Configurations](#)
- [Chapter 18, CFM Support on PEB Configuration](#)

Related Documents

Use this guide with these documents for details about the commands used in the configurations:

- *Carrier Ethernet Command Reference*
- *Network Services Module Command Reference*

Note: All ZebOS-XP technical manuals are available to licensed customers at http://www.ipinfusion.com/support/document_list.

Chapter Organization

The chapters in this guide are organized into these major sections:

- An overview that explains a configuration in words
- Topology with a diagram that shows the devices and connections used in the configuration
- Configuration steps in a table for each device where the left-hand side shows the commands you enter and the right-hand side explains the actions that the commands perform
- Validation which shows commands and their output that verify the configuration

Support

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CHAPTER 1 Ethernet CFM Configurations

This chapter contains examples of Ethernet Operations and Management (OAM) configurations using the Connectivity Fault Management (CFM) protocol.

Connectivity Fault Management detects, verifies, isolates and notifies connectivity failures on a Virtual Bridged LAN (B-VLAN) based on the protocol standard specified in IEEE 802.1ag 2007. It provides discovery and verification of paths through 802.1 bridges and LANs and is part of the Operation, Administration and Management (OAM) module in ZebOS-XP. CFM is transparent to customer data being transported by a network and is capable of providing maximum fault management. CFM extensions also support enhanced fault management, fault monitoring and performance measurement and supports the requirements of the ITU Y.1731 standard.

Topology

Figure 1-1 displays a sample CFM topology.

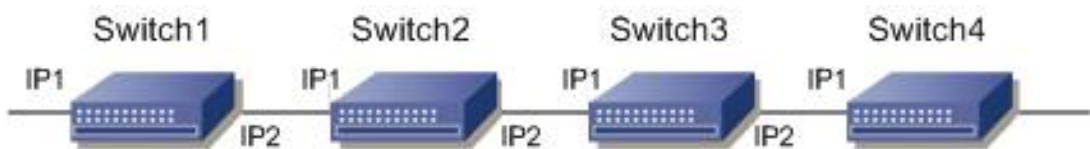


Figure 1-1: CFM Topology

Legend

The following table is the legend for Figure 1-1:

IP1	eth1
IP2	eth2

Down MEP

SW1

SW1#configure terminal	Enter configure mode.
SW1(config)#bridge 1 protocol rstp vlan-bridge	Create bridge 1 as an RSTP VLAN-aware bridge.
SW1(config)#vlan database	Enter VLAN configure mode.
SW1(config-vlan)#vlan 2 bridge 1	Create VLAN 2 on bridge 1.
SW1(config-vlan)#vlan 3 bridge 1	Create VLAN 3 on bridge 1.
SW1(config-vlan)#vlan 4 bridge 1	Create VLAN 4 on bridge 1.
SW1(config-vlan)#exit	Exit VLAN configure mode.

Ethernet CFM Configurations

SW1(config)#ethernet cfm configure vlan 2 bridge 1	Configure VLAN 2 as primary VLAN.
SW1(config-cfm-vlan)#add vid 3 bridge 1	Add secondary VLAN ID (VID) 3.
SW1(config-cfm-vlan)#add vid 4 bridge 1	Add secondary VLAN ID (VID) 4.
SW1(config-cfm-vlan)#exit	Exit CFM VLAN mode.
SW1(config)#ethernet cfm domain-name type character-string name domain1 level 7 mip-creation default bridge 1	Enter CFM mode and create domain domain1 at level 7, setting MIP creation permissions to the default.
SW1(config-ether-cfm)#service ma-type integer ma-name 200 vlan 2 mip-creation default	Create an MA with type as integer and set MIP creation permissions to the default.
SW1(config-ether-cfm)#mep crosscheck mpid 151 vlan 2	Enable crosscheck to remote MEP on VLAN 2.
SW1(config-ether-cfm)#exit	Exit Ethernet CFM mode.
SW1(config)#interface eth2	Configure interface eth2.
SW1(config-if)#switchport	Configure eth2 as switch port.
SW1(config-if)#bridge-group 1	Configure eth2 in bridge group 1.
SW1(config-if)#switchport mode trunk	Make the interface a trunk.
SW1(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth2.
SW1(config-if)#ethernet cfm mep down mpid 152 active true domain domain1 vlan 2 local-vid 3 bridge 1	Enter CFM MEP mode and create a down MEP, assign an MPID, associate it with domain1 in VLAN 2, local VID 3, and bridge 1.
SW1(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface.
SW1(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
SW1(config-if)#exit	Exit Interface mode.
SW1(config)#ethernet cfm domain-name type character-string name domain1 level 7 mipcreation default bridge 1	Enter CFM mode.
SW1(config-ether-cfm)#cc vlan 2 interval 5	Configure CC time interval.

SW2

SW2#configure terminal	Enter configure mode.
SW2(config)#bridge 1 protocol rstp vlan-bridge	Create bridge 1 as an RSTP VLAN-aware bridge.
SW2(config)#vlan database	Enter VLAN configure mode.
SW2(config-vlan)#vlan 2 bridge 1	Create VLAN 2 on bridge 1.
SW2(config-vlan)#vlan 3 bridge 1	Create VLAN 3 on bridge 1.
SW2(config-vlan)#vlan 4 bridge 1	Create VLAN 4 on bridge 1.
SW2(config-vlan)#exit	Exit configure VLAN mode.
SW2(config)#interface eth1	Configure interface eth1.
SW2(config-if)#switchport	Configure eth1 as switch port.
SW2(config-if)#bridge-group 1	Configure eth1 in bridge group 1.

SW2(config-if)#switchport mode trunk	Configure interface mode as trunk.
SW2(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth1.
SW2(config)#interface eth2	Configure interface eth2.
SW2(config-if)#switchport	Configure eth2 as switch port.
SW2(config-if)#bridge-group 1	Configure eth2 in bridge group 1.
SW2(config-if)#switchport mode trunk	Configure interface mode as trunk.
SW2(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth2.
SW2(config)#ethernet cfm default-md-level entry vid 2 level 7 mip-creation default bridge 1	Create default MD level table to control MIP creation permissions.

SW3

SW3#configure terminal	Enter configure mode.
SW3(config)#bridge 1 protocol rstp vlan-bridge	Create bridge 1 as an RSTP VLAN-aware bridge.
SW3(config)#vlan database	Enter VLAN configure mode.
SW3(config-vlan)#vlan 2 bridge 1	Create VLAN 2 on bridge 1.
SW3(config-vlan)#vlan 3 bridge 1	Create VLAN 3 on bridge 1.
SW3(config-vlan)#vlan 4 bridge 1	Create VLAN 4 on bridge 1.
SW3(config-vlan)#exit	Exit VLAN configure mode.
SW3(config)#interface eth1	Configure interface eth1.
SW3(config-if)#switchport	Configure eth1 as switch port.
SW3(config-if)#bridge-group 1	Configure eth1 in bridge group 1.
SW3(config-if)#switchport mode trunk	Configure interface mode as trunk.
SW3(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth1.
SW3(config)#interface eth2	Configure interface eth2.
SW3(config-if)#switchport	Configure interface as switch port.
SW3(config-if)#bridge-group 1	Configure eth2 in bridge group 1.
SW3(config-if)#switchport mode trunk	Configure eth2 mode as trunk.
SW3(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth2.
SW3(config)#ethernet cfm default-md-level entry vid 2 level 7 mip-creation default bridge 1	Create default MD level table to control MIP creation permissions.

SW4

SW4#configure terminal	Enter configure mode.
SW4(config)#bridge 1 protocol rstp vlan-bridge	Create bridge 1 as an RSTP VLAN-aware bridge.

Ethernet CFM Configurations

SW4(config)#vlan database	Enter VLAN configure mode.
SW4(config-vlan)#vlan 2 bridge 1	Create VLAN 2 on bridge 1.
SW4(config-vlan)#vlan 3 bridge 1	Create VLAN 3 on bridge 1.
SW4(config-vlan)#vlan 4 bridge 1	Create VLAN 4 on bridge 1.
SW4(config-vlan)#exit	Exit VLAN configure mode.
SW4(config)#ethernet cfm configure vlan 2 bridge 1	Configure VLAN 2 as primary VLAN.
SW4(config-cfm-vlan)#add vid 3 bridge 1	Add secondary VLAN ID 3 to bridge 1.
SW4(config-cfm-vlan)#add vid 4 bridge 1	Add secondary VLAN ID 4 to bridge 1.
SW4(config-cfm-vlan)#exit	Exit CFM VLAN mode.
SW4(config)#ethernet cfm domain-name type character-string name domain1 level 7 mip-creation default bridge 1	Enter CFM mode and create domain domain1 at level 7, setting MIP creation permissions to the default.
SW4(config-ether-cfm)#service ma-type integer ma-name 200 vlan 2 mip-creation default	Create MA with type as integer and set MIP creation permissions to the default.
SW4(config-ether-cfm)#mep crosscheck mpid 152 vlan 2	Enable crosscheck to remote MEP ID in VLAN 2.
SW4(config-ether-cfm)#exit	Exit Ethernet CFM mode.
SW4(config)#interface eth1	Configure interface eth1.
SW4(config-if)#switchport	Configure eth1 as switch port.
SW4(config-if)#bridge-group 1	Configure eth1 in bridge group 1.
SW4(config-if)#switchport mode trunk	Configure interface mode as trunk.
SW4(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth1.
SW4(config-if)#ethernet cfm mep down mpid 151 active true domain domain1 vlan 2 local-vid 3 bridge 1	Enter CFM MEP mode and create a down MEP in domain1 for VLAN 2 local VID 3 on bridge 1.
SW4(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface.
SW4(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
SW4(config-if)#exit	Exit Interface mode.
SW4(config)#ethernet cfm domain-name type character-string name domain1 level 7 mip-creation default bridge 1	Enter CFM mode.
SW4(config-ether-cfm)#cc vlan 2 interval 5	Configure CC time interval.

Validation

show ethernet cfm maintenance-points remote, show ethernet cfm maintenance-points local, show ethernet cfm maintenance-points remote domain, and ping ethernet multicast mepid

Up MEP

SW1

SW1#configure terminal	Enter configure mode.
SW1(config)#bridge 1 protocol rstp vlan-bridge	Create bridge 1 as an RSTP VLAN-aware bridge.
SW1(config)#vlan database	Enter VLAN configure mode.
SW1(config-vlan)#vlan 2 bridge 1	Create VLAN 2 on bridge 1.
SW1(config-vlan)#vlan 3 bridge 1	Create VLAN 3 on bridge 1.
SW1(config-vlan)#vlan 4 bridge 1	Create VLAN 4 on bridge 1.
SW1(config-vlan)#exit	Exit VLAN configure mode.
SW1(config)#ethernet cfm configure vlan 2 bridge 1	Configure VLAN 2 as primary VLAN.
SW1(config-cfm-vlan)#add vid 3 bridge 1	Add secondary VLAN ID (VID) 3.
SW1(config-cfm-vlan)#add vid 4 bridge 1	Add secondary VLAN ID (VID) 4.
SW1(config-cfm-vlan)#exit	Exit CFM VLAN mode.
SW1(config)#ethernet cfm domain-name type character-string name domain1 level 7 mip-creation default bridge 1	Enter CFM mode and create domain domain1 at level 7, setting MIP creation permissions to the default.
SW1(config-ether-cfm)#service ma-type integer ma-name 200 vlan 2 mip-creation default	Create MA with type as integer and set MIP creation permissions to the default.
SW1(config-ether-cfm)#mep crosscheck mpid 151 vlan 2	Configure crosscheck to remote MEP in VLAN 2.
SW1(config-ether-cfm)#exit	Exit Ethernet CFM mode.
SW1(config)#interface eth1	Configure interface eth1.
SW1(config-if)#switchport	Configure interface as switch port.
SW1(config-if)#bridge-group 1	Configure interface in bridge group 1.
SW1(config-if)#switchport mode trunk	Configure interface mode as trunk.
SW1(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth1.
SW1(config-if)#ethernet cfm mep up mpid 152 active true domain domain1 vlan 2 local-vid 3 bridge 1	Enter CFM MEP mode and create an up MEP assigned to domain1, VLAN 2, local VID 3, and bridge 1.
SW1(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast CC on the interface.
SW1(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
SW1(config-if)#exit	Exit interface mode.
SW1(config)#interface eth2	Configure interface eth2.
SW1(config-if)#switchport	Configure eth2 as switch port.
SW1(config-if)#bridge-group 1	Configure eth2 in bridge group
SW1(config-if)#switchport mode trunk	Make the interface a trunk.

SW1(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth2.
SW1(config)#ethernet cfm default-md-level entry vid 2 level 7 mip-creation default bridge 1	Create default MD level table to control MIP creation permissions.

SW2

SW2#configure terminal	Enter configure mode.
SW2(config)#bridge 1 protocol rstp vlan-bridge	Create bridge 1 as an RSTP VLAN-aware bridge.
SW2(config)#vlan database	Enter VLAN configure mode.
SW2(config-vlan)#vlan 2 bridge 1	Create VLAN 2 on bridge 1.
SW2(config-vlan)#vlan 3 bridge 1	Create VLAN 3 on bridge 1.
SW2(config-vlan)#vlan 4 bridge 1	Create VLAN 4 on bridge 1.
SW2(config-vlan)#exit	Exit VLAN configure mode.
SW2(config)#interface eth1	Configure interface as eth1.
SW2(config-if)#switchport	Configure interface as switch port.
SW2(config-if)#bridge-group 1	Configure eth1 in bridge group.
SW2(config-if)#switchport mode trunk	Configure eth1 mode as trunk.
SW2(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth1.
SW2(config)#interface eth2	Configure interface eth2.
SW2(config-if)#switchport	Configure eth2 as switch port.
SW2(config-if)#bridge-group 1	Configure eth2 in bridge group
SW2(config-if)#switchport mode trunk	Configure interface mode as trunk.
SW2(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth2.
SW2(config)#ethernet cfm default-md-level entry vid 2 level 7 mip-creation default bridge 1	Create default MD level table to control MIP creation permissions.

SW3

SW3#configure terminal	Enter configure mode.
SW3(config)#bridge 1 protocol rstp vlan-bridge	Create bridge 1 as an RSTP VLAN-aware bridge.
SW3(config)#vlan database	Enter VLAN configure mode.
SW3(config-vlan)#vlan 2 bridge 1	Create VLAN 2 on bridge 1.
SW3(config-vlan)#vlan 3 bridge 1	Create VLAN 3 on bridge 1.
SW3(config-vlan)#vlan 4 bridge 1	Create VLAN 4 on bridge 1.
SW3(config-vlan)#exit	Exit VLAN configure mode.
SW3(config)#interface eth1	Configure interface as eth1.

SW3(config-if)#switchport	Configure eth1 as switch port
SW3(config-if)#bridge-group 1	Configure eth1 in bridge group.
SW3(config-if)#switchport mode trunk	Configure interface mode as trunk..
SW3(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth1.
SW3(config)#interface eth2	Configure interface eth2.
SW3(config-if)#switchport	Configure interface as switch port
SW3(config-if)#bridge-group 1	Configure interface in bridge group
SW3(config-if)#switchport mode trunk	Configure interface mode as trunk.
SW3(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth2.
SW3(config)#ethernet cfm default-md-level entry vid 2 level 7 mip-creation default bridge 1	Create default MD level table to control MIP creation permissions.

SW4

SW4#configure terminal	Enter configure mode.
SW4(config)#bridge 1 protocol rstp vlan-bridge	Create bridge 1 as an RSTP VLAN-aware bridge
SW4(config)#vlan database	Enter VLAN configure mode.
SW4(config-vlan)#vlan 2 bridge 1	Create VLAN 2 on bridge 1.
SW4(config-vlan)#vlan 3 bridge 1	Create VLAN 3 on bridge 1.
SW4(config-vlan)#vlan 4 bridge 1	Create VLAN 4 on bridge 1.
SW4(config-vlan)#exit	Exit VLAN configure mode.
SW4(config)#ethernet cfm configure vlan 2 bridge 1	Configuring VLAN 2 as primary VLAN.
SW4(config-cfm-vlan)#add vid 3 bridge 1	Add secondary VLAN ID (VID) 3.
SW4(config-cfm-vlan)#add vid 4 bridge 1	Add secondary VLAN ID (VID) 4.
SW4(config-cfm-vlan)#exit	Exit CFM VLAN database mode.
SW4(config)#ethernet cfm domain-name type character-string name domain1 level 7 mip-creation default bridge 1	Enter CFM mode and create domain domain1 at level 7, setting MIP creation permissions to the default.
SW4(config-ether-cfm)#service ma-type integer ma-name 200 vlan 2 mip-creation default	Create an MA with type as integer and set MIP creation permissions to the default.
SW4(config-ether-cfm)#mep crosscheck mpid 152 vlan 2	Enable crosscheck on MEP.
SW4(config-ether-cfm)#exit	Exit Ethernet CFM mode.
SW4(config)#interface eth2	Configure interface eth2.
SW4(config-if)#switchport	Configure eth2 as switch port
SW4(config-if)#bridge-group 1	Configure eth2 in bridge group 1.
SW4(config-if)#switchport mode trunk	Configure interface mode as trunk.
SW4(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth2.

Ethernet CFM Configurations

SW4(config-if)#ethernet cfm mep up mpid 151 active true domain domain1 vlan 2 local-vid 3 bridge 1	Enter CFM MEP mode and create a Up MEP for domain1, VLAN 2, local VID 3 on bridge 1.
SW4(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast CC on the interface.
SW4(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
SW4(config-if)#exit	Exit interface mode.
SW4(config)#interface eth1	Configure interface eth1.
SW4(config-if)#switchport	Configure eth1 as switch port
SW4(config-if)#bridge-group 1	Configure eth1 in bridge group
SW4(config-if)#switchport mode trunk	Make the interface a trunk.
SW4(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface eth1.
SW4(config)#ethernet cfm default-md-level entry vid 2 level 7 mip-creation default bridge 1	Create default MD level table to control MIP creation permissions.

Validation

show ethernet cfm maintenance-points remote, show ethernet cfm maintenance-points local, show ethernet cfm maintenance-points remote domain, and ping ethernet multicast

CHAPTER 2 CFM Over PBB Configurations

This chapter describes how to configure 802.1ah Connectivity Fault Management (CFM) over Provider Backbone Bridges (PBB) in ZebOS-XP. The IEEE 802.1ah CFM specification amends IEEE 802.1ag by including additional operational modes of MEP (Maintenance End Points) and MIP (Maintenance Intermediate Points) to support CFM for PBBN (Provider Backbone Bridge Networks):

- In 802.1ag, a MEP or MIP is identified by a MEP ID, MA (Maintenance Association) ID, MD (Maintenance Domain), MD Level, and B-VLAN (backbone VLAN).
- In 802.1ah, the MEP/MIP identification also includes the I-SID (Service Instance ID).

CFM-PBB Components

Three different components are configured as a part of the CFM-PBB setup:

I-BEB	An I-BEB is the I-Component Bridge of the PBBN (provider backbone bridge network). The I-Component consists of the PIP (Provider Instance Port) and CNP (Customer Network Port). This is an S-VLAN (Service VLAN) component with one or more PIPs.
B-BEB	A B-BEB is the B-Component Bridge of the PBBN. The B-Component consists of the PNP (Provider Network Port) and the CBP (Customer Backbone Port). This is an S-VLAN component with one or more CBPs.
BCB	A BCB is an S-VLAN bridge used within the core of the PBBN.

Topology

The diagram depicts two I-component bridges at the edge of a service domain, two B-component bridges, and one backbone core bridge (BCB).

Figure 2-1 displays a sample CFM topology.

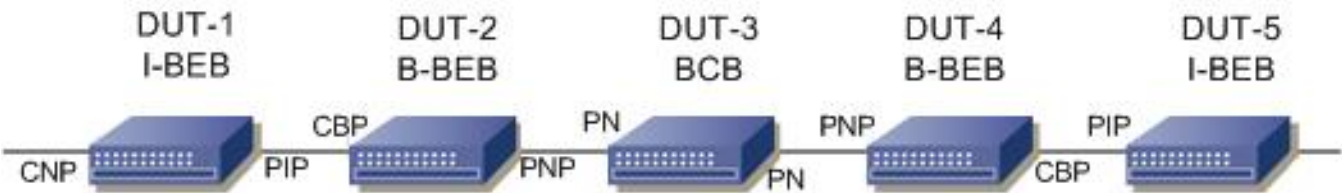


Figure 2-1: CFM Service Domain Topology

Legend

The following table is the legend for Figure 2-1:

B-BEB	B-Component Backbone Bridge
BCB	Backbone Core Bridge
I-BEB	I-Component Backbone Bridge
CNP	Customer Network Port

PIP	Provider Instance Port
PNP	Provider Network Port
PN	Provider Network
CBP	Customer Backbone Port

I-BEB (DUT-1)

DUT-1#configure terminal	Enter configure mode.
DUT-1(config)#bridge beb mac 1111.1111.1111 1 Protocol provider-mstp	Configure bridge 1 as an I-component bridge.
DUT-1(config)#ethernet cfm enable	Enable CFM globally.
DUT-1(config)#vlan database	Enter VLAN configure mode.
DUT-1(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure VLAN 3 as a service VLAN and associate it with bridge 1.
DUT-1(config-vlan)#exit	Exit VLAN configure mode.
DUT-1(config)#ethernet cfm pbb domain-type service name abc level 3 bridge 1	Create a service type domain and associate it with the bridge.
DUT-1(config-ether-cfm-pbb)#service pbb 12 isid 3	Create an MA for the domain.
DUT-1(config-ether-cfm-pbb)#mep pbb crosscheck mpid 3 isid 3	Configure the remote MEP.
DUT-1(config-ether-cfm-pbb)#exit	Exit MA configure mode.
DUT-1(config)#pbb isid list	Enter I-SID configure mode.
DUT-1(pbb-isid)#isid 3 name 3 i-component 1	Create an I-SID entry on I-component 1.
DUT-1(pbb-isid)#exit	Exit I-SID configure mode.
DUT-1(config)#interface eth1	Enter interface mode.
DUT-1(config-if)#switchport	Configure the interface as Layer 2.
DUT-1(config-if)#bridge-group 1	Associate the interface with bridge 1.
DUT-1(config-if)#switchport mode pip	Configure the interface as a PIP.
DUT-1(config-if)#switchport beb vlan 3 pip	Make VLAN 3 the default for the PIP.
DUT-1(config-if)#exit	Exit interface mode
DUT-1(config)#interface eth2	Enter interface mode.
DUT-1(config-if)#switchport	Configure the interface as a Layer 2 Interface
DUT-1(config-if)#bridge-group 1	Associate the interface with bridge 1.
DUT-1(config-if)#switchport mode cnp	Configure the interface as a CNP that receives and transmits frames for a single customer.
DUT-1(config-if)#switchport beb vlan 3 cnp	Make VLAN 3 the default for the CNP.
DUT-1(config-if)#switchport beb customer-network svlan add 3 instance 3 egress-port eth1	Map VLAN 3 to I-SID 3.
DUT-1(config-if)#exit	Exit interface mode.

DUT-1(config)#ethernet cfm pbb domain-name type character-string name abc pbb-domain- type service level 3 mip-creation none bridge 1	Configure a domain, setting the name, type, level, and MIP creation permissions.
DUT-1(config-ether-cfm-pbb)#service pbb ma- type string ma-name 12 isid 3 mip-creation none	Configure an MA for I-SID 3.
DUT-1(config-ether-cfm-pbb)#mep pbb crosscheck mpid 164 isid 3	Configure cross checking for I-SID 3, associating it with remote MEP 164.
DUT-1(config-ether-cfm-pbb)#end	Go to privileged exec mode,
DUT-1#configure terminal	Enter configure mode.
DUT-1(config)#interface eth1	Enter interface mode.
DUT-1(config-if)#ethernet cfm pbb mep down mpid 61 domain-name abc isid 3 bridge 1	Create a MEP for I-SID 3.
DUT-1(config-if-eth-cfm-pbb-mep)#cc multicast state enable	Enable continuity checking (CC) for MEP 61.
DUT-1(config-if-eth-cfm-pbb-mep)#exit	Exit CFM MEP mode.
DUT-1(config-if)#exit	Exit interface mode.
DUT-1(config)#exit	Exit configure mode.

B-BEB (DUT-2)

DUT-2#configure terminal	Enter configure mode.
DUT-2(config)#bridge beb mac 1111.1111.1111 backbone protocol provider-mstp	Configure bridge 1 as an I-component bridge.
DUT-2(config)#ethernet cfm enable	Enable CFM globally.
DUT-2(config)#vlan database	Enter VLAN configure mode.
DUT-2(config-vlan)#vlan 3 type backbone point-point state enable	Configure VLAN 3 as a backbone VLAN.
DUT-2(config-vlan)#exit	Exit VLAN configure mode.
DUT-2(config)#interface eth1	Enter interface mode.
DUT-2(config-if)#switchport	Configure the interface as Layer 2
DUT-2(config-if)#bridge-group backbone	Associate eth1 with the bridge.
DUT-2(config-if)#switchport mode cbp	Configure the interface as a CBP.
DUT-2(config-if)#switchport beb vlan 3 cbp	Make VLAN 3 the default for the CBP.
DUT-2(config-if)#switchport beb customer- backbone instance add 3 bvlan 3	Map the BVID (backbone VLAN ID) to the VLAN.
DUT-2(config-if)#exit	Exit interface mode.
DUT-2(config-if)#interface eth2	Enter interface mode.
DUT-2(config-if)#switchport	Configure the interface as a Layer 2 interface.
DUT-2(config-if)#bridge-group backbone	Associate the interface with the backbone bridge.
DUT-2(config-if)#switchport mode pnp	Configure the interface as a PNP that receives and transmits frames for multiple customers.
DUT-2(config-if)#switchport beb vlan 3 pnp	Make VLAN 3 the default for the PNP.

CFM Over PBB Configurations

DUT-2(config-if)#exit	Exit interface mode.
DUT-2(config)#ethernet cfm pbb domain-name type character-string name abc pbb-domain- type service level 3 mip-creation none backbone	Configure a domain, setting the name, type, level, and MIP creation permissions.
DUT-2(config-ether-cfm-pbb)#service pbb ma- type string ma-name 12 isid 3 mip-creation none	Configure an MA for I-SID 3.
DUT-2(config-ether-cfm-pbb)#exit	Exit Ethernet CFM PBB mode,
DUT-2(config)#exit	Exit global configure mode.

BCB (DUT-3)

DUT-3#configure terminal	Enter configure mode.
DUT-3(config)#bridge 1 protocol provider- mstp	Configure bridge 1.
DUT-3(config)#ethernet cfm enable	Enable CFM globally.
DUT-3(config)#vlan database	Enter VLAN configure mode.
DUT-3(config-vlan)#vlan 3 type service point-point Bridge 1 state enable	Configure VLAN 3 as a service VLAN.
DUT-3(config-vlan)#exit	Exit VLAN configure mode.
DUT-3(config)#interface eth1	Enter interface mode.
DUT-3(config-if)#switchport	Configure the interface as Layer 2.
DUT-3(config-if)#bridge-group 1	Associate the interface with bridge 1.
DUT-3(config-if)#switchport mode provider- network	Configure the interface as a provider network.
DUT-3(config-if)#switchport provider- network allowed vlan add 3	Associate VLAN 3 to the interface.
DUT-3(config-if)#exit	Exit interface mode.
DUT-3(config)#interface eth2	Enter interface mode.
DUT-3(config-if)#switchport	Configure the interface as a Layer 2 interface.
DUT-3(config-if)#bridge-group 1	Associate the interface with bridge 1.
DUT-3(config-if)#switchport mode provider- network	Configure the interface as a provider network.
DUT-3(config-if)#switchport provider- network allowed vlan add 3	Associate VLAN 3 to the interface.
DUT-3(config-if)#exit	Exit interface mode.
DUT-3(config)#exit	Exit configure mode.

B-BEB (DUT-4)

DUT-4#configure terminal	Enter configure mode.
DUT-4(config)#bridge beb mac 1111.1111.1111 backbone protocol provider-mstp	Configure bridge 1 as an I-component bridge.
DUT-4(config)#ethernet cfm enable	Enable CFM globally.
DUT-4(config)#vlan database	Enter VLAN configure mode.
DUT-4(config-vlan)#vlan 3 type backbone point-point state enable	Configure VLAN 3 as a backbone VLAN.
DUT-4(config-vlan)#exit	Exit VLAN configure mode.
DUT-4(config)#interface eth1	Enter interface mode.
DUT-4(config-if)#switchport	Configure the interface as Layer 2.
DUT-4(config-if)#bridge-group backbone	Associate eth1 with the backbone bridge.
DUT-4(config-if)#switchport mode cbp	Configure the interface as a CBP.
DUT-4(config-if)#switchport beb vlan 3 cbp	Make VLAN 3 the default for the CBP.
DUT-4(config-if)#switchport beb customer-backbone instance add 3 bvlan 3	Map the BVID (backbone VLAN ID) to the VLAN.
DUT-4(config-if)#exit	Exit interface mode.
DUT-4(config-if)#interface eth2	Enter interface mode.
DUT-4(config-if)#switchport	Configure the interface as Layer 2.
DUT-4(config-if)#bridge-group backbone	Associate the interface with the backbone bridge.
DUT-4(config-if)#switchport mode pnp	Configure the interface as a PNP that receives and transmits frames for multiple customers.
DUT-4(config-if)#switchport beb vlan 3 pnp	Make VLAN 3 the default for the PNP.
DUT-4(config-if)#switchport beb provider-network bvlan all	Configure the interface as a provider network, associating all backbone VLANs to the PNP port.
DUT-4(config-if)#exit	Exit interface mode.
DUT-4(config)#exit	Exit configure mode.

I-BEB (DUT-5)

DUT-5#configure terminal	Enter configure mode.
DUT-5(config)#bridge beb mac 1111.1111.1111 1 Protocol provider-mstp	Configure the bridge as an I-component bridge.
DUT-5(config)#ethernet cfm enable	Enable CFM globally.
DUT-5(config)#vlan database	Enter VLAN configure mode.
DUT-5(config-vlan)#vlan 3 type service point-point Bridge 1 state enable	Configure VLAN 3 as a service VLAN and associate it with bridge 1.
DUT-5(config-vlan)#exit	Exit VLAN configure mode.
DUT-5(config)#pbb isid list	Enter I-SID configure mode.
DUT-5(pbb-isid)#isid 3 name 3 i-component 1	Create an I-SID entry on I-component 1.

DUT-5 (pbb-isid) #exit	Exit I-SID configure mode.
DUT-5 (config) #interface eth1	Enter interface mode.
DUT-5 (config-if) #switchport	Configure the interface as Layer 2.
DUT-5 (config-if) #bridge-group 1	Associate it with bridge 1.
DUT-5 (config-if) #switchport mode pip	Configure the interface as a PIP.
DUT-5 (config-if) #switchport beb vlan 3 pip	Make VLAN 3 the default for the PIP.
DUT-5 (config-if) #exit	Exit interface mode.
DUT-5 (config) #interface eth2	Enter interface mode.
DUT-5 (config-if) #switchport	Configure the interface as Layer 2.
DUT-5 (config-if) #bridge-group 1	Associate it with bridge 1.
DUT-5 (config-if) #switchport mode cnp	Configure the interface as a CNP that receives and transmits frames for a single customer.
DUT-5 (config-if) #switchport beb vlan 3 cnp	Make VLAN 3 the default for the CNP.
DUT-5 (config-if) #switchport beb customer-network svlan add 3 instance 3 egress-port eth1	Map the VLAN ID to the I-SID.
DUT-5 (config-if) #exit	Exit interface mode.
DUT-5 (config) #ethernet cfm pbb domain-name type character-string name abc pbb-domain-type service level 3 mip-creation none bridge 1	Configure a domain, setting the name, type, level, and MIP creation permissions.
DUT-5 (config-ether-cfm-pbb) #service pbb ma-type string ma-name 12 isid 3 mip-creation none	Configure an MA for I-SID 3.
DUT-5 (config-ether-cfm-pbb) #mep pbb crosscheck mpid 61 isid 3	Configure cross checking for I-SID 3, associating it with remote MEP 164.
DUT-5 (config-ether-cfm-pbb) #exit	Exit Ethernet CFM PBB mode,
DUT-5 (config) #interface eth1	Enter interface mode.
DUT-5 (config-if) #ethernet cfm pbb mep down mpid 164 domain-name abc isid 3 bridge 1	Create a MEP for I-SID 3.
DUT-5 (config-if-eth-cfm-pbb-mep) #cc multicast state enable	Enable continuity checking (CC) for MEP 164.
DUT-5 (config-if) #end	Return to privileged exec mode.

Validation

The following `show` command for DUT-5 displays information about the maintenance points in the domain named abc associated with I-SID 3, on bridge 1, at maintenance level 3:

```
DUT-5#show ethernet cfm pbb maintenance-points remote domain-name abc isid 3 bridge 1
MPID      LEVEL      ISID      MEP-UP      Remote Mac
-----
3          3          3          Yes          0002.a5e0.9563
```

The following `ping` command displays loopback and test information for the configured elements:

```
DUT-5#ping ethernet pbb multicast mepid 23 domain-name abc isid 3 tlv data 20 bridge 1
Host MEP: 23
Number of RMEPs that replied to mcast frame = 1
```

LBR received from the following
0002.a5e0.9563
success rate is 100 (1/1)

The following show command for DUT-1 displays detailed information about the domain, including maintenance level, interface type, domain type, VLAN ID, service instance ID, topology, port ID, continuity check status and MAC address:

```
DUT-1#show ethernet cfm pbb maintenance-points local mep domain-name abc bridge 1
MPID DOMAIN_NAME LEVEL TYPE Domain-Type VLAN ISID Topo-Type PORT CC-Status Mac-address
-----
23   abc           3   MEP  service      3    3    default   eth1 enabled 0002.b3d4.3f25
```


CHAPTER 3 Ethernet to the First Mile OAM Configuration

This chapter contains a complete sample Ethernet to the First Mile - Operation Administration and Maintenance (EFM-OAM) configuration.

The main functions of EFM-OAM are link performance monitoring, fault detection, fault signaling and loopback signaling. Slow Protocol frames called OAM Protocol Data Units (OAMPDUs) deliver OAM information. OAMPDUs contain the appropriate control and status information used to monitor, test and troubleshoot OAM-enabled links.

Topology

Figure 3-1 displays a sample EFM topology.



Figure 3-1: EFM Topology

ZebOS1

ZebOS1#configure terminal	Enter configure mode.
ZebOS1(config)#interface eth2	Enter interface mode.
ZebOS1(config-if)#ethernet oam enable	Enable Ethernet OAM in eth2.
ZebOS1(config-if)#ethernet oam mode active	Configure Ethernet OAM mode as active in eth1. (The default mode is passive.)
ZebOS1(config-if)#ethernet oam timeout 10	Configure the link-timer as 10. Upon expiry of the link timer, the discovery process will restart.
ZebOS1(config-if)#ethernet oam max-rate 1	Specify the maximum number of OAMPDUS to be sent per second. The range is <1-10>.
ZebOS2(config-if)#end	Exit interface mode.

ZebOS2

ZebOS2#configure terminal	Enter configure mode.
ZebOS2(config)#interface eth2	Enter interface mode.
ZebOS2(config-if)#ethernet oam enable	Enable Ethernet OAM in eth2.
ZebOS2(config-if)#ethernet oam mode active	Configure Ethernet OAM mode as active in eth1. (The default mode is passive.)
ZebOS2(config-if)#ethernet oam timeout 10	Configure the link-timer as 10. Upon expiry of the link timer, the discovery process will restart
ZebOS2(config-if)#end	Exit interface mode.

Validation

The EFM Discovery Machine State should be “send any” in both machines. This is the expected normal operating state for OAM on fully-operational links. The various states of OAM discovery state machine are defined below.

Discovery State	Description
ACTIVE_SEND_LOCAL	A DTE configured in Active mode sends Information OAMPDUs that only contain the Local Information TLV. This state is called ACTIVE_SEND_LOCAL. While in this state, the local DTE waits for Information OAMPDUs received from the remote DTE.
PASSIVE_WAIT	DTE configured in Passive mode waits until receiving Information OAMPDUs with Local Information TLVs before sending any Information OAMPDUs with Local Information TLVs. This state is called PASSIVE_WAIT. By waiting until first receiving an Information OAMPDU with the Local Information TLV, a Passive DTE cannot complete the OAM Discovery process when connected to another Passive DTE.
SEND_LOCAL_REMOTE	Once the local DTE has received an Information OAMPDU with the Local Information TLV from the remote DTE, the local DTE begins sending Information OAMPDUs that contain both the Local and Remote Information TLVs. This state is called SEND_LOCAL_REMOTE.

Discovery State	Description
SEND_LOCAL_REMOTE_OK	If the local OAM client deems the settings on both the local and remote DTEs are acceptable, it enters the SEND_LOCAL_REMOTE_OK state.
SEND_ANY	Once an OAMPDU has been received, indicating the remote device is satisfied with the respective settings, the local device enters the SEND_ANY state. This is the expected normal operating state for OAM on fully operational links.
FAULT	If OAM is reset, disabled, or the link timer expires, the Discovery process returns to the FAULT state.

Validation

```

ZebOS1#show ethernet oam eth2
eth2
Discovery State Machine Details:
EFM Discovery Machine State:      Send Any
Local Parser State:               Forward
Local Multiplexer State:          Forward
Remote Parser State:              Forward
Remote Multiplexer State:         Forward
Local Client:
  Symbol Period Error:
    Window:                       05f5e100 Symbol(s)
    Threshold:                     00 Symbol(s)
    Last Window Symbols Errors:    00 Symbol(s)
    Total Symbols Errors:          00 Symbol(s)
    Total Symbols Errors Events:   0 Events(s)
    Relative Timestamp of the Event: 0 x 100 milliseconds
  Frame Error:
    Window:                       100 x 100 milliseconds
    Threshold:                     1 Error Frame(s)
    Last Window Frame Errors:      0 Frame(s)
    Total Frame Errors:            00 Frames(s)
    Total Frame Errors Events:     0 Events(s)
    Relative Timestamp of the Event: 0 x 100 milliseconds
  Frame Period Error:
    Window:                       989680 Frames
    Threshold:                     1 Error Frame(s)
    Last Window Frame Errors:      0 Frame(s)
    Total Frame Errors:            00 Frames(s)
    Total Frame Period Errors Events: 0 Events(s)
    Relative Timestamp of the Event: 0 x 100 milliseconds
  Frame Seconds Error:
    Window:                       1000 x 100 milliseconds
    Threshold:                     1 Error Second(s)
    Last Window Frame Second Errors: 0 Frame(s)
    Total Frame Second Errors:     00 Frames(s)
    Total Frame Second Errors Events: 0 Events(s)
    Relative Timestamp of the Event: 0 x 100 milliseconds
ZebOS1#show ethernet oam discovery interface eth2

```

eth2

Local client:

Administrative configurations:

Mode:	active
Unidirection:	supported
Link monitor:	supported(on)
Remote Loopback:	supported
MIB retrieval:	not supported
MTU Size :	1518

Operational status:

Port status:	operational
Loopback status:	no loopback
PDU revision:	1

Remote client:

MAC address: 0002.b33e.401d

Vendor(oui): 3 0 50

Administrative configurations:

Mode:	active
Unidirection:	supported
Link monitor:	supported
Remote Loopback:	supported
MIB retrieval:	not supported
MTU Size :	1518

Remote Loopback

You must enable Ethernet OAM remote loopback on an interface for the local OAM client to start OAM remote loopback operations. Ethernet OAM remote loopback is disabled by default.

Note: For `ethernet oam remote-loopback start` command to be successful, the node should receive at least one PDU.

ZebOS1#configure terminal	Enter configure mode.
ZebOS1(config)#interface eth2	Enter interface mode.
ZebOS1(config-if)#ethernet oam remote-loopback supported	Enable Ethernet remote loopback on eth2.
ZebOS1(config-if)#ethernet oam remote-loopback start	Turn remote-loopback ON on eth2
ZebOS1(config-if)#ethernet oam remote-loopback stop	Turn remote-loopback OFF on eth2
ZebOS1(config-if)#end	Exit interface mode.

Validation

An OAM entity can put its remote entity into loopback mode using a loopback control OAMPDU. In loopback mode, every frame received is transmitted back on that same port except for OAMPDUs. The periodic exchange of OAMPDUs must continue during loopback state to maintain the OAM session. Once we enable remote loopback in ZebOS1, it sends out a loopback control OAMPDU with Enable remote loopback command. When ZebOS2 receives it, it changes its parser state to Loopback and MUX state to discard and then sends out information OAMPDU with updated state information.

```
ZebOS1#show ethernet oam eth2
eth2
Discovery State Machine Details:
EFM Discovery Machine State:      Send Any
Local Parser State:                Discard
Local Multiplexer State:          Forward
Remote Parser State:              Loopback
Remote Multiplexer State:         Invalid
```

Link Monitoring Event

We can configure high and low threshold for link-monitoring features. We can also configure an error disable action if one of the high thresholds is exceeded.

ZebOS1#configure terminal	Enter configure mode.
ZebOS1(config)#interface eth2	Enter interface mode.
ZebOS1(config-if)#ethernet oam link-monitor supported	Enable the interface to support link monitoring. This is the default.
ZebOS1(config-if)#ethernet oam link-monitor on	Start link monitoring.

ZebOS1(config-if)#ethernet oam link-monitor frame threshold high 5000 low 200 window 500	Configure a high and low threshold for frame events. Specify the number of seconds to set a window period during which error frames are counted.
ZebOS1(config-if)#ethernet oam link-monitor frame-errors 3000	Configure this stub CLI to generate frames with the specified error value.
ZebOS1(config-if)#ethernet oam link-monitor frame-period threshold high 3000 low 500	Configure high and low thresholds for frame-period events.
ZebOS1(config-if)#ethernet oam link-monitor frame-seconds threshold high 600 low 200	Configure high and low thresholds for frame-seconds events.
ZebOS1(config-if)#ethernet oam link-monitor symbol-period threshold high 40000 low 1000	Configure high and low thresholds for symbol events.
ZebOS1(config-if)#ethernet oam link-monitor high threshold action error-disable- interface	Configure the error-disable-action that should take place on the interface when one of the high thresholds is exceeded.
ZebOS1(config-if)#end	Exit interface mode.

Validation

When link monitoring is ON and the number of errors (frame-errors, seconds-errors, or symbol period errors) exceeds the low threshold, a corresponding event notification PDU is sent. If the number of errors exceeds high threshold and a high threshold action (error-disable-interface) has been configured, the interface is disabled (shut down).

```
ZebOS1#show ethernet oam status interface eth2
eth2
```

General:

```
Mode: active
PDU max rate: 10 packets per second
PDU min rate: 1 packet per 1 second
Link timeout: 5 seconds
High threshold action: disable interface
```

Link Monitoring:

```
Status: supported(on)
Symbol Period Error:
  Window: 100 million symbols
  Low threshold: 1000 error symbol(s)
  High threshold: 40000 error symbol(s)
Frame Error:
  Window: 500 x 100 milliseconds
  Low threshold: 200 error frame(s)
  High threshold: 5000 error frame(s)
Frame Period Error:
  Window: 1000 x 100,000 frames
  Low threshold: 500 error frame(s)
  High threshold: 500 error frame(s)
Frame Seconds Error:
  Window: 1000 x 100 milliseconds
  Low threshold: 200 error second(s)
  High threshold: 600 error second(s)
```

Show output of the interface disabled through high threshold action:

```
interface eth2
```



```
ip address 23.5.9.3/24
shutdown
```

Remote Failure Detection Configuration

An error-disable action can be configured to occur on an interface so that if any of the critical link events (link fault, dying gasp, etc.) occurs in the remote machine, the interface is shut down.

ZebOS1#configure terminal	Enter configure mode.
ZebOS1(config)#interface eth2	Enter interface mode.
ZebOS1#ethernet oam remote-failure critical-event dying-gasp link-fault action error-disable-interface	Configure the Ethernet OAM remote-failure action on eth2. Configure the interface to shut down when any of the critical link events take place on the remote machine.
ZebOS2(config-if)#ethernet oam local-event critical-event	Set this stub CLI to generate a critical event.
ZebOS2(config-if)#ethernet oam local-event dying-gasp	Set this stub CLI to generate a dying-gasp event.
ZebOS2(config-if)#ethernet oam local-event link-fault	Set this stub CLI to generate a link-fault event.
ZebOS1(config-if)#end	Exit interface mode.

Validation

When a remote failure action (`error-disable-interface`) is configured in ZebOS1 and when a critical link event (link fault, dying gasp, or other critical event) occurs in ZebOS2, the interface is disabled (shut down).

CHAPTER 4 Link Layer Discovery Protocol Configuration

This chapter contains a complete sample Link Layer Discovery Protocol (LLDP) configuration.

LLDP is a neighbor discovery protocol that defines a method for network access devices using Ethernet connectivity to advertise themselves to other devices on the same physical LAN, and then to store information about the network. It allows a device to learn higher-layer management reachability and connection endpoint information from adjacent devices. Using LLDP, a network device is able to advertise its identity, its capabilities and its media-specific configuration, as well as learn the same information from other connected devices.

Topology

Figure 4-1 displays a sample LLDP topology.



Figure 4-1: LLDP Topology

LLDPv1

Note: All configuration commands in the table below should be followed for each machines.

#configure terminal	Enter configure mode.
(config)#set lldp system-name L2-LLDP	Specify a system name.
(config)#set lldp system-description TEST-LLDP	Specify a system description.
(config)#bridge 1 protocol ieee vlan-bridge	Configure an IEEE VLAN-aware bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure a VLAN and add it to the bridge.
(config)#exit	Exit the VLAN configuration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#set lldp enable txrx	Enable an LLDP agent on the port.
(config-if)#lldp tlv ieee-8021-org-specific management-address port-description system-capabilities system-description system-name	Enable the various TLV's to be transmitted on the port.
(config-if)#switchport	Set switching characteristics on the port.
(config-if)#bridge-group 1	Associate the interface to the bridge.
(config)#exit	Exit interface mode.

Validation

1. Verify the remote system information.

```
#show lldp port eth1
Remote LLDP
MAC Address: 0 d0 b7 1b 8 93
TTL: 120
Interface Number: 3
Port Vlan ID: 0
AutoNego Support:
AutoNego Capability: 0
Operational MAU Type: 0
/* PoE Feature Starts */
Power via MDI Capability (raw data):
(Use command [show poe port remote] for details):
  MDI power support: 0x0
  PSE power pair: 0x0
  Power class: 0x0
  Type/source/priority: 0x0
  PD requested power value: 0x0
  PSE allocated power value: 0x0
/* PoE Feature Ends*/
Link Aggregation Status:
Link Aggregation Port ID: 0
Max Frame Size: 0
System name: L2-LLDP
System Description: TEST-LLDP
System Capabilities: 512
System Capabilities Enabled: 512
```

2. Verify the LLDP configurations in the local machine.

```
#show running-config
!
no service password-encryption
!
no service dhcp
ip domain-lookup
!
mpls propagate-ttl
!
vrrp vmac enable
no ipv6 forwarding
bridge 1 protocol ieee vlan-bridge
lldp system-name L2-LLDP
lldp system-description TEST-LLDP
!
interface lo
 ip address 127.0.0.1/8
!
interface eth0
 ip address 2.2.2.42/24
!
interface eth1
 switchport
 bridge-group 1
```

```

switchport mode access
set lldp enable txrx
lldp tlv chassis-id port-id ttl port-description system-name system-
capabilities system-description management-address ieee-8021-org-specific
!
interface eth2
!
interface eth3
ip address 10.87.125.41/24
!
interface svlan0.1
!
interface vlan1.1
!
line con 0
login
line vty 0 4
login
!
end

```

3. Verify the LLDP port statistics.

```

#show lldp port eth1 statistics
LLDP Port statistics for eth1
Frames transmitted: 36
Frames Aged out: 0
Frames Discarded: 0
Frames with Error: 0
Frames Received: 37
TLVs discarded: 0
TLVs unrecognized 0

```

LLDPv2

Default Agent

All configuration commands in the table below should be followed for each machines.

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol ieee vlan- bridge	Configure an IEEE VLAN-aware bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure a VLAN and add it to the bridge.
(config-vlan)#exit	Exit the VLAN configuration mode.
(config)#interface eth1	Enter interface mode.
(config-if)# set lldp port-description LLDP-Interface	Specify port description
(config-if)#lldp-agent	Enter into the default agent
(lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(lldp-agent)# set lldp chassis-id-tlv ip- address	Configure the subtype for chassis-id TLV

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(lldp-agent)# set lldp port-id-tlv mac-address	Configure the subtype for port-id TLV
(lldp-agent)# lldp tlv-select basic-mgmt port-description	Enable the port-description TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt system-name	Enable the system-name TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt system-capabilities	Enable the system-capabilities TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt system-description	Enable the system-description TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt management-address	Enable the management-address TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific port-vlanid	Enable the VLAN-id TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific vlan-name	Enable the VLAN-NAME TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific port-ptcl-vlanid	Enable the Port and Protocol VLAN id TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific ptcl-identity	Enable the Protocol Identity TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific vid-digest	Enable the VID Usage Digest TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific mgmt-vid	Enable the Management VID TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific link-agg	Enable the Link Aggregation TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8023-org-specific mac-phy	Enable the MAC/PHY Configuration/Status TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8023-org-specific max-mtu-size	Enable the Maximum Frame Size TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8023-org-specific power-via-mdi	Enable Power-Via-MDI TLV to be transmitted on the port.
(lldp-agent)# set lldp timer msg-fast-TX 5	Defines the time interval during fast transmission periods
(lldp-agent)# set lldp Tx-fast-init 6	Defines the number of LLDPDUs that are transmitted during a fast transmission period
(lldp-agent)#exit	Exit the lldp agent mode
(config-if)#switchport	Set switching characteristics on the port.
(config-if)#bridge-group 1	Associate the interface to the bridge.
(config-if)#exit	Exit interface mode.

Validation

1. Verify the LLDP configurations in the local machine

```
#show running-config lldp
!
interface lo
  lldp-agent
!
interface eth0
```

```

lldp-agent
!
interface eth1
lldp-agent
  set lldp enable txrx
  lldp tlv-select basic-mgmt port-description
  lldp tlv-select basic-mgmt system-name
  lldp tlv-select basic-mgmt system-capabilities
  lldp tlv-select basic-mgmt system-description
  lldp tlv-select basic-mgmt management-address
  lldp tlv-select ieee-8021-org-specific port-vlanid
  lldp tlv-select ieee-8021-org-specific vlan-name
  lldp tlv-select ieee-8021-org-specific port-ptcl-vlanid
  lldp tlv-select ieee-8021-org-specific ptcl-identity
  lldp tlv-select ieee-8021-org-specific vid-digest
  lldp tlv-select ieee-8021-org-specific mgmt-vid
  lldp tlv-select ieee-8021-org-specific link-agg
  lldp tlv-select ieee-8023-org-specific mac-phy
  lldp tlv-select ieee-8023-org-specific link-agg
  lldp tlv-select ieee-8023-org-specific max-mtu-size
  lldp tlv-select ieee-8023-org-specific power-via-mdi
  set lldp timer msg-fast-TX 5
  set lldp tx-fast-init 6
!
interface eth2
  lldp-agent
!
interface eth3
  lldp-agent
!
interface sit0
  lldp-agent
!
interface svlan0.1
  lldp-agent
!
interface vlan1.1
  lldp-agent
!
interface vlan1.2
  lldp-agent

```

2. Verify the LLDP port statistics

```
#show lldp interface eth1 nearest-bridge
```

```

Agent Mode : Nearest bridge
Enable (tx/rx): Y/Y
MED Enabled :N
Device Type: NOT_DEFINED
LLDP Agent traffic statistics:
Total frames transmitted: 24
Total entries aged: 0
Total frames recieved: 16
Total frames received in error: 0
Total frames discarded: 0
Total discarded TLVs: 0
Total unrecognised TLVs: 0

```

Customer Bridge

All configuration commands in the table below should be followed for each machines.

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol ieee vlan- bridge	Configure an IEEE VLAN-aware bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure a VLAN and add it to the bridge.
(config-vlan)#exit	Exit the VLAN configuration mode.
(config)#interface eth1	Enter interface mode.
(config-if)# set lldp port-description LLDP-Interface	Specify port description
(config-if)#lldp-agent customer-bridge	Enter into the Customer Bridge agent
(lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(lldp-agent)# set lldp chassis-id-tlv ip-address	Configure the subtype for chassis-id TLV
(lldp-agent)# set lldp port-id-tlv mac-address	Configure the subtype for port-id TLV
(lldp-agent)# lldp tlv-select basic-mgmt port-description	Enable the port-description TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt system-name	Enable the system-name TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt system-capabilities	Enable the system-capabilities TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt system-description	Enable the system-description TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt management-address	Enable the management-address TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific port-vlanid	Enable the VLAN-id TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific vlan-name	Enable the VLAN-NAME TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific port-ptcl-vlanid	Enable the Port and Protocol VLAN id TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific ptcl-identity	Enable the Protocol Identity TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific vid-digest	Enable the VID Usage Digest TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific mgmt-vid	Enable the Management VID TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific link-agg	Enable the Link Aggregation TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8023-org-specific mac-phy	Enable the MAC/PHY Configuration/Status TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8023-org-specific max-mtu-size	Enable the Maximum Frame Size TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8023-org-specific power-via-mdi	Enable The Power-Via-MDI TLV to be transmitted on the port

(lldp-agent)# set lldp timer msg-fast-TX 5	Defines the time interval during fast transmission periods
(lldp-agent)# set lldp Tx-fast-init 6	Defines the number of LLDPDU that are transmitted during a fast transmission period
(lldp-agent)#exit	Exit the lldp agent mode
(config-if)#switchport	Set switching characteristics on the port.
(config-if)#bridge-group 1	Associate the interface to the bridge.
(config-if)#exit	Exit interface mode.

Validation

1. Verify the LLDP configurations in the local machine

```
#show running-config lldp
!
interface lo
  lldp-agent
!
interface eth0
  lldp-agent
!
interface eth1
lldp-agent customer-bridge
  set lldp enable txrx
  lldp tlv-select basic-mgmt port-description
  lldp tlv-select basic-mgmt system-name
  lldp tlv-select basic-mgmt system-capabilities
  lldp tlv-select basic-mgmt system-description
  lldp tlv-select basic-mgmt management-address
  lldp tlv-select ieee-8021-org-specific port-vlanid
  lldp tlv-select ieee-8021-org-specific vlan-name
  lldp tlv-select ieee-8021-org-specific port-ptcl-vlanid
  lldp tlv-select ieee-8021-org-specific ptcl-identity
  lldp tlv-select ieee-8021-org-specific vid-digest
  lldp tlv-select ieee-8021-org-specific mgmt-vid
  lldp tlv-select ieee-8021-org-specific link-agg
  lldp tlv-select ieee-8023-org-specific mac-phy
  lldp tlv-select ieee-8023-org-specific link-agg
  lldp tlv-select ieee-8023-org-specific max-mtu-size
  lldp tlv-select ieee-8023-org-specific power-via-mdi
  set lldp timer msg-fast-TX 5
  set lldp tx-fast-init 6
!
interface eth2
  lldp-agent
!
interface eth3
  lldp-agent
!
interface sit0
  lldp-agent
!
interface svlan0.1
  lldp-agent
!
interface vlan1.1
```

```
lldp-agent
!
interface vlan1.2
lldp-agent
```

2. Verify the LLDP port statistics

```
#show lldp interface eth1 Customer-bridge
```

```
Agent Mode : Customer-bridge
Enable (tx/rx): Y/Y
MED Enabled : NOT_DEFINED
Device Type: Non
LLDP Agent traffic statistics:
Total frames transmitted: 21
Total entries aged: 0
Total frames recieved: 15
Total frames received in error: 0
Total frames discarded: 0
Total discarded TLVs: 0
Total unrecognised TLVs: 0
```

Non-Tpmr-Bridge

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol ieee vlan- bridge	Configure an IEEE VLAN-aware bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure a VLAN and add it to the bridge.
(config-vlan)#exit	Exit the VLAN configuration mode.
(config)#interface eth1	Enter interface mode.
(config-if)# set lldp port-description LLDP-Interface	Specify port description
(config-if)#lldp-agent non-tpmr-bridge	Enter into the Non tpmr Bridge agent
(lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(lldp-agent)# set lldp chassis-id-tlv ip-address	Configure the subtype for chassis-id TLV
(lldp-agent)# set lldp port-id-tlv mac-address	Configure the subtype for port-id TLV
(lldp-agent)# lldp tlv-select basic-mgmt port-description	Enable the port-description TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt system-name	Enable the system-name TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt system-capabilities	Enable the system-capabilities TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt system-description	Enable the system-description TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select basic-mgmt management-address	Enable the management-address TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific port-vlanid	Enable the VLAN-id TLV to be transmitted on the port

(lldp-agent)# lldp tlv-select ieee-8021-org-specific vlan-name	Enable the VLAN-NAME TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific port-ptcl-vlanid	Enable the Port and Protocol VLAN id TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific ptcl-identity	Enable the Protocol Identity TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific vid-digest	Enable the VID Usage Digest TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific mgmt-vid	Enable the Management VID TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8021-org-specific link-agg	Enable the Link Aggregation TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8023-org-specific mac-phy	Enable the MAC/PHY Configuration/Status TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8023-org-specific max-mtu-size	Enable the Maximum Frame Size TLV to be transmitted on the port
(lldp-agent)# lldp tlv-select ieee-8023-org-specific power-via-mdi	Enable Power-Via-MDI TLV to be transmitted on the port.
(lldp-agent)# set lldp timer msg-fast-TX 5	Defines the time interval during fast transmission periods
(lldp-agent)# set lldp Tx-fast-init 6	Defines the number of LLDPDUs that are transmitted during a fast transmission period
(lldp-agent)#exit	Exit the lldp agent mode
(config-if)#switchport	Set switching characteristics on the port.
(config-if)#bridge-group 1	Associate the interface to the bridge.
(config-if)#exit	Exit interface mode.

Validation

1. Verify the LLDP configurations in the local machine

```
#show running-config lldp
!
interface lo
  lldp-agent
!
interface eth0
  lldp-agent
!
interface eth1
lldp-agent non-tpmr-bridge
  set lldp enable txrx
  lldp tlv-select basic-mgmt port-description
  lldp tlv-select basic-mgmt system-name
  lldp tlv-select basic-mgmt system-capabilities
  lldp tlv-select basic-mgmt system-description
  lldp tlv-select basic-mgmt management-address
  lldp tlv-select ieee-8021-org-specific port-vlanid
  lldp tlv-select ieee-8021-org-specific vlan-name
  lldp tlv-select ieee-8021-org-specific port-ptcl-vlanid
  lldp tlv-select ieee-8021-org-specific ptcl-identity
  lldp tlv-select ieee-8021-org-specific vid-digest
  lldp tlv-select ieee-8021-org-specific mgmt-vid
```

```
lldp tlv-select ieee-8021-org-specific link-agg
lldp tlv-select ieee-8023-org-specific mac-phy
lldp tlv-select ieee-8023-org-specific link-agg
lldp tlv-select ieee-8023-org-specific max-mtu-size
lldp tlv-select ieee-8023-org-specific power-via-mdi
set lldp timer msg-fast-TX 5
set lldp tx-fast-init 6
!
interface eth2
  lldp-agent
!
interface eth3
  lldp-agent
!
interface sit0
  lldp-agent
!
interface svlan0.1
  lldp-agent
!
interface vlan1.1
  lldp-agent
!
interface vlan1.2
  lldp-agent
```

2. Verify the LLDP port statistics

```
#show lldp interface eth1 Non-TPMR-bridge
```

```
Agent Mode : Non-TPMR-bridge
```

```
Enable (tx/rx): Y/Y
MED Enabled :N
Device Type: NOT_DEFINED
LLDP Agent traffic statistics:
Total frames transmitted: 20
Total entries aged: 0
Total frames recieved: 13
Total frames received in error: 0
Total frames discarded: 0
Total discarded TLVs: 0
Total unrecognised TLVs: 0
```

LLDP-MED

LLDP extensions and behavior requirements are described specifically in the areas of network Configuration and policy, device location (including for Emergency Call Service / E911), Power over Ethernet management, and inventory management.

Based on the device type, different TLVs are advertised by the Station.

LLDP-MED Network Connectivity Device

LLDP-MED Network Connectivity Devices, as defined in this Standard, provide access to the IEEE 802 based LAN infrastructure for LLDP-MED Endpoint Devices. An LLDP-MED Network Connectivity Device is a LAN access device based on any of the following technologies:

- LAN Switch/Router
- IEEE 802.1 Bridge
- IEEE 802.3 Repeater (included for historical reasons)
- IEEE 802.11 Wireless Access Point
- Any device that supports the IEEE 802.1AB and MED extensions defined by this Standard and can relay IEEE 802 frames via any method.

Configuration Command

```
set lldp med-devtype net-connect
```

LLDP-MED Generic Endpoint (Class I)

The LLDP-MED Generic Endpoint (Class I) definition is applicable to all endpoint products that require the base LLDP discovery services, however do not support IP media or act as an end-user communication appliance. Such devices may include (but are not limited to) IP Communication Controllers, other communication related servers, or any device requiring basic services.

Configuration Command

```
set lldp med-devtype ep-class1
```

LLDP-MED Generic Endpoint (Class 2)

The LLDP-MED Media Endpoint (Class II) definition is applicable to all endpoint products that have IP media capabilities however may or may not be associated with a particular end user. Capabilities include all of the capabilities defined for the previous Generic Endpoint Class (Class I), and are extended to include aspects related to media streaming. Example product categories expected to adhere to this class include (but are not limited to) Voice / Media Gateways, Conference Bridges, Media Servers, and similar

Configuration Command

```
set lldp med-devtype ep-class2
```

LLDP-MED Generic Endpoint (Class 3)

The LLDP-MED Communication Endpoint (Class III) definition is applicable to all endpoint products that act as end user communication appliances supporting IP media. Capabilities include all of the capabilities defined for the previous Generic Endpoint (Class I) and Media Endpoint (Class II) classes, and are extended to include aspects related to end user devices. Example product categories expected to adhere to this class include (but are not limited to) end user communication appliances, such as IP Phones, PC-based softphones, or other communication appliances that directly support the end user.

Configuration Command

```
set lldp med-devtype ep-class3
```

Machine A

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol ieee vlan- bridge	Configure an IEEE VLAN-aware bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure a VLAN and add it to the bridge.
(config-vlan)#exit	Exit the VLAN configuration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#lldp-agent	Enter into the default agent
(lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(lldp-agent)#exit	Exit the lldp agent mode
(config-if)#lldp-agent customer-bridge	Enter into the customer-bridge agent
(lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(lldp-agent)#exit	Exit the lldp agent mode
(config-if)#lldp-agent non-tpmr-bridge	Enter into the non-tpmr-bridge agent
(lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(lldp-agent)#exit	Exit the lldp agent mode
(config-if)# set lldp med-devtype net-connect	Configure the med device type
(config-if)#switchport	Set switching characteristics on the port.
(config-if)#bridge-group 1	Associate the interface to the bridge.
(config-if)#exit	Exit interface mode.

Machine B

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol ieee vlan-bridge	Configure an IEEE VLAN-aware bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure a VLAN and add it to the bridge.
(config-vlan)#exit	Exit the VLAN configuration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#lldp-agent	Enter into the default agent
(lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(lldp-agent)#exit	Exit the lldp agent mode
(config-if)#lldp-agent customer-bridge	Enter into the customer-bridge agent

(lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(lldp-agent)#exit	Exit the lldp agent mode
(config-if)#lldp-agent non-tpmr-bridge	Enter into the non-tpmr-bridge agent
(lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(lldp-agent)#exit	Exit the lldp agent mode
(config-if)# set lldp med-devtype {ep-class1 ep-class2 ep-class3}	Configure the med device type
(config-if)#switchport	Set switching characteristics on the port.
(config-if)#bridge-group 1	Associate the interface to the bridge.
(config-if)#exit	Exit interface mode.

Validation

1. Verify the LLDP configurations on Machine A

```
#show running-config lldp
!
interface lo
  lldp-agent
!
interface eth0
  lldp-agent
!
interface eth1
  set lldp med-devtype net-connect
  lldp-agent
  set lldp enable txrx
  lldp tlv-select med media-capabilities
  lldp tlv-select med network-policy
  lldp tlv-select med location
  lldp tlv-select med extended-power-via-mdi
lldp-agent non-TPMR-bridge
  set lldp enable txrx
  lldp tlv-select med media-capabilities
  lldp tlv-select med network-policy
  lldp tlv-select med location
  lldp tlv-select med extended-power-via-mdi
lldp-agent customer-bridge
  set lldp enable txrx
  lldp tlv-select med media-capabilities
  lldp tlv-select med network-policy
  lldp tlv-select med location
  lldp tlv-select med extended-power-via-mdi
!
interface eth2
  lldp-agent
!
interface eth3
  lldp-agent
!
interface sit0
  lldp-agent
!
```

```
interface svlan0.1
  lldp-agent
!
interface vlan1.1
  lldp-agent
!
interface vlan1.2
  lldp-agent
!
```

2. Verify the LLDP port statistics on machine A

```
#sh lldp interface eth1
```

```
Agent Mode: Customer-bridge
Enable (tx/rx): Y/Y
MED Enabled :Y
Device Type: NETWORK_CONNECTIVITY
LLDP Agent traffic statistics:
Total frames transmitted: 20
Total entries aged: 0
Total frames recieved: 6
Total frames received in error: 0
Total frames discarded: 0
Total discarded TLVs: 0
Total unrecognised TLVs: 0
```

```
Agent Mode : Non-TPMR-bridge
Enable (tx/rx): Y/Y
MED Enabled :Y
Device Type: NETWORK_CONNECTIVITY
LLDP Agent traffic statistics:
Total frames transmitted: 19
Total entries aged: 0
Total frames recieved: 9
Total frames received in error: 0
Total frames discarded: 0
Total discarded TLVs: 0
Total unrecognised TLVs: 0
```

```
Agent Mode : Nearest bridge
Enable (tx/rx): Y/Y
MED Enabled :Y
Device Type: NETWORK_CONNECTIVITY
LLDP Agent traffic statistics:
Total frames transmitted: 21
Total entries aged: 0
Total frames recieved: 5
Total frames received in error: 0
Total frames discarded: 0
Total discarded TLVs: 0
Total unrecognised TLVs: 0
```

3. Verify the LLDP configurations for end device ep-class3 on machine B

```
#show running-config lldp
!
interface lo
  lldp-agent
```



```

!
interface eth0
  lldp-agent
!
interface eth1
  set lldp med-devtype ep-class3
  lldp-agent
  set lldp enable txrx
  lldp tlv-select med network-policy
lldp-agent non-TPMR-bridge
  set lldp enable txrx
  lldp tlv-select med network-policy
lldp-agent customer-bridge
  set lldp enable txrx
  lldp tlv-select med network-policy
!
interface eth2
  lldp-agent
!
interface eth3
  lldp-agent
!
interface sit0
  lldp-agent
!
interface svlan0.1
  lldp-agent
!
interface vlan1.1
  lldp-agent
!
interface vlan1.2
  lldp-agent
!

```

4. Verify the LLDP port statistics on machine B

```

#sh lldp interface eth1

Agent Mode: Customer-bridge
Enable (tx/rx): Y/Y
MED Enabled :Y
Device Type: END_POINT_CLASS_3
LLDP Agent traffic statistics:
Total frames transmitted: 15
Total entries aged: 0
Total frames recieved: 5
Total frames received in error: 0
Total frames discarded: 0
Total discarded TLVs: 0
Total unrecognised TLVs: 0

Agent Mode : Non-TPMR-bridge
Enable (tx/rx): Y/Y
MED Enabled :Y
Device Type: END_POINT_CLASS_3
LLDP Agent traffic statistics:
Total frames transmitted: 17

```

```
Total entries aged: 0
Total frames recieved: 7
Total frames received in error: 0
Total frames discarded: 0
Total discarded TLVs: 0
Total unrecognised TLVs: 0
```

```
Agent Mode : Nearest bridge
Enable (tx/rx): Y/Y
MED Enabled :Y
Device Type: END_POINT_CLASS_3
LLDP Agent traffic statistics:
Total frames transmitted: 18
Total entries aged: 0
Total frames recieved: 9
Total frames received in error: 0
Total frames discarded: 0
Total discarded TLVs: 0
Total unrecognised TLVs: 0
```

Configuring LLDPv2 through SNMP

Note: As a pre-requisite LSR, FTN, NON-TPMR-BRIDGE and Customer Bridge must be configured using CLI.

LLDPv2 nearest bridge agent MIB objects Configuration

1. Enable transmission only (txonly)

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.1 int 1
SNMPv2-SMI::org.111.2.802.1.1.13.1.1.8.1.3.3.1 = INTEGER: 1
```

2. Enable reception only (rxonly)

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.1 int 2
SNMPv2-SMI::org.111.2.802.1.1.13.1.1.8.1.3.3.1 = INTEGER: 2
```

3. Enable transmission and reception (txrx)

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.1 int 3
SNMPv2-SMI::org.111.2.802.1.1.13.1.1.8.1.3.3.1 = INTEGER: 3
```

4. Disable transmission and reception

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.1 int 4
SNMPv2-SMI::org.111.2.802.1.1.13.1.1.8.1.3.3.1 = INTEGER: 4
```

LLDPv2 non-tpmr bridge agent MIB objects Configuration

1. Enable transmission only (txonly)

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.2 int 1
SNMPv2-SMI:: org.111.2.802.1.1.13.1.1.8.1.3.3.2 = INTEGER: 1
```

2. Enable reception only (rxonly)

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.2 int 2
SNMPv2-SMI:: org.111.2.802.1.1.13.1.1.8.1.3.3.2 = INTEGER: 2
```

3. Enable transmission and reception (txrx)

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.2 int 3
SNMPv2-SMI::org.111.2.802.1.1.13.1.1.8.1.3.3.2 = INTEGER: 3
```

4. Disable transmission and reception

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.2 int 4
SNMPv2-SMI:: org.111.2.802.1.1.13.1.1.8.1.3.3.2 = INTEGER: 4
```

LLDPv2 customer bridge agent MIB objects Configuration**1. Enable transmission only (txonly)**

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.3 int 1
SNMPv2-SMI:: org.111.2.802.1.1.13.1.1.8.1.3.3.3 = INTEGER: 1
```

2. Enable reception only (rxonly)

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.3 int 2
SNMPv2-SMI:: org.111.2.802.1.1.13.1.1.8.1.3.3.3 = INTEGER: 2
```

3. Enable transmission and reception (txrx)

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.3 int 3
SNMPv2-SMI::org.111.2.802.1.1.13.1.1.8.1.3.3.3 = INTEGER: 3
```

4. Disable transmission and reception

```
[root@localhost sbin]# snmpset -v 2c -c test 10.12.48.158
.1.3.111.2.802.1.1.13.1.1.8.1.3.5.3 int 4
SNMPv2-SMI::org.111.2.802.1.1.13.1.1.8.1.3.3.3 = INTEGER: 4
```

SNMPSET and SNMPGET for lldpV2MessageTxInterval

```
snmpset of lldpV2MessageTxInterval will set the time interval between LLDPDU.
[root@localhost ~]# snmpset -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.1.0 u 5
iso.3.111.2.802.1.1.13.1.1.1.0 = Gauge32: 5
[root@localhost ~]# snmpget -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.1.0
iso.3.111.2.802.1.1.13.1.1.1.0 = Gauge32: 5
```

SNMPSET and SNMPGET for lldpV2MessageTxHoldMultiplier

The time-to-live value expressed as a multiple of the lldpV2MessageTxInterval object

```
[root@localhost ~]# snmpset -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.2.0 u 3
iso.3.111.2.802.1.1.13.1.1.2.0 = Gauge32: 3
[root@localhost ~]# snmpget -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.2.0
iso.3.111.2.802.1.1.13.1.1.2.0 = Gauge32: 3
```

SNMPSET and SNMPGET for lldpV2ReinitDelay

The lldpV2ReinitDelay indicates the delay (in units of seconds) from when lldpPortConfigAdminStatus object of a particular port becomes 'disabled' until re-initialization is attempted.

```
[root@localhost ~]# snmpset -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.3.0 u 6
iso.3.111.2.802.1.1.13.1.1.3.0 = Gauge32: 6
```

```
[root@localhost ~]# snmpget -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.3.0
iso.3.111.2.802.1.1.13.1.1.3.0 = Gauge32: 6
```

SNMPSET and SNMPGET for lldpV2TxCreditMax

The maximum number of consecutive LLDPDUs that can be transmitted at any time.

```
[root@localhost ~]# snmpset -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.5.0 u 6
iso.3.111.2.802.1.1.13.1.1.5.0 = Gauge32: 6

[root@localhost ~]# snmpget -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.5.0
iso.3.111.2.802.1.1.13.1.1.5.0 = Gauge32: 6
```

SNMPSET and SNMPGET for lldpV2MessageFastTx

The interval at which LLDP frames are transmitted on behalf of the LLDP agent during fast transmission period

```
[root@localhost ~]# snmpset -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.6.0 u 5
iso.3.111.2.802.1.1.13.1.1.6.0 = Gauge32: 5
[root@localhost ~]# snmpget -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.6.0
iso.3.111.2.802.1.1.13.1.1.6.0 = Gauge32: 5
```

SNMPSET and SNMPGET for lldpV2MessageFastTx

The initial value used to initialize the txFast variable which determines the number of transmissions that are made in fast transmission mode.

```
[root@localhost ~]# snmpset -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.7.0 u 8
iso.3.111.2.802.1.1.13.1.1.7.0 = Gauge32: 8
[root@localhost ~]# snmpget -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.7.0
iso.3.111.2.802.1.1.13.1.1.7.0 = Gauge32: 8
```

SNMP WALK for lldpV2PortConfigTable

```
snmpwalk on lldpV2PortConfigTable will returns entire values in
lldpV2PortConfigTable
snmpwalk -v 2c -c test 10.12.20.194 .1.3.111.2.802.1.1.13.1.1.8
```

Sample output

```
[root@localhost ~]# snmpwalk -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.8
iso.3.111.2.802.1.1.13.1.1.8.1.3.1.1 = INTEGER: 4
iso.3.111.2.802.1.1.13.1.1.8.1.3.2.1 = INTEGER: 4
iso.3.111.2.802.1.1.13.1.1.8.1.3.3.1 = INTEGER: 4
iso.3.111.2.802.1.1.13.1.1.8.1.3.4.1 = INTEGER: 4
iso.3.111.2.802.1.1.13.1.1.8.1.3.5.1 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.1.8.1.3.5.2 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.1.8.1.3.5.3 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.1.8.1.3.6.1 = INTEGER: 4
iso.3.111.2.802.1.1.13.1.1.8.1.3.8.1 = INTEGER: 4
iso.3.111.2.802.1.1.13.1.1.8.1.3.10.1 = INTEGER: 4
iso.3.111.2.802.1.1.13.1.1.8.1.4.1.1 = INTEGER: 0
iso.3.111.2.802.1.1.13.1.1.8.1.4.2.1 = INTEGER: 0
iso.3.111.2.802.1.1.13.1.1.8.1.4.3.1 = INTEGER: 0
iso.3.111.2.802.1.1.13.1.1.8.1.4.4.1 = INTEGER: 0
```

```

iso.3.111.2.802.1.1.13.1.1.8.1.4.5.1 = INTEGER: 0
iso.3.111.2.802.1.1.13.1.1.8.1.4.5.2 = INTEGER: 0
iso.3.111.2.802.1.1.13.1.1.8.1.4.5.3 = INTEGER: 0
iso.3.111.2.802.1.1.13.1.1.8.1.4.6.1 = INTEGER: 0
iso.3.111.2.802.1.1.13.1.1.8.1.4.8.1 = INTEGER: 0
iso.3.111.2.802.1.1.13.1.1.8.1.4.10.1 = INTEGER: 0
iso.3.111.2.802.1.1.13.1.1.8.1.5.1.1 = Hex-STRING: 00
iso.3.111.2.802.1.1.13.1.1.8.1.5.2.1 = Hex-STRING: 00
iso.3.111.2.802.1.1.13.1.1.8.1.5.3.1 = Hex-STRING: 00
iso.3.111.2.802.1.1.13.1.1.8.1.5.4.1 = Hex-STRING: 00
iso.3.111.2.802.1.1.13.1.1.8.1.5.5.1 = Hex-STRING: F0
iso.3.111.2.802.1.1.13.1.1.8.1.5.5.2 = Hex-STRING: F0
iso.3.111.2.802.1.1.13.1.1.8.1.5.5.3 = Hex-STRING: F0
iso.3.111.2.802.1.1.13.1.1.8.1.5.6.1 = Hex-STRING: 00
iso.3.111.2.802.1.1.13.1.1.8.1.5.8.1 = Hex-STRING: 00
iso.3.111.2.802.1.1.13.1.1.8.1.5.10.1 = Hex-STRING: 00

```

SNMP WALK for lldpV2DestAddressTable

```

snmpwalk on lldpV2DestAddressTable will returns entire values in
lldpV2DestAddressTable
snmpwalk -v 2c -c test 10.12.20.194 .1.3.111.2.802.1.1.13.1.1.9

```

Sample output

```

[root@localhost ~]# snmpwalk -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.1.9
iso.3.111.2.802.1.1.13.1.1.9.1.2.1 = Hex-STRING: 01 80 C2 00 00 0E
iso.3.111.2.802.1.1.13.1.1.9.1.2.2 = Hex-STRING: 01 80 C2 00 00 03
iso.3.111.2.802.1.1.13.1.1.9.1.2.3 = Hex-STRING: 01 80 C2 00 00 00

```

SNMP WALK for lldpV2StatsTxPortTable

```

snmpwalk on lldpV2StatsTxPortTable will returns entire values in
lldpV2StatsTxPortTable
snmpwalk -v 2c -c test 10.12.20.194 .1.3.111.2.802.1.1.13.1.2.6

```

Sample output:

```

[root@localhost ~]# snmpwalk -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.2.6
iso.3.111.2.802.1.1.13.1.2.6.1.3.1.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.3.2.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.3.3.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.3.4.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.3.5.1 = Counter32: 86
iso.3.111.2.802.1.1.13.1.2.6.1.3.5.2 = Counter32: 87
iso.3.111.2.802.1.1.13.1.2.6.1.3.5.3 = Counter32: 87
iso.3.111.2.802.1.1.13.1.2.6.1.3.6.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.3.8.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.3.10.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.3.12.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.4.1.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.4.2.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.4.3.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.4.4.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.4.5.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.4.5.2 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.4.5.3 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.4.6.1 = Counter32: 0

```

```
iso.3.111.2.802.1.1.13.1.2.6.1.4.8.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.4.10.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.6.1.4.12.1 = Counter32: 0
```

SNMP WALK for lldpV2StatsRxPortTable

snmpwalk on lldpV2StatsRxPortTable will returns entire values in lldpV2StatsRxPortTable

```
snmpwalk -v 2c -c test 10.12.20.194 .1.3.111.2.802.1.1.13.1.2.7
```

Sample output

```
[root@localhost ~]# snmpwalk -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.2.7
iso.3.111.2.802.1.1.13.1.2.7.1.3.1.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.3.2.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.3.3.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.3.4.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.3.5.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.3.5.2 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.3.5.3 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.3.6.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.3.8.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.3.10.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.3.12.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.1.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.2.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.3.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.4.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.5.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.5.2 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.5.3 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.6.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.8.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.10.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.4.12.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.5.1.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.5.2.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.5.3.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.5.4.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.5.5.1 = Counter32: 90
iso.3.111.2.802.1.1.13.1.2.7.1.5.5.2 = Counter32: 73
iso.3.111.2.802.1.1.13.1.2.7.1.5.5.3 = Counter32: 73
iso.3.111.2.802.1.1.13.1.2.7.1.5.6.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.5.8.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.5.10.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.5.12.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.1.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.2.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.3.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.4.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.5.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.5.2 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.5.3 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.6.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.8.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.10.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.6.12.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.7.1.1 = Counter32: 0
```

```

iso.3.111.2.802.1.1.13.1.2.7.1.7.2.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.7.3.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.7.4.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.7.5.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.7.5.2 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.7.5.3 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.7.6.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.7.8.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.7.10.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.7.12.1 = Counter32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.1.1 = Gauge32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.2.1 = Gauge32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.3.1 = Gauge32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.4.1 = Gauge32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.5.1 = Gauge32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.5.2 = Gauge32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.5.3 = Gauge32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.6.1 = Gauge32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.8.1 = Gauge32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.10.1 = Gauge32: 0
iso.3.111.2.802.1.1.13.1.2.7.1.8.12.1 = Gauge32: 0

```

SNMP WALK for lldpV2LocPortTable

```

snmpwalk on lldpV2LocPortTable will returns entire values in
lldpV2LocPortTable
snmpwalk -v 2c -c test 10.12.20.194 .1.3.111.2.802.1.1.13.1.3.7

```

Sample output

```

[root@localhost ~]# snmpwalk -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.3.7
iso.3.111.2.802.1.1.13.1.3.7.1.2.1 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.3.7.1.2.2 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.3.7.1.2.3 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.3.7.1.2.4 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.3.7.1.2.5 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.3.7.1.2.6 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.3.7.1.2.8 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.3.7.1.2.10 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.3.7.1.2.12 = INTEGER: 3
iso.3.111.2.802.1.1.13.1.3.7.1.3.1 = Hex-STRING: 00 00 00 00 00 00
iso.3.111.2.802.1.1.13.1.3.7.1.3.2 = Hex-STRING: 00 02 A5 4E CE 62
iso.3.111.2.802.1.1.13.1.3.7.1.3.3 = Hex-STRING: 00 02 A5 4E CE 63
iso.3.111.2.802.1.1.13.1.3.7.1.3.4 = Hex-STRING: 00 02 A5 4F 00 18
iso.3.111.2.802.1.1.13.1.3.7.1.3.5 = Hex-STRING: 00 02 A5 4F 00 19
iso.3.111.2.802.1.1.13.1.3.7.1.3.6 = Hex-STRING: 2C 27 D7 3D E4 76
iso.3.111.2.802.1.1.13.1.3.7.1.3.8 = Hex-STRING: 00 00 00 00 00 00
iso.3.111.2.802.1.1.13.1.3.7.1.3.10 = Hex-STRING: 00 02 A5 4F 00 19
iso.3.111.2.802.1.1.13.1.3.7.1.3.12 = Hex-STRING: 00 02 A5 4F 00 19
iso.3.111.2.802.1.1.13.1.3.7.1.4.1 = ""
iso.3.111.2.802.1.1.13.1.3.7.1.4.2 = ""
iso.3.111.2.802.1.1.13.1.3.7.1.4.3 = ""
iso.3.111.2.802.1.1.13.1.3.7.1.4.4 = ""
iso.3.111.2.802.1.1.13.1.3.7.1.4.5 = ""
iso.3.111.2.802.1.1.13.1.3.7.1.4.6 = ""
iso.3.111.2.802.1.1.13.1.3.7.1.4.8 = ""
iso.3.111.2.802.1.1.13.1.3.7.1.4.10 = ""
iso.3.111.2.802.1.1.13.1.3.7.1.4.12 = ""

```



```
iso.3.111.2.802.1.1.13.1.4.2.1.5.0.5.2.2.6.0.2.165.78.212.176 = OID:
ccitt.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0
iso.3.111.2.802.1.1.13.1.4.2.1.5.0.5.3.3.6.0.2.165.78.212.176 = OID:
ccitt.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0
```

SNMP WALK for lldpV2RemOrgDefInfoTable

snmpwalk on lldpV2RemOrgDefInfoTable will returns entire values in lldpV2RemOrgDefInfoTable

```
snmpwalk -v 2c -c test 10.12.20.194 .1.3.111.2.802.1.1.13.1.4.4.1
```

Sample output

```
[root@localhost ~]# snmpwalk -v 2c -c test 10.12.20.194
.1.3.111.2.802.1.1.13.1.4.4.1
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.128.194.1.0 = Hex-STRING: 01 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.128.194.2.0 = Hex-STRING: 00 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.128.194.3.1 = STRING: "default"
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.128.194.4.0 = Hex-STRING: 82 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.128.194.5.0 = Hex-STRING: 00 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.128.194.6.0 = Hex-STRING: 00 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.128.194.7.0 = Hex-STRING: 01 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.18.15.1.0 = Hex-STRING: 01 00 00 00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.18.15.2.0 = Hex-STRING: 00 00 00 00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.18.15.3.0 = Hex-STRING: 00 00 00 00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.1.5.0.18.15.4.0 = Hex-STRING: dc 05 00 00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.128.194.1.0 = Hex-STRING: 01 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.128.194.2.0 = Hex-STRING: 00 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.128.194.3.1 = STRING: "default"
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.128.194.4.0 = Hex-STRING: 82 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.128.194.5.0 = Hex-STRING: 00 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.128.194.6.0 = Hex-STRING: 00 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.128.194.7.0 = Hex-STRING: 01 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.18.15.1.0 = Hex-STRING: 01 00 00 00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.18.15.2.0 = Hex-STRING: 00 00 00 00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.18.15.3.0 = Hex-STRING: 00 00 00 00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.2.4.0.18.15.4.0 = Hex-STRING: dc 05 00 00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.128.194.1.0 = Hex-STRING: 01 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.128.194.2.0 = Hex-STRING: 00 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.128.194.3.1 = STRING: "default"
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.128.194.4.0 = Hex-STRING: 82 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.128.194.5.0 = Hex-STRING: 00 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.128.194.6.0 = Hex-STRING: 00 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.128.194.7.0 = Hex-STRING: 01 00 00
00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.18.15.1.0 = Hex-STRING: 01 00 00 00
```

```
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.18.15.2.0 = Hex-STRING: 00 00 00 00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.18.15.3.0 = Hex-STRING: 00 00 00 00
iso.3.111.2.802.1.1.13.1.4.4.1.4.0.5.3.6.0.18.15.4.0 = Hex-STRING: dc 05 00 00
```

SNMPSET and SNMPGET for LLDPXDOT3LOCPOWERPRIORITY (PoE MIB)

```
/usr/bin/snmpset -c abc -v2c localhost
org.111.2.802.1.1.13.1.5.4623.1.2.2.1.9.28 i 2
SNMPv2-SMI::org.111.2.802.1.1.13.1.5.4623.1.2.2.1.9.28 = INTEGER: 2
```

```
/usr/bin/snmpget -c abc -v2c localhost
org.111.2.802.1.1.13.1.5.4623.1.2.2.1.9.28
SNMPv2-SMI::org.111.2.802.1.1.13.1.5.4623.1.2.2.1.9.28 = INTEGER: 2
```

SNMPSET and SNMPGET for LLDPV2XDOT3PORTCONFIGTLVSTXENABLE (PoE MIB)

```
/usr/bin/snmpset -c abc -v2c localhost SNMPv2-
SMI::org.111.2.802.1.1.13.1.5.4623.1.2.2.1.12.28.1 s "2"
```

```
/usr/bin/snmpget -c abc -v2c localhost SNMPv2-
SMI::org.111.2.802.1.1.13.1.5.4623.1.2.2.1.12.28.1
SNMPv2-SMI::org.111.2.802.1.1.13.1.5.4623.1.2.2.1.12.28.1 = Hex-STRING: 02
```

SNMPSET and SNMPGET for LLDPXMEDPORTCONFIGTLVSTXENABLE (PoE MIB)

```
/usr/bin/snmpset -c abc -v2c localhost iso.0.8802.1.1.2.1.5.4795.1.1.2.1.2.28
s "1"
iso.0.8802.1.1.2.1.5.4795.1.1.2.1.2.28 = STRING: "1"
```

CHAPTER 5 Provider Bridging Configuration

This chapter contains sample Provider Bridging configurations.

A Provider Bridged network is a virtual bridged LAN that comprises of Provider Bridges (SVLAN Bridges and Provider Edge Bridges), attached LANs, and is under the administrative control of a single service provider. Provider Bridges interconnect the separate MACs of the IEEE 802 LANs that compose a Provider Bridged network, relaying frames to provide connectivity between all the LANs to provide customer interfaces for each service instance. Provider Bridging allows a service provider to offer an equivalent of separate LAN segments, bridged or virtual bridged LANs, over the Provider Bridged network. This feature offers inter-operability and consistent management. It also requires minimum cooperation between the customers and service provider and does not require cooperation among the customers.

Provider Bridging with Customer Hosts

This sample shows configuring a Provider Bridged network with customer hosts.

Topology

Figure 5-1 displays a sample Provider Bridged topology.

Note: NOTE: Customer Host machine will always send untagged traffic.

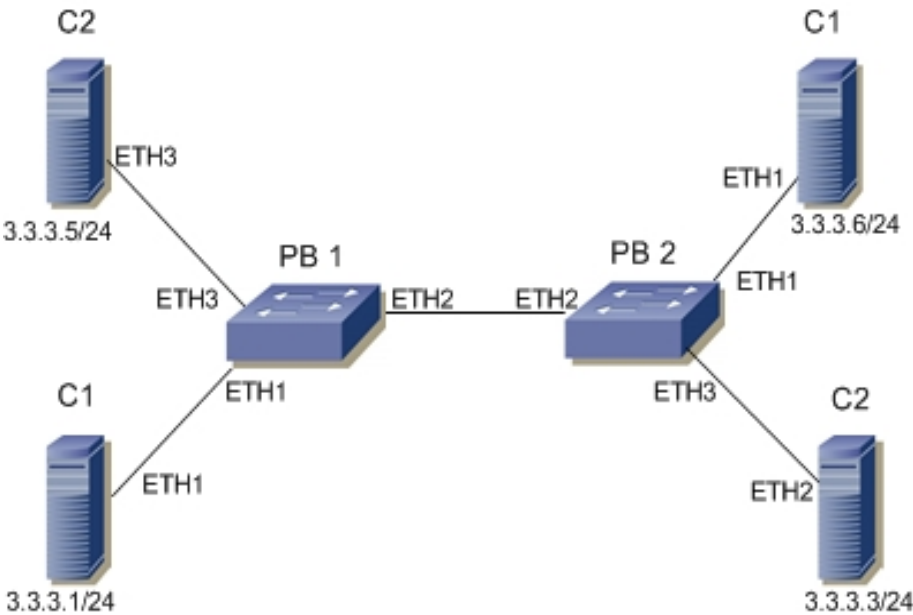


Figure 5-1: Provider Bridge Topology

Legend

The following table is the legend for Figure 5-1:

C1	Customer 1 host machines
C2	Customer 2 host machines
PB1, PB2	Provider bridges

PB1

PB1#configure terminal	Enter configure mode.
PB1(config)#bridge 1 protocol provider-mstp edge	Configure bridge 1 as a provider edge bridge.
PB1(config)#vlan database	Enter the VLAN Configure mode.
PB1(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure VLAN 2 as a customer VLAN and associate it with bridge 1.
PB1(config-vlan)#vlan 4 type customer bridge 1 state enable	Configure VLAN 4 as a customer VLAN and associate it with bridge 1.
PB1(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure VLAN 3 as a service VLAN and associate it with bridge 1.
PB1(config-vlan)#vlan 6 type service point-point bridge 1 state enable	Configure VLAN 6 as a service VLAN and associate it with bridge 1.
PB1(config-vlan)#exit	Exit the VLAN Configure mode.
PB1(config)#interface eth1	Enter interface mode.
PB1(config-if)#switchport	Configure eth1 as a Layer-2 interface.
PB1(config-if)#bridge-group 1	Associate the eth1 interface with bridge 1.
PB1(config-if)#switchport mode customer-edge access	Configure the interface to access mode.
PB1(config-if)#switchport customer-edge access vlan 2	Associate the eth1 interface with VLAN 2.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#interface eth3	Enter interface mode.
PB1(config-if)#switchport	Configure eth3 as a Layer-2 interface.
PB1(config-if)#bridge-group 1	Associate the eth3 interface with bridge 1.
PB1(config-if)#switchport mode customer-edge access	Configure the interface to access mode.
PB1(config-if)#switchport customer-edge access vlan 4	Associate the eth3 interface with VLAN 4.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#interface eth2	Enter interface mode.
PB1(config-if)#switchport	Configure eth2 as a Layer-2 interface.
PB1(config-if)#bridge-group 1	Associate the eth2 interface with bridge 1.
PB1(config-if)#switchport provider-network allowed vlan add 3,6	Associate Service VLAN 3 and Service VLAN 6 with the provider network.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#cvlan registration table customer1 bridge 1	Create a CVLAN table customer1, and associate it with bridge 1.

PB1(config-cvlan-registration)#cvlan 2 svlan 3	Map CVLAN 2 with SVLAN 3.
PB1(config-cvlan-registration)#exit	Exit the CVLAN table configuration.
PB1(config)#cvlan registration table customer2 bridge 1	Create a CVLAN table customer2, and associate it with bridge 1.
PB1(config-cvlan-registration)#cvlan 4 svlan 6	Map CVLAN 4 with SVLAN 6.
PB1(config-cvlan-registration)#exit	Exit the CVLAN table configuration.
PB1(config)#interface eth1	Enter interface mode.
PB1(config-if)#switchport customer-edge vlan registration customer1	Associate the customer1 table with the interface.
PB1(config-cvlan-registration)#exit	Exit the CVLAN table configuration.
PB1(config)#interface eth3	Enter interface mode.
PB1(config-if)#switchport customer-edge vlan registration customer2	Associate the customer2 table with the interface.
PB1(config-cvlan-registration)#exit	Exit the CVLAN table configuration.

PB2

PB2#configure terminal	Enter configure mode.
PB2(config)#bridge 1 protocol provider-mstp edge	Configure bridge 1 as a provider edge bridge.
PB2(config)#vlan database	Enter the VLAN Configure mode.
PB2(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure VLAN 2 as a customer VLAN and associate it with bridge 1.
PB2(config-vlan)#vlan 4 type customer bridge 1 state enable	Configure VLAN 4 as a customer VLAN and associate it with bridge 1.
PB2(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure VLAN 3 as a service VLAN and associate it with bridge 1.
PB2(config-vlan)#vlan 6 type service point-point bridge 1 state enable	Configure VLAN 6 as a service VLAN and associate it with bridge 1.
PB2(config-vlan)#exit	Exit the VLAN Configure mode.
PB2(config)#interface eth1	Enter interface mode.
PB2(config-if)#switchport	Configure eth1 as a Layer-2 interface.
PB2(config-if)#bridge-group 1	Associate the eth1 interface with bridge 1.
PB2(config-if)#switchport mode customer-edge access	Configure the interface to access mode.
PB2(config-if)#switchport customer-edge access vlan 2	Associate the eth1 interface with VLAN 2.
PB2(config-if)#exit	Exit interface mode.
PB2(config)#interface eth3	Enter interface mode.
PB2(config-if)#switchport	Configure eth3 as a Layer-2 interface.
PB2(config-if)#bridge-group 1	Associate the eth3 interface with bridge 1.
PB2(config-if)#switchport mode customer-edge access	Configure the interface to access mode.

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PB2(config-if)#switchport customer-edge access vlan 4	Associate the eth3 interface with VLAN 4.
PB2(config-if)#exit	Exit interface mode.
PB2(config)#interface eth2	Enter interface mode.
PB2(config-if)#switchport	Configure eth2 as a Layer-2 interface.
PB2(config-if)#bridge-group 1	Associate the eth2 interface with bridge 1.
PB2(config-if)#switchport provider-network allowed vlan add 3,6	Associate Service VLAN 3 and Service VLAN 6 with the provider network.
PB2(config-if)#exit	Exit interface mode.
PB2(config)#cvlan registration table customer1 bridge 1	Create a CVLAN table customer1, and associate it with bridge 1.
PB2(config-cvlan-registration)#cvlan 2 svlan 3	Map CVLAN 2 with SVLAN 3.
PB2(config-cvlan-registration)#exit	Exit the CVLAN table configuration.
PB2(config)#cvlan registration table customer2 bridge 1	Create a CVLAN table customer2, and associate it with bridge 1.
PB2(config-cvlan-registration)#cvlan 4 svlan 6	Map CVLAN 4 with SVLAN 6.
PB2(config-cvlan-registration)#exit	Exit the CVLAN table configuration.
PB2(config)#interface eth1	Enter interface mode.
PB2(config-if)#switchport customer-edge vlan registration customer1	Associate the customer1 table with the interface.
PB2(config-cvlan-registration)#exit	Exit the CVLAN table configuration.
PB2(config)#interface eth3	Enter interface mode.
PB2(config-if)#switchport customer-edge vlan registration customer2	Associate the customer2 table with the interface.
PB2(config-cvlan-registration)#exit	Exit the CVLAN table configuration.

Validation

```
PB2#sh cvlan registration table
Bridge          Table Name      Port List
=====
1               customer1      eth1
CVLAN ID        SVLAN ID
=====
2               3
Bridge          Table Name      Port List
=====
1               customer2      eth3
CVLAN ID        SVLAN ID
=====
4               6
```

Customer C1

Customer C1 (3.3.3.1) on VLAN2 should be able to ping customer C1's other site (3.3.3.3) on the same VLAN.

```
[root@C1 root]#ping 3.3.3.3
```

```
PING 3.3.3.3(3.3.3.3) 56(84) bytes of data.  
64 bytes from 3.3.3.3: icmp_seq=1 ttl=64 time=1.06 ms  
64 bytes from 3.3.3.3: icmp_seq=2 ttl=64 time=0.394 ms  
--- 3.3.3.3 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 1004ms  
rtt min/avg/max/mdev = 0.394/0.730/1.067/0.337 ms
```

Customer C1 (3.3.3.1) on VLAN 2 should not be able to ping customer C2's site (3.3.3.6) on VLAN 4.

```
[root@C1 root]#ping 3.3.3.6  
PING 3.3.3.6 (3.3.3.6) 56(84) bytes of data.  
--- 3.3.3.6 ping statistics ---  
3 packets transmitted, 0 received, 100% packet loss, time 2010ms
```

Customer C2

Customer C2 (3.3.3.6) on VLAN 4 should be able to ping customer C2's other site (3.3.3.5) on the same VLAN.

```
[root@C2 root]#ping 3.3.3.5  
PING 3.3.3.5 (3.3.3.5) 56(84) bytes of data.  
64 bytes from 3.3.3.5: icmp_seq=1 ttl=64 time=0.647 ms  
64 bytes from 3.3.3.5: icmp_seq=2 ttl=64 time=0.342 ms  
64 bytes from 3.3.3.5: icmp_seq=3 ttl=64 time=0.358 ms  
--- 3.3.3.5 ping statistics ---  
3 packets transmitted, 3 received, 0% packet loss, time 2011ms  
rtt min/avg/max/mdev = 0.342/0.449/0.648/0.141 ms
```

Customer C2 (3.3.3.6) on VLAN 4 should not be able to ping customer C1's other site (3.3.3.1) on VLAN 2.

```
[root@C2 root]#ping 3.3.3.1  
PING 3.3.3.1 (3.3.3.1) 56(84) bytes of data.  
--- 3.3.3.1 ping statistics ---  
2 packets transmitted, 0 received, 100% packet loss, time 1018ms
```

Provider Bridging with Customer Equipment

This sample shows configuring a Provider Bridged network with customer equipment.

Topology

Figure 5-2 displays a sample Provider Bridged topology with customer equipment.

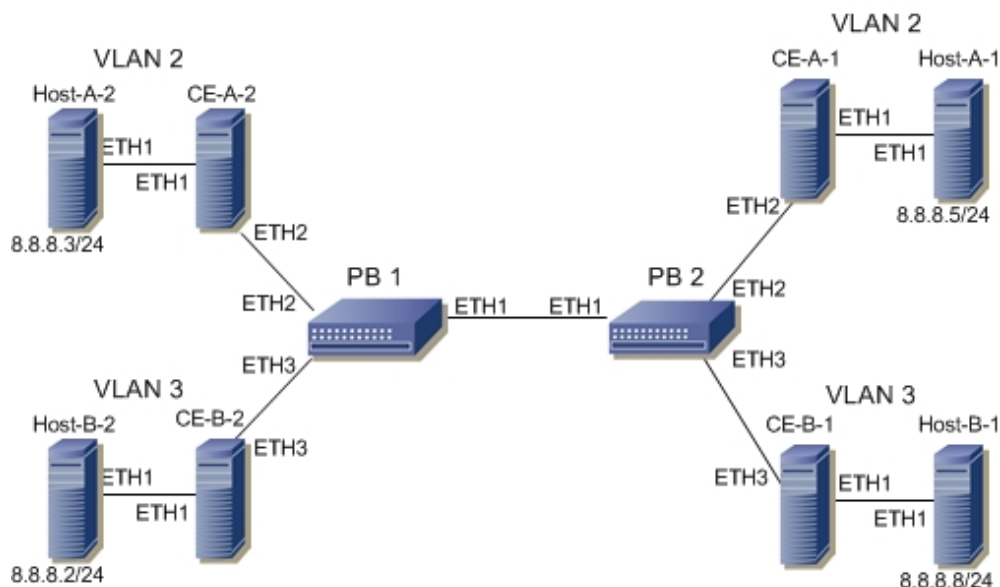


Figure 5-2: Provider Bridging with Customer Equipment Topology

Legend

The following table is the legend for [Figure 5-2](#) on page 64:

CE-A-1, CE-A-2, CE-B-1, CE-B-2	Customer equipment
Host A-1, Host A-2, Host B-1, Host B-2	Customer host machines
PB1, PB2	Provider edge bridges

PB1

PB1#configure terminal	Enter configure mode.
PB1(config)#bridge 1 protocol provider-mstp edge	Configure bridge 1 as a provider MSTP edge bridge.
PB1(config)#vlan database	Enter the VLAN Configure mode.
PB1(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure VLAN 2 as a customer VLAN and associate it with bridge 1.
PB1(config-vlan)#vlan 3 type customer bridge 1 state enable	Configure VLAN 3 as a customer VLAN and associate it with bridge 1.
PB1(config-vlan)#vlan 4 type service point-point bridge 1 state enable	Configure VLAN 4 as a service VLAN and associate it with bridge 1.
PB1(config-vlan)#vlan 5 type service point-point bridge 1 state enable	Configure VLAN 5 as a service VLAN and associate it with bridge 1.
PB1(config-vlan)#exit	Exit the VLAN Configure mode.
PB1(config)#interface eth2	Enter interface mode.
PB1(config-if)#switchport	Configure eth2 as a Layer-2 interface.
PB1(config-if)#bridge-group 1	Associate the eth2 interface with bridge 1.
PB1(config-if)#switchport mode customer-edge hybrid	Configure the eth2 interface to hybrid mode.

PB1(config-if)#switchport customer-edge hybrid allowed vlan all	Configure the eth2 interface to allow all VLANs.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#interface eth3	Enter interface mode.
PB1(config-if)#switchport	Configure eth3 as a Layer-2 interface.
PB1(config-if)#bridge-group 1	Associate the eth3 interface with bridge 1.
PB1(config-if)#switchport mode customer-edge hybrid	Configure the eth3 interface to hybrid mode.
PB1(config-if)#switchport customer-edge hybrid allowed vlan all	Configure the eth3 interface to allow all VLANs.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#interface eth1	Enter interface mode.
PB1(config-if)#switchport	Configure eth1 as a Layer-2 interface.
PB1(config-if)#bridge-group 1	Associate the eth1 interface with bridge 1.
PB1(config-if)#switchport provider-network allowed vlan add 4,5	Associate Service VLAN 4 and Service VLAN 5 with the provider network.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#cvlan registration table customer1 bridge 1	Create a CVLAN table customer1, and associate it with bridge 1.
PB1(config-cvlan-registration)#cvlan 1 svlan 4	Map CVLAN 1 with SVLAN 4.
PB1(config-cvlan-registration)#cvlan 2 svlan 4	Map CVLAN 2 with SVLAN 4.
PB1(config-cvlan-registration)#exit	Exit the CVLAN table configuration.
PB1(config)#cvlan registration table customer2 bridge 1	Create a CVLAN table customer2, and associate it with bridge 1.
PB1(config-cvlan-registration)#cvlan 1 svlan 5	Map CVLAN 1 with SVLAN 5.
PB1(config-cvlan-registration)#cvlan 3 svlan 5	Map CVLAN 3 with SVLAN 5.
PB1(config-cvlan-registration)#exit	Exit the CVLAN table configuration.
PB1(config)#interface eth2	Enter interface mode.
PB1(config-if)#switchport customer-edge vlan registration customer1	Associate the customer1 table with the interface.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#interface eth3	Enter interface mode.
PB1(config-if)#switchport customer-edge vlan registration customer2	Associate the customer2 table with the interface.
PB1(config-if)#exit	Exit interface mode.

PB2

PB2#configure terminal	Enter configure mode.
PB2(config)#bridge 1 protocol provider-mstp edge	Configure bridge 1 as a provider MSTP edge bridge.

Provider Bridging Configuration

PB2(config)#vlan database	Enter the VLAN Configure mode.
PB2(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure VLAN 2 as a customer VLAN and associate it with bridge 1.
PB2(config-vlan)#vlan 3 type customer bridge 1 state enable	Configure VLAN 3 as a customer VLAN and associate it with bridge 1.
PB2(config-vlan)#vlan 4 type service point-point bridge 1 state enable	Configure VLAN 4 as a service VLAN and associate it with bridge 1.
PB2(config-vlan)#vlan 5 type service point-point bridge 1 state enable	Configure VLAN 5 as a service VLAN and associate it with bridge 1.
PB2(config-vlan)#exit	Exit the VLAN Configure mode.
PB2(config)#interface eth2	Enter interface mode.
PB2(config-if)#switchport	Configure eth2 as a Layer-2 interface.
PB2(config-if)#bridge-group 1	Associate the eth2 interface with bridge 1.
PB2(config-if)#switchport mode customer-edge hybrid	Configure the eth2 interface to hybrid mode.
PB2(config-if)#switchport customer-edge hybrid allowed vlan all	Configure the eth2 interface to allow all VLANs.
PB2(config-if)#exit	Exit interface mode.
PB2(config)#interface eth3	Enter interface mode.
PB2(config-if)#switchport	Configure eth3 as a Layer-2 interface.
PB2(config-if)#bridge-group 1	Associate the eth3 interface with bridge 1.
PB2(config-if)#switchport mode customer-edge hybrid	Configure the eth3 interface to hybrid mode.
PB2(config-if)#switchport customer-edge hybrid allowed vlan all	Configure the eth3 interface to allow all VLANs.
PB2(config-if)#exit	Exit interface mode.
PB2(config)#interface eth1	Enter interface mode.
PB2(config-if)#switchport	Configure eth1 as a Layer-2 interface.
PB2(config-if)#bridge-group 1	Associate the eth1 interface with bridge 1.
PB2(config-if)#switchport provider-network allowed vlan add 4,5	Associate Service VLAN 4 and Service VLAN 5 with the provider network.
PB2(config-if)#exit	Exit interface mode.
PB2(config)#cvlan registration table customer1 bridge 1	Create a CVLAN table customer1, and associate it with bridge 1.
PB2(config-cvlan-registration)#cvlan 1 svlan 4	Map CVLAN 1 with SVLAN 4.
PB2(config-cvlan-registration)#cvlan 2 svlan 4	Map CVLAN 2 with SVLAN 4.
PB2(config-cvlan-registration)#exit	Exit the CVLAN table configuration.
PB2(config)#cvlan registration table customer2 bridge 1	Create a CVLAN table customer2, and associate it with bridge 1.
PB2(config-cvlan-registration)#cvlan 1 svlan 5	Map CVLAN 1 with SVLAN 5.
PB2(config-cvlan-registration)#cvlan 3 svlan 5	Map CVLAN 3 with SVLAN 5.
PB2(config-cvlan-registration)#exit	Exit the CVLAN table configuration.

PB2(config)#interface eth2	Enter interface mode.
PB2(config-if)#switchport customer-edge vlan registration customer1	Associate the customer1 table with the interface.
PB2(config-if)#exit	Exit interface mode.
PB2(config)#interface eth3	Enter interface mode.
PB2(config-if)#switchport customer-edge vlan registration customer2	Associate the customer2 table with the interface.
PB2(config-if)#exit	Exit interface mode.

CE-A-1

CE-A-1#configure terminal	Enter configure mode.
CE-A-1(config)#bridge 1 protocol mstp	Create an MSTP bridge.
CE-A-1(config)#vlan database	Enter the VLAN Configure mode.
CE-A-1(config-vlan)#vlan 2 bridge 1 state enable	Create VLAN 2, and associate it with bridge 1.
CE-A-1(config-vlan)#exit	Exit the VLAN Configure mode.
CE-A-1(config)#interface eth1	Enter interface mode.
CE-A-1(config-if)#switchport	Configure eth1 as a Layer-2 interface.
CE-A-1(config-if)#bridge-group 1	Associate the eth1 interface with bridge 1.
CE-A-1(config-if)#switchport mode hybrid	Configure the eth1 interface to hybrid mode.
CE-A-1(config-if)#switchport hybrid allowed vlan all	Configure the eth1 interface to allow all VLANs.
CE-A-1(config-if)#exit	Exit interface mode.
CE-A-1(config)#interface eth2	Enter interface mode.
CE-A-1(config-if)#switchport	Configure eth2 as a Layer-2 interface.
CE-A-1(config-if)#bridge-group 1	Associate the eth2 interface with bridge 1.
CE-A-1(config-if)#switchport mode hybrid	Configure the eth2 interface to hybrid mode.
CE-A-1(config-if)#switchport hybrid allowed vlan all	Configure the eth2 interface to allow all VLANs.
CE-A-1(config-if)#exit	Exit interface mode.

CE-A-2

CE-A-2#configure terminal	Enter configure mode.
CE-A-2(config)#bridge 1 protocol mstp	Create an MSTP bridge.
CE-A-2(config)#vlan database	Enter the VLAN Configure mode.
CE-A-2(config-vlan)#vlan 2 bridge 1 state enable	Create VLAN 2, and associate it with bridge 1.
CE-A-2(config-vlan)#exit	Exit the VLAN Configure mode.
CE-A-2(config)#interface eth1	Enter interface mode.
CE-A-2(config-if)#switchport	Configure eth1 as a Layer-2 interface.

Provider Bridging Configuration

CE-A-2(config-if)#bridge-group 1	Associate the eth1 interface with bridge 1.
CE-A-2(config-if)#switchport mode hybrid	Configure the eth1 interface to hybrid mode.
CE-A-2(config-if)#switchport hybrid allowed vlan all	Configure the eth1 interface to allow all VLANs.
CE-A-2(config-if)#exit	Exit interface mode.
CE-A-2(config)#interface eth2	Enter interface mode.
CE-A-2(config-if)#switchport	Configure eth2 as a Layer-2 interface.
CE-A-2(config-if)#bridge-group 1	Associate the eth2 interface with bridge 1.
CE-A-2(config-if)#switchport mode hybrid	Configure the eth2 interface to hybrid mode.
CE-A-2(config-if)#switchport hybrid allowed vlan all	Configure the eth2 interface to allow all VLANs.
CE-A-2(config-if)#exit	Exit interface mode.

CE-B-1

CE-B-1#configure terminal	Enter configure mode.
CE-B-1(config)#bridge 1 protocol mstp	Create an MSTP bridge.
CE-B-1(config)#vlan database	Enter the VLAN Configure mode.
CE-B-1(config-vlan)#vlan 3 bridge 1 state enable	Create VLAN 3, and associate it with bridge 1.
CE-B-1(config-vlan)#exit	Exit the VLAN Configure mode.
CE-B-1(config)#interface eth1	Enter interface mode.
CE-B-1(config-if)#switchport	Configure eth1 as a Layer-2 interface.
CE-B-1(config-if)#bridge-group 1	Associate the eth1 interface with bridge 1.
CE-B-1(config-if)#switchport mode hybrid	Configure the eth1 interface to hybrid mode.
CE-B-1(config-if)#switchport hybrid allowed vlan all	Configure the eth1 interface to allow all VLANs.
CE-B-1(config-if)#exit	Exit interface mode.
CE-B-1(config)#interface eth3	Enter interface mode.
CE-B-1(config-if)#switchport	Configure eth3 as a Layer-2 interface.
CE-B-1(config-if)#bridge-group 1	Associate the eth3 interface with bridge 1.
CE-B-1(config-if)#switchport mode hybrid	Configure the eth3 interface to hybrid mode.
CE-B-1(config-if)#switchport hybrid allowed vlan all	Configure the eth3 interface to allow all VLANs.
CE-B-1(config-if)#exit	Exit interface mode.

CE-B-2

CE-B-2#configure terminal	Enter configure mode.
CE-B-2(config)#bridge 1 protocol mstp	Create an MSTP bridge.
CE-B-2(config)#vlan database	Enter the VLAN Configure mode.

CE-B-2(config-vlan)#vlan 3 bridge 1 state enable	Create VLAN 3, and associate it with bridge 1.
CE-B-2(config-vlan)#exit	Exit the VLAN Configure mode.
CE-B-2(config)#interface eth1	Enter interface mode.
CE-B-2(config-if)#switchport	Configure eth1 as a Layer-2 interface.
CE-B-2(config-if)#bridge-group 1	Associate the eth1 interface with bridge 1.
CE-B-2(config-if)#switchport mode hybrid	Configure the eth1 interface to hybrid mode.
CE-B-2(config-if)#switchport hybrid allowed vlan all	Configure the eth1 interface to allow all VLANs.
CE-B-2(config-if)#exit	Exit interface mode.
CE-B-2(config)#interface eth3	Enter interface mode.
CE-B-2(config-if)#switchport	Configure eth3 as a Layer-2 interface.
CE-B-2(config-if)#bridge-group 1	Associate the eth3 interface with bridge 1.
CE-B-2(config-if)#switchport mode hybrid	Configure the eth3 interface to hybrid mode.
CE-B-2(config-if)#switchport hybrid allowed vlan all	Configure the eth3 interface to allow all VLANs.
CE-B-2(config-if)#exit	Exit interface mode.

Validation

```
PB1#show cvlan registration table bridge 1
Bridge          Table Name      Port List
=====
1               customer1      eth2
CVLAN ID        SVLAN ID
=====
1               4
2               4
```

```
Bridge          Table Name      Port List
=====
1               customer2      eth0
CVLAN ID        SVLAN ID
=====
1               5
3               5
```

```
PB2#show cvlan registration table bridge 1
Bridge          Table Name      Port List
=====
1               customer1      eth2
CVLAN ID        SVLAN ID
=====
1               4
2               4
```

Bridge	Table Name	Port List
=====	=====	=====
1	customer2	eth0

CVLAN ID	SVLAN ID
=====	=====
1	5
3	5

Host A-1 and Host A-2

Host machine (Host-A-1 [8.8.8.5]) of customer A on VLAN2 should be able to ping host machine (Host-A-2 [8.8.8.3]) in customer A's other site on the same VLAN.

```
[root@Host-A-1 root]#ping 8.8.8.3
PING 8.8.8.3(8.8.8.3) 56(84) bytes of data.
64 bytes from 8.8.8.3: icmp_seq=1 ttl=64 time=0.032 ms
64 bytes from 8.8.8.3: icmp_seq=2 ttl=64 time=0.015 ms
--- 8.8.8.3 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 0.015/0.023/0.032/0.009 ms
```

Host B-2 and Host B-1

Host machine (Host-B-2 [8.8.8.2]) of customer B on VLAN3 should be able to ping host machine (Host-B-1 [8.8.8.8]) in customer B's other site on the same VLAN.

```
[root@Host-B-2 root]#ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.2: icmp_seq=1 ttl=64 time=0.032 ms
64 bytes from 8.8.8.2: icmp_seq=2 ttl=64 time=0.015 ms
--- 8.8.8.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 0.015/0.023/0.032/0.009 ms
```

Host A-2 and Host B-1

Host machine (Host-A-2 [8.8.8.3]) of customer A on VLAN2 should not be able to ping host machine (Host-B-1 [8.8.8.8]) in customer B's site because it is in a different VLAN.

```
[root@Host-A-2 root]#ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
--- 8.8.8.8 ping statistics ---
6 packets transmitted, 0 received, 100% packet loss, time 5010ms
```

Host B-2 and Host A-1

Host machine (Host-B-2 [8.8.8.2]) of customer B on VLAN3 should not be able to ping host machine (Host-A-1 [8.8.8.5]) in customer A's site because it is in a different VLAN.

```
[root@QA-33 root]#ping 8.8.8.5
PING 8.8.8.5 (8.8.8.5) 56(84) bytes of data.
--- 8.8.8.5 ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 1015ms
```

CHAPTER 6 MEF UNI Configuration

This chapter contains samples of Link Aggregation Control Protocol (LACP) configuration for a User Network Interface (UNI) within a Metro Ethernet Network (MEN) framework. ZebOS-XP conforms to the Metro Ethernet Forum (MEF) specification `mef11.doc`.

A User Network Interface (UNI) can be configured to Peer, Tunnel, or Discard the Layer 2 protocols LACP and DOT1X. The default behavior is Peering. In the case of LACP Peering, all customer-edge ports configured for aggregation should be aggregated and synchronized with the host.

Note: MEF UNI is not supported for ZebIC releases.

LACP Peering

In this example, PB 1 and PB 2 are provider-MSTP edge bridges that communicate directly with each other via eth0. The interfaces on Host 1 and Host 2 (eth1 and eth2) are Layer 2 interfaces. Depending on what restrictions may be set, traffic can be sent from Host 1, passing through PB 1 and PB 2, and received on Host 2. Messages may also be sent in the other direction, depending on the provider and customer restrictions for sending and receiving interfaces.

Figure 6-1 displays a sample UNI topology.

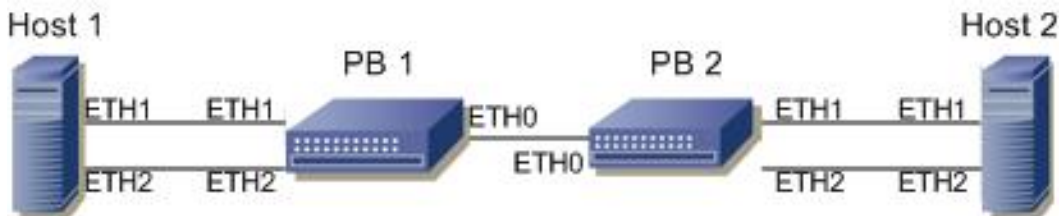


Figure 6-1: UNI Topology

Legend

The following table is the legend for Figure 6-1:

PB1 and PB2	Provider Edge Bridges
Host-1 and Host-2	Host machines

PB1

PB1#configure terminal	Enter configure mode.
PB1(config)#bridge 1 protocol provider-mstp edge	Configure the bridge as a provider-MSTP edge bridge.
PB1(config)#vlan database	Enter VLAN configure mode .
PB1(config-vlan)#vlan 10 type service point-point bridge 1 state enable	Configure VLAN 10 as service VLAN (point-to-point EVC) and associate it with bridge.
PB1(config-vlan)#exit	Exit VLAN database configuration mode.

PB1(config)#cvlan registration table map1 bridge 1	Create CVLAN registration table, map1, and associate it with bridge 1.
PB1(config-cvlan-registration)#cvlan 1 svlan 10	Map CVLAN 1 (default VLAN) to SVLAN 10.
PB1(config-cvlan-registration)#exit	Exit CVLAN-registration mode.
PB1(config)#interface eth1	Enter interface mode.
PB1(config-if)#switchport	Configure the interface as a Layer 2 interface
PB1(config-if)#bridge-group 1	Associate it with bridge 1.
PB1(config-if)#switchport mode customer-edge hybrid	Configure the interface as customer-edge port in hybrid mode.
PB1(config-if)#switchport customer-edge vlan registration map1	Associate map1 (the CVLAN registration table) with the interface.
PB1(config-if)#channel-group 2 mode passive	Associate the interface to a channel group specified in passive mode, so that link aggregation is enabled on the interface.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#interface eth2	Enter interface mode.
PB1(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB1(config-if)#bridge-group 1	Associate it with bridge 1.
PB1(config-if)#switchport mode customer-edge hybrid	Configure the interface as customer-edge port in hybrid mode.
PB1(config-if)#switchport customer-edge vlan registration map1	Associate map1 (the CVLAN registration table) with the interface.
PB1(config-if)#channel-group 2 mode passive	Associate the interface to a channel group specified in passive mode, so that link aggregation is enabled on the interface.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#interface eth0	Enter interface mode.
PB1(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB1(config-if)#bridge-group 1	Associate the interface with bridge 1.
PB1(config-if)#switchport mode provider- network	Configure the interface as a provider-network port.
PB1(config-if)#switchport provider-network allowed vlan add 10	Configure the provider-network port to allow SVLAN 10.
PB1(config-if)#exit	Exit interface mode.

PB2

PB2#configure terminal	Enter configure mode.
PB2(config)#bridge 1 protocol provider-mstp edge	Configure the bridge as a provider-MSTP edge bridge.
PB2(config)#vlan database	Enter VLAN configure mode.
PB2(config-vlan)#vlan 10 type service point- point bridge 1 state enable	Configure VLAN 10 as service VLAN, associate it with bridge 1, and enable point-to-point.
PB2(config-vlan)#exit	Exit VLAN database configuration mode.

PB2(config)#cvlan registration table map1 bridge 1	Create a CVLAN registration table, map1, and associate it with bridge 1.
PB2(config-cvlan-registration)#cvlan 1 svlan 10	Map CVLAN 1 (default VLAN) with SVLAN 10.
PB2(config-cvlan-registration)#exit	Exit Configure CVLAN Registration mode.
PB2(config)#interface eth1	Enter interface mode.
PB2(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB2(config-if)#bridge-group 1	Associate it with bridge 1.
PB2(config-if)#switchport mode customer-edge hybrid	Configure the interface as a customer-edge port in hybrid mode.
PB2(config-if)#switchport customer-edge vlan registration map	Associate map1 (the CVLAN registration table) with the interface.
PB2(config-if)#channel-group 4 mode passive	Associate the interface to a channel group specified in passive mode, so that link aggregation is enabled on the interface.
PB2(config-if)#exit	Exit interface mode.

Host Machines

HOST-1

HOST-1#configure terminal	Enter configure mode.
HOST-1(config)#interface eth1	Enter interface mode.
HOST-1(config-if)#switchport	Configure the interface as a Layer 2 interface.
HOST-1(config-if)#channel-group 1 mode active	Associate the interface to a channel group specified in active mode, so that link aggregation is enabled on the interface.
HOST-1(config-if)#exit	Exit interface mode.
HOST-1(config)#interface eth2	Enter interface mode.
HOST-1(config-if)#switchport	Configure the interface as a Layer 2 interface.
HOST-1(config-if)#channel-group 1 mode active	Associate the interface to a channel group specified in active mode, so that link aggregation is enabled on the interface.

HOST-2

HOST-2#configure terminal	Enter configure mode.
HOST-2(config)#interface eth1	Enter interface mode.
HOST-2(config-if)#switchport	Configure the interface as a Layer 2 interface.
HOST-2(config-if)#channel-group 3 mode active	Associate the interface to a channel group specified in active mode, so that link aggregation is enabled on the interface.
HOST-2(config-if)#exit	Exit interface mode.
HOST-2(config)#interface eth2	Enter interface mode.
HOST-2(config-if)#switchport	Configure the interface as a Layer 2 interface.
HOST-2(config-if)#channel-group 3 mode active	Associate the interface to a channel group specified in active mode, so that link aggregation is enabled on the interface.

Validation

PB1

```
PB1#show cvlan registration table bridge
Bridge          Table Name      Port List
=====
1               map1          eth1, eth2
CVLAN ID        SVLAN ID
=====
1               10
```

```
PB2#show cvlan registration table bridge 1
Bridge          Table Name      Port List
=====
1               map1          eth1, eth2
CVLAN ID        SVLAN ID
=====
1               10
```

```
PB1#show cvlan registration table bridge
Bridge          Table Name      Port List
=====
1               map1          eth1, eth2
CVLAN ID        SVLAN ID
=====
1               10
```

```
PB2#show cvlan registration table bridge 1
Bridge          Table Name      Port List
=====
1               map1          eth1, eth2
CVLAN ID        SVLAN ID
=====
1               10
```

```
PB1#show running-config
!
bridge 1 protocol provider-mstp edge
!
vlan database
  vlan 10 type service point-point bridge 1 name VLAN0010
  vlan 10 type service point-point bridge 1 state enable
!
cvlan registration table map1 bridge 1
  cvlan 1 svlan 10
!
interface eth0
  switchport
  bridge-group 1
  switchport mode provider-network
```

```
switchport provider-network allowed vlan add 10
!
interface eth1
switchport
bridge-group 1
switchport mode customer-edge hybrid
switchport mode customer-edge hybrid acceptable-frame-type all
switchport customer-edge vlan registration map1
channel-group 2 mode passive
lacp timeout long
!
interface eth2
switchport
bridge-group 1
switchport mode customer-edge hybrid
switchport mode customer-edge hybrid acceptable-frame-type all
switchport customer-edge vlan registration map1
channel-group 2 mode passive
lacp timeout long
!
interface po2
mac-address 0000.0000.0000
switchport
bridge-group 1
switchport mode customer-edge hybrid
switchport mode customer-edge hybrid acceptable-frame-type all
switchport customer-edge vlan registration map1
no multicast
!
end
```

PB2

```
PB2#show running-config
!
bridge 1 protocol provider-mstp edge
!
vlan database
vlan 10 type service point-point bridge 1 name VLAN0010
vlan 10 type service point-point bridge 1 state enable
!
cvlan registration table map1 bridge 1
cvlan 1 svlan 10
!
interface eth0
switchport
bridge-group 1
switchport mode provider-network
switchport provider-network allowed vlan add 10
!
```

```
interface eth1
  switchport
  bridge-group 1
  switchport mode customer-edge hybrid
  switchport mode customer-edge hybrid acceptable-frame-type all
  switchport customer-edge vlan registration map1
  channel-group 4 mode passive
  lacp timeout long
!
interface eth2
  switchport
  bridge-group 1
  switchport mode customer-edge hybrid
  switchport mode customer-edge hybrid acceptable-frame-type all
  switchport customer-edge vlan registration map1
  channel-group 4 mode passive
  lacp timeout long
!
interface po4
  mac-address 0000.0000.0000
  switchport
  bridge-group 1
  switchport mode customer-edge hybrid
  switchport mode customer-edge hybrid acceptable-frame-type all
  switchport customer-edge vlan registration map1
  no multicast
!
end
```

HOST-2

```
HOST-2#show running-config
!
interface eth1
  channel-group 3 mode active
  lacp timeout long
!
interface eth2
  channel-group 3 mode active
  lacp timeout long
!
interface po3
  mac-address 0000.0000.0000
  no multicast
!
end
```

Verification

HOST-1 Configuration

HOST-1#configure terminal	Enter configure mode.
HOST-1(config)#interface po1	Enter interface mode.
HOST-1(config-if)#ip address 3.3.3.1/24	Configure IP address to po1 (aggregated interface).

HOST-2 Configuration

HOST-2#configure terminal	Enter configure mode.
HOST-2(config)#interface po3	Enter interface mode.
HOST-2(config-if)#ip address 3.3.3.2/24	Configure IP address to po3 (aggregated interface).

Aggregated interface allows packets to pass through.

```
[root@Host-2 root]#ping 3.3.3.1
PING 3.3.3.1 (3.3.3.1) 56(84) bytes of data.
64 bytes from 3.3.3.1: icmp_seq=1 ttl=64 time=0.606 ms
64 bytes from 3.3.3.1: icmp_seq=2 ttl=64 time=0.551 ms
```

DOT1.X Tunneling in UNI

UNI can be configured to tunnel the Layer 2 protocol DOT1.X. When DOT1.X is present, a Tunneling xsupplicant on one side of a Provider Network gets authenticated by RADIUS server, which is in other side of the Provider Network. The customer-edge port (UNI) of the Provider Network is configured to tunnel DOT1.X packets.

Figure 6-2 displays a sample DOT1.X Tunneling in UNI topology.

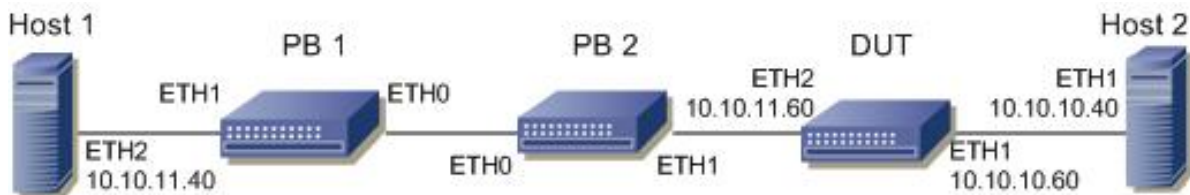


Figure 6-2: DOT1.X Tunneling in UNI Topology

Legend

The following table is the legend for Figure 6-2:

PB1 and PB2	Provider Edge Bridges
Host-1	Xsupplicant; eth2=10.10.11.40
Host-2	RADIUS Server; eth1=10.10.10.40

PB1

PB1#configure terminal	Enter configure mode.
PB1(config)#bridge 1 protocol provider-mstp edge	Configure the bridge as a provider-MSTP edge bridge.
PB1(config)#vlan database	Enter VLAN configure mode.
PB1(config-vlan)#vlan 10 type service point-point bridge 1 state enable	Configure VLAN 10 as service VLAN (point-to-point EVC) and associate it with bridge 1.
PB1(config-vlan)#exit	Exit VLAN configure mode.
PB1(config)#cvlan registration table map1 bridge 1	Create a CVLAN registration table, map1, and associate it with bridge 1.
PB1(config-cvlan-registration)#cvlan 1 svlan 10	Map CVLAN 1 (default VLAN) with SVLAN 10.
PB1(config-cvlan-registration)#exit	Exit CVLAN registration mode.
PB1(config)#interface eth1	Enter interface mode.
PB1(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB1(config-if)#bridge-group 1	Associate it with bridge 1.
PB1(config-if)#switchport mode customer-edge hybrid	Configure the interface as customer-edge port in hybrid mode.
PB1(config-if)#switchport customer-edge vlan registration map1	Associate map1 (the CVLAN registration table) with the interface.
PB1(config-if)#l2protocol dot1x tunnel 10	Configure the interface to tunnel dot1x packets.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#interface eth0	Enter interface mode
PB1(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB1(config-if)#bridge-group 1	Associate it with bridge 1.
PB1(config-if)#switchport mode provider-network	Configure the interface as provider-network port.
PB1(config-if)#switchport provider-network allowed vlan add 10	Configure the provider-network port to allow SVLAN 10.
PB1(config-if)#exit	Exit interface mode

PB2

PB2#configure terminal	Enter configure mode.
PB2(config)#bridge 1 protocol provider-mstp edge	Configure the bridge as a provider-MSTP edge bridge.
PB2(config)#vlan database	Enter VLAN database.
PB2(config-vlan)#vlan 10 type service point-point bridge 1 state enable	Configure VLAN 10 as a service VLAN (point-to-point EVC) and associate it with bridge 1.
PB2(config-vlan)#exit	Exit VLAN database configuration mode.
PB2(config)#cvlan registration table map1 bridge 1	Create a CVLAN registration table, map1, and associate it with bridge 1.

PB2(config-cvlan-registration)#cvlan 1 svlan 10	Map CVLAN 1 (default VLAN) to SVLAN 10.
PB2(config-cvlan-registration)#exit	Exit CVLAN-registration mode.
PB2(config)#interface eth1	Enter interface mode.
PB2(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB2(config-if)#bridge-group 1	Associate it with bridge 1.
PB2(config-if)#switchport mode customer-edge hybrid	Configure the interface as customer-edge port in hybrid mode.
PB2(config-if)#switchport customer-edge vlan registration map1	Associate map1 (the CVLAN registration table) with the interface.
PB2(config-if)#l2protocol dot1x tunnel 10	Configure the interface to tunnel DOT1.X packets.
PB2(config-if)#exit	Exit interface mode.
PB2(config)#interface eth0	Enter interface mode.
PB2(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB2(config-if)#bridge-group 1	Associate it with bridge 1.
PB2(config-if)#switchport mode provider-network	Configure the interface as provider-network port.
PB2(config-if)#switchport provider-network allowed vlan add 10	Configure the provider-network port to allow SVLAN 10.
PB2(config-if)#exit	Exit interface mode.

DUT

DUT#configure terminal	Enter configure mode
DUT(config)#radius-server host 10.10.10.40 auth-port 1812 key authd	Configure the RADIUS server parameters: <ul style="list-style-type: none"> 10.10.10.40—IP address of the remote RADIUS server. 1812—UDP destination port for authentication requests. The default is 1812, and the range is <0 to 65536>. authd—Authentication key used between the DUT and the RADIUS daemon running on the RADIUS server.
DUT(config)#dot1x system-auth-ctrl	Enable IEEE 802.1x authentication globally on the DUT.
DUT(config)#interface eth1	Enter interface mode.
DUT(config-if)#ip address 10.10.10.70/24	Configure IP address to the interface.
DUT(config-if)#exit	Exit interface mode.
DUT(config)#interface eth2	Enter interface mode.
DUT(config)#ip address 10.10.11.70/24	Configure IP address to the interface.
DUT(config-if)#dot1x port-control auto	Enable IEEE 802.1x authentication on the port.
DUT(config-if)#dot1x port-control dir in	Configure the interface to allow control packets from xsupplicant.
DUT(config-if)#dot1x protocol-version 1	Configure the DOT1.X protocol version as 1.
DUT(config-if)#exit	Exit interface mode

HOST-2 Radius Server

<pre>[root@RADIUS-SERVER root]#ifconfig eth1 10.10.10.40 broadcast 10.10.10.255 netmask 255.255.255.0</pre>	Configure IP address of interface eth1 on RADIUS Server.
<pre>[root@RADIUS-SERVER root]#route add -net 10.10.11.0 netmask 255.255.255.0 gw 10.10.10.60</pre>	Configure route to xsupplicant (10.10.11.40) through the eth1 of DUT (10.10.10.60) as the gateway.

HOST-1 Xsupplicant

<pre>[root@XSUPPLICANT1 root]#ifconfig eth2 10.10.11.40 broadcast 10.10.11.255 netmask 255.255.255.0</pre>	Configure IP address of interface eth2 on RADIUS Server.
<pre>[root@XSUPPLICANT1 root]#route add -net 10.10.10.0 netmask 255.255.255.0 gw 10.10.11.60</pre>	Configure route to RADIUS server (10.10.10.40) through eth2 of DUT (10.10.11.60) as the gateway.

1. Start Radius daemon on Radius server:

```
[root@RADIUS-SERVER root]#radiusd -X
```

2. Start xsupplicant daemon in xsupplicant:

```
[root@XSUPPLICANT1 root]#xsupplicant -c /usr/local/etc/1x/md5-example.conf -f -d s
```

Validation

```
DUT#show dot1x all
802.1X Port-Based Authentication Enabled
  RADIUS server address: 10.10.10.40:1812
  Next radius message id: 2
  RADIUS client address: not configured
802.1X info for interface eth0
  Supplicant name: testuser
  Supplicant address: 0008.c73b.05ce
  portEnabled: true - portControl: Auto
  portStatus: Authorized - currentId: 17
  reAuthenticate: disabled
  reAuthPeriod: 3600
  abort:F fail:F start:F timeout:F success:T
  PAE: state: Authenticated - portMode: Auto
  PAE: reAuthCount: 0 - rxRespId: 0
  PAE: quietPeriod: 60 - reauthMax: 2 - txPeriod: 30
  BE: state: Idle - reqCount: 0 - idFromServer: 16
  BE: suppTimeout: 30 - serverTimeout: 30 - maxReq: 2
  CD: adminControlledDirections: in - operControlledDirections: in
  CD: bridgeDetected: false
  KR: rxKey: false
  KT: keyAvailable: false - keyTxEnabled: false
```


Xsupplicant should be able to ping RADIUS Server.

```
[root@XSUPPLICANT1 root]#ping 10.10.10.40
PING 3.3.3.1 (3.3.3.1) 56(84) bytes of data.
64 bytes from 10.10.10.40: icmp_seq=1 ttl=64 time=0.606 ms
64 bytes from 10.10.10.40: icmp_seq=2 ttl=64 time=0.551 ms
```

Bundling in UNI

A UNI can be configured for bundling. A CVLAN registration table with only one SVLAN is supported on the UNI configured for bundling. Multiple CVLANs can be mapped to the SVLAN.

Figure 6-3 displays a sample Bundling in UNI topology.

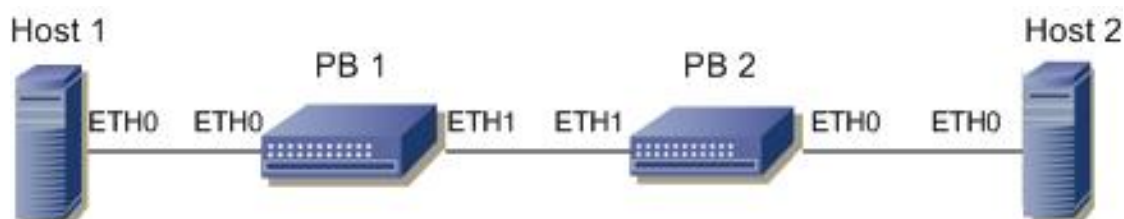


Figure 6-3: Bundling in UNI Topology

Legend

The following table is the legend for Figure 6-2:

Host-1 and Host-2	Host machines
PB1 and PB2	Provider Edge Bridges

PB1

PB1#configure terminal	Enter configure mode.
PB1(config)#bridge 1 protocol provider-mstp edge	Configure the bridge as a provider-MSTP edge bridge.
PB1(config)#vlan database	Enter VLAN configure mode.
PB1(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure VLAN 2 as a customer VLAN and associate it with bridge 1.
PB1(config-vlan)#vlan 3 type customer bridge 1 state enable	Configure VLAN 3 as a customer VLAN and associate it with bridge 1.
PB1(config-vlan)#vlan 4 type customer bridge 1 state enable	Configure VLAN 4 as a customer VLAN and associate it with bridge 1.
PB1(config-vlan)#vlan 20 type service point-point bridge 1 state enable	Configure VLAN 20 as service VLAN (point-to-point EVC) and associate it with bridge 1.
PB1(config-vlan)#vlan 30 type service point-point bridge 1 state enable	Configure VLAN 30 as service VLAN (point-to-point EVC) and associate it with bridge 1.
PB1(config-vlan)#exit	Exit VLAN database configuration mode.

PB1(config)#cvlan registration table map1 bridge 1	Create a CVLAN registration table, map1, and associate it with bridge 1.
PB1(config-cvlan-registration)#cvlan 2 svlan 20	Map CVLAN 2 (default VLAN) with SVLAN 20.
PB1(config-cvlan-registration)#cvlan 3 svlan 20	Map CVLAN 3(default VLAN) with SVLAN 20.
PB1(config-cvlan-registration)#exit	Exit CVLAN-registration mode.
PB1(config)#interface eth0	Enter interface mode.
PB1(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB1(config-if)#bridge-group 1	Associate it with bridge 1.
PB1(config-if)#switchport mode customer-edge hybrid	Configure the interface as customer-edge port in hybrid mode.
PB1(config-if)##switchport customer-edge hybrid allowed vlan add 2 egress-tagged enable	Configure the customer-edge port to allow CVLAN 2, with egress-tagged enabled.
PB1(config-if)##switchport customer-edge hybrid allowed vlan add 3 egress-tagged enable	Configure the customer-edge port to allow CVLAN 3, with egress-tagged enabled.
PB1(config-if)##switchport customer-edge hybrid allowed vlan add 4 egress-tagged enable	Configure the customer-edge port to allow CVLAN 4, with egress-tagged enabled.
PB1(config-if)#switchport customer-edge vlan registration map1	Associate map1 (the CVLAN registration table) with the interface.
PB1(config-if)#ethernet uni bundle	Configure the UNI for bundling.
PB1(config-if)#exit	Exit interface mode.
PB1(config)#interface eth1	Enter interface mode.
PB1(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB1(config-if)#bridge-group 1	Associate it with bridge 1.
PB1(config-if)#switchport mode provider- network	Configure the interface as a provider-network port.
PB1(config-if)#switchport provider-network allowed vlan add 20	Configure the provider-network port to allow SVLAN 20.
PB1(config-if)#switchport provider-network allowed vlan add 30	Configure the provider-network port to allow SVLAN 30.
PB1(config-if)#exit	Exit interface mode.

PB2

PB2#configure terminal	Enter configure mode.
PB2(config)#bridge 1 protocol provider-mstp edge	Configure the bridge as a provider-MSTP edge bridge.
PB2(config)#vlan database	Enter VLAN configure mode.
PB2(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure VLAN 2 as a customer VLAN and associate it with bridge 1.
PB2(config-vlan)#vlan 3 type customer bridge 1 state enable	Configure VLAN 3 as a customer VLAN and associate it with bridge 1.

PB2(config-vlan)#vlan 4 type customer bridge 1 state enable	Configure VLAN 4 as a customer VLAN and associate it with bridge 1.
PB2(config-vlan)#vlan 20 type service point-point bridge 1 state enable	Configure VLAN 20 as service VLAN (point-to-point EVC) and associate it with bridge 1.
PB2(config-vlan)#vlan 30 type service point-point bridge 1 state enable	Configure VLAN 30 as service VLAN (point-to-point EVC) and associate it with bridge 1.
PB2(config-vlan)#exit	Exit VLAN configure mode.
PB2(config)#cvlan registration table map1 bridge 1	Create a CVLAN registration table, map1, and associate it with bridge 1.
PB2(config-cvlan-registration)#cvlan 2 svlan 20	Map CVLAN 2 (default VLAN) to SVLAN 20.
PB2(config-cvlan-registration)#cvlan 3 svlan 20	Map CVLAN 3(default VLAN) to SVLAN 20.
PB2(config-cvlan-registration)#exit	Exit CVLAN registration mode.
PB2(config)#interface eth0	Enter interface mode.
PB2(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB2(config-if)#bridge-group 1	Associate it with bridge 1.
PB2(config-if)#switchport mode customer-edge hybrid	Configure the interface as customer-edge port in hybrid mode.
PB2(config-if)##switchport customer-edge hybrid allowed vlan add 2 egress-tagged enable	Configure the customer-edge port to allow CVLAN 2, with egress-tagged enabled.
PB2(config-if)##switchport customer-edge hybrid allowed vlan add 3 egress-tagged enable	Configure the customer-edge port to allow CVLAN 3, with egress-tagged enabled.
PB2(config-if)##switchport customer-edge hybrid allowed vlan add 4 egress-tagged enable	Configure the customer-edge port to allow CVLAN 4, with egress-tagged enabled.
PB2(config-if)#switchport customer-edge vlan registration map1	Associate map1 (the CVLAN registration table) with the interface.
PB2(config-if)#ethernet uni bundle	Configure the UNI for bundling.
PB2(config-if)#exit	Exit interface mode.
PB2(config)#interface eth1	Enter interface mode.
PB2(config-if)#switchport	Configure the interface as a Layer 2 interface.
PB2(config-if)#bridge-group 1	Associate it with bridge 1.
PB2(config-if)#switchport mode provider-network	Configure the interface as provider-network port.
PB2(config-if)#switchport provider-network allowed vlan add 20	Configure the provider-network port to allow SVLAN 20.
PB2(config-if)#switchport provider-network allowed vlan add 30	Configure the provider-network port to allow SVLAN 30.
PB2(config-if)#exit	Exit interface mode.

HOST-1

[root@HOST-1 root]#vconfig add eth0 2	Configure tagged interface for VLAN 2.
[root@HOST-1 root]#ifconfig eth0.2 2.2.2.1	Configure IP address for VLAN 2 tagged interface.

[root@HOST-1 root]#vconfig add eth0 3	Configure tagged interface for VLAN 3.
[root@HOST-1 root]#ifconfig eth0.3 3.3.3.1	Configure IP address for VLAN 3 tagged interface.
[root@HOST-1 root]#vconfig add eth0 4	Configure tagged interface for VLAN 4.
[root@HOST-1 root]#ifconfig eth0.4 4.4.4.1	Configure IP address for VLAN 4 tagged interface.

HOST-2

[root@HOST-2 root]#vconfig add eth0 2	Configure tagged interface for VLAN 2.
[root@HOST-2 root]#ifconfig eth0.2 2.2.2.2	Configure IP address for VLAN 2 tagged interface.
[root@HOST-2 root]#vconfig add eth0 3	Configure tagged interface for VLAN 3.
[root@HOST-2 root]#ifconfig eth0.3 3.3.3.2	Configure IP address for VLAN 3 tagged interface.
[root@HOST-2 root]#vconfig add eth0 4	Configure tagged interface for VLAN 4.
[root@HOST-2 root]#ifconfig eth0.4 4.4.4.2	Configure IP address for VLAN 4 tagged interface.

Validation

PB1

```

PB1#show running-config
!
bridge 1 protocol provider-mstp edge
!
vlan database
vlan 2 type customer bridge 1 name VLAN0002
vlan 2 type customer bridge 1 state enable
vlan 3 type customer bridge 1 name VLAN0003
vlan 3 type customer bridge 1 state enable
vlan 4 type customer bridge 1 name VLAN0004
vlan 4 type customer bridge 1 state enable
vlan 20 type service point-point bridge 1 name VLAN0020
vlan 20 type service point-point bridge 1 state enable
vlan 30 type service point-point bridge 1 name VLAN0030
vlan 30 type service point-point bridge 1 state enable
!
cvlan registration table map2 bridge 1
cvlan 2 svlan 20
cvlan 3 svlan 20
!
interface eth1
switchport
bridge-group 1
switchport mode provider-network
switchport provider-network allowed vlan add 20
switchport provider-network allowed vlan add 30
!
interface eth0
switchport

```

```
bridge-group 1
switchport mode customer-edge hybrid
switchport mode customer-edge hybrid acceptable-frame-type all
switchport customer-edge hybrid allowed vlan add 2 egress-tagged enable
switchport customer-edge hybrid allowed vlan add 3 egress-tagged enable
switchport customer-edge hybrid allowed vlan add 4 egress-tagged enable
switchport customer-edge vlan registration map1
ethernet uni bundle
!
end
```

PB2

```
PB1#show running-config
!
bridge 1 protocol provider-mstp edge
!
vlan database
vlan 2 type customer bridge 1 name VLAN0002
vlan 2 type customer bridge 1 state enable
vlan 3 type customer bridge 1 name VLAN0003
vlan 3 type customer bridge 1 state enable
vlan 4 type customer bridge 1 name VLAN0004
vlan 4 type customer bridge 1 state enable
vlan 20 type service point-point bridge 1 name VLAN0020
vlan 20 type service point-point bridge 1 state enable
vlan 30 type service point-point bridge 1 name VLAN0030
vlan 30 type service point-point bridge 1 state enable
!
cvlan registration table map2 bridge 1
cvlan 2 svlan 20
cvlan 3 svlan 20
!
interface eth1
switchport
bridge-group 1
switchport mode provider-network
switchport provider-network allowed vlan add 20
switchport provider-network allowed vlan add 30
!
interface eth0
switchport
bridge-group 1
switchport mode customer-edge hybrid
switchport mode customer-edge hybrid acceptable-frame-type all
switchport customer-edge hybrid allowed vlan add 2 egress-tagged enable
switchport customer-edge hybrid allowed vlan add 3 egress-tagged enable
switchport customer-edge hybrid allowed vlan add 4 egress-tagged enable
switchport customer-edge vlan registration map1
ethernet uni bundle
!
```

end

1. Verify whether frames with C-VLAN-ID which is mapped to S-VLAN passes through the UNI.

Ping should go through eth0.2 of HOST-1 and eth0.2 of HOST-2:

```
[root@HOST-1 root]#ping 2.2.2.2
PING 2.2.2.2 (2.2.2.2) 56(84) bytes of data.
64 bytes from 2.2.2.2: icmp_seq=1 ttl=64 time=1.41 ms
64 bytes from 2.2.2.2: icmp_seq=2 ttl=64 time=0.776 ms
--- 2.2.2.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1005ms
rtt min/avg/max/mdev = 0.776/1.096/1.417/0.322 ms
```

Ping should go through eth0.3 of HOST-1 and eth0.3 of HOST-2:

```
[root@HOST-1 root]#ping 3.3.3.2
PING 3.3.3.2 (3.3.3.2) 56(84) bytes of data.
64 bytes from 3.3.3.2: icmp_seq=1 ttl=64 time=1.42 ms
64 bytes from 3.3.3.2: icmp_seq=2 ttl=64 time=0.752 ms
--- 3.3.3.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1009ms
rtt min/avg/max/mdev = 0.752/1.089/1.426/0.337 ms
```

2. Verify whether frames with C-VLAN-ID which is mapped to S-VLAN passes through the UNI.

Ping should not go through eth0.4 of HOST-1 and eth0.4 of HOST-2:

```
[root@HOST-1 root]#ping 4.4.4.2
PING 4.4.4.2 (4.4.4.2) 56(84) bytes of data.
From 4.4.4.1 icmp_seq=1 Destination Host Unreachable
From 4.4.4.1 icmp_seq=2 Destination Host Unreachable
From 4.4.4.1 icmp_seq=3 Destination Host Unreachable
--- 2.2.2.3 ping statistics ---
4 packets transmitted, 0 received, +3 errors, 100% packet loss, time 3028ms
, pipe 3
```

3. Verify whether CVLAN registration table is not getting modified in contradiction to configuration of UNI to which it is associated. Modify CVLAN registration table (map1 of PB1) and try mapping CVLAN 4 to SVLAN 30.

Map1 should not get modified as it is associated to customer-edge port (eth0 of PB1), which is configured for bundling.

```
PB1#configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

```
PB1(config)#cvlan registration table map1 bridge 1
PB1(config-cvlan-registration)#cvlan 4 svlan 30
% CVLAN Map Contradicts the service attribute
PB1(config-cvlan-registration)#
```

CHAPTER 7 MEF ENNI Configuration

These requirements detail the method of interconnection between two Operator MENs including the protocols that support the exchange of the information needed to support the UNI to UNI Ethernet Services. This interface is called the External Network Network Interface (ENNI). The Protocol Data Units exchanged at the ENNI are called ENNI Frames. These requirements detail the connectivity attributes that are supported by an Operator MEN. Such attributes can exist between UNIs as described in MEF standards.

- **OVC** - Operator Virtual Connection
- **OVC End Point** - An association of an OVC with a specific External Interface i.e., UNI/ENNI
- **ENNI** - A reference point representing the boundary between two Operator
- MENs that are operated as separate administrative domains

Note: MEF ENNI is not supported for ZebIC releases.

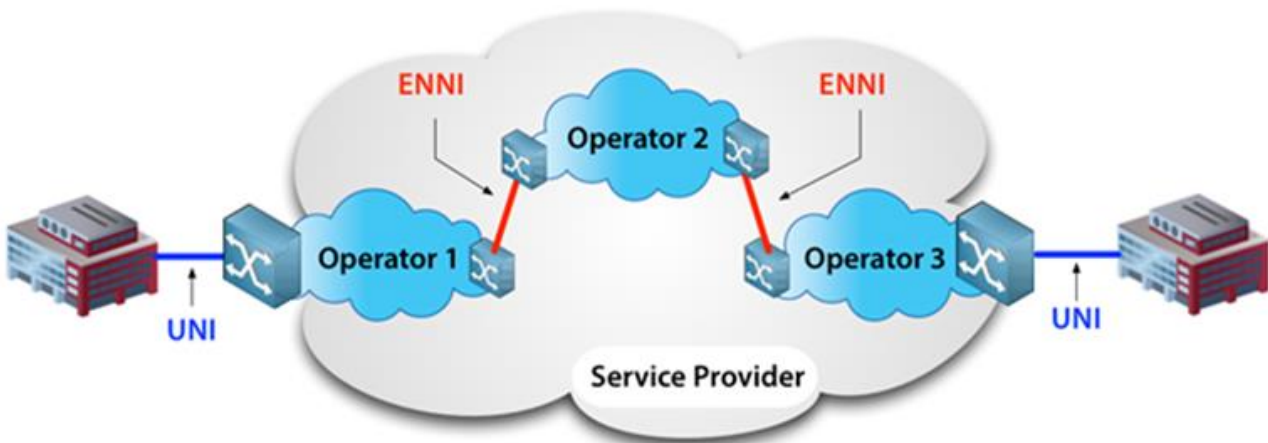


Figure 7-1: ENNI Topology

Operator Services Attributes

The Service Model for the use of the ENNI involves the purchase of services from one or more Operators. These services are the exchange of traffic among ENNIs and UNIs that are supported by each Operator MEN.

ENNI Service Attributes

The ENNI is the point of demarcation between the responsibilities of two Operators. For each instance of an ENNI, there are two sets of ENNI Service Attributes, one for each Operator.

The End Point Map specifies how each S-Tagged ENNI Frame is associated with an OVC EndPoint within an Operator MEN.

OVC Service Attributes

An OVC End Point represents the logical attachment of an OVC to an External Interface. At each External Interface, there must be a way to map each frame to at most one OVC End Point.

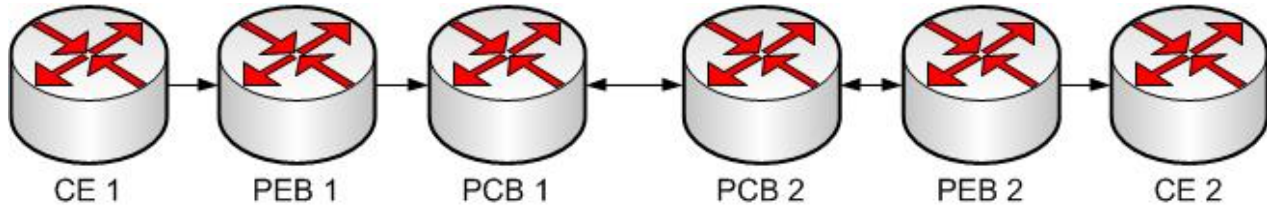


Figure 7-2: OVC End Points

PEB1

(config)#bridge 1 protocol provider-mstp edge	Configure bridge 1 as Provider-MSTP edge
(config)#vlan database	Enter Vlan database
(config-vlan)# vlan 2 type customer bridge 1 state enable	Create Customer Vlan 2
(config-vlan)# vlan 4 type service point-point bridge 1 state enable	Create Service Vlan 4
(config-vlan)# ethernet svlan 4 ovc-id OVC1 oep-id oep1 bridge 1	Associate Svlan4 to oep id & Create OVC1
(config-mst)#oep mapping table map1 bridge 1	Create Map1.
(config-oep-mapping)# cvlan 2 oep-id oep1	Register the association of mapping between Cvlan & oep id 1
(config-oep-mapping)#ex	exit
(config)#interface eth1	Enter interface mode
(config-if)# switchport	Enter Switchport Mode
(config-if)# bridge-group 1	Enter Bridge-Group 1
(config-if)# switchport mode customer-edge hybrid	Make the switchport Mode hybrid
(config-if)# switchport mode customer-edge hybrid acceptable-frame-type all	Make the mode customer-edge to accept all the frames
(config-if)# switchport customer-edge hybrid allowed vlan all	Make the mode customer-edge to accept all the frames
(config-if)#ethernet uni-oep mapping table 1	Associate the map1 to cvlan
(config-if)#ex	Exit domain configuration mode.
(config)#interface eth2	Enter interface mode.
(config-if)# switchport	Enter switchport mode
(config-if)# bridge-group 1	Enter the bridge-group mode

(config-if)# switchport mode provider-network	Make the mode provider-network
(config-if)# switchport provider-network allowed vlan all	Allow all the vlans

PCB1

(config)#bridge 1 protocol provider-mstp	Configure bridge 1 as Provider-MSTP edge
(config)#vlan database	Enter Vlan database
(config-vlan)# vlan 4 type service point-point bridge 1 state enable	Create s Vlan 4
(config-vlan)# ethernet svlan 4 ovc-id OVC1 oep-id oep2 bridge 1	Associate Svlan4 to oep id & Create OVC1
(config-vlan)# vlan 1023 type service point-point bridge 1 state enable	Create s Vlan 1023
(config-mst)#oep mapping table map2 bridge 1	Create Map2.
(config-oep-mapping)# svlan 1023 oep-id oep2	Register the association of mapping between Svlan & oep id 2
(config-oep-mapping)#ex	exit
(config)#interface eth1	Enter interface mode
(config-if)# switchport	Enter Switchport Mode
(config-if)# bridge-group 1	Enter Bridge-Group 1
(config-if)# switchport mode provider-network	Make the switchport Mode provider-network
(config-if)# switchport provider-network allowed vlan all	Make the mode provider-network to accept all the frames
(config-if)# ethernet enni-oep mapping table map2	Associate the map2 to svlan
(lldp-agent)# exit	exit
(config-if)#interface eth2	Enter interface mode.
(config-if)# switchport	Enter switchport mode
(config-if)# bridge-group 1	Enter the bridge-group mode
(config-if)# switchport mode provider-network	Make the mode provider-network
(config-if)# switchport provider-network allowed vlan all	Allow all the svlans

PCB2

(config)#bridge 1 protocol provider-mstp	Configure bridge 1 as Provider-MSTP edge
(config)#vlan database	Enter Vlan database

MEF ENNI Configuration

(config-vlan)# vlan 5 type service point-point bridge 1 state enable	Create s Vlan 5
(config-vlan)# ethernet svlan 5 ovc-id OVC2 oep-id oep3 bridge 1	Associate Svlan4 to oep id & Create OVC1
(config-vlan)# vlan 1023 type service point-point bridge 1 state enable	Create s Vlan 1023
(config-mst)#oep mapping table map3 bridge 1	Create Map3.
(config-oep-mapping)# svlan 1023 oep-id oep3	Register the association of mapping between Svlan & oep id 2
(config-oep-mapping)#ex	exit
(config)#interface eth1	Enter interface mode
(config-if)# switchport	Enter Switchport Mode
(config-if)# bridge-group 1	Enter Bridge-Group 1
(config-if)# switchport mode provider-network	Make the switchport Mode provider-network
(config-if)# switchport provider-network allowed vlan all	Make the mode provider-network to accept all the frames
(config-if)# ethernet enni-oep mapping table map3	Associate the map3 to svlan
(lldp-agent)# exit	exit
(config-if)#interface eth2	Enter interface mode.
(config-if)# switchport	Enter switchport mode
(config-if)# bridge-group 1	Enter the bridge-group mode
(config-if)# switchport mode provider-network	Make the mode provider-network
(config-if)# switchport provider-network allowed vlan all	Allow all the vlans

PEB2

(config)#bridge 1 protocol provider-mstp edge	Configure bridge 1 as Provider-MSTP edge
(config)#vlan database	Enter Vlan database
(config-vlan)# vlan 2 type customer bridge 1 state enable	Create Customer Vlan 2
(config-vlan)# vlan 5 type service point-point bridge 1 state enable	Create Service Vlan 5
(config-vlan)# ethernet svlan 5 ovc-id OVC2 oep-id oep4 bridge 1	Associate Svlan 5to oep id & Create OVC1
(config-mst)#oep mapping table map4 bridge 1	Create Map4.
(config-oep-mapping)# cvlan 2 oep-id oep4	Register the association of mapping between Cvlan & oep id 4
(config-oep-mapping)#ex	exit

(config)#interface eth1	Enter interface mode
(config-if)# switchport	Enter Switchport Mode
(config-if)# bridge-group 1	Enter Bridge-Group 1
(config-if)# switchport mode customer-edge hybrid	Make the switchport Mode hybrid
(config-if)# switchport mode customer-edge hybrid acceptable-frame-type all	Make the mode customer-edge to accept all the frames
(config-if)# switchport customer-edge hybrid allowed vlan add 2 egress-tagged enable	Make the mode customer-edge to accept all the frames
(config-if)#ex	Associate the map1 to cvlan
(config)#interface eth2	Exit domain configuration mode.
(config-if)# switchport	Enter interface mode.
(config-if)# bridge-group 1	Enter switchport mode
(config-if)# switchport mode provider-network	Enter the bridge-group mode
(config-if)# switchport provider-network allowed vlan all	Make the mode provider-network
(config-if)#ex	Allow all the vlans

Validation

PEB1

```
Rtr2#show ethernet enni ovc attributes ovc-id OVC1 bridge 1
% Bridge name - 1
% -----
% OVC-ID      - OVC1
% OVC Type    - point-to-point
% -----
% OEP-ID      - oep1
% -----
% MAX OEP     - 2
% MAX OVC     - 1
% CE-VLAN ID Preservation - no
% CE-VLAN CoS Preservation - no
% S-VLAN ID Preservation - no
% S-VLAN CoS Preservation - no
```

PCB1

```
Rtr3#show ethernet enni ovc attributes ovc-id OVC1 bridge 1
% Bridge name - 1
% -----
% OVC-ID      - OVC1
% OVC Type    - point-to-point
% -----
% OEP-ID      - oep2
% -----
```

```
% MAX OEP      - 2
% MAX OVC      - 1
% CE-VLAN ID Preservation - no
% CE-VLAN CoS Preservation - no
% S-VLAN ID Preservation - no
% S-VLAN CoS Preservation - no
```

PCB2

```
Rtr4#show ethernet enni ovc attributes ovc-id OVC2 bridge 1
% Bridge name - 1
% -----
% OVC-ID      - OVC2
% OVC Type    - point-to-point
% -----
% OEP-ID      - oep3
% -----
% MAX OEP     - 2
% MAX OVC     - 1
% CE-VLAN ID Preservation - no
% CE-VLAN CoS Preservation - no
% S-VLAN ID Preservation - no
% S-VLAN CoS Preservation - no
```

PEB2

```
Rtr5#show ethernet enni ovc attributes ovc-id OVC2 bridge 1
% Bridge name - 1
% -----
% OVC-ID      - OVC2
% OVC Type    - point-to-point
% -----
% OEP-ID      - oep4
% -----
% MAX OEP     - 2
% MAX OVC     - 1
% CE-VLAN ID Preservation - no
% CE-VLAN CoS Preservation - no
% S-VLAN ID Preservation - no
% S-VLAN CoS Preservation - no
```

Note: You can also use this command:

```
show ethernet enni ovc attributes interface eth1
```

Layer 2 Control Protocol

This section provides requirements for the processing of a Subscriber's Layer 2 Control Protocol (L2CP) Service Frames for the services defined in this document. The requirements are intended to provide guidance for actual

deployments of the Ethernet services, while at the same time allowing for flexibility among the Service Provider offerings.

The document address Service Frames carrying a MAC Destination Address (DA) within the range 01-80-C2-00-00-00 through 01-80-C2-00-00-0F and 01-80-C2-00-00-20 through 01-80-C2-00-00-2F.

EPL, EP-LAN, and EP-TREE Services

EPL, EP-TREE and EP-LAN must process the L2CP frames based on the Destination MAC address as specified in the following table.

Destination MAC Address	L2CP action for EPL, EP-Tre, EP-LAN
01-80-C2-00-00-00	MUST Tunnel
01-80-C2-00-00-01 through 01-80-C2-00-00-0A	MUST NOT Tunnel (additional requirements may apply as per the sub-section 8.1.1, 8.1.3, 8.1.5)
01-80-C2-00-00-0B	MUST Tunnel
01-80-C2-00-00-0C	MUST Tunnel
01-80-C2-00-00-0D	MUST Tunnel
01-80-C2-00-00-0E	MUST Tunnel
01-80-C2-00-00-0F	MUST NOT Tunnel (additional requirements may apply as per the sub-section 8.1.1, 8.1.3, 8.1.5)

EVPL, EVP-LAN, and EVP-TREE Services

Destination MAC Address	L2CP action for EPL, EP-Tre, EP-LAN
01-80-C2-00-00-01 through 01-80-C2-00-00-0F	MUST NOT Tunnel (additional requirements may apply as per the sub-section 8.1.2, 8.1.4, 8.1.6)

L2CP action for Services

Following are the typical examples and configuration for the three (tunnel/peer/discard) L2CP actions for MEF services.

STP Tunneling Configuration

Topology

In this example, PB 1 and PB 2 are provider-MSTP edge bridges that communicate directly with each other via eth0. The interfaces on Host 1 and Host 2 (eth1 and eth2) are Layer 2 interfaces. Depending on what restrictions may be set, traffic can be sent from Host 1, passing through PB 1 and PB 2, and received on Host 2. Messages may also be sent in the other direction, depending on the provider and customer restrictions for sending and receiving interfaces.

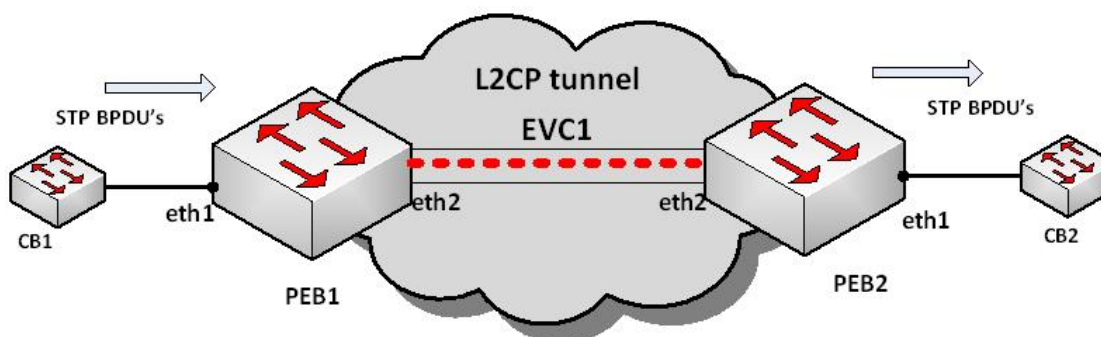


Figure 7-3: Tunnel Topology

PEB1

PEB1#configure terminal	Enter configure mode.
PEB1 (config)#bridge 1 protocol provider-mstp edge	Configure the bridge as a provider-MSTP edge bridge.
PEB1 (config)#vlan database	Enter VLAN configure mode.
PEB1 (config-vlan)# vlan 2 type customer bridge 1 state enable	Configure VLAN 2 as customer vlan
PEB1 (config-vlan)# vlan 3 type customer bridge 1 state enable	Configure VLAN 3 as customer vlan
PEB1 (config-vlan)# vlan 4 type customer bridge 1 state enable	Configure VLAN 4 as customer vlan
PEB1 (config-vlan)# vlan 5 type customer bridge 1 state enable	Configure VLAN 5 as customer vlan
PEB1 (config-vlan)# vlan 6 type service point-point bridge 1 state enable	Configure VLAN 6 as service VLAN (point-to-point EVC) and associate it with bridge.
PEB1 (config-vlan)# exit	Exit from vlan database
PEB1 (config)#cvlan registration table map1 bridge 1	Create CVLAN registration table, map1, and associate it with bridge 1.
PEB1 (config-cvlan-registration)#cvlan 1 svlan	Map CVLAN 1 (default VLAN) to SVLAN 6.

PEB1 (config-cvlan-registration)#cvlan 2 svlan	Map CVLAN 2 to SVLAN 6.
PEB1 (config-cvlan-registration)#cvlan 3 svlan	Map CVLAN 3 to SVLAN 6.
PEB1 (config-cvlan-registration)#cvlan 4 svlan	Map CVLAN 4 to SVLAN 6.
PEB1 (config-cvlan-registration)#cvlan 5 svlan	Map CVLAN 5 to SVLAN 6.
PEB1 (config)#interface eth1	Enter interface mode.
PEB1 (config-if)#switchport	Configure the interface as a Layer 2 interface
PEB1 (config-if)#bridge-group 1	Associate it with bridge 1.
PEB1 (config-if)#switchport mode customer-edge hybrid	Configure the interface as customer-edge port in hybrid mode.
PEB1 (config-if)#switchport customer-edge hybrid allowed vlan all	Configure the interface as customer-edge port in hybrid mode and allow all the vlans
PEB1 (config-if)#switchport customer-edge vlan registration map1	Associate map1 (the CVLAN registration table) with the interface.
PEB1 (config-if)#ethernet uni all-to-one	Configure UNI as all to one bundling.
PEB1 (config-if)#exit	Exit interface mode.
PEB1 (config)#interface eth2	Enter interface mode.
PEB1 (config-if)#switchport	Configure the interface as a Layer 2 interface.
PEB1 (config-if)#bridge-group 1	Associate the interface with bridge 1.
PEB1 (config-if)#switchport mode provider-network	Configure the interface as a provider-network port.
PEB1 (config-if)#switchport provider-network allowed vlan all	Configure the provider-network port to allow all
PEB1 (config-if)#exit	Exit interface mode.
PEB1 (config)#vlan database	Enter vlan database.
PEB1 (config-vlan)# ethernet svlan 6 evc-id evc1 bridge 1	Assigning the name to svlan or EVC .
PEB1 (config-vlan)# exit	Exit interface mode.

PEB2

PEB2#configure terminal	Enter configure mode.
PEB2 (config)#bridge 1 protocol provider-mstp edge	Configure the bridge as a provider-MSTP edge bridge.
PEB2 (config)#vlan database	Enter VLAN configure mode.

MEF ENNI Configuration

PEB2(config-vlan)# vlan 2 type customer bridge 1 state enable	Configure VLAN 2 as customer vlan
PEB2(config-vlan)# vlan 3 type customer bridge 1 state enable	Configure VLAN 3 as customer vlan
PEB2(config-vlan)# vlan 4 type customer bridge 1 state enable	Configure VLAN 4 as customer vlan
PEB2(config-vlan)# vlan 5 type customer bridge 1 state enable	Configure VLAN 5 as customer vlan
PEB2(config-vlan)# vlan 6 type service point-point bridge 1 state enable	Configure VLAN 6 as service VLAN (point-to-point EVC) and associate it with bridge.
PEB2(config-vlan)# exit	Exit from vlan database
PEB2(config)#cvlan registration table map1 bridge 1	Create CVLAN registration table, map1, and associate it with bridge 1.
PEB2(config-cvlan-registration)#cvlan 1 svlan	Map CVLAN 1 (default VLAN) to SVLAN 6.
PEB2(config-cvlan-registration)#cvlan 2 svlan	Map CVLAN 2 to SVLAN 6.
PEB2(config-cvlan-registration)#cvlan 3 svlan	Map CVLAN 3 to SVLAN 6.
PEB2(config-cvlan-registration)#cvlan 4 svlan	Map CVLAN 4 to SVLAN 6.
PEB2(config-cvlan-registration)#cvlan 5 svlan	Map CVLAN 5 to SVLAN 6.
PEB2(config)#interface eth1	Enter interface mode.
PEB2(config-if)#switchport	Configure the interface as a Layer 2 interface
PEB2(config-if)#bridge-group 1	Associate it with bridge 1.
PEB2(config-if)#switchport mode customer- edge hybrid	Configure the interface as customer-edge port in hybrid mode.
PEB2(config-if)#switchport customer-edge hybrid allowed vlan all	Configure the interface as customer-edge port in hybrid mode and allow all the vlans
PEB2(config-if)#switchport customer-edge vlan registration map1	Associate map1 (the CVLAN registration table) with the interface.
PEB2(config-if)#ethernet uni all-to-one	Configure UNI as all to one bundling.
PEB2(config-if)#exit	Exit interface mode.
PEB2(config)#interface eth2	Enter interface mode.
PEB2(config-if)#switchport	Configure the interface as a Layer 2 interface.
PEB2(config-if)#bridge-group 1	Associate the interface with bridge 1.
PEB2(config-if)#switchport mode provider- network	Configure the interface as a provider-network port.
PEB2(config-if)#switchport provider-network allowed vlan all	Configure the provider-network port to allow all

PEB2(config-if)#exit	Exit interface mode.
PEB2(config)#vlan database	Enter vlan database.
PEB2(config-vlan)# ethernet svlan 6 evc-id evc1 bridge 1	Assigning the name to svlan or EVC .
PEB2(config-vlan)# exit	Exit interface mode.

HOST 1

HOST-1#configure terminal	Enter configure mode.
HOST-1#bridge 1 protocol ieee vlan-bridge	Configure bridge 1 ieee vlan aware bridge.
HOST-1(config)#interface eth1	Enter interface mode.
HOST-1(config-if)#switchport	Configure the interface as a Layer 2 interface.
HOST-1(config-if)#bridge-group 1	Associate the interface with bridge 1.
HOST-1(config-if)#exit	Exit interface mode.

HOST-2

HOST-2#configure terminal	Enter configure mode.
HOST-2#bridge 1 protocol ieee vlan-bridge	Configure bridge 1 ieee vlan aware bridge.
HOST-2(config)#interface eth1	Enter interface mode.
HOST-2(config-if)#switchport	Configure the interface as a Layer 2 interface.
HOST-2(config-if)#bridge-group 1	Associate the interface with bridge 1.
HOST-2(config-if)#exit	Exit interface mode.

Validation

PEB1#show cvlan registration table bridge 1

Bridge	Table Name	Port List
1	map1	eth1

CVLAN ID	SVLAN ID
2	6
1	6
4	6
3	6
5	6

PEB2#show cvlan registration table bridge 1

Bridge	Table Name	Port List
1	map1	eth1

CVLAN ID	SVLAN ID
=====	=====
2	6
1	6
4	6
3	6
5	6

Show Run for PEB1

PEB1#show running-config

```
!  
bridge 1 protocol provider-mstp edge  
spanning-tree mode provider-rstp  
ce-vlan preserve-cos 6 bridge 1  
ce-vlan preserve-vlanid 6 bridge 1  
ethernet cfm enable  
!  
vlan database  
vlan 2 type customer bridge 1 name VLAN0002  
vlan 2 type customer bridge 1 state enable  
vlan 3 type customer bridge 1 name VLAN0003  
vlan 3 type customer bridge 1 state enable  
vlan 4 type customer bridge 1 name VLAN0004  
vlan 4 type customer bridge 1 state enable  
vlan 5 type customer bridge 1 name VLAN0005  
vlan 5 type customer bridge 1 state enable  
vlan 6 type service point-point bridge 1 name VLAN0006  
vlan 6 type service point-point bridge 1 state enable  
ethernet svlan 6 evc-id evc1 bridge 1  
!  
spanning-tree mst configuration  
!  
cvlan registration table map1 bridge 1  
  cvlan 2 svlan 6  
  cvlan 1 svlan 6  
  cvlan 4 svlan 6  
  cvlan 3 svlan 6  
  cvlan 5 svlan 6  
!  
interface eth1  
  switchport  
  bridge-group 1  
  switchport mode customer-edge hybrid  
  switchport mode customer-edge hybrid acceptable-frame-type all  
  switchport customer-edge hybrid allowed vlan all  
  switchport customer-edge vlan registration map1  
  l2protocol stp tunnel vlan 6  
  l2protocol gmrp tunnel vlan 6  
  l2protocol mmrp tunnel vlan 6
```

```

l2protocol gvrp tunnel vlan 6
l2protocol mvrp tunnel vlan 6
l2protocol lacp peer
l2protocol dot1x peer
l2protocol efm peer
l2protocol elmi peer
l2protocol lldp peer
l2protocol ptp peer
l2protocol synce peer
l2protocol pause discard
ethernet uni all-to-one
ethernet uni max-evc 1
no shutdown
no snmp trap link-status
set lldp locally-assigned p8p1
lldp port-id-tlv local
no dcbx enable
customer-spanning-tree provider-edge svlan 6 path-cost 128
!
interface eth2
  switchport
  bridge-group 1
  switchport mode provider-network
  switchport provider-network allowed vlan all
  switchport provider-network allowed vlan remove 2
  switchport provider-network allowed vlan remove 4
  switchport provider-network allowed vlan remove 3
  switchport provider-network allowed vlan remove 5
  no shutdown
  no snmp trap link-status
  set lldp locally-assigned p9p1
  lldp port-id-tlv local
  no dcbx enable
!
```

Show Run for PEB2

```

PEB2#show running-config
!
bridge 1 protocol provider-mstp edge
spanning-tree mode provider-rstp
ce-vlan preserve-cos 6 bridge 1
ce-vlan preserve-vlanid 6 bridge 1
ethernet cfm enable
!
vlan database
vlan 2 type customer bridge 1 name VLAN0002
vlan 2 type customer bridge 1 state enable
vlan 3 type customer bridge 1 name VLAN0003
vlan 3 type customer bridge 1 state enable
vlan 4 type customer bridge 1 name VLAN0004
```

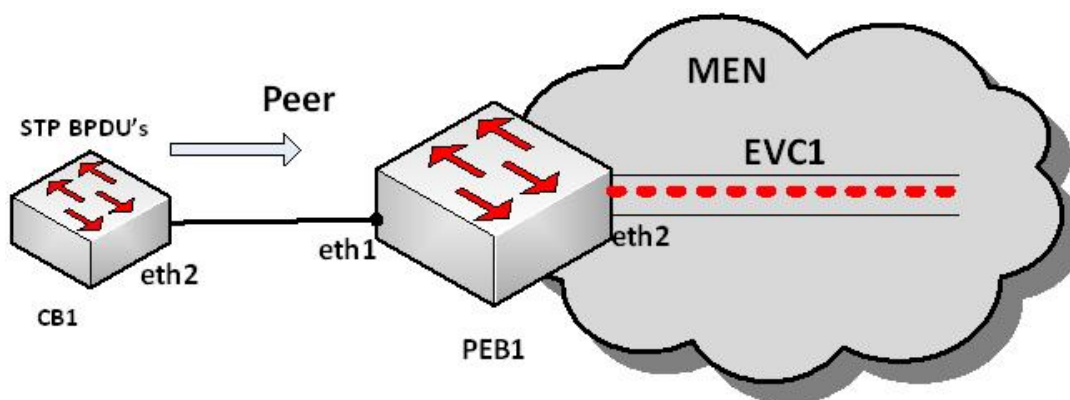
```
vlan 4 type customer bridge 1 state enable
vlan 5 type customer bridge 1 name VLAN0005
vlan 5 type customer bridge 1 state enable
vlan 6 type service point-point bridge 1 name VLAN0006
vlan 6 type service point-point bridge 1 state enable
ethernet svlan 6 evc-id evc1 bridge 1
!
spanning-tree mst configuration
!
cvlan registration table map1 bridge 1
  cvlan 2 svlan 6
  cvlan 1 svlan 6
  cvlan 4 svlan 6
  cvlan 3 svlan 6
  cvlan 5 svlan 6
!
interface eth1
  switchport
  bridge-group 1
  switchport mode customer-edge hybrid
  switchport mode customer-edge hybrid acceptable-frame-type all
  switchport customer-edge hybrid allowed vlan all
  switchport customer-edge vlan registration map1
  l2protocol stp tunnel vlan 6
  l2protocol gmrp tunnel vlan 6
  l2protocol mmrp tunnel vlan 6
  l2protocol gvrp tunnel vlan 6
  l2protocol mvrp tunnel vlan 6
  l2protocol lacp peer
  l2protocol dot1x peer
  l2protocol efm peer
  l2protocol elmi peer
  l2protocol lldp peer
  l2protocol ptp peer
  l2protocol synce peer
  l2protocol pause discard
  ethernet uni all-to-one
  ethernet uni max-evc 1
  no shutdown
  no snmp trap link-status
  set lldp locally-assigned p8p1
  lldp port-id-tlv local
  no dcbx enable
  customer-spanning-tree provider-edge svlan 6 path-cost 128
!
interface eth2
  switchport
  bridge-group 1
  switchport mode provider-network
  switchport provider-network allowed vlan all
```

```

switchport provider-network allowed vlan remove 2
switchport provider-network allowed vlan remove 4
switchport provider-network allowed vlan remove 3
switchport provider-network allowed vlan remove 5
no shutdown
no snmp trap link-status
set lldp locally-assigned p9p1
lldp port-id-tlv local
no dcbx enable
!
```

STP Tunneling

Topology



PEB1

PEB1#configure terminal	Enter configure mode.
PEB1(config)#bridge 1 protocol provider-mstp edge	Configure the bridge as a provider-MSTP edge bridge.
PEB1(config)#vlan database	Enter VLAN configure mode.
PEB1(config-vlan)# vlan 2 type customer bridge 1 state enable	Configure VLAN 2 as customer vlan
PEB1(config-vlan)# vlan 3 type customer bridge 1 state enable	Configure VLAN 3 as customer vlan
PEB1(config-vlan)# vlan 4 type customer bridge 1 state enable	Configure VLAN 4 as customer vlan
PEB1(config-vlan)# vlan 5 type customer bridge 1 state enable	Configure VLAN 5 as customer vlan
PEB1(config-vlan)# vlan 6 type service point-point bridge 1 state enable	Configure VLAN 6 as service VLAN (point-to-point EVC) and associate it with bridge.
PEB1(config-vlan)# vlan 7 type service point-point bridge 1 state enable	Configure VLAN 7 as service VLAN (point-to-point EVC) and associate it with bridge.

MEF ENNI Configuration

PEB1(config-vlan)# exit	Exit from vlan database
PEB1(config)#cvlan registration table map1 bridge 1	Create CVLAN registration table, map1, and associate it with bridge 1.
PEB1(config-cvlan-registration)#cvlan 1 svlan	Map CVLAN 1 (default VLAN) to SVLAN 6.
PEB1(config-cvlan-registration)#cvlan 2 svlan	Map CVLAN 2 to SVLAN 6.
PEB1(config-cvlan-registration)#cvlan 3 svlan	Map CVLAN 3 to SVLAN 6.
PEB1(config-cvlan-registration)#cvlan 4 svlan	Map CVLAN 4 to SVLAN 7.
PEB1(config-cvlan-registration)#cvlan 5 svlan	Map CVLAN 5 to SVLAN 7.
PEB1(config)#interface eth1	Enter interface mode.
PEB1(config-if)#switchport	Configure the interface as a Layer 2 interface
PEB1(config-if)#bridge-group 1	Associate it with bridge 1.
PEB1(config-if)#switchport mode customer-edge hybrid	Configure the interface as customer-edge port in hybrid mode.
PEB1(config-if)#switchport customer-edge hybrid allowed vlan all	Configure the interface as customer-edge port in hybrid mode and allow all the vlans
PEB1(config-if)#switchport customer-edge vlan registration map1	Associate map1 (the CVLAN registration table) with the interface.
PEB1(config-if)#exit	Exit interface mode.
PEB1(config)#interface eth2	Enter interface mode.
PEB1(config-if)#switchport	Configure the interface as a Layer 2 interface.
PEB1(config-if)#bridge-group 1	Associate the interface with bridge 1.
PEB1(config-if)#switchport mode provider-network	Configure the interface as a provider-network port.
PEB1(config-if)#switchport provider-network allowed vlan all	Configure the provider-network port to allow all
PEB1(config-if)#exit	Exit interface mode.
PEB1(config)#vlan database	Enter vlan database.
PEB1(config-vlan)# ethernet svlan 6 evc-id evc1 bridge 1	Assigning the name to svlan or EVC.
PEB1(config-vlan)# ethernet svlan 7 evc-id evc1 bridge 1	Assigning the name to svlan or EVC.
PEB1(config-vlan)# exit	Exit interface mode.

Host Machines (CB1)

HOST-1

HOST-1#configure terminal	Enter configure mode.
HOST-1#bridge 1 protocol ieee vlan-bridge	Configure bridge 1 ieee vlan aware bridge.
HOST-1 (config)#interface eth2	Enter interface mode.
HOST-1 (config-if)#switchport	Configure the interface as a Layer 2 interface.
HOST-1 (config-if)#bridge-group 1	Associate the interface with bridge 1.
HOST-1 (config-if)#exit	Exit interface mode.

Validation

```
PEB1#show cvlan registration table bridge 1
```

Bridge	Table Name	Port List
1	map1	eth1

CVLAN ID	SVLAN ID
2	6
1	6
4	7
3	6
5	7

Show Run for PEB1

```
PEB1#show running-config
```

```
!
bridge 1 protocol provider-mstp edge
spanning-tree mode provider-rstp
ethernet cfm enable
!
vlan database
vlan 2 type customer bridge 1 name VLAN0002
vlan 2 type customer bridge 1 state enable
vlan 3 type customer bridge 1 name VLAN0003
vlan 3 type customer bridge 1 state enable
vlan 4 type customer bridge 1 name VLAN0004
vlan 4 type customer bridge 1 state enable
vlan 5 type customer bridge 1 name VLAN0005
vlan 5 type customer bridge 1 state enable
vlan 6 type service point-point bridge 1 name VLAN0006
vlan 6 type service point-point bridge 1 state enable
ethernet svlan 6 evc-id evc1 bridge 1
vlan 7 type service point-point bridge 1 name VLAN0007
vlan 7 type service point-point bridge 1 state enable
```

```
!  
spanning-tree mst configuration  
!  
cvlan registration table map1 bridge 1  
  cvlan 2 svlan 6  
  cvlan 1 svlan 6  
  cvlan 4 svlan 7  
  cvlan 3 svlan 6  
  cvlan 5 svlan 7  
!  
interface eth1  
  switchport  
  bridge-group 1  
  switchport mode customer-edge hybrid  
  switchport mode customer-edge hybrid acceptable-frame-type all  
  switchport customer-edge hybrid allowed vlan all  
  switchport customer-edge vlan registration map1  
  l2protocol stp peer  
  l2protocol gmrp peer  
  l2protocol mmrp peer  
  l2protocol gvrp peer  
  l2protocol mvrp peer  
  l2protocol lacp peer  
  l2protocol dot1x peer  
  l2protocol efm peer  
  l2protocol elmi peer  
  l2protocol lldp discard  
  l2protocol ptp peer  
  l2protocol synce peer  
  l2protocol pause discard  
  no shutdown  
!  
interface eth2  
  switchport  
  bridge-group 1  
  switchport mode provider-network  
  switchport provider-network allowed vlan all  
  switchport provider-network allowed vlan remove 2  
  switchport provider-network allowed vlan remove 4  
  switchport provider-network allowed vlan remove 3  
  switchport provider-network allowed vlan remove 5  
  no shutdown  
  lldp-agent  
  no dcbx enable
```

Spanning-tree status of eth2 of CB1:

```
% 1: portfast bpdu-filter disabled  
% 1: portfast bpdu-guard disabled  
% 1: portfast errdisable timeout disabled  
% 1: portfast errdisable timeout interval 300 sec
```



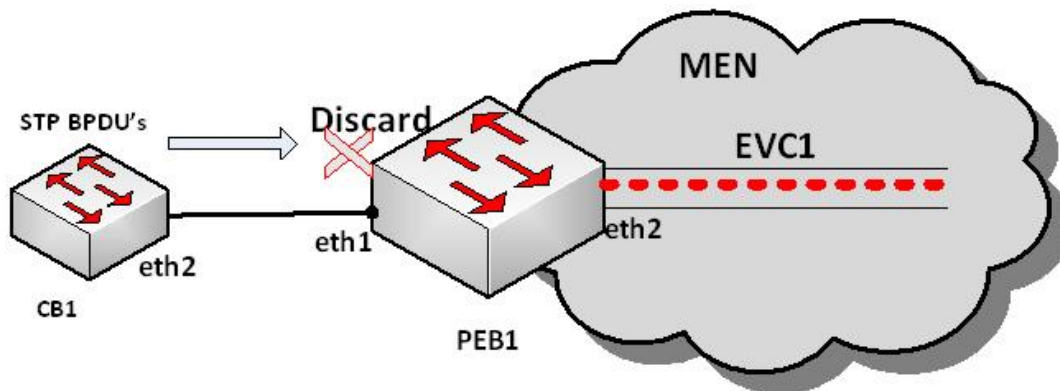
```
% eth2: Port Number 4 - Ifindex 4 - Port Id 8004 - Role Designated - State Forwarding
% eth2: Designated External Path Cost 0 -Internal Path Cost 0
% eth2: Configured Path Cost 20000 - Add type Explicit ref count 1
% eth2: Designated Port Id 8004 - CIST Priority 128 -
% eth2: CIST Root 800008002725e07a
% eth2: Regional Root 800008002725e07a
% eth2: Designated Bridge 800008002725e07a
% eth2: Message Age 0 - Max Age 20
% eth2: CIST Hello Time 2 - Forward Delay 15
% eth2: CIST Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change timer 0
% eth2: forward-transitions 1
% eth2: Version Multiple Spanning Tree Protocol - Received None - Send MSTP
% eth2: No portfast configured - Current portfast off
% eth2: bpdu-guard default - Current bpdu-guard off
% eth2: bpdu-filter default - Current bpdu-filter off
% eth2: no root guard configured - Current root guard off
% eth2: Configured Link Type point-to-point - Current point-to-point
% eth2: No auto-edge configured - Current port Auto Edge off
```

Spanning-tree status of eth1 of PEB1:

```
%
% eth1: Port Number 4 - Ifindex 4 - Port Id 2fff - Role Rootport - State Forwarding
% eth1: Designated Path Cost 0
% eth1: Configured Path Cost 20000 - Add type Explicit ref count 1
% eth1: Designated Port Id 8004 - Priority 32 -
% eth1: Root 800008002725e07a
% eth1: Designated Bridge ffff080027731b56
% eth1: Message Age 0 - Max Age 20
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 3 - Hello Timer 2 - topo change timer 0
% eth1: forward-transitions 1
% eth1: Version Rapid Spanning Tree Protocol - Received MSTP - Send RSTP
% eth1: No portfast configured - Current portfast off
% eth1: bpdu-guard default - Current bpdu-guard off
% eth1: bpdu-filter default - Current bpdu-filter off
% eth1: no root guard configured - Current root guard off
% eth1: Configured Link Type point-to-point - Current point-to-point
% eth1: No auto-edge configured - Current port Auto Edge off
```

STP Discarding

Topology



PEB1

PEB1#configure terminal	Enter configure mode.
PEB1 (config)#bridge 1 protocol provider-mstp edge	Configure the bridge as a provider-MSTP edge bridge.
PEB1 (config)#vlan database	Enter VLAN configure mode.
PEB1 (config-vlan)# vlan 2 type customer bridge 1 state enable	Configure VLAN 2 as customer vlan
PEB1 (config-vlan)# vlan 3 type customer bridge 1 state enable	Configure VLAN 3 as customer vlan
PEB1 (config-vlan)# vlan 4 type customer bridge 1 state enable	Configure VLAN 4 as customer vlan
PEB1 (config-vlan)# vlan 5 type customer bridge 1 state enable	Configure VLAN 5 as customer vlan
PEB1 (config-vlan)# vlan 6 type service point-point bridge 1 state enable	Configure VLAN 6 as service VLAN (point-to-point EVC) and associate it with bridge.
PEB1 (config-vlan)# vlan 7 type service point-point bridge 1 state enable	Configure VLAN 7 as service VLAN (point-to-point EVC) and associate it with bridge.
PEB1 (config-vlan)# exit	Exit from vlan database
PEB1 (config)#cvlan registration table map1 bridge 1	Create CVLAN registration table, map1, and associate it with bridge 1.
PEB1 (config-cvlan-registration)#cvlan 1 svlan	Map CVLAN 1 (default VLAN) to SVLAN 6.
PEB1 (config-cvlan-registration)#cvlan 2 svlan	Map CVLAN 2 to SVLAN 6.
PEB1 (config-cvlan-registration)#cvlan 3 svlan	Map CVLAN 3 to SVLAN 6.
PEB1 (config-cvlan-registration)#cvlan 4 svlan	Map CVLAN 4 to SVLAN 7.

PEB1(config-cvlan-registration)#cvlan 5 svlan	Map CVLAN 5 to SVLAN 7.
PEB1(config)#interface eth1	Enter interface mode.
PEB1(config-if)#switchport	Configure the interface as a Layer 2 interface
PEB1(config-if)#bridge-group 1	Associate it with bridge 1.
PEB1(config-if)#switchport mode customer- edge hybrid	Configure the interface as customer-edge port in hybrid mode.
PEB1(config-if)#switchport customer-edge hybrid allowed vlan all	Configure the interface as customer-edge port in hybrid mode and allow all the vlans
PEB1(config-if)#switchport customer-edge vlan registration map1	Associate map1 (the CVLAN registration table) with the interface.
PEB1(config-if)#l2protocol stp discard	Discard STP service frames.
PEB1(config-if)#exit	Exit interface mode.
PEB1(config)#interface eth2	Enter interface mode.
PEB1(config-if)#switchport	Configure the interface as a Layer 2 interface.
PEB1(config-if)#bridge-group 1	Associate the interface with bridge 1.
PEB1(config-if)#switchport mode provider- network	Configure the interface as a provider-network port.
PEB1(config-if)#switchport provider-network allowed vlan all	Configure the provider-network port to allow all
PEB1(config-if)#exit	Exit interface mode.
PEB1(config)#vlan database	Enter vlan database.
PEB1(config-vlan)# ethernet svlan 6 evc-id evc1 bridge 1	Assigning the name to svlan or EVC.
PEB1(config-vlan)# ethernet svlan 7 evc-id evc1 bridge 1	Assigning the name to svlan or EVC.
PEB1(config-vlan)# exit	Exit interface mode.

Configurations for HOST Machines (CB1)

HOST-1

HOST-1#configure terminal	Enter configure mode.
HOST-1#bridge 1 protocol ieee vlan-bridge	Configure bridge 1 ieee vlan aware bridge.
HOST-1(config)#interface eth2	Enter interface mode.
HOST-1(config-if)#switchport	Configure the interface as a Layer 2 interface.

HOST-1 (config-if) #bridge-group 1	Associate the interface with bridge 1.
HOST-1 (config-if) #exit	Exit interface mode.

Validation

```
PEB1#show cvlan registration table bridge 1
```

Bridge	Table Name	Port List
=====	=====	=====
1	map1	eth1

CVLAN ID	SVLAN ID
=====	=====
2	6
1	6
4	7
3	6
5	7

Show Run for PEB1

```
PEB1#show running-config
```

```

!
bridge 1 protocol provider-mstp edge
spanning-tree mode provider-rstp
ethernet cfm enable
!
vlan database
vlan 2 type customer bridge 1 name VLAN0002
vlan 2 type customer bridge 1 state enable
vlan 3 type customer bridge 1 name VLAN0003
vlan 3 type customer bridge 1 state enable
vlan 4 type customer bridge 1 name VLAN0004
vlan 4 type customer bridge 1 state enable
vlan 5 type customer bridge 1 name VLAN0005
vlan 5 type customer bridge 1 state enable
vlan 6 type service point-point bridge 1 name VLAN0006
vlan 6 type service point-point bridge 1 state enable
ethernet svlan 6 evc-id evc1 bridge 1
vlan 7 type service point-point bridge 1 name VLAN0007
vlan 7 type service point-point bridge 1 state enable
!
spanning-tree mst configuration
!
cvlan registration table map1 bridge 1
cvlan 2 svlan 6
cvlan 1 svlan 6
cvlan 4 svlan 7
cvlan 3 svlan 6
cvlan 5 svlan 7
!

```

```
interface eth1
  switchport
  bridge-group 1
  switchport mode customer-edge hybrid
  switchport mode customer-edge hybrid acceptable-frame-type all
  switchport customer-edge hybrid allowed vlan all
  switchport customer-edge vlan registration map1
  l2protocol stp discard
  l2protocol gmrp peer
  l2protocol mmrp peer
  l2protocol gvrp peer
  l2protocol mvrp peer
  l2protocol lacp peer
  l2protocol dot1x peer
  l2protocol efm peer
  l2protocol elmi peer
  l2protocol lldp discard
  l2protocol ptp peer
  l2protocol synce peer
  l2protocol pause discard
  no shutdown
!
interface eth2
  switchport
  bridge-group 1
  switchport mode provider-network
  switchport provider-network allowed vlan all
  switchport provider-network allowed vlan remove 2
  switchport provider-network allowed vlan remove 4
  switchport provider-network allowed vlan remove 3
  switchport provider-network allowed vlan remove 5
  no shutdown
  lldp-agent
  no dcbx enable
  exit
!
```

Spanning-tree status of eth2 of CB1:

```
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% eth2: Port Number 4 - Ifindex 4 - Port Id 8004 - Role Designated - State Forwarding
% eth2: Designated External Path Cost 0 -Internal Path Cost 0
% eth2: Configured Path Cost 20000 - Add type Explicit ref count 1
% eth2: Designated Port Id 8004 - CIST Priority 128 -
% eth2: CIST Root 800008002725e07a
% eth2: Regional Root 800008002725e07a
% eth2: Designated Bridge 800008002725e07a
% eth2: Message Age 0 - Max Age 20
```

```
% eth2: CIST Hello Time 2 - Forward Delay 15
% eth2: CIST Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
% eth2: forward-transitions 1
% eth2: Version Multiple Spanning Tree Protocol - Received None - Send MSTP
% eth2: No portfast configured - Current portfast off
% eth2: bpdu-guard default - Current bpdu-guard off
% eth2: bpdu-filter default - Current bpdu-filter off
% eth2: no root guard configured - Current root guard off
% eth2: Configured Link Type point-to-point - Current point-to-point
% eth2: No auto-edge configured - Current port Auto Edge off
```

Spanning-tree status of eth1 of PEB1 :

```
% eth1: Port Number 4 - Ifindex 4 - Port Id 2fff - Role Disabled - State Forwarding
% eth1: Designated Path Cost 0
% eth1: Configured Path Cost 20000 - Add type Explicit ref count 1
% eth1: Designated Port Id 2fff - Priority 32 -
% eth1: Message Age 0 - Max Age 20
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
% eth1: forward-transitions 2
% eth1: Version Rapid Spanning Tree Protocol - Received None - Send RSTP
% eth1: No portfast configured - Current portfast off
% eth1: bpdu-guard default - Current bpdu-guard off
% eth1: bpdu-filter default - Current bpdu-filter off
% eth1: no root guard configured - Current root guard off
% eth1: Configured Link Type point-to-point - Current point-to-point
% eth1: No auto-edge configured - Current port Auto Edge off
```

Note: Configuration for other protocols is same as the above example. It should be configured for either of the following tunnel, peer, or discard as per MEF 6.1.1

CHAPTER 8 User Network Interface Configuration

This chapter contains a complete sample User Network Interface (UNI) configuration.

Topology

Figure 8-1 displays what you want to accomplish after you are finished with the sample configuration.

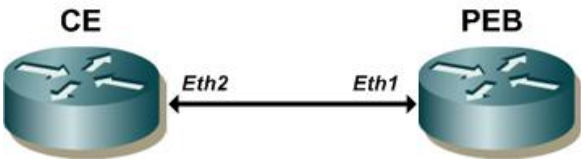


Figure 8-1: Simple UNI Configuration

CFM Convergence on UNI-MEG

The following steps describe how to configure Connectivity Fault Management (CFM) convergence on a UNI-MEG (Maintenance Entity Group).

CE

Do the following to configure a customer edge (CE):

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Configure bridge 1 as RSTP-VLAN aware.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure eth1 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to an interface.
(config-if)#switchport mode trunk	Configure port as a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all the VLANs on the Eth1 interface.
(config-if)#exit	Exit the eth1 interface mode.
(config)#ethernet cfm domain-name type character-string name test level 0 mip-creation default bridge 1	Enter CFM mode and create a domain at level 0 on bridge 1.
(config-ether-cfm)#service ma-type integer ma-name 13	Create a service ID.
(config-ether-cfm)#mep crosscheck mpid 11	Configure crosscheck between host MEP and the remote MEP.
(config-ether-cfm)#exit	Exit domain configuration mode.
(config)#interface eth1	Enter interface mode.

(config-if)#ethernet cfm mep down mpid 10 active true domain abc uni-mep bridge 1	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP).
(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config)#exit	Exit interface mode.

PEB

Do the following to configure a provider edge bridge (PEB):

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-rstp edge	Configure bridge 1 as RSTP-VLAN aware.
(config)#cvlan registration table map1 bridge 1	Configure the CVLAN registration table map1 on bridge 1.
(config-cvlan-registration)#cvlan 1 svlan 1	Map CVLAN 1 to SVLAN 1.
(config-cvlan-registration)#exit	Exit the Configure CVLAN registration mode.
(config)#interface eth1	Go to Interface mode.
(config-if)#switchport	Configure eth1 as a layer2 port.
(config-if)#bridge-group 1	Associates the eth1 interface with bridge 1.
(config-if)#switchport mode customer-edge hybrid	Configure port as a customer-edge hybrid.
(config-if)#switchport customer-edge hybrid allowed vlan all	Allow all VLANs on the eth1 interface.
(config-if)#switchport customer-edge vlan registration map1	Associate map1 with the interface.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm domain-name type character-string name abc level 0 mip- creation default bridge 1	Enter CFM mode and create a domain at level 0 on bridge 1.
(config-ether-cfm)#service ma-type integer ma-name 13	Create a service ID.
(config-ether-cfm)#mep crosscheck mpid 10	Configure crosscheck between host MEP and the remote MEP.
(config-ether-cfm)#exit	Exit the ether-cfm Config mode.
(config)#interface eth1	Enter interface mode.
(config)#PEB1 (config-if)#ethernet cfm mep down mpid 11 active true domain abc uni-mep bridge 1	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP).
(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.

Validation

Enter the commands listed in the sections below to confirm the configurations.

```
#show ethernet cfm maintenance-points remote domain abc bridge 1
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
11	0	0	Yes	0007.e9a5.61c1	False	Configured

Provider Edge Bridge

Do the following to configure a Provider Edge Bridge (PEB):

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-mstp edge	Configure bridge 1 as a provider-MSTP edge.
(config)#vlan database	Enter the VLAN configure mode.
(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure customer VLAN 2 and associate with bridge 1.
(config-vlan)#vlan 4 type customer bridge 1 state enable	Configure customer VLAN 4 and associate with bridge 1.
(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure service VLAN 3 and associate with bridge 1.
(config-vlan)#vlan 5 type service multipoint-multipoint bridge 1 state enable	Configure service VLAN 5 and associate with bridge 1.
(config-vlan)#exit	Exit the VLAN configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table map1 on bridge 1.
(config-cvlan-registration)#cvlan 2 svlan 4	Map CVLAN 2 to SVLAN 4.
(config-cvlan-registration)#cvlan 3 svlan 5	Map CVLAN 3 to SVLAN 5.
(config-cvlan-registration)#exit	Exit configure CVLAN registration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure the eth1 interface as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode customer-edge hybrid	Configure port as a customer-edge hybrid.
(config-if)#switchport customer-edge hybrid allowed vlan all	Allow all VLANs on the eth1 interface.
(config-if)#switchport customer-edge vlan registration map1	Associate map1 with the eth1 interface.
(config-if)#exit	Exit interface mode
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure the eth2 interface as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to an interface.
(config-if)#switchport mode provider-network	Configure port as a provider-network.

(config-if)#switchport provider-network allowed vlan all	Allow all the VLANs created on the Eth2 interface.
(config-if)#exit	Exit interface mode
(config)#interface eth1	Enter interface mode.
(config-if)#ingress-policing uni cir 1	Configure the ingress-policing committed information rate to 1.
(config-if)#ingress-policing uni cbs 1500	Configure the ingress-policing committed burst size to 1500.
(config-if)#ingress-policing uni eir 2	Configure the ingress-policing excess information rate to 2.
(config-if)#ingress-policing uni ebs 3000	Configure the ingress-policing excess burst size to 3000.
(config-if)#ingress-policing uni coupling-flag enable	Enable the ingress-policing coupling flag.
(config-if)#ingress-policing uni color-mode color-aware	Configure the ingress-policing color mode to color-aware.
(config-if)#ingress-policing uni active	Activate the egress-shaping excess information rate.
(config-if)#egress-shaping uni cir 1	Configure the egress-shaping committed information rate to 1.
(config-if)#egress-shaping uni cbs 1500	Configure the egress-shaping committed burst size to 1500.
(config-if)#egress-shaping uni eir 2	Configure the egress-shaping excess information rate to 2.
(config-if)#egress-shaping uni ebs 3000	Configure the egress-shaping excess burst size to 3000.
(config-if)#egress-shaping uni coupling-flag enable	Enable the egress-shaping coupling flag.
(config-if)#egress-shaping uni color-mode color-aware	Configure the egress-shaping color mode to color-aware.
(config-if)#egress-shaping uni active	Activate egress-shaping.
(config-if)#exit	Exit interface mode.

Provider Edge Bridge

Do the following to configure a Provider Edge Bridge (PEB):

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-mstp edge	Configure bridge 1 as a provider-MSTP edge.
(config)#vlan database	Enter the VLAN configure mode.
(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure customer VLAN 2 and associate with bridge 1.
(config-vlan)#vlan 4 type customer bridge 1 state enable	Configure customer VLAN 4 and associate with bridge 1.
(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure service VLAN 3 and associate with bridge 1.
(config-vlan)#vlan 5 type service multipoint-multipoint bridge 1 state enable	Configure service VLAN 5 and associate with bridge 1
(config-vlan)##ethernet svlan 3 evc-id serv3 bridge 1	Configure EVC-ID for SVLAN 3.
(config-vlan)#ethernet svlan 5 evc-id serv5 bridge 1	Configure EVC-ID for SVLAN 5.

<code>(config-vlan)#exit</code>	Exit the VLAN configure mode.
<code>(config)#cvlan registration table map1 bridge 1</code>	Configure CVLAN registration table map1 on bridge 1.
<code>(config-cvlan-registration)#cvlan 2 svlan 4</code>	Map CVLAN 2 to SVLAN 4.
<code>(config-cvlan-registration)#cvlan 3 svlan 5</code>	Map CVLAN 3 to SVLAN 5.
<code>(config-cvlan-registration)#exit</code>	Exit configure CVLAN registration mode.
<code>(config)#interface eth1</code>	Enter interface mode.
<code>(config-if)#switchport</code>	Configure the eth1 interface as a layer 2 port.
<code>(config-if)#bridge-group 1</code>	Associate bridge to interface.
<code>(config-if)#switchport mode customer-edge hybrid</code>	Configure port as a customer-edge hybrid.
<code>(config-if)#switchport customer-edge hybrid allowed vlan all</code>	Allow all VLANs on the Eth1 interface.
<code>(config-if)#switchport customer-edge vlan registration map1</code>	Associate map1 with the Eth1 interface.
<code>(config-if)#exit</code>	Exit interface mode
<code>(config)#interface eth2</code>	Enter interface mode.
<code>(config-if)#switchport</code>	Configure the eth2 interface as a layer 2 port.
<code>(config-if)#bridge-group 1</code>	Associate bridge to an interface.
<code>(config-if)#switchport mode provider-network</code>	Configure port as a provider-network.
<code>(config-if)#switchport provider-network allowed vlan all</code>	Allow all the VLANs created on the Eth2 interface.
<code>(config-if)#exit</code>	Exit interface mode
<code>(config)#interface eth1</code>	Enter interface mode.

Provider Edge Bridge

Do the following to configure a Provider Edge Bridge (PEB):

<code>#configure terminal</code>	Enter configure mode.
<code>(config)#bridge 1 protocol provider-mstp edge</code>	Configure bridge 1 as a provider-MSTP edge.
<code>(config)#vlan database</code>	Enter the VLAN configure mode.
<code>(config-vlan)#vlan 2 type customer bridge 1 state enable</code>	Configure customer VLAN 2 and associate with bridge 1.
<code>(config-vlan)#vlan 4 type customer bridge 1 state enable</code>	Configure customer VLAN 4 and associate with bridge 1.
<code>(config-vlan)#vlan 3 type service point-point bridge 1 state enable</code>	Configure service VLAN 3 and associate with bridge 1.
<code>(config-vlan)#vlan 5 type service multipoint-multipoint bridge 1 state enable</code>	Configure service VLAN 5 and associate with bridge 1
<code>(config-vlan)##ethernet svlan 3 evc-id serv3 bridge 1</code>	Configure EVC-ID for SVLAN 3.
<code>(config-vlan)#ethernet svlan 5 evc-id serv5 bridge 1</code>	Configure EVC-ID for SVLAN 5.
<code>(config-vlan)#exit</code>	Exit the VLAN configure mode.

(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table map1 on bridge 1.
(config-cvlan-registration)#cvlan 2 svlan 4	Map CVLAN 2 to SVLAN 4.
(config-cvlan-registration)#cvlan 3 svlan 5	Map CVLAN 3 to SVLAN 5.
(config-cvlan-registration)#exit	Exit configure CVLAN registration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure the Eth1 interface as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode customer-edge hybrid	Configure port as a customer-edge hybrid.
(config-if)#switchport customer-edge hybrid allowed vlan all	Allow all VLANs on the Eth1 interface.
(config-if)#switchport customer-edge vlan registration map1	Associate map1 with the Eth1 interface.
(config-if)#exit	Exit interface mode
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure the Eth2 interface as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to an interface.
(config-if)#switchport mode provider-network	Configure port as a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all the VLANs created on the Eth2 interface.
(config-if)#exit	Exit interface mode
(config)#interface eth1	Enter interface mode.
(config-if)#exit	Exit interface mode.

EVC ID, UNI EVC ID, UNI ID and UNI List service attributes

The following steps describe configuration for EVC ID, UNI EVC ID, UNI Identifier and UNI List service attributes.

PEB

Do the following to configure a Provider Edge Bridge (PEB):

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-mstp edge	Configure bridge 1 as a provider-MSTP edge.
(config)#vlan database	Enter the VLAN configure mode.
(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure customer VLAN 2 and associate with bridge 1.
(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure service VLAN 3 and associate with bridge 1.
(config-vlan)#vlan 4 type customer bridge 1 state enable	Configure customer VLAN 4 and associate with bridge 1.
(config-vlan)#vlan 5 type service multipoint-multipoint bridge 1 state enable	Configure service VLAN 5 and associate with bridge 1

<code>(config-vlan)#exit</code>	Exit the VLAN configure mode.
<code>(config)#cvlan registration table map1 bridge 1</code>	Configure CVLAN registration table map1 on bridge 1.
<code>(config-cvlan-registration)#cvlan 2 svlan 3</code>	Map CVLAN 2 to SVLAN 3.
<code>(config-cvlan-registration)#exit</code>	Exit configure CVLAN registration mode.
<code>(config)#interface eth1</code>	Enter interface mode.
<code>(config-if)#switchport</code>	Configure the Eth1 interface as a layer 2 port.
<code>(config-if)#bridge-group 1</code>	Associate bridge to interface.
<code>(config-if)#switchport mode customer-edge hybrid</code>	Configure port as a customer-edge hybrid.
<code>(config-if)#switchport customer-edge hybrid allowed vlan all</code>	Allow all VLANs on the eth1 interface.
<code>(config-if)#switchport customer-edge vlan registration map1</code>	Associate map1 with the eth1 interface.
<code>(config-if)#exit</code>	Exit interface mode
<code>(config)#interface eth2</code>	Enter interface mode.
<code>(config-if)#switchport</code>	Configure the eth2 interface as a layer 2 port.
<code>(config-if)#bridge-group 1</code>	Associate bridge to an interface.
<code>(config-if)#switchport mode provider-network</code>	Configure port as a provider-network.
<code>(config-if)#switchport provider-network allowed vlan all</code>	Allow all the VLANs created on the Eth2 interface.
<code>(config-if)#exit</code>	Exit interface mode
<code>(config)#vlan database</code>	Enter the VLAN configure mode.
<code>(config-vlan)#ethernet svlan 3 evc-id svlan3 bridge 1</code>	Configure an EVC-ID for SVLAN 3.
<code>(config-vlan)#exit</code>	Exit VLAN the configure mode.
<code>(config)#interface eth1</code>	Enter interface mode.
<code>(config-if)#ethernet uni id uni1</code>	Configure a UNI ID.
<code>(config-if)#exit</code>	Exit interface mode

Validation

Enter the commands listed in the sections below to confirm the configurations.

```
#show ethernet uni evc-id bridge 1
-----
Bridge-name Interface-name UNI-ID, EVC-ID
-----
1           eth1           uni1,svlan3

#show ethernet uni list bridge 1
% Bridge-name      VLAN-ID Interface-name UNI-LIST
% =====
% 1                3      eth1           uni-eth,Root
```

MEF 10.2 Configuration

This section shows how to enable MEF10.2 on a bridge and interface.

MEF 10.2 introduced the concept of a rooted-multipoint EVC as shown in [Figure 8-2](#).

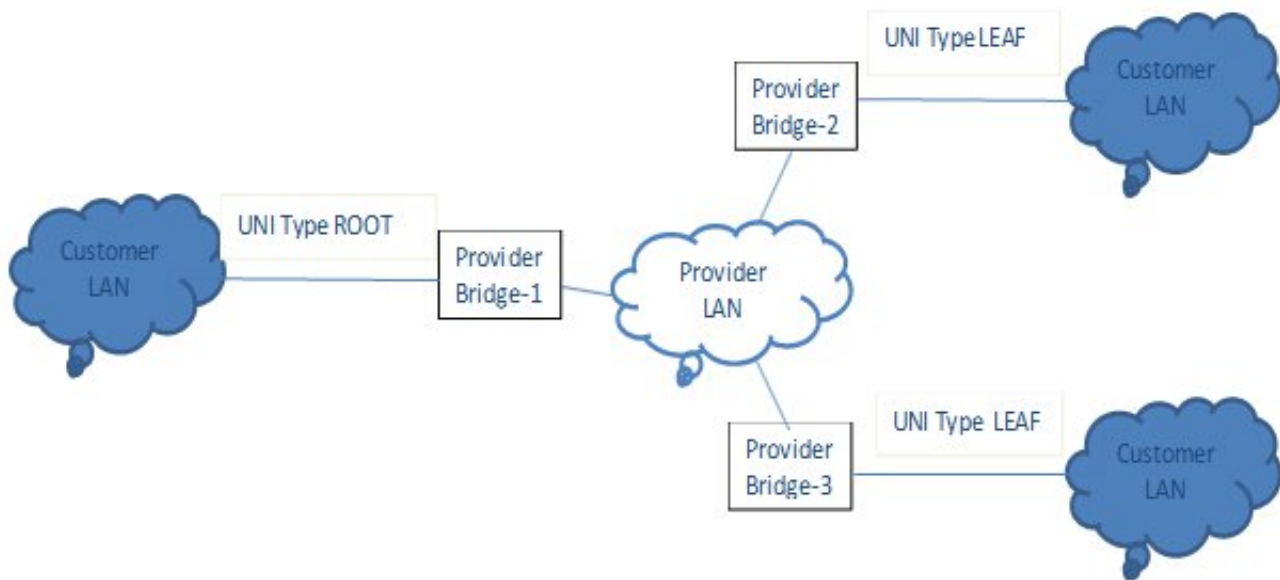


Figure 8-2: Rooted Multipoint EVC

The User Network Interface (UNI) is the physical demarcation point between the responsibility of the Service Provider and the responsibility of the Subscriber. An Ethernet Virtual Connection (EVC) is an association of two or more UNIs. A given UNI can support more than one EVC via the Service Multiplexing attribute.

There are three types of EVCs:

- In a point-to-point EVC, exactly two UNIs are associated with one another.
- In a multipoint EVC, two or more UNIs are associated with one another
- In a rooted-multipoint EVC, one or more of the UNIs must be designated as root and each of the other UNIs must be designated as a leaf. If root, the UNI can send service frames to all other points in the EVC; if leaf, the UNI can send and receive service frames to and from root only.

Topology



Zebos1

Figure 8-3: Provider Bridge

Ethernet Service Attributes Configuration

Zebos1

These commands enable the rooted multipoint EVC on the bridge and UNI creation on the port. All default values will be set.

#configure terminal	Enter Configure Mode
(config)#bridge 32 protocol provider-mstp edge	Create bridge as provider edge bridge
(config)#vlan database	Enables ETS on the bridge
(config-vlan)#vlan 4 type service rooted-multipoint bridge 32 name VLAN4 state enable	Configure VLAN service as rooted multipoint
(config-vlan)#ethernet svlan 4 evc-id EVC4 bridge 32	Create EVC id for configured rooted multipoint service VLAN
(config-vlan)#exit	Exit VLAN mode
(config)#interface eth1	Configure interface eth1
(config-if)#switchport	Configure eth1 as a Layer 2 port
(config-if)#bridge-group 32	Configure eth1 in bridge group 1
(config-if)#ethernet uni id test1 type leaf evc-id EVC4	Configure UNI type as a leaf of a rooted multipoint EVC

Validation

1. Verify the Ethernet service attribute configurations on the interface.

```
#show ethernet uni evc attributes interface eth1
```

```
% Interface Name - eth1
% -----
%  UNI - ID          |UNI Type|EVC-ID          |S-VLAN-ID
% =====
% test1              |leaf    |EVC4             |4
% =====
% MAX - EVC - 4094
```

2. Verify the Ethernet service attribute configurations for rooted multipoint EVC using the EVC identifier.

```
#show ethernet uni evc attributes evc-id EVC4 bridge 32
```

```
% Bridge name - 32
% -----
% EVC-ID        - EVC4
% EVC Type      - rooted-multipoint
% UNI List (UNI-ID, UNI-Type)
% -----
% test1, Leaf
% -----
% MAX UNI      - 0
% CE-VLAN Preservation - no
```

3. Verify the Ethernet service attribute UNI details for rooted multipoint EVC using the service VLAN.

```
#show ethernet uni list svlan 4 bridge 32
```

```
% Bridge-name      VLAN-ID Interface-name UNI-LIST
```

```
% =====
% 32          4          eth1          test1, Leaf
```

4. Verify the UNI details on the bridge.

```
#show ethernet uni list bridge 32
% Bridge-name      VLAN-ID Interface-name UNI-LIST
% =====
% 32                1          eth1          test1,
% 32                4          eth1          test1, Leaf
```

Zebos1

#configure terminal	Enter Configure Mode
(config)#bridge 32 protocol provider-mstp edge	Create bridge as provider edge bridge
(config)#vlan database	Enables ETS on the bridge
(config-vlan)#vlan 4 type service rooted-multipoint bridge 32 name VLAN4 state enable	Configure VLAN service as rooted multipoint
(config-vlan)#ethernet svlan 4 evc-id EVC4 bridge 32	Create EVC id for configured rooted multipoint service VLAN
(config-vlan)#exit	Exit VLAN mode
(config)#interface eth1	Configure interface eth1
(config-if)#switchport	Configure eth1 as a Layer 2 port
(config-if)#bridge-group 32	Configure eth1 in bridge group 1
(config-if)#ethernet uni id test1 type leaf evc-id EVC4	Configure UNI type as leaf for configured rooted-multipoint EVC
(config-if)#l2protocol (stp gvrp mvrp dot1x lacp) tunnel vlan 4 cos-id 100	Assign a CoS identifier to a group of L2 protocols

MEF 10.2 Configuration

This section shows how to enable MEF10.2 on a bridge and interface.

The User Network Interface (UNI) is the physical demarcation point between the responsibility of the Service Provider and the responsibility of the Subscriber. An Ethernet Virtual Connection (EVC) is an association of two or more UNIs. A given UNI can support more than one EVC via the Service Multiplexing attribute.

There are three types of EVCs:

- In a point-to-point EVC, exactly two UNIs are associated with one another.
- In a multipoint EVC, two or more UNIs are associated with one another.
- In a rooted-multipoint EVC, one or more of the UNIs must be designated as root and each of the other UNIs must be designated as a leaf. If root, the UNI can send service frames to all other points in the EVC; if leaf, the UNI can send and receive service frames to and from root only.

MEF 10.2 introduced the concept of a rooted-multipoint EVC as shown in [Figure 8-4](#).

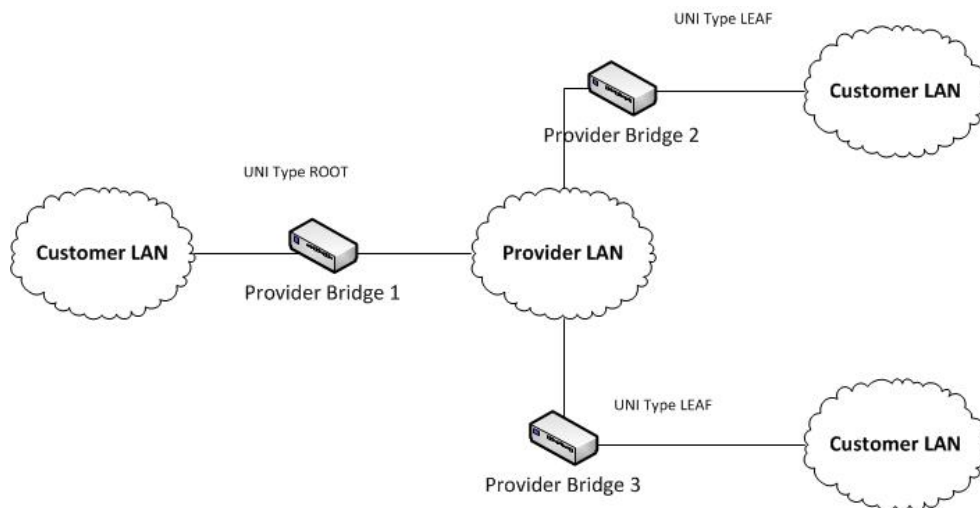


Figure 8-4: Rooted Multipoint EVC

Topology



Figure 8-5: Provider Bridge

Ethernet Service Attributes Configuration

Zebos1

These commands enable the rooted multipoint EVC on the bridge and UNI creation on the port. All default values will be set.

#configure terminal	Enter Configure Mode
(config)#bridge 32 protocol provider- mstp edge	Create bridge as provider edge bridge
(config)#vlan database	Enables ETS on the bridge
(config-vlan)#vlan 4 type service rooted-multipoint bridge 32 name VLAN4 state enable	Configure VLAN service as rooted multipoint
(config-vlan)#ethernet svlan 4 evc-id EVC4 bridge 32	Create EVC id for configured rooted multipoint service VLAN
(config-vlan)#exit	Exit VLAN mode
(config)#interface eth1	Configure interface eth1
(config-if)#switchport	Configure eth1 as a Layer 2 port
(config-if)#bridge-group 32	Configure eth1 in bridge group 1
(config-if)#ethernet uni id test1 type leaf evc-id EVC4	Configure UNI type as a leaf of a rooted multipoint EVC

Frame Delay Measurement

This section shows how to enable Frame Delay Measurement on a bridge and interface.

One Way ETH-DM Configurations

Zebos1

#configure terminal	Enter Configure Mode on RTR1
(config)#ethernet cfm domain-name type character-string name MD1 level 3 mip-	Create domain-name, level & mip on RTR1
(config)# mep mpid 1 vlan 2	Associate mpid to vlan on RTR1
(config-vlan)# ldm unicast rmpid 2 duration 20 interval 3	Enable 1 dm on RTR1
(config-vlan)# exit	Exit the mode
#configure terminal	Enter Configure Mode
(config-vlan)# ethernet cfm domain-name type character-string name MD1 level 3 mip-	Create domain-name, level & mip on RTR2
(config-vlan)# mep mpid 2 vlan 2	Associate mpid to vlan on RTR2
(config)# ldm receive duration 10	Receive the time stamp on other RTR2

Validation

```

rtr4(config-cfm-mep)#lrm receive duration 10
Host MEP : 2
Remote MEP : 1
frame delay measurement = 11516548603397031321
frame delay measurement = 11516548603397031322   frame delay variation = 1
frame delay measurement = 11516548603397031323   frame delay variation = 1
frame delay measurement = 11516548603397031324   frame delay variation = 1
frame delay measurement = 11516548603397031325   frame delay variation = 1
frame delay measurement = 11516548603397031326   frame delay variation = 1
frame delay measurement = 11516548603397031327   frame delay variation = 1
frame delay measurement = 11516548603397031328   frame delay variation = 1
frame delay measurement = 11516548603397031329   frame delay variation = 1
frame delay measurement = 11516548603397031330   frame delay variation = 1
rtr4(config-cfm-mep)#end

```

Two Way ETH-DM Configurations

Zebos1

#configure terminal	Enter Configure Mode on RTR1
(config)#ethernet cfm domain-name type character-string name MD1 level 3 mip-	Create domain-name, level & mip on RTR1
(config)# mep mpid 1 vlan 2	Associate mpid to vlan on RTR1
(config-vlan)# lrm unicast rmpid 2 duration 20 interval 3	Enable 1 dm on RTR1
(config-vlan)# exit	Exit the mode
#configure terminal	Enter Configure Mode
(config-vlan)# ethernet cfm domain-name type character-string name MD1 level 3	Create domain-name, level & mip on RTR2
(config-vlan)# mep mpid 2 vlan 2	Associate mpid to vlan on RTR2
(config)# dmm unicast rmpid 2 duration 10	Receive the time stamp on other RTR2

Validation

```

rtr1(config-cfm-mep)#dmm unicast rmpid 2 duration 10 interval 3^M^M
Total number of DMM sent = 10
Host MEP : 1
Delay Measurement for each frame sent is as follows
Frame Number 1
frame delay measurement = 0
Frame Number 2
frame delay measurement = 0
Frame Number 3
frame delay measurement = 0
Frame Number 4

```

```
frame delay measurement = 0
Frame Number 5
frame delay measurement = 0
Frame Number 6
frame delay measurement = 0
Frame Number 7
frame delay measurement = 0
Frame Number 8
frame delay measurement = 0
Frame Number 9
frame delay measurement = 0
Frame Number 10
frame delay measurement = 0
```

DVM Configurations

Zebos1

#configure terminal	Enter Configure Mode on RTR1
(config)#ethernet cfm domain-name type character-string name MD1 level 3 mip-creation default	Create domain-name, level & mip on RTR1
(config)# mep mpid 1 vlan 2	Associate mpid to vlan on RTR1
(config)# dvm multicast rmpid 1 duration 30	Receive the time stamp on other RTR2

Validation

```
rtr4(config-cfm-mep)#l2m receive duration 10
Host MEP : 2
Remote MEP : 1
frame delay measurement = 11516548603397042623
frame delay measurement = 11516548603397042624   frame delay variation = 1
frame delay measurement = 11516548603397042625   frame delay variation = 1
frame delay measurement = 11516548603397042626   frame delay variation = 1
frame delay measurement = 11516548603397042627   frame delay variation = 1
frame delay measurement = 11516548603397042628   frame delay variation = 1
frame delay measurement = 11516548603397042629   frame delay variation = 1
frame delay measurement = 11516548603397042630   frame delay variation = 1
frame delay measurement = 11516548603397042631   frame delay variation = 1
```

CHAPTER 9 Provider Backbone Bridging Configuration

This chapter contains complete examples of Provider Backbone Bridging configurations.

Note: Provider Backbone Bridging is not supported for ZebIC releases.

Provider Backbone Bridging (PBB), as specified in IEEE 802.1ah/Draft 4.1, provides a network operator with an Ethernet backbone for its (PB) Provider Bridge-based Ethernet service access network. Frames sent across a PBB network are encapsulated with an additional backbone MAC header with backbone MAC addresses, and a B-VLAN tag space independent of attached customer networks. Each customer service frame is recognized by a service instance ID (I-SID). The Ethernet Virtual Circuit (EVC) is recognized by the Service VLAN (S-VLAN). Packets through the provider network are doubly tagged. The Enhanced Internal Sub-layer Services (EISS) have been extended to support the PBB I- and B-component architecture.

Topology

Figure 9-1 displays a simple PBB Configuration topology.

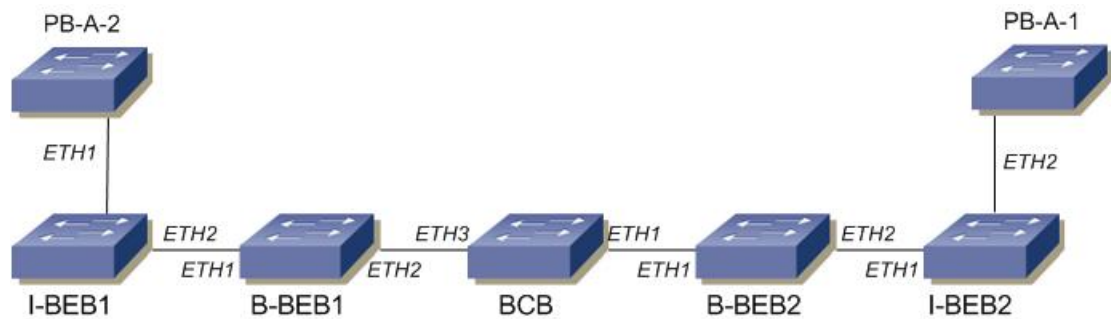


Figure 9-1: Provider Backbone Bridging Topology

Legend

The following table is the legend for Figure 9-1:

PB-A	Provider Bridges
I_BEB	I-BEB provider backbone bridge
B_BEB	B-BEB provider backbone bridge
BCB	Backbone Core Bridge

I_BEB1

I_BEB1#configure terminal	Enter configure mode.
I_BEB1(config)#bridge beb mac 0001.0001.0001 1 protocol provider-mstp	Configure bridge as a beb (backbone edge bridge).

Provider Backbone Bridging Configuration

I_BEB1(config)#spanning-tree mode provider-rstp	Configure spanning tree mode as RSTP.
I_BEB1(config)#bridge CNP-3 priority 61440	Assigning priority to bridge.
I_BEB1(config)#vlan database	Enter VLAN configure mode.
I_BEB1(config-vlan)#vlan 3 type service point-point bridge 1 name ipi3	Configure S-VLAN 3 as a service type and associate it with a name ipi3.
I_BEB1(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure S-VLAN 3 as a service type and associate it with bridge 1.
I_BEB1(config-vlan)#exit	Exit VLAN configure mode.
I_BEB1(config)#pbb isid list	Enter the service instance configure mode.
I_BEB1(pbb-isid)#isid 1 name isid1 i-component 1	Configure instance 1 on I-component bridge 1 with name isid1. Creates a VIP port for the service instance.
iI_BEB1(pbb-isid)#exit	Exit service instance configure mode.
I_BEB1(config)#interface eth1	Enter interface mode.
I_BEB1(config-if)#no shutdown	Administratively shut down the interface.
I_BEB1(config-if)#switchport	Configure eth1 as a Layer 2 port.
I_BEB1(config-if)#bridge-group 1	Associate the eth1 with bridge group 1.
I_BEB1(config-if)#switchport mode cnp	Configure eth1 as a cnp (customer network port).
I_BEB1(config-if)#switchport beb vlan 3 cnp	Associate B-VLAN 3 with eth1.
I_BEB1(config-if)#switchport beb customer-network svlan add 3 instance 1 egress-port eth2	Configure SVLAN to service instance mapping, and specify an egress port for the service instance.
I_BEB1(config-if)#exit	Exit interface mode
I_BEB1(config)#interface eth2	Enter interface mode.
I_BEB1(config-if)#no shutdown	Administratively shut down the interface.
I_BEB1(config-if)#switchport	Configure eth2 as a Layer 2 port.
I_BEB1(config-if)#bridge-group 1	Associate the eth2 with bridge group 1.
I_BEB1(config-if)#switchport mode pip	Configure the interface as a pip (provider instance port).
I_BEB1(config-if)#switchport beb vlan 3 pip	Configure the interface as a pip (provider instance port).
I_BEB1(config-if)#switchport beb pip backbone-source-mac 0003.ffc7.cada	Configure MAC 0003.ffc7.cad for pip.
I_BEB1(config-if)#switchport beb vip instance 1 allowed all	Map ISID to allow all ingress and egress frames with ISID 1.
I_BEB1(config-if)#exit	Exit interface mode.
I_BEB1(config)#interface eth3	Enter interface mode.
I_BEB1(config-if)#shutdown	Shut down the interface.
I_BEB1(config-if)#exit	Exit interface mode.

Validation

The following commands display the state of service instance 1 and service instance 2:

```
I_BEB1#show beb bridge 1
Interface name       : eth1
Switchport mode     : cnp
```

```
Interface name      : eth2
Switchport mode    : pip
```

The following command on I_BEB1 displays CNP details for bridge 1:

```
I_BEB1#show beb bridge 1 cnp
CNP configuration for bridge 1
=====
Interface  ServiceType ServiceID ServiceName svlans
=====
eth1      SvlanBased 1      isid1  3 to 3
```

The following command on I_BEB1 displays PIP configuration for bridge 1:

```
I_BEB1#show beb bridge 1 pip
PIP configuration for bridge 1
=====
icompid port_num port_name
=====
1      4      eth2
```

The following command on I_BEB1 displays VIP configuration for bridge 1:

```
show beb bridge 1 vip
VIP configuration for bridge 1
=====
Interface  Instance InstanceName def-DBMAC status
=====
1          1      isid1  011e.8300.0001 Not Dispatched
```

The following command on I_BEB1 displays VLAN information for bridge 1:

```
I_BEB1#show beb bridge 1 vlan
Service VLANs
Bridge      VLAN ID  Name              State  Member ports
=====
1           1      default          ACTIVE
Service VLANs
Bridge      VLAN ID  Name              State  Member ports
=====
1           3      ipi3             ACTIVE  eth1eth2
```

B_BEB1

B_BEB1#configure terminal	Enter configure mode.
B_BEB1(config)#spanning-tree mode provider-rstp	Configure spanning tree mode as RSTP.
B_BEB1(config)#bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure bridge as a beb (backbone edge bridge).
B_BEB1(config)#vlan database	Enter VLAN configure mode.
B_BEB1(config-vlan)#vlan 3 type backbone point-point name ipi3	Configure S-VLAN 3 as a backbone and associate it with a name ipi3.
B_BEB1(config-vlan)#vlan 3 type backbone point-point state enable	Configure BVLAN 3 as a backbone VLAN and associate it with backbone.
B_BEB1(config-vlan)#exit	Exit VLAN configure mode.
B_BEB1(config)#interface eth1	Enter interface mode.
B_BEB1(config-if)#no shutdown	Administratively shut down the interface.
B_BEB1(config-if)#switchport	Configure eth1 as a Layer 2 port.
B_BEB1(config-if)#bridge-group backbone	Associate eth1 with bridge backbone.
B_BEB1(config-if)#switchport mode cbp	Configure the interface as a cbp (customer backbone port).
B_BEB1(config-if)#switchport beb vlan 3 cbp	Associate B-VLAN 3 with eth1.
B_BEB1(config-if)#switchport beb customer-backbone instance add 1 bvlan 3	Configure SVLAN to service instance mapping for BVLAN 3
B_BEB1(config-if)#exit	Exit interface mode.
B_BEB1(config)#interface eth2	Enter interface mode.
B_BEB1(config-if)#no shutdown	Administratively shut down the interface.
B_BEB1(config-if)#switchport	Configure eth2 as a Layer 2 port.
B_BEB1(config-if)#bridge-group backbone	Associate eth2 with bridge backbone.
B_BEB1(config-if)#switchport mode pnp	Configure eth2 as a pnp (provider network port).
B_BEB1(config-if)#switchport beb vlan 3 pnp	Associate B-VLAN 3 with eth2.
B_BEB1(config-if)#switchport beb provider-network bvlan add 3	Associate BVLAN 3 with interface eth2. A BVLAN must be defined before a service instance can be mapped to transport over it.
B_BEB1(config-if)#exit	Exit interface mode.
B_BEB1(config)#interface eth3	Enter interface mode.
B_BEB1(config-if)#shutdown	Shut down the interface.
B_BEB1(config-if)#exit	Exit interface mode.

Validation

The following command on B_BEB1 displays backbone bridge details:

```
B_BEB1#show beb bridge backbone
Interface name      : eth1
```



```

Switchport mode      : cbp
Interface name       : eth2
Switchport mode      : pnp

```

The following command on B_BEB1 displays customer backbone port details:

```

B_BEB1#show beb bridge backbone cbp
Default vlan 3 customer-backbone
CBP configuration for backbone bridge
=====
Interface      BVID      Instance      status
=====
eth1  3      1      Not Dispatched

```

The following command on B_BEB1 displays backbone VLAN information:

```

B_BEB1#show beb bridge backbone vlan
Bridge          VLAN ID  Name          State      Member ports
=====
backbone        1        default      ACTIVE
Backbone VLANs
Bridge          VLAN ID  Name          State      Member ports
=====
backbone        3        ipi3          ACTIVE    eth1eth2

```

BCB

BCB#configure terminal	Enter configure mode.
BCB(config)#bridge 1 protocol provider-mstp	Configure bridge 1 as a provider bridge.
BCB(config)#spanning-tree mode provider-rstp	Configure spanning tree mode as RSTP.
BCB(config)#no data-center-bridging enable bridge 1	Disables data center bridging on bridge 1.
BCB(config)#no data-center-bridging enable	Disables data center bridging.
BCB(config)#bridge shutdown 1 bridge-forward	Configure BCB to forwarding mode.
BCB(config)#vlan database	Enter VLAN configure mode.
BCB(config-vlan)#vlan 3 type service point-point bridge 1 name ipi3	Configure S-VLAN 3 as a service type and associate it with a name ipi3.
BCB(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure S-VLAN 3 as a service type and associate it with bridge 1.
BCB(config-vlan)#exit	Exit the VLAN Database mode.
BCB(config)#interface eth1	Enter interface mode.
BCB(config-if)#no shutdown	Administratively shut down the interface.
BCB(config-if)#switchport	Configure eth1 as a Layer 2 port.

BCB(config-if)#bridge-group 1	Associate the eth1 with bridge group 1.
BCB(config-if)#switchport mode provider-network	Configure port as a provider-network.
BCB(config-if)#switchport provider-network allowed vlan add 3	Configure the provider-network port to allow SVLAN 3.
BCB(config-if)#exit	Exit interface mode.
BCB(config)#interface eth3	Enter interface mode.
BCB(config-if)#no shutdown	Administratively shut down the interface.
BCB(config-if)#bridge-group 1	Associate the eth3 with bridge group 1.
BCB(config-if)#switchport mode provider-network	Configure port as a provider-network.
BCB(config-if)#switchport provider-network allowed vlan add 3	Configure the provider-network port to allow SVLAN 3.
BCB(config-if)#exit	Exit interface mode.

B_BEB2

B_BEB2#configure terminal	Enter configure mode.
B_BEB2(config)#spanning-tree mode provider-rstp	Configure spanning tree mode as RSTP.
B_BEB2(config)#bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure bridge as a beb (backbone edge bridge).
B_BEB2(config)#vlan database	Enter VLAN configure mode.
B_BEB2(config-vlan)#vlan 3 type backbone point-point name ipi3	Configure S-VLAN 3 as a backbone and associate it with a name ipi3.
B_BEB2(config-vlan)#vlan 3 type backbone point-point state enable	Configure BVLAN 3 as a backbone VLAN and associate it with backbone.
B_BEB2(config-vlan)#exit	Exit VLAN configure mode.
B_BEB2(config)#interface eth1	Enter interface mode.
B_BEB2(config-if)#no shutdown	Administratively shut down the interface.
B_BEB2(config-if)#switchport	Configure eth1 as a Layer 2 port.
B_BEB2(config-if)#bridge-group backbone	Associate eth1 with bridge backbone.
B_BEB2(config-if)#switchport mode pnp	Configure eth1 as a pnp.
B_BEB2(config-if)#switchport beb vlan 3 pnp	Associate B-VLAN 3 with eth1.
B_BEB2(config-if)#switchport beb provider-network bvlan add 3	Associate BVLAN 3 with interface eth1. A BVLAN must be defined before a service instance can be mapped to transport over it.
B_BEB2(config-if)#exit	Exit interface mode.
B_BEB2(config)#interface eth2	Enter interface mode.
B_BEB2(config-if)#no shutdown	Administratively shut down the interface.
B_BEB2(config-if)#switchport	Configure eth2 as a Layer 2 port.
B_BEB2(config-if)#bridge-group backbone	Associate eth2 with bridge backbone.

B_BEB2(config-if)#switchport mode cbp	Configure the interface as a cbp (customer backbone port).
B_BEB2(config-if)#switchport beb vlan 3 cbp	Associate B-VLAN 3 with eth2.
B_BEB2(config-if)#switchport beb customer-backbone instance add 1 bvlan 3	Configure SVLAN to service instance mapping for BVLAN 3.
B_BEB2(config-if)#exit	Exit interface mode.

Validation

The following command on B_BEB2 displays the bridge details:

```
B_BEB2#show beb bridge backbone
Interface name      : eth1
Switchport mode    : pnp
Interface name      : eth2
Switchport mode    : cbp
```

The following command on B_BEB2 displays customer backbone port details:

```
B_BEB2#show beb bridge backbone cbp
Default vlan 3 customer-backbone
CBP configuration for backbone bridge
=====
Interface   BVID   Instance   status
=====
eth2  3    1    Not Dispatched
```

The following command on B_BEB2 displays VLAN information for the bridge:

```
B_BEB2#show beb bridge backbone vlan
Bridge      VLAN ID  Name                State  Member ports
=====
backbone    1        default            ACTIVE

Backbone VLANs
Bridge      VLAN ID  Name                State  Member ports
=====
backbone    3        ipi3               ACTIVE  eth1
```

I_BEB2

I_BEB2#configure terminal	Enter configure mode.
I_BEB2(config)#bridge beb mac 0001.0001.0001 1 protocol provider-mstp	Configure bridge as a beb (backbone edge bridge).

I_BEB2(config)#spanning-tree mode provider-rstp	Configure spanning tree mode as RSTP.
I_BEB1(config)#bridge CNP-4 priority 61440	Assigning priority to bridge.
I_BEB2(config)#vlan database	Enter VLAN configure mode.
I_BEB2(config-vlan)#vlan 3 type service point-point bridge 1 name ipi3	Configure S-VLAN 3 as a service type and associate it with a name ipi3.
I_BEB2(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure S-VLAN 3 as a service type and associate it with bridge 1.
I_BEB1(config)#pbb isid list	Enter the service instance configure mode.
I_BEB1(pbb-isid)#isid 1 name isid1 i-component 1	Configure instance 1 on I-component bridge 1 with name isid1. Creates a VIP port for the service instance.
I_BEB1(pbb-isid)#exit	Exit service instance configure mode.
I_BEB2(config-vlan)#exit	Exit the VLAN Database mode.
I_BEB2(config)#interface eth1	Enter interface mode.
I_BEB2(config-if)#no shutdown	Administratively shut down the interface.
I_BEB2(config-if)#switchport	Configure eth2 as a Layer 2 port.
I_BEB2(config-if)#bridge-group 1	Associate the eth1 with bridge group 1.
I_BEB2(config-if)#switchport mode pip	Configure the interface as a pip (provider instance port).
I_BEB2(config-if)#switchport beb vlan 3 pip	Associate B-VLAN 3 with eth1.
I_BEB2(config-if)#switchport beb pip backbone-source-mac 0003.ff7e.20d4	Configure 0003.ff7e.20d4 for pip.
I_BEB2(config-if)#switchport beb vip instance 1 allowed all	Map ISID to allow all ingress and egress frames with ISID 1.
I_BEB2(config-if)#exit	Exit interface mode.
I_BEB2(config)#interface eth2	Enter interface mode.
I_BEB2(config-if)#no shutdown	Administratively shut down the interface.
I_BEB2(config-if)#switchport	Configure eth2 as a Layer 2 port.
I_BEB2(config-if)#bridge-group 1	Associate the eth2 with bridge group 1.
I_BEB2(config-if)#switchport mode cnp	Configure the interface as a cnp (customer network port).
I_BEB2(config-if)#switchport beb vlan 3 cnp	Associate B-VLAN 3 with eth1.
I_BEB2(config-if)#switchport beb customer-network svlan add 3 instance 1 egress-port eth1	Configure SVLAN to service instance mapping, and specify an egress port for the service instance.
I_BEB2(config-if)#exit	Exit interface mode.
I_BEB2(config)#interface eth3	Enter interface mode.
I_BEB2(config-if)#shutdown	Shut down the interface.
I_BEB2(config-if)#exit	Exit interface mode.

Validation

The following command on I_BEB2 displays the bridge details:

```
I_BEB2#show beb bridge backbone
Interface name      : eth2
Switchport mode    : cnp
```

```
Interface name      : eth1
Switchport mode    : pip
```

The following command on I_BEB1 displays CNP details for bridge 1:

```
I_BEB2#show beb bridge 1 cnp
CNP configuration for bridge 1
=====
Interface  ServiceType ServiceID ServiceName svlans
=====
eth2      SvlanBased 1      isid1  3 to 3
```

The following command on I_BEB2 displays PIP configuration for bridge 1:

```
I_BEB2#show beb bridge 1 pip
PIP configuration for bridge 1
=====
icompid port_num port_name
=====
1      3      eth1
```

The following command on I_BEB2 displays VIP configuration for bridge 1:

```
I_BEB_2#show beb bridge 1 vip
VIP configuration for bridge 1
=====
Interface  Instance InstanceName def-DBMAC status
=====
1          1          isid1  011e.8300.0001 Not Dispatched
```

The following command on I_BEB2 displays VLAN information for the bridge:

```
I_BEB2#show beb bridge 1 vlan
Service VLANs
Bridge      VLAN ID  Name      State  Member ports
=====
1           1      default  ACTIVE
Service VLANs
Bridge      VLAN ID  Name      State  Member ports
=====
1           3      ipi3      ACTIVE  eth2 eth1
```


CHAPTER 10 Ethernet Protection Switching Configuration

Ethernet Protection Switching (EPS) describes the specifics of protection switching for Ethernet VLAN signals. Protection switching is a fully allocated survivability mechanism, in the sense that the route and bandwidth of the protection entity is reserved for a selected working entity.

The configurations in this section relate to the simple topology below, and are for creating and configuring an Ethernet Protection Switching group.

Topology

Figure 10-1 displays a simple EPS Configuration topology.

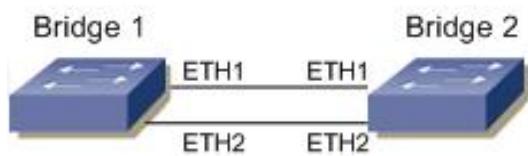


Figure 10-1: EPS Configuration Topology

Bridge 1

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol mstp	Add bridge1 to the multiple spanning tree (MST) table.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Enable the state of VLAN 2 on bridge 1 to allow forwarding of frames over VLAN 2 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#spanning-tree mst configuration	Enter MST configuration mode.
(config-mst)#bridge 1 instance 1 vlan 2	Create an instance of VLAN. VLANs must be created before being associating with an instance. If the VLAN range is not specified, the instance will not be created.
(config-mst)#exit	Exit MST configuration mode.
(config)#ethernet cfm domain-name type character-string name test level 3 mip-creation none bridge 1	Enter CFM mode and create domain test on bridge 1 at level 3.
(config-ether-cfm)#service ma-type string ma-name eps vlan 2 mip-creation none	Define a Maintenance Association (MA) for the domain created.
(config-ether-cfm)#mep crosscheck mpid 20 vlan 2 mac 0007.e9a5.1cc9	Configure crosscheck to the MEP at MAC address 0007.e9a5.1cc9.
(config-ether-cfm)#mep crosscheck mpid 21 vlan 2 mac 0007.e9a5.1cd8	Configure crosscheck to the MEP at MAC address 0007.e9a5.1cd9.
(config-ether-cfm)#exit	Exit CFM configuration mode.

Ethernet Protection Switching Configuration

(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure eth1 as switch port.
(config-if)#bridge-group 1	Associate the eth1 with bridge group 1.
(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface.
(config-if)#ethernet cfm mep down mpid 10 active true domain test vlan 2 bridge 1	Configure the interface as an MEP (Maintenance End Point).
(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure eth2 as switch port.
(config-if)#bridge-group 1	Associate interface eth2 with bridge group 1.
(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface.
(config-if)#ethernet cfm mep down mpid 11 active true domain test vlan 2 bridge 1	Configure the interface as an MEP.
(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#bridge 1 g8031 eps-id 10 working-port eth1 protection-port eth2 instance 3	Configure EPS protection group 10 with the working-port on eth1 and the protection-port on eth2.
(config)#g8031 configure vlan eps-id 10 bridge 1	Enter G8031 Configure VLAN mode.
(g8031-config-vlan)#g8031 vlan 2 primary	Configure VLAN 2 as primary.
(g8031-config-vlan)#exit	Exit G8031 Configure VLAN mode.
(config)#g8031 configure switching eps-id 10 bridge 1	Enter G8031 Configure Switching mode.
(g8031-config-switching)#g8031 mode bridging permanent restoration revertive	Configure the switching mode as permanent with restoration as revertive.
(g8031-config-switching)#g8031 ethernet md-name test service-id eps	Associate the EPS group to the CFM domain and MA created.
(g8031-config-switching)#exit	Exit G8031 Configure Switching mode.

Bridge 2

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol mstp	Add a bridge 1 to the MST table.
(config)#vlan database	Enter VLAN configure mode.

(config-vlan)#vlan 2 bridge 1 state enable	Enable the state of VLAN 2 on bridge 1 to allow forwarding of frames over VLAN 2 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#spanning-tree mst configuration	Enter MST configuration mode.
(config-mst)#bridge 1 instance 1 vlan 2	Create an instance of VLAN. VLANs must be created before being associating with an instance.
(config-mst)#exit	Exit MST configuration mode.
(config)#ethernet cfm domain-name type character-string name test level 3 mip-creation none bridge 1	Enter CFM mode and create domain test on bridge 1 at level 3.
(config-ether-cfm)#service ma-type string ma-name eps vlan 2 mip-creation none	Define an MA for the domain created.
(config-ether-cfm)#mep crosscheck mpid 10 vlan 2 mac 0007.e9a5.1c4d	Configure crosscheck to the MEP at MAC address 0007.e9a5.1c4d.
(config-ether-cfm)#mep crosscheck mpid 11 vlan 2 mac 0007.e9a5.1996	Configure crosscheck to the MEP at MAC address 0007.e9a5.1996.
(config-ether-cfm)#exit	Exit CFM configuration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure eth1 as switch port.
(config-if)#bridge-group 1	Associate the interface eth1 with bridge group 1.
(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface.
(config-if)#ethernet cfm mep down mpid 20 active true domain test vlan 2 bridge 1	Configure the interface as an MEP.
(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure eth2 as switch port.
(config-if)#bridge-group 1	Associate the interface eth2 with bridge group 1
(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
(config-if)#ethernet cfm mep down mpid 21 active true domain test vlan 2 bridge 1	Configure the interface as an MEP.
(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#bridge 1 g8031 eps-id 10 working-port eth1 protection-port eth2 instance 3	Configure EPS protection group 10 with the working-port on eth1 and the protection-port on eth2.
(config)#g8031 configure vlan eps-id 10 bridge 1	Enter the G8031 Configure VLAN mode.
(g8031-config-vlan)#g8031 vlan 2 primary	Configure the VLAN created as primary.

(g8031-config-vlan)#exit	Exit G8031 Configure VLAN mode.
(config)#g8031 configure switching eps-id 10 bridge 1	Enter G8031 Configure Switching mode.
(g8031-config-switching)#g8031 mode bridging permanent restoration revertive	Configure the switching mode as permanent with restoration as revertive.
(g8031-config-switching)#g8031 ethernet md-name test service-id eps	Associate the EPS group created to the CFM domain and MA created.
(g8031-config-switching)#exit	Exit G8031 Configure Switching mode.

Removing Ethernet Protection Switching

The configurations in this section relate to the same simple topology, and are for removing an Ethernet Protection Switching group.

Bridge 1

(config)#g8031 configure switching eps-id 10 bridge 1	Enter G8031 Configure Switching mode.
(config)#no g8031 ethernet md-name test service-id eps	Remove the association of EPS group 10 with the CFM domain and MA..
(g8031-config-switching)#no g8031 mode	Reconfigure the switching mode to no g8031 mode.
(g8031-config-switching)#exit	Exit G8031 Configure Switching mode.
(config)#no bridge 1 g8031 eps-id 10	Delete EPS protection group 10.

Bridge 2

(config)#g8031 configure switching eps-id 10 bridge 1	Enter G8031 Configure Switching mode.
(config)#no g8031 ethernet md-name test service-id eps	Remove the association of EPS group 10 with the CFM domain and MA..
(g8031-config-switching)#no g8031 mode	Reconfigure the switching mode to no g8031 mode.
(g8031-config-switching)#exit	Exit G8031 Configure Switching mode.
(config)#no bridge 1 g8031 eps-id 10	Delete EPS protection group 10.

CHAPTER 11 PBB-TE Configurations

The configurations in the chapter illustrate how to set up Provider Backbone Bridging Traffic Engineering with different network topologies. Examples are provided for Ethernet Switched Path, Automated Protection Switching, Unicast Connectivity Fault Management, and Multicast Connectivity Fault Management.

Note: Provider Backbone Bridging is not supported for ZebIC releases.

Ethernet Switched Path

These configurations are for setting up an Ethernet Switched Path (ESP) in a PBB-TE topology.

Figure 11-1 displays a simple ESP topology.

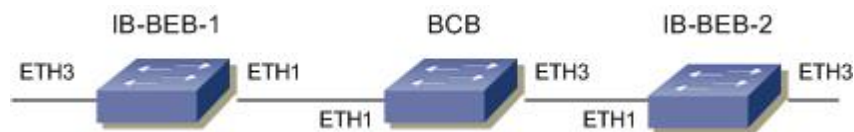


Figure 11-1: ESP Topology

IB-BEB-1

IB-BEB-1#configure terminal	Enter configure mode.
IB-BEB-1(config)#bridge beb mac aabb.1a5f.7611 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC aabb.1a5f.7611.
IB-BEB-1(config)#bridge beb mac bbbb.bbbb.bbba backbone protocol provider-mstp	Configure backbone bridge 1 with MAC bbbb.bbbb.bbba.
IB-BEB-1(config)#vlan database	Enter VLAN configure mode.
IB-BEB-1(config-vlan)#vlan 2 type service point-point bridge 1 state enable	Configure VLAN 2 as a service VLAN and associate it with bridge 1.
IB-BEB-1(config-vlan)#vlan 4 type backbone point-point state enable	Configure VLAN 4 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#vlan 5 type backbone point-point state enable	Configure VLAN 5 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#vlan 6 type backbone point-point state enable	Configure VLAN 6 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#vlan 7 type backbone point-point state enable	Configure VLAN 7 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#exit	Exit VLAN configure mode.
IB-BEB-1(config)#interface eth3	Enter interface mode.
IB-BEB-1(config-if)#switchport	Configure eth3 as a Layer-2 interface.
IB-BEB-1(config-if)#bridge-group 1	Associate eth3 with bridge-group 1.
IB-BEB-1(config-if)#switchport mode cnp	Set the switching abilities of this interface to CNP mode.

IB-BEB-1 (config-if)#switchport beb customer-network svlan add 2 instance 1 name customer1	Map SVLAN to I-SID.
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#interface eth1	Enter interface mode.
IB-BEB-1 (config-if)#switchport	Configure eth1 as a Layer-2 interface.
IB-BEB-1 (config-if)#bridge-group backbone	Associate eth1 with bridge-group backbone.
IB-BEB-1 (config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-1 (config-if)#switchport beb provider-network bvlan add 4	Add BVLAN to PNP.
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#interface eth2	Enter interface mode.
IB-BEB-1 (config-if)#switchport	Configure eth2 as a Layer-2 interface.
IB-BEB-1 (config-if)#bridge-group backbone	Associate eth2 with bridge-group backbone.
IB-BEB-1 (config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-1 (config-if)#switchport beb provider-network bvlan add 4	Add BVLAN to PNP.
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#interface pip.1	Enter interface mode.
IB-BEB-1 (config-if)#switchport beb pip backbone-source-mac 0100.1111.1211	Configure MAC 0100.1111.1211 for pip.1.
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#interface cbp.1	Enter interface mode.
IB-BEB-1 (config-if)#switchport beb customer-backbone instance add 1 bvlan 4	Map BVLAN to I-SID.
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#pbb-te configure tesid 10	Configure a TE-SID with SID as 10.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 4	Associate backbone VLAN 4 to TE-SID 10.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 5	Associate backbone VLAN 5 to TE-SID 10.
IB-BEB-1 (pbb-te-vlan-config)#exit	Exit TE-SID mode.
IB-BEB-1 (config)#pbb-te configure tesid 20	Configure a TE-SID with SID as 20.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 6	Associate backbone VLAN 6 to TE-SID 20.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 7	Associate backbone VLAN 6 to TE-SID 20.
IB-BEB-1 (pbb-te-vlan-config)#exit	Exit TE-SID mode.
IB-BEB-1 (config)#interface cbp.1	Enter interface mode.
IB-BEB-1 (config-if)#pbb-te esp tesid 10 egress remote-mac 0100.1111.1212 vlan 4 pnp eth1	Configure TE-SID 10 with remote MAC address 0100.1111.1212, and specify the egress backbone VLAN and egress interface (eth1).
IB-BEB-1 (config-if)#pbb-te esp tesid 10 ingress remote-mac 0100.1111.1212 vlan 5	Configure TE-SID 10 with remote MAC address 0100.1111.1212, and specify the ingress backbone VLAN.
IB-BEB-1 (config-if)#pbb-te esp tesid 20 egress remote-mac 0100.1111.1212 vlan 6 pnp eth1	Configure TE-SID 20 with remote MAC address 0100.1111.1212, and specify the egress backbone VLAN and egress interface (eth1).

IB-BEB-1 (config-if)#pbb-te esp tesid 20 ingress remote-mac 0100.1111.1212 vlan 7	Configure TE-SID 20 with remote MAC address 0100.1111.1212, and specify the ingress backbone VLAN.
IB-BEB-1 (config-if)#exit	Exit interface mode.

IB-BEB-2

IB-BEB-2#configure terminal	Enter configure mode.
IB-BEB-2 (config)#bridge beb mac aabb.1a5f.7612 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC aabb.1a5f.7612.
IB-BEB-2 (config)#bridge beb mac bbbb.bbbb.bbbb backbone protocol provider-mstp	Configure backbone bridge 1 with MAC bbbb.bbbb.bbbb.
IB-BEB-2 (config)#vlan database	Enter VLAN configure mode.
IB-BEB-2 (config-vlan)#vlan 2 type service point-point bridge 1 state enable	Configure VLAN 2 as a service VLAN and associate it with bridge 1.
IB-BEB-2 (config-vlan)#vlan 4 type backbone point-point state enable	Configure VLAN 4 as a backbone point-to-point VLAN.
IB-BEB-2 (config-vlan)#vlan 5 type backbone point-point state enable	Configure VLAN 5 as a backbone point-to-point VLAN.
IB-BEB-2 (config-vlan)#vlan 6 type backbone point-point state enable	Configure VLAN 6 as a backbone point-to-point VLAN.
IB-BEB-2 (config-vlan)#vlan 7 type backbone point-point state enable	Configure VLAN 7 as a backbone point-to-point VLAN.
IB-BEB-2 (config-vlan)#exit	Exit VLAN configure mode.
IB-BEB-2 (config)#interface eth3	Enter interface mode.
IB-BEB-2 (config-if)#switchport	Configure eth3 as a Layer-2 interface.
IB-BEB-2 (config-if)#bridge-group 1	Associate eth3 with bridge-group 1.
IB-BEB-2 (config-if)#switchport mode cnp	Set the switching abilities of this interface to CNP mode.
IB-BEB-2 (config-if)#switchport beb customer-network svlan add 2 instance 1 name customer1	Map SVLAN to I-SID.
IB-BEB-2 (config-if)#exit	Exit interface mode.
IB-BEB-2 (config)#interface eth1	Enter interface mode.
IB-BEB-2 (config-if)#switchport	Configure eth1 as a Layer-2 interface.
IB-BEB-2 (config-if)#bridge-group backbone	Associate eth1 with bridge-group backbone.
IB-BEB-2 (config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-2 (config-if)#switchport beb provider-network bvlan add 4	Add BVLAN to PNP.
IB-BEB-2 (config-if)#exit	Exit interface mode.
IB-BEB-2 (config)#interface eth2	Enter interface mode.
IB-BEB-2 (config-if)#switchport	Configure eth2 as a Layer-2 interface.
IB-BEB-2 (config-if)#bridge-group backbone	Associate eth2 with bridge-group backbone.
IB-BEB-2 (config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.

IB-BEB-2(config-if)#switchport beb provider-network bvlan add 4	Add BVLAN to PNP.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#interface pip.1	Enter interface mode.
IB-BEB-2(config-if)#switchport beb pip backbone-source-mac 0100.1111.1212	Configure MAC 0100.1111.1212 for interface pip.1.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#interface cbp.1	Enter interface mode.
IB-BEB-2(config-if)#switchport beb customer-backbone instance add 1 bvlan 4	Map BVLAN to I-SID.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#pbb-te configure tesid 10	Configure a TE-SID with SID as 10.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 4	Associate backbone VLAN 4 to TE-SID 10.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 5	Associate backbone VLAN 5 to TE-SID 10.
IB-BEB-2(pbb-te-vlan-config)#exit	Exit the TE-SID mode.
IB-BEB-2(config)#pbb-te configure tesid 20	Configure a TE-SID with SID as 20.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 6	Associate backbone VLAN 6 to TE-SID 20.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 7	Associate backbone VLAN 6 to TE-SID 20.
IB-BEB-2(pbb-te-vlan-config)#exit	Exit the TE-SID mode.
IB-BEB-2(config)#interface cbp.1	Enter interface mode.
IB-BEB-2(config-if)#pbb-te esp tesid 10 egress remote-mac 0100.1111.1211 vlan 5 pnp eth1	Configure TE-SID 10 with remote MAC address 0100.1111.1211, and specify the egress backbone VLAN and egress interface (eth1).
IB-BEB-2(config-if)#pbb-te esp tesid 10 ingress remote-mac 0100.1111.1211 vlan 4	Configure TE-SID 10 with remote MAC 0100.1111.1211, and specify the ingress backbone VLAN.
IB-BEB-2(config-if)#pbb-te esp tesid 20 egress remote-mac 0100.1111.1211 vlan 6 pnp eth1	Configure TE-SID 20 with remote MAC 0100.1111.1211, and specify the egress backbone VLAN and egress interface (eth1).
IB-BEB-2(config-if)#pbb-te esp tesid 20 ingress remote-mac 0100.1111.1211 vlan 7	Configure TE-SID 20 with remote MAC 0100.1111.1211, and specify the ingress backbone VLAN.
IB-BEB-2(config-if)#exit	Exit interface mode.

BCB

BCB#configure terminal	Enter configure mode.
BCB(config)#bridge 1 protocol provider-mstp	Configure bridge 1 as a provider bridge.
BCB(config)#vlan database	Enter VLAN configure mode.
BCB(config-vlan)#vlan 4 type service point-point bridge 1 state enable	Configure VLAN 4 as a service VLAN and associate it with bridge 1.
BCB(config-vlan)#vlan 5 type service point-point bridge 1 state enable	Configure VLAN 5 as a service VLAN and associate it with bridge 1.
BCB(config-vlan)#vlan 6 type service point-point bridge 1 state enable	Configure VLAN 6 as a service VLAN and associate it with bridge 1.

BCB(config-vlan)#vlan 7 type service point-point bridge 1 state enable	Configure VLAN 7 as a service VLAN and associate it with bridge 1.
BCB(config-vlan)#exit	Exit the VLAN configuration mode.
BCB(config)#interface eth1	Enter interface mode.
BCB(config-if)#switchport	Configure eth1 as a Layer-2 interface.
BCB(config-if)#bridge-group 1	Associate eth1 with bridge 1.
BCB(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB(config-if)#switchport provider-network allowed vlan add 4	Associate Service VLAN 4 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 5	Associate Service VLAN 5 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 6	Associate Service VLAN 6 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 7	Associate Service VLAN 7 with the provider network.
BCB(config-if)#exit	Exit interface mode.
BCB(config)#interface eth3	Enter interface mode.
BCB(config-if)#switchport	Configure eth3 as a Layer-2 interface
BCB(config-if)#bridge-group 1	Associate eth3 with bridge 1.
BCB(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB(config-if)#switchport provider-network allowed vlan add 4	Associate Service VLAN 4 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 5	Associate Service VLAN 5 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 6	Associate Service VLAN 6 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 7	Associate Service VLAN 7 with the provider network.
BCB(config-if)#exit	Exit interface mode.
BCB(config)#bridge 1 address 0100.1111.1212 forward eth3 vlan 4	Add a static FDB entry to the FDB table to forward all frames with MAC address 0100.1111.1212 and VLAN 4 to interface eth3.
BCB(config)#bridge 1 address 0100.1111.1211 forward eth1 vlan 5	Add a static FDB entry to the FDB table to forward all frames with MAC address 0100.1111.1211 and VLAN 5 to interface eth1.
BCB(config)#exit	Exit the Configure mode.

Validation

IB-BEB-1

```
IB-BEB-1#show pbb-te tesid all
TESID: 10
```

```
cbp interface: cbp.1
```

ESP Id	SMAC	DMAC	ESP-VID	Ingress	Multicast
000	0100.1111.1211	0100.1111.1212	4	Yes	No
001	0100.1111.1211	0100.1111.1212	5	No	No

```
TESID: 20
```

```
cbp interface: cbp.1
```

ESP Id	SMAC	DMAC	ESP-VID	Ingress	Multicast
000	0100.1111.1211	0100.1111.1212	6	Yes	No
001	0100.1111.1211	0100.1111.1212	7	No	No

```
IB-BEB-1#
```

IB-BEB2

```
IB-BEB-2#show pbb-te tesid all
```

```
TESID: 10
```

```
cbp interface: cbp.1
```

ESP Id	SMAC	DMAC	ESP-VID	Ingress	Multicast
000	0100.1111.1212	0100.1111.1211	5	Yes	No
001	0100.1111.1212	0100.1111.1211	4	No	No

```
TESID: 20
```

```
cbp interface: cbp.1
```

ESP Id	SMAC	DMAC	ESP-VID	Ingress	Multicast
000	0100.1111.1212	0100.1111.1211	6	Yes	No
001	0100.1111.1212	0100.1111.1211	7	No	No

```
IB-BEB-2#
```

Automatic Protection Switching

These configurations are for setting up Automatic Protection Switching (APS) in a PBB-TE topology. [Figure 11-2](#) displays a simple APS topology.

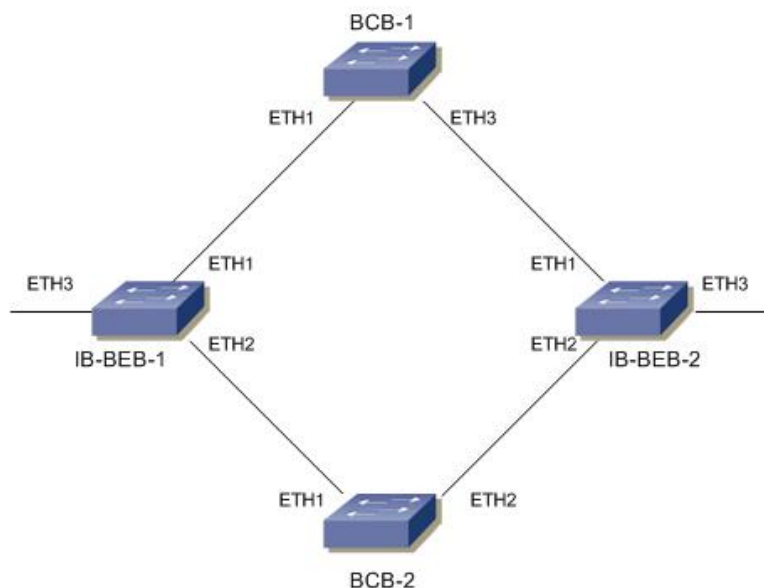


Figure 11-2: APS Topology

IB-BEB-1

IB-BEB-1#configure terminal	Enter configure mode.
IB-BEB-1(config)#bridge beb mac 0001.0001.0001 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC 0001.0001.0001.
IB-BEB-1(config)#bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure backbone bridge 1 with MAC 0001.0001.0001.
IB-BEB-1(config)#vlan database	Enter VLAN configure mode.
IB-BEB-1(config-vlan)#vlan 2 type service point-point bridge 1 state enable	Configure VLAN 2 as a service VLAN and associate it with bridge 1.
IB-BEB-1(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure VLAN 3 as a service VLAN and associate it with bridge 1.
IB-BEB-1(config-vlan)#vlan 4 type backbone point-point state enable	Configure VLAN 4 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#vlan 5 type backbone point-point state enable	Configure VLAN 5 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#vlan 6 type backbone point-point state enable	Configure VLAN 6 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#vlan 7 type backbone point-point state enable	Configure VLAN 7 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#exit	Exit VLAN configure mode.
IB-BEB-1(config)#interface eth3	Enter interface mode.
IB-BEB-1(config-if)#switchport	Configure eth3 as a Layer-2 interface.
IB-BEB-1(config-if)#bridge-group 1	Associate eth3 with bridge-group 1.
IB-BEB-1(config-if)#switchport mode cnp	Set the switching abilities of this interface to CNP mode.
IB-BEB-1(config-if)#switchport beb vlan 2 cnp	Assign VLAN 2 to CNP.
IB-BEB-1(config-if)#switchport beb customer-network svlan add range 2 3 instance 1 name customer1	Map SVLAN to I-SID.
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#interface eth1	Enter interface mode.
IB-BEB-1(config-if)#switchport	Configure eth1 as a Layer-2 interface.
IB-BEB-1(config-if)#bridge-group backbone	Associate eth1 with bridge-group backbone.
IB-BEB-1(config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-1(config-if)#switchport beb vlan 5 pnp	Add BVLAN to PNP.
IB-BEB-1(config-if)#switchport beb provider-network bvlan all	Allow all BVLANs.
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#interface eth2	Enter interface mode.
IB-BEB-1(config-if)#switchport	Configure eth2 as a Layer-2 interface.
IB-BEB-1(config-if)#bridge-group backbone	Associate eth2 with bridge-group backbone.

IB-BEB-1 (config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-1 (config-if)#switchport beb vlan 7 pnp	Add BVLAN to PNP.
IB-BEB-1 (config-if)#switchport beb provider-network bvlan all	Allow all BVLANS.
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#interface pip.1	Enter interface mode.
IB-BEB-1 (config-if)#switchport beb pip backbone-source-mac 0005.1111.1211	Configure MAC address 0005.1111.1211 for interface pip.1
IB-BEB-1 (config-if)#switchport beb vip instance 1 allowed all	Map ISID to allow all ingress and egress frames with ISID 1.
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#interface cbp.1	Enter interface mode.
IB-BEB-1 (config-if)#switchport beb customer-backbone instance add 1 bvlan 5	Map BVLAN to I-SID.
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#pbb-te configure tesid 10	Configure a TE-SID with SID as 10.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 4	Associate backbone VLAN 4 to TE-SID 10.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 5	Associate backbone VLAN 5 to TE-SID 10.
IB-BEB-1 (pbb-te-vlan-config)#exit	Exit the TE-SID mode.
IB-BEB-1 (config)#pbb-te configure tesid 20	Configure a TE-SID with SID as 20.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 6	Associate backbone VLAN 6 to TE-SID 20.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 7	Associate backbone VLAN 7 to TE-SID 20.
IB-BEB-1 (pbb-te-vlan-config)#exit	Exit the TE-SID mode.
IB-BEB-1 (config)#interface cbp.1	Enter interface mode.
IB-BEB-1 (config-if)#pbb-te esp tesid 10 ingress remote-mac 0005.1111.1212 vlan 4	Configure TE-SID 10 with remote MAC address 0005.1111.1212, and specify the ingress backbone VLAN.
IB-BEB-1 (config-if)#pbb-te esp tesid 10 egress remote-mac 0005.1111.1212 vlan 5 pnp eth1	Configure TE-SID 10 with remote MAC address 0005.1111.1212, and specify the egress backbone VLAN and egress interface (eth1).
IB-BEB-1 (config-if)#pbb-te esp tesid 20 ingress remote-mac 0005.1111.1212 vlan 6	Configure TE-SID 20 with remote MAC address 0005.1111.1212, and specify the ingress backbone VLAN.
IB-BEB-1 (config-if)#pbb-te esp tesid 20 egress remote-mac 0005.1111.1212 vlan 7 pnp eth2	Configure TE-SID 20 with remote MAC address 0005.1111.1212, and specify the egress backbone VLAN and egress interface (eth2).
B-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure a PBB-TE MD with name abc on level 3 for backbone bridge.
IB-BEB-1 (config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name FOR_TESID_10 te-sid 10 mip-creation default	Configure an MA for TE-SID 10 with MA name FOR_TESID_10.

IB-BEB-1(config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 70 te-sid 10 mac 0005.1111.1212	Add an RMEP (remote MEP) for TE-SID 10.
IB-BEB-1(config-ether-cfm-pbb-te)#exit	Exit CFM configuration mode.
IB-BEB-1(config)#interface cbp.1	Enter interface mode.
IB-BEB-1(config-if)#ethernet cfm pbb-te mep up mpid 40 domain-name abc te-sid 10 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 10 with MEP ID 40.
IB-BEB-1(config-if-eth-cfm-pbb-te-mep)#cc unicast rmpid 70 state enable	Enable unicast continuity checking (CC) for TE-SID 10 and MEP 40.
IB-BEB-1(config-if-eth-cfm-pbb-te-mep)#exit	Exit CFM MEP mode.
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure a PBB-TE MD with name abc on level 3 for backbone bridge.
IB-BEB-1(config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name FOR_TESID_20 te-sid 20 mip-creation default	Configure an MA for TE-SID 10 with MA name FOR_TESID_20.
IB-BEB-1(config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 70 te-sid 20 mac 0005.1111.1212	Add an RMEP for TE-SID 20.
IB-BEB-1(config-ether-cfm-pbb-te)#exit	Exit CFM configuration mode.
IB-BEB-1(config)#interface cbp.1	Enter interface mode.
IB-BEB-1(config-if)#ethernet cfm pbb-te mep up mpid 40 domain-name abc te-sid 20 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 20 with MEP ID 40.
IB-BEB-1(config-if-eth-cfm-pbb-te-mep)#cc unicast rmpid 70 state enable	Enable unicast continuity checking (CC) for TE-SID 20 and MEP 40.
IB-BEB-1(config-if-eth-cfm-pbb-te-mep)#exit	Exit CFM MEP mode.
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#interface cbp.1	Enter interface mode.
IB-BEB-1(config-if)#pbb-te aps-group 1 working-tesi 10 protection-tesi 20	Create an APS GROUP with ID 1 with working-tesi as 10 and protection-tesi as 20.
IB-BEB-1(config-if)#pbb-te aps-group 1 isid add 1	Associate ISID 1 to APS Group 1.
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#pbb-te configure switching cbp cbp.1 aps-group 1	Enter the APS Group configuration mode.
IB-BEB-1(pbb-te-config-switching)#pbb-te associate aps-group 1 cbp cbp.1 md-name abc working ma-name FOR_TESID_10 protective ma-name FOR_TESID_20	Associate APS group 1 to MD with name abc and working MA FOR_TESID_10 and protection MA FOR_TESID_20.
IB-BEB-1(pbb-te-config-switching)#exit	Exit the APS Group Configuration mode.

BCB-1

BCB-1#configure terminal	Enter configure mode.
BCB-1(config)#bridge 1 protocol provider-mstp	Configure bridge 1 as a provider bridge.
BCB-1(config)#vlan database	Enter the VLAN Configure mode.
BCB-1(config-vlan)#vlan 4 type service point-point bridge 1 state enable	Configure VLAN 4 as a service VLAN and associate it with bridge 1.
BCB-1(config-vlan)#vlan 5 type service point-point bridge 1 state enable	Configure VLAN 5 as a service VLAN and associate it with bridge 1.
BCB-1(config-vlan)#exit	Exit VLAN configure mode.
BCB-1(config)#interface eth1	Enter interface mode.
BCB-1(config-if)#switchport	Configure eth1 as a Layer-2 interface.
BCB-1(config-if)#bridge-group 1	Associate eth1 with bridge 1.
BCB-1(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB-1(config-if)#switchport provider-network allowed vlan add 4	Associate Service VLAN 4 with the provider network.
BCB-1(config-if)#switchport provider-network allowed vlan add 5	Associate Service VLAN 5 with the provider network.
BCB-1(config-if)#exit	Exit interface mode.
BCB-1(config)#interface eth3	Enter interface mode.
BCB-1(config-if)#switchport	Configure eth3 as a Layer-2 interface.
BCB-1(config-if)#bridge-group 1	Associate eth3 with bridge 1.
BCB-1(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB-1(config-if)#switchport provider-network allowed vlan add 4	Associate Service VLAN 4 with the provider network.
BCB-1(config-if)#switchport provider-network allowed vlan add 5	Associate Service VLAN 5 with the provider network.
BCB-1(config-if)#exit	Exit interface mode.
BCB-1(config)#bridge 1 address 0005.1111.1212 forward eth3 vlan 5	Add a static FDB entry to the FDB table to forward all frames with MAC address 0005.1111.1212 and VLAN 4 to interface eth3.
BCB-1(config)#bridge 1 address 0005.1111.1211 forward eth1 vlan 4	Add a static FDB entry to the FDB table to forward all frames with MAC address 0005.1111.1211 and VLAN 5 to interface eth1.
BCB-1(config)#exit	Exit the Configure mode.

BCB-2

BCB-2#configure terminal	Enter configure mode.
BCB-2(config)#bridge 1 protocol provider-mstp	Configure bridge 1 as a provider bridge.

BCB-2(config)#vlan database	Enter the VLAN Configure mode.
BCB-2(config-vlan)#vlan 6 type service point-point bridge 1 state enable	Configure VLAN 6 as a service VLAN and associate it with bridge 1.
BCB-2(config-vlan)#vlan 7 type service point-point bridge 1 state enable	Configure VLAN 7 as a service VLAN and associate it with bridge 1.
BCB-2(config-vlan)#exit	Exit VLAN Configure mode.
BCB-2(config)#interface eth1	Enter interface mode.
BCB-2(config-if)#switchport	Configure eth1 as a Layer-2 interface.
BCB-2(config-if)#bridge-group 1	Associate eth1 with bridge 1.
BCB-2(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB-2(config-if)#switchport provider-network allowed vlan add 6	Associate Service VLAN 6 with the provider network.
BCB-2(config-if)#switchport provider-network allowed vlan add 7	Associate Service VLAN 7 with the provider network.
BCB-2(config-if)#exit	Exit interface mode.
BCB-2(config)#interface eth2	Enter interface mode.
BCB-2(config-if)#switchport	Configure eth2 as a Layer-2 interface.
BCB-2(config-if)#bridge-group 1	Associate the eth2 interface with bridge 1.
BCB-2(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB-2(config-if)#switchport provider-network allowed vlan add 6	Associate Service VLAN 6 with the provider network.
BCB-2(config-if)#switchport provider-network allowed vlan add 7	Associate Service VLAN 7 with the provider network.
BCB-2(config-if)#exit	Exit interface mode.
BCB-2(config)#bridge 1 address 0005.1111.1212 forward eth2 vlan 7	Add a static FDB entry to the FDB table to forward all frames with MAC address 0005.1111.1212 and VLAN 7 to interface eth3.
BCB-2(config)#bridge 1 address 0005.1111.1211 forward eth1 vlan 6	Add a static FDB entry to the FDB table to forward all frames with MAC address 0005.1111.1211 and VLAN 6 to interface eth1.
BCB-2(config)#exit	Exit the Configure mode.

IB-BEB-2

IB-BEB-2#configure terminal	Enter configure mode.
IB-BEB-2(config)#bridge beb mac 0001.0001.0001 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC 0001.0001.0001.
IB-BEB-2(config)#bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure backbone bridge 1 with MAC 0001.0001.0001.
IB-BEB-2(config)#vlan database	Enter VLAN configure mode.

IB-BEB-2(config-vlan)#vlan 2 type service point-point bridge 1 state enable	Configure VLAN 2 as a service VLAN and associate it with bridge 1.
IB-BEB-2(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure VLAN 3 as a service VLAN and associate it with bridge 1.
IB-BEB-2(config-vlan)#vlan 4 type backbone point-point state enable	Configure VLAN 4 as a backbone point-to-point VLAN.
IB-BEB-2(config-vlan)#vlan 5 type backbone point-point state enable	Configure VLAN 5 as a backbone point-to-point VLAN.
IB-BEB-2(config-vlan)#vlan 6 type backbone point-point state enable	Configure VLAN 6 as a backbone point-to-point VLAN
IB-BEB-2(config-vlan)#vlan 7 type backbone point-point state enable	Configure VLAN 7 as a backbone point-to-point VLAN.
IB-BEB-2(config-vlan)#exit	Exit VLAN configure mode.
IB-BEB-2(config)#interface eth3	Enter interface mode.
IB-BEB-2(config-if)#switchport	Configure eth3 as a Layer-2 interface.
IB-BEB-2(config-if)#bridge-group 1	Associate eth3 with bridge-group 1.
IB-BEB-2(config-if)#switchport mode cnp	Set the switching abilities of this interface to CNP mode.
IB-BEB-2(config-if)#switchport beb vlan 2 cnp	Assign VLAN 2 to CNP.
IB-BEB-2(config-if)#switchport beb customer-network svlan add range 2 3 instance 1 name customer1	Map SVLAN to I-SID.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#interface eth1	Enter interface mode.
IB-BEB-2(config-if)#switchport	Configure eth1 as a Layer-2 interface.
IB-BEB-2(config-if)#bridge-group backbone	Associate eth1 with bridge-group backbone
IB-BEB-2(config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-2(config-if)#switchport beb vlan 4 pnp	Add BVLAN to PNP.
IB-BEB-2(config-if)#switchport beb provider-network bvlan all	Allow all BVLANS.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#interface eth2	Enter interface mode.
IB-BEB-2(config-if)#switchport	Configure eth2 as a Layer-2 interface.
IB-BEB-2(config-if)#bridge-group backbone	Associate eth2 with bridge-group backbone.
IB-BEB-2(config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-2(config-if)#switchport beb vlan 6 pnp	Add BVLAN to PNP.
IB-BEB-2(config-if)#switchport beb provider-network bvlan all	Allow all BVLANS.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#interface pip.1	Enter interface mode.

IB-BEB-2(config-if)#switchport beb pip backbone-source-mac 0005.1111.1212	Configure MAC 0005.1111.1212 for interface pip.1.
IB-BEB-2(config-if)#switchport beb vip instance 1 allowed all	Map ISID to allow all ingress and egress frames with ISID 1.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#interface cbp.1	Enter interface mode.
IB-BEB-2(config-if)#switchport beb customer-backbone instance add 1 bvlan 4	Map SVLAN to I-SID.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#pbb-te configure tesid 10	Configure a TE-SID with SID as 10.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 4	Associate backbone VLAN 4 to TE-SID 10.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 5	Associate backbone VLAN 5 to TE-SID 10.
IB-BEB-2(pbb-te-vlan-config)#exit	Exit the TE-SID mode.
IB-BEB-2(config)#pbb-te configure tesid 20	Configure a TE-SID with SID as 20.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 6	Associate backbone VLAN 6 to TE-SID 20.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 7	Associate backbone VLAN 6 to TE-SID 20.
IB-BEB-2(pbb-te-vlan-config)#exit	Exit the TE-SID mode.
IB-BEB-2(config)#interface cbp.1	Enter interface mode.
IB-BEB-2(config-if)#pbb-te esp tesid 10 ingress remote-mac 0005.1111.1211 vlan 5	Configure TE-SID 10 with remote MAC address 0005.1111.1211, and specify the ingress backbone VLAN.
IB-BEB-2(config-if)#pbb-te esp tesid 10 egress remote-mac 0005.1111.1211 vlan 4 pnp eth1	Configure TE-SID 10 with remote MAC address 0005.1111.1211, and specify the egress backbone VLAN and egress interface (eth1).
IB-BEB-2(config-if)#pbb-te esp tesid 20 ingress remote-mac 0005.1111.1211 vlan 7	Configure TE-SID 20 with remote MAC address 0005.1111.1211, and specify the ingress backbone VLAN.
IB-BEB-2(config-if)#pbb-te esp tesid 20 egress remote-mac 0005.1111.1211 vlan 6 pnp eth2	Configure TE-SID 20 with remote MAC address 0005.1111.1211, and specify the egress backbone VLAN and egress interface (eth2).
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure PBB-TE MD with name abc on level 3 for backbone bridge.
IB-BEB-2(config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name FOR_TESID_10 te-sid 10 mip-creation default	Configure MA for TE-SID 10 with MA name FOR_TESID_10.
IB-BEB-2(config-ether-cfm-pbb-te)#mep pbb- te crosscheck mpid 40 te-sid 10 mac 0005.1111.1211	Add an RMEP for TESID 10.
IB-BEB-2(config-ether-cfm-pbb-te)#exit	Exit CFM configuration mode.
IB-BEB-2(config)#interface cbp.1	Enter interface mode.
IB-BEB-2(config-if)#ethernet cfm pbb-te mep up mpid 70 domain-name abc te-sid 10 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 10 with MEP ID 70.
IB-BEB-2(config-if-eth-cfm-pbb-te-mep)#cc unicast rmpid 40 state enable	Enable continuity checking (CC) for TE-SID 10 and MEP 70.

IB-BEB-2 (config-if-eth-cfm-pbb-te-mep) #exit	Exit CFM MEP mode.
IB-BEB-2 (config-if) #exit	Exit interface mode.
IB-BEB-2 (config) #ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure PBB-TE MD with name abc on level 3 for backbone bridge.
IB-BEB-2 (config-ether-cfm-pbb-te) #service pbb-te ma-type string ma-name FOR_TESID_20 te-sid 20 mip-creation default	Configure MA for TE-SID 20 with MA name FOR_TESID_20.
IB-BEB-2 (config-ether-cfm-pbb-te) #mep pbb-te crosscheck mpid 40 te-sid 20 mac 0005.1111.1211	Add an RMEP for TE-SID 20.
IB-BEB-2 (config-ether-cfm-pbb-te) #exit	Exit CFM configuration mode
IB-BEB-2 (config) #interface cbp.1	Enter interface mode.
IB-BEB-2 (config-if) #ethernet cfm pbb-te mep up mpid 70 domain-name abc te-sid 20 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 20 with MEP ID 70.
IB-BEB-2 (config-if-eth-cfm-pbb-te-mep) #cc unicast rmpid 40 state enable	Enable continuity checking (CC) for TE-SID 20 and MEP 70.
IB-BEB-2 (config-if-eth-cfm-pbb-te-mep) #exit	Exit CFM MEP mode.
IB-BEB-2 (config-if) #exit	Exit interface mode.
IB-BEB-2 (config) #interface cbp.1	Enter interface mode.
IB-BEB-2 (config-if) #pbb-te aps-group 1 working-tesi 10 protection-tesi 20	Create an APS GROUP with ID 1 with working-tesi as 10 and protection-tesi as 20.
IB-BEB-2 (config-if) #pbb-te aps-group 1 isid add 1	Associate ISID 1 to APS Group 1.
IB-BEB-2 (config-if) #exit	Exit interface mode.
IB-BEB-2 (config) #pbb-te configure switching cbp cbp.1 aps-group 1	Enter the APS Group configuration mode.
IB-BEB-2 (pbb-te-config-switching) #pbb-te associate aps-group 1 cbp cbp.1 md-name abc working ma-name FOR_TESID_10 protective ma-name FOR_TESID_20	Associating APS group 1 to MD with name abc and working MA FOR_TESID_10 and protection MA FOR_TESID_20.
IB-BEB-2 (pbb-te-config-switching) #exit	Exit the APS Group Configuration mode.

Verification and Validation

Enter the commands listed in the sections below to confirm the configurations.

Verify CFM Configuration for APS

On IB-BEB-1

```
IB-BEB-1#show ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 10 bridge backbone
```


MPID	LEVEL	TESID	MEP-UP	Remote Mac	RDI	TE-MISMATCH
70	3	10	Yes	0005.1111.1212	False	

```

IB-BEB-1#
IB-BEB-1#
IB-BEB-1#show ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 20
bridge backbone

```

MPID	LEVEL	TESID	MEP-UP	Remote Mac	RDI	TE-MISMATCH
70	3	20	Yes	0005.1111.1212	False	

```

IB-BEB-1#

```

On IB-BEB-2

```

IB-BEB-2#show ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 10
bridge backbone

```

MPID	LEVEL	TESID	MEP-UP	Remote Mac	RDI	TE-MISMATCH
40	3	10	Yes	0005.1111.1211	True	

```

IB-BEB-2#
IB-BEB-2#show ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 20
bridge backbone

```

MPID	LEVEL	TESID	MEP-UP	Remote Mac	RDI	TE-MISMATCH
40	3	20	Yes	0005.1111.1211	True	

```

IB-BEB-2#

```

Verify APS Configuration

On IB-BEB-1

```

IB-BEB-1#show pbb-te aps-group 1

```

Bridge	ApsID	Working-Path	Protection-Path	Current-State	Active-Path
backbone	1	10	20	No-Request	10

On IB-BEB-2

```

IB-BEB-2#show pbb-te aps-group all

```

Bridge	ApsID	Working-Path	Protection-Path	Current-State	Active-Path
backbone	1	10	20	No-Request	10

Verify Switchover Process

Set eth1 to down on IB-BEB-1 to check that switchover takes place correctly when the working-tesi goes down.

```

IB-BEB-1(config)#interface eth1
IB-BEB-1(config-if)#shutdown
IB-BEB-1(config-if)#end

```

Verify switchover using the following commands:

```

IB-BEB-1#show pbb-te aps-group all

```

Bridge	ApsID	Working-Path	Protection-Path	Current-State	Active-Path
backbone	1	10	20	Working SF	20

```
IB-BEB-1#show pbb-te aps-group all
```

Bridge	ApsID	Working-Path	Protection-Path	Current-State	Active-Path
backbone	1	10	20	No-Request	20

Note: After eth1 of IB-BEB-1 is shut down, the Active path becomes 20, which is the protection-tesi.

Unicast Connectivity Fault Management

These configurations are for setting up Unicast Connectivity Fault Management (CFM) in a PBB-TE network.

Figure 11-3 displays a simple Unicast CFM topology.

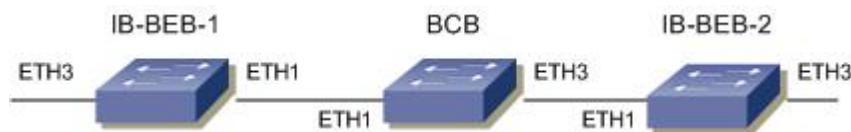


Figure 11-3: Unicast CFM Topology

IB-BEB-1

IB-BEB-1#configure terminal	Enter configure mode.
IB-BEB-1(config)#bridge beb mac 0001.0001.0001 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC 0001.0001.0001.
IB-BEB-1(config)#bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure backbone bridge 1 with MAC 0001.0001.0001.
IB-BEB-1(config)#vlan database	Enter VLAN configure mode.
IB-BEB-1(config-vlan)#vlan 2 type service point-point bridge 1 state enable	Configure VLAN 2 as a service VLAN and associate it with bridge 1.
IB-BEB-1(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure VLAN 3 as a service VLAN and associate it with bridge 1.
IB-BEB-1(config-vlan)#vlan 4 type backbone point-point state enable	Configure VLAN 4 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#vlan 5 type backbone point-point state enable	Configure VLAN 5 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#exit	Exit the VLAN configuration mode.
IB-BEB-1(config)#interface eth3	Enter interface mode.
IB-BEB-1(config-if)#switchport	Configure eth3 as a Layer-2 interface.
IB-BEB-1(config-if)#bridge-group 1	Associate eth3 with bridge-group 1.
IB-BEB-1(config-if)#switchport mode cnp	Set the switching abilities of this interface to CNP mode.

IB-BEB-1(config-if)#switchport beb vlan 2 cnp	Assign VLAN 2 to CNP.
IB-BEB-1(config-if)#switchport beb customer-network svlan add range 2 3 instance 1 name customer1	Map SVLAN to I-SID.
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#interface eth1	Enter interface mode.
IB-BEB-1(config-if)#switchport	Configure eth1 as a Layer-2 interface.
IB-BEB-1(config-if)#bridge-group backbone	Associate eth1 with bridge-group backbone.
IB-BEB-1(config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-1(config-if)#switchport beb vlan 5 pnp	Add BVLAN to PNP.
IB-BEB-1(config-if)#switchport beb provider-network bvlan all	Allow all BVLANS.
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#interface pip.1	Enter interface mode.
IB-BEB-1(config-if)#switchport beb pip backbone-source-mac 0005.1111.1211	Configure MAC 0005.1111.1211 for interface pip.1.
IB-BEB-1(config-if)#switchport beb vip instance 1 allowed all	Map ISID to allow all ingress and egress frames with ISID 1.
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#interface cbp.1	Enter interface mode.
IB-BEB-1(config-if)#switchport beb customer-backbone instance add 1 bvlan 4	Map BVLAN to I-SID.
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#pbb-te configure tesid 10	Configure a TE-SID with SID as 10.
IB-BEB-1(pbb-te-vlan-config)#pbb-te vlan 4	Associate backbone VLAN 4 to TE-SID 10.
IB-BEB-1(pbb-te-vlan-config)#pbb-te vlan 5	Associate backbone VLAN 5 to TE-SID 10.
IB-BEB-1(pbb-te-vlan-config)#exit	Exit the TE-SID mode.
IB-BEB-1(config)#interface cbp.1	Enter interface mode.
IB-BEB-1(config-if)#pbb-te esp tesid 10 ingress remote-mac 0005.1111.1212 vlan 4	Configure TE-SID 10 with remote MAC address 0005.1111.1212, and specify the ingress backbone VLAN.
IB-BEB-1(config-if)#pbb-te esp tesid 10 egress remote-mac 0005.1111.1212 vlan 5 pnp eth1	Configure TE-SID 10 with remote MAC address 0005.1111.1212, and specify the egress backbone VLAN and egress interface (eth1).
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure a PBB-TE MD with name abc on level 3 for backbone bridge.
IB-BEB-1(config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name MAC_IB_BEB_1 te-sid 10 mip-creation default	Configure an MA for TE-SID 10 with MA name MAC_IB_BEB_1.
IB-BEB-1(config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 70 te-sid 10 mac 0005.1111.1212	Add an RMEP for TE-SID 10.

IB-BEB-1 (config-ether-cfm-pbb-te) #exit	Exit CFM configuration mode.
IB-BEB-1 (config) #interface cbp.1	Enter interface mode.
IB-BEB-1 (config-if) #ethernet cfm pbb-te mep up mpid 40 domain-name abc te-sid 10 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 10 with MEP ID 40.
IB-BEB-1 (config-if-eth-cfm-pbb-te-mep) #cc unicast rmpid 70 state enable	Enable continuity checking (CC) for TE-SID 10 and MEP 40.
IB-BEB-1 (config-if-eth-cfm-pbb-te-mep) #exit	Exit CFM MEP mode.
IB-BEB-1 (config-if) #exit	Exit interface mode.
IB-BEB-1 (config) #exit	Exit configure mode.

IB-BEB-2

IB-BEB-2#configure terminal	Enter configure mode.
IB-BEB-2 (config) #bridge beb mac 0001.0001.0001 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC 0001.0001.0001.
IB-BEB-2 (config) #bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure backbone bridge 1 with MAC 0001.0001.0001.
IB-BEB-2 (config) #vlan database	Enter VLAN configure mode.
IB-BEB-2 (config-vlan) #vlan 2 type service point-point bridge 1 state enable	Configure VLAN 2 as a service VLAN and associate it with bridge 1.
IB-BEB-2 (config-vlan) #vlan 3 type service point-point bridge 1 state enable	Configure VLAN 3 as a service VLAN and associate it with bridge 1.
IB-BEB-2 (config-vlan) #vlan 4 type backbone point-point state enable	Configure VLAN 4 as a backbone point-to-point VLAN.
IB-BEB-2 (config-vlan) #vlan 5 type backbone point-point state enable	Configure VLAN 5 as a backbone point-to-point VLAN.
IB-BEB-2 (config-vlan) #exit	Exit VLAN configure mode.
IB-BEB-2 (config) #interface eth3	Enter interface mode.
IB-BEB-2 (config-if) #switchport	Configure eth3 as a Layer-2 interface.
IB-BEB-2 (config-if) #bridge-group 1	Associate eth3 with bridge-group 1.
IB-BEB-2 (config-if) #switchport mode cnp	Set the switching abilities of this interface to CNP mode.
IB-BEB-2 (config-if) #switchport beb vlan 2 cnp	Assign VLAN 2 to CNP.
IB-BEB-2 (config-if) #switchport beb customer-network svlan add range 2 3 instance 1 name customer1	Map SVLAN to I-SID.
IB-BEB-2 (config-if) #exit	Exit interface mode.
IB-BEB-2 (config) #interface eth1	Enter interface mode.
IB-BEB-2 (config-if) #switchport	Configure eth1 as a Layer-2 interface.
IB-BEB-2 (config-if) #bridge-group backbone	Associate eth1 with bridge-group backbone.
IB-BEB-2 (config-if) #switchport mode pnp	Set the switching abilities of this interface to PNP mode.

IB-BEB-2(config-if)#switchport beb vlan 4 pnp	Add BVLAN 4 to PNP.
IB-BEB-2(config-if)#switchport beb provider-network bvlan all	Allow all BVLANS.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#interface pip.1	Enter interface mode.
IB-BEB-2(config-if)#switchport beb pip backbone-source-mac 0005.1111.1212	Configure MAC 0005.1111.1212 for pip.1.
IB-BEB-2(config-if)#switchport beb vip instance 1 allowed all	Map ISID to allow all ingress and egress frames with ISID 1.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#interface cbp.1	Enter interface mode.
IB-BEB-2(config-if)#switchport beb customer-backbone instance add 1 bvlan 4	Map BVLAN to I-SID.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#pbb-te configure tesid 10	Configure a TE-SID with SID as 10.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 4	Associate backbone VLAN 4 to TE-SID 10.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 5	Associate backbone VLAN 5 to TE-SID 10.
IB-BEB-2(pbb-te-vlan-config)#exit	Exit the TE-SID mode.
IB-BEB-2(config)#interface cbp.1	Enter interface mode.
IB-BEB-2(config-if)#pbb-te esp tesid 10 ingress remote-mac 0005.1111.1211 vlan 5	Configure TE-SID 10 with remote MAC address 0005.1111.1211, and specify the ingress backbone VLAN.
IB-BEB-2(config-if)#pbb-te esp tesid 10 egress remote-mac 0005.1111.1211 vlan 4 pnp eth1	Configure TE-SID 10 with remote MAC address 0005.1111.1211, and specify the egress backbone VLAN and egress interface (eth1).
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure a PBB-TE MD with name abc on level 3 for backbone bridge.
IB-BEB-2(config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name MA_IB_BEB_2 te-sid 10 mip-creation default	Configure an MA for TE-SID 10 with MA name MAC_IB_BEB_2.
IB-BEB-2(config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 40 te-sid 10 mac 0005.1111.1211	Add an RMEP for TE-SID 10.
IB-BEB-2(config-ether-cfm-pbb-te)#exit	Exit CFM configuration mode.
IB-BEB-2(config)#interface cbp.1	Enter interface mode.
IB-BEB-2(config-if)#ethernet cfm pbb-te mep up mpid 70 domain-name abc te-sid 10 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 10 with MEP ID 70.
IB-BEB-2(config-if-eth-cfm-pbb-te-mep)#cc unicast rmpid 40 state enable	Enable continuity checking (CC) for TE-SID 10 and MEP 70.
IB-BEB-2(config-if-eth-cfm-pbb-te-mep)#exit	Exit CFM MEP mode.

IB-BEB-2 (config-if) #exit	Exit interface mode.
IB-BEB-2 (config) #end	Exit configuration mode.

BCB

BCB#configure terminal	Enter configure mode.
BCB(config)#bridge 1 protocol provider-mstp	Configure bridge 1 as a provider bridge.
BCB(config)#vlan database	Enter the VLAN Configure mode.
BCB(config-vlan)#vlan 4 type service point-point bridge 1 state enable	Configure VLAN 4 as a service VLAN and associate it with bridge 1.
BCB(config-vlan)#vlan 5 type service point-point bridge 1 state enable	Configure VLAN 5 as a service VLAN and associate it with bridge 1.
BCB(config-vlan)#exit	Exit VLAN Configure mode.
BCB(config)#interface eth1	Enter interface mode.
BCB(config-if)#switchport	Configure eth1 as a Layer-2 interface.
BCB(config-if)#bridge-group 1	Associate eth1 with bridge 1.
BCB(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB(config-if)#switchport provider-network allowed vlan add 4	Associate Service VLAN 4 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 5	Associate Service VLAN 5 with the provider network.
BCB(config-if)#exit	Exit interface mode.
BCB(config)#interface eth3	Enter interface mode.
BCB(config-if)#switchport	Configure eth3 as a Layer-2 interface.
BCB(config-if)#bridge-group 1	Associate eth3 with bridge 1.
BCB(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB(config-if)#switchport provider-network allowed vlan add 4	Associate Service VLAN 4 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 5	Associate Service VLAN 5 with the provider network.
BCB(config-if)#exit	Exit interface mode.
BCB(config)#bridge 1 address 0005.1111.1212 forward eth3 vlan 5	Add a static FDB entry to the FDB table to forward all frames with MAC address 0005.1111.1212 and VLAN 5 to interface eth3.
BCB(config)#bridge 1 address 0005.1111.1211 forward eth1 vlan 4	Add a static FDB entry to the FDB table to forward all frames with MAC address 0005.1111.1211 and VLAN 4 to interface eth1.
BCB(config)#exit	Exit the Configure mode.

Validation

Use the commands listed in the sections below to verify and validate the configurations.

Verify CFM Maintenance Points

On IB-BEB-1

```
IB-BEB-1#show ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 10
bridge backbone
```

MPID	LEVEL	TESID	MEP-UP	Remote Mac	RDI	TE-MISMATCH
70	3	10	Yes	0005.1111.1212	True	

70	3	10	Yes	0005.1111.1212	True	
----	---	----	-----	----------------	------	--

```
IB-BEB-1#
```

On IB-BEB-2

```
IB-BEB-2#show ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 10
bridge backbone
```

MPID	LEVEL	TESID	MEP-UP	Remote Mac	RDI	TE-MISMATCH
40	3	10	Yes	0005.1111.1211	True	

40	3	10	Yes	0005.1111.1211	True	
----	---	----	-----	----------------	------	--

Verify CFM Traceroute

On IB-BEB-1

```
IB-BEB-1#traceroute pbb-te ethernet esp-da-mac 0005.1111.1212 domain-name abc te-sid 10
tlv pbb-te-mip reverse-vid 4 bridge backbone
```

source mac	Hops	Relay-action
0005.1111.1212	1	1

0005.1111.1212	1	1
----------------	---	---

On IB-BEB-2

```
IB-BEB-2#traceroute pbb-te ethernet esp-da-mac 0005.1111.1211 domain-name abc te-sid 10
tlv pbb-te-mip reverse-vid 5 bridge backbone
```

source mac	Hops	Relay-action
0005.1111.1211	1	1

0005.1111.1211	1	1
----------------	---	---

Verify CFM Ping

On IB-BEB-1

```
IB-BEB-1#ping ethernet pbb-te unicast rmepid 70 mepid 40 domain-name abc te-sid 10
bridge backbone
```

```
success rate is 100 (5/5)
```

```
IB-BEB-1#
```

On IB-BEB-2

```
IB-BEB-2#ping ethernet pbb-te unicast rmepid 40 mepid 70 domain-name abc te-sid 10
bridge backbone
```

```
success rate is 100 (5/5)
```

```
IB-BEB-2#
```

Multicast Connectivity Fault Management

These configurations are for setting up multicast Connectivity Fault Management (CFM) in a PBB-TE network.

[Figure 11-4](#) displays a simple CFM topology.

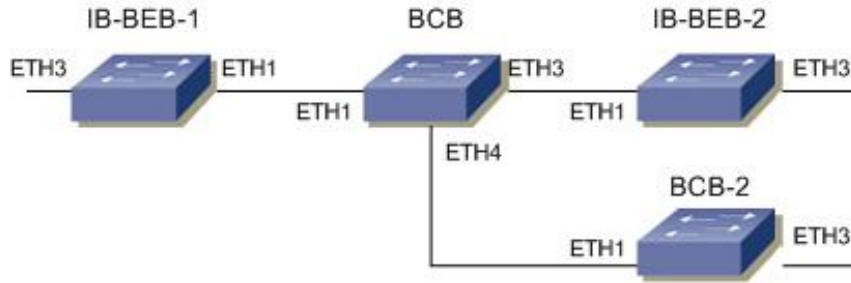


Figure 11-4: CFM Topology

IB-BEB1

IB-BEB-1#configure terminal	Enter configure mode.
IB-BEB-1(config)#bridge beb mac 0001.0001.0001 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC 0001.0001.0001.
IB-BEB-1(config)#bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure backbone bridge 1 with MAC 0001.0001.0001.
IB-BEB-1(config)#vlan database	Enter VLAN configure mode.
IB-BEB-1(config-vlan)#vlan 10 type service point-point bridge 1 state enable	Configure VLAN 10 as a service VLAN and associate it with bridge 1.
IB-BEB-1(config-vlan)#vlan 20 type service point-point bridge 1 state enable	Configure VLAN 20 as a service VLAN and associate it with bridge 1.
IB-BEB-1(config-vlan)#vlan 40 type backbone point-point state enable	Configure VLAN 30 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#vlan 30 type backbone point-point state enable	Configure VLAN 40 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#vlan 50 type backbone point-point state enable	Configure VLAN 50 as a backbone point-to-point VLAN.
IB-BEB-1(config-vlan)#exit	Exit VLAN configure mode.
IB-BEB-1(config)#interface eth3	Enter interface mode.
IB-BEB-1(config-if)#switchport	Configure eth3 as a Layer-2 interface.
IB-BEB-1(config-if)#bridge-group 1	Associate eth3 with bridge-group 1.
IB-BEB-1(config-if)#switchport mode cnp	Set the switching abilities of this interface to CNP mode.
IB-BEB-1(config-if)#switchport beb vlan 10 cnp	Assign VLAN 10 to CNP.
IB-BEB-1(config-if)#switchport beb customer- network svlan add range 10 20 instance 2 name isid	Map SVLAN to I-SID.
IB-BEB-1(config-if)#exit	Exit interface mode.
IB-BEB-1(config)#interface eth1	Enter interface mode.
IB-BEB-1(config-if)#switchport	Configure eth1 as a Layer-2 interface.
IB-BEB-1(config-if)#bridge-group backbone	Associate eth1 with bridge-group backbone.
IB-BEB-1(config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-1(config-if)#switchport beb vlan 40 pnp	Add BVLAN to PNP.

IB-BEB-1 (config-if)#switchport beb provider-network bvlan all	Allow all BVLANs.
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#interface pip.1	Enter interface mode.
IB-BEB-1 (config-if)#switchport beb pip backbone-source-mac 0005.0005.0003	Configure MAC 0005.0005.0003 for interface pip.1.
IB-BEB-1 (config-if)#switchport beb vip instance 2 allowed all	Map ISID to allow all ingress and egress frames with ISID 1.
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#pbb-te configure tesid 3	Configure a TE-SID with SID as 3.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 40	Associate backbone VLAN 40 to TE-SID 3.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 30	Associate backbone VLAN 30 to TE-SID 3.
IB-BEB-1 (pbb-te-vlan-config)#pbb-te vlan 50	Associate backbone VLAN 50 to TE-SID 3.
IB-BEB-1 (pbb-te-vlan-config)#exit	Exit the TE-SID mode.
IB-BEB-1 (config)#interface cbp.1	Enter interface mode.
IB-BEB-1 (config-if)#pbb-te esp tesid 3 ingress remote-mac 0075.0075.0003 vlan 30	Configure TE-SID 3 with remote MAC address 0075.0075.0003, and specify the ingress backbone VLAN.
IB-BEB-1 (config-if)#pbb-te esp tesid 3 ingress remote-mac 0085.0085.0003 vlan 50	Configure TE-SID 3 with remote MAC address 0085.0085.0003, and specify the ingress backbone VLAN.
IB-BEB-1 (config-if)#pbb-te esp tesid 3 egress multicast remote-mac 0180.c200.0030 vlan 40 pnp eth1	Configure TE-SID 3 with remote multicast MAC address 0180.c200.0030, and specify the egress backbone VLAN and egress interface (eth1).
IB-BEB-1 (config-if)#exit	Exit interface mode.
IB-BEB-1 (config)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure PBB-TE MD with name abc on level 3 for backbone bridge.
IB-BEB-1 (config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name 12 te-sid 3 mip-creation default	Configure an MA for TE-SID 3 with MA name 12.
IB-BEB-1 (config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 42 te-sid 3 mac 075.075.03	Add an RMEP for TE-SID 3.
IB-BEB-1 (config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 82 te-sid 3 mac 085.085.03	Exit CFM configuration mode.
IB-BEB-1 (config)#interface cbp.1	Enter interface mode.
IB-BEB-1 (config-if)#ethernet cfm pbb-te mep up mpid 3 domain-name abc te-sid 3 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 3.
IB-BEB-2 (config-if-eth-cfm-pbb-te-mep)#cc multicast state enable	Enable continuity checking (CC) for TE-SID 3 and MEP 3.
IB-BEB-2 (config-if-eth-cfm-pbb-te-mep)#exit	Exit CFM MEP mode.
IB-BEB-1 (config-if)#exit	Exit interface mode.

Configuration for BCB

BCB#configure terminal	Enter configure mode.
BCB(config)#bridge 1 protocol provider-mstp	Configure bridge 1 as a provider bridge.
BCB(config)#vlan database	Enter the VLAN Configure mode.
BCB(config-vlan)#vlan 30 type service point-point bridge 1 state enable	Configure VLAN 30 as a service VLAN and associate it with bridge 1.
BCB(config-vlan)#vlan 40 type service point-point bridge 1 state enable	Configure VLAN 40 as a service VLAN and associate it with bridge 1.
BCB(config-vlan)#vlan 50 type service point-point bridge 1 state enable	Configure VLAN 50 as a service VLAN and associate it with bridge 1.
BCB(config-vlan)#exit	Exit VLAN configure mode.
BCB(config)#pbb-te configure tesid 3	Configure TE-SID 3.
BCB(pbb-te-vlan-config)#pbb-te bridge 1 vlan 40	Associate backbone VLAN 40 to TE-SID 3.
BCB(pbb-te-vlan-config)#pbb-te bridge 1 vlan 30	Associate backbone VLAN 30 to TE-SID 3.
BCB(pbb-te-vlan-config)#pbb-te bridge 1 vlan 50	Associate backbone VLAN 50 to TE-SID 3.
BCB(pbb-te-vlan-config)#exit	Exit PBB-TE VLAN configure mode.
BCB(config)#interface eth1	Enter interface mode.
BCB(config-if)#switchport	Configure eth1 as a Layer-2 interface.
BCB(config-if)#bridge-group 1	Associate eth1 with bridge 1.
BCB(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB(config-if)#switchport provider-network allowed vlan add 30	Associate Service VLAN 30 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 40	Associate Service VLAN 40 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 50	Associate Service VLAN 50 with the provider network.
BCB(config)#exit	Exit interface mode.
BCB(config)#interface eth2	Enter interface mode.
BCB(config-if)#switchport	Configure eth2 as a Layer-2 interface.
BCB(config-if)#bridge-group 1	Associate eth2 with bridge 1.
BCB(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB(config-if)#switchport provider-network allowed vlan add 30	Associate Service VLAN 30 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 40	Associate Service VLAN 40 with the provider network.
BCB(config-if)#exit	Exit interface mode.
BCB(config)#interface eth3	Enter interface mode.

BCB(config-if)#switchport	Configure eth3 as a Layer-2 interface.
BCB(config-if)#bridge-group 1	Associate the eth3 interface with bridge 1.
BCB(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode
BCB(config-if)#switchport provider-network allowed vlan add 30	Associate Service VLAN 30 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 40	Associate Service VLAN 40 with the provider network.
BCB(config-if)#exit	Exit interface mode.
BCB(config)#interface eth4	Enter interface mode.
BCB(config-if)#switchport	Configure eth4 as a Layer-2 interface.
BCB(config-if)#bridge-group 1	Associate eth4 with bridge 1.
BCB(config-if)#switchport mode provider-network	Set the switching abilities of this interface to provider-network mode.
BCB(config-if)#switchport provider-network allowed vlan add 40	Associate Service VLAN 40 with the provider network.
BCB(config-if)#switchport provider-network allowed vlan add 50	Associate Service VLAN 50 with the provider network.
BCB(config-if)#exit	Exit interface mode.
BCB(config)#bridge 1 address 0005.0005.0003 forward eth1 vlan 30	Add a static FDB entry to the FDB table to forward all frames with MAC address 0005.0005.0003 and VLAN 30 to interface eth1.
BCB(config)#bridge 1 address 0075.0075.0003 forward eth3 vlan 40	Add a static FDB entry to the FDB table to forward all frames with MAC address 0075.0075.0003 and VLAN 40 to interface eth3.
BCB(config)#bridge 1 address 0085.0085.0003 forward eth4 vlan 40	Add a static FDB entry to the FDB table to forward all frames with MAC address 0085.0085.0003 and VLAN 40 to interface eth4.
BCB(config)#bridge 1 address 0180.c200.0030 forward eth3 vlan 40	Add a static FDB entry to the FDB table to forward all frames with MAC address 0180.c200.0030 and VLAN 40 to interface eth3.
BCB(config)#bridge 1 address 0180.c200.0030 forward eth4 vlan 40	Add a static FDB entry to the FDB table to forward all frames with MAC address 0180.c200.0030 and VLAN 40 to interface eth4.
BCB(config)#exit	Exit the Configure mode.

IB-BEB2

IB-BEB-2#configure terminal	Enter configure mode.
IB-BEB-2(config)#bridge beb mac 0001.0001.0002 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC 0001.0001.0002.
IB-BEB-2(config)#bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure backbone bridge 1 with MAC 0001.0001.0001.
IB-BEB-2(config)#vlan database	Enter VLAN configure mode.

IB-BEB-2(config-vlan)#vlan 10 type service point-point bridge 1 state enable	Configure VLAN 10 as a backbone point-to-point VLAN.
IB-BEB-2(config-vlan)#vlan 30 type backbone point-point state enable	Configure VLAN 30 as a backbone point-to-point VLAN.
IB-BEB-2(config-vlan)#vlan 40 type backbone point-point state enable	Configure VLAN 40 as a backbone point-to-point VLAN.
IB-BEB-2(config-vlan)#exit	Exit VLAN configure mode.
IB-BEB-2(config)#interface eth3	Enter interface mode.
IB-BEB-2(config-if)#switchport	Configure eth3 as a Layer-2 interface.
IB-BEB-2(config-if)#bridge-group 1	Associate eth3 with bridge-group 1.
IB-BEB-2(config-if)#switchport mode cnp	Set the switching abilities of this interface to CNP mode.
IB-BEB-2(config-if)#switchport beb vlan 10 cnp	Assign VLAN 10 to CNP.
IB-BEB-2(config-if)#switchport beb customer-network svlan add range 10 20 instance 2 name isid	Map SVLAN to I-SID.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#interface eth1	Enter interface mode.
IB-BEB-2(config-if)#switchport	Configure eth1 as a Layer-2 interface.
IB-BEB-2(config-if)#bridge-group backbone	Associate eth1 with bridge-group backbone.
IB-BEB-2(config-if)#switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-2(config-if)#switchport beb vlan 40 pnp	Add BVLAN 40 to PNP.
IB-BEB-2(config-if)#switchport beb provider-network bvlan all	Allow all BVLANs.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#interface pip.1	Enter interface mode.
IB-BEB-2(config-if)#switchport beb pip backbone-source-mac 0075.0075.0003	Configure MAC 0075.0075.0003 for interface pip.1.
IB-BEB-2(config-if)#switchport beb vip instance 2 allowed all	Map ISID to allow all ingress and egress frames with ISID 1.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#pbb-te configure tesid 3	Configure a TE-SID with SID as 3.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 30	Associate backbone VLAN 30 to TE-SID 3.
IB-BEB-2(pbb-te-vlan-config)#pbb-te vlan 40	Associate backbone VLAN 40 to TE-SID 3.
IB-BEB-2(pbb-te-vlan-config)#exit	Exit the TE-SID mode.
IB-BEB-2(config)#interface cbp.1	Enter interface mode.
IB-BEB-2(config-if)#pbb-te esp tesid 3 ingress multicast mcast-mac 0180.c200.0030 remote-mac 0005.0005.0003 vlan 40	Configure TE-SID 3 with remote MAC address 0005.0005.0003 and multicast MAC address 0180.c200.0030; then specify the ingress backbone VLAN.
IB-BEB-2(config-if)#pbb-te esp tesid 3 egress remote-mac 0005.0005.0003 vlan 30 pnp eth1	Configure TE-SID 3 with remote MAC address 0005.0005.0003, and specify the egress backbone VLAN and egress interface (eth1).
IB-BEB-2(config-if)#exit	Exit interface mode.

IB-BEB-2(config)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure a PBB-TE MD with name abc on level 3 for backbone bridge.
IB-BEB-2(config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name 12 te-sid 3 mip-creation default	Configure an MA for TE-SID 3 with MA name 12.
IB-BEB-2(config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 3 te-sid 3 mac 05.05.03	Add an RMEP for TE-SID 3.
IB-BEB-2(config-ether-cfm-pbb-te)#exit	Exit CFM configuration mode.
IB-BEB-2(config)#interface cbp.1	Enter interface mode.
IB-BEB-2(config-if)#ethernet cfm pbb-te mep up mpid 42 domain-name abc te-sid 3 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 3.
IB-BEB-2(config-if-eth-cfm-pbb-te-mep)#cc unicast rmpid 3 state enable	Enable continuity checking (CC) for TE-SID 3 and MEP 42.
IB-BEB-2(config-if-eth-cfm-pbb-te-mep)#exit	Exit CFM MEP mode.
IB-BEB-2(config-if)#exit	Exit interface mode.
IB-BEB-2(config)#exit	Exit configure mode.

IB-BEB3

IB-BEB-3#configure terminal	Enter configure mode.
IB-BEB-3(config)#bridge beb mac 0001.0001.0002 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC 0001.0001.0002.
IB-BEB-3(config)#bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure backbone bridge 1 with MAC 0001.0001.0001.
IB-BEB-3(config)#vlan database	Enter VLAN configure mode.
IB-BEB-3(config-vlan)#vlan 10 type service point-point bridge 1 state enable	Configure VLAN 10 as a backbone point-to-point VLAN.
IB-BEB-3(config-vlan)#vlan 30 type backbone point-point state enable	Configure VLAN 30 as a backbone point-to-point VLAN.
IB-BEB-3(config-vlan)#vlan 40 type backbone point-point state enable	Configure VLAN 40 as a backbone point-to-point VLAN.
IB-BEB-3(config-vlan)#vlan 50 type backbone point-point state enable	Configure VLAN 50 as a backbone point-to-point VLAN.
IB-BEB-3(config-vlan)#exit	Exit VLAN configure mode.
IB-BEB-3(config)#interface eth3	Enter interface mode.
IB-BEB-3(config-if)#switchport	Configure eth3 as a Layer-2 interface.
IB-BEB-3(config-if)#bridge-group 1	Associate eth3 with bridge-group 1.
IB-BEB-3(config-if)#switchport mode cnp	Set the switching abilities of this interface to CNP mode.
IB-BEB-3(config-if)#switchport beb vlan 10 cnp	Assign VLAN 10 to CNP.
IB-BEB-3(config-if)#switchport beb customer-network svlan add range 10 20 instance 2 name isid	Map SVLAN to I-SID.

IB-BEB-3 (config-if) #exit	Exit interface mode.
IB-BEB-3 (config) #interface eth1	Enter interface mode.
IB-BEB-3 (config-if) #switchport	Configure eth1 as a Layer-2 interface.
IB-BEB-3 (config-if) #bridge-group backbone	Associate eth1 with bridge-group backbone.
IB-BEB-3 (config-if) #switchport mode pnp	Set the switching abilities of this interface to PNP mode.
IB-BEB-3 (config-if) #switchport beb vlan 50 pnp	Add BVLAN to PNP.
IB-BEB-3 (config-if) #switchport beb provider-network bvlan all	Allow all BVLANs.
IB-BEB-3 (config-if) #exit	Exit interface mode.
IB-BEB-3 (config) #interface pip.1	Enter interface mode.
IB-BEB-3 (config-if) #switchport beb pip backbone-source-mac 0085.0085.0003	Configure MAC 0085.0085.0003 for interface pip.1.
IB-BEB-3 (config-if) #switchport beb vip instance 2 allowed all	Map ISID to allow all ingress and egress frames with ISID 2.
IB-BEB-3 (config-if) #exit	Exit interface mode.
IB-BEB-3 (config) #pbb-te configure tesid 3	Configure a TE-SID with SID as 3.
IB-BEB-3 (pbb-te-vlan-config) #pbb-te vlan 40	Associate backbone VLAN 40 to TE-SID 3.
IB-BEB-3 (pbb-te-vlan-config) #pbb-te vlan 50	Associate backbone VLAN 50 to TE-SID 3.
IB-BEB-3 (pbb-te-vlan-config) #exit	Exit the TE-SID mode.
IB-BEB-3 (config) #interface cbp.1	Enter interface mode.
IB-BEB-3 (config-if) #pbb-te esp tesid 3 ingress multicast mcast-mac 0180.c200.0030 remote-mac 0005.0005.0003 vlan 40	Configure TE-SID 3 with remote MAC address 0005.0005.0003 and multicast MAC as 0180.c200.0030; then specify the ingress backbone VLAN.
IB-BEB-3 (config-if) #pbb-te esp tesid 3 egress remote-mac 0005.0005.0003 vlan 50 pnp eth1	Configure TE-SID 3 with remote MAC address 0005.0005.0003, and specify the egress backbone VLAN and egress interface (eth1).
IB-BEB-3 (config-if) #exit	Exit interface mode.
IB-BEB-3 (config) #ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure a PBB-TE MD with name abc on level 3 for backbone bridge.
IB-BEB-3 (config-ether-cfm-pbb-te) #service pbb-te ma-type string ma-name 12 te-sid 3 mip-creation default	Configure an MA for TE-SID 3 with MA name 12.
IB-BEB-3 (config-ether-cfm-pbb-te) #mep pbb-te crosscheck mpid 3 te-sid 3 mac 05.05.03	Add an RMEP for TESID 3.
IB-BEB-3 (config-ether-cfm-pbb-te) #exit	Exit CFM configuration mode.
IB-BEB-3 (config) #interface cbp.1	Enter interface mode.
IB-BEB-3 (config-if) #ethernet cfm pbb-te mep up mpid 82 domain-name abc te-sid 3 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 3.
IB-BEB-3 (config-if-eth-cfm-pbb-te-mep) #cc unicast rmpid 3 state enable	Enable continuity checking (CC) for TE-SID 3 and MEP 82.

IB-BEB-3 (config-if-eth-cfm-pbb-te-mep) #exit	Exit CFM MEP mode.
IB-BEB-3 (config-if) #exit	Exit interface mode.
IB-BEB-3 (config) #exit	Exit the configure mode.

Validation

Follow the steps in the sections below to verify and validate the configurations.

Verify CFM Maintenance Points

On IB-BEB-1

```
IB-BEB-1#sh ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 3
bridge backbone
```

MPID	LEVEL	TESID	MEP-UP	Remote Mac	RDI	TE-MISMATCH
42	3	3	Yes	0075.0075.0003	False	
82	3	3	Yes	0085.0085.0003	False	

IB-BEB-1#

On IB-BEB-2

```
IB-BEB-2#sh ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 3
bridge backbone
```

MPID	LEVEL	TESID	MEP-UP	Remote Mac	RDI	TE-MISMATCH
3	3	3	Yes	0005.0005.0003	False	

IB-BEB-2#

On IB-BEB-3

```
IB-BEB-3#sh ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 3
bridge backbone
```

MPID	LEVEL	TESID	MEP-UP	Remote Mac	RDI	TE-MISMATCH
3	3	3	Yes	0005.0005.0003	False	

IB-BEB-3#

Verify CFM Traceroute

On IB-BEB-1

```
IB-BEB-1#traceroute pbb-te ethernet esp-da-mac 75.75.3 domain-name abc te-sid 3 tlv pbb-
te-mip reverse-vid 30 bridge backbone
```

source mac	Hops	Relay-action
0075.0075.0003	1	1

IB-BEB-1#

```
IB-BEB-1#traceroute pbb-te ethernet esp-da-mac 85.85.3 domain-name abc te-sid 3 tlv pbb-
te-mip reverse-vid 50 bridge backbone
```

source mac	Hops	Relay-action
0085.0085.0003	1	1

IB-BEB-1#

On IB-BEB-2

```
IB-BEB-2#traceroute pbb-te ethernet esp-da-mac 5.5.3 domain-name abc te-sid 3 tlv pbb-  
te-mip reverse-vid 40 bridge backbone  
source mac          Hops      Relay-action  
0005.0005.0003      1        1  
IB-BEB-2#
```

On IB-BEB-3

```
IB-BEB-3#traceroute pbb-te ethernet esp-da-mac 5.5.3 domain-name abc te-sid 3 tlv pbb-  
te-mip  
reverse-vid 40 bridge backbone  
source mac          Hops      Relay-action  
0005.0005.0003      1        1  
IB-BEB-3#
```

Verify CFM PING

On IB-BEB-1

```
IB-BEB-1#ping ethernet pbb-te multicast mepid 3 domain-name abc te-sid 3 bridge backbone  
Host MEP: 3  
Number of RMEPs that replied to mcast frame = 2  
LBR received from the following  
  0075.0075.0003  
    success rate is 100 (1/1)  
  0085.0085.0003  
    success rate is 100 (1/1)  
IB-BEB-1#
```

On IB-BEB-2

```
IB-BEB-2#ping ethernet pbb-te unicast rmepid 3 mepid 42 domain-name abc te-sid 3 bridge  
backbone  
  success rate is 100 (5/5)  
IB-BEB-2#
```

On IB-BEB-3

```
IB-BEB-3#  
IB-BEB-3#ping ethernet pbb-te unicast rmepid 3 mepid 82 domain-name abc te-sid 3 bridge  
backbone  
  success rate is 100 (5/5)  
IB-BEB-3#
```


CHAPTER 12 PBB-TE Ethernet Switched Path Configuration

This chapter contains a complete sample PBB-TE Ethernet Switched Path (ESP) configuration in a PBB-TE topology. Currently, all PBB-TE configurations are static. To support ESP configuration dynamically (GMPLS), the dependency of the dynamic configuration is removed from the static configuration part. In addition, there is no command specifically to create an ISID. SVLAN-to-ISID mapping creates an ISID association with the interface and mapping with the SVLAN. The following configuration examples illustrate how to set up PBB-TE different network topologies. Examples are provided for Ethernet Switched Path (ESP).

Note: Provider Backbone Bridging is not supported for ZebIC releases.

Topology

Figure 12-1 displays a simple ESP topology.

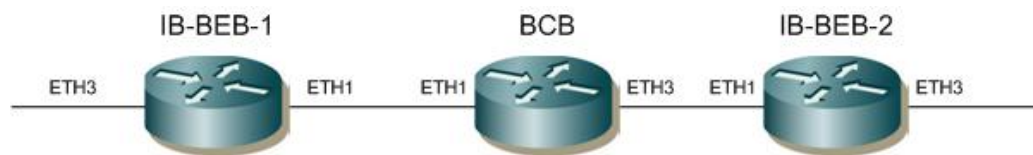


Figure 12-1: Ethernet Switched Path Topology

IB-BEB-1

Do the following to configure an I-component and B-component (IB) on Backbone Edge Bridge (BEB) 1:

#configure terminal	Enter configure mode.
(config)#bridge beb mac aaaa.aaaa.aaaa 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC aaaa.aaaa.aaaa.
(config)#bridge beb mac bbbb.bbbb.bbbb backbone protocol provider-mstp	Configure backbone bridge 1 with MAC bbbb.bbbb.bbbb.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 type service point-point bridge 1 state enable	Configure VLAN 2 as a service VLAN and associate it with bridge 1.
(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure VLAN 3 as a service VLAN and associate it with bridge 1.
(config-vlan)#vlan 4 type backbone point-point state enable	Configure VLAN 4 as a backbone point-to-point VLAN.
(config-vlan)#vlan 5 type backbone point-point state enable	Configure VLAN 5 as a backbone point-to-point VLAN.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#pbb isid list	Enter the Service instance configuration mode.
(pbb-isid)#isid 1 name c1 i-component 1	Configure instance 1 on I-component bridge 1 with name c1. Creates a VIP port for the service instance.

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(pbb-isid)#exit	Exit instance configuration mode.
(config)#interface eth3	Enter interface mode.
(config-if)#switchport	Configure Eth3 as a Layer-2 interface.
(config-if)#bridge-group 1	Associate Eth3 with bridge-group 1.
(config-if)#switchport mode cnp	Set the switching characteristics of this interface to CNP mode.
(config-if)#switchport beb customer-network svlan add 2 instance 1	Map SVLAN to I-SID.
(config-if)#exit	Exit interface mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a Layer-2 interface.
(config-if)#bridge-group backbone	Associate Eth1 with bridge-group backbone.
(config-if)#switchport mode pnp	Set the switching characteristics of this interface to PNP mode.
(config-if)#switchport beb provider-network bvlan add 4	Add BVLAN to PNP.
(config-if)#exit	Exit interface mode.
(config)#pbb-te vlan add range 4 5	Add VLAN 4 and VLAN 5 to te-region.
(config)#interface pip.1	Enter the PIP interface mode.
(config-if)#switchport beb pip backbone-source-mac 0100.1111.1211	Configure PIP source MAC address. This address is internally copied to customer backbone MAC address, as well.
(config-if)#exit	Exit PIP interface mode.
(config)#interface cbp.1	Associate the TESI to a local CBP interface.
(pbb-te-config)#switchport beb customer-backbone instance add 1 bvlan 4	Configure service instance to BVLAN 4 mapping for service instance 1.
(pbb-te-config)#switchport beb customer-backbone instance add 1 bvlan 5	Configure service instance to BVLAN 5 mapping for service instance 1.
(pbb-te-config)#pbb-te configure tesid 10 name trunk-1	Configure TESID 10 with name trunk-1.
(pbb-te-config)#cbp interface cbp.1	Associate the TESI to a local CBP interface.
(pbb-te-config)#esp egress remote-mac 0100.1111.1212 vlan 4	Add egress ESP for VLAN 4.
(pbb-te-config)#esp ingress remote-mac 0100.1111.1212 vlan 5	Add ingress ESP for VLAN 5.
(pbb-te-config)#esp egress pnp add eth1	Configure egress ESP PNP interface.
(pbb-te-config)#exit	Exit pbb-te mode.

IB-BEB-2

Do the following to configure an I-component and B-component (IB) on Backbone Edge Bridge (BEB) 2:

#configure terminal	Enter configure mode.
(config)#bridge beb mac aaaa.aaaa.aaaa 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC aaaa.aaaa.aaaa.

(config)#bridge beb mac bbbb.bbbb.bbbb backbone protocol provider-mstp	Configure backbone bridge 1 with MAC bbbb.bbbb.bbbb.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 type service point-point bridge 1 state enable	Configure VLAN 2 as a service VLAN and associate it with bridge 1.
(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Configure VLAN 3 as a service VLAN and associate it with bridge 1.
(config-vlan)#vlan 4 type backbone point-point state enable	Configure VLAN 4 as a backbone point-to-point VLAN.
(config-vlan)#vlan 5 type backbone point-point state enable	Configure VLAN 5 as a backbone point-to-point VLAN.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#pbb isid list	Enter the Service instance configuration mode.
(pbb-isid)#isid 1 name c1 i-component 1	Configure instance 1 on I-component bridge 1 with name c1. Creates a VIP port for the service instance.
(pbb-isid)#exit	Exit instance configuration mode.
(config)#interface eth3	Enter interface mode.
(config-if)#switchport	Configure Eth3 as a Layer-2 interface.
(config-if)#bridge-group 1	Associate Eth3 with bridge-group 1.
(config-if)#switchport mode cnp	Set the switching characteristics of this interface to CNP mode.
(config-if)#switchport beb customer-network svlan add 2 instance 1	Map SVLAN to I-SID.
(config-if)#exit	Exit interface mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a Layer-2 interface.
(config-if)#bridge-group backbone	Associate Eth1 with bridge-group backbone.
(config-if)#switchport mode pnp	Set the switching characteristics of this interface to PNP mode.
(config-if)#switchport beb provider-network bvlan add 5	Add BVLAN to PNP.
(config-if)#exit	Exit interface mode.
(config)#pbb-te vlan add range 4 5	Adds VLAN 4 and VLAN 5 to te-region.
(config)#interface pip.1	Enter the PIP interface mode.
(config-if)#switchport beb pip backbone- source-mac 0100.1111.1212	Configure PIP source MAC address. This address is internally copied to customer backbone MAC address, as well.
(config-if)#exit	Exit PIP interface mode.
(config)#interface cbp.1	Associate the TESI to a local CBP interface.
(pbb-te-config)#switchport beb customer- backbone instance add 1 bvlan 4	Configure service instance to BVLAN 4 mapping for service instance 1.
(pbb-te-config)#switchport beb customer- backbone instance add 1 bvlan 5	Configure service instance to BVLAN 5 mapping for service instance 1.
(pbb-te-config)#pbb-te configure tesid 10 name trunk-1	Configure TESID 10 with name trunk-1.
(pbb-te-config)#cbp interface cbp.1	Associate the TESI to a local CBP interface.

(pbb-te-config)#esp egress remote-mac 0100.1111.1212 vlan 4	Add egress ESP for VLAN 4.
(pbb-te-config)#esp ingress remote-mac 0100.1111.1212 vlan 5	Add ingress ESP for VLAN 5.
(pbb-te-config)#esp egress pnp add eth1	Configure egress ESP PNP interface.
(pbb-te-config)#exit	Exit pbb-te mode

BCB

Do the following to configure Backbone Core Bridge (BCB):

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-mstp	Configure bridge 1 as a provider bridge.
(config)#vlan database	Enter the VLAN Configure mode.
(config-vlan)#vlan 4 type service point-point bridge 1 state enable	Configure VLAN 4 as a service VLAN and associate it with bridge 1.
(config-vlan)#vlan 5 type service point-point bridge 1 state enable	Configure VLAN 5 as a service VLAN and associate it with bridge 1.
(config-vlan)#exit	Exit the VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a Layer-2 interface.
(config-if)#bridge-group 1	Associate Eth1 with bridge 1.
(config-if)#switchport mode provider-network	Set the switching characteristics of this interface to provider-network mode.
(config-if)#switchport provider-network allowed vlan add 4	Associate Service VLAN 4 with the provider network.
(config-if)#switchport provider-network allowed vlan add 5	Associate Service VLAN 5 with the provider network.
(config-if)#exit	Exit interface mode.
(config)#interface eth3	Enter interface mode.
(config-if)#switchport	Configure Eth3 as a Layer-2 interface.
(config-if)#bridge-group 1	Associate Eth3 with bridge 1.
(config-if)#switchport mode provider-network	Set the switching characteristics of this interface to provider-network mode.
(config-if)#switchport provider-network allowed vlan add 4	Associate Service VLAN 4 with the provider network.
(config-if)#switchport provider-network allowed vlan add 5	Associate Service VLAN 5 with the provider network.
(config-if)#exit	Exit interface mode.
(config)#bridge 1 address 0100.1111.1212 forward eth2 vlan 5	Add a static FDB entry to the FDB table to forward all frames with MAC address 0100.1111.1212 and VLAN 5 to interface Eth2.

```
(config)#bridge 1 address 0100.1111.1211
forward eth1 vlan 5
```

Add a static FDB entry to the FDB table to forward all frames with MAC address 0100.1111.1211 and VLAN 4 to interface Eth1.

```
(config)#exit
```

Exit the Configure mode.

Validation

Enter the commands listed in the sections below to confirm the configurations.

On IB-BEB-1

```
#show pbb-te all
TESID: 10
cbp interface: cbp.1
tesi type: static
tesi mode: passive
ESP Id  SMAC          DMAC          ESP-VID Ingress  Multicast
000     0100.1111.1211 0100.1111.1212 4       Yes     No
001     0100.1111.1211 0100.1111.1212 5       No      No
#show pbb-te tesid 10
TESID: 10
cbp interface: cbp.1
tesi type: static
tesi mode: passive
ESP Id  SMAC          DMAC          ESP-VID Ingress  Multicast
000     0100.1111.1211 0100.1111.1212 4       Yes     No
001     0100.1111.1211 0100.1111.1212 5       No      No
```

On IB-BEB-2

```
#show pbb-te all
TESID: 10
cbp interface: cbp.1
tesi type: static
tesi mode: passive
ESP Id  SMAC          DMAC          ESP-VID Ingress  Multicast
000     0100.1111.1212 0100.1111.1211 5       Yes     No
001     0100.1111.1212 0100.1111.1211 4       No      No
IB-BEB-1##show pbb-te tesid 10
TESID: 10
cbp interface: cbp.1
tesi type: static
tesi mode: passive
ESP Id  SMAC          DMAC          ESP-VID Ingress  Multicast
000     0100.1111.1212 0100.1111.1211 5       Yes     No
001     0100.1111.1212 0100.1111.1211 4       No      No
```


CHAPTER 13 PBB-TE APS Configuration

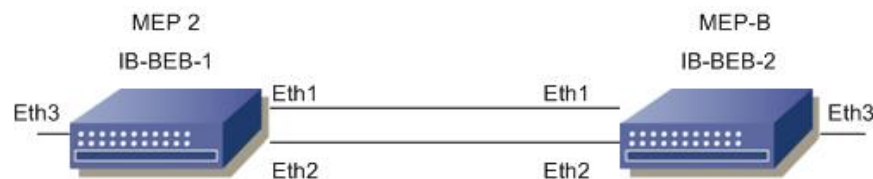
The following section describes the configuration for setting up Automatic Protection Switching (APS) in a PBB-TE topology. Specifically, this requirement mainly concerns PBB-TE APS load sharing.

In most configurations, two PBB-TE APS Protection Groups (PG1 and PG2) share two TESIDs (TESID-1 & TESID-2). PG1 uses TESID-1 as a working TESID and TESID-2 as a protection TESID. Conversely, PG2 uses TESID-2 as a working TESID and TESID-1 as a protection TESID. These two protection groups operate on their own independent state machine. If any of the TESID fail, load sharing occurs due to the protection switching mechanism.

Note: Provider Backbone Bridging is not supported for ZebIC releases.

Topology

Figure 13-1 displays a simple PBB-TE Automatic Protection Switching (APS) topology.



IB-BEB-1

Do the following to configure an I-component and B-component (IB) on Backbone Edge Bridge (BEB) 1:

#configure terminal	Enter configure mode.
(config)#bridge beb mac 0001.0001.0001 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC 0001.0001.0001.
(config)#spanning-tree mode provider-rstp	Configure spanning tree mode as rstp
(config)#bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure a backbone bridge 1 with MAC 0001.0001.0001.
(config)#ethernet cfm enable	Enable CFM globally.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 10 type service point- point bridge 1 name ipi10	Configure VLAN 10 as a service VLAN, associate it with bridge 1.
(config-vlan)#vlan 10 type service point- point bridge 1 state enable	Configure VLAN 10 as a service VLAN, associate it with bridge 1 and set state to enable.
(config-vlan)#vlan 20 type service point- point bridge 1 name ipi20	Configure VLAN 20 as a service VLAN, associate it with bridge 1.
(config-vlan)#vlan 20 type service point- point bridge 1 state enable	Configure VLAN 20 as a service VLAN, associate it with bridge 1 and set state to enable.

(config-vlan)#vlan 30 type service point-point bridge 1 name ipi30	Configure VLAN 30 as a service VLAN, associate it with bridge 1.
(config-vlan)#vlan 30 type service point-point bridge 1 state enable	Configure VLAN 30 as a service VLAN, associate it with bridge 1 and set state to enable.
(config-vlan)#vlan 40 type backbone point-point name ipi40	Configure VLAN 40 as a backbone point-to-point VLAN.
(config-vlan)#vlan 40 type backbone point-point state enable	Configure VLAN 40 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#vlan 30 type backbone point-point name abc	Configure VLAN 30 as a backbone point-to-point VLAN.
(config-vlan)#vlan 30 type backbone point-point state enable	Configure VLAN 30 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#vlan 50 type backbone point-point name ipi50	Configure VLAN 50 as a backbone point-to-point VLAN.
(config-vlan)#vlan 50 type backbone point-point state enable	Configure VLAN50 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#vlan 60 type backbone point-point name ipi60	Configure VLAN 40 as a backbone point-to-point VLAN.
(config-vlan)#vlan 60 type backbone point-point state enable	Configure VLAN 60 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#vlan 70 type backbone point-point name ipi70	Configure VLAN 70 as a backbone point-to-point VLAN.
(config-vlan)#vlan 70 type backbone point-point state enable	Configure VLAN 70 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#vlan 80 type backbone point-point name ipi80	Configure VLAN 80 as a backbone point-to-point VLAN.
(config-vlan)#vlan 80 type backbone point-point state enable	Configure VLAN 80 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#exit	Exit the VLAN configuration mode.
(config)#pbb-te vlan add 30	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb-te vlan add 40	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb-te vlan add 50	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb-te vlan add 60	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb-te vlan add 70	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb-te vlan add 80	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb isid list	Enter the ISID configuration mode.
(pbb-isid)#isid 2 name c2 i-component 1	Create an ISID 2 and associate it with i-component 1.
(pbb-isid)#isid 3 name c3 i-component 1	Create an ISID 3 and associate it with i-component 1.
(pbb-isid)#isid 4 name c4 i-component 1	Create an ISID 3 and associate it with i-component 1.
(pbb-isid)#exit	Exit the ISID configuration mode.
(config)#pbb-te configure tesid 3	Configure a TE-SID with SID as 3.
(pbb-te-config)#cbp interface cbp.1	Associate the TESI to a local CBP interface.
(pbb-te-config)#exit	Exit interface mode.
(config-if)#pbb-te configure tesid 5	Configure a TE-SID with SID as 5.
(config-if)#interface cbp.1	Enter interface mode.
(config-if)#exit	Exit interface mode.

(config)#interface eth3	Enter interface mode.
(config-if)#switchport	Configure eth3 as a Layer-2 interface.
(config-if)#bridge-group 1	Associate the eth3 interface with bridge 1.
(config-if)#switchport mode cnp	Set the switching characteristics of this interface to CNP mode.
(config-if)#switchport beb customer-network svlan add 10 instance 2	Map SVLAN 10 to I-ISID 2.
(config-if)#switchport beb customer-network svlan add 20 instance 3	Map SVLAN 20 to I-ISID 3.
(config-if)#switchport beb customer-network svlan add 30 instance 4	Map SVLAN 30 to I-ISID 4.
(config-if)#no shutdown	Administratively shut down the interface.
(config-if)#no multicast	
(config-if)#exit	Exit interface mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure eth1 as a Layer-2 interface.
(config-if)#bridge-group backbone	Associate eth1 with bridge-group backbone.
(config-if)#switchport mode pnp	Set the switching characteristics of this interface to PNP mode.
(config-if)#switchport beb vlan 40 pnp	Add BVLAN 40 to PNP.
(config-if)#switchport beb provider-network bvlan all	Allow all BVLANS.
(config-if)#no shutdown	Administratively shut down the interface.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure eth2 as a Layer-2 interface.
(config-if)#bridge-group backbone	Associate eth2 with bridge-group backbone.
(config-if)#switchport mode pnp	Set the switching characteristics of this interface to PNP mode.
(config-if)#switchport beb vlan 70 pnp	Add BVLAN 70 to PNP.
(config-if)#switchport beb provider-network bvlan all	Allow all BVLANS.
(config-if)#no shutdown	Administratively shut down the interface.
(config-if)#exit	Exit interface mode.
(config)#interface pip.1	Enter interface mode.
(config-if)#switchport beb pip backbone- source-mac 0005.1111.1212	Configure MAC address 0005.1111.1212 for interface pip.1.
(config-if)#exit	Exit interface mode.
(pbb-te-config)#interface cbp.1	Enter interface mode.
(pbb-te-config)#switchport beb customer- backbone instance add 2 bvlan 40	Configure service instance to BVLAN 40 mapping for customer-backbone instance 2.
(pbb-te-config)#switchport beb customer- backbone instance add 3 bvlan 60	Configure service instance to BVLAN 60 mapping for customer-backbone instance 3.
(pbb-te-config)#switchport beb customer- backbone instance add 4 bvlan 80	Configure service instance to BVLAN 80 mapping for customer-backbone instance 4.

PBB-TE APS Configuration

(pbb-te-config)#no shutdown	Administratively shut down the interface.
(config-if)#exit	Exit interface mode.
(config)#interface cbp.1	Enter interface mode.
(pbb-te-config)#pbb-te configure esp tesi 3	Enter the ESP configure mode.
(pbb-te-esp-if-config)#esp ingress remote-mac 0075.0075.0003 vlan 30	Add ESP ingress for remote-mac 0075.0075.0003 and VLAN 30.
(pbb-te-esp-if-config)#esp egress remote-mac 0075.0075.0003 vlan 40	Add ESP egress for remote-mac 0075.0075.0003 and VLAN 40.
(pbb-te-esp-if-config)#esp egress pnp add eth1	Add a PNP interface to this TESI.
(pbb-te-esp-if-config)#exit	Exit the ESP Configure mode.
(config-if)#pbb-te configure esp tesi 5	Enter the ESP Configure mode.
(pbb-te-esp-if-config)#esp ingress remote-mac 0075.0075.0003 vlan 70	Add ESP ingress for remote-mac 0075.0075.0003 and VLAN 70.
(pbb-te-esp-if-config)#esp egress remote-mac 0075.0075.0003 vlan 80	Add ESP egress for remote-mac 0075.0075.0003 and VLAN 80.
(pbb-te-esp-if-config)#esp egress pnp add eth2	Add a PNP interface to this TESI.
(pbb-te-esp-if-config)#exit	Exit the ESP Configure mode.
(config)#exit	Exit interface mode.
(config)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure a PBB-TE MD with name abc on level 3 for backbone bridge.
(config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name 12 te-sid 3 mip-creation default	Configure an MA for TE-SID 3 with MA name 12.
(config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 70 te-sid 3 mac 075.075.03	Add an RMEP (remote MEP) for TE-SID 3.
(config-ether-cfm-pbb-te)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure a PBB-TE MD with name abc on level 3 for backbone bridge.
(config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name 14 te-sid 5 mip-creation default	Configure an MA for TE-SID 5 with MA name 14.
(config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 72 te-sid 5 mac 75.75.03	Add an RMEP (remote MEP) for TE-SID 5.
(config-ether-cfm-pbb-te)#exit	Exit this Configure mode.
(config-if)#interface cbp.1	Enter interface mode.
(pbb-te-config)#ethernet cfm pbb-te mep up mpid 90 domain-name abc te-sid 3 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 3 with MEP ID 90.
(config-if-eth-cfm-pbb-te-mep)#cc unicast rmpid 70 state enable	Enable continuity checking (CC) for TE-SID 3 and MEP 90.
(config-if-eth-cfm-pbb-te-mep)#exit	Exit CFM MEP mode.
(pbb-te-config)#ethernet cfm pbb-te mep up mpid 92 domain-name abc te-sid 5 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 5 with MEP ID 92.
(config-if-eth-cfm-pbb-te-mep)#cc unicast rmpid 72 state enable	Enable continuity checking (CC) for TE-SID 5 and MEP 92.

(config-if-eth-cfm-pbb-te-mep)#exit	Exit CFM MEP mode.
(pbb-te-config)#pbb-te aps-group 10 working-tesi 3 protection-tesi 5	Create an APS GROUP 10 with working-tesi as 3 and protection-tesi as 5.
(pbb-te-config)#pbb-te aps-group 10 isid add 2	Associate ISID 2 to APS Group 10.
(pbb-te-config)#pbb-te aps-group 20 working-tesi 5 protection-tesi 3	Create an APS GROUP 20 with working-tesi as 5 and protection-tesi as 3.
(pbb-te-config)#pbb-te aps-group 20 isid add 3	Associate ISID 3 to APS Group 20.
(pbb-te-config)#pbb-te configure switching cbp cbp.1 aps-group 10	Enter the APS Group configuration mode.
(pbb-te-config-switching)#pbb-te associate aps-group 10 cbp cbp.1 md-name abc working ma-name 12 protective ma-name 14	Associate APS group 10 to MD with name abc and working MA name 12 and protection MA name 14.
(pbb-te-config-switching)#exit	Exit APS group configuration mode to configuration mode.
(pbb-te-config-switching)#pbb-te configure switching cbp cbp.1 aps-group 20	Enter the APS Group configuration mode.
(pbb-te-config-switching)#pbb-te associate aps-group 20 cbp cbp.1 md-name abc working ma-name 14 protective ma-name 12	Associate APS group 20 to MD with name abc and working MA name 14 and protection MA name 12.
(config-if)#exit	Enter the APS Group configuration mode.

IB-BEB-2

Do the following to configure an I-component and B-component (IB) on Backbone Edge Bridge (BEB) 2:

#configure terminal	Enter configure mode.
(config)#bridge beb mac 0001.0001.0001 1 protocol provider-mstp	Configure an I-component bridge 1 with MAC 0001.0001.0001.
(config)#spanning-tree mode provider-rstp	Configure spanning tree mode as rstp
(config)#bridge beb mac 0001.0001.0001 backbone protocol provider-mstp	Configure a backbone bridge 1 with MAC 0001.0001.0001.
(config)#ethernet cfm enable	Enable CFM globally.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 10 type service point-point bridge 1 name ipi10	Configure VLAN 10 as a service VLAN, associate it with bridge 1.
(config-vlan)#vlan 10 type service point-point bridge 1 state enable	Configure VLAN 10 as a service VLAN, associate it with bridge 1 and set state to enable.
(config-vlan)#vlan 20 type service point-point bridge 1 name ipi20	Configure VLAN 20 as a service VLAN, associate it with bridge 1.
(config-vlan)#vlan 20 type service point-point bridge 1 state enable	Configure VLAN 20 as a service VLAN, associate it with bridge 1 and set state to enable.
(config-vlan)#vlan 30 type service point-point bridge 1 name ipi30	Configure VLAN 30 as a service VLAN, associate it with bridge 1.
(config-vlan)#vlan 30 type service point-point bridge 1 state enable	Configure VLAN 30 as a service VLAN, associate it with bridge 1 and set state to enable.

(config-vlan)#vlan 40 type backbone point-point name ipi40	Configure VLAN 40 as a backbone point-to-point VLAN.
(config-vlan)#vlan 40 type backbone point-point state enable	Configure VLAN 40 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#vlan 30 type backbone point-point name abc	Configure VLAN 30 as a backbone point-to-point VLAN.
(config-vlan)#vlan 30 type backbone point-point state enable	Configure VLAN 30 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#vlan 50 type backbone point-point name ipi50	Configure VLAN 50 as a backbone point-to-point VLAN.
(config-vlan)#vlan 50 type backbone point-point state enable	Configure VLAN50 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#vlan 60 type backbone point-point name ipi60	Configure VLAN 40 as a backbone point-to-point VLAN.
(config-vlan)#vlan 60 type backbone point-point state enable	Configure VLAN 60 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#vlan 70 type backbone point-point name ipi70	Configure VLAN 70 as a backbone point-to-point VLAN.
(config-vlan)#vlan 70 type backbone point-point state enable	Configure VLAN 70 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#vlan 80 type backbone point-point name ipi80	Configure VLAN 80 as a backbone point-to-point VLAN.
(config-vlan)#vlan 80 type backbone point-point state enable	Configure VLAN 80 as a backbone point-to-point VLAN and set state to enable.
(config-vlan)#exit	Exit the VLAN configuration mode.
(config)#pbb-te vlan add 30	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb-te vlan add 40	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb-te vlan add 50	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb-te vlan add 60	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb-te vlan add 70	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb-te vlan add 80	Configure the backbone VLANs to be part of the TE-region.
(config)#pbb isid list	Enter the ISID configuration mode.
(pbb-isid)#isid 2 name c2 i-component 1	Create an ISID 2 and associate it with i-component 1.
(pbb-isid)#isid 3 name c3 i-component 1	Create an ISID 3 and associate it with i-component 1.
(pbb-isid)#isid 4 name c4 i-component 1	Create an ISID 3 and associate it with i-component 1.
(pbb-isid)#exit	Exit the ISID configuration mode.
(config)#pbb-te configure tesid 3	Configure a TE-SID with SID as 3.
(pbb-te-config)#cbp interface cbp.1	Associate the TESI to a local CBP interface.
(pbb-te-config)#exit	Exit interface mode.
(config-if)#pbb-te configure tesid 5	Configure a TE-SID with SID as 5.
(config-if)#interface cbp.1	Enter interface mode.
(config-if)#exit	Exit interface mode.
(config)#interface eth3	Enter interface mode.
(config-if)#switchport	Configure eth3 as a Layer-2 interface.
(config-if)#bridge-group 1	Associate the eth3 interface with bridge 1.

(config-if)#switchport mode cnp	Set the switching characteristics of this interface to CNP mode.
(config-if)#switchport beb customer-network svlan add 10 instance 2	Map SVLAN 10 to I-ISID 2.
(config-if)#switchport beb customer-network svlan add 20 instance 3	Map SVLAN 20 to I-ISID 3.
(config-if)#switchport beb customer-network svlan add 30 instance 4	Map SVLAN 30 to I-ISID 4.
(config-if)#no shutdown	Administratively shut down the interface.
(config-if)#no multicast	
(config-if)#exit	Exit interface mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure eth1 as a Layer-2 interface.
(config-if)#bridge-group backbone	Associate eth1 with bridge-group backbone.
(config-if)#switchport mode pnp	Set the switching characteristics of this interface to PNP mode.
(config-if)#switchport beb vlan 30 pnp	Add BVLAN 30 to PNP.
(config-if)#switchport beb provider-network bvlan all	Allow all BVLANS.
(config-if)#no shutdown	Administratively shut down the interface.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure eth2 as a Layer-2 interface.
(config-if)#bridge-group backbone	Associate eth2 with bridge-group backbone.
(config-if)#switchport mode pnp	Set the switching characteristics of this interface to PNP mode.
(config-if)#switchport beb vlan 70 pnp	Add BVLAN 70 to PNP.
(config-if)#switchport beb provider-network bvlan all	Allow all BVLANS.
(config-if)#no shutdown	Administratively shut down the interface.
(config-if)#exit	Exit interface mode.
(config)#interface pip.1	Enter interface mode.
(config-if)#switchport beb pip backbone- source-mac 0075.0075.0003	Configure MAC address 0075.0075.0003 for interface pip.1.
(config-if)#exit	Exit interface mode.
(config-if)#interface cbp.1	Enter interface mode.
(config-if)#switchport beb customer-backbone instance add 2 bvlan 30	Configure service instance to BVLAN 30 mapping for customer-backbone instance 2.
(config-if)#switchport beb customer-backbone instance add 3 bvlan 50	Configure service instance to BVLAN 50 mapping for customer-backbone instance 3.
(config-if)#switchport beb customer-backbone instance add 4 bvlan 70	Configure service instance to BVLAN 70 mapping for customer-backbone instance 4.
(config-if)#pbb-te configure esp tesi 3	Enter the ESP configure mode.
(pbb-te-esp-if-config)#esp ingress remote-mac 0075.0075.0003 vlan 40	Add ESP ingress for remote-mac 0075.0075.0003 and VLAN 40.

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(pbb-te-esp-if-config)#esp egress remote-mac 0075.0075.0003 vlan 30	Add ESP egress for remote-mac 0075.0075.0003 and VLAN 30.
(pbb-te-esp-if-config)#esp egress pnp add eth1	Add a PNP interface to this TESI.
(pbb-te-esp-if-config)#exit	Exit the ESP Configure mode.
(config-if)#pbb-te configure esp tesi 5	Enter the ESP Configure mode.
(pbb-te-esp-if-config)#esp ingress remote-mac 005.005.0003 vlan 80	Add ESP ingress for remote-mac 0075.0075.0003 and VLAN 80.
(pbb-te-esp-if-config)#esp egress remote-mac 005.005.0003 vlan 70	Add ESP egress for remote-mac 0075.0075.0003 and VLAN 70.
(pbb-te-esp-if-config)#esp egress pnp add eth2	Add a PNP interface to this TESI.
(pbb-te-esp-if-config)#exit	Exit the ESP Configure mode.
(config-if)#exit	Exit interface mode.
(config-if)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure a PBB-TE MD with name abc on level 3 for backbone bridge.
(config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name 12 te-sid 3 mip-creation default	Configure an MA for TE-SID 3 with MA name 12.
(config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 90 te-sid 3 mac 05.05.03	Add an RMEP (remote MEP) for TE-SID 3.
(config-ether-cfm-pbb-te)#ethernet cfm pbb-te domain-name type character-string name abc level 3 mip-creation default bridge backbone	Configure a PBB-TE MD with name abc on level 3 for backbone bridge.
(config-ether-cfm-pbb-te)#service pbb-te ma-type string ma-name 14 te-sid 5 mip-creation default	Configure an MA for TE-SID 5 with MA name 14.
(config-ether-cfm-pbb-te)#mep pbb-te crosscheck mpid 92 te-sid 5 mac 05.05.03	Add an RMEP (remote MEP) for TE-SID 5.
(config-ether-cfm-pbb-te)#exit	Exit ESP Configure mode.
(config-if)#interface cbp.1	Enter interface mode.
(config-if)#ethernet cfm pbb-te mep up mpid 70 domain-name abc te-sid 3 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 3 with MEP ID 70.
(config-if-eth-cfm-pbb-te-mep)#cc unicast rmpid 90 state enable	Enable continuity checking (CC) for TE-SID 3 and MEP 70
(config-if-eth-cfm-pbb-te-mep)#exit	Exit CFM MEP mode.
(config-if)#ethernet cfm pbb-te mep up mpid 72 domain-name abc te-sid 5 bridge backbone	Configure an UP MEP on logical CBP for TE-SID 5 with MEP ID 72.
(config-if-eth-cfm-pbb-te-mep)#cc unicast rmpid 72 state enable	Enable continuity checking (CC) for TE-SID 5 and MEP 72.
(config-if-eth-cfm-pbb-te-mep)#exit	Exit CFM MEP mode.
(config-if)#pbb-te aps-group 10 working-tesi 3 protection-tesi 5	Create an APS GROUP 10 with working-tesi as 3 and protection-tesi as 5.
(config-if)#pbb-te aps-group 10 isid add 2	Associate ISID 2 to APS Group 10.
(config-if)#pbb-te aps-group 20 working-tesi 5 protection-tesi 3	Create an APS GROUP 20 with working-tesi as 5 and protection-tesi as 3.
(config-if)#pbb-te aps-group 20 isid add 3	Associate ISID 3 to APS Group 20.

(config-if)#pbb-te configure switching cbp cbp.1 aps-group 10	Enter the APS Group configuration mode.
(pbb-te-config-switching)#pbb-te associate aps-group 10 cbp cbp.1 md-name abc working ma-name 12 protective ma-name 14	Associate APS group 10 to MD with name abc and working MA name 12 and protection MA name 14.
(pbb-te-config-switching)#exit	Exit APS group configuration mode to configuration mode.
(pbb-te-config-switching)#pbb-te configure switching cbp cbp.1 aps-group 20	Enter the APS Group configuration mode.
(pbb-te-config-switching)#pbb-te associate aps-group 20 cbp cbp.1 md-name abc working ma-name 14 protective ma-name 12	Associate APS group 20 to MD with name abc and working MA name 14 and protection MA name 12.
(config-if)#exit	Enter the APS Group configuration mode.

Validation

Enter the commands listed in the sections below to confirm the configurations.

Verify CFM Configuration for APS

On IB-BEB-1

```
#show ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 10
bridge backbone
MPIDLEVELTESIDMEP-UPRemote MacRDITE-MISMATCH
-----
40310Yes0005.1111.1212False
##sh ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 20 bridge
backbone
MPIDLEVELTESIDMEP-UPRemote MacRDITE-MISMATCH
-----
60320 Yes0005.1111.1212False
#sh ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 30 bridge
backbone
MPIDLEVELTESIDMEP-UPRemote MacRDITE-MISMATCH
-----
80330Yes0005.1111.1212False
```

On IB-BEB-2

```
IB-BEB-2#sh ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 10
bridge backbone
MPIDLEVELTESIDMEP-UPRemote MacRDITE-MISMATCH
-----
50310Yes0005.1111.1211False
IB-BEB-2#sh ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 20
bridge backbone
MPIDLEVELTESIDMEP-UPRemote MacRDITE-MISMATCH
```

```
-----
70320Yes0005.1111.1211False
IB-BEB-2#sh ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 30
bridge backbone
MPIDLEVELTESIDMEP-UPRemote MacRDITE-MISMATCH
-----
90330Yes0005.1111.1211False
```

Verify PBB-TE APS Group Configuration

```
#sh pbb-te aps-group all
BridgeApsIDWorking-Path Protection-PathCurrent-StateActive-Path
-----
Backbone11020No-Request10
Backbone22030No-Request20
IB-BEB-2#sh pbb-te aps-group all
BridgeApsIDWorking-PathProtection-PathCurrent-StateActive-Path
-----
Backbone11020No-Request10
Backbone22030No-Request20
```

On disabling CCM on TE-SID 10, the state of aps-group 1 on IB-BEB-1 changes to Working SF

Disabling CCMs on TE-SID 10 on IB-BEB-2

```
IB-BEB-2#con t
Enter configuration commands, one per line. End with CNTL/Z.
IB-BEB-2(config)#ethernet cfm pbb-te cc unicast mpid 40 rmpid 50 state disable
domain-name abc te-sid 10 bridge backbone
IB-BEB-2(config)#end
IB-BEB-1
#show ethernet cfm pbb-te maintenance-points remote domain-name abc te-sid 10
bridge backbone
MPIDLEVELTESIDMEP-UPRemote MacRDITE-MISMATCH
-----
40310No0005.1111.1212False
#sh pbb-te aps-group 1
BridgeApsIDWorking-PathProtection-PathCurrent-StateActive-Path
-----
Backbone11020Working SF20
```

Verify Automatic Protection Switching

To verify automatic protection switching when common TE-SID (shared between 2 protection groups) link is down

BCB-2

```
(config)#interface eth1
(config-if)#shutdown
```

IB-BEB-1

```
#show pbb-te aps-group 1
BridgeApsIDWorking-PathProtection-PathCurrent-StateActive-Path
-----
Backbone11020ProtectionSF10
```

To verify automatic protection switching when “MANUAL SWITCH” command is executed on the TESID which is shared in protection groups.

```
(config)#pbb-te configure switching cbp cbp.1 aps-group 1
(pbb-te-config-switching)#manual-switch tesi 20
Verify status for Protection group 1
#show pbb-te aps-group 1
BridgeApsIDWorking-PathProtection-PathCurrent-StateActive-Path
-----
Backbone11020ManualSwitchtoWorking10
IB-BEB-2#show pbb-te aps-group 1
BridgeApsIDWorking-PathProtection-PathCurrent-StateActive-Path
-----
Backbone11020No-Request 10
```

Verify status for Protection group 2

```
#show pbb-te aps-group 2
#show pbb-te aps-group 1
BridgeApsIDWorking-PathProtection-PathCurrent-StateActive-Path
-----
Backbone12030ManualSwitchtoWorking30
IB-BEB-2#show pbb-te aps-group 1
BridgeApsIDWorking-PathProtection-PathCurrent-StateActive-Path
-----
Backbone12030No-Request30
```


CHAPTER 14 Service OAM Configuration

This chapter contains a complete sample Service OAM (SOAM) configuration. Service OAM requirements represent expectations of Service Providers when managing Ethernet services within a MEN (Metro Ethernet Network) and subscribers when managing Ethernet services across a MEN. Service OAM framework describes the high-level constructs used to model different MEN and service components that are relevant for OAM.

This feature adds to the existing MEF 17 implementation in ZebOS-XP. With this feature, users can monitor the connectivity status of an MA or an MEG.

Topology

Figure 14-1 displays a sample SOAM topology.

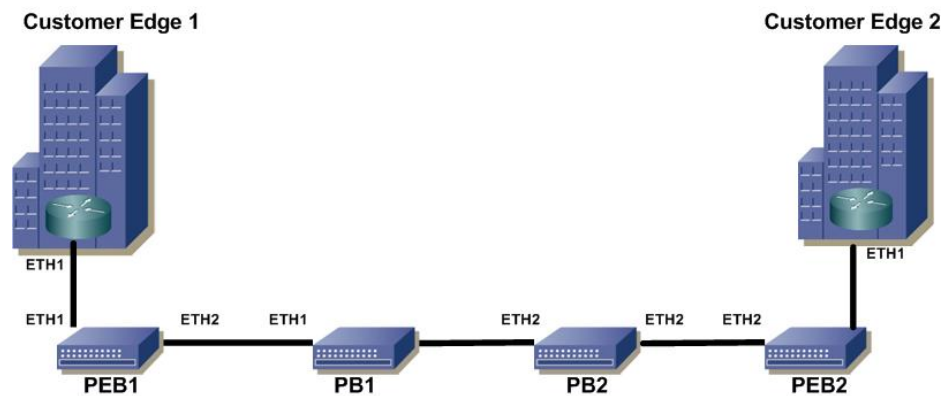


Figure 14-1: Service OAM Topology

Customer Edge 1

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol mstp	Configure bridge 1 as mstp bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 name abc	Create VLAN 2 on bridge 1.
(config-vlan)#vlan 2 bridge 1 state enable	Enable VLAN 2 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)interface eth1	Enter interface mode.
(config-if)#switchport	Configure eth1 as a Layer 2 port.
(config-if)#bridge-group 1	Configure eth1 in bridge group 1.
(config-if)#switchport mode hybrid	Make the interface a hybrid.
(config-if)#switchport hybrid allowed vlan add 2 egress-tagged enable	Allow VLAN 2 on interface eth1.

(config-if)#exit	Exit interface mode.
(config)#ethernet cfm domain-name type character-string name test level 5 mip-creation default bridge 1	Enter CFM mode and create a level 5 domain.
(config-ether-cfm)#service ma-type string ma-name abc vlan 2 mip-creation default	Configure MA abc on VLAN 2.
(config-ether-cfm)#mep crosscheck mpid 20 vlan 2 mac 000f.1f48.6269	Configure the remote MEPID 20 with the MAC address of remote MEP interface.
(config-ether-cfm)#exit	exit from ether cfm mode
(config)#interface eth1	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 10 active true domain test vlan 2 local-vid 2 bridge 1	Enter CFM MEP mode and configure a local MEP 10 on VLAN 2.
(config-if-eth-cfm-mep)#cc unicast rmpid 20 state enable	Enable unicast CCM messages for local MEP 10 and remote MEP 20.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.

PEB1

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-mstp edge	Configure bridge 1 as provider mstp bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 type customer bridge 1 name ipi2	Create VLAN 2 on bridge 1.
(config-vlan)#vlan 2 type customer bridge 1 state enable	Enable VLAN 2 on bridge 1.
(config-vlan)#vlan 3 type service point-point bridge 1 name ipi3	Create VLAN 3 on bridge 1.
(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Enable VLAN 3 on bridge 1.
(config)#cvlan registration table map1 bridge 1	Create a CVLAN registration table.
(config-cvlan-registration)#cvlan 2 svlan 3	Create a mapping between VLAN 2 and VLAN 3.
(config-cvlan-registration)#Exit	Exit configure CVLAN registration mode.
(config)interface eth1	Enter interface mode.
(config-if)#switchport	Configure eth1 as a Layer 2 port.
(config-if)#bridge-group 1	Configure eth1 in bridge group 1.
(config-if)#switchport mode customer-edge hybrid	Make the interface a customer-edge hybrid.
(config-if)#switchport customer-edge hybrid allowed vlan add 2 egress-tagged enable	Allow VLAN 2 on interface eth1.
(config-if)#switchport customer-edge vlan registration map1	Add the CVLAN registration table to interface.
(config-if)#switchport provider-edge vlan 3 untagged-vlan 2	Configuring the provider edge VLAN on the interface.

(config-if)#switchport provider-edge vlan 3 default-vlan 2	Configuring the provider edge default VLAN on the interface.
(config-if)#exit	Exit interface mode.
(config)interface eth2	Enter interface mode.
(config-if)#switchport	Configure eth2 as a Layer 2 port.
(config-if)#bridge-group 1	Configure eth2 in bridge group 1.
(config-if)#switchport mode provider-network	Make the interface a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all VLANs on interface eth2.
(config-if)#switchport provider-network allowed vlan remove 2	Configuration to remove the VLAN 2 from provider network.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm configure default-md-level level 5 mip-creation default bridge 1	Enable default-md-level on bridge 1.

PB1

Note: You need to do a similar configuration as shown below for PB2, PEB2 and CE2.

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-mstp	Configure bridge 1 as provider mstp bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 3 type service point-point bridge 1 name ipi3	Create VLAN 3 on bridge 1.
(config-vlan)#vlan 3 type service point-point bridge 1 state enable	Enable VLAN 3 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)interface eth1	Enter interface mode.
(config-if)#switchport	Configure eth1 as a Layer 2 port.
(config-if)#bridge-group 1	Configure eth1 in bridge group 1.
(config-if)#switchport mode provider-network	Make the interface a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all VLANs on interface eth1.
(config-if)#exit	Exit interface mode.
(config)interface eth2	Enter interface mode.
(config-if)#switchport	Configure eth1 as a Layer 2 port.
(config-if)#bridge-group 1	Configure eth1 in bridge group 1.
(config-if)#switchport mode provider-network	Make the interface a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all VLANs on interface eth1.
(config-if)#exit	Interface mode.
(config)#ethernet cfm configure default-md-level level 5 mip-creation default bridge 1	Enable default-md-level on bridge 1.

Validation

```
#sh ethernet cfm ma status domain test vlan 2 mep 10 bridge 1
MA/MEG Status - Active
  CONFIGURED RMEP COUNT                      CONVERGED RMEP COUNT
=====
                1                                1
MEP STATUS
MEPID      DIRECTION      CONNECTIVITY STATUS      INTERFACE
=====
10          Down MEP      Fully Connected          eth1

#sh ethernet cfm maintenance-points remote domain test vlan 2 bridge 1
MPID  LEVEL    VLAN    ACTIVE    Remote Mac      RDI    FLAGS
-----
20     5        2       Yes      000f.1f48.6269  False  Configured
```

The ITU-T G.8032 Ethernet Ring Protection Switching (ERPS) recommendation specifies protection switching mechanisms and protocols for Ethernet layer network rings. This feature provides protection switching for ring nodes that are connected to adjacent nodes (participating in the same ring) using two independent links.

Topology

Figure 15-1 displays a sample Ring Protection topology on which protection switching is configured with four bridges. The Ring Protection Link (RPL) owner is the link between Bridge 2 and Bridge 3 (eth2 to eth1), on which one side of the link is defined explicitly as RPL owner. The rest of the bridges are explicitly configured RPL non owner to enable ERPS in the ring.

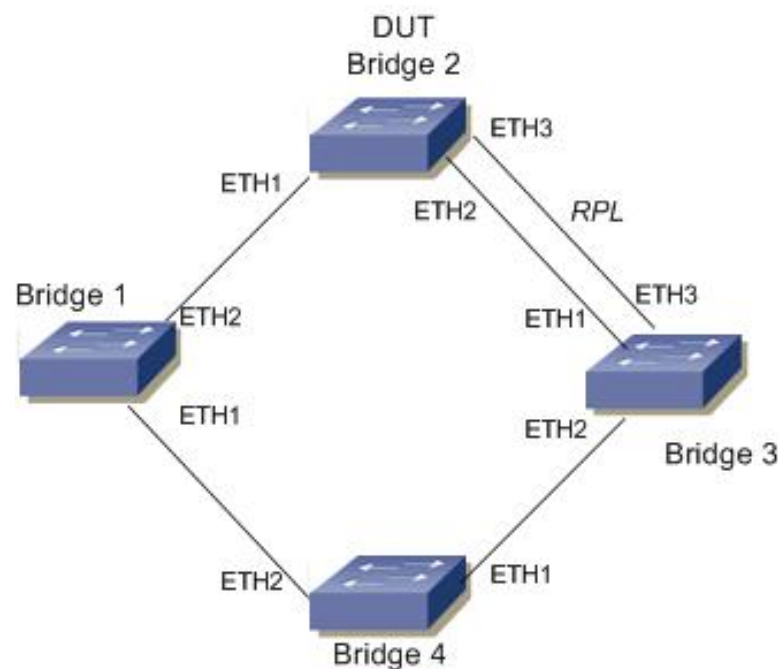


Figure 15-1: Ring Protection Topology

Note: The Connectivity Fault Management (CFM) configurations described below must be completed and CFM convergence checked before starting the ERPS configurations.

Bridge 2

#configure terminal	Enter configure mode.
(config)#bridge 2 protocol ieee vlan-bridge	Configure bridge 2 as VLAN aware.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 5 bridge 2 name ipi5	Create VLAN 5 on bridge 2.

(config-vlan)#vlan 10 bridge 2 name ipi10	Create VLAN 10 on bridge 2.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a Layer 2 port.
(config-if)#bridge-group 2	Configure Eth1 in bridge group 2.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth1.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a Layer 2 port.
(config-if)#bridge-group 2	Configure Eth2 in bridge group 2.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth2.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm domain-name type character-string name customer level 7 mip-creation default bridge 2	Enter CFM mode and create a domain.
(config-ether-cfm)#service ma-type integer ma-name 13 vlan 5 mip-creation default	Create an MA for VLAN 5 which becomes part of the ring.
(config-ether-cfm)#mep crosscheck mpid 400 vlan 5	Enable crosschecking on the MEP for the neighbor with MPID 400.
(config-ether-cfm)#mep crosscheck mpid 100 vlan 5	Enable crosschecking on the MEP for the neighbor with MPID 100.
(config-ether-cfm)#exit	Exit CFM mode.
(config-if)#interface eth1	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 405 active true domain customer vlan 5 local-vid 5 bridge 2	Enter CFM MEP mode and configure MEP 405 as a down MEP in domain customer for VLAN 5.
(config-if-eth-cfm-mep)#cc multicast state enable	Start multicast CC with MEPID 405 for VLAN 5.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 105 active true domain customer vlan 5 local-vid 5 bridge 2	Enter CFM MEP mode and configure MEP 105 as a down MEP in domain customer for VLAN 5.
(config-if-eth-cfm-mep)#cc multicast state enable	Start multicast CC with MEPID 105 for VLAN 5.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.

Bridge 1

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol ieee vlan-bridge	Configure bridge 1 as VLAN aware.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 5 bridge 1 name ipi5	Create VLAN 5 on bridge 1.
(config-vlan)#vlan 10 bridge 1 name ipil0	Create VLAN 10 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth1 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth1.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth2 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth2.
(config-if)#exit	Exit interface mode.
(config)#bridge 1 protocol ieee vlan-bridge	Configure bridge 1 as VLAN aware.
(config)#vlan database	Enter VLAN configure mode.
(config)#ethernet cfm domain-name type character-string name customer level 7 mip- creation default bridge 1	Enter CFM mode and create a domain.
(config-ether-cfm)#service ma-type integer ma-name 13 vlan 5 mip-creation default	Create an MA for VLAN 5 which becomes part of the ring.
(config-ether-cfm)#mep crosscheck mpid 305 vlan 5	Enable crosschecking on the MEP for the neighbor with MPID 305.
(config-ether-cfm)#mep crosscheck mpid 405 vlan 5	Enable crosschecking on the MEP for the neighbor with MPID 405.
(config-ether-cfm)#exit	Exit CFM mode.
(config)#interface eth1	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 405 active true domain customer vlan 5 local-vid 5 bridge 1	Enter CFM MEP mode and configure MEP 405 as a down MEP in domain customer for VLAN 5.
(config-if-eth-cfm-mep)#cc multicast state enable	Start multicast CC with MEPID 405 for VLAN 5.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.

<code>(config-if)#exit</code>	Exit interface mode.
<code>(config)#interface eth2</code>	Enter interface mode.
<code>(config-if)#ethernet cfm mep down mpid 300 active true domain customer vlan 5 local-vid 5 bridge 1</code>	Enter CFM MEP mode and configure MEP 300 as a down MEP in domain customer for VLAN 5.
<code>(config-if-eth-cfm-mep)#cc multicast state enable</code>	Start multicast CC with MEPID 300 for VLAN 5.
<code>(config-if-eth-cfm-mep)#exit</code>	Exit CFM MEP mode.
<code>(config-if)#exit</code>	Exit interface mode.

Bridge 3

<code>#configure terminal</code>	Enter configure mode.
<code>(config)#bridge 3 protocol ieee vlan-bridge</code>	Configure bridge 3 as VLAN aware.
<code>(config)#vlan database</code>	Enter VLAN configure mode.
<code>(config-vlan)#vlan 5 bridge 3 name ipi5</code>	Create VLAN 5 on bridge 3.
<code>(config-vlan)#vlan 10 bridge 3 name ipil0</code>	Create VLAN 10 on bridge 3.
<code>(config-vlan)#exit</code>	Exit VLAN configure mode.
<code>(config)#interface eth1</code>	Enter interface mode.
<code>(config-if)#switchport</code>	Configure Eth1 as a Layer 2 port.
<code>(config-if)#bridge-group 3</code>	Configure Eth1 in bridge group 3.
<code>(config-if)#switchport mode trunk</code>	Make the interface a trunk.
<code>(config-if)#switchport trunk allowed vlan all</code>	Allow all VLANs on interface Eth1.
<code>(config-if)#exit</code>	Exit interface mode.
<code>(config)#interface eth2</code>	Enter interface mode.
<code>(config-if)#switchport</code>	Configure Eth2 as a Layer 2 port.
<code>(config-if)#bridge-group 3</code>	Configure Eth2 in bridge group 3.
<code>(config-if)#switchport mode trunk</code>	Make the interface a trunk.
<code>(config-if)#switchport trunk allowed vlan all</code>	Allow all VLANs on interface Eth2.
<code>(config-if)#exit</code>	Exit interface mode.
<code>(config)#bridge 3 protocol ieee vlan-bridge</code>	Configure bridge 3 as VLAN aware.
<code>(config)#vlan database</code>	Enter VLAN configure mode.
<code>(config)#ethernet cfm domain-name type character-string name customer level 7 mip- creation default bridge 3</code>	Enter CFM mode and create a domain.
<code>(config-ether-cfm)#service ma-type integer ma-name 13 vlan 5 mip-creation default</code>	Create an MA for VLAN 5 which becomes part of the ring.
<code>(config-ether-cfm)#mep crosscheck mpid 105 vlan 5</code>	Enable crosschecking on the MEP for the neighbor with MPID as 105.

(config-ether-cfm)#mep crosscheck mpid 205 vlan 5	Enable crosschecking on the MEP for the neighbor with MPID 205.
(config-ether-cfm)#exit	Exit CFM mode.
(config-if)#exit	Exit interface mode.
(config)#interface eth1	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 405 active true domain customer vlan 5 local-vid 5 bridge 3	Enter CFM MEP mode and configure MEP 100 as a down MEP in domain customer for VLAN 5.
(config-if-eth-cfm-mep)#cc multicast state enable	Start multicast CC with MEPID 405 for VLAN 5.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 200 active true domain customer vlan 5 local-vid 5 bridge 1	Enter CFM MEP mode and configure MEP 200 as a down MEP in domain customer for VLAN 5.
(config-if-eth-cfm-mep)#cc multicast state enable	Start multicast CC with MEPID 200 for VLAN 5.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.

Bridge 4

#configure terminal	Enter configure mode.
(config)#bridge 4 protocol ieee vlan-bridge	Configure bridge 4 as VLAN aware.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 5 bridge 4 name ipi5	Create VLAN 5 on bridge 4.
(config-vlan)#vlan 10 bridge 4 name ipi10	Create VLAN 10 on bridge 4.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a Layer 2 port.
(config-if)#bridge-group 4	Configure Eth1 in bridge group 4.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth1.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a Layer 2 port.
(config-if)#bridge-group 4	Configure Eth2 in bridge group 4.
(config-if)#switchport mode trunk	Make the interface a trunk.

(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth2.
(config-if)#exit	Exit interface mode.
(config)#bridge 4 protocol ieee vlan-bridge	Configure bridge 4 as VLAN aware.
(config)#vlan database	Enter VLAN configure mode.
(config)#ethernet cfm domain-name type character-string name customer level 7 mip-creation default bridge 4	Enter CFM mode and create a domain.
(config-ether-cfm)#service ma-type integer ma-name 13 vlan 5 mip-creation default	Create an MA for VLAN 5 which becomes part of the ring.
(config-ether-cfm)#mep crosscheck mpid 200 vlan 5	Enable crosschecking on the MEP for neighbor (part of the ring) with MPID as 200.
(config-ether-cfm)#mep crosscheck mpid 300 vlan 5	Enable crosschecking on the MEP for neighbor (part of the ring) with MPID 300.
(config-ether-cfm)#exit	Exit CFM mode.
(config-if)#interface eth1	Enter interface mode.
(config)#ethernet cfm mep down mpid 205 active true domain customer vlan 5 local-vid 5 bridge 4	Enter CFM MEP mode and configure MEP 205 as a down MEP in domain customer for VLAN 5.
(config-if-eth-cfm-mep)#cc multicast state enable	Start multicast CC with MEPID 205 for VLAN 5.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 200 active true domain customer vlan 5 local-vid 5 bridge 4	Enter CFM MEP mode and configure MEP 200 as a down MEP in domain customer for VLAN 5.
(config-if-eth-cfm-mep)#cc multicast state enable	Start multicast CC with MEPID 200 for VLAN 5.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.

Validation

Check the convergence of CFM on all bridges for level 7 in VLAN 5 for bridge 1 using the following command:

```
#show ethernet cfm maintenance-points remote level 7 vlan 5 bridge 1
```

Adding G.8032 Ring Protection Switching

Bridge 2

#configure terminal	Enter configure mode.
(config)#bridge 2 g8032 ring-id 2 east-interface eth2 west-interface eth1 instance 1	Configure the bridge with G.8032 for a specific ring ID, identify the east and west interfaces, and associate them with MSTP instance 1.
(config)#g8032 configure vlan ring-id 2 bridge 2	Enter G.8032 configure VLAN mode.
(g8032-config-vlan)#g8032 vlan 5 control	Set VLAN 5 as control.
(g8032-config-vlan)#exit	Exit G.8032 configure VLAN mode.
(config)#g8032 configure switching ring-id 2 bridge 2	Enter G.8032 configure switching mode.
(g8032-config-switch)#g8032 md-name customer service-id 13 bridge 1 ring-id 2	Associate an MD and MA name to the ring.
For hardware	
(g8032-config-cfm)#g8032 mep mpid 105 rmepid 100	Associate RMEP to the connected MEP
(g8032-config-cfm)#g8032 mep mpid 405 rmepid 400	Associate RMEP to the connected MEP
(g8032-config-cfm)#exit	Exit G.8032 configure cfm mode
(g8032-config-switch) #g8032 rpl owner east-interface	Configure the Ring Protection Link node as Owner and specify the interface as RPL owner. with east interface .The same may also be configured with west-interface.
(g8032-config-switch)#exit	Exit G.8032 configure switching mode.

Bridge 1

#configure terminal	Enter configure mode.
(config)#bridge 1 g8032 ring-id 2 east-interface eth2 west-interface eth1 instance 1	Configure the bridge with G.8032 for a specific ring ID, identify the east and west interfaces, and associate them with MSTP instance 1.
(config)#g8032 configure vlan ring-id 2 bridge 1	Enter G.8032 configure VLAN mode.
(g8032-config-vlan)#g8032 vlan 5 control	Set VLAN 5 as control.
(g8032-config-vlan)#exit	Exit G.8032 configure VLAN mode.
(config)#g8032 configure switching ring-id 2 bridge 1	Enter G.8032 configure switching mode.
(g8032-config-switch)#g8032 md-name customer service-id 13 bridge 1 ring-id 2	Associate an MD and MA name to the ring.
For hardware	
(g8032-config-cfm)#g8032 mep mpid 300 rmepid 305	Associate RMEP to the connected MEP

(g8032-config-cfm)#g8032 mep mpid 400 rmepid 405	Associate RMEP to the connected MEP
(g8032-config-cfm)#exit	Exit G.8032 configure cfm mode
(g8032-config-switch) #g8032 rpl non-owner none	Configure the Ring Protection Link node as Owner and specify the RPL owner.
(g8032-config-switch)#exit	Exit G.8032 configure switching mode.

Bridge 3

#configure terminal	Enter configure mode.
(config)#bridge 3 g8032 ring-id 2 east-interface eth2 west-interface eth1 instance 1	Configure the bridge with G.8032 for a specific ring ID and identify the east and west interfaces with xSTP instance 1.
(config)#g8032 configure vlan ring-id 2 bridge 3	Enter G.8032 configure VLAN mode.
(g8032-config-vlan)#g8032 vlan 5 control	Set VLAN 5 as control.
(g8032-config-vlan)#exit	Exit G.8032 configure VLAN mode.
(config)#g8032 configure switching ring-id 2 bridge 3	Enter G.8032 configure switching mode.
(g8032-config-switch)#g8032 md-name customer service-id 13 bridge 3 ring-id 2	Associate an MD and MA name to the ring.
For hardware	
(g8032-config-cfm)#g8032 mep mpid 100 rmepid 105	Associate RMEP to the connected MEP
(g8032-config-cfm)#g8032 mep mpid 200 rmepid 205	Associate RMEP to the connected MEP
(g8032-config-cfm)#exit	Exit G.8032 configure cfm mode
(g8032-config-switch) #g8032 rpl non-owner none	Configure the Ring Protection Link node as Owner and specify the RPL owner.
(g8032-config-switch)#exit	Exit G.8032 configure switching mode.

Bridge 4

#configure terminal	Enter configure mode.
(config)#bridge 4 g8032 ring-id 2 east-interface eth2 west-interface eth1 instance 1	Configure the bridge with G.8032 for a specific ring ID, identify the east and west interfaces, and associate them with MSTP instance 1.
(config)#g8032 configure vlan ring-id 2 bridge 4	Enter G.8032 configure VLAN mode.
(g8032-config-vlan)#g8032 vlan 5 control	Set VLAN 5 as control.
(g8032-config-vlan)#exit	Exit G.8032 configure VLAN mode.
(config)#g8032 configure switching ring-id 2 bridge 4	Enter G.8032 configure switching mode.
(g8032-config-switch)#g8032 md-name customer service-id 13 bridge 4 ring-id 2	Associate an MD and MA name to the ring.
For hardware	

(g8032-config-cfm)#g8032 mep mpid 205 rmepid 200	Associate RMEP to the connected MEP
(g8032-config-cfm)#g8032 mep mpid 305 rmepid 300	Associate RMEP to the connected MEP
(g8032-config-cfm)#exit	Exit G.8032 configure cfm mode
(g8032-config-switch)#g8032 rpl non-owner none	Configure the Ring Protection Link node as Owner and specify the RPL owner.
(g8032-config-switch)#exit	Exit G.8032 configure switching mode.

Setting Ring Protection Switching Timers

The commands below are for setting the Ring Protection Switching timers for the ring of bridges.

#configure terminal	Enter configure mode.
(config)#g8032 configure switching ring-id 1 bridge 1	Enter G.8032 configure switching mode.
(g8032-config-switching)#g8032 timer wait-to-restore 360	Set wait-to-restore timer to 360 seconds.
(g8032-config-switching)#g8032 timer hold-off 100	Set the hold-off timer to 100 milli seconds.
(g8032-config-switching)#g8032 timer guard-timer 10	Set the guard-timer to 10 milli seconds.
(g8032-config-switching)#exit	Exit G.8032 configure switching mode.

Removing G.8032 Ring Configurations

The steps below are used to remove Ring Protection Switching configurations from the bridges.

Bridge 2

#configure terminal	Enter configure mode.
(config)#g8032 configure switching ring-id 2 bridge 2	Enter G.8032 configure switching mode.
(g8032-config-switch)#no g8032 md-name customer service-id 13 bridge 2 ring-id 2	Remove the association of the bridge and the G.8032 ring with CFM using md-name and service-id.
(g8032-config-switch)#exit	Exit G.8032 configure switching mode.
(config)#no bridge 2 g8032 ring-id 2	Remove G.8032 ring 2 for bridge 2

Bridge 1

#configure terminal	Enter configure mode.
(config)#g8032 configure switching ring-id 2 bridge 1	Enter G.8032 configure switching mode.
(g8032-config-switch)#no g8032 md-name customer service-id 13 bridge 1 ring-id 2	Remove the association of the bridge and the G.8032 ring with CFM using md-name and service-id.

(g8032-config-switch)#exit	Exit G.8032 configure switching mode.
(config)#no bridge 1 g8032 ring-id 2	Remove G.8032 ring 2 for bridge 1

Bridge 3

#configure terminal	Enter configure mode.
(config)#g8032 configure switching ring-id 2 bridge 3	Enter G.8032 configure switching mode.
(g8032-config-switch)#no g8032 md-name customer service-id 13 bridge 3 ring-id 2	Remove the association of the bridge and the G.8032 ring with CFM using md-name and service-id.
(g8032-config-switch)#exit	Exit G.8032 configure switching mode.
(config)#no bridge 3 g8032 ring-id 2	Remove G.8032 ring 2 for bridge 3

Bridge 4

#configure terminal	Enter configure mode.
(config)#g8032 configure switching ring-id 2 bridge 4	Enter G.8032 configure switching mode.
(g8032-config-switch)#no g8032 md-name customer service-id 13 bridge 4 ring-id 2	Remove the association of the bridge and the G.8032 ring with CFM using md-name and service-id.
(g8032-config-switch)#exit	Exit G.8032 configure switching mode.
(config)#no bridge 4 g8032 ring-id 2	Remove G.8032 ring 2 for bridge 4

Validation

The following command displays G.8032 information for ring-id 2:

```
#show bridge 1 g8032 ring-id 2
```

The following command displays G.8032 information for all rings configured:

```
#show bridge 1 g8032
```

G8032v1 Configuration with Sub Ring

Ethernet ring protection enables the interconnection of rings using either a single-node or dual-node (a shared link). ERPS protects services that are traversing interconnected rings. For interconnected rings that use dual nodes, ERPS ensures that a super loop does not form in the event that a shared link fails. Only a RPL (Ring Protection Link) with a highest priority protects a ring when a shared link fails. This prevents the formation of a super loop. A signal failure on a non-shared link (that is, when the ring is in idle state) triggers protection switching within the ring where the link failed. All other interconnected rings will ignore this event.

Note: G.8032 (2008) Ethernet Ring Protection Switching (ERPS) Version 1 is obsolete for X86 platform. For hardware platforms only G.8032 Version 1 is supported.

Topology

Figure 15-2 displays a sample Ethernet Ring Protection Switching topology.

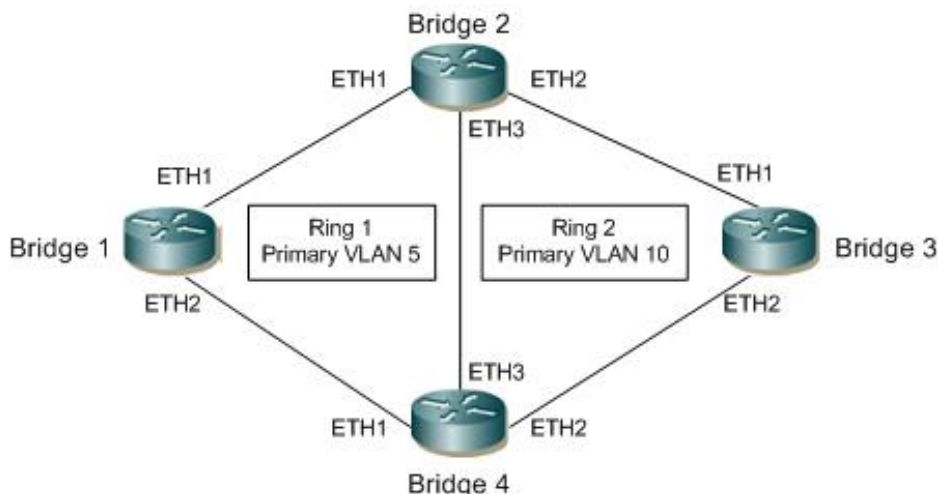


Figure 15-2: Simple Ethernet Ring Protection Switching Topology

Bridge 1

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol mstp	Configure MSTP bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 5 bridge 1 name ipi5	Create VLAN 5 on bridge 1.
(config-vlan)#vlan 10 bridge 1 name ipi10	Create VLAN 10 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth1 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth1.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth2 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth2.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm domain-name type character-string name test level 7 mip-creation none bridge 1	Enter CFM mode and create domain test at level 7, setting MIP creation permissions to the default.
(config-ether-cfm)#service ma-type string ma-name 12 vlan 5 mip-creation none	Create MA with type as integer and set MIP creation permissions to default.
(config-ether-cfm)#mep crosscheck mpid 13 vlan 5 mac 0007.e9a5.1cd1	Enable crosscheck to remote MEP 13 on VLAN 5.

(config-ether-cfm)#mep crosscheck mpid 10 vlan 5 mac 0002.b328.52f5	Enable crosscheck to remote MEP 10 on VLAN 5.
(config-ether-cfm)#exit	Exit ether-cfm mode.
(config)#int eth1	Enter interface mode
(config-if)#ethernet cfm mep down mpid 11 active true domain test vlan 5 local-vid 5 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 5 and bridge 1
(config-if-eth-cfm-mep)#cc unicast rmpid 10 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#int eth2	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 12 active true domain test vlan 5 local-vid 5 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 5 and bridge 1.
(config-if-eth-cfm-mep)#cc unicast rmpid 13 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#bridge 1 g8032 ring-id 1 east- interface eth1 west-interface eth2 instance 2control	Create g8032 bridge with ring-ID 1.
(config)#g8032 configure vlan ring-id 1 bridge 1	Enter the g8032 VLAN configuration mode.
(g8032-config-vlan)#g8032 vlan 5 control	Configure VLAN 5 as control.
(g8032-config-vlan)#exit	Exit g8032 VLAN configuration mode.
(config)#g8032 configure switching ring-id 1 bridge 1	Enter the g8032 switching parameters configuration mode.
(g8032-config-switch)#g8032 md-name test service-id 12 bridge 1 ring-id 1	Associate g8032 switch with CFM.
*For HW Platforms (g8032-config-cfm)#g8032 mep mpid 11 rmepid 10	Associate RMEP to the connected MEP.
*For HW Platforms (g8032-config-cfm)#g8032 mep mpid 12 rmepid 13	Associate RMEP to the connected MEP.
*For HW Platforms (g8032-config-cfm)#exit	Exit G.8032 configure cfm mode.
(g8032-config-switch)#g8032 rpl owner east- interface	Configure RPL owner.
(g8032-config-switch)#end	Exit the g8032 switch configuration mode.

Bridge 2

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol mstp	Configure MSTP bridge.
(config)#vlan database	Enter VLAN configure mode.

(config-vlan)#vlan 5 bridge 1 name ipi5	Create VLAN 5 on bridge 1.
(config-vlan)#vlan 10 bridge 1 name ipi10	Create VLAN 10 on bridge 1.
(config-vlan)#vlan 20 bridge 1 name ipi20	Create VLAN 20 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth1 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth1.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth2 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth2.
(config-if)#exit	Exit interface mode.
(config)#interface eth3	Enter interface mode.
(config-if)#switchport	Configure Eth3 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth3 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth3.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm domain-name type character-string name test level 7 mip-creation none bridge 1	Enter CFM mode and create domain test at level 7, setting MIP creation permissions to the default.
(config-ether-cfm)#service ma-type string ma-name 12 vlan 5 mip-creation none	Create MA with type as integer and set MIP creation permissions to default.
(config-ether-cfm)#mep crosscheck mpid 11 vlan 5 mac 0002.a5dd.9563	Enable crosscheck to remote MEP 11 on VLAN 5.
(config-ether-cfm)#mep crosscheck mpid 19 vlan 5 mac 0002.a581.9563	Enable crosscheck to remote MEP 19 on VLAN 5.
(config-ether-cfm)#service ma-type string ma-name 13 vlan 10 mip-creation none	Create MA with type as integer and set MIP creation permissions to default.
(config-ether-cfm)#mep crosscheck mpid 20 vlan 19 mac 0002.a581.9563	Enable crosscheck to remote MEP 20 on VLAN 5.
(config-ether-cfm)#mep crosscheck mpid 19 vlan 5 mac 0002.a5ad.9563	Enable crosscheck to remote MEP 19 on VLAN 5.
(config-ether-cfm)#exit	Exit ether-cfm mode.
(config)#int eth1	Enter interface mode
(config-if)#ethernet cfm mep down mpid 10 active true domain test vlan 5 local-vid 5 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 5 and bridge 1
(config-if-eth-cfm-mep)#cc unicast rmpid 11 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.

(config-if)#exit	Exit interface mode.
(config)#int eth2	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 17 active true domain test vlan 10 local-vid 10 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 10 and bridge 1.
(config-if-eth-cfm-mep)#cc unicast rmpid 16 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#int eth3	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 18 active true domain test vlan 10 local-vid 10 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 10 and bridge 1.
(config-if-eth-cfm-mep)#cc unicast rmpid 19 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#ethernet cfm mep down mpid 18 active true domain test vlan 5 local-vid 5 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 5 and bridge 1.
(config-if-eth-cfm-mep)#cc unicast rmpid 19 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#bridge 1 g8032 ring-id 1 east- interface eth1 west-interface eth3 instance 2	Create g8032 bridge with ring-ID 1.
(config)#bridge 1 g8032 ring-id 2 east- interface eth2 west-interface eth3 instance 3	Create g8032 bridge with ring-ID 2.
(config)#g8032 configure vlan ring-id 1 bridge 1	Enter the g8032 VLAN configuration mode.
(g8032-config-vlan)#g8032 vlan 20	Configure VLAN 20.
(g8032-config-vlan)#g8032 vlan 5 control	Configure VLAN 5 as control.
(g8032-config-vlan)#exit	Exit g8032 VLAN configuration mode.
(config)#g8032 configure vlan ring-id 2 bridge 1	Enter the g8032 VLAN configuration mode.
(g8032-config-vlan)#g8032 vlan 20	Configure VLAN 20.
(g8032-config-vlan)#g8032 vlan 10 control	Configure VLAN 10 as control.
(g8032-config-vlan)#exit	Exit g8032 VLAN configuration mode.
(config)#g8032 configure switching ring-id 1 bridge 1	Enter the g8032 switching parameters configuration mode.
(g8032-config-switch)#g8032 md-name test service-id 12 bridge 1 ring-id 1	Associate g8032 switch with CFM.
(g8032-config-switch)#g8032 rpl non-owner none	Configure RPL non-owner.
(g8032-config-switch)#g8032 shared-link interface eth3 peer-ring 2	Create shared link with peer ring.
(g8032-config-switch)#exit	Exit the g8032 switch configuration mode.

(config)#g8032 configure switching ring-id 2 bridge 1	Enter the g8032 switching parameters configuration mode.
(g8032-config-switch)#g8032 md-name test service-id 13 bridge 1 ring-id 2	Associate g8032 switch with CFM.
*For HW Platforms (g8032-config-cfm)#g8032 mep mpid 17 rmepid 16	Associate RMEP to the connected MEP.
*For HW Platforms (g8032-config-cfm)#g8032 mep mpid 18 rmepid 19	Associate RMEP to the connected MEP.
*For HW Platforms (g8032-config-cfm)#exit	Exit G.8032 configure cfm mode.
(g8032-config-switch)#g8032 rpl non-owner none	Configure RPL non-owner.
(g8032-config-switch)#g8032 shared-link interface eth3 peer-ring 1	Create shared link with a peer ring.
(g8032-config-switch)#end	Exit the g8032 switch configuration mode.

Bridge 3

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol mstp	Configure MSTP bridge.
(config)##vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 5 bridge 1 name ipi5	Create VLAN 5 on bridge 1.
(config-vlan)#vlan 10 bridge 1 name ipi10	Create VLAN 10 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth1 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth1.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth2 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth2.
(config-if)#exit	Exit interface mode.
(config)#interface eth3	Enter interface mode.
(config-if)#switchport	Configure Eth3 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth3 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth3.

(config-if)#exit	Exit interface mode.
(config)#ethernet cfm domain-name type character-string name test level 7 mip-creation none bridge 1	Enter CFM mode and create domain test at level 7, setting MIP creation permissions to the default.
(config-ether-cfm)#service ma-type string ma-name 13 vlan 10 mip-creation none	Create MA with type as integer and set MIP creation permissions to default.
(config-ether-cfm)#mep crosscheck mpid 14 vlan 10 mac 0002.a581.9562	Enable crosscheck to remote MEP 14 on VLAN 10.
(config-ether-cfm)#mep crosscheck mpid 17 vlan 10 mac 0002.b328.5272	Enable crosscheck to remote MEP 17 on VLAN 10.
(config-ether-cfm)#exit	Exit ether-cfm mode.
(config)#int eth1	Enter interface mode
(config-if)#ethernet cfm mep down mpid 16 active true domain test vlan 10 local-vid 10 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 10 and bridge 1
(config-if-eth-cfm-mep)#cc unicast rmpid 17 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#int eth2	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 15 active true domain test vlan 10 local-vid 10 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 10 and bridge 1.
(config-if-eth-cfm-mep)#cc unicast rmpid 14 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#bridge 1 g8032 ring-id 2 east-interface eth1 west-interface eth2 instance 2	Create g8032 bridge with ring-ID 2.
(config)#g8032 configure vlan ring-id 2 bridge 1	Enter the g8032 VLAN configuration mode.
(g8032-config-vlan)#g8032 vlan 10 control	Configure VLAN 10 as control.
(g8032-config-vlan)#exit	Exit g8032 VLAN configuration mode.
(config)#g8032 configure switching ring-id 2 bridge 1	Enter the g8032 switching parameters configuration mode.
(g8032-config-switch)#g8032 md-name test service-id 13 bridge 1 ring-id 2	Associate g8032 switch with CFM.
*For HW Platforms (g8032-config-cfm)#g8032 mep mpid 16 rmepid 17	Associate RMEP to the connected MEP.
*For HW Platforms (g8032-config-cfm)#g8032 mep mpid 15 rmepid 14	Associate RMEP to the connected MEP.
*For HW Platforms (g8032-config-cfm)#exit	Exit G.8032 configure cfm mode.
(g8032-config-switch)#g8032 rpl owner east-interface	Configure RPL owner.
(g8032-config-switch)#end	Exit the g8032 switch configuration mode.

Bridge 4

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol mstp	Configure MSTP bridge.
(config)##vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 5 bridge 1 name ipi5	Create VLAN 5 on bridge 1.
(config-vlan)#vlan 10 bridge 1 name ipi10	Create VLAN 10 on bridge 1.
(config-vlan)#vlan 20 bridge 1 name ipi20	Create VLAN 20 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth1 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth1.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth2 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth2.
(config-if)#exit	Exit interface mode.
(config)#interface eth3	Enter interface mode.
(config-if)#switchport	Configure Eth3 as a Layer 2 port.
(config-if)#bridge-group 1	Configure Eth3 in bridge group 1.
(config-if)#switchport mode trunk	Make the interface a trunk.
(config-if)#switchport trunk allowed vlan all	Allow all VLANs on interface Eth3.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm domain-name type character-string name test level 7 mip-creation none bridge 1	Enter CFM mode and create domain test at level 7, setting MIP creation permissions to the default.
(config-ether-cfm)#service ma-type string ma-name 12 vlan 5 mip-creation none	Create MA with type as integer and set MIP creation permissions to default.
(config-ether-cfm)#mep crosscheck mpid 12 vlan 5 mac 00d0.v727.a854	Enable crosscheck to remote MEP 12 on VLAN 5.
(config-ether-cfm)#mep crosscheck mpid 18 vlan 5 mac 0002.b328.5273	Enable crosscheck to remote MEP 18 on VLAN 5.
(config-ether-cfm)#service ma-type string ma-name 13 vlan 10 mip-creation none	Create MA with type as integer and set MIP creation permissions to default.
(config-ether-cfm)#mep crosscheck mpid 15 vlan 10 mac 00d0.b793.9e57	Enable crosscheck to remote MEP 15 on VLAN 10.
(config-ether-cfm)#mep crosscheck mpid 18 vlan 10 mac 0002.b328.5273	Enable crosscheck to remote MEP 18 on VLAN 10.
(config-ether-cfm)#exit	Exit ether-cfm mode.

(config)#int eth1	Enter interface mode
(config-if)#ethernet cfm mep down mpid 13 active true domain test vlan 5 local-vid 5 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 5 and bridge 1
(config-if-eth-cfm-mep)#cc unicast rmpid 12 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#int eth2	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 14 active true domain test vlan 10 local-vid 10 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 10 and bridge 1.
(config-if-eth-cfm-mep)#cc unicast rmpid 15 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#int eth3	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 19 active true domain test vlan 5 local-vid 5 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 5 and bridge 1.
(config-if-eth-cfm-mep)#cc unicast rmpid 19 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#ethernet cfm mep down mpid 19 active true domain test vlan 10 local-vid 10 bridge 1	Create a down MEP, assign an MPID, associate it with domain test in VLAN 10 and bridge 1.
(config-if-eth-cfm-mep)#cc unicast rmpid 18 state enable	Enable unicast continuity checking (CC).
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
(config)#bridge 1 g8032 ring-id 1 east- interface eth1 west-interface eth3 instance 2	Create g8032 bridge with ring-ID 1.
(config)#bridge 1 g8032 ring-id 2 east- interface eth2 west-interface eth3 instance 3	Create g8032 bridge with ring-ID 2.
(config)#g8032 configure vlan ring-id 1 bridge 1	Enter the g8032 VLAN configuration mode.
(g8032-config-vlan)#g8032 vlan 20	Configure VLAN 20.
(g8032-config-vlan)#g8032 vlan 5 control	Configure VLAN 5 as control.
(g8032-config-vlan)#exit	Exit g8032 VLAN configuration mode.
(config)#g8032 configure vlan ring-id 2 bridge 1	Enter the g8032 VLAN configuration mode.
(g8032-config-vlan)#g8032 vlan 20	Configure VLAN 20.
(g8032-config-vlan)#g8032 vlan 10 control	Configure VLAN 10 as control.
(g8032-config-vlan)#exit	Exit g8032 VLAN configuration mode.
(config)#g8032 configure switching ring-id 1 bridge 1	Enter the g8032 switching parameters configuration mode.

(g8032-config-switch)#g8032 md-name test service-id 12 bridge 1 ring-id 1	Associate g8032 switch with CFM.
(g8032-config-switch)#g8032 rpl non-owner none	Configure RPL non-owner.
(g8032-config-switch)#g8032 shared-link interface eth3 peer-ring 2	Create shared link with peer ring.
(g8032-config-switch)#exit	Exit switch configuration mode.
(config)#g8032 configure switching ring-id 2 bridge 1	Enter the g8032 switching parameters configuration mode.
(g8032-config-switch)#g8032 md-name test service-id 13 bridge 1 ring-id 2	Associate g8032 switch with CFM.
*For HW Platforms (g8032-config-cfm)#g8032 mep mpid 14 rmepid 15	Associate RMEP to the connected MEP.
*For HW Platforms (g8032-config-cfm)#g8032 mep mpid 19 rmepid 18	Associate RMEP to the connected MEP.
*For HW Platforms (g8032-config-cfm)#exit	Exit G.8032 configure cfm mode.
(g8032-config-switch)#g8032 rpl non-owner none	Configure RPL non-owner.
(g8032-config-switch)#g8032 shared-link interface eth3 peer-ring 1	Create shared link with a peer ring.
(g8032-config-switch)#end	Exit the g8032 switch configuration mode.

Validation

Enter the commands listed in the sections below to confirm the configurations.

Bridge 1

```
#show ethernet cfm maintenance-points remote domain test vlan 5 bridge 1
MPID      LEVEL      VLAN      ACTIVE      Remote Mac      RDI      FLAGS
-----
13         7         5         Yes         0007.e9a5.1cd1  False    Configured
10         7         5         Yes         0002.b328.52f5  False    Configured
#show bridge 1 g8032
Bridge 1
Ringid    Current  Role    East    Status  West    Status  Primary  Current  Peer
Shared
ID        State      Intf      Intf      VLAN    Event   Ring
ID    Link
--      --      --      --      --      --      --      --      --
1      Idle    OWNER   eth1    Blocked eth2    Forward  5        NR-RB
```

Bridge 2

```
#show ethernet cfm maintenance-points remote domain test vlan 5 bridge 1
MPID      LEVEL      VLAN      ACTIVE      Remote Mac      RDI      FLAGS
-----
11         7         5         Yes         0002.a5dd.9563  False    Configured
19         7         5         Yes         0002.a581.9563  False    Configured
```

```
#show ethernet cfm maintenance-points remote domain test vlan 10 bridge 1
MPID      LEVEL      VLAN      ACTIVE      Remote Mac      RDI      FLAGS
-----
---
19         7          10        Yes         0002.a581.9563   False    Configured
16         7          10        Yes         0002.a5ad.9563   False    Configured
#show bridge 1 g8032
Bridge 1
Ringid    Current  Role    East  Status  West  Status  Primary  Current  Peer
Shared
ID         State      Intf      Intf      VLAN      Event
RingID    Link
--         --         --         --         --         --
1         Idle      Non-Owner eth1  Forward eth3  Forward   5         NR-RB
2 eth3
2         Idle      Non-Owner eth2  Forward eth3  Forward  10         NR-RB
1 eth3
Protected Vlans
20
20
```

Bridge 3

```
BRIDGE3#show ethernet cfm maintenance-points remote domain test vlan 10 bridge 1
MPID      LEVEL      VLAN      ACTIVE      Remote Mac      RDI      FLAGS
-----
---
14         7          10        Yes         0002.a581.9562   True     Configured
17         7          10        Yes         0002.b328.5272   False    Configured
BRIDGE3#show bridge 1 g8032
Bridge 1
Ringid    Current  Role    East  Status  West  Status  Primary  Current  Peer
Shared
ID         State      Intf      Intf      VLAN      Event  Ring
ID         Link
--         --         --         --         --         --
2         Idle      OWNER    eth1  Blocked eth2  Forward   10         NR-RB
```

Bridge 4

```
BRIDGE4#show ethernet cfm maintenance-points remote domain test vlan 5 bridge 1
MPID      LEVEL      VLAN      ACTIVE      Remote Mac      RDI      FLAGS
-----
---
12         7          5         Yes         00d0.b727.a854   False    Configured
18         7          5         Yes         0002.b328.5273   True     Configured
BRIDGE4#show ethernet cfm maintenance-points remote domain test vlan 10 bridge 1
MPID      LEVEL      VLAN      ACTIVE      Remote Mac      RDI      FLAGS
-----
---
15         7          10        Yes         00d0.b793.9e57   False    Configured
18         7          10        Yes         0002.b328.5273   False    Configured
BRIDGE4#show bridge 1 g8032
Bridge 1
Ringid    Current  Role    East  Status  West  Status  Primary  Current  Peer
Shared
```

ID	State		Intf		Intf		VLAN	Event	Ring
ID	Link								
--	--	--	--	--	--	--	--	--	--
1	Idle	Non-Owner	eth1	Forward	eth3	Forward	5	NR-RB	
2	eth3								
2	Idle	Non-Owner	eth2	Forward	eth3	Forward	10	NR-RB	
1	eth3								
Protected Vlans									
20									
20									

CHAPTER 16 G.8032 ERPS Version 2

This chapter contains a complete sample configuration for G.8032 Ethernet Ring Protection Switching (ERPS). “Version 2” refers to ITU-T Recommendation G.8032/Y.1344 as published in February 2012.

Note: ERPS version 2 is not supported for ZebIC releases.

Topology

Figure 16-1 displays a Ethernet Ring Protection Switching topology.

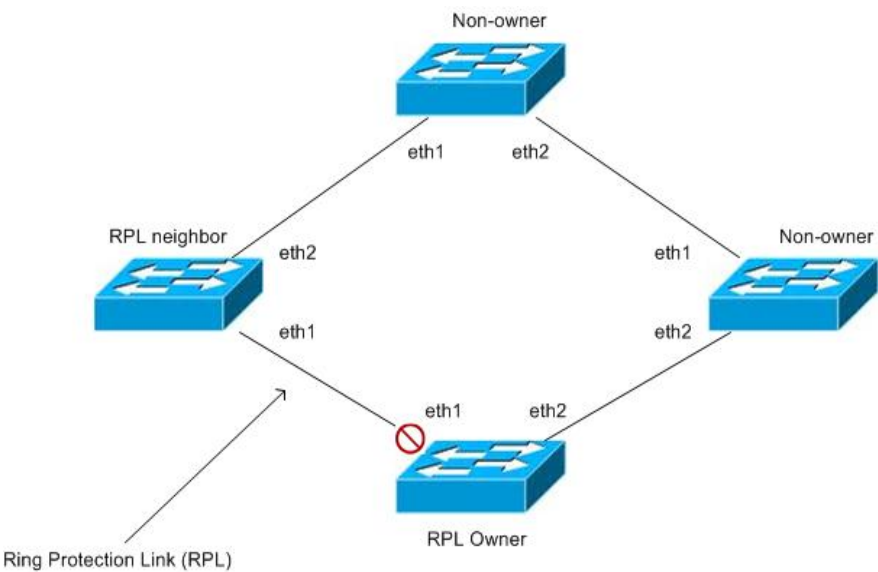


Figure 16-1: Ring Protection Link (RPL)

RPL Owner

<code>rtr1#configure terminal</code>	Enter configure mode
<code>rtr1(config)#bridge 1 protocol ieee vlan-bridge</code>	Configure bridge 1 as VLAN-aware
<code>rtr1(config)#vlan database</code>	Enter VLAN configure mode
<code>rtr1(config-vlan)#vlan 2 bridge 1</code>	Configure VLAN 2 and associate it with bridge 1
<code>rtr1(config-vlan)#exit</code>	Exit VLAN configure mode
<code>rtr1(config)#int eth1</code>	Enter interface mode
<code>rtr1(config-if)#switchport</code>	Configure the interface as a layer 2 interface
<code>rtr1(config-if)#bridge-group 1</code>	Bind the interface to bridge 1
<code>rtr1(config-if)#switchport mode trunk</code>	Configure the switchport mode as trunk

rtr1(config-if)#switchport trunk allowed vlan all	Associate the trunk to all VLANs
rtr1(config-if)#exit	Exit interface mode
rtr1(config)#int eth2	Enter interface mode
rtr1(config-if)#switchport	Configure the interface as a layer 2 interface
rtr1(config-if)#bridge-group 1	Bind the interface to bridge 1
rtr1(config-if)#switchport mode trunk	Configure the switchport mode as trunk
rtr1(config-if)#switchport trunk allowed vlan all	Associate the trunk to all VLANs
rtr1(config-if)#exit	Exit interface mode
rtr1(config)#g8032 profile P1 bridge 1	Create profile a profile and enter G.8032 profile configure mode
rtr1(g8032-profile-config)#timer wait-to-restore 5	Configure wait-to-restore timer
rtr1(g8032-profile-config)#timer hold-off 10	Configure hold-off timer
rtr1(g8032-profile-config)#timer guard-timer 50	Configure guard-timer
rtr1(g8032-profile-config)#enable revertive	Enable revertive mode
rtr1(g8032-profile-config)#exit	Exit G.8032 profile configure mode
rtr1(config)#bridge 1 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
rtr1(config)#g8032 erp-instance major bridge 1	Create ERP instance on bridge 1 and enter G.8032 configure switch mode
rtr1(g8032-config-switch)#physical-ring R1	Associate physical ring to ERP instance
rtr1(g8032-config-switch)#rpl role owner east-interface	Configure RPL role as owner
rtr1(g8032-config-switch)#profile name P1	Associate profile to ERP instance
rtr1(g8032-config-switch)#vlan 2 raps-channel	Associate VLAN 2 with the R-APS channel
rtr1(g8032-config-switch)#ring-id 5	Configure the ring identifier
rtr1(g8032-config-switch)#level 4	Configure the level to carry in R-APS messages
rtr1(g8032-config-switch)#exit	Exit G.8032 configure switch mode

RPL Neighbor

rtr2#configure terminal	Enter configure mode
rtr2(config)#bridge 1 protocol ieee vlan-bridge	Configure bridge 1 as VLAN-aware
rtr2(config)#vlan database	Enter VLAN configure mode
rtr2(config-vlan)#vlan 2 bridge 1	Configure VLAN 2 and associate it with bridge 1
rtr2(config-vlan)#exit	Exit VLAN configure mode
rtr2(config)#int eth1	Enter interface mode
rtr2(config-if)#switchport	Configure the interface as a layer 2 interface

<code>rtr2(config-if)#bridge-group 1</code>	Bind the interface to bridge 1
<code>rtr2(config-if)#switchport mode trunk</code>	Configure the switchport mode as trunk
<code>rtr2(config-if)#switchport trunk allowed vlan all</code>	Associate the trunk to all VLANs
<code>rtr2(config-if)#exit</code>	Exit interface mode
<code>rtr2(config)#int eth2</code>	Enter interface mode
<code>rtr2(config-if)#switchport</code>	Configure the interface as a layer 2 interface
<code>rtr2(config-if)#bridge-group 1</code>	Bind the interface to bridge 1
<code>rtr2(config-if)#switchport mode trunk</code>	Configure the switchport mode as trunk.
<code>rtr2(config-if)#switchport trunk allowed vlan all</code>	Associate the trunk to all VLANs
<code>rtr2(config-if)#exit</code>	Exit interface mode
<code>rtr2(config)#g8032 profile P1 bridge 1</code>	Create profile a profile and enter G.8032 profile configure mode
<code>rtr2(g8032-profile-config)#timer wait-to-restore 5</code>	Configure wait-to-restore timer
<code>rtr2(g8032-profile-config)#timer hold-off 10</code>	Configure hold-off timer
<code>rtr2(g8032-profile-config)#timer guard-timer 50</code>	Configure guard-timer
<code>rtr2(g8032-profile-config)#enable revertive</code>	Enable revertive mode
<code>rtr2(g8032-profile-config)#exit</code>	Exit G.8032 profile configure mode
<code>rtr2(config)#bridge 1 g8032 physical-ring R1 east-interface eth1 west-interface eth2</code>	Configure physical ring, specifying the east and west interfaces
<code>rtr2(config)#g8032 erp-instance major bridge 1</code>	Create ERP instance on bridge 1 and enter G.8032 configure switch mode
<code>rtr2(g8032-config-switch)#physical-ring R1</code>	Associate physical ring to ERP instance
<code>rtr2(g8032-config-switch)#rpl role neighbor east-interface</code>	Configure RPL role as neighbor
<code>rtr2(g8032-config-switch)#profile name P1</code>	Associate profile to ERP instance
<code>rtr2(g8032-config-switch)#vlan 2 raps-channel</code>	Associate VLAN 2 with the R-APS channel
<code>rtr2(g8032-config-switch)#ring-id 5</code>	Configure the ring identifier
<code>rtr2(g8032-config-switch)#level 4</code>	Configure the level to carry in R-APS messages
<code>rtr2(g8032-config-switch)#exit</code>	Exit G.8032 configure switch mode

RPL Non-Owner

<code>rtr3#configure terminal</code>	Enter configure mode
<code>rtr3(config)#bridge 1 protocol ieee vlan-bridge</code>	Configure bridge 1 as VLAN-aware
<code>rtr3(config)#vlan database</code>	Enter VLAN configure mode
<code>rtr3(config-vlan)#vlan 2 bridge 1</code>	Configure VLAN 2 and associate it with bridge 1
<code>rtr3(config-vlan)#exit</code>	Exit VLAN configure mode

<code>rtr3(config)#int eth1</code>	Enter interface mode
<code>rtr3(config-if)#switchport</code>	Configure the interface as a layer 2 interface
<code>rtr3(config-if)#bridge-group 1</code>	Bind the interface to bridge 1
<code>rtr3(config-if)#switchport mode trunk</code>	Configure the switchport mode as trunk
<code>rtr3(config-if)#switchport trunk allowed vlan all</code>	Associate the trunk to all VLANs
<code>rtr3(config-if)#exit</code>	Exit interface mode
<code>rtr3(config)#int eth2</code>	Enter interface mode
<code>rtr3(config-if)#switchport</code>	Configure the interface as a layer 2 interface
<code>rtr3(config-if)#bridge-group 1</code>	Bind the interface to bridge 1
<code>rtr3(config-if)#switchport mode trunk</code>	Configure the switchport mode as trunk.
<code>rtr3(config-if)#switchport trunk allowed vlan all</code>	Associate the trunk to all VLANs
<code>rtr3(config-if)#exit</code>	Exit interface mode
<code>rtr3(config)#g8032 profile P1 bridge 1</code>	Create profile a profile and enter G.8032 profile configure mode
<code>rtr3(g8032-profile-config)#timer wait-to-restore 5</code>	Configure wait-to-restore timer
<code>rtr3(g8032-profile-config)#timer hold-off 10</code>	Configure hold-off timer
<code>rtr3(g8032-profile-config)#timer guard-timer 50</code>	Configure guard-timer
<code>rtr3(g8032-profile-config)#enable revertive</code>	Enable revertive mode
<code>rtr3(g8032-profile-config)#exit</code>	Exit G.8032 profile configure mode
<code>rtr3(config)#bridge 1 g8032 physical-ring R1 east-interface eth1 west-interface eth2</code>	Configure physical ring, specifying the east and west interfaces
<code>rtr3(config)#g8032 erp-instance major bridge 1</code>	Create ERP instance on bridge 1 and enter G.8032 configure switch mode
<code>rtr3(g8032-config-switch)#physical-ring R1</code>	Associate physical ring to ERP instance
<code>rtr3(g8032-config-switch)#rpl role non-owner</code>	Configure RPL role as non-owner
<code>rtr3(g8032-config-switch)#profile name P1</code>	Associate profile to ERP instance
<code>rtr3(g8032-config-switch)#vlan 2 raps-channel</code>	Associate VLAN 2 with the R-APS channel
<code>rtr3(g8032-config-switch)#ring-id 5</code>	Configure the ring identifier
<code>rtr3(g8032-config-switch)#level 4</code>	Configure the level to carry in R-APS messages
<code>rtr3(g8032-config-switch)#exit</code>	Exit G.8032 configure switch mode

Validation

show erp-instance

```

rtr1#sh g8032 erp-instance major bridge 1
Inst Name   : major
State       : G8032_ST_IDLE

```



```

Phy Ring    : R1
Role        : OWNER
East Link   : Link_Blocked
West Link   : Link_Unblocked
Attached    : -
Attached To : -
Virtual ID  : -:-

```

```

-----
Channel      | Interface      | Profile
(LEVL, VID, RID) | (east,ver) , (west,ver) |
=====
(4, 2, 5)    | (eth1 , V=1), (eth2 , V=1) | P1
=====
DataTraffic:

```

show profile

```

rtr1#sh g8032 profile P1 bridge 1
Profile : P1
=====
Wait-To-Restore : 5 mins
Hold Off Timer  : 1 secs
Guard Timer     : 500 ms
Wait-To-Block   : 5500 ms
Protection Type : Revertive

```

show physical-ring

```

rtr1#sh g8032 physical-ring R1 bridge 1
Ring      : R1
=====
Bridge    : 1
East      : eth1
West      : eth2
ERP Inst  :major,

```

Force Switch/Manual Switch

Force Switch

rtr1(config)#g8032 erp-instance major bridge 1	Enter G.8032 configure switch mode
rtr1(g8032-config-switch)#force-switch east-interface	Force switch the east interface
rtr1(g8032-config-switch)#exit	Exit G.8032 configure switch mode

show erp-instance

```

rtr1#sh g8032 erp-instance major bridge 1
Inst Name  : major
State      : G8032_ST_FS
Phy Ring   : R1

```

```

Role       : OWNER
East Link  : Link_Blocked
West Link  : Link_Unblocked
Attached   : -
Attached To: -
Virtual ID : -:-

```

```

-----
Channel    | Interface                | Profile
(LEVL, VID, RID) | (east,ver) , (west,ver) |
=====
(4,      2,      5) | (eth1 , V=1), (eth2 , V=1) | P1
=====

```

DataTraffic:

Manual Switch

rtr1(config)#g8032 erp-instance major bridge 1	Enter G.8032 configure switch mode
rtr1(g8032-config-switch)#manual-switch east-interface	Perform a manual switch for the east interface
rtr1(g8032-config-switch)#exit	Exit G.8032 configure switch mode

show erp-instance

```

rtr1#sh g8032 erp-instance major bridge 1
Inst Name   : major
State       : G8032_ST_MS
Phy Ring    : R1
Role        : OWNER
East Link   : Link_Blocked
West Link   : Link_Unblocked
Attached    : -
Attached To : -
Virtual ID  : -:-

```

```

-----
Channel    | Interface                | Profile
(LEVL, VID, RID) | (east,ver) , (west,ver) |
=====
(4,      2,      5) | (eth1 , V=1), (eth2 , V=1) | P1
=====

```

DataTraffic:

Clearing the Force Switch /Manual Switch

rtr1(config)#g8032 erp-instance major bridge 1	Enter G.8032 configure switch mode
rtr1(g8032-config-switch)#clear	Clear the force switch/manual switch
rtr1(g8032-config-switch)#exit	Exit G.8032 configure switch mode

show erp-instance

```

rtr1#sh g8032 erp-instance major bridge 1
Inst Name   : major
State       : G8032_ST_IDLE
Phy Ring    : R1
Role        : OWNER
East Link   : Link_Blocked
West Link   : Link_Unblocked
Attached    : -
Attached To : -
Virtual ID  : -:-

```

```

-----
Channel      | Interface      | Profile
(LEVL, VID, RID) | (east,ver) , (west,ver) |
=====
(4,    2,    5) | (eth1 , V=1), (eth2 , V=1) | P1
=====

```

DataTraffic:

Miscellaneous Commands

rtr1(config)#g8032 erp-instance major bridge 1	Enter G.8032 configure switch mode
rtr1(g8032-config-switch)#virtual-channel 2 attached-to-instance MI1	Create a virtual channel and attach to an instance
rtr1(g8032-config-switch)#no virtual-channel	Delete the virtual channel
rtr1(g8032-config-switch)#non-virtual-channel	Create a non virtual channel
rtr1(g8032-config-switch)#no non-virtual-channel	Delete the non virtual channel
rtr1(g8032-config-switch)#no sub-ring	Delete a sub-ring
rtr1(g8032-config-switch)#tcn-propagation enable	Enable tcn-propagation
rtr1(g8032-config-switch)#tcn-propagation disable	Disable tcn-propagation
rtr1(g8032-config-switch)#version 0	Set the version as V1
rtr1(g8032-config-switch)#exit	Exit G.8032 configure switch mode
rtr1(g8032-config-switch)#no raps-channel	Delete raps-channel
rtr1(g8032-config-switch)#no data-traffic	Delete data-traffic
rtr1(config)#no bridge 1 g8032 physical-ring R1	Delete a physical ring

<code>rtr1(config)#no g8032 erp-instance major bridge 1</code>	Delete an ERP instance
<code>rtr1(config)#no g8032 profile P1 bridge 1</code>	Delete a g8032 profile

G8032v2 Configuration with Sub Ring

The diagrams below show the topology of G8032v2 configuration with a sub ring.

Topology with a Virtual Channel

Figure 16-2 displays a sample sub ring configuration topology with a virtual channel.

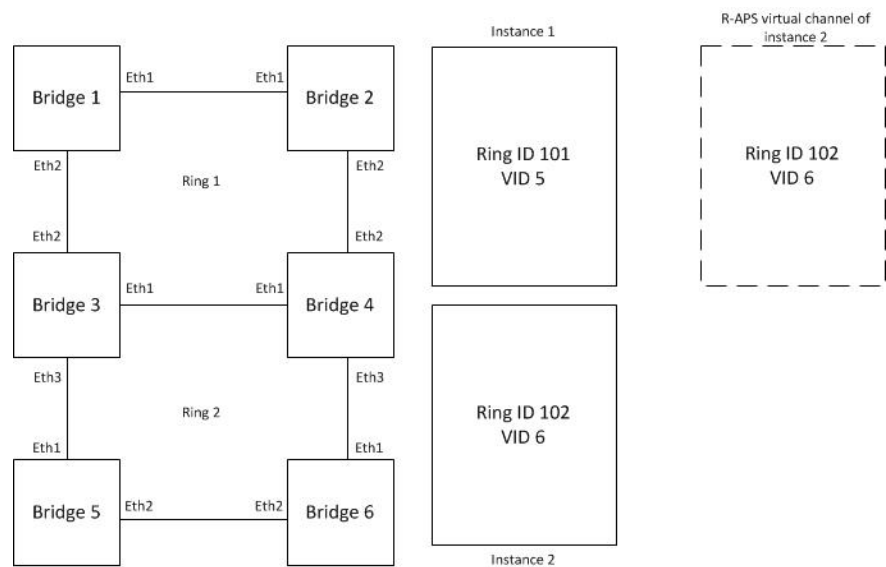


Figure 16-2: Topology 1- Sub Ring Configuration with Virtual Channel

Topology without a Virtual Channel

Figure 16-3 displays a sample sub ring configuration topology without a virtual channel.

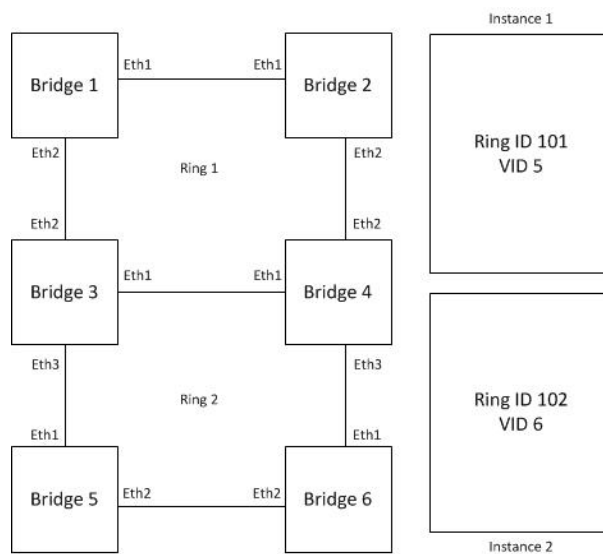


Figure 16-3: Sub Ring Configuration without Virtual Channel

CFM Configuration with a Virtual Channel

Bridge 1

Bridgel#conf t	Enter configure mode
Bridgel(config)#bridge 1 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridgel(config)#vlan database	Enter VLAN configure mode
Bridgel(config-vlan)#vlan 5 bridge 1 state enable	Configure a VLAN and add it to the bridge
Bridgel(config-vlan)#vlan 6 bridge 1 state enable	Configure a VLAN and add it to the bridge
Bridgel(config-vlan)#exit	Exit the VLAN configuration mode
Bridgel(config)#ethernet cfm domain-name type character-string name customer level 7 mip-creation default bridge 1	Enter CFM mode and create a domain at level 0 on bridge1
Bridgel(config-ether-cfm)#service ma-type integer ma-name 13 vlan 5 mip-creation default	Create a service ID
Bridgel(config-ether-cfm)#service ma-type integer ma-name 14 vlan 6 mip-creation default	Create a service ID
Bridgel(config-ether-cfm)#mep crosscheck mpid 103 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridgel(config-ether-cfm)#mep crosscheck mpid 108 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridgel(config-ether-cfm)#mep crosscheck mpid 117 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridgel(config-ether-cfm)#mep crosscheck mpid 121 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridgel(config-ether-cfm)#exit	Exit domain configuration mode
Bridgel(config)#interface eth1	Enter interface mode
Bridgel(config-if)#switchport	Configure interface as a layer2 port
Bridgel(config-if)#bridge-group 1	Associates the interface Eth1 with bridge 1
Bridgel(config-if)#ethernet cfm mep down mpid 101 active true domain customer vlan 5 local-vid 5 bridge 1	Configure the interface as MEP
Bridgel(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridgel(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridgel(config-if)#ethernet cfm mep down mpid 115 active true domain customer vlan 6 local-vid 6 bridge 1	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP)
Bridgel(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridgel(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridgel(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode

Bridge1(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge1(config-if)#exit	Exit interface mode
Bridge1(config)#interface eth2	Enter interface mode
Bridge1(config-if)#switchport	Configure interface as a layer2 port
Bridge1(config-if)#bridge-group 1	Associates the interface Eth2 with bridge 1
Bridge1(config-if)#ethernet cfm mep down mpid 102 active true domain customer vlan 5 local-vid 5 bridge 1	Configure the interface as an MEP
Bridge1(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge1(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge1(config-if)#ethernet cfm mep down mpid 116 active true domain customer vlan 6 local-vid 6 bridge 1	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP)
Bridge1(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge1(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge1(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge1(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge1(config-if)#end	Exit

Bridge 2

Bridge2#conf t	Enter configure mode
Enter configuration commands, one per line. End with CNTL/Z.	Configure an IEEE VLAN-aware bridge
Bridge2(config)#bridge 2 protocol ieee vlan	Enter VLAN configure mode
Bridge2(config)#vlan database	Enter VLAN configure mode
Bridge2(config-vlan)#vlan 5 bridge 2 state enable	Configure a VLAN and add it to the bridge
Bridge2(config-vlan)#vlan 6 bridge 2 state enable	Configure a VLAN and add it to the bridge
Bridge2(config-vlan)#exit	Exit the VLAN configuration mode
Bridge2(config)#ethernet cfm domain-name type character-string name customer level 7 mip-creation default bridge 2	Enter CFM mode and create a domain at level 0 on bridge1
Bridge2(config-ether-cfm)#service ma- type integer ma-name 13 vlan 5 mip- creation default	Create a service ID
Bridge2(config-ether-cfm)#service ma- type integer ma-name 14 vlan 6 mip- creation default	Create a service ID
Bridge2(config-ether-cfm)#mep crosscheck mpid 101 vlan 5	Configure crosscheck between host MEP and the remote MEP

Bridge2(config-ether-cfm)#mep crosscheck mpid 106 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge2(config-ether-cfm)#mep crosscheck mpid 115 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge2(config-ether-cfm)#mep crosscheck mpid 119 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge2(config-ether-cfm)#exit	Exit domain configuration mode
Bridge2(config)#interface eth1	Enter interface mode
Bridge2(config-if)#switchport	Configure interface as a layer2 port
Bridge2(config-if)#bridge-group 2	Associates the Eth1 interface with bridge 2
Bridge2(config-if)#ethernet cfm mep down mpid 103 active true domain customer vlan 5 local-vid 5 bridge 2	Configure the interface as an MEP
Bridge2(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge2(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge2(config-if)#ethernet cfm mep down mpid 117 active true domain customer vlan 6 local-vid 6 bridge 2	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP)
Bridge2(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge2(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge2(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge2(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge2(config-if)#exit	Exit interface mode
Bridge2(config)#interface eth2	Enter interface mode
Bridge2(config-if)#switchport	Configure interface as a layer2 port
Bridge2(config-if)#bridge-group 2	Associates the Eth2 interface with bridge 2
Bridge2(config-if)#ethernet cfm mep down mpid 104 active true domain customer vlan 5 local-vid 5 bridge 1	Configure the interface as an MEP
Bridge2(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge2(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge2(config-if)#ethernet cfm mep down mpid 118 active true domain customer vlan 6 local-vid 6 bridge 2	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP)
Bridge2(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge2(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge2(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge2(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge2(config-if)#end	Exit

Bridge 3

Bridge3#conf t	Enter configure mode
Bridge3(config)#bridge 3 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridge3(config)#vlan database	Enter VLAN configure mode
Bridge3(config-vlan)#vlan 5 bridge 3 state enable	Configure a VLAN and add it to the bridge
Bridge3(config-vlan)#vlan 6 bridge 3 state enable	Configure a VLAN and add it to the bridge
Bridge3(config-vlan)#exit	Exit the VLAN configuration mode
Bridge3(config)#ethernet cfm domain- name type character-string name customer level 7 mip-creation default bridge 3	Enter CFM mode and create a domain at level 0 on bridge1
Bridge3(config-ether-cfm)#service ma- type integer ma-name 13 vlan 5 mip- creation default	Create a service ID
Bridge3(config-ether-cfm)#service ma- type integer ma-name 14 vlan 6 mip- creation default	Create a service ID
Bridge3(config-ether-cfm)#mep crosscheck mpid 104 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge3(config-ether-cfm)#mep crosscheck mpid 107 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge3(config-ether-cfm)#mep crosscheck mpid 111 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge3(config-ether-cfm)#mep crosscheck mpid 118 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge3(config-ether-cfm)#mep crosscheck mpid 122 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge3(config-ether-cfm)#exit	Exit domain configuration mode
Bridge3(config)#interface eth1	Enter interface mode
Bridge3(config-if)#switchport	Configure interface as a layer2 port
Bridge3(config-if)#bridge-group 3	Associates the Eth1 interface with bridge 1
Bridge3(config-if)#ethernet cfm mep down mpid 105 active true domain customer vlan 5 local-vid 5 bridge 3	Configure the interface as an MEP
Bridge3(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge3(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge3(config-if)#ethernet cfm mep down mpid 120 active true domain customer vlan 6 local-vid 6 bridge 3	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP)
Bridge3(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge3(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge3(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode

Bridge3(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge1(config-if)#exit	Exit interface mode
Bridge1(config)#interface eth2	Enter interface mode
Bridge1(config-if)#switchport	Configure interface as a layer2 port
Bridge1(config-if)#bridge-group 3	Associates the interface Eth2 with bridge 3
Bridge1(config-if)#ethernet cfm mep down mpid 102 active true domain customer vlan 5 local-vid 5 bridge 3	Configure the interface as an MEP
Bridge3(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge3(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge3(config-if)#ethernet cfm mep down mpid 119 active true domain customer vlan 6 local-vid 6 bridge 3	Configure the interface as an MEP
Bridge3(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge3(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge3(config-if)#exit	Exit interface mode
Bridge3(config)#interface eth3	Enter interface mode
Bridge3(config-if)#switchport	Configure interface as a layer2 port
Bridge3(config-if)#bridge-group 3	Associates the Eth3 interface with bridge 3
Bridge3(config-if)#ethernet cfm mep down mpid 114 active true domain customer vlan 6 local-vid 6 bridge 3	Configure the interface as an MEP
Bridge3(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge3(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge3(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge3(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge3(config-if)#exit	Exit interface mode

Bridge 4

Bridge4#conf t	Enter configure mode
Bridge4(config)#bridge 4 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridge4(config)#vlan database	Enter VLAN configure mode
Bridge4(config-vlan)#vlan 5 bridge 4 state enable	Configure a VLAN and add it to the bridge
Bridge4(config-vlan)#vlan 6 bridge 4 state enable	Configure a VLAN and add it to the bridge
Bridge4(config-vlan)#exit	Exit the VLAN configuration mode

Bridge4(config)#ethernet cfm domain-name type character-string name customer level 7 mip-creation default bridge 4	Enter CFM mode and create a domain at level 0 on bridge4
Bridge4(config-ether-cfm)#service ma-type integer ma-name 13 vlan 5 mip-creation default	Create a service ID
Bridge4(config-ether-cfm)#service ma-type integer ma-name 14 vlan 6 mip-creation default	Create a service ID
Bridge4(config-ether-cfm)#mep crosscheck mpid 102 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge4(config-ether-cfm)#mep crosscheck mpid 105 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge4(config-ether-cfm)#mep crosscheck mpid 109 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge4(config-ether-cfm)#mep crosscheck mpid 116 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge4(config-ether-cfm)#mep crosscheck mpid 120 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge4(config-ether-cfm)#exit	Exit domain configuration mode
Bridge4(config)#interface eth1	Enter interface mode
Bridge4(config-if)#switchport	Configure interface as a layer2 port
Bridge4(config-if)#bridge-group 4	Associates the interface Eth1 with bridge 4
Bridge4(config-if)#ethernet cfm mep down mpid 107 active true domain customer vlan 5 local-vid 5 bridge 4	Configure the interface as an MEP
Bridge4(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge4(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge4(config-if)#ethernet cfm mep down mpid 122 active true domain customer vlan 6 local-vid 6 bridge 4	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP)
Bridge4(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge4(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge4(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge4(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge4(config-if)#exit	Exit interface mode
Bridge4(config)#interface eth2	Enter interface mode
Bridge4(config-if)#switchport	Configure interface as a layer2 port
Bridge4(config-if)#bridge-group 4	Associates the Eth2 interface with bridge 4
Bridge4(config-if)#ethernet cfm mep down mpid 108 active true domain customer vlan 5 local-vid 5 bridge 4	Configure the interface as an MEP
Bridge4(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface

Bridge4(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge4(config-if)#ethernet cfm mep down mpid 121 active true domain customer vlan 6 local-vid 6 bridge 4	Configure the interface as an MEP
Bridge4(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge4(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge4(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge4(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge4(config-if)#exit	Exit interface mode
Bridge4(config)#interface eth3	Enter interface mode
Bridge4(config-if)#switchport	Configure interface as a layer2 port
Bridge4(config-if)#bridge-group 4	Associates the Eth3 interface with bridge 4
Bridge4(config-if)#ethernet cfm mep down mpid 113 active true domain customer vlan 6 local-vid 6 bridge 4	Configure the interface as an MEP
Bridge4(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge4(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge4(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge4(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge4(config-if)#exit	Exit interface mode

Bridge 5

Bridge5#conf t	Enter configure mode
Bridge5(config)#bridge 5 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridge5(config)#vlan database	Enter VLAN configure mode
Bridge5(config-vlan)#vlan 6 bridge 5 state enable	Configure a VLAN and add it to the bridge
Bridge5(config-vlan)#exit	Exit the VLAN configuration mode
Bridge5(config)#ethernet cfm domain- name type character-string name customer level 7 mip-creation default bridge 5	Enter CFM mode and create a domain at level 0 on bridge1
Bridge5(config-ether-cfm)#service ma- type integer ma-name 14 vlan 6 mip- creation default	Create a service ID
Bridge5(config-ether-cfm)#mep crosscheck mpid 113 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge5(config-ether-cfm)#mep crosscheck mpid 112 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge5(config-ether-cfm)#exit	Exit domain configuration mode

Bridge5(config)#interface eth1	Enter interface mode
Bridge5(config-if)#switchport	Configure interface as a layer2 port
Bridge5(config-if)#bridge-group 5	Associates the Eth1 interface with bridge 5
Bridge5(config-if)#ethernet cfm mep down mpid 109 active true domain customer vlan 6 local-vid 6 bridge 5	Configure the interface as an MEP
Bridge5(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge5(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge5(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge5(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge5(config-if)#exit	Exit CFM MEP mode
Bridge5(config)#interface eth2	Enter interface mode
Bridge5(config-if)#switchport	Configure interface as a layer2 port
Bridge5(config-if)#bridge-group 5	Associates the Eth2 interface with bridge 5
Bridge5(config-if)#ethernet cfm mep down mpid 110 active true domain customer vlan 6 local-vid 6 bridge 5	Configure the interface as an MEP
Bridge5(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge5(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge5(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge5(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge5(config-if)#end	Exit interface mode

Bridge 6

Bridge6#conf t	Enter configure mode
Bridge6(config)#bridge 6 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridge6(config)#vlan database	Enter VLAN configure mode
Bridge6(config-vlan)#vlan 6 bridge 6 state enable	Configure a VLAN and add it to the bridge
Bridge6(config-vlan)#exit	Exit the VLAN configuration mode
Bridge6(config)#ethernet cfm domain- name type character-string name customer level 7 mip-creation default bridge 6	Enter CFM mode and create a domain at level 0 on bridge1
Bridge6(config-ether-cfm)#service ma- type integer ma-name 14 vlan 6 mip- creation default	Create a service ID
Bridge6(config-ether-cfm)#mep crosscheck mpid 110 vlan 6	Configure crosscheck between host MEP and the remote MEP

Bridge6(config-ether-cfm)#mep crosscheck mpid 114 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge6(config-ether-cfm)#exit	Exit domain configuration mode
Bridge6(config)#interface eth1	Enter interface mode
Bridge6(config-if)#switchport	Configure interface as a layer2 port
Bridge6(config-if)#bridge-group 6	Associates the Eth1 interface with bridge 6
Bridge6(config-if)#ethernet cfm mep down mpid 111 active true domain customer vlan 6 local-vid 6 bridge 6	Configure the interface as an MEP
Bridge6(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge6(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge6(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge6(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge6(config-if)#exit	Exit CFM MEP mode
Bridge6(config)#interface eth2	Enter interface mode
Bridge6(config-if)#switchport	Configure interface as a layer2 port
Bridge6(config-if)#bridge-group 6	Associates the Eth2 interface with bridge 6
Bridge6(config-if)#ethernet cfm mep down mpid 112 active true domain customer vlan 6 local-vid 6 bridge 6	Configure the interface as an MEP
Bridge6(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge6(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge6(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge6(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge6(config-if)#end	Exit interface mode

CCM Convergence Verification

Bridge 1

```
Bridge1#show ethernet cfm maintenance-points remote level 7 vlan 5 bridge 1
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
103	7	5	Yes	5254.0059.424f	False	Configured
108	7	5	Yes	5254.006b.866f	False	Configured

Bridge 2

```
Bridge2#show ethernet cfm maintenance-points remote level 7 vlan 5 bridge 2
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
101	7	5	Yes	5254.00dd.c9e6	False	Configured
106	7	5	Yes	5254.00cc.bf79	False	Configured

Bridge 3

```
Bridge3#show ethernet cfm maintenance-points remote level 7 vlan 6 bridge 13
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
111	7	6	Yes	5254.009d.93ae	False	Configured

```
Bridge3#show ethernet cfm maintenance-points remote level 7 vlan 5 bridge 1
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
104	7	5	Yes	5254.0053.71fc	False	Configured
107	7	5	Yes	5254.000f.258f	False	Configured

Bridge 4

```
Bridge4#show ethernet cfm maintenance-points remote level 7 vlan 5 bridge 14
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
102	7	5	Yes	5254.005e.7609	False	Configured
105	7	5	Yes	5254.0014.d97d	False	Configured

```
Bridge4#show ethernet cfm maintenance-points remote level 7 vlan 6 bridge 1
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
109	7	6	Yes	5254.0090.8b1a	False	Configured

Bridge 5

```
Bridge5#show ethernet cfm maintenance-points remote level 7 vlan 6 bridge 5
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
113	7	6	Yes	5254.0013.9c53	False	Configured
112	7	6	Yes	5254.0085.25e1	False	Configured

Bridge 6

```
Bridge6#show ethernet cfm maintenance-points remote level 7 vlan 6 bridge 6
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
110	7	6	Yes	5254.0000.eb38	False	Configured
114	7	6	Yes	5254.0025.5930	False	Configured

Configuration with a Virtual Channel**Bridge 1**

Bridgel#configure terminal	Enter configure mode
Bridgel (config)#g8032 profile profile1 bridge 1	Create a profile and enter G.8032 profile configure mode
Bridgel (g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridgel (config)#bridge 1 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
Bridgel (config)#g8032 profile profile1 bridge 1	Create a profile and enter G.8032 profile configure mode

Bridge1(g8032-profile-config)#timer wait 1	Configure wait-to-restore timer
Bridge1(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge1(config)#g8032 erp-instance ERP_INST_1 bridge 1	Create ERP instance on bridge 1 and enter G.8032 configure switch mode
Bridge1(g8032-config-switch)#physical-ring R1	Associate physical ring to ERP instance
Bridge1(g8032-config-switch)#vlan 5 raps-channel	Associate VLAN 5 with the R-APS channel
Bridge1(g8032-config-switch)#ring-id 101	Configure the ring identifier
Bridge1(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge1(g8032-config-switch)#rpl role owner east-interface	Configure RPL role as neighbor
Bridge1(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge1(g8032-config-switch)#vlan 6 data-traffic	
Bridge1(g8032-config-switch)#exit	

Bridge 2

Bridge2#configure terminal	Enter configure mode
Bridge2(config)#g8032 profile profile1 bridge 2	Create a profile and enter G.8032 profile configure mode
Bridge2(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge2(config)#bridge 2 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge2(config)#g8032 profile profile1 bridge 2	Create a profile and enter G.8032 profile configure mode
Bridge2(g8032-profile-config)#timer wait 1	Configure wait-to-restore timer
Bridge2(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge2(config)#g8032 erp-instance ERP_INST_1 bridge 2	Create ERP instance on bridge 2 and enter G.8032 configure switch mode
Bridge2(g8032-config-switch)#physical-ring R1	Associate physical ring to ERP instance
Bridge2(g8032-config-switch)#vlan 5 raps-channel	Associate VLAN 5 with the R-APS channel
Bridge2(g8032-config-switch)#ring-id 101	Configure the ring identifier
Bridge2(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge2(g8032-config-switch)#rpl role neigh east-interface	Configure RPL role as neighbor
Bridge2(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages

Bridge2(g8032-config-switch)#vlan 6 data-traffic	Configure VLAN data traffic
Bridge2(g8032-config-switch)#exit	Exit G.8032 configuration switch mode

Bridge 3

Bridge3#configure terminal	Enter configure mode
Bridge3(config)#g8032 profile profile1 bridge 3	Create a profile and enter G.8032 profile configure mode
Bridge3(g8032-profile-config)#timer wait 1	Set wait-to-restore timer
Bridge3(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge3(config)#bridge 3 g8032 physical- ring R1 east-interface eth1 west- interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge3(config)#g8032 profile profile1 bridge 3	Create a profile and enter G.8032 profile configure mode
Bridge3(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge3(config)#g8032 erp-instance ERP_INST_1 bridge 3	Create ERP instance on bridge 3 and enter G.8032 configure switch mode
Bridge3(g8032-config-switch)#physical- ring R1	Associate physical ring to ERP instance
Bridge3(g8032-config-switch)#vlan 5 raps-channel	Associate VLAN 5 with the R-APS channel
Bridge3(g8032-config-switch)#ring-id 101	Configure the ring identifier
Bridge3(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge3(g8032-config-switch)#rpl role non-owner	Configure the Ring Protection Link node as Owner and specify the RPL owner
Bridge3(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge3(g8032-config-switch)#exit	Exit G.8032 configure switch mode
Bridge3(config)#bridge 1 g8032 physical- ring R2 east-interface eth1 west- interface eth3	Configure physical ring, specifying the east and west interfaces
Bridge3(config)#g8032 erp-instance ERP_INST_2 bridge 1	Create a profile and enter G.8032 profile configure mode
Bridge3(g8032-config-switch)#physical- ring R2	Associate physical ring to ERP instance
Bridge3(g8032-config-switch)#ring-id 102	Configure the ring identifier
Bridge3(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge3(g8032-config-switch)#rpl role non-owner	Configure RPL role as non-owner
Bridge3(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge3(g8032-config-switch)#sub-ring block east-interface	Associate profile to ERP instance
Bridge3(g8032-config-switch)#vlan 6 raps-channel	Associate VLAN 6 with the R-APS channel

Bridge3(g8032-config-switch)#virtual-channel 6 attached-to-instance ERP_INST_1	Create a virtual channel and attach to an instance
Bridge3(g8032-config-switch)#ex	Exit G.8032 configure switch mode

Bridge 4

Bridge4#configure terminal	Enter configure mode
Bridge4(config)#g8032 profile profile1 bridge 4	Create a profile and enter G.8032 profile configure mode
Bridge4(g8032-profile-config)#timer wait 1	Set wait-to-restore timer
Bridge4(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge4(config)#bridge 4 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge4(config)#g8032 profile profile1 bridge 4	Create a profile and enter G.8032 profile configure mode
Bridge4(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge4(config)#g8032 erp-instance ERP_INST_1 bridge 4	Create ERP instance on bridge 4 and enter G.8032 configure switch mode
Bridge4(g8032-config-switch)#physical-ring R1	Associate physical ring to ERP instance
Bridge4(g8032-config-switch)#vlan 5 raps-channel	Associate VLAN 5 with the R-APS channel
Bridge4(g8032-config-switch)#ring-id 101	Configure the ring identifier
Bridge4(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge4(g8032-config-switch)#rpl role non-owner	Configure the Ring Protection Link node as Owner and specify the RPL owner
Bridge4(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge4(g8032-config-switch)#exit	Exit G.8032 configure switch mode
Bridge4(config)#bridge 4 g8032 physical-ring R2 east-interface eth1 west-interface eth3	Configure physical ring, specifying the east and west interfaces
Bridge4(config)#g8032 erp-instance ERP_INST_2 bridge 4	Create ERP instance on bridge 4 and enter G.8032 configure switch mode
Bridge4(g8032-config-switch)#physical-ring R2	Associate physical ring to ERP instance
Bridge4(g8032-config-switch)#ring-id 102	Configure the ring identifier
Bridge4(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge4(g8032-config-switch)#rpl role non-owner	Configure RPL role as non-owner
Bridge4(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge4(g8032-config-switch)#sub-ring block east-interface	Associate profile to ERP instance

Bridge4(g8032-config-switch)#virtual-channel 6 attached ERP_INST_1	Create a virtual channel and attach to an instance
Bridge4(g8032-config-switch)#vlan 6 raps-channel	Associate VLAN 5 with the R-APS channel
Bridge4(g8032-config-switch)#end	Exit G.8032 configure switch mode

Bridge 5

Bridge5#configure terminal	Enter configure mode
Bridge5(config)#g8032 profile profile1 bridge 5	Create a profile and enter G.8032 profile configure mode
Bridge5(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge5(config)#bridge 5 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge5(config)#g8032 profile profile1 bridge 5	Create a profile and enter G.8032 profile configure mode
Bridge5(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge5(config)#g8032 erp-instance ERP_INST_1 bridge 5	Create ERP instance on bridge 5 and enter G.8032 configure switch mode
Bridge5(g8032-config-switch)#physical-ring R1	Associate physical ring to ERP instance
Bridge5(g8032-config-switch)#vlan 6 raps-channel	Associate VLAN 6 with the R-APS channel
Bridge5(g8032-config-switch)#ring-id 102	Configure the ring identifier
Bridge5(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge5(g8032-config-switch)#rpl role owner west-interface	Configure the Ring Protection Link node as Owner and specify the RPL owner
Bridge5(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge5(g8032-config-switch)#end	Exit G.8032 configure switch mode

Bridge 6

Bridge6#configure terminal	Enter configure mode
Bridge6(config)#g8032 profile profile1 bridge 6	Create a profile and enter G.8032 profile configure mode
Bridge6(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge6(config)#bridge 6 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge6(config)#vlan database	Enter VLAN configure mode
Bridge6(config-vlan)#vlan 6 bridge 6 state enable	Configure a VLAN and add it to the bridge
Bridge6(config-vlan)#exit	Exit the VLAN configuration mode
Bridge6(config)#g8032 erp-instance ERP_INST_1 bridge 6	Create ERP instance on bridge 6 and enter G.8032 configure switch mode

Bridge6(g8032-config-switch)#physical-ring R1	Associate physical ring to ERP instance
Bridge6(g8032-config-switch)#vlan 6 raps-channel	Associate VLAN 6 with the R-APS channel
Bridge6(g8032-config-switch)#ring-id 102	Configure the ring identifier
Bridge6(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge6(g8032-config-switch)#rpl role neigh west-interface	Configure RPL role as neighbor
Bridge6(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge6(g8032-config-switch)#end	Exit G.8032 configure switch mode

CFM Configuration without a Virtual Channel

Bridge 1

Bridge1#conf t	Enter configure mode
Bridge1(config)#bridge 1 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridge1(config)#vlan database	Enter VLAN configure mode
Bridge1(config-vlan)#vlan 5 bridge 1 state enable	Configure a VLAN and add it to the bridge
Bridge1(config-vlan)#exit	Exit the VLAN configuration mode
Bridge1(config)#ethernet cfm domain-name type character-string name customer level 7 mip-creation default bridge 1	Enter CFM mode and create a domain at level 0 on bridge1
Bridge1(config-ether-cfm)#service ma-type integer ma-name 13 vlan 5 mip-creation default	Create a service ID
Bridge1(config-ether-cfm)#mep crosscheck mpid 103 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge1(config-ether-cfm)#mep crosscheck mpid 108 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge1(config-ether-cfm)#exit	Exit domain configuration mode
Bridge1(config)#interface eth1	Enter interface mode
Bridge1(config-if)#switchport	Configure interface as a layer2 port
Bridge1(config-if)#bridge-group 1	Associates the Eth1 interface with bridge 1
Bridge1(config-if)#ethernet cfm mep down mpid 101 active true domain customer vlan 5 local-vid 5 bridge 1	Configure the interface as an MEP
Bridge1(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface

Bridge1 (config-if-eth-cfm-mep) #exit	Exit CFM MEP mode
Bridge1 (config-if) #switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge1 (config-if) #switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge1 (config-if) #exit	Exit interface mode
Bridge1 (config) #interface eth2	Enter interface mode
Bridge1 (config-if) #switchport	Configure interface as a layer2 port
Bridge1 (config-if) #bridge-group 1	Associates the Eth2 interface with bridge 1
Bridge1 (config-if) #ethernet cfm mep down mpid 102 active true domain customer vlan 5 local-vid 5 bridge 1	Configure the interface as an MEP
Bridge1 (config-if-eth-cfm-mep) #cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge1 (config-if-eth-cfm-mep) #exit	Exit CFM MEP mode
Bridge1 (config-if) #switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge1 (config-if) #switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge1 (config-if) #end	Exit

Bridge 2

Bridge2#conf t	Enter configure mode
Bridge2 (config) #bridge 2 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridge2 (config) #vlan database	Enter VLAN configure mode
Bridge2 (config-vlan) #vlan 5 bridge 2 state enable	Configure a VLAN and add it to the bridge
Bridge2 (config-vlan) #exit	Exit the VLAN configuration mode
Bridge2 (config) #ethernet cfm domain-name type character-string name customer level 7 mip-creation default bridge 2	Enter CFM mode and create a domain at level 0 on bridge2
Bridge2 (config-ether-cfm) #service ma-type integer ma-name 13 vlan 5 mip-creation default	Create a service ID
Bridge2 (config-ether-cfm) #mep crosscheck mpid 101 vlan 5	Configure crosscheck between host MEP and the remote MEP

Bridge2(config-ether-cfm)#mep crosscheck mpid 106 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge2(config-ether-cfm)#exit	Exit domain configuration mode
Bridge2(config)#interface eth1	Enter interface mode
Bridge2(config-if)#switchport	Configure Eth1 as a layer2 port
Bridge2(config-if)#bridge-group 2	Associates the Eth1 interface with bridge 2
Bridge2(config-if)#ethernet cfm mep down mpid 103 active true domain customer vlan 5 local-vid 5 bridge 2	Configure the interface as an MEP
Bridge2(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge2(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge2(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge2(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge2(config-if)#exit	Exit interface mode
Bridge2(config)#interface eth2	Enter interface mode
Bridge2(config-if)#switchport	Configure interface as a layer2 port
Bridge2(config-if)#bridge-group 2	Associates the Eth1 interface with bridge 2
Bridge2(config-if)#ethernet cfm mep down mpid 104 active true domain customer vlan 5 local-vid 5 bridge 2	Configure the interface as an MEP
Bridge2(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge2(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge2(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge2(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge2(config-if)#end	Exit

Bridge 3

Bridge3#conf t	Enter configure mode
Bridge3(config)#bridge 3 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridge3(config)#vlan database	Enter VLAN configure mode
Bridge3(config-vlan)#vlan 5 bridge 3 state enable	Configure a VLAN and add it to the bridge
Bridge3(config-vlan)#vlan 6 bridge 3 state enable	Configure a VLAN and add it to the bridge

Bridge3(config-vlan)#exit	Exit the VLAN configuration mode
Bridge3(config)#ethernet cfm domain-name type character-string name customer level 7 mip-creation default bridge 3	Enter CFM mode and create a domain at level 0 on bridge 3
Bridge3(config-ether-cfm)#service ma-type integer ma-name 13 vlan 5 mip-creation default	Create a service ID
Bridge3(config-ether-cfm)#service ma-type integer ma-name 14 vlan 6 mip-creation default	Create a service ID
Bridge3(config-ether-cfm)#mep crosscheck mpid 104 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge3(config-ether-cfm)#mep crosscheck mpid 107 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge3(config-ether-cfm)#mep crosscheck mpid 111 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge3(config-ether-cfm)#exit	Exit domain configuration mode
Bridge3(config)#interface eth1	Enter interface mode
Bridge3(config-if)#switchport	Configure Eth1 as a layer2 port
Bridge3(config-if)#bridge-group 3	Associates the Eth1 interface with bridge 3
Bridge3(config-if)#ethernet cfm mep down mpid 105 active true domain customer vlan 5 local-vid 5 bridge 3	Configure the interface as an MEP
Bridge3(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge3(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge3(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge3(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge3(config-if)#exit	Exit interface mode
Bridge3(config)#interface eth2	Enter interface mode
Bridge3(config-if)#switchport	Configure Eth2 as a layer2 port
Bridge3(config-if)#bridge-group 3	Associates the Eth2 interface with bridge 3
Bridge3(config-if)#ethernet cfm mep down mpid 106 active true domain customer vlan 5 local-vid 5 bridge 3	Configure the interface as an MEP
Bridge3(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge3(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge3(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge3(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge3(config-if)#exit	Exit interface mode

Bridge3(config)#interface eth3	Enter interface mode
Bridge3(config-if)#switchport	Configure Eth3 as a layer2 port
Bridge3(config-if)#bridge-group 3	Associates the Eth13interface with bridge 3
Bridge3(config-if)#ethernet cfm mep down mpid 114 active true domain customer vlan 6 local-vid 6 bridge 3	Configure the interface as an MEP
Bridge3(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge3(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge3(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge3(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge3(config-if)#exit	Exit interface mode

Bridge 4

Bridge4#conf t	Enter configure mode
Bridge4(config)#bridge 4 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridge4(config)#vlan database	Enter VLAN configure mode
Bridge4(config-vlan)#vlan 5 bridge 4 state enable	Configure a VLAN and add it to the bridge
Bridge4(config-vlan)#vlan 6 bridge 4 state enable	Configure a VLAN and add it to the bridge
Bridge4(config-vlan)#exit	Exit the VLAN configuration mode
Bridge4(config)#ethernet cfm domain-name type character-string name customer level 7 mip-creation default bridge 4	Enter CFM mode and create a domain at level 0 on bridge1
Bridge4(config-ether-cfm)#service ma- type integer ma-name 13 vlan 5 mip- creation default	Create a service ID
Bridge4(config-ether-cfm)#service ma- type integer ma-name 14 vlan 6 mip- creation default	Create a service ID
Bridge4(config-ether-cfm)#mep crosscheck mpid 102 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge4(config-ether-cfm)#mep crosscheck mpid 105 vlan 5	Configure crosscheck between host MEP and the remote MEP
Bridge4(config-ether-cfm)#mep crosscheck mpid 109 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge4(config-ether-cfm)#exit	Exit domain configuration mode
Bridge4(config)#interface eth1	Enter interface mode
Bridge4(config-if)#switchport	Configure Eth1 as a layer2 port
Bridge4(config-if)#bridge-group 4	Associates the Eth1 interface with bridge 4
Bridge4(config-if)#ethernet cfm mep down mpid 107 active true domain customer vlan 5 local-vid 5 bridge 4	Configure the interface as an MEP

Bridge4(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge4(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge4(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge4(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge4(config-if)#exit	Exit interface mode
Bridge4(config)#interface eth2	Enter interface mode
Bridge4(config-if)#switchport	Configure Eth2 as a layer2 port
Bridge4(config-if)#bridge-group 4	Associates the Eth2 interface with bridge 4
Bridge4(config-if)#ethernet cfm mep down mpid 108 active true domain customer vlan 5 local-vid 5 bridge 4	Configure the interface as an MEP
Bridge4(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge4(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge4(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge4(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge4(config-if)#exit	Exit interface mode
Bridge4(config)#interface eth3	Enter interface mode
Bridge4(config-if)#switchport	Configure Eth3 as a layer2 port
Bridge4(config-if)#bridge-group 4	Associates the Eth3 interface with bridge 4
Bridge4(config-if)#ethernet cfm mep down mpid 113 active true domain customer vlan 6 local-vid 6 bridge 4	Configure the interface as an MEP
Bridge4(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge4(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge4(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge4(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge4(config-if)#exit	Exit interface mode

Bridge 5

Bridge5#conf t	Enter configure mode
Bridge5(config)#bridge 5 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridge5(config)#vlan database	Enter VLAN configure mode
Bridge5(config-vlan)#vlan 6 bridge 5 state enable	Configure a VLAN and add it to the bridge
Bridge5(config-vlan)#exit	Exit the VLAN configuration mode
Bridge5(config)#ethernet cfm domain- name type character-string name customer level 7 mip-creation default bridge 5	Enter CFM mode and create a domain at level 0 on bridge5

Bridge5(config-ether-cfm)#service ma-type integer ma-name 14 vlan 6 mip-creation default	Create a service ID
Bridge5(config-ether-cfm)#mep crosscheck mpid 113 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge5(config-ether-cfm)#mep crosscheck mpid 112 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge5(config-ether-cfm)#exit	Exit domain configuration mode
Bridge5(config)#interface eth1	Enter interface mode
Bridge5(config-if)#switchport	Configure interface as a layer2 port
Bridge5(config-if)#bridge-group 5	Associates the Eth1 interface with bridge 5
Bridge5(config-if)#ethernet cfm mep down mpid 109 active true domain customer vlan 6 local-vid 6 bridge 5	Configure the interface as an MEP
Bridge5(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge5(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge5(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge5(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge5(config-if)#exit	Exit interface mode
Bridge5(config)#interface eth2	Enter interface mode
Bridge5(config-if)#switchport	Configure interface as a layer2 port
Bridge5(config-if)#bridge-group 5	Associates the Eth2 interface with bridge 5
Bridge5(config-if)#ethernet cfm mep down mpid 110 active true domain customer vlan 6 local-vid 6 bridge 5	Configure the interface as an MEP
Bridge5(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge5(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge5(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge5(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge5(config-if)#end	Exit interface mode

Bridge 6

Bridge6#conf t	Enter configure mode
Bridge6(config)#bridge 6 protocol ieee vlan	Configure an IEEE VLAN-aware bridge
Bridge6(config)#vlan database	Enter VLAN configure mode
Bridge6(config-vlan)#vlan 6 bridge 6 state enable	Configure a VLAN and add it to the bridge
Bridge6(config-vlan)#exit	Exit the VLAN configuration mode

Bridge6(config)#ethernet cfm domain-name type character-string name customer level 7 mip-creation default bridge 6	Enter CFM mode and create a domain at level 0 on bridge6
Bridge6(config-ether-cfm)#service ma-type integer ma-name 14 vlan 6 mip-creation default	Create a service ID
Bridge6(config-ether-cfm)#mep crosscheck mpid 110 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge6(config-ether-cfm)#mep crosscheck mpid 114 vlan 6	Configure crosscheck between host MEP and the remote MEP
Bridge6(config-ether-cfm)#exit	Exit domain configuration mode
Bridge6(config)#interface eth1	Enter interface mode
Bridge6(config-if)#switchport	Configure interface as a layer2 port
Bridge6(config-if)#bridge-group 6	Associates the Eth1 interface with bridge 6
Bridge6(config-if)#ethernet cfm mep down mpid 111 active true domain customer vlan 6 local-vid 6 bridge 6	Configure the interface as an MEP
Bridge6(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge6(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge6(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge6(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge6(config-if)#exit	Exit interface mode
Bridge6(config)#interface eth2	Enter interface mode
Bridge6(config-if)#switchport	Configure interface as a layer2 port
Bridge6(config-if)#bridge-group 1	Associates the Eth2 interface with bridge 6
Bridge6(config-if)#ethernet cfm mep down mpid 112 active true domain customer vlan 6 local-vid 6 bridge 6	Configure the interface as an MEP
Bridge6(config-if-eth-cfm-mep)#cc multicast state enable	Enable multicast continuity checking (CC) on the interface
Bridge6(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode
Bridge6(config-if)#switchport mode trunk	Set the switching abilities of this interface to trunk mode
Bridge6(config-if)#switchport trunk allowed vlan all	Allow all VLANs on this interface
Bridge6(config-if)#end	Exit interface mode

CCM Convergence Verification

Bridge 1

```
Bridge1#show ethernet cfm maintenance-points remote level 7 vlan 5 bridge 1
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
103	7	5	Yes	5254.0059.424f	False	Configured
108	7	5	Yes	5254.006b.866f	False	Configured

Bridge 2

```
Bridge2#show ethernet cfm maintenance-points remote level 7 vlan 5 bridge 2
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
101	7	5	Yes	5254.00dd.c9e6	False	Configured
106	7	5	Yes	5254.00cc.bf79	False	Configured

Bridge 3

```
Bridge3#show ethernet cfm maintenance-points remote level 7 vlan 6 bridge 3
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
111	7	6	Yes	5254.009d.93ae	False	Configured

```
Bridge3#show ethernet cfm maintenance-points remote level 7 vlan 5 bridge 1
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
104	7	5	Yes	5254.0053.71fc	False	Configured
107	7	5	Yes	5254.000f.258f	False	Configured

Bridge 4

```
Bridge4#show ethernet cfm maintenance-points remote level 7 vlan 5 bridge 4
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
102	7	5	Yes	5254.005e.7609	False	Configured
105	7	5	Yes	5254.0014.d97d	False	Configured

```
Bridge4#show ethernet cfm maintenance-points remote level 7 vlan 6 bridge 1
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
109	7	6	Yes	5254.0090.8b1a	False	Configured

Bridge 5

```
Bridge5#show ethernet cfm maintenance-points remote level 7 vlan 6 bridge 5
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
113	7	6	Yes	5254.0013.9c53	False	Configured
112	7	6	Yes	5254.0085.25e1	False	Configured

Bridge 6

```
Bridge6#show ethernet cfm maintenance-points remote level 7 vlan 6 bridge 6
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
110	7	6	Yes	5254.0000.eb38	False	Configured
114	7	6	Yes	5254.0025.5930	False	Configured

Configuration without a Virtual Channel

Bridge 1

Bridge1#configure terminal	Enter configure mode
Bridge1(config)#g8032 profile profile1 bridge 1	Create a profile and enter G.8032 profile configure mode
Bridge1(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge1(config)#bridge 1 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge1(config)#g8032 profile profile1 bridge 1	Create a profile and enter G.8032 profile configure mode
Bridge1(g8032-profile-config)#timer wait 1	Configure wait-to-restore timer
Bridge1(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge1(config)#g8032 erp-instance ERP_INST_1 bridge 1	Create ERP instance on bridge 1 and enter G.8032 configure switch mode
Bridge1(g8032-config- switch)#physical-ring R1	Associate physical ring to ERP instance
Bridge1(g8032-config-switch)#vlan 5 raps-channel	Associate VLAN 5 with the R-APS channel
Bridge1(g8032-config-switch)#ring-id 101	Configure the ring identifier
Bridge1(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge1(g8032-config-switch)#rpl role owner east-interface	Configure RPL role as neighbor
Bridge1(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge1(g8032-config-switch)#exit	Exit G.8032 profile configure mode

Bridge 2

Bridge2#configure terminal	Enter configure mode
Bridge2(config)#g8032 profile profile1 bridge 2	Create a profile and enter G.8032 profile configure mode
Bridge2(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge2(config)#bridge 2 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge2(config)#g8032 profile profile1 bridge 2	Create a profile and enter G.8032 profile configure mode
Bridge2(g8032-profile-config)#timer wait 1	Configure wait-to-restore timer
Bridge2(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge2(config)#g8032 erp-instance ERP_INST_1 bridge 2	Create ERP instance on bridge 2 and enter G.8032 configure

Bridge2(g8032-config-switch)#physical-ring R1	Associate physical ring to ERP instance
Bridge2(g8032-config-switch)#vlan 5 raps-channel	Associate VLAN 5 with the R-APS channel
Bridge2(g8032-config-switch)#ring-id 101	Configure the ring identifier
Bridge2(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge2(g8032-config-switch)#rpl role neigh east-interface	Configure RPL role as neighbor
Bridge2(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge2(g8032-config-switch)#exit	Exit interface mode

Bridge 3

Bridge3#configure terminal	Enter configure mode
Bridge3(config)#g8032 profile profile1 bridge 3	Create a profile and enter G.8032 profile configure mode
Bridge3(g8032-profile-config)#timer wait 1	Set wait-to-restore timer
Bridge3(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge3(config)#bridge 3 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge3(config)#g8032 profile profile1 bridge 3	Create a profile and enter G.8032 profile configure mode
Bridge3(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge3(config)#g8032 erp-instance ERP_INST_1 bridge 3	Create ERP instance on bridge 3 and enter G.8032 configure switch mode
Bridge3(g8032-config-switch)#physical-ring R1	Associate physical ring to ERP instance
Bridge3(g8032-config-switch)#vlan 5 raps-channel	Associate VLAN 5 with the R-APS channel
Bridge3(g8032-config-switch)#ring-id 101	Configure the ring identifier
Bridge3(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge3(g8032-config-switch)#rpl role non-owner	Configure the Ring Protection Link node as Owner and specify the RPL owner
Bridge3(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge3(g8032-config-switch)#exit	Exit G.8032 configure switch mode
Bridge3(config)#bridge 3 g8032 physical-ring R2 east-interface eth1 west-interface eth3	Configure physical ring, specifying the east and west interfaces
Bridge3(config)#g8032 erp-instance ERP_INST_2 bridge 3	Create a profile and enter G.8032 profile configure mode
Bridge3(g8032-config-switch)#physical-ring R2	Associate physical ring to ERP instance

Bridge3 (g8032-config-switch)#ring-id 102	Configure the ring identifier
Bridge3 (g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge3 (g8032-config-switch)#rpl role non-owner	Configure RPL role as non-owner
Bridge3 (g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge3 (g8032-config-switch)#sub-ring block east-interface	Associate profile to ERP instance
Bridge3 (g8032-config-switch)#vlan 6 raps-channel	Associate VLAN 6 with the R-APS channel
Bridge3 (g8032-config-switch)#non-virtual-channel	
Bridge3 (g8032-config-switch)#end	Exit G.8032 configure switch mode

Bridge 4

Bridge4#configure terminal	Enter configure mode
Bridge4 (config)#g8032 profile profile1 bridge 4	Create a profile and enter G.8032 profile configure mode
Bridge4 (g8032-profile-config)#timer wait 1	Set wait-to-restore timer
Bridge4 (g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge4 (config)#bridge 4 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge4 (config)#g8032 profile profile1 bridge 4	Create a profile and enter G.8032 profile configure mode
Bridge4 (g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge4 (config)#g8032 erp-instance ERP_INST_1 bridge 4	Create ERP instance on bridge 4 and enter G.8032 configure switch mode
Bridge4 (g8032-config-switch)#physical-ring R1	Associate physical ring to ERP instance
Bridge4 (g8032-config-switch)#vlan 5 raps-channel	Associate VLAN 5 with the R-APS channel
Bridge4 (g8032-config-switch)#ring-id 101	Configure the ring identifier
Bridge4 (g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge4 (g8032-config-switch)#rpl role non-owner	Configure the Ring Protection Link node as Owner and specify the RPL owner
Bridge4 (g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge4 (g8032-config-switch)#exit	Exit G.8032 configure switch mode
Bridge4 (config)#bridge 4 g8032 physical-ring R2 east-interface eth1 west-interface eth3	Configure physical ring, specifying the east and west interfaces
Bridge4 (config)#g8032 erp-instance ERP_INST_2 bridge 4	Create ERP instance on bridge 4 and enter G.8032 configure switch mode

Bridge4(g8032-config-switch)#physical-ring R2	Associate physical ring to ERP instance
Bridge4(g8032-config-switch)#ring-id 102	Configure the ring identifier
Bridge4(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge4(g8032-config-switch)#rpl role non-owner	Configure RPL role as non-owner
Bridge4(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge4(g8032-config-switch)#sub-ring block east-interface	Associate profile to ERP instance
Bridge4(g8032-config-switch)#non-virtual-channel	
Bridge4(g8032-config-switch)#vlan 6 raps-channel	Associate VLAN 5 with the R-APS channel
Bridge4(g8032-config-switch)#end	Exit G.8032 configure switch mode

Bridge 5

Bridge5#configure terminal	Enter configure mode
Bridge5(config)#g8032 profile profile1 bridge 5	Create a profile and enter G.8032 profile configure mode
Bridge5(g8032-profile-config)#timer wait 1	
Bridge5(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge5(config)#bridge 5 g8032 physical-ring R1 east-interface eth1 west-interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge5(config)#g8032 profile profile1 bridge 5	Create a profile and enter G.8032 profile configure mode
Bridge5(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge5(config)#g8032 erp-instance ERP_INST_1 bridge 5	Create ERP instance on bridge 5 and enter G.8032 configure switch mode
Bridge5(g8032-config-switch)#physical-ring R1	Associate physical ring to ERP instance
Bridge5(g8032-config-switch)#vlan 6 raps-channel	Associate VLAN 6 with the R-APS channel
Bridge5(g8032-config-switch)#ring-id 102	Configure the ring identifier
Bridge5(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge5(g8032-config-switch)#rpl role owner west-interface	Configure the Ring Protection Link node as Owner and specify the RPL owner
Bridge5(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge5(g8032-config-switch)#non-virtual-channel	
Bridge5(g8032-config-switch)#end	Exit G.8032 configure switch mode

Bridge 6

Bridge6#configure terminal	Enter configure mode
Bridge6(config)#g8032 profile profile1 bridge 6	Create a profile and enter G.8032 profile configure mode
Bridge6(g8032-profile-config)#timer wait 1	
Bridge6(g8032-profile-config)#exit	Exit G.8032 profile configure mode
Bridge6(config)#bridge 6 g8032 physical- ring R1 east-interface eth1 west- interface eth2	Configure physical ring, specifying the east and west interfaces
Bridge6(config)#g8032 erp-instance ERP_INST_1 bridge 6	Create ERP instance on bridge 6 and enter G.8032 configure switch mode
Bridge6(g8032-config-switch)#physical- ring R1	Associate physical ring to ERP instance
Bridge6(g8032-config-switch)#vlan 6 raps- channel	Associate VLAN 6 with the R-APS channel
Bridge6(g8032-config-switch)#ring-id 102	Configure the ring identifier
Bridge6(g8032-config-switch)#profile name profile1	Associate profile to ERP instance
Bridge6(g8032-config-switch)#rpl role neigh west-interface	Configure RPL role as neighbor
Bridge6(g8032-config-switch)#level 7	Configure the level to carry in R-APS messages
Bridge6(g8032-config-switch)#non- virtual-channel	
Bridge6(g8032-config-switch)#end	Exit G.8032 configure switch mode

CHAPTER 17 Dual-Ended LMM Configurations

This chapter contains a complete sample Dual-ended LMM (Loss Measurement Message) configurations.

Dual-ended ETH-LM (Ethernet Loss Measurement) provides proactive OAM for performance monitoring and for fault management. By default, in a point-to-point Maintenance Entity (ME), each Maintenance Endpoint (MEP) sends periodic, dual-ended frames with ETH-LM information to its peer MEP to help facilitate frame loss measurements at the peer MEP. Each MEP terminates the dual-ended frames with the ETH-LM information and makes both a near-end and far-end loss measurements. The CCM (Continuity Check Message) frame that carries the ETH-LM information will continue to do so until the ETH-LM is disabled for the MEP. When configured for proactive loss measurement, a MEP periodically transmits CCM frames with the following information elements:

- TxFCf: Value of the local counter TxFCI at the time of transmission of the CCM frame.
- RxFCb: Value of the local counter RxFCI at the time of reception of the last CCM frame from the peer MEP.
- TxFCb: Value of TxFCf in the last received CCM frame from the peer MEP

Figure 17-1 displays a sample Dual-ended LMM (Loss Measurement Message) topology.

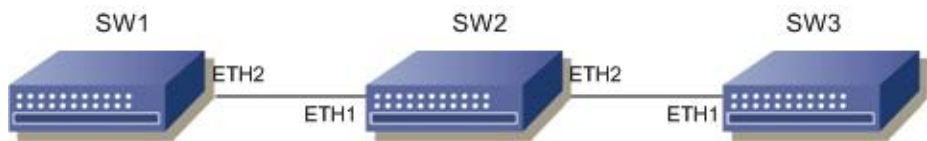


Figure 17-1: Simple Connectivity Fault Management Topology

SW1

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol mstp	Configure MSTP bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure VLAN 2 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a layer-2 interface.
(config-if)#bridge-group 1	Associate Eth2 with bridge-group 1.
(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
(config-if)#switchport trunk allowed vlan all	Configure the interface to allow all the VLANs.
(config-if)#no shutdown	Administratively shut down the interface.
(config-if)#exit	Exit interface mode
(config)#ethernet cfm domain-name type character-string name test level 5 mip-creation default bridge 1	Enter CFM mode and create domain test at level 5 on bridge 1.
(config-ether-cfm)#service ma-type string ma- name abc vlan 2 mip-creation default	Configure MA abc on VLAN 2.
(config-ether-cfm)#exit	Exit CFM mode.

Dual-Ended LMM Configurations

(config)#interface eth2	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 10 active true domain test vlan 2 local-vid 2 bridge 1	Enter CFM MEP mode and configure down MEP 10 on VLAN 2.
(config)#ethernet cfm domain-name type character-string name test level 5 mip-creation default bridge 1	Enter CFM mode.
(config-ether-cfm)#mep crosscheck mpid 20 vlan 2 mac 0002.b328.5260	Configure the MEP crosscheck using the Remote MAC address of SW3-Eth1.
(config-ether-cfm)#exit	Exit CFM mode.
(config)#interface eth2	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 10 active true domain test vlan 2 local-vid 2 bridge 1	Enter CFM MEP mode and configure down MEP 10 on VLAN 2.
(config-if-eth-cfm-mep)#cc unicast rmpid 20 state enable	Enable CCMs on RMPID 20.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
For x86 platform only (config)#ethernet cfm lmm enable mepid 10 rmepid 20 domain test vlan 2 bridge 1	Configure Ethernet LMM on MEPID 10.
(config)#ethernet cfm lmm frame count simulator start	Start the frame count measurement.

SW2

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol mstp	Configure MSTP bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure VLAN 2 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a layer-2 interface.
(config-if)#bridge-group 1	Associate Eth1 with bridge-group 1.
(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
(config-if)#switchport trunk allowed vlan all	Configure the interface to allow all the VLANs.
(config-if)#no shutdown	Administratively shut down the interface.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a layer-2 interface.
(config-if)#bridge-group 1	Associate Eth2 with bridge-group 1.
(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
(config-if)#switchport trunk allowed vlan all	Configure the interface to allow all the VLANs.
(config-if)#ethernet cfm configure default-md-level level 5 mip-creation default bridge 1	Configure default MD with level 5.

SW3

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol mstp	Configure MSTP bridge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure VLAN 2 on bridge 1.
(config-vlan)#exit	Exit VLAN configure mode
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a layer-2 interface.
(config-if)#bridge-group 1	Associate Eth2 with bridge-group 1.
(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
(config-if)#switchport trunk allowed vlan all	Configure the interface to allow all the VLANs.
(config-if)#no shutdown	Administratively shut down the interface.
(config)#ethernet cfm domain-name type character-string name test level 5 mip-creation default bridge 1	Enter CFM mode and create domain test at level 5 on bridge 1.
(config-ether-cfm)#service ma-type string ma-name abc vlan 2 mip-creation default	Configure MA abc on VLAN 2.
(config)#interface eth1	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 20 active true domain test vlan 2 local-vid 2 bridge 1	Enter CFM MEP mode and configure down MEP 20 on VLAN 2.
(config)#ethernet cfm domain-name type character-string name test level 5 mip-creation default bridge 1	Enter CFM mode.
(config-ether-cfm)#mep crosscheck mpid 20 vlan 2 mac 0007.e92a5.1c4e	Configure the MEP crosscheck using the Remote MAC address of SW1-eth2.
(config-ether-cfm)#exit	Exit CFM mode.
(config)#interface eth1	Enter interface mode.
(config-if)#ethernet cfm mep down mpid 20 active true domain test vlan 2 local-vid 2 bridge 1	Enter CFM MEP mode and configure down MEP 20 on VLAN 2.
(config-if-eth-cfm-mep)#cc unicast rmpid 10 state enable	Enable CCMs on RMPID 10.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.
(config-if)#exit	Exit interface mode.
For x86 platform only (config)#ethernet cfm lmm enable mepid 20 rmpid 10 domain test vlan 2 bridge 1	Configure Ethernet LMM on MEPID 20.
(config)#ethernet cfm lmm frame count simulator start	Start the frame count measurement.

Validation

```
#show ethernet cfm maintenance-points remote domain test vlan 2 bridge 1
MPID      LEVEL      VLAN      ACTIVE      Remote Mac      RDI      FLAGS
-----
--
20         5          2         Yes         0002.b328.5260   False    Configured
#show ethernet cfm maintenance-points remote domain test vlan 2 bridge 1
MPID      LEVEL      VLAN      ACTIVE      Remote Mac      RDI      FLAGS
-----
--
10         5          2         Yes         0007.e9a5.1c4e   False    Configured
#show ethernet cfm dual-ended lmm mep 10 domain test vlan 2 bridge 1
MEPID: 10, RMEPID: 20
Start Time: 2010/04/27 13:45:54
Near-End Frame Loss: 11
Far-End Frame Loss:  11
Current Time: 2010/04/27 14:14:47
Current Near-End Frame Loss: 0
Current Far-End Frame Loss:  0
#show ethernet cfm dual-ended lmm mep 20 domain test vlan 2 bridge 1
MEPID: 20, RMEPID: 10
Start Time: 2010/04/28 05:48:07
Near-End Frame Loss: 11
Far-End Frame Loss:  11
Current Time: 2010/04/28 06:16:55
Current Near-End Frame Loss: 0
Current Far-End Frame Loss:  0
```

CHAPTER 18 CFM Support on PEB Configuration

This chapter contains a complete sample configuration for Connectivity Fault Management (CFM) support on a Provider Edge Bridge (PEB) network.

Connectivity Fault Management provides a path for end-to-end service instance monitoring across Provider Bridging Network. It includes a mechanism for CFM frames to flow across PB network in compliance with IEEE 802.1ag 2007 Section 22.6, and MEF 17 and MEF20.

Topology

Figure 18-1 displays a simple CFM topology.

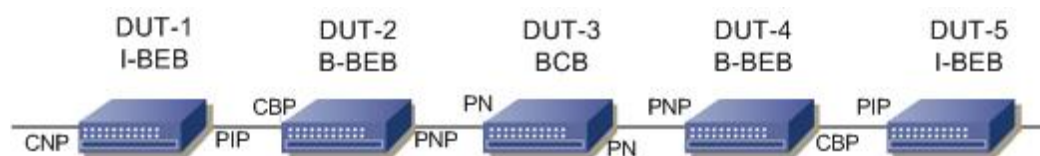


Figure 18-1: Simple Connectivity Fault Management (CFM) Topology

CE1

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Configure bridge 1 as RSTP VLAN aware.
(config)#vlan database	Enter vlan configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure vlan 2 and associate it with bridge 1.
(config-vlan)#exit	Exit vlan configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode trunk	Configure port as trunk.
(config-if)#switchport trunk allowed vlan all	Allow all the VLANs created on interface.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm domain-name type character-string name test level 5 mip-creation default bridge 1	Enter CFM mode and create a domain at level 5 on the bridge.
(config-ether-cfm)#service ma-type string ma-name abc vlan 2 mip-creation default	Associate service ID to VLAN.
(config-ether-cfm)#mep crosscheck mpid 20 vlan 2 mac 0008.a16c.eecd	Configure crosscheck between host MEP and the remote MEP.
(config-ether-cfm)#exit	Exit CFM mode.
(config)#interface eth1	Enter interface mode.

(config-if)#ethernet cfm mep down mpid 10 active true domain test vlan 2 local-vid 2 bridge 1	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP).
(config-if-eth-cfm-mep)#cc unicast rmpid 20 state enable	Enable unicast continuity checking (CC) in the selected service instance (MA) instance with the configured domain-level.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.

PEB1

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-rstp edge	Configure bridge 1 as a provider-RSTP edge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure customer VLAN 2 and associate it with bridge 1.
(config-vlan)#vlan 3 type service multipoint- multipoint bridge 1 state enable	Configure service VLAN 3 as multipoint-to-multipoint and associate it with bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table map1 on bridge 1.
(config-cvlan-registration)#cvlan 2 svlan 3	Map CVLAN 2 to SVLAN 3.
(config-cvlan-registration)#exit	Exit configure CVLAN registration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode customer-edge hybrid	Configure port as customer-edge hybrid.
(config-if)#switchport customer-edge hybrid allowed vlan add 2 egress-tagged enable	Allow the VLAN 2 created on interface.
(config-if)#switchport customer-edge vlan registration map1	Associate map1 with the interface.
(config-if)#switchport provider-edge vlan 3 untagged-vlan 2	Configure untagged VID.
(config-if)#switchport provider-edge vlan 3 default-vlan 2	Configure default VID.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode provider-network	Configure port as a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all the VLANs created on interface.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm configure default-md- level level 5 mip-creation default bridge 1	Configure MIP on level 5 for bridge 1 and set MIP creation permissions.

PB

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-rstp	Configure bridge 1 as a provider-RSTP.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 3 type service multipoint-multipoint bridge 1 state enable	Configure service vlan 3 as multipoint-to-multipoint and associate it with bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode provider-network	Configure port as a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all the VLANs created on interface.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode provider-network	Configure port as a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all the VLANs created on interface.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm configure default-md-level level 5 mip-creation default bridge 1	Configure MIP on level 5 for bridge 1 and set MIP creation permissions.

PEB2

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-rstp edge	Configure bridge 1 as a provider-RSTP edge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure customer VLAN 2 and associate it with bridge 1.
(config-vlan)#vlan 3 type service multipoint-multipoint bridge 1 state enable	Configure service VLAN 3 as multipoint-to-multipoint and associate it with bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table map1 on bridge 1.
(config-cvlan-registration)#cvlan 2 svlan 3	Map CVLAN 2 to SVLAN 3.
(config-cvlan-registration)#exit	Exit configure CVLAN registration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a layer 2 port.

(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode customer-edge hybrid	Configure port as customer-edge hybrid.
(config-if)#switchport customer-edge hybrid allowed vlan add 2 egress-tagged enable	Allow the VLAN 2 created on interface.
(config-if)#switchport customer-edge vlan registration map1	Associate map1 with the interface.
(config-if)#switchport provider-edge vlan 3 untagged-vlan 2	Configure untagged VID.
(config-if)#switchport provider-edge vlan 3 default-vlan 2	Configure default VID.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode provider-network	Configure port as a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all the VLANs created on interface.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm configure default-md-level level 5 mip-creation default bridge 1	Configure MIP on level 5 for bridge 1 and set MIP creation permissions.

CE2

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Configure bridge 1 as RSTP VLAN aware.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure VLAN 2 and associate it with bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode trunk	Configure port as trunk.
(config-if)#switchport trunk allowed vlan all	Allow all the VLANs created on interface.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm domain-name type character-string name test level 5 mip-creation default bridge 1	Enter CFM mode and create a domain at level 5 on the bridge.
(config-ether-cfm)#service ma-type string ma-name abc vlan 2 mip-creation default	Associate service ID to VLAN.
(config-ether-cfm)#mep crosscheck mpid 10 vlan 2 mac 00d0.b7ba.db76	Configure crosscheck between host MEP and the remote MEP.
(config-ether-cfm)#exit	Exit domain configuration mode.
(config)#interface eth1	Enter interface mode.

(config-if)#ethernet cfm mep down mpid 20 active true domain test vlan 2 local-vid 2 bridge 1	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP).
(config-if-eth-cfm-mep)#cc unicast rmpid 20 state enable	Enable unicast continuity checking (CC) in the selected service instance (MA) instance with the configured domain-level.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.

Validation

```
#show ethernet cfm maintenance-points remote domain test vlan 2 bridge 1
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
20	5	2	Yes	0008.a16c.eecd	False	Configured

CE1#

```
#show ethernet cfm maintenance-points remote domain test vlan 2 bridge 1
```

MPID	LEVEL	VLAN	ACTIVE	Remote Mac	RDI	FLAGS
10	5	2	Yes	00d0.b7ba.db76	False	Configured

CE2#

CFM Convergence between two Provider Edge Bridges

Figure 18-2 displays a simple topology of CFM Convergence between two Provider Edge Bridges.



Figure 18-2: Simple Connectivity Fault Management Topology

PEB1

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-rstp edge	Configure bridge 1 as a provider-RSTP edge.
(config)#vlan database	Enter VLAN configure mode
(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure customer VLAN 2 and associate it with bridge 1.
(config-vlan)#vlan 3 type service multipoint- multipoint bridge 1 state enable	Configure service VLAN 3 as multipoint-to-multipoint and associate it with bridge 1.

(config-vlan)#exit	Exit VLAN configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table map1 on bridge 1.
(config-cvlan-registration)#cvlan 2 svlan 3	Map CVLAN 2 to SVLAN 3.
(config-cvlan-registration)#exit	Exit configure CVLAN registration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode customer-edge hybrid	Configure port as customer-edge hybrid.
(config-if)#switchport customer-edge hybrid allowed vlan add 2 egress-tagged enable	Allow the VLAN 2 created on interface.
(config-if)#switchport customer-edge vlan registration map1	Associate map1 with the interface.
(config-if)#switchport provider-edge vlan 3 untagged-vlan 2	Configure untagged VID.
(config-if)#switchport provider-edge vlan 3 default-vlan 2	Configure default VID.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode provider-network	Configure port as a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all the VLANs created on interface.
(config-if)#exit	Exit interface mode.
(config-if)#ethernet cfm domain-name type character-string name check level 4 mip-creation default bridge 1	Enter CFM mode and create a domain at level 4 on bridge 1.
(config-ether-cfm)#service ma-type string ma-name abc vlan 3 mip-creation default	Associate service ID to VLAN.
(config-ether-cfm)#mep crosscheck mpid 52 vlan 3 mac 0007.e9a5.6182	Configure crosscheck between host MEP and the remote MEP.
(config-ether-cfm)#Exit	Exit domain configuration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#ethernet cfm mep up mpid 36 active true domain check vlan 3 local-vid 3 bridge 1	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP).
(config-if-eth-cfm-mep)#cc unicast rmpid 52 state enable	Enable unicast continuity checking (cc) in the selected service instance (MA) instance with the configured domain-level.

Provider Bridge

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-rstp	Configure bridge 1 as a provider-RSTP.

(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 3 type service multipoint-multipoint bridge 1 state enable	Configure service VLAN 3 as multipoint-to-multipoint and associate it with bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode provider-network	Configure port as a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all the VLANs created on interface.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode provider-network	Configure port as a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all the VLANs created on interface.
(config-if)#exit	Exit interface mode.
(config)#ethernet cfm configure default-md-level level 4 mip-creation default bridge 1	Configure MIP on level 4 for bridge 1 and set MIP creation permissions.

PEB2

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-rstp edge	Configure bridge 1 as a provider-RSTP edge.
(config)#vlan database	Enter VLAN configure mode.
(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure customer VLAN 2 and associate it with bridge 1.
(config-vlan)#vlan 3 type service multipoint-multipoint bridge 1 state enable	Configure service VLAN 3 as multipoint-to-multipoint and associate it with bridge 1.
(config-vlan)#exit	Exit VLAN configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table map1 on bridge 1.
(config-cvlan-registration)#cvlan 2 svlan 3	Map CVLAN 2 to SVLAN 3.
(config-cvlan-registration)#exit	Exit configure CVLAN registration mode.
(config)#interface eth1	Enter interface mode.
(config-if)#switchport	Configure Eth1 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode customer-edge hybrid	Configure port as customer-edge hybrid.
(config-if)#switchport customer-edge hybrid allowed vlan add 2 egress-tagged enable	Allow the VLAN 2 created on interface.
(config-if)#switchport customer-edge vlan registration map1	Associate map1 with the interface.

(config-if)#switchport provider-edge vlan 3 untagged-vlan 2	Configure untagged VID.
(config-if)#switchport provider-edge vlan 3 default-vlan 2	Configure default VID.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode.
(config-if)#switchport	Configure Eth2 as a layer 2 port.
(config-if)#bridge-group 1	Associate bridge to interface.
(config-if)#switchport mode provider-network	Configure port as a provider-network.
(config-if)#switchport provider-network allowed vlan all	Allow all the VLANs created on interface.
(config-if)#exit	Exit interface mode.
(config-if)#ethernet cfm domain-name type character-string name check level 4 mip-creation default bridge 1	Enter CFM mode and create a domain at level 4 on bridge 1.
(config-ether-cfm)#service ma-type string ma-name abc vlan 3 mip-creation default	Associate service ID to VLAN.
(config-ether-cfm)#mep crosscheck mpid 36 vlan 3 mac 0007.e9a5.6182	Configure crosscheck between host MEP and the remote MEP.
(config-ether-cfm)#exit	Exit CFM mode.
(config)#interface eth1	Enter interface mode.
(config-if)#ethernet cfm mep up mpid 52 active true domain check vlan 3 local-vid 3 bridge 1	Enter CFM MEP mode and configure the interface as a maintenance end point (MEP).
(config-if-eth-cfm-mep)#cc unicast rmpid 36 state enable	Enable unicast continuity checking (cc) in the selected service instance (MA) instance with the configured domain-level.
(config-if-eth-cfm-mep)#exit	Exit CFM MEP mode.

Validation

```
#show ethernet cfm maintenance-points remote domain check vlan 3 bridge 1
MPID      LEVEL      VLAN      ACTIVE      Remote Mac      RDI      FLAGS
-----
--
52         4           3         Yes         0007.e9a5.617b  False    Configured
#
#show ethernet cfm maintenance-points remote domain check vlan 3 bridge 1
MPID      LEVEL      VLAN      ACTIVE      Remote Mac      RDI      FLAGS
-----
--
36         4           3         Yes         0007.e9a5.6182  False    Configured
```

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