



# **OcNOS®**

## **Open Compute Network Operating System for Data Centers Version 6.5.4**

**Layer 2 Guide**

**April 2025**

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IP Infusion Inc.  
3979 Freedom Circle  
Suite 900  
Santa Clara, California 95054  
<http://www.ipinfusion.com/>

For support, questions, or comments via E-mail, contact:  
[support@ipinfusion.com](mailto:support@ipinfusion.com)

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# Contents

<b>Preface</b>	<b>15</b>
IP Maestro Support	15
Audience	15
Conventions	15
Chapter Organization	15
Related Documentation	15
Migration Guide	16
Feature Availability	16
Support	16
Comments	16
<b>Command Line Interface</b>	<b>17</b>
Overview	17
Command Line Interface Help	17
Command Completion	18
Command Abbreviations	18
Command Line Errors	18
Command Negation	19
Syntax Conventions	19
Variable Placeholders	20
Command Description Format	21
Keyboard Operations	21
Show Command Modifiers	22
String Parameters	25
Command Modes	25
Transaction-based Command-line Interface	27
<b>Layer 2 Configuration</b>	<b>28</b>
CHAPTER 1    802.1X Configuration	29
Topology	29
Configuration	30
Validation	30
CHAPTER 2    Disabling Native VLAN Configuration	32
Topology	32
Configuration	32
Validation	33
Configuring acceptable-frame-type vlan-tagged on ingress interface	34
CHAPTER 3    Disabling Native VLAN Configuration on Trunk mode	36
Topology	36
Configuration	36
Configuring Disable-Native-VLAN on Trunk mode	38

---

CHAPTER 4	Disable Spanning Tree Configuration	40
	Disabling MSTP Configuration	40
	STP Configuration	45
	RSTP Configuration	48
CHAPTER 1	Layer 2 Control Protocols Tunneling	52
	Overview	52
	L2CP Tunneling for Provider Bridging	52
	L2CP Tunneling for VXLAN	53
CHAPTER 6	Link Aggregation Configuration	56
	Topology	56
	Dynamic LAG Configuration	56
	Static LAG Configuration	59
	Static LAG Minimum Link Configuration	61
	Static-LAG Minimum Bandwidth Configuration	63
	Dynamic-LAG Minimum Link Configuration	66
	Dynamic LAG Minimum Bandwidth Configuration	70
	LACP Minimum-Link, Minimum-Bandwidth Configurations on dynamic, static Channel-Groups with MLAG	73
	LACP Force-Up	85
	Validation	87
	LACP force-up with McLAG	90
	Validation	94
CHAPTER 7	LACP Aggregator Force-up	100
	Overview	100
	LACP Aggregator Force-up for Dynamic LAG Configuration	100
	LACP Aggregator Force-up for MLAG Configuration	102
	Implementation Examples	106
	CLI Commands	107
	Glossary	108
CHAPTER 8	Link Layer Discovery Protocol Configuration	109
	Topology	109
	LLDPv2 (Interface Mode TLV)	109
	LLDPV2 (Global Mode TLV)	116
	LLDP-MED	118
CHAPTER 9	MLAG Configuration	126
	Dynamic Configuration	126
	Static Configuration	136
	ARP ACL Configuration	146
	Disabling STP for MLAG	153
	Port-isolation for MLAG	157
CHAPTER 10	MSTP Configuration	166
	Configuration	166

---

---

CHAPTER 11	Port Security Configuration	181
	Secured MACs Learned Dynamically	181
	Secured MAC Addresses Learned Statically	184
	Static Mode	185
	Port Security using MLAG	188
CHAPTER 12	Traffic Segmentation-Protected Port	194
	Topology	194
	Isolated-Promiscuous Configuration	194
	Validation	195
	Isolated-Isolated Configuration	198
	Validation	198
CHAPTER 13	RPVST+ Configuration	202
	Topology	202
	Configuration	202
CHAPTER 14	RSTP Configuration	208
	Configuration	208
CHAPTER 15	Spanning Tree Protocol Configuration	217
	Configurations	217
CHAPTER 16	VLAN Configuration	225
	Configuring VLAN Tags	225
CHAPTER 17	Private VLAN Configuration	232
	Topology	232
	Configure PVLAN Trunk and Promiscuous Trunk Port	232
	Configure PVLAN Trunk and Promiscuous Access Port	235
CHAPTER 18	MAC Authentication Bypass	240
CHAPTER 19	Unidirectional Link Detection Configuration	243
	Overview	243
CHAPTER 20	Provider Bridging Configuration	246
	Single Provider Bridge Configuration	246
	Two Provider Bridge Configuration	249
	Layer 2 Protocol Tunneling (L2PT/L2CP Tunneling)	253
	Provider Bridging with VLAN Translation	256
	Provider Bridging QoS Configuration	268
	Provider Bridging Untagged-pep Configuration	277
CHAPTER 21	Provider Bridging Configuration (SVLAN)	282
	Customer-Network Port (CNP)	282
	STAG-based Interface	282
	Port-based Interface	282
	Topology	283
	Configuration	283
	Validation	285

---

---

CHAPTER 22	MLAG with Provider Bridging Configuration	286
	L2CP with MLAG-Provider Bridging Configuring	300
CHAPTER 23	Support IGMP Snooping for Provider Bridge	304
	Overview	304
	Prerequisites	304
	Configuration	305
	Abbreviations	313
CHAPTER 24	ErrDisable for Link-Flapping Configuration	314
	Topology	314
	Automatic Recovery	314
	Log Message	315
	Manual Recovery	315
	Errdisable at the Interface Level	317
CHAPTER 25	ErrDisable for Storm-Control Configuration	318
	Topology	318
	Automatic Recovery	318
	Log Message	319
	Manual Recovery	320
	Errdisable at the Interface Level	321
CHAPTER 26	Traffic Mirroring Configuration	326
	SPAN Overview	326
	Port Mirroring Configuration	327
	VLAN and Rule Based Mirroring	330
	RSPAN Overview	331
	VLAN and Rule Based Mirroring Configuration	333
	VLAN Mirroring Using VLAN Ranges Configuration	335
	Configuration	336
	Revised CLI Commands	353
	Abbreviations	354
	<b>Cross-Connect (XC) Configuration</b>	<b>355</b>
CHAPTER 1	Cross-Connect (XC)	356
	Topology	356
	Configuration using Topology-1	356
	Validation	358
	Configuration using Topology-2	364
	Validation	366
	Configuring Cross connect using Static lag interfaces	368
	Validation	369
CHAPTER 2	Cross-Connect (XC) Resiliency	371
CHAPTER 3	CFM over xConnect Configuration	380
	Topology	380
	Configuration	380
	Validation	385

---

CHAPTER 4	VLAN Cross-Connect (XC)	387
	Overview	387
	Topology	387
	Configuration - Single-tagged VLAN	388
	Double-tagged VLAN	391
<b>Data Center Bridging Configuration</b>		<b>395</b>
CHAPTER 1	Priority-based Flow Control Configuration	396
	Configuring a Bridge and Interface for PFC	396
	Configuring Priorities and Link Delay Allowance for PFC	396
CHAPTER 2	Data Centre Bridging Capability Exchange Configuration	398
	Configuring ETS Parameter Exchange	398
	Configuring PFC Parameter Exchange	400
CHAPTER 3	PFC with QOS Configuration	403
	Topology	403
<b>Layer 2 Command Reference</b>		<b>409</b>
CHAPTER 1	Port Based xConnect Commands	410
	backup	411
	cross-connect	412
	cross-connect switchover type revertive	413
	disable	414
	ep1 ep2	415
	link-fault-pass-through enable	416
	show cross-connect	417
CHAPTER 2	Fundamental Layer 2 Commands	419
	errdisable cause	420
	errdisable link-flap-setting	421
	errdisable storm-control	422
	errdisable timeout	423
	show errdisable details	424
	show interface errdisable status	425
	show running-config switch	426
	show tcp	428
	watch static-mac-movement	430
CHAPTER 3	Bridge Commands	431
	bridge acquire	432
	bridge address	433
	bridge ageing	434
	bridge forward-time	435
	bridge hello-time	436
	bridge mac-priority-override	437
	bridge max-age	438
	bridge max-hops	439

---

bridge priority	440
bridge shutdown	441
bridge transmit-holdcount	442
bridge-group	443
bridge-group path-cost	444
bridge-group priority	445
clear allowed-ethertype	446
clear mac address-table	447
dot1ad ethertype	449
mac ageing display	450
show allowed-ethertype	451
show bridge	452
show interface switchport	454
show mac address-table count bridge	456
show mac address-table bridge	457
show mac-address-table bridge 1 learning	459
switchport	460
switchport allowed ethertype	461
<b>CHAPTER 4 Spanning Tree Protocol Commands</b>	<b>462</b>
bridge cisco-interoperability	464
bridge instance	465
bridge instance priority	466
bridge instance vlan	467
bridge multiple-spanning-tree	468
bridge protocol ieee	469
bridge protocol mstp	470
bridge protocol rstp	471
bridge provider-rstp	472
bridge rapid-spanning-tree	473
bridge region	474
bridge revision	475
bridge spanning-tree	476
bridge spanning-tree errdisable-timeout	477
bridge spanning-tree force-version	478
bridge spanning-tree pathcost	479
bridge spanning-tree portfast	480
bridge te-msti	481
bridge te-msti vlan	482
bridge-group instance	483
bridge-group instance path-cost	484
bridge-group instance priority	485
bridge-group path-cost	486
bridge-group priority	487
bridge-group spanning-tree	488
clear spanning-tree detected protocols	489
clear spanning-tree statistics	490

---



---

customer-spanning-tree customer-edge path-cost . . . . .	491
customer-spanning-tree customer-edge priority . . . . .	492
customer-spanning-tree forward-time . . . . .	493
customer-spanning-tree hello-time . . . . .	494
customer-spanning-tree max-age . . . . .	495
customer-spanning-tree priority . . . . .	496
customer-spanning-tree provider-edge path-cost . . . . .	497
customer-spanning-tree provider-edge priority . . . . .	498
customer-spanning-tree transmit-holdcount. . . . .	499
debug mstp . . . . .	500
show debugging mstp . . . . .	502
show spanning-tree . . . . .	503
show spanning-tree mst . . . . .	507
show spanning-tree statistics . . . . .	509
snmp restart mstp. . . . .	512
spanning-tree autoedge . . . . .	513
spanning-tree edgeport . . . . .	514
spanning-tree guard. . . . .	515
spanning-tree instance restricted-role. . . . .	516
spanning-tree instance restricted-tcn . . . . .	517
spanning-tree link-type . . . . .	518
spanning-tree mst configuration. . . . .	519
spanning-tree bpdu-filter . . . . .	520
spanning-tree bpdu-guard. . . . .	521
spanning-tree restricted-domain-role . . . . .	522
spanning-tree restricted-role. . . . .	523
spanning-tree restricted-tcn . . . . .	524
spanning-tree te-msti configuration . . . . .	525
storm-control . . . . .	526
show storm-control. . . . .	529
<b>CHAPTER 5 RPVST+ Commands. . . . .</b>	<b>530</b>
bridge vlan. . . . .	531
bridge vlan priority . . . . .	532
bridge-group vlan . . . . .	533
bridge protocol rpvt+ . . . . .	534
bridge rapid-pervlan-spanning-tree . . . . .	535
show spanning-tree rpvt+ . . . . .	536
spanning-tree rpvt+ configuration . . . . .	540
spanning-tree vlan restricted-role . . . . .	541
spanning-tree vlan restricted-tcn . . . . .	542
<b>CHAPTER 6 Link Aggregation Commands . . . . .</b>	<b>543</b>
channel-group mode . . . . .	544
clear lacp . . . . .	546
debug lacp. . . . .	547
interface po . . . . .	548
interface sa . . . . .	549

---

---

lacp destination-mac	550
lacp force-up	551
lacp port-priority	552
lacp system-priority	553
lacp timeout	554
port-channel load-balance	555
port-channel min-bandwidth - dynamic LAG min-bandwidth	556
port-channel min-links - dynamic LAG min-links	557
port-channel min-bandwidth - static LAG min-bandwidth	558
port-channel min-links - static LAG min-links	559
show debugging lacp	560
show etherchannel	561
show lacp sys-id	564
show lacp-counter	565
show port etherchannel	566
show static-channel load-balance	569
snmp restart lacp	570
static-channel-group	571
<b>CHAPTER 7 Multi-Chassis Link Aggregation Commands</b>	<b>573</b>
clear mcec statistics	574
debug mcec	575
domain-address	576
domain hello timeout	577
domain priority	578
domain-system-number	579
idl-higig	580
intra-domain-peer	581
mcec domain configuration	582
mlag	583
mode	584
show mcec statistics	585
show mlag detail	587
show mlag domain	589
show mlag stp-synchronization status	592
show spanning-tree mlag operational-config	593
show spanning-tree mlag sync-detail	594
switchover type	595
<b>CHAPTER 8 VLAN and Private VLAN Commands</b>	<b>596</b>
global-bridge-vlan-check enable	598
private-vlan association	599
private-vlan community	600
private-vlan isolated	601
private-vlan primary	602
show dtag vlan	603
show vlan access-map	604
show vlan	605

---

---

show vlan brief . . . . .	607
show vlan classifier . . . . .	608
show vlan-reservation . . . . .	610
switchport access . . . . .	612
switchport hybrid . . . . .	613
switchport mode . . . . .	614
switchport mode access ingress-filter . . . . .	615
switchport mode hybrid ingress-filter . . . . .	616
switchport mode trunk ingress-filter . . . . .	617
switchport trunk allowed vlan dtag . . . . .	618
switchport mode (trunk) disable-native-vlan . . . . .	619
switchport mode hybrid acceptable-frame-type . . . . .	620
switchport trunk allowed . . . . .	621
switchport mode trunk disable-native-vlan . . . . .	623
switchport trunk native . . . . .	624
switchport mode private-vlan . . . . .	625
switchport private-vlan association-trunk . . . . .	626
switchport private-vlan host-association . . . . .	627
switchport private-vlan mapping . . . . .	628
feature vlan classifier . . . . .	629
vlan classifier activate . . . . .	630
vlan classifier group . . . . .	631
vlan classifier rule ipv4 . . . . .	632
vlan classifier rule mac . . . . .	633
vlan classifier rule proto . . . . .	634
vlan database . . . . .	636
vlan-reservation . . . . .	637
vlan VLAN_RANGE bridge . . . . .	638
vlan VLAN_RANGE type customer . . . . .	639
vlan VLAN_RANGE type service . . . . .	640
CHAPTER 9 802.1x Commands . . . . .	642
auth-mac . . . . .	643
auth-mac mode . . . . .	644
auth-mac dynamic-vlan-creation . . . . .	645
auth-mac mac-aging . . . . .	646
auth-mac system-auth-ctrl . . . . .	647
auth-port . . . . .	648
debug dot1x . . . . .	649
dot1x port-control . . . . .	650
dot1x protocol-version . . . . .	651
dot1x quiet-period . . . . .	652
dot1x reauthMax . . . . .	653
dot1x reauthentication . . . . .	654
dot1x system-auth-ctrl . . . . .	655
dot1x timeout re-authperiod . . . . .	656
dot1x timeout server-timeout . . . . .	657

---

---

dot1x timeout supp-timeout . . . . .	658
dot1x timeout tx-period . . . . .	659
ip radius source-interface . . . . .	660
key-string . . . . .	661
key-string encrypted . . . . .	662
radius-server dot1x host . . . . .	663
retransmit . . . . .	664
show debugging dot1x . . . . .	665
show dot1x . . . . .	666
timeout . . . . .	669
<b>CHAPTER 10 Link Layer Discovery Protocol Commands . . . . .</b>	<b>670</b>
lldp debug . . . . .	671
lldp (disable enable) default-agent . . . . .	672
lldp ip . . . . .	673
lldp run . . . . .	674
lldp tlv . . . . .	675
lldp tlv-select . . . . .	676
set lldp chassis-id-tlv . . . . .	678
set lldp disable . . . . .	679
set lldp enable . . . . .	680
set lldp locally-assigned . . . . .	681
set lldp management-address-tlv . . . . .	682
set lldp msg-tx-hold . . . . .	683
set lldp timer . . . . .	684
set lldp too-many-neighbors . . . . .	685
show lldp . . . . .	686
snmp restart lldp . . . . .	687
<b>CHAPTER 11 Link Layer Discovery Protocol v2 Commands . . . . .</b>	<b>688</b>
clear lldp counters . . . . .	689
lldp-agent . . . . .	690
lldp debug . . . . .	691
lldp run . . . . .	692
set lldp agt-circuit-id . . . . .	693
set lldp enable . . . . .	694
set lldp chassis-id-tlv . . . . .	695
set lldp chassis locally-assigned . . . . .	696
set lldp disable . . . . .	697
set lldp locally-assigned . . . . .	698
set lldp management-address-tlv . . . . .	699
set lldp med-devtype . . . . .	700
set lldp msg-tx-hold . . . . .	701
set lldp port-id-tlv . . . . .	702
set lldp timer . . . . .	703
set lldp too-many-neighbors . . . . .	705
lldp tlv-select . . . . .	706
lldp tlv-select med . . . . .	707

---

---

lldp tlv-select basic-mgmt . . . . .	708
lldp tlv-select ieee-8021-org-specific . . . . .	709
lldp tlv-select ieee-8023-org-specific . . . . .	710
set lldp system-description . . . . .	711
set lldp system-name . . . . .	712
set lldp tx-fast-init . . . . .	713
set lldp tx-max-credit . . . . .	714
show debugging lldp . . . . .	715
show lldp neighbors . . . . .	716
show lldp interface . . . . .	719
snmp restart lldp . . . . .	721
<b>CHAPTER 12 Port Security Commands . . . . .</b>	<b>722</b>
port-security . . . . .	723
show port-security . . . . .	724
switchport port-security . . . . .	725
switchport port-security logging . . . . .	726
switchport port-security mac-address . . . . .	727
switchport port-security maximum . . . . .	729
<b>CHAPTER 13 VLAN Cross-Connect Commands . . . . .</b>	<b>730</b>
cross-connect . . . . .	731
disable . . . . .	732
outer-vlan VLAN_RANGE2 (inner-vlan VLAN_RANGE2  ) . . . . .	734
show cross-connect . . . . .	735
<b>CHAPTER 14 Unidirectional Link Detection Commands . . . . .</b>	<b>736</b>
udld . . . . .	737
udld message-time . . . . .	738
udld mode . . . . .	739
udld state . . . . .	740
show udld . . . . .	741
show udld interface . . . . .	742
<b>CHAPTER 15 Layer 2 Control Protocols Tunneling Commands . . . . .</b>	<b>743</b>
clear l2protocol interface counters . . . . .	744
l2protocol . . . . .	745
l2protocol encapsulation dest-mac . . . . .	746
show l2protocol interface counters . . . . .	747
show l2protocol processing interface . . . . .	748
<b>CHAPTER 16 Provider Bridging Commands . . . . .</b>	<b>749</b>
bridge protocol provider-mstp . . . . .	750
bridge protocol provider-rstp . . . . .	751
cvlan registration table . . . . .	752
cvlan svlan . . . . .	753
dotad . . . . .	755
show cvlan registration table . . . . .	756
switchport customer-edge . . . . .	757
switchport customer-edge hybrid . . . . .	758

---

switchport customer-edge trunk . . . . .	759
switchport customer-edge vlan registration . . . . .	760
switchport customer-network allowed vlan . . . . .	761
switchport customer-network vlan . . . . .	762
switchport mode . . . . .	763
switchport mode customer-edge . . . . .	764
switchport mode customer-edge hybrid acceptable-frame-type . . . . .	765
switchport provider-network . . . . .	766
switchport provider-network isolated-vlan . . . . .	767
switchport provider-network vlan translation . . . . .	768
vlan type . . . . .	770
vlan type customer . . . . .	771
<b>CHAPTER 17 Traffic Mirroring Commands . . . . .</b>	<b>772</b>
monitor session . . . . .	773
monitor session shut . . . . .	774
source interface . . . . .	775
source vlan . . . . .	776
destination interface . . . . .	777
no shut . . . . .	778
shut . . . . .	779
filter . . . . .	780
description . . . . .	782
remote destination . . . . .	783
show monitor . . . . .	784
show monitor session . . . . .	786
show filter . . . . .	789
show monitor running configuration . . . . .	790
<b>Data Center Bridging Command Reference . . . . .</b>	<b>791</b>
<b>CHAPTER 1 Data Center Bridge Commands . . . . .</b>	<b>792</b>
data-center-bridging . . . . .	793
show data-center-bridging . . . . .	794
<b>CHAPTER 2 Priority-based Flow Control Commands . . . . .</b>	<b>797</b>
priority-flow-control accept-peer-config . . . . .	798
priority-flow-control advertise-local-config . . . . .	799
priority-flow-control enable . . . . .	800
priority-flow-control cap . . . . .	801
priority-flow-control enable priority . . . . .	802
priority-flow-control link-delay-allowance . . . . .	803
priority-flow-control mode . . . . .	804
show priority-flow-control details . . . . .	805
show priority-flow-control statistics . . . . .	807
<b>Index . . . . .</b>	<b>808</b>

# Preface

This guide describes how to configure OcNOS.

## IP Maestro Support

Monitor devices running OcNOS Release 6.3.4-70 and above using IP Maestro software.

## Audience

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

## 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, parameters, files, and directories

## Chapter Organization

The chapters in command references are organized as described in [Command Description Format](#).

The chapters in configuration guides 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

## Related Documentation

For information about installing of OcNOS, see the *Installation Guide* for your platform.

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## Migration Guide

Check the *Migration Guide* for configuration changes to make when migrating from one version of OcNOS to another.

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## Feature Availability

The features described in this document that are available depend upon the OcNOS SKU that you purchased. See the *Application Notes* for a description of the OcNOS SKUs.

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## Support

For support-related questions, contact [support@ipinfusion.com](mailto:support@ipinfusion.com).

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## Comments

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# Command Line Interface

This chapter introduces the OcNOS Command Line Interface (CLI) and how to use its features.

## Overview

You use the CLI to configure, monitor, and maintain OcNOS devices. The CLI is text-based and each command is usually associated with a specific task.

You can give the commands described in this manual locally from the console of a device running OcNOS or remotely from a terminal emulator such as `putty` or `xterm`. You can also use the commands in scripts to automate configuration tasks.

## Command Line Interface Help

You access the CLI help by entering a full or partial command string and a question mark “?”. The CLI displays the command keywords or parameters along with a short description. For example, at the CLI command prompt, type:

```
> show ?
```

The CLI displays this keyword list with short descriptions for each keyword:

```
show ?
  application-priority      Application Priority
  arp                      Internet Protocol (IP)
  bfd                      Bidirectional Forwarding Detection (BFD)
  bgp                      Border Gateway Protocol (BGP)
  bi-lsp                   Bi-directional lsp status and configuration
  bridge                   Bridge group commands
  ce-vlan                  COS Preservation for Customer Edge VLAN
  class-map                Class map entry
  cli                     Show CLI tree of current mode
  clns                    Connectionless-Mode Network Service (CLNS)
  control-adjacency        Control Adjacency status and configuration
  control-channel          Control Channel status and configuration
  cspf                    CSPF Information
  customer                Display Customer spanning-tree
  cvlan                   Display CVLAN information
  debugging               Debugging functions (see also 'undebug')
  etherchannel            LACP etherchannel
  ethernet                Layer-2
  ...
```

If you type the ? in the middle of a keyword, the CLI displays help for that keyword only.

```
> show de?
debugging  Debugging functions (see also 'undebug')
```

If you type the ? in the middle of a keyword, but the incomplete keyword matches several other keywords, OcNOS displays help for all matching keywords.

```
> show i? (CLI does not display the question mark).
interface  Interface status and configuration
ip         IP information
isis       ISIS information
```

---

## Command Completion

The CLI can complete the spelling of a command or a parameter. Begin typing the command or parameter and then press the tab key. For example, at the CLI command prompt type `sh`:

```
> sh
```

Press the tab key. The CLI displays:

```
> show
```

If the spelling of a command or parameter is ambiguous, the CLI displays the choices that match the abbreviation. Type `show i` and press the tab key. The CLI displays:

```
> show i
  interface  ip          ipv6          isis
> show i
```

The CLI displays the `interface` and `ip` keywords. Type `n` to select `interface` and press the tab key. The CLI displays:

```
> show in
> show interface
```

Type `?` and the CLI displays the list of parameters for the `show interface` command.

```
> show interface
  IFNAME  Interface name
  |       Output modifiers
>         Output redirection
<cr>
```

The CLI displays the only parameter associated with this command, the `IFNAME` parameter.

---

## Command Abbreviations

The CLI accepts abbreviations that uniquely identify a keyword in commands. For example:

```
> sh int xe0
```

is an abbreviation for:

```
> show interface xe0
```

---

## Command Line Errors

Any unknown spelling causes the CLI to display the error `Unrecognized command` in response to the `?`. The CLI displays the command again as last entered.

```
> show dd?
% Unrecognized command
> show dd
```

When you press the Enter key after typing an invalid command, the CLI displays:

```
(config)#router ospf here
                        ^
% Invalid input detected at '^' marker.
```

where the `^` points to the first character in error in the command.

If a command is incomplete, the CLI displays the following message:

```
> show
% Incomplete command.
```

Some commands are too long for the display line and can wrap mid-parameter or mid-keyword, as shown below. This does *not* cause an error and the command performs as expected:

```
area 10.10.0.18 virtual-link 10.10.0.19 authent
ication-key 57393
```

---

## Command Negation

Many commands have a `no` form that resets a feature to its default value or disables the feature. For example:

- The `ip address` command assigns an IPv4 address to an interface
- The `no ip address` command removes an IPv4 address from an interface

---

## Syntax Conventions

[Table P-2](#) describes the conventions used to represent command syntax in this reference.

**Table P-2: Syntax conventions**

Convention	Description	Example
monospaced font	Command strings entered on a command line	<code>show ip ospf</code>
lowercase	Keywords that you enter exactly as shown in the command syntax.	<code>show ip ospf</code>
UPPERCASE	See <a href="#">Variable Placeholders</a>	<code>IFNAME</code>
( )	Optional parameters, from which you must select one. Vertical bars delimit the selections. Do not enter the parentheses or vertical bars as part of the command.	<code>(A.B.C.D &lt;0-4294967295&gt;)</code>
( )	Optional parameters, from which you select one or none. Vertical bars delimit the selections. Do not enter the parentheses or vertical bars as part of the command.	<code>(A.B.C.D &lt;0-4294967295&gt; )</code>
( )	Optional parameter which you can specify or omit. Do not enter the parentheses or vertical bar as part of the command.	<code>(IFNAME )</code>
{ }	Optional parameters, from which you must select one or more. Vertical bars delimit the selections. Do not enter the braces or vertical bars as part of the command.	<code>{intra-area &lt;1-255&gt; inter-area &lt;1-255&gt; external &lt;1-255&gt;}</code>

**Table P-2: Syntax conventions (Continued)**

Convention	Description	Example
[ ]	Optional parameters, from which you select zero or more. Vertical bars delimit the selections. Do not enter the brackets or vertical bars as part of the command.	[<1-65535> AA:NN internet local-AS no-advertise no-export]
?	Nonrepeatable parameter. The parameter that follows a question mark can only appear once in a command string. Do not enter the question mark as part of the command.	?route-map WORD
.	Repeatable parameter. The parameter that follows a period can be repeated more than once. Do not enter the period as part of the command.	set as-path prepend .<1-65535>

## Variable Placeholders

Table P-3 shows the tokens used in command syntax use to represent variables for which you supply a value.

**Table P-3: Variable placeholders**

Token	Description
WORD	A contiguous text string (excluding spaces)
LINE	A text string, including spaces; no other parameters can follow this parameter
IFNAME	Interface name whose format varies depending on the platform; examples are: eth0, Ethernet0, ethernet0, xe0
A.B.C.D	IPv4 address
A.B.C.D/M	IPv4 address and mask/prefix
X:X::X:X	IPv6 address
X:X::X:X/M	IPv6 address and mask/prefix
HH:MM:SS	Time format
AA:NN	BGP community value
XX:XX:XX:XX:XX:XX	MAC address
<1-5> <1-65535> <0-2147483647> <0-4294967295>	Numeric range

---

## Command Description Format

Table P-4 explains the sections used to describe each command in this reference.

**Table P-4: Command descriptions**

Section	Description
<b>Command Name</b>	The name of the command, followed by what the command does and when should it be used
<b>Command Syntax</b>	The syntax of the command
<b>Parameters</b>	Parameters and options for the command
<b>Default</b>	The state before the command is executed
<b>Command Mode</b>	The mode in which the command runs; see <a href="#">Command Modes</a>
<b>Example</b>	An example of the command being executed

---

## Keyboard Operations

Table P-5 lists the operations you can perform from the keyboard.

**Table P-5: Keyboard operations**

Key combination	Operation
Left arrow or Ctrl+b	Moves one character to the left. When a command extends beyond a single line, you can press left arrow or Ctrl+b repeatedly to scroll toward the beginning of the line, or you can press Ctrl+a to go directly to the beginning of the line.
Right arrow or Ctrl-f	Moves one character to the right. When a command extends beyond a single line, you can press right arrow or Ctrl+f repeatedly to scroll toward the end of the line, or you can press Ctrl+e to go directly to the end of the line.
Esc, b	Moves back one word
Esc, f	Moves forward one word
Ctrl+e	Moves to end of the line
Ctrl+a	Moves to the beginning of the line
Ctrl+u	Deletes the line
Ctrl+w	Deletes from the cursor to the previous whitespace
Alt+d	Deletes the current word
Ctrl+k	Deletes from the cursor to the end of line
Ctrl+y	Pastes text previously deleted with Ctrl+k, Alt+d, Ctrl+w, or Ctrl+u at the cursor

**Table P-5: Keyboard operations (Continued)**

Key combination	Operation
Ctrl+t	Transposes the current character with the previous character
Ctrl+c	Ignores the current line and redisplay the command prompt
Ctrl+z	Ends configuration mode and returns to exec mode
Ctrl+l	Clears the screen
Up Arrow or Ctrl+p	Scroll backward through command history
Down Arrow or Ctrl+n	Scroll forward through command history

---

## Show Command Modifiers

You can use two tokens to modify the output of a `show` command. Enter a question mark to display these tokens:

```
# show users ?
  | Output modifiers
  > Output redirection
```

You can type the | (vertical bar character) to use output modifiers. For example:

```
> show rsvp | ?
begin      Begin with the line that matches
exclude    Exclude lines that match
include    Include lines that match
last       Last few lines
redirect   Redirect output
```

---

## Begin Modifier

The `begin` modifier displays the output beginning with the first line that contains the input string (everything typed after the `begin` keyword). For example:

```
# show running-config | begin xe1
...skipping
interface xe1
  ipv6 address fe80::204:75ff:fee6:5393/64
!
interface xe2
  ipv6 address fe80::20d:56ff:fe96:725a/64
!
line con 0
  login
!
end
```

You can specify a regular expression after the `begin` keyword. This example begins the output at a line with either “xe2” or “xe4”:

```
# show running-config | begin xe[3-4]
...skipping
```

```

interface xe3
 shutdown
!
interface xe4
 shutdown
!
interface svlan0.1
 no shutdown
!
route-map myroute permit 3
!
route-map mymap1 permit 10
!
route-map rmap1 permit 3
!
line con 0
 login
line vty 0 4
 login
!
end

```

---

## Include Modifier

The `include` modifier includes only those lines of output that contain the input string. In the output below, all lines containing the word “input” are included:

```

# show interface xe1 | include input
input packets 80434552, bytes 2147483647, dropped 0, multicast packets 0
input errors 0, length 0, overrun 0, CRC 0, frame 0, fifo 1, missed 0

```

You can specify a regular expression after the `include` keyword. This examples includes all lines with “input” or “output”:

```

#show interface xe0 | include (in|out)put
input packets 597058, bytes 338081476, dropped 0, multicast packets 0
input errors 0, length 0, overrun 0, CRC 0, frame 0, fifo 0, missed 0
output packets 613147, bytes 126055987, dropped 0
output errors 0, aborted 0, carrier 0, fifo 0, heartbeat 0, window 0

```

---

## Exclude Modifier

The `exclude` modifier excludes all lines of output that contain the input string. In the following output example, all lines containing the word “input” are excluded:

```

# show interface xe1 | exclude input
Interface xe1
Scope: both
Hardware is Ethernet, address is 0004.75e6.5393
index 3 metric 1 mtu 1500 <UP,BROADCAST,RUNNING,MULTICAST>
VRF Binding: Not bound
Administrative Group(s): None
DSTE Bandwidth Constraint Mode is MAM
inet6 fe80::204:75ff:fee6:5393/64
output packets 4438, bytes 394940, dropped 0
output errors 0, aborted 0, carrier 0, fifo 0, heartbeat 0, window 0
collisions 0

```

You can specify a regular expression after the `exclude` keyword. This example excludes lines with “output” or “input”:

```
# show interface xe0 | exclude (in|out)put
Interface xe0
  Scope: both
  Hardware is Ethernet   Current HW addr: 001b.2139.6c4a
  Physical:001b.2139.6c4a Logical:(not set)
  index 2 metric 1 mtu 1500 duplex-full arp ageing timeout 3000
  <UP,BROADCAST,RUNNING,MULTICAST>
  VRF Binding: Not bound
  Bandwidth 100m
  DHCP client is disabled.
  inet 10.1.2.173/24 broadcast 10.1.2.255
  VRRP Master of :   VRRP is not configured on this interface.
  inet6 fe80::21b:21ff:fe39:6c4a/64
  collisions 0
```

---

## Redirect Modifier

The `redirect` modifier writes the output into a file. The output is not displayed.

```
# show cli history | redirect /var/frame.txt
```

The output redirection token (`>`) does the same thing:

```
# show cli history >/var/frame.txt
```

---

## Last Modifier

The `last` modifier displays the output of last few number of lines (As per the user input). The last number ranges from 1 to 9999.

For example:

```
#show running-config | last 10
```



---

## String Parameters

The restrictions in [Table P-6](#) apply for all string parameters used in OcNOS commands, unless some other restrictions are noted for a particular command.

**Table P-6: String parameter restrictions**

Restriction	Description
Input length	1965 characters or less
Restricted special characters	"?", ",", ">", " ", and "=" The " " is allowed only for <code>description</code> CLI in interface mode.

---

## Command Modes

Commands are grouped into modes arranged in a hierarchy. Each mode has its own set of commands. [Table P-7](#) lists the command modes common to all protocols.

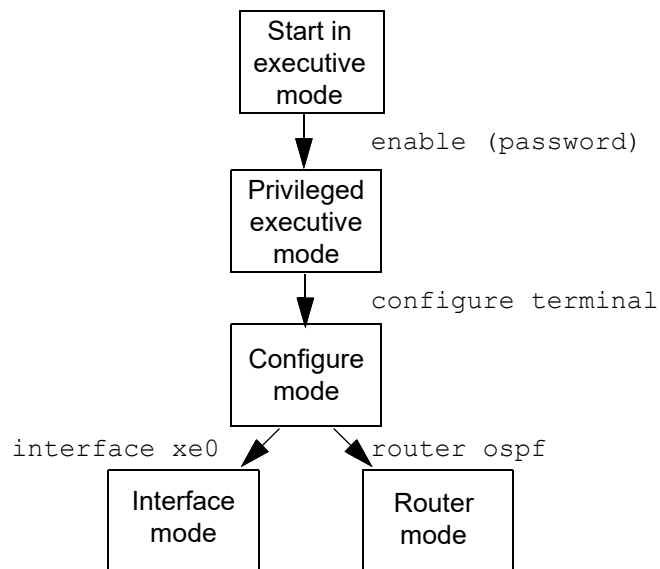
**Table P-7: Common command modes**

Name	Description
Executive mode	Also called <i>view</i> mode, this is the first mode to appear after you start the CLI. It is a base mode from where you can perform basic commands such as <code>show</code> , <code>exit</code> , <code>quit</code> , <code>help</code> , and <code>enable</code> .
Privileged executive mode	Also called <i>enable</i> mode, in this mode you can run additional basic commands such as <code>debug</code> , <code>write</code> , and <code>show</code> .
Configure mode	Also called <i>configure terminal</i> mode, in this mode you can run configuration commands and go into other modes such as interface, router, route map, key chain, and address family.  Configure mode is single user. Only one user at a time can be in configure mode.
Interface mode	In this mode you can configure protocol-specific settings for a particular interface. Any setting you configure in this mode overrides a setting configured in router mode.
Router mode	This mode is used to configure router-specific settings for a protocol such as BGP or OSPF.

---

## Command Mode Tree

The diagram below shows the common command mode hierarchy.



**Figure P-1: Common command modes**

To change modes:

1. Enter privileged executive mode by entering `enable` in Executive mode.
2. Enter configure mode by entering `configure terminal` in Privileged Executive mode.

The example below shows moving from executive mode to privileged executive mode to configure mode and finally to router mode:

```
> enable mypassword
# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
(config)# router ospf
(config-router)#
```

**Note:** Each protocol can have modes in addition to the common command modes. See the command reference for the respective protocol for details.

---

## Transaction-based Command-line Interface

The OcNOS command line interface is transaction based:

- Any changes done in configure mode are stored in a separate *candidate* configuration that you can view with the `show transaction current` command.
- When a configuration is complete, apply the candidate configuration to the running configuration with the `commit` command.
- If a `commit` fails, no configuration is applied as the entire transaction is considered failed. You can continue to change the candidate configuration and then retry the `commit`.
- Discard the candidate configuration with the `abort transaction` command.
- Check the last aborted transaction with the `show transaction last-aborted` command.
- Multiple configurations cannot be removed with a single commit. You must remove each configuration followed by a commit.

**Note:** All commands MUST be executed only in the default CML shell (`cmlsh`). If you log in as `root` and start `imish` then the system configurations will go out of sync. The `imish` shell is not supported and should not be started manually.

# Layer 2 Configuration

## CHAPTER 1 802.1X Configuration

IEEE 802.1x restricts unauthenticated devices from connecting to a switch. Only after authentication is successful, traffic is allowed through the switch.

### Topology

In this example, a radius server keeps the client information, validating the identity of the client and updating the switch about the authentication status of the client. The switch is the physical access between the two clients and the server. It requests information from the client, relays information to the server and then back to the client. To configure 802.1x authentication, enable authentication on ports eth1 and eth2 and specify the radius server IP address and port.

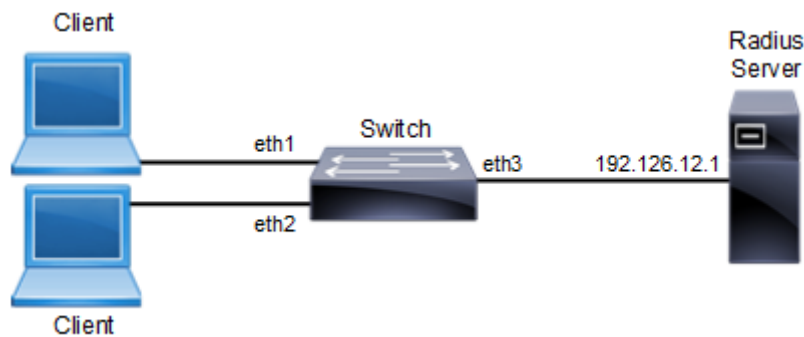


Figure 1-1: 802.1x Topology

## Configuration

### Switch

Switch#configure terminal	Enter configure mode.
Switch(config)#port-security disable	Disable the port-security.
Switch(config)#dot1x system-auth-ctrl	Enable authentication globally.
Switch(config)#interface eth2	Enter interface mode.
Switch(config-if)#switchport	Enable switch port on interface.
Switch(config-if)#dot1x port-control auto	Enable authentication (via Radius) on port (eth2).
Switch(config-if)#exit	Exit interface mode.
Switch(config)#interface eth1	Enter interface mode.
Switch(config-if)#switchport	Enable switch port on interface.
Switch(config-if)#dot1x port-control auto	Enable authentication (via Radius) on port (eth1).
Switch(config-if)#exit	Exit interface mode.
Switch(config)# radius-server dot1x keystring testing123	Specify the key with string name between radius server and client
Switch(config)#radius-server dot1x host 192.126.12.1	Specify the radius server address.
Switch(config-if)#commit	Commit the transaction.
Switch(config-if)#exit	Exit interface mode.
Switch(config)#interface eth3	Enter interface mode.
Switch(config-if)#ip address 192.126.12.2/24	Set the IP address on interface eth3.
Switch(config-if)#commit	Commit the transaction.
Switch(config-if)#exit	Exit interface mode.

## Validation

```
#show dot1x all
```

```
802.1X Port-Based Authentication Enabled RADIUS server address: 192.168.1.1:60000 Next
radius message id: 147
```

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802.1X Configuration

RADIUS client address: not configured 802.1X info for interface eth1

portEnabled: true - portControl: Auto portStatus: Unauthorized - currentId: 29 protocol  
version: 2

reAuthenticate: disabled reAuthPeriod: 3600

abort:F fail:F start:F timeout:F success:F PAE: state: Connecting - portMode: Auto PAE:  
reAuthCount: 1 - rxRespId: 0

```
PAE: quietPeriod: 60 - reauthMax: 2 - txPeriod: 30 BE: state: Idle - reqCount: 0 -
idFromServer: 0 BE: suppTimeout: 30 - serverTimeout: 30
CD: adminControlledDirections: in - operControlledDirections: in CD: bridgeDetected:
false
KR: rxKey: false
KT: keyAvailable: false - keyTxEnabled: false

802.1X info for interface eth2 portEnabled: true - portControl: Auto portStatus:
Unauthorized - currentId: 29 protocol version: 2
reAuthenticate: disabled reAuthPeriod: 3600
abort:F fail:F start:F timeout:F success:F PAE: state: Connecting - portMode: Auto PAE:
reAuthCount: 1 - rxRespId: 0
PAE: quietPeriod: 60 - reauthMax: 2 - txPeriod: 30 BE: state: Idle - reqCount: 0 -
idFromServer: 0 BE: suppTimeout: 30 - serverTimeout: 30
CD: adminControlledDirections: in - operControlledDirections: in CD: bridgeDetected:
false
KR: rxKey: false
KT: keyAvailable: false - keyTxEnabled: false
#show dot1x
802.1X Port-Based Authentication Enabled RADIUS server address: 192.168.1.1:60000 Next
radius message id: 147
RADIUS client address: not configured
```

## CHAPTER 2 Disabling Native VLAN Configuration

This chapter contains sample configurations to check the functionality to drop the untagged traffic by disabling the native vlan by configuring acceptable-frame-type vlan-tagged.

### Topology



Figure 2-2: Native VLAN Topology

### Configuration

#### SW1

SW1#configure terminal	Enter configuration mode
SW1(config)# bridge 1 protocol rstp vlan-bridge	Create bridge
SW1(config)#vlan database	Enter VLAN configuration mode
SW1(config-vlan)#vlan 2-10 bridge 1 state enable	Create 2-10 vlans
SW1(config-vlan)#exit	Exit VLAN configuration mode
SW1(config)#interface xe6	Enter interface configuration mode for xe6
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode hybrid	Configure port mode as hybrid
SW1(config-if)# switchport hybrid allowed vlan all	Allow all the vlans on the xe6 port
SW1(config-if)#exit	Exit from interface mode
SW1(config)#interface xe21	Enter interface configuration mode for xe21
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode hybrid	Configure port mode as hybrid
SW1(config-if)# switchport hybrid allowed vlan all	Allow all the vlans on the xe21 port
SW1(config-if)#exit	Exit from interface mode
SW1(config)#commit	Commit the candidate configuration to the running configuration



**SW2**

SW2#configure terminal	Enter configuration mode
SW2(config)# bridge 1 protocol rstp vlan-bridge	Create bridge
SW2(config)#vlan database	Enter VLAN configuration mode
SW2(config-vlan)#vlan 2-10 bridge 1 state enable	Create 2-10 vlans
SW2(config-vlan)#exit	Exit VLAN configuration mode
SW2(config)#interface xe6	Enter interface configuration mode for xe6
SW2(config-if)#switchport	Configure switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode hybrid	Configure port mode as hybrid
SW2(config-if)# switchport hybrid allowed vlan all	Allow all the vlans on the xe6 port
SW2(config-if)#exit	Exit from interface mode
SW2(config)#interface xe13	Enter interface configuration mode for xe13
SW2(config-if)#switchport	Configure switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode hybrid	Configure port mode as hybrid
SW2(config-if)# switchport hybrid allowed vlan all	Allow all the vlans on the xe13 port
SW2(config-if)#exit	Exit from interface mode
SW2(config)#commit	Commit the candidate configuration to the running configuration

**Validation**

Sending untagged, vlan-5 and vlan-6 traffic from ixia-1 to ixia-2. In the show bridge o/p we can see all the mac entries learnt for all the traffics.

In the show vlan brief output for default vlan interface xe21 is having port type as untagged (u).

```
SW1#show bridge
```

```
bridge 1 is running on rstp vlan-bridge
```

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1	1			xe21	0000.0000.0003	1	300
1	5			xe21	0000.0000.0005	1	300
1	6			xe21	0000.0000.0006	1	300

```
SW1#sh int counters rate mbps
```

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps

ce53	0.00	0	0.00	0
xe6	0.00	0	2960.63	246719
xe8	0.00	0	0.00	0
xe9	0.00	0	0.00	0
xe21	2960.63	246719	0.00	0

SW1#sh vlan brief

Bridge	VLAN ID	Name	State	H/W Status	Member ports (u)-Untagged, (t)-Tagged
=====	=====	=====	=====	=====	=====
1	1	default	ACTIVE	Success	xe6(u) xe21(u)
1	2	VLAN0002	ACTIVE	Success	xe6(t) xe21(t)
1	3	VLAN0003	ACTIVE	Success	xe6(t) xe21(t)
1	4	VLAN0004	ACTIVE	Success	xe6(t) xe21(t)
1	5	VLAN0005	ACTIVE	Success	xe6(t) xe21(t)
1	6	VLAN0006	ACTIVE	Success	xe6(t) xe21(t)
1	7	VLAN0007	ACTIVE	Success	xe6(t) xe21(t)
1	8	VLAN0008	ACTIVE	Success	xe6(t) xe21(t)
1	9	VLAN0009	ACTIVE	Success	xe6(t) xe21(t)
1	10	VLAN0010	ACTIVE	Success	xe6(t) xe21(t)

## Configuring acceptable-frame-type vlan-tagged on ingress interface

### SW1

SW1(config)#interface xe21	Enter interface configuration mode for xe21
SW1(config-if)# switchport mode hybrid acceptable-frame-type vlan-tagged	Configure acceptable-frame-type vlan-tagged
SW1(config-if)#exit	Exit from interface mode
SW1(config)#commit	Commit the candidate configuration to the running configuration

### Validation

After configuring acceptable-frame-type vlan-tagged, In the show bridge o/p we can see that un-tagged traffic is dropped (.0003 mac entry is not present), and traffic also getting dropped for that specific stream.

Now on show vlan brief output we can see that xe21 interface is having port type as tagged (t).

SW1#sh show bridge

bridge 1 is running on rstp vlan-bridge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
-----+	-----+	-----+	-----+	-----+	-----+	-----+	-----+
1	5			xe21	0010.9400.0003	1	300
1	6			xe21	0010.9400.0004	1	300

SW1#sh int counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
ce53	0.00	0	0.00	0
xe6	0.00	0	1971.13	164480
xe8	0.00	0	0.00	0
xe9	0.00	0	0.00	0
xe21	2960.64	246720	0.00	0

SW1#sh vlan brief

Bridge	VLAN ID	Name	State	H/W Status	Member ports (u)-Untagged, (t)-Tagged
1	1	default	ACTIVE	Success	xe6(u) xe21(t)
1	2	VLAN0002	ACTIVE	Success	xe6(t) xe21(t)
1	3	VLAN0003	ACTIVE	Success	xe6(t) xe21(t)
1	4	VLAN0004	ACTIVE	Success	xe6(t) xe21(t)
1	5	VLAN0005	ACTIVE	Success	xe6(t) xe21(t)
1	6	VLAN0006	ACTIVE	Success	xe6(t) xe21(t)
1	7	VLAN0007	ACTIVE	Success	xe6(t) xe21(t)
1	8	VLAN0008	ACTIVE	Success	xe6(t) xe21(t)
1	9	VLAN0009	ACTIVE	Success	xe6(t) xe21(t)
1	10	VLAN0010	ACTIVE	Success	xe6(t) xe21(t)

## CHAPTER 3 Disabling Native VLAN Configuration on Trunk mode

This chapter contains sample configurations to check the functionality to drop the untagged traffic by disabling the native VLAN by configuring disable-native-VLAN.

### Topology



Figure 3-3: Native VLAN Topology

### Configuration

#### SW1

SW1#configure terminal	Enter configuration mode
SW1(config)#bridge 1 protocol mstp	Create bridge
SW1(config)#vlan database	Enter VLAN configuration mode
SW1(config-vlan)#vlan 2-10 bridge 1 state enable	Create 2-10 vlans
SW1(config-vlan)#exit	Exit VLAN configuration mode
SW1(config)#interface xe21	Enter interface configuration mode for xe21
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode trunk	Configure port mode as trunk
SW1(config-if)#switchport trunk allowed vlan all	Allow all the VLANs on the xe21 port
SW1(config-if)#exit	Exit from interface mode
SW1(config)#interface xe6	Enter interface configuration mode for xe6
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode trunk	Configure port mode as trunk
SW1(config-if)#switchport trunk allowed vlan all	Allow all the VLANs on the xe6 port
SW1(config-if)#exit	Exit from interface mode
SW1(config)#commit	Commit the candidate configuration to the running configuration

**SW2**

SW2#configure terminal	Enter configuration mode
SW2(config)#bridge 1 protocol rstp vlan-bridge	Create bridge
SW2(config)#vlan database	Enter VLAN configuration mode
SW2(config-vlan)#vlan 2-10 bridge 1 state enable	Create 2-10 vlans
SW2(config-vlan)#exit	Exit VLAN configuration mode
SW2(config)#interface xe6	Enter interface configuration mode for xe6
SW2(config-if)#switchport	Configure switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode trunk	Configure port mode as trunk
SW2(config-if)#switchport trunk allowed vlan all	Allow all the VLANs on the xe6 port
SW2(config-if)#exit	Exit from interface mode
SW2(config)#interface xe13	Enter interface configuration mode for xe13
SW2(config-if)#switchport	Configure switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode trunk	Configure port mode as trunk
SW2(config-if)#switchport trunk allowed vlan all	Allow all the VLANs on the xe13 port
SW2(config-if)#exit	Exit from interface mode
SW2(config)#commit	Commit the candidate configuration to the running configuration

**Validation**

Sending untagged, VLAN-5 and VLAN-6 traffic from IXIA-1 to IXIA-2. In the show bridge output we can see all the MAC entries learnt for all the traffics.

In the show vlan brief output for default VLAN interface xe21 is having port type as untagged (u).

```
SW1#show bridge
```

```
bridge 1 is running on mstp
```

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1	1			xe21	0010.9400.0001	1	300

```
SW1#show interface counters rate mbps
```

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
xe21	621.21	606650	0.00	0
xe6	0.00	0	621.21	606651

```
SW1#show vlan brief
```

Bridge	VLAN ID	Name	State	H/W Status	Member ports (u)-Untagged, (t)-Tagged
=====	=====	=====	=====	=====	=====
1	1	default	ACTIVE	Success	xe21 (u) xe6 (u)
1	2	VLAN0002	ACTIVE	Success	xe21 (t) xe6 (t)
1	3	VLAN0003	ACTIVE	Success	xe21 (t) xe6 (t)
1	4	VLAN0004	ACTIVE	Success	xe21 (t) xe6 (t)
1	5	VLAN0005	ACTIVE	Success	xe21 (t) xe6 (t)
1	6	VLAN0006	ACTIVE	Success	xe21 (t) xe6 (t)
1	7	VLAN0007	ACTIVE	Success	xe21 (t) xe6 (t)
1	8	VLAN0008	ACTIVE	Success	xe21 (t) xe6 (t)
1	9	VLAN0009	ACTIVE	Success	xe21 (t) xe6 (t)
1	10	VLAN0010	ACTIVE	Success	xe21 (t) xe6 (t)

## Configuring Disable-Native-VLAN on Trunk mode

### SW1

SW1(config)#interface xe21	Enter interface configuration mode for xe21
SW1(config-if)#switchport mode trunk disable-native-vlan	Configure disable native VLAN on trunk mode
SW1(config-if)#exit	Exit from interface mode
SW1(config)#commit	Commit the candidate configuration to the running configuration

## Validation

After configuring disable-native-vlan, show vlan brief output we can see that xe21 interface is having port type as tagged (t).

```
SW1#show bridge
```

```
bridge 1 is running on mstp
```

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
-----+	-----+	-----+	-----+	-----+	-----+	-----+	-----+
1	1			xe21	0010.9400.0001	1	300

```
SW1SW1#show vlan brief
```

Bridge	VLAN ID	Name	State	H/W Status	Member ports (u)-Untagged, (t)-Tagged
=====	=====	=====	=====	=====	=====
1	1	default	ACTIVE	Success	xe21 (t) xe6 (u)
1	2	VLAN0002	ACTIVE	Success	xe21 (t) xe6 (t)
1	3	VLAN0003	ACTIVE	Success	xe21 (t) xe6 (t)
1	4	VLAN0004	ACTIVE	Success	xe21 (t) xe6 (t)
1	5	VLAN0005	ACTIVE	Success	xe21 (t) xe6 (t)

---

1	6	VLAN0006	ACTIVE	Success	xe21(t)	xe6(t)
1	7	VLAN0007	ACTIVE	Success	xe21(t)	xe6(t)
1	8	VLAN0008	ACTIVE	Success	xe21(t)	xe6(t)
1	9	VLAN0009	ACTIVE	Success	xe21(t)	xe6(t)
1	10	VLAN0010	ACTIVE	Success	xe21(t)	xe6(t)

SW1#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
Xe21	864.88	844613	0.00	0
Xe6	0.00	0	0.00	0

SW1#show interface counters drop-stats

Interface xe21

Rx Policy Discards: 454522965

Rx EGR Port Unavail: 454522967

## CHAPTER 4 Disable Spanning Tree Configuration

This chapter describes disabling spanning tree operation on a per Multiple Spanning Tree Instance (MSTI) basis.

### Topology

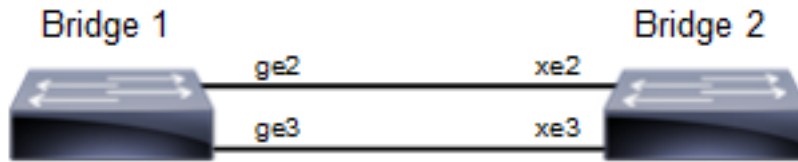


Figure 4-4: Disable Spanning Tree Topology

Note: Run the `switchport` command on each port to change to Layer-2 mode.

### Disabling MSTP Configuration

#### Bridge 1

##### Disabling MSTP per instance

<code>Bridge1(config-mst)#no bridge 1 instance 2</code>	Disable spanning tree for MSTP on instance 2
<code>Bridge1(config-mst)#no bridge 1 instance 3</code>	Disable spanning tree for MSTP on instance 3
<code>Bridge1(config-mst)#commit</code>	Commit candidate configuration to be running configuration

##### Disabling MSTP globally

<code>Bridge1(config)#no bridge 1 multiple-spanning-tree enable bridge-forward</code>	Disable spanning tree globally for MSTP and keeping the ports in forwarding state.
<code>Bridge1(config)#commit</code>	Commit candidate configuration to be running configuration

##### Disabling MSTP per port

<code>Bridge1(config)#interface ge2</code>	Enter interface mode for ge2.
<code>Bridge1(config-if)#bridge-group 1 spanning-tree disable</code>	Disable spanning tree per port for MSTP and put port on forwarding state. This command disables any type of STP on the port.
<code>Bridge1(config-if)#commit</code>	Commit candidate configuration to be running configuration

#### Bridge 2

##### Disabling MSTP per instance

<code>Bridge2(config-mst)#no bridge 1 instance 2</code>	Disable spanning tree for MSTP on instance 2
---	--



Bridge2(config-mst)#no bridge 1 instance 3	Disable spanning tree for MSTP on instance 3
Bridge2(config-mst)#commit	Commit candidate configuration to be running configuration

### Disabling MSTP globally

Bridge2(config)#no bridge 1 multiple-spanning-tree enable bridge-forward	Disable spanning tree globally for MSTP.
Bridge2(config)#commit	Commit candidate configuration to be running configuration

### Disabling MSTP per port

Bridge2(config)#interface xe2	Enter interface mode for xe2.
Bridge2(config-if)#bridge-group 1 spanning-tree disable	Disable spanning tree per port for MSTP and put port on forwarding state. This command disables any type of STP on the port.
Bridge2(config-if)#commit	Commit candidate configuration to be running configuration

## Validation

### Bridge 1

Verify MSTP details with the `show spanning-tree mst detail` command.

```
#show spanning-tree mst detail
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: CIST Root Path Cost 0 - CIST Root Port 905 - CIST Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6 -
Max-hops 20
% 1: CIST Root Id 80003417ebfbe9c4
% 1: CIST Reg Root Id 80003417ebfbe9c4
% 1: CIST Bridge Id 800064006ac779a0
% 1: 9 topology change(s) - last topology change Thu Nov 17 15:06:17 2016
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% ge2: Port Number 905 - Ifindex 5001 - Port Id 0x8389 - Role Rootport -
State Forwarding
% ge2: Designated External Path Cost 0 -Internal Path Cost 20000
% ge2: Configured Path Cost 20000 - Add type Explicit ref count 2
% ge2: Designated Port Id 0x838a - CIST Priority 128 -
% ge2: CIST Root 80003417ebfbe9c4
% ge2: Regional Root 80003417ebfbe9c4
% ge2: Designated Bridge 80003417ebfbe9c4
% ge2: Message Age 0 - Max Age 20
% ge2: CIST Hello Time 2 - Forward Delay 15
% ge2: CIST Forward Timer 0 - Msg Age Timer 4 - Hello Timer 0 - topo change
timer 0
% ge2: forward-transitions 1
% ge2: Version Multiple Spanning Tree Protocol - Received MSTP - Send MSTP
% ge2: No portfast configured - Current portfast off
% ge2: bpdu-guard default - Current bpdu-guard off
% ge2: bpdu-filter default - Current bpdu-filter off
```

```
% ge2: no root guard configured      - Current root guard off
% ge2: Configured Link Type point-to-point - Current point-to-point
% ge2: No auto-edge configured - Current port Auto Edge off
%
% ge3: Port Number 908 - Ifindex 5004 - Port Id 0x838c - Role Alternate -
State Discarding
% ge3: Designated External Path Cost 0 -Internal Path Cost 20000
% ge3: Configured Path Cost 20000 - Add type Explicit ref count 2
% ge3: Designated Port Id 0x838b - CIST Priority 128 -
% ge3: CIST Root 80003417ebfbe9c4
% ge3: Regional Root 80003417ebfbe9c4
% ge3: Designated Bridge 80003417ebfbe9c4
% ge3: Message Age 0 - Max Age 20
% ge3: CIST Hello Time 2 - Forward Delay 15
% ge3: CIST Forward Timer 0 - Msg Age Timer 5 - Hello Timer 1 - topo change
timer 0
% ge3: forward-transitions 2
% ge3: Version Multiple Spanning Tree Protocol - Received MSTP - Send MSTP
% ge3: No portfast configured - Current portfast off
% ge3: bpdu-guard default - Current bpdu-guard off
% ge3: bpdu-filter default - Current bpdu-filter off
% ge3: no root guard configured      - Current root guard off
% ge3: Configured Link Type point-to-point - Current point-to-point
% ge3: No auto-edge configured - Current port Auto Edge off

% Instance 2: Vlans: 2

% 1: MSTI Root Path Cost 20000 -MSTI Root Port 5001 - MSTI Bridge Priority
32768
% 1: MSTI Root Id 80023417ebfbe9c4
% 1: MSTI Bridge Id 800264006ac779a0
% ge2: Port Number 905 - Ifindex 5001 - Port Id 0x8389 - Role Rootport -
State Forwarding
% ge2: Designated Internal Path Cost 0 - Designated Port Id 0x838a
% ge2: Configured Internal Path Cost 20000
% ge2: Configured CST External Path cost 20000
% ge2: CST Priority 128 - MSTI Priority 128
% ge2: Designated Root 80023417ebfbe9c4
% ge2: Designated Bridge 800264006ac779a0
% ge2: Message Age 0
% ge2: Hello Time 2 - Forward Delay 15
% ge2: Forward Timer 0 - Msg Age Timer 4 - Hello Timer 0

% Instance 3: Vlans: 3

% 1: MSTI Root Path Cost 0 -MSTI Root Port 0 - MSTI Bridge Priority 32768
% 1: MSTI Root Id 800364006ac779a0
% 1: MSTI Bridge Id 800364006ac779a0
% ge3: Port Number 908 - Ifindex 5004 - Port Id 0x838c - Role Designated -
State Forwarding
% ge3: Designated Internal Path Cost 0 - Designated Port Id 0x838c
% ge3: Configured Internal Path Cost 20000
% ge3: Configured CST External Path cost 20000
% ge3: CST Priority 128 - MSTI Priority 128
% ge3: Designated Root 800364006ac779a0
% ge3: Designated Bridge 800364006ac779a0
% ge3: Message Age 0
% ge3: Hello Time 2 - Forward Delay 15
```

```
% ge3: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1
```

Verify MSTP configurations when MSTP is enabled globally.

```
#show running-config
!
bridge 1 protocol mstp
!
```

Verify MSTP configurations when MSTP is disabled globally.

```
#show running-config
!
bridge 1 protocol mstp
no bridge 1 multiple-spanning-tree enable bridge-forward
!
```

Verify MSTP configurations when MSTP instance 2 and 3 is enabled.

```
#show running-config spanning-tree
!
spanning-tree mst configuration
bridge 1 instance 2
bridge 1 instance 2 vlan 2
bridge 1 instance 3
bridge 1 instance 3 vlan 3
!
interface xe2
bridge-group 1 instance 2
!
interface xe3
bridge-group 1 instance 3
!
```

- Verify MSTP configurations when MSTP instance 2 is disabled

```
#show running-config spanning-tree
!
spanning-tree mst configuration
bridge 1 instance 3
bridge 1 instance 3 vlan 3
!
interface ge3
bridge-group 1 instance 3
!
```

Verify MSTP configurations when spanning-tree is enabled on interface.

```
#show running-config interface ge2
!
interface ge2
switchport
bridge-group 1
switchport mode access
switchport access vlan 2
bridge-group 1 instance 2
!
```

Verify MSTP configurations when spanning-tree is disabled on interface.

```
#show running-config interface ge2
!
interface ge2
switchport
```

```
bridge-group 1 spanning-tree disable
switchport mode access
switchport access vlan 2
bridge-group 1 instance 2
```

Verify MSTP details after disabling spanning-tree on interface ge2 with the show spanning-tree mst details command.

```
#show spanning-tree mst detail
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: CIST Root Path Cost 0 - CIST Root Port 908 - CIST Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6 -
Max-hops 20
% 1: CIST Root Id 80003417ebfbe9c4
% 1: CIST Reg Root Id 80003417ebfbe9c4
% 1: CIST Bridge Id 800064006ac779a0
% 1: 10 topology change(s) - last topology change Fri Nov 25 21:21:05 2016

% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% ge2: Port Number 905 - Ifindex 5001 - Port Id 0x8389 - Role Disabled -
State Forwarding
% ge2: Designated External Path Cost 0 -Internal Path Cost 20000
% ge2: Configured Path Cost 20000 - Add type Explicit ref count 2
% ge2: Designated Port Id 0x838a - CIST Priority 128 -
% ge2: Message Age 0 - Max Age 20
% ge2: CIST Hello Time 2 - Forward Delay 15
% ge2: CIST Forward Timer 0 - Msg Age Timer 4 - Hello Timer 0 - topo change
timer 0
% ge2: forward-transitions 2
% ge2: Version Multiple Spanning Tree Protocol - Received MSTP - Send MSTP
% ge2: No portfast configured - Current portfast off
% ge2: bpdu-guard default - Current bpdu-guard off
% ge2: bpdu-filter default - Current bpdu-filter off
% ge2: no root guard configured - Current root guard off
% ge2: Configured Link Type point-to-point - Current point-to-point
% ge2: No auto-edge configured - Current port Auto Edge off
% ge3: Port Number 908 - Ifindex 5004 - Port Id 0x838c - Role Rootport -
State Forwarding
% ge3: Designated External Path Cost 0 -Internal Path Cost 20000
% ge3: Configured Path Cost 20000 - Add type Explicit ref count 2
% ge3: Designated Port Id 0x838b - CIST Priority 128 -
% ge3: CIST Root 80003417ebfbe9c4
% ge3: Regional Root 80003417ebfbe9c4
% ge3: Designated Bridge 80003417ebfbe9c4
% ge3: Message Age 0 - Max Age 20
% ge3: CIST Hello Time 2 - Forward Delay 15
% ge3: CIST Forward Timer 0 - Msg Age Timer 4 - Hello Timer 1 - topo change
timer 0
% ge3: forward-transitions 3
% ge3: Version Multiple Spanning Tree Protocol - Received MSTP - Send MSTP
% ge3: No portfast configured - Current portfast off
% ge3: bpdu-guard default - Current bpdu-guard off
% ge3: bpdu-filter default - Current bpdu-filter off
% ge3: no root guard configured - Current root guard off
% ge3: Configured Link Type point-to-point - Current point-to-point
```

```
% ge3: No auto-edge configured - Current port Auto Edge off

% Instance 2: Vlans: 2

% 1: MSTI Root Path Cost 0 -MSTI Root Port 0 - MSTI Bridge Priority 32768
% 1: MSTI Root Id 800264006ac779a0
% 1: MSTI Bridge Id 800264006ac779a0
% ge2: Port Number 905 - Ifindex 5001 - Port Id 0x8389 - Role Disabled -
State Discarding
% ge2: Designated Internal Path Cost 0 - Designated Port Id 0x8389
% ge2: Configured Internal Path Cost 20000
% ge2: Configured CST External Path cost 20000
% ge2: CST Priority 128 - MSTI Priority 128
% ge2: Designated Root 800264006ac779a0
% ge2: Designated Bridge 800264006ac779a0
% ge2: Message Age 0
% ge2: Hello Time 2 - Forward Delay 15
% ge2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0

% Instance 3: Vlans: 3

% 1: MSTI Root Path Cost 20000 -MSTI Root Port 5004 - MSTI Bridge Priority
32768
% 1: MSTI Root Id 80033417ebfbe9c4
% 1: MSTI Bridge Id 800364006ac779a0
% ge3: Port Number 908 - Ifindex 5004 - Port Id 0x838c - Role Rootport -
State Forwarding
% ge3: Designated Internal Path Cost 0 - Designated Port Id 0x838b
% ge3: Configured Internal Path Cost 20000
% ge3: Configured CST External Path cost 20000
% ge3: CST Priority 128 - MSTI Priority 128
% ge3: Designated Root 80033417ebfbe9c4
% ge3: Designated Bridge 800364006ac779a0
% ge3: Message Age 0
% ge3: Hello Time 2 - Forward Delay 15
% ge3: Forward Timer 0 - Msg Age Timer 4 - Hello Timer 1
```

---

## STP Configuration

### Bridge 1

#### Disabling STP globally

Bridgel(config)#no bridge 1 spanning-tree enable bridge-forward	Disable spanning tree globally for STP.
Bridgel(config)#commit	Commit candidate configuration to be running configuration

#### Disabling STP per port

Bridgel(config)#interface ge2	Enter interface mode for ge2.
-------------------------------	-------------------------------

Bridge1(config-if)#bridge-group 1 spanning-tree disable	Disable spanning tree per port for STP and put port on forwarding state. This command disables any type of STP on the port.
Bridge1(config)#commit	Commit candidate configuration to be running configuration

## Bridge 2

### Disabling STP globally

Bridge2(config)#no bridge 1 spanning-tree enable bridge-forward	Disable spanning tree globally for STP.
Bridge2(config)#commit	Commit candidate configuration to be running configuration

### Disabling STP per port

Bridge2(config)#interface xe2	Enter interface mode for xe2.
Bridge2(config-if)#bridge-group 1 spanning-tree disable	Disable spanning tree per port for STP and put port on forwarding state. This command disables any type of STP on the port.
Bridge2(config-if)#commit	Commit candidate configuration to be running configuration

## Validation

### Bridge 1

Verify STP details when stp is enabled globally and ge2 and ge3 are part of the bridge using the `show spanning-tree` command.

```
#show spanning-tree
% 1: Bridge up - Spanning Tree Enabled - topology change
% 1: Root Path Cost 4 - Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6 -
Root port 905
% 1: Root Id 80003417ebfbe9c4
% 1: Bridge Id 800064006ac779a0
% 1: 3 topology changes - last topology change Tue Nov 15 21:33:53 2016
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec

%ge2: Port Number 905 - Ifindex 5001 - Port Id 0x8389 - path cost 4 -
designated cost 0
%ge2: Designated Port Id 0x838a - state Forwarding -Priority 128
%ge2: Designated root 80003417ebfbe9c4
%ge2: Designated Bridge 80003417ebfbe9c4
%ge2: Message Age 0 - Max Age 20
%ge2: Hello Time 2 - Forward Delay 15
%ge2: Forward Timer 0 - Msg Age Timer 18 - Hello Timer 1 - topo change timer0
%ge2: forward-transitions 1
%ge2: No portfast configured - Current portfast
%ge2: bpdu-guard default- Current bpdu-guard off
%ge2: bpdu-filter default- Current bpdu-filter off
%ge2: no root guard configured- Current root guard off
```

```
%ge3: Port Number 908 - Ifindex 5004 - Port Id 0x838c - path cost 4 -
designated cost 0
%ge3: Designated Port Id 0x838b - state Blocked -Priority 128
%ge3: Designated root 80003417ebfbe9c4
%ge3: Designated Bridge 80003417ebfbe9c4
%ge3: Message Age 0 - Max Age 20
%ge3: Hello Time 2 - Forward Delay 15
%ge3: Forward Timer 0 - Msg Age Timer 19 - Hello Timer 1 - topo change timer0
%ge3: forward-transitions 0
%ge3: No portfast configured - Currentportfast off
%ge3: bpdu-guarddefault- Current bpdu-guard off
%ge3: bpdu-filter default- Current bpdu-filter off
%ge3: no root guard configured- Current root guard off
%
```

Verify STP configurations when STP is enabled globally.

```
#show running-config
!
bridge 1 protocol ieee vlan-bridge
!
```

Verify STP configurations when STP is disabled globally.

```
#show running-config
!
bridge 1 protocol ieee vlan-bridge
no bridge 1 spanning-tree enable bridge-forward
!
```

Verify STP configurations when spanning-tree is enabled on interface.

```
#show running-config interface ge2
!
interface ge2
switchport
bridge-group 1
switchport mode trunk
switchport trunk allowed vlan all
!
```

Verify STP configurations when spanning-tree is disabled on interface.

```
#show running-config interface ge2
!
interface ge2
switchport
bridge-group 1 spanning-tree disable
switchport mode trunk
switchport trunk allowed vlan all
!
```

Verify STP details after disabling spanning-tree on interface ge2 with the show spanning-tree command.

```
#show spanning-tree
% 1: Bridge up - Spanning Tree Enabled
% 1: Root Path Cost 4 - Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6 -
Root port 908
% 1: Root Id 80003417ebfbe9c4
% 1: Bridge Id 800064006ac779a0
% 1: 5 topology changes - last topology change Fri Nov 25 21:15:35 2016
% 1: portfast bpdu-filter disabled
```

```

% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
%   ge2: Port Number 905 - Ifindex 5001 - Port Id 0x8389 - path cost 4 -
designated cost 0
%   ge2: Designated Port Id 0x838a - state Disabled -Priority 128
%   ge2: Message Age 0 - Max Age 20
%   ge2: Hello Time 2 - Forward Delay 15
%   ge2: Forward Timer 0 - Msg Age Timer 18 - Hello Timer 0 - topo change
timer 23
%   ge2: forward-transitions 2
%   ge2: No portfast configured - Current portfast off
%   ge2: bpdu-guard default - Current bpdu-guard off
%   ge2: bpdu-filter default - Current bpdu-filter off
%   ge2: no root guard configured - Current root guard off
%
%   ge3: Port Number 908 - Ifindex 5004 - Port Id 0x838c - path cost 4 -
designated cost 0
%   ge3: Designated Port Id 0x838b - state Forwarding -Priority 128
%   ge3: Designated root 80003417ebfbe9c4
%   ge3: Designated Bridge 80003417ebfbe9c4
%   ge3: Message Age 0 - Max Age 20
%   ge3: Hello Time 2 - Forward Delay 15
%   ge3: Forward Timer 0 - Msg Age Timer 19 - Hello Timer 1 - topo change
timer 23
%   ge3: forward-transitions 2
%   ge3: No portfast configured - Current portfast off
%   ge3: bpdu-guard default - Current bpdu-guard off
%   ge3: bpdu-filter default - Current bpdu-filter off
%   ge3: no root guard configured - Current root guard off

```

## RSTP Configuration

### Bridge 1

#### Disabling RSTP globally

Bridgel(config)#no bridge 1 rapid-spanning-tree enable bridge-forward	Disable spanning tree globally for RSTP.
Bridgel(config)#commit	Commit candidate configuration to be running configuration

#### Disabling RSTP per port

Bridgel(config)#interface ge2	Enter interface mode for ge2.
Bridgel(config-if)#bridge-group 1 spanning-tree disable	Disable spanning tree per port for RSTP and put port on forwarding state. This command disables any type of STP on the port.
Bridgel(config-if)#commit	Commit candidate configuration to be running configuration



## Bridge 2

### Disabling RSTP globally

Bridge2(config)#no bridge 1 rapid-spanning-tree enable bridge-forward	Disable spanning tree globally for RSTP.
Bridge2(config)#commit	Commit candidate configuration to be running configuration

### Disabling RSTP per port

Bridge2(config)#interface xe2	Enter interface mode for xe2.
Bridge2(config-if)#bridge-group 1 spanning-tree disable	Disable spanning tree per port for RSTP and put port on forwarding state. This command disables any type of STP on the port.
Bridge2(config)#commit	Commit candidate configuration to be running configuration

## Validation

### Bridge 1

Verify RSTP details when rstp is enabled globally and ge2 and ge3 are part of the bridge using the `show spanning-tree` command.

```
#show spanning-tree
% 1: Bridge up - Spanning Tree Enabled- topology change detected
% 1: Root Path Cost 20000 - Root Port 905 -Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 1: Root Id 80003417ebfbe9c4
% 1: Bridge Id 800064006ac779a0
% 1: last topology change Tue Nov 15 21:44:31 2016
% 1: 7 topology change(s)- last topology change Tue Nov 15 21:44:31 2016
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% ge2: Port Number 905 - Ifindex 5001 - Port Id 0x8389 - Role Rootport - State Forwarding
% ge2: Designated Path Cost 0
% ge2: Configured Path Cost 20000- Add type Explicit ref count 1
% ge2: Designated Port Id 0x838a - Priority 128-
% ge2: Root 80003417ebfbe9c4
% ge2: Designated Bridge 80003417ebfbe9c4
% ge2: Message Age 0 - Max Age 20
% ge2: Hello Time 2 - Forward Delay 15
% ge2: Forward Timer 0 - Msg Age Timer 4 - Hello Timer 1 - topo change timer 0
% ge2: forward-transitions 1
% ge2: Version Rapid Spanning Tree Protocol - Received RSTP - Send RSTP
% ge2: No portfast configured - Currentportfast off
% ge2: bpdu-guarddefault- Current bpdu-guard off
% ge2: bpdu-filter default- Current bpdu-filter off
% ge2: no root guard configured- Current root guard off
% ge2: Configured Link Type point-to-point - Current point-to-point
% ge2: No auto-edge configured - Current port Auto Edge off
```

```
% ge3: Port Number 908 - Ifindex 5004 - Port Id 0x838c - Role Alternate -
State Discarding
% ge3: Designated Path Cost 0
% ge3: Configured Path Cost 20000- Add type Explicit ref count 1
% ge3: Designated Port Id 0x838b - Priority 128-
% ge3: Root 80003417ebfbe9c4
% ge3: Designated Bridge 80003417ebfbe9c4
% ge3: Message Age 0 - Max Age 20
% ge3: Hello Time 2 - Forward Delay 15
% ge3: Forward Timer 0 - Msg Age Timer 5 - Hello Timer 0 - topo change timer
0
% ge3: forward-transitions 2
% ge3: Version Rapid Spanning Tree Protocol - Received RSTP - Send RSTP
% ge3: No portfast configured - Currentportfast off
% ge3: bpdu-guarddefault- Current bpdu-guard off
% ge3: bpdu-filter default- Current bpdu-filter off
% ge3: no root guard configured- Current root guard off
% ge3: Configured Link Type point-to-point - Current point-to-point
% ge3: No auto-edge configured - Current port Auto Edge off
%
```

Verify RSTP configurations when RSTP is enabled globally.

```
#show running-config
!
bridge 1 protocol rstp vlan-bridge
!
```

- Verify RSTP configurations when RSTP is disabled globally

```
#show running-config
!
bridge 1 protocol rstp vlan-bridge
no bridge 1 rapid-spanning-tree enable bridge-forward
!
```

Verify RSTP configurations when spanning-tree is enabled on interface.

```
#show running-config interface ge2
!
interface ge2
switchport
bridge-group 1
switchport mode trunk
switchport trunk allowed vlan all
!
```

Verify RSTP configurations when spanning-tree is disabled on interface.

```
#show running-config interface ge2
!
interface ge2
switchport
bridge-group 1 spanning-tree disable
switchport mode trunk
switchport trunk allowed vlan all
```

Verify RSTP details after disabling spanning-tree on interface ge2 with the show spanning-tree command.

```
#sh spanning-tree
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: Root Path Cost 20000 - Root Port 908 - Bridge Priority 32768
```

```
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 1: Root Id 80003417ebfbe9c4
% 1: Bridge Id 800064006ac779a0
% 1: last topology change Fri Nov 25 21:08:56 2016
% 1: 11 topology change(s) - last topology change Fri Nov 25 21:08:56 2016
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% ge2: Port Number 905 - Ifindex 5001 - Port Id 0x8389 - Role Disabled -
State Forwarding
% ge2: Designated Path Cost 0
% ge2: Configured Path Cost 20000 - Add type Explicit ref count 1
% ge2: Designated Port Id 0x838a - Priority 128 -
% ge2: Message Age 0 - Max Age 20
% ge2: Hello Time 2 - Forward Delay 15
% ge2: Forward Timer 0 - Msg Age Timer 5 - Hello Timer 0 - topo change timer
0
% ge2: forward-transitions 2
% ge2: Version Rapid Spanning Tree Protocol - Received RSTP - Send RSTP
% ge2: No portfast configured - Current portfast off
% ge2: bpdu-guard default - Current bpdu-guard off
% ge2: bpdu-filter default - Current bpdu-filter off
% ge2: no root guard configured - Current root guard off
% ge2: Configured Link Type point-to-point - Current point-to-point
% ge2: No auto-edge configured - Current port Auto Edge off
%
% ge3: Port Number 908 - Ifindex 5004 - Port Id 0x838c - Role Rootport -
State Forwarding
% ge3: Designated Path Cost 0
% ge3: Configured Path Cost 20000 - Add type Explicit ref count 1
% ge3: Designated Port Id 0x838b - Priority 128 -
% ge3: Root 80003417ebfbe9c4
% ge3: Designated Bridge 80003417ebfbe9c4
% ge3: Message Age 0 - Max Age 20
% ge3: Hello Time 2 - Forward Delay 15
% ge3: Forward Timer 0 - Msg Age Timer 5 - Hello Timer 1 - topo change timer
0
% ge3: forward-transitions 3
% ge3: Version Rapid Spanning Tree Protocol - Received RSTP - Send RSTP
% ge3: No portfast configured - Current portfast off
% ge3: bpdu-guard default - Current bpdu-guard off
% ge3: bpdu-filter default - Current bpdu-filter off
% ge3: no root guard configured - Current root guard off
% ge3: Configured Link Type point-to-point - Current point-to-point
% ge3: No auto-edge configured - Current port Auto Edge off
```

## Overview

The Layer 2 Control Protocols (L2CP) processing specified here is based largely on the IEEE 802.1Q specification for handling L2CP Frames, i.e. if they should be forwarded, peered, or discarded.

IEEE 802.1Q provides a mechanism for separating the Layer2 control plane into multiple customer and provider control planes. It allows a certain layer 2 control protocol to operate only within a provider network, or to allow interaction between the customer and the provider network, or to pass transparently through a provider network with complete isolation from other customer networks.

In case of non-PB case, packet is forwarded without changing any MAC.

## L2CP Tunneling for Provider Bridging

L2CP tunneling provides support for tunneling control plane frames between CE nodes.

In the context of PB, a L2CP frame is defined as any frame containing a destination MAC address as 01:00:0C:CD:CD:D0 or 01:04:DF:CD:CD:D0 (which can be changed via CLI)

When control frames received at CEP port of a PE bridge, predefined multicast address (01-00-C2-CD-CD-D0) is replaced as destination for tunneling the packets across service provider network. If control packets are customer vlan tagged or untagged, then PE bridge will append corresponding service vlan tag to the control packet as per registration table / vlan translation table mapped to the port and send it across the service provider as a data packet.

When tunneled control packet with multicast address (01-00-C2-CD-CD-D0) received on PNP port, the multicast address is replaced with corresponding control packet multicast address and cvlan/svlan removal or update is done as per registration table / vlan translation table.

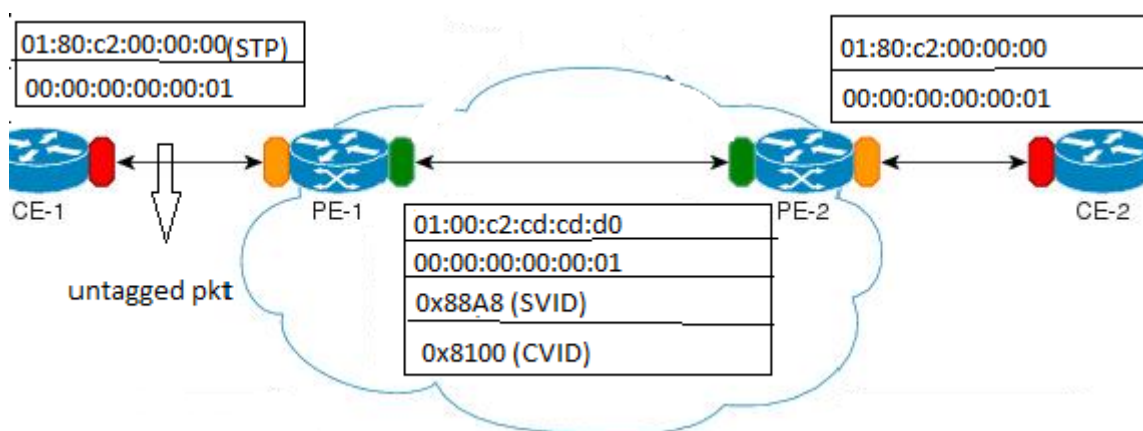
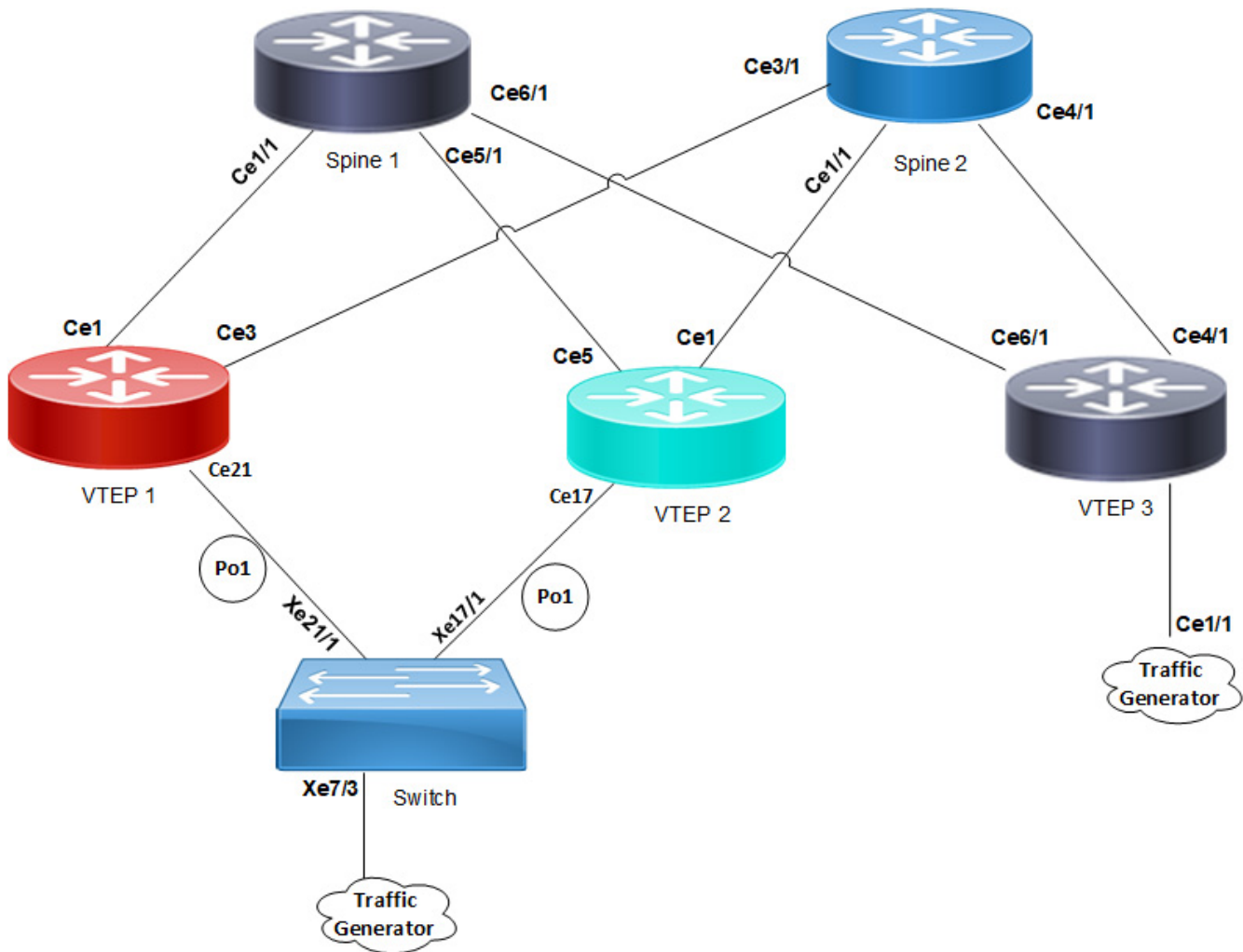


Figure 5-5: L2CP tunneling for provider bridging

## L2CP Tunneling for VXLAN

L2CP tunneling provides support for tunneling Control plane frames across VXLAN/MH.

### Topology



**Figure 5-6: L2CP tunneling for VXLAN**

VXLAN creates LAN segments using a MAC in IP encapsulation. The encapsulation carries the original L2 frame received from a host to the destination in another server using IP tunnels. The endpoints of the virtualized tunnel formed using VXLAN are called VTEPs (VXLAN Tunnel EndPoints).

L2CP tunneling provides support for tunneling control plane frames across VXLAN with MH/SH combination.

Any L2CP frame that is destined towards other end with a multicast destination MAC Address for L2 protocol is decided by looking at the frame and upon the configured values of the L2CP Service Attributes.

As and when Control packets with default destination MAC address for any L2 protocol is generated, it will be forwarded by VTEPs that are part of MH towards the VTEP that is part of SH and vice versa.

During this operation, the default destination MAC address for any L2 protocol is replaced with predefined multicast address as destination for tunneling the packets across SPINE nodes. When tunneled control packet with pre-defined multicast address received on ingress port on the other end of the VTEP, the multicast address is replaced with corresponding control packet multicast address.

## Basic Configuration for L2CP on Provider Bridging

Enabling tunneling at interface:

```
(config)#bridge 1 protocol provider-rstp edge
(config)#vlan database
(config-vlan)#vlan 2-10 bridge 1 state enable
(config-vlan)#vlan 11 type service point-point bridge 1 state enable
(config-vlan)#ex
(config)#cvlan registration table map1 bridge 1
(config-cvlan-registration)#cvlan 2 svlan 11
(config-cvlan-registration)#ex
(config)#interface xe1
(config-if)#switchport
(config-if)#bridge-group 1
(config-if)#switchport mode customer-edge hybrid
(config-if)#switchport customer-edge hybrid allowed vlan all
(config-if)#switchport customer-edge vlan registration map1
(config-if)#l2protocol stp tunnel
#show running-config interface xe1
!
interface xe1
speed 1g
switchport
bridge-group 1
switchport mode customer-edge hybrid
switchport customer-edge hybrid allowed vlan all
switchport customer-edge vlan registration map1
l2protocol stp tunnel
customer-spanning-tree provider-edge svlan 11 path-cost 128
(config-if)#commit
```

Configuring egress interfaces:

```
(config)#interface xe2
(config-if)#switchport
(config-if)#bridge-group 1
(config-if)#switchport mode provider-network
(config-if)#switchport provider-network allowed vlan all
(config-if)#commit
```

To display L2protocol information:

```
#show l2protocol processing interface xe1
```

Bridge	Interface Name	Protocol	Processing Status	Hardware Status
=====	=====	=====	=====	=====
1	xe1	stp	Tunnel	Tunnel

---

1	xe1	lACP	Peer	Peer
1	xe1	dot1x	Peer	Peer
1	xe1	lldp	Peer	Peer
1	xe1	efm	Peer	Peer
1	xe1	elmi	Peer	Peer

To display L2protocol counters:

```
#show l2protocol interface counters
```

```
Interface xe1
```

```
Tunnel          : stp                      : 45
```

## CHAPTER 6 Link Aggregation Configuration

This chapter contains a complete sample Link Aggregation Group configuration.

LACP is based on the 802.3ad IEEE specification. It allows bundling of several physical interfaces to form a single logical channel providing enhanced performance and redundancy. The aggregated interface is viewed as a single link to each switch. The spanning tree views it as one interface and not as two or three interfaces. When there is a failure in one physical interface, the other interfaces stay up and there is no disruption. Traffic can be load balanced within an LACP trunk group in a controlled manner using the hashing algorithm. The maximum number of physical Ethernet links in a single logical channel depends upon the hardware support.

Note:

- Physical interfaces will inherit the properties of LAG port once it is attached to be part of LAG, irrespective of the configuration present on the physical interface.
- In case of Dynamic and Static LAG, it is possible to move member ports from one LAG to another LAG.
- Configure LAG port as a switch or router port, before adding member ports into it.
- LAG configuration is not allowed on inactive subsidiary ports. Configuring LAG on subsidiary ports before executing port breakout commands on control ports causes issues.
- Remove any LAG configuration from subsidiary ports before issuing the `no port breakout` command.
- Switchport configuration is not allowed on inactive subsidiary ports. Applying switchport configuration on subsidiary ports before executing the port breakout command causes issues.
- Do not execute the `no port breakout` command on subsidiary ports configured with switchport.

### Topology

In [Figure 6-7](#), 3 links are configured between the two switches S1 and S2. These three links are assigned the same administrative key (1) so that they aggregate to form a single channel 1. They are viewed by the STP as one interface.

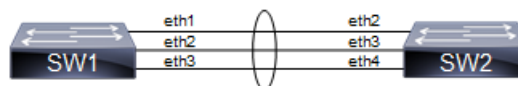


Figure 6-7: LACP Topology

### Dynamic LAG Configuration

#### SW1

SW1#configure terminal	Enter configure mode.
SW1(config)# bridge 1 protocol mstp	Configure bridge 1 as MSTP bridge
SW1(config)#vlan database	Enter vlan database mode.
SW1(config-vlan)#vlan 2-10 bridge 1 state enable	Configure a VLAN and add it to the bridge.
SW1(config-vlan)#exit	Exit vlan configuration mode.



SW1(config)#lacp system-priority 20000	Set the system priority of this switch. This priority is used for determining the system that is responsible for resolving conflicts in the choice of aggregation groups. A lower numerical value has a higher priority.
SW1(config)#interface po10	Enter into port channel interface po10.
SW1(config-if)#switchport	Configure po10 as a layer 2 port.
SW1(config-if)#bridge-group 1	Associate bridge to an interface.
SW1(config-if)#switchport mode trunk	Configure port as a trunk.
SW1(config-if)#switchport trunk allowed vlan all	Allow all the VLANs on the po10 interface.
SW1(config-if)#exit	Exit interface mode.
SW1(config)#interface eth1	Enter interface mode.
SW1(config-if)#channel-group 10 mode active	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW1(config-if)#exit	Exit interface mode.
SW1(config)#interface eth2	Enter interface mode.
SW1(config-if)#channel-group 10 mode active	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW1(config-if)#exit	Exit interface mode.
SW1(config)#interface eth3	Enter interface mode.
SW1(config-if)#channel-group 10 mode active	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW1(config-if)#commit	Commit the transaction.
SW1(config-if)#exit	Exit interface mode.

## S2

SW2#configure terminal	Enter configure mode.
SW2(config)# bridge 1 protocol mstp	Configure bridge 1 as MSTP bridge
SW2(config)#vlan database	Enter vlan database mode.
SW2(config-vlan)#vlan 2-10 bridge 1 state enable	Configure a VLAN and add it to the bridge.
SW2(config-vlan)#exit	Exit vlan configuration mode.
SW1(config)#interface po10	Enter into port channel interface sa10.
SW2(config-if)#switchport	Configure po10 as a layer 2 port.
SW2(config-if)#bridge-group 1	Associate bridge to an interface.
SW2(config-if)#switchport mode trunk	Configure port as a trunk.
SW2(config-if)#switchport trunk allowed vlan all	Allow all the VLANs on the po10 interface.
SW2(config-if)#exit	Exit interface mode.
SW2(config)#interface eth2	Enter interface mode.

SW2(config-if)#channel-group 10 mode active	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW2(config-if)#exit	Exit interface mode.
SW2(config)#interface eth3	Enter interface mode.
SW2(config-if)#channel-group 10 mode active	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW2(config-if)#exit	Exit interface mode.
SW2(config)#interface eth4	Enter interface mode.
SW2(config-if)#channel-group 10 mode active	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW2(config-if)#commit	Commit the transaction.
SW2(config-if)#exit	Exit interface mode.

## Validation

show etherchannel detail, show etherchannel summary, show running-config interface po10, show running-config interface eth1

```
#show etherchannel detail
% Aggregator po10 7
% Aggregator Type: Layer2
% Mac address: 08:00:27:50:6a:9b
% Admin Key: 0010 - Oper Key 0010
% Actor LAG ID- 0x4e20,08-00-27-ab-ea-38,0x000a
% Receive link count: 3 - Transmit link count: 3
% Individual: 0 - Ready: 1
% Partner LAG ID- 0x4e20,08-00-27-f8-3c-30,0x000a
% Link: eth1 (3) sync: 1
% Link: eth2 (4) sync: 1
% Link: eth3 (5) sync: 1
% Collector max delay: 5
```

```
#show etherchannel summary
% Aggregator po10 7
% Aggregator Type: Layer2
% Admin Key: 0010 - Oper Key 0010
% Aggregator Type: Layer2
% Link: eth1 (3) sync: 1
% Link: eth2 (4) sync: 1
% Link: eth3 (5) sync: 1
```

```
#show running-config interface po10
!
interface po10
 switchport
 bridge-group 1
 switchport mode trunk
 switchport trunk allowed vlan all
```

```
#show running-config interface eth1
```

```

!
interface eth1
 channel-group 10 mode active

```

## Static LAG Configuration

### SW1

SW1#configure terminal	Enter configure mode.
SW1(config)# bridge 1 protocol mstp	Configure bridge 1 as MSTP bridge
SW1(config)#vlan database	Enter vlan database mode.
SW1(config-vlan)#vlan 2-10 bridge 1 state enable	Configure a VLAN and add it to the bridge.
SW1(config-vlan)#exit	Exit vlan configuration mode.
SW1(config)#interface sa10	Enter into port channel interface sa10.
SW1(config-if)#switchport	Configure sa10 as a layer 2 port.
SW1(config-if)#bridge-group 1	Associate bridge to an interface.
SW1(config-if)#switchport mode trunk	Configure port as a trunk.
SW1(config-if)#switchport trunk allowed vlan all	Allow all the VLANs on the po10 interface.
SW1(config-if)#exit	Exit interface mode.
SW1(config)#interface eth1	Enter interface mode.
SW1(config-if)#static-channel-group 10	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW1(config-if)#exit	Exit interface mode.
SW1(config)#interface eth2	Enter interface mode.
SW1(config-if)#static-channel-group 10	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW1(config-if)#exit	Exit interface mode.
SW1(config)#interface eth3	Enter interface mode.
SW1(config-if)#static-channel-group 10	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW1(config-if)#commit	Commit the transaction.
SW1(config-if)#exit	Exit interface mode.

### SW2

SW2#configure terminal	Enter configure mode.
SW2(config)# bridge 1 protocol mstp	Configure bridge 1 as MSTP bridge
SW2(config)#vlan database	Enter vlan database mode.
SW2(config-vlan)#vlan 2-10 bridge 1 state enable	Configure a VLAN and add it to the bridge.

SW2(config-vlan)#exit	Exit vlan configuration mode.
SW2(config)#interface sa10	Enter into port channel interface sa10.
SW2(config-if)#switchport	Configure sa10 as a layer 2 port.
SW2(config-if)#bridge-group 1	Associate bridge to an interface.
SW2(config-if)#switchport mode trunk	Configure port as a trunk.
SW2(config-if)#switchport trunk allowed vlan all	Allow all the VLANs on the po10 interface.
SW2(config-if)#exit	Exit interface mode.
SW2(config)#interface eth2	Enter interface mode.
SW2(config-if)#static-channel-group 10	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW2(config-if)#exit	Exit interface mode.
SW2(config)#interface eth3	Enter interface mode.
SW2(config-if)#static-channel-group 10	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW2(config-if)#exit	Exit interface mode.
SW2(config)#interface eth4	Enter interface mode.
SW2(config-if)#static-channel-group 10	Add this interface to channel group 10 and enable link aggregation so that it can be selected for aggregation by the local system.
SW2(config-if)#exit	Exit interface mode.
SW1(config)#commit	Commit the transaction.

## Validation

```
#show static-channel-group
% Static Aggregator: sa10
% Member status:
  eth1    up
  eth2    up
  eth3    up

#show running-config interface sa10
!
interface sa10
  switchport
  bridge-group 1
  switchport mode trunk
  switchport trunk allowed vlan all

#show running-config interface eth1
!
interface eth1
  static-channel-group 10
```

## Static LAG Minimum Link Configuration

Configure the minimum number of ports that must be linked up and bundled in the LACP port channel. We can configure the minimum links range from 2 to 32. If the number of ports aggregated to the port channel is less than the minimum number of links configured, then the port channel enters the Protocol Down because of the minimum link state.

Note: Minimum links should be configured the same on both sides for optimal performance.

### Topology

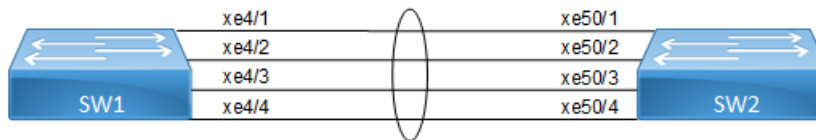


Figure 6-8: LAG Minimum Link

### SW11

#configure terminal	Enter configure mode.
(config)#interface sa10	Creating interface static-lag sa10
(config-if)#port-channel min-links 4	Configuring port channel minimum links as 4(range is 2-32)
(config-if)#commit	Commit the transaction.
(config-if)#exit	Exit the configure mode

### Validation

#### SW1

```
#show static-channel-group 10
% Static Aggregator: sa10
% Minimum-Links 4
% Member status:
    xe4/1      up
    xe4/2      up
    xe4/3      up
    xe4/4      up
```

```
#show running-config interface sa10
!
interface sa10
  switchport
  bridge-group 1
  switchport mode trunk
  switchport trunk allowed vlan all
  port-channel min-links 4
```

**SW2**

#configure terminal	Enter configure mode.
(config)#interface sa10	Creating interface port-channel sa10
(config-if)#port-channel min-links 4	Configuring port channel minimum links as 4 (range is 2-32)
(config-if)#commit	Commit the transaction.
(config-if)#exit	Exit the configure mode

**Validation****SW2**

```
#show running-config interface sa10
!
interface sa10
  switchport
  bridge-group 1
  switchport mode trunk
  switchport trunk allowed vlan all
  port-channel min-links 4
!
```

```
#show static-channel-group 10
% Static Aggregator: sa10
% Minimum-Links 4
% Member status:
    Xe50/1      up
    Xe50/2      up
    Xe50/3      up
    Xe50/4      up
```

Note: When a sa goes down due to the minimum links configured (number of minimum links is greater than the links aggregated to the sa).

SW1:

=====

```
#OcNOS#sh int brief sa10
```

```
Codes: ETH - Ethernet, LB - Loopback, AGG - Aggregate, MLAG - MLAG Aggregate
       FR - Frame Relay, TUN - Tunnel, PBB - PBB Logical Port, VP - Virtual
Port
       CVP - Channelised Virtual Port, METH - Management Ethernet, UNK-
Unknown
       ED - ErrDisabled, PD - Protocol Down, AD - Admin Down,
IA - InActive
       PD(Min L/B) - Protocol Down Min-Links/Bandwidth
       DV - DDM Violation, NA - Not Applicable
       NOM - No operational members, PVID - Port Vlan-id
       Ctl - Control Port (Br-Breakout/Bu-Bundle)
       HD - ESI Hold Timer Down
```

```
-----
--
```

```

Port-channel  Type  PVID  Mode                Status  Reason  Speed
Interface
-----

```

```

sa10          AGG    1      trunk              down    PD (Min L/B)  0
OcNOS#

```

```

SW2:
=====

```

```

OcNOS#show int brief sa10

```

```

Codes: ETH - Ethernet, LB - Loopback, AGG - Aggregate, MLAG - MLAG Aggregate
       FR - Frame Relay, TUN -Tunnel, PBB - PBB Logical Port, VP - Virtual
Port
       CVP - Channelised Virtual Port, METH - Management Ethernet, UNK-
Unknown
       ED - ErrDisabled, PD - Protocol Down, AD - Admin Down,
       IA - InActive
       PD (Min L/B) - Protocol Down Min-Links/Bandwidth
       DV - DDM Violation, NA - Not Applicable
       NOM - No operational members, PVID - Port Vlan-id
       Ctl - Control Port (Br-Breakout/Bu-Bundle)
       HD - ESI Hold Timer Down

```

```

-----
--
Port-channel  Type  PVID  Mode                Status  Reason  Speed
Interface
-----
sa10          AGG    1      trunk              down    PD (Min L/B)  0
OcNOS#

```

## Static-LAG Minimum Bandwidth Configuration

Configure the minimum bandwidth allowed for ports that must be linked up and bundled in the LACP port channel. We can configure the minimum bandwidth range from `BANDWIDTH <1-999>k|m` for 1 to 999 kilo bits or mega bits `<1-1000>g` for 1 to 1000 giga bits. If the Total bandwidth of ports aggregated to the port channel is less than the minimum Bandwidth value configured, then the port channel enters the Protocol Down because of the minimum Bandwidth state.

Note: Minimum Bandwidth should be configured the same on both sides for optimal performance.

## Topology

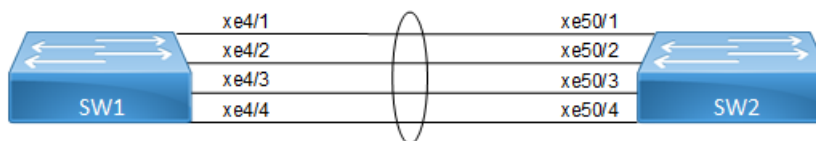


Figure 6-9: LAG Minimum Bandwidth

**SW1**

#configure terminal	Enter configure mode.
(config)#interface sa10	Creating interface static-lag sa10
(config-if)#port-channel min-bandwidth 40g	Configuring port channel minimum bandwidth as 40g (range from BANDWIDTH <1-999>k m for 1 to 999 kilo bits or mega bits <1-1000>g for 1 to 1000 giga bits.)
(config-if)#commit	Commit the transaction.
(config-if)#exit	Exit the configure mode

**Validation****SW1**

```
#show static-channel-group 10
% Static Aggregator: sa10
% Minimum- 4
% Member status:
    xe4/1      up
    xe4/2      up
    xe4/3      up
    xe4/4      up
```

```
#show running-config interface sa10
!
interface sa10
  switchport
  bridge-group 1
  switchport mode trunk
  switchport trunk allowed vlan all
  port-channel load-balance src-dst-mac
  port-channel min-links 40g
```

**SW2**

#configure terminal	Enter configure mode.
(config)#interface sa10	Creating interface port-channel sa10
(config-if)#port-channel min-bandwidth 40g	Configuring port channel minimum bandwidth as 40g (range from BANDWIDTH <1-999>k m for 1 to 999 kilo bits or mega bits <1-1000>g for 1 to 1000 giga bits.)
(config-if)#commit	Commit the transaction.
(config-if)#exit	Exit the configure mode



## Validation

### SW2

```
#show running-config interface sa10
!
interface sa10
  switchport
  bridge-group 1
  switchport mode trunk
  switchport trunk allowed vlan all
  port-channel min-bandwidth 40g
!

#show static-channel-group 10
% Static Aggregator: sa10
% Minimum-bandwidth 40g
% Member status:
    Xe50/1      up
    Xe50/2      up
    Xe50/3      up
    Xe50/4      up
```

**Note:** When sa goes down due to [Total Bandwidth of sa] <[ Minimum Bandwidth value Configured]

```
SW1:
=====
#OcNOS #show int brief sa10

Codes: ETH - Ethernet, LB - Loopback, AGG - Aggregate, MLAG - MLAG Aggregate
       FR - Frame Relay, TUN -Tunnel, PBB - PBB Logical Port, VP - Virtual
Port
       CVP - Channelised Virtual Port, METH - Management Ethernet, UNK-
Unknown
       ED - ErrDisabled, PD - Protocol Down, AD - Admin Down,
       IA - InActive
       PD(Min L/B) - Protocol Down Min-Links/Bandwidth
       DV - DDM Violation, NA - Not Applicable
       NOM - No operational members, PVID - Port Vlan-id
       Ctl - Control Port (Br-Breakout/Bu-Bundle)
       HD - ESI Hold Timer Down

-----
--
Port-channel Type PVID Mode                Status   Reason Speed
Interface
-----
--
sa10          AGG    1      trunk                down     PD (Min L/B)  0
OcNOS#

SW2:
=====
```

```
OcNOS#show int brief sa10
```

```
Codes: ETH - Ethernet, LB - Loopback, AGG - Aggregate, MLAG - MLAG Aggregate
       FR - Frame Relay, TUN -Tunnel, PBB - PBB Logical Port, VP - Virtual
Port
       CVP - Channelised Virtual Port, METH - Management Ethernet, UNK-
Unknown
       ED - ErrDisabled, PD - Protocol Down, AD - Admin Down,
       IA - InActive
       PD(Min L/B) - Protocol Down Min-Links/Bandwidth
       DV - DDM Violation, NA - Not Applicable
       NOM - No operational members, PVID - Port Vlan-id
       Ctl - Control Port (Br-Breakout/Bu-Bundle)
       HD - ESI Hold Timer Down
```

```
-----
--
Port-channel  Type  PVID  Mode                Status  Reason  Speed
Interface
-----
--
sa10           AGG    1     trunk              down    PD(Min L/B)  0
OcNOS#
```

!

## Dynamic-LAG Minimum Link Configuration

Configure the minimum number of ports that must be linked up and bundled in the LACP port channel. We can configure the minimum links range from 2 to 32. If the number of ports aggregated to the port channel is less than the minimum number of links configured, then the port channel enters the Protocol Down because of the minimum link state.

Note: Minimum links should be configured the same on both sides for optimal performance.

### Topology

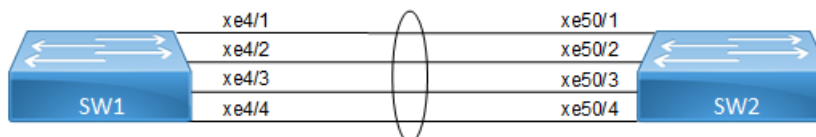


Figure 6-10: LAG Minimum Link

### SW1

#configure terminal	Enter configure mode.
(config)#interface po10	Creating interface port-channel po10
(config-if)#port-channel min-links 4	Configuring port channel minimum links as 4 (range is 2-32)
(config-if)#commit	Commit the transaction.
(config-if)#exit	Exit the configure mode

## Validation

### SW1

```
#show running-config interface po10

interface po10
  switchport
  bridge-group 1
  switchport mode trunk
  switchport trunk allowed vlan all
  port-channel min-links 4
!

!

#show etherchannel
-----
% LACP Aggregator: po10
% Min-links : 4
% Member:
  xe4/1
  xe4/2
  xe4/3
  xe4/4
-----

#show etherchannel summary

% Aggregator po10 100010
% Aggregator Type: Layer2
% Admin Key: 0010 - Oper Key 0010
%   Link: xe4/4 (10072) sync: 1
%   Link: xe4/1 (10069) sync: 1
%   Link: xe4/2 (10070) sync: 1
%   Link: xe4/3 (10071) sync: 1
-----
```

### SW2

#configure terminal	Enter configure mode.
(config)#interface po10	Creating interface port-channel po10
(config-if)#port-channel min-links 4	Configuring port channel minimum links as 4 (range is 2-32)
(config-if)#commit	Commit the transaction.
(config-if)#exit	Exit the configure mode

## Validation

### SW2

```
#show running-config interface po10
!
interface po10
```

```

switchport
bridge-group 1
switchport mode trunk
switchport trunk allowed vlan all
port-channel min-links 4
!

```

```
#show etherchannel
```

```

% LACP Aggregator: po10
% Min-links: 4
% Member:
    xe50/1
    xe50/2
    xe50/3
    xe50/4

```

```
#show etherchannel summary
```

```

% Aggregator po10 100010
% Aggregator Type: Layer2
% Admin Key: 0010 - Oper Key 0010
%   Link: xe50/4 (10072) sync: 1
%   Link: xe50/1 (10069) sync: 1
%   Link: xe50/2 (10070) sync: 1
%   Link: xe50/3 (10071) sync: 1

```

**Note:** When a PO goes down due to the minimum links configured (number of minimum links is greater than the links aggregated to the PO).

SW1:

====

```
#OcnOS#show int brief po10
```

Codes: ETH - Ethernet, LB - Loopback, AGG - Aggregate, MLAG - MLAG Aggregate  
FR - Frame Relay, TUN - Tunnel, PBB - PBB Logical Port, VP - Virtual  
Port

CVP - Channelised Virtual Port, METH - Management Ethernet, UNK-  
Unknown

ED - ErrDisabled, PD - Protocol Down, AD - Admin Down,

IA - InActive

PD(Min L/B) - Protocol Down Min-Links/Bandwidth

DV - DDM Violation, NA - Not Applicable

NOM - No operational members, PVID - Port Vlan-id

Ctl - Control Port (Br-Breakout/Bu-Bundle)

HD - ESI Hold Timer Down

```

-----
--
Port-channel  Type  PVID  Mode                Status  Reason  Speed
Interface
-----
--
po10           AGG    1      trunk              down    PD(Min L/B)  0

```

OcNOS#

```
OcNOS#show etherchannel
% LACP Aggregator: po10
% Min-links: 4
% Protocol Down (Min L/B): True
% Member:
    xe4/1
    xe4/2
    xe4/3
    xe4/4
```

SW2:

=====

```
OcNOS#show etherchannel
% LACP Aggregator: po10
% Min-links: 4
% Protocol Down (Min L/B): True
% Member:
    Xe50/1
    Xe50/2
    Xe50/3
    xe50/4
```

OcNOS#show int brief po10

Codes: ETH - Ethernet, LB - Loopback, AGG - Aggregate, MLAG - MLAG Aggregate  
FR - Frame Relay, TUN - Tunnel, PBB - PBB Logical Port, VP - Virtual  
Port  
CVP - Channelised Virtual Port, METH - Management Ethernet, UNK-  
Unknown  
ED - ErrDisabled, PD - Protocol Down, AD - Admin Down,  
IA - InActive  
PD(Min L/B) - Protocol Down Min-Links/Bandwidth  
DV - DDM Violation, NA - Not Applicable  
NOM - No operational members, PVID - Port Vlan-id  
Ctl - Control Port (Br-Breakout/Bu-Bundle)  
HD - ESI Hold Timer Down

```
-----
--
Port-channel  Type   PVID  Mode                Status   Reason   Speed
Interface
-----
--
po10          AGG    1     trunk              down    PD(Min L/B)  0
OcNOS#
```

## Dynamic LAG Minimum Bandwidth Configuration

Configure the minimum bandwidth allowed for ports that must be linked up and bundled in the LACP port channel. We can configure the minimum bandwidth range from BANDWIDTH <1-999>k|m for 1 to 999 kilo bits or mega bits <1-1000>g for 1 to 1000 giga bits. If the Total bandwidth of ports aggregated to the port channel is less than the minimum Bandwidth value configured, then the port channel enters the Protocol Down because of the minimum Bandwidth state.

Note: Minimum Bandwidth should be configured the same on both sides for optimal performance.

### Topology

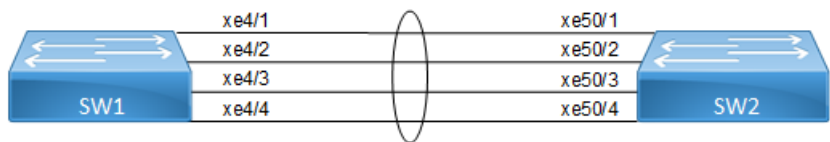


Figure 6-11: LAG Minimum Bandwidth

### SW1

#configure terminal	Enter configure mode.
(config)#interface po10	Creating interface port-channel po10
(config-if)#port-channel min-bandwidth 40g	Configuring port channel minimum bandwidth as 40g (range from BANDWIDTH <1-999>k m for 1 to 999 kilo bits or mega bits <1-1000>g for 1 to 1000 giga bits.)
(config-if)#commit	Commit the transaction.
(config-if)#exit	Exit the configure mode

### Validation

### SW1

```
#show running-config interface po10

interface po10
  switchport
  bridge-group 1
  switchport mode trunk
  switchport trunk allowed vlan all
  port-channel min-bandwidth 40g
  !

!

#show etherchannel
-----
% LACP Aggregator: po10
% Min-Bandwidth : 40g
% Member:
  xe4/1
  xe4/2
  xe4/3
```

```
xe4/4
-----

#show etherchannel summary

% Aggregator po10 100010
% Aggregator Type: Layer2
% Admin Key: 0010 - Oper Key 0010
%   Link: xe4/4 (10072) sync: 1
%   Link: xe4/1 (10069) sync: 1
%   Link: xe4/2 (10070) sync: 1
%   Link: xe4/3 (10071) sync: 1
-----
```

SW2

#configure terminal	Enter configure mode.
(config)#interface po10	Creating interface port-channel po10
(config-if)#port-channel min-bandwidth 40g	Configuring port channel minimum bandwidth as 40g (range from BANDWIDTH <1-999>k m for 1 to 999 kilo bits or mega bits <1-1000>g for 1 to 1000 giga bits.)
(config-if)#commit	Commit the transaction.
(config-if)#exit	Exit the configure mode

Validation

SW2

```
#show running-config interface po10
!
interface po10
  switchport
  bridge-group 1
  switchport mode trunk
  switchport trunk allowed vlan all
  port-channel min-bandwidth 40g
!

#show etherchannel

% LACP Aggregator: po10
% Min-Bandwidth : 40g
% Member:
  xe50/1
  xe50/2
  xe50/3
  xe50/4

#show etherchannel summary

% Aggregator po10 100010
% Aggregator Type: Layer2
```

```
% Admin Key: 0010 - Oper Key 0010
% Link: xe50/4 (10072) sync: 1
% Link: xe50/1 (10069) sync: 1
% Link: xe50/2 (10070) sync: 1
% Link: xe50/3 (10071) sync: 1
```

**Note:** When a PO goes down due to the [Total bandwidth] < [minimum bandwidth configured]

SW1:

=====

OcNOS#show int brief po10

```
Codes: ETH - Ethernet, LB - Loopback, AGG - Aggregate, MLAG - MLAG Aggregate
FR - Frame Relay, TUN -Tunnel, PBB - PBB Logical Port, VP - Virtual
Port
CVP - Channelised Virtual Port, METH - Management Ethernet, UNK-
Unknown
ED - ErrDisabled, PD - Protocol Down, AD - Admin Down,
IA - InActive
PD(Min L/B) - Protocol Down Min-Links/Bandwidth
DV - DDM Violation, NA - Not Applicable
NOM - No operational members, PVID - Port Vlan-id
Ctl - Control Port (Br-Breakout/Bu-Bundle)
HD - ESI Hold Timer Down
```

```
-----
--
Port-channel Type  PVID  Mode                Status  Reason  Speed
Interface
-----
--
po10             AGG    1      trunk              down    PD(Min L/B)  0
OcNOS#
```

```
OcNOS#show etherchannel
% LACP Aggregator: po10
% Min-Bandwidth : 40g
% Protocol Down (Min L/B): True
% Member:
  xe4/1
  xe4/2
  xe4/3
  xe4/4
```

SW2:

=====

```
OcNOS#show etherchannel
% LACP Aggregator: po10
% Min-Bandwidth : 40g
% Protocol Down (Min L/B): True
% Member:
  Xe50/1
  Xe50/2
  Xe50/3
```



```

xe50/4

OcNOS#show int brief po10

Codes: ETH - Ethernet, LB - Loopback, AGG - Aggregate, MLAG - MLAG Aggregate
       FR - Frame Relay, TUN -Tunnel, PBB - PBB Logical Port, VP - Virtual
Port
       CVP - Channelised Virtual Port, METH - Management Ethernet, UNK-
Unknown
       ED - ErrDisabled, PD - Protocol Down, AD - Admin Down,
       IA - InActive
       PD(Min L/B) - Protocol Down Min-Links/Bandwidth
       DV - DDM Violation, NA - Not Applicable
       NOM - No operational members, PVID - Port Vlan-id
       Ctl - Control Port (Br-Breakout/Bu-Bundle)
       HD - ESI Hold Timer Down

-----
--
Port-channel  Type  PVID  Mode                Status  Reason  Speed
Interface
-----
--
po10          AGG    1     trunk              down    PD(Min L/B)  0
OcNOS#

```

## LACP Minimum-Link, Minimum-Bandwidth Configurations on dynamic, static Channel-Groups with MLAG.

### Overview

OcNOS allows the configuration of minimum number of the LAG members per LAG group. Both these configurations are meaningful in case the LAG is used for incremental-BW mode. The minimum configuration controls the minimum number of members /bandwidth that must be operationally up / bandwidth available to declare their LAG as operationally UP.

When static/dynamic LAG interface configured with minimum links / minimum bandwidth, the following conditions are to be met:

- Ports which are admin and operational up are considered for min-link.
- The specified minimum number of links should be up.
- Min-link and min-bandwidth cannot co-exist.
- When ports are down due to min-link/min-bandwidth, in show interface brief command output, port down with the corresponding reason code for the failure due to min-link/min-bandwidth.

### Minimum Active Members/Bandwidth

The user can specify the minimum number of members that must be operationally up to declare their LAG as operationally UP. Note that this parameter applies to static/dynamic LAG.

```
port-channel min-links <2 - 32>
```

The minimum active member configuration will be allowed to be modified to be greater than the current number of active members. In such configuration, the LAG operational status will become operationally down.

The user can specify the minimum bandwidth, based on the configured value and the ports that satisfy the conditions LAG will be operationally UP. This parameter is applied for static/dynamic LAG.

```
port-channel min-bandwidth BANDWIDTH
```

BANDWIDTH <1-999>k|m for 1 to 999 kilo bits or mega bits <1-1000>g for 1 to 1000 giga bits.

When condition fails, the operational state changes to DOWN.

Note: Do not configure minimum-link, Minimum Bandwidth both on TORS and switches at the same time to avoid flaps of MLAG.

Topology

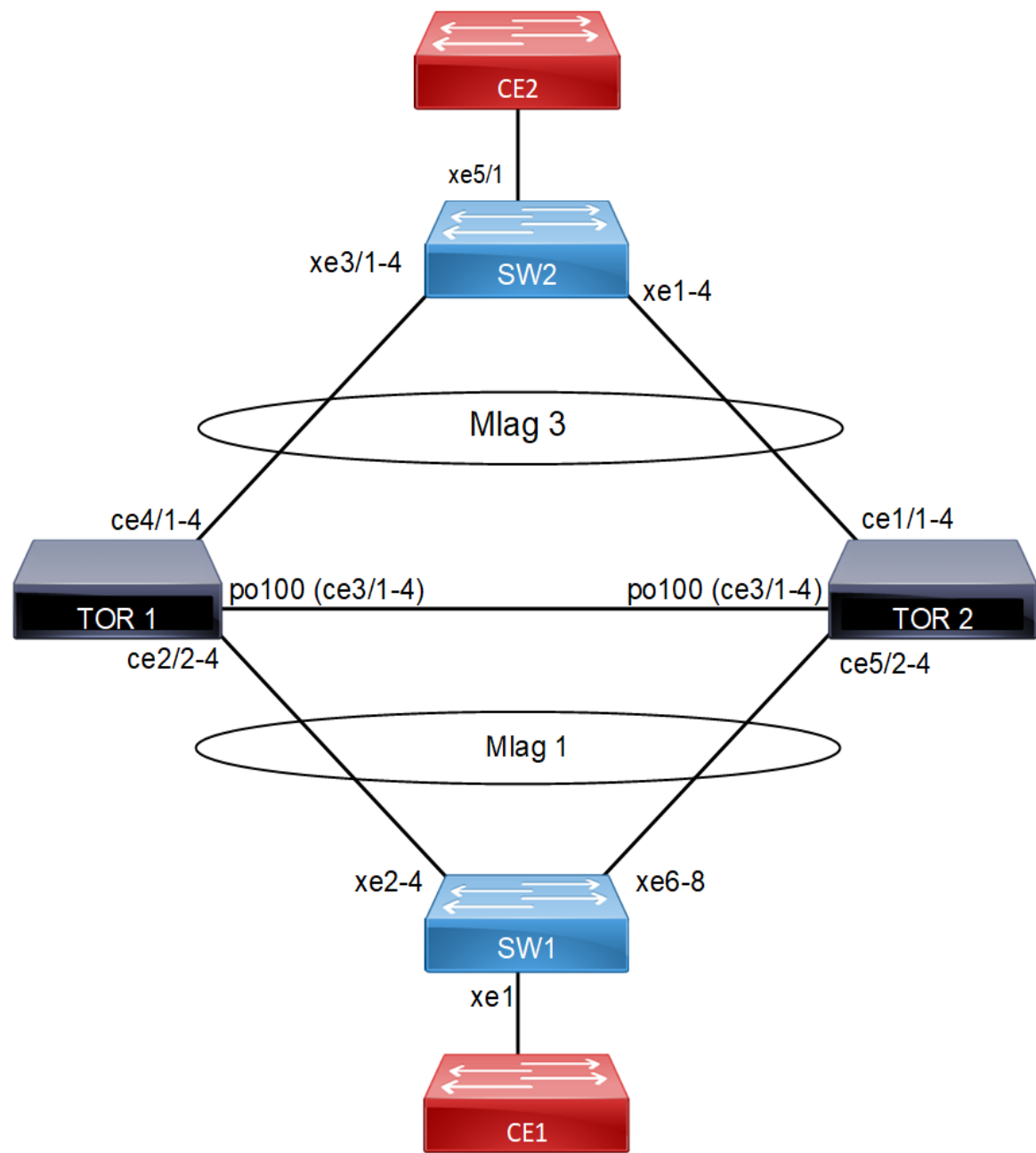


Figure 6-12: MC - LAG Topology

Configuration

TOR1:

#configure terminal	Enter configure mode.
(config)# bridge 1 protocol rstp vlan-bridge	Configure bridge type

(config)# vlan database	Enter vlan database mode
(config-vlan)# vlan 600,601,502 bridge 1 state enable	Configure a vlans and add it to the bridge.
(config-if)#exit	Exit vlan configuration mode.
(config)#interface mlag1	Enter Interface mode
(config-if)# switchport	Make mlag as layer2 port
(config-if)# bridge-group 1	Attach interface to bridge
(config-if)# switchport mode trunk	Configure trunk port
(config-if)# switchport trunk allowed vlan add 600,601,502	Add interface to vlans
(config-if)# spanning-tree edgeport	Configure port as edge port to avoid loops
(config-if)# spanning-tree bpdu-filter enable	Enable bpdu filter to avoid loops
(config-if)#mtu 9216	Configure mtu.
(config-if)#exit	Return to privilege mode
(config)#interface mlag3	Enter Interface mode
(config-if)# switchport	Make mlag as layer2 port
(config-if)# bridge-group 1	Attach interface to bridge
(config-if)# switchport mode trunk	Configure trunk port
(config-if)# switchport trunk allowed vlan add 600,502	Add interface to vlans
(config-if)# spanning-tree edgeport	Configure port as edge port to avoid loops
(config-if)# spanning-tree bpdu-filter enable	Enable bpdu filter to avoid loops
(config-if)#mtu 9216	Configure mtu.
(config-if)#exit	Return to privilege mode
(config)#commit	Commit the candidate configuration to the running Configuration.
(config)#interface po100	Enter Interface mode
(config-if)# switchport	Make po as layer2 port
(config-if)#exit	Exit interface mode.
(config)#interface sa1	Enter Interface mode
(config-if)# switchport	Make sa1 as layer2 port
(config-if)# port-channel load-balance src-dst-mac	Enable load balance
(config-if)#exit	Return to privilege mode
(config)#interface sa3	Enter Interface mode
(config-if)# switchport	Make sa3 as layer2 port
(config-if)# port-channel load-balance src-dst-mac	Enable load balance
(config-if)#exit	Return to privilege mode
(config)#interface ce2/4	Enter Interface mode

(config-if)# static-channel-group 1	Add interface to sa1
(config-if)#exit	Return to privilege mode
(config)#interface ce3/1	Enter Interface mode
(config-if)# channel-group 100 mode active	Add interface to po100
(config-if)#exit	Return to privilege mode
(config)#interface ce3/2	Enter Interface mode
(config-if)# channel-group 100 mode active	Add interface to po100
(config-if)#exit	Return to privilege mode
(config)#interface ce3/3	Enter Interface mode
(config-if)# channel-group 100 mode active	Add interface to po100
(config-if)#exit	Return to privilege mode
(config)#interface ce3/4	Enter Interface mode
(config-if)# channel-group 100 mode active	Add interface to po100
(config-if)#exit	Return to privilege mode
(config)#interface ce4/1	Enter Interface mode
(config-if)# static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#interface ce4/2	Enter Interface mode
(config-if)# static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#interface ce4/3	Enter Interface mode
(config-if)# static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#commit	Commit the candidate configuration to the running Configuration.
(config)#mcec domain configuration	Enter Multichassis Etherchannel domain configuration mode.
(config-mcec-domain)# domain-address 1111.2222.3333	Configure the domain address.
(config-mcec-domain)# domain-system-number 1	Configure the domain system number
(config-mcec-domain)# intra-domain-link po100	Specify the intra domain link for MLAG communication
(config-mcec-domain)#exit	Return to privilege mode
(config)#int mlag1	Enter Interface mode
(config-if)#mode active-standby	Configure mlag mode for mlag1
(config-if)#switchover type revertive 10	Configure revertive timer
(config-if)#exit	Return to privilege mode
(config)#interface sa1	Enter Interface mode
(config-if)#mlag 1	Map sa1 to mlag1
(config-if)#exit	Return to privilege mode
(config)#int mlag3	Enter Interface mode

(config-if)#mode active-standby	Configure mlag mode for mlag3
(config-if)#switchover type revertive 10	Configure revertive timer
(config-if)#exit	Return to privilege mode
(config)#interface sa3	Enter Interface mode
(config-if)#mlag 3	Map sa3 to mlag3
(config-if)#exit	Return to privilege mode
(config-if)# interface sa1	Enter sa interface mode
(config-if)#port-channel min-links 3	Configure min-link value on sa interface
(config)#interface sa3	Enter sa Interface mode
(config-if)#port-channel min-bandwidth 30g	Configure min-bandwidth value on sa/po interface
(config-if)#commit	Commit the candidate configuration to the running Configuration.
(config-if)#exit	Exit interface mode.

## TOR2

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Configure bridge type
(config)# vlan database	Enter vlan database
(config-vlan)# vlan 600,601,502 bridge 1 state enable	Configure vlans
(config-vlan)#exit	Exit vlan configure mode.
(config)#interface mlag1	Enter Interface mode
(config-if)# switchport	Make mlag as layer2 port
(config-if)# bridge-group 1	Attach interface to bridge
(config-if)# switchport mode trunk	Configure trunk port
(config-if)# switchport trunk allowed vlan add 600,601,502	Add interface to vlans
(config-if)# spanning-tree edgeport	Configure port as edge port to avoid loops
(config-if)# spanning-tree bpdu-filter enable	Enable bpdu filter to avoid loops
(config-if)#mtu 9216	Configure mtu.
(config-if)#exit	Return to privilege mode
(config)#interface mlag3	Enter Interface mode
(config-if)# switchport	Make mlag as layer2 port
(config-if)# bridge-group 1	Attach interface to bridge
(config-if)# switchport mode trunk	Configure trunk port
(config-if)# switchport trunk allowed vlan add 600,502	Add interface to vlans
(config-if)# spanning-tree edgeport	Configure port as edge port to avoid loops

(config-if)# spanning-tree bpdu-filter enable	Enable bpdu filter to avoid loops
(config-if)#mtu 9216	Configure mtu.
(config-if)#exit	Return to privilege mode
(config)#commit	Commit the candidate configuration to the running Configuration.
(config)#interface po100	Enter Interface mode
(config-if)# switchport	Make po(IDL) as layer2 port
(config-if)#exit	Return to privilege mode
(config)#interface sa1	Enter Interface mode
(config-if)# switchport	Make sa1 as layer2 port
(config-if)# port-channel load-balance src-dst-mac	Enable load balance
(config-if)#exit	Return to privilege mode
(config)#interface sa3	Enter Interface mode
(config-if)# switchport	Make sa3 as layer2 port
(config-if)# port-channel load-balance src-dst-mac	Enable load balance
(config-if)#exit	Return to privilege mode
(config)#interface ce1/1	Enter Interface mode
(config-if)# static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#interface ce1/2	Enter Interface mode
(config-if)# static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#interface ce1/3	Enter Interface mode
(config-if)# static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#interface ce3/1	Enter Interface mode
(config-if)# channel-group 100 mode active	Add interface to po100
(config-if)#exit	Return to privilege mode
(config)#interface ce3/2	Enter Interface mode
(config-if)# channel-group 100 mode active	Add interface to po100
(config-if)#exit	Return to privilege mode
(config)#interface ce3/3	Enter Interface mode
(config-if)# channel-group 100 mode active	Add interface to po100
(config-if)#exit	Return to privilege mode
(config)#interface ce3/4	Enter Interface mode
(config-if)# channel-group 100 mode active	Add interface to po100
(config-if)#exit	Return to privilege mode

(config)#interface ce5/1	Enter Interface mode
(config-if)# static-channel-group 1	Add interface to sa1
(config-if)#exit	Return to privilege mode
(config)#interface ce5/2	Enter Interface mode
(config-if)# static-channel-group 1	Add interface to sa1
(config-if)#exit	Return to privilege mode
(config)#interface ce5/3	Enter Interface mode
(config-if)# static-channel-group 1	Add interface to sa1
(config-if)#exit	Return to privilege mode
(config)#commit	Commit the candidate configuration to the running Configuration.
(config)#mcec domain configuration	Enter Multichassis Etherchannel domain configuration mode.
(config-mcec-domain)# domain-address 1111.2222.3333	Configure the domain address.
(config-mcec-domain)# domain-system-number 2	Configure the domain system number
(config-mcec-domain)# intra-domain-link po100	Specify the intra domain link for MLAG communication
(config-mcec-domain)#exit	Return to privilege mode
(config)#int mlag1	Enter Interface mode
(config-if)#mode active-standby	Configure mlag mode for mlag1
(config-if)#switchover type revertive 10	Configure revertive timer
(config-if)#exit	Return to privilege mode
(config)#interface sa1	Enter Interface mode
(config-if)#mlag 1	Map sa1 to mlag1
(config-if)#exit	Return to privilege mode
(config)#int mlag3	Enter Interface mode
(config-if)#mode active-standby	Configure mlag mode for mlag3
(config-if)#switchover type revertive 10	Configure revertive timer
(config-if)#exit	Return to privilege mode
(config)#interface sa3	Enter Interface mode
(config-if)#mlag 3	Map sa3 to mlag3
(config-if)#exit	Return to privilege mode
(config-if)#interface sa1	Enter sa interface mode
(config-if)#port-channel min-links 3	Configure min-link value on sa interface
(config)#interface sa3	Enter sa Interface mode
(config-if)#port-channel min-bandwidth 30g	Configure min-bandwidth value on sa interface.
(config-if)#commit	Commit the candidate configuration to the running Configuration.
(config-if)#exit	Exit interface mode.



**SW1**

#configure terminal	Enter Configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Configure bridge type
(config)#vlan database	Create vlan database
(config-vlan)#vlan 600,601,502,101,100,300,401,402 bridge 1 state enable	Create Vlans
(config-vlan)#exit	Exit vlan configuration mode.
(config)#interface xe1	Enter Interface mode
(config-if)# switchport	Make xe1 as layer2 port
(config-if)# bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#spanning-tree edgeport	Configure port as edgeport
(config-if)#spanning-tree bpdu-filter enable	Enable spanning tree bpdu filter
(config-if)# mtu 9216	Configure mtu
(config-if)#exit	Return to privilege mode
(config)#interface sa1	Enter Interface mode
(config-if)# switchport	Make xe1 as layer2 port
(config-if)# bridge-group 1	Associate the interface 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 add 100,101,300,401,402,502	Enable all VLAN identifiers on this interface.
(config-if)# port-channel load-balance src- dst-mac	Enable load balance
(config-if)#spanning-tree edgeport	Configure port as edgeport
(config-if)#spanning-tree bpdu-filter enable	Enable spanning tree bpdu filter
(config-if)# mtu 9216	Configure mtu
(config-if)#exit	Return to privilege mode
(config)#interface xe2	Enter Interface mode
(config-if)# static-channel-group 1	Add interface to sa1
(config-if)#exit	Return to privilege mode
(config)#interface xe3	Enter Interface mode
(config-if)# static-channel-group 1	Add interface to sa1
(config-if)#exit	Return to privilege mode
(config)#interface xe4	Enter Interface mode
(config-if)#static-channel-group 1	Add interface to sa1
(config-if)#exit	Return to privilege mode
(config)#interface xe6	Enter Interface mode
(config-if)# static-channel-group 1	Add interface to sa3

(config-if)#exit	Return to privilege mode
(config)#interface xe7	Enter Interface mode
(config-if)# static-channel-group 1	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#interface xe8	Enter Interface mode
(config-if)# static-channel-group 1	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#commit	Commit the candidate configuration to the running Configuration.

**SW2**

(config)#bridge 1 protocol rstp vlan-bridge	Configure bridge type
(config)#vlan database	Create vlan database
(config-vlan)#vlan 600,601,502,101,100,300,401,402 bridge 1 state enable	Create vlans
(config-vlan)#exit	Exit vlan configuration mode
(config)#interface xe5/1	Enter Interface mode
(config-if)# switchport	Make xe1 as layer2 port
(config-if)# bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#spanning-tree edgeport	Configure port as edge port
(config-if)#spanning-tree bpdu-filter enable	Enable spanning tree bpdu filter
(config-if)# mtu 9216	Configure mtu
(config-if)#exit	Return to privilege mode
(config)#interface sa3	Enter Interface mode
(config-if)# switchport	Make xe1 as layer2 port
(config-if)# bridge-group 1	Associate the interface 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 add 100,101,401,402,600,502	Enable all VLAN identifiers on this interface.
(config-if)# port-channel load-balance src-dst-mac	Enable load balance
(config-if)#spanning-tree edgeport	Configure port as edge port
(config-if)#spanning-tree bpdu-filter enable	Enable spanning tree bpdu filter
(config-if)# mtu 9216	Configure mtu
(config-if)#exit	Return to privilege mode
(config)#interface xe3/1	Enter Interface mode
(config-if)# static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode

(config)#interface xe3/2	Enter Interface mode
(config-if)# static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#interface xe3/3	Enter Interface mode
(config-if)#static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#interface xe1/1	Enter Interface mode
(config-if)#static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#interface xe1/2	Enter Interface mode
(config-if)# static-channel-group 3	Add interface to sa3
(config-if)#exit	Return to privilege mode
(config)#interface xe1/3	Enter Interface mode
(config-if)#static-channel-group 3	Add interface to sa3
(config-if)#exit	Exit interface mode.
(config)#commit	Commit the candidate configuration to the running Configuration.

This configuration is applicable for the dynamic LAG with MLAG topology except dynamic LAG interface creations, which needs to be referred from the dynamic LAG configurations given above.

## Validation Commands

sh int brief sa [id], sh int brief po [id], sh mlag-domain summary, sh static-channel-group <sa id>, <sh etherchannel>, sh running-config interface sa [id], <sh etherchannel summary>.

When sa or po goes down due to min-link or min-bandwidth not satisfied, below validations to be done:

### TOR

====

```
#show int brief sa1
Codes: ETH - Ethernet, LB - Loopback, AGG - Aggregate, MLAG - MLAG Aggregate
      FR - Frame Relay, TUN -Tunnel, PBB - PBB Logical Port, VP - Virtual
Port
      CVP - Channelised Virtual Port, METH - Management Ethernet, UNK-
Unknown
      ED - ErrDisabled, PD - Protocol Down, AD - Admin Down,
      IA - InActive
      PD(Min L/B) - Protocol Down Min-Links/Bandwidth
      DV - DDM Violation, NA - Not Applicable
      NOM - No operational members, PVID - Port Vlan-id
      Ctl - Control Port (Br-Breakout/Bu-Bundle)
      HD - ESI Hold Timer Down
```

```
-----
Port-channel Type  PVID  Mode                Status  Reason  Speed
Interface
```

```
-----
--
sa1          AGG    1      trunk          down      PD (Min L/B)    0
```

```
#
```

```
#sh int brief po100
```

```
Codes: ETH - Ethernet, LB - Loopback, AGG - Aggregate, MLAG - MLAG Aggregate
        FR - Frame Relay, TUN -Tunnel, PBB - PBB Logical Port, VP - Virtual
Port
        CVP - Channelised Virtual Port, METH - Management Ethernet, UNK-
Unknown
        ED - ErrDisabled, PD - Protocol Down, AD - Admin Down,
        IA - InActive
        PD (Min L/B) - Protocol Down Min-Links/Bandwidth
        DV - DDM Violation, NA - Not Applicable
        NOM - No operational members, PVID - Port Vlan-id
        Ctl - Control Port (Br-Breakout/Bu-Bundle)
        HD - ESI Hold Timer Down
```

```
-----
--
Port-channel  Type  PVID  Mode          Status  Reason  Speed
Interface
-----
```

```
--
po100          AGG    1      trunk          down      PD (Min L/B)    0
```

```
#
```

```
#sh etherchannel
```

```
% LACP Aggregator: po100
```

```
% Min-Bandwidth : 40g
```

```
% Protocol Down (Min L/B) : True
```

```
% Member:
```

```
ce3/1
```

```
ce3/2
```

```
ce3/3
```

```
ce3/4
```

```
-----
% LACP Aggregator: sa1
```

```
% Min-links : 3
```

```
% Protocol Down (Min L/B): True
```

```
% Member:
```

```
ce2/2
```

```
ce2/3
```

```
ce2/4
```

```
-----
% LACP Aggregator: sa3
```

```
% Member:
```

```
ce4/1
```

```
ce4/2
```

```
ce4/3
```

```
#
```

```
#show running-config interface sa1
```

```
!
```

```
interface sa1
```

```
switchport
```

```

port-channel min-links 3
mlag 1
!

#show static-channel-group 1
Static Aggregator: sa1
Minimum-Links 3
Member Status
ce2/2          down
ce2/3          down
ce2/4          down
#
#show etherchannel summary
Aggregator po100 100100
Aggregator Type: Layer2
Admin Key: 0100 - Oper Key 0100
Link: ce3/1 (5057) sync: 0
Link: ce3/2 (5058) sync: 0
Link: ce3/3 (5059) sync: 0
Link: ce3/4 (5060) sync: 0
-----

```

## LACP Force-Up

In an aggregated environment, there are some parameters that are set for member ports in lag. Whenever the parameters are set and conditions are satisfied, the port channel will be in SYNC. If force-up mode is enabled for the member port, the port channel will always be in SYNC even if the parameters are not set i.e. the traffic will not be affected and the port channel will never go down.

## LACP force-up with Dynamic LAG

### Topology

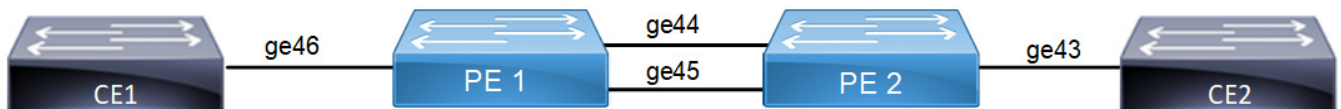


Figure 6-13: LACP force-up with Dynamic LAG

### PE1

#configure terminal	Enter configure mode.
(config)#hostname PE1	Configure host name
(config)#bridge 1 protocol rstp vlan-bridge	Create a RSTP VLAN bridge on customer side
(config)#vlan database	Enter vlan database.
(config-vlan)#vlan 2-100 bridge 1 state enable	Configure VLAN for the bridge
(config-vlan)#exit	Exit vlan configuration mode.
(config)#interface ge46	Enter interface mode

(config-if)#switchport	Make interface as Switchport
(config-if)#bridge-group 1	Associate the interface to bridge
(config-if)#switchport mode hybrid	Configure the mode as hybrid
(config-if)#switchport hybrid allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#load-interval 30	Configure load period in multiple of 30 seconds
(config-if)#exit	Exit interface mode.
(config)#interface po1	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#bridge-group 1	Associate the interface to bridge
(config-if)#switchport mode hybrid	Configure the mode as hybrid
(config-if)#switchport hybrid allowed vlan all	Configure allowed vlan all for the hybrid mode
(config-if)#load-interval 30	Configure load period in multiple of 30 seconds
(config-if)#exit	Exit interface mode.
(config)#interface ge44	Enter interface mode
(config-if)#channel-group 1 mode active	Adding interface to channel-group 1
(config-if)#exit	Exit interface mode.
(config)#interface ge45	Enter interface mode
(config-if)#channel-group 1 mode active	Adding interface to channel-group 1
(config-if)#commit	Commit the candidate configuration to the running Configuration.
(config-if)#exit	Exit interface mode.

## PE2

#configure terminal	Enter configure mode.
(config)#hostname PE2	Configure host name
(config)#bridge 1 protocol provider-rstp edge	Create provider rstp edge bridge
(config)#vlan database	Enter vlan database mode
(config-vlan)#vlan 2-100 type customer bridge 1 state enable	Configure customer VLAN for the bridge
(config-vlan)#vlan 100 type service point-point bridge 1 state enable	Configure service VLAN for the bridge
(config)#exit	Exit vlan database mode
(config)#cvlan registration table map1 bridge 1	Creating registration table
(config-cvlan-registration)#cvlan 2-100 svlan 100	Mapping cvlan to svlan
(config-cvlan-registration)#exit	Exit cvlan registration mode.
(config)#commit	Commit the candidate configuration to the running Configuration.

(config)#interface ge43	Enter interface mode
(config-if)#switchport	Make interface as Switchport
(config-if)#bridge-group 1	Associate the interface to bridge
(config-if)#switchport mode provider-network	Configure the mode as provider-network
(config-if)# switchport provider-network allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#load-interval 30	Configure load period in multiple of 30 seconds
(config-if)#exit	Exit interface mode.
(config)#interface pol	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#bridge-group 1	Associate the interface with bridge group 1
(config-if)#switchport mode customer-edge hybrid	Set the switching characteristics of this interface to customer-edge hybrid
(config-if)#switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer-edge hybrid and allow vlan all
(config-if)#switchport customer-edge vlan registration map1	Configuring the registration table mapping on lag interface
(config-if)#load-interval 30	Configure load period in multiple of 30 seconds
(config-if)#exit	Exit interface mode.
(config)#interface ge44	Enter interface mode
(config-if)#channel-group 1 mode active	Adding interface to channel-group 1
(config-if)#lacp force-up	Enable lacp force-up for the member port interface
(config-if)#exit	Exit interface mode.
(config)#interface ge45	Enter interface mode
(config-if)#channel-group 1 mode active	Adding interface to channel-group 1
(config-if)#commit	Commit the candidate configuration to the running Configuration.
(config-if)#exit	Exit interface mode.

Send L2 traffic with incremental source mac of 1000 and with VLAN 100 from CE1 and with incremental source mac of 1000 and with SVLAN 100(TPID 0x88a8), CVLAN 100 from CE2.

## Validation

### PE1

```
CE1#show mac address-table count bridge 1
MAC Entries for all vlans:
Dynamic Address Count: 2001
Static (User-defined) Unicast MAC Address Count: 0
Static (User-defined) Multicast MAC Address Count: 0
Total MAC Addresses in Use: 2001
```

```
CE1#show etherchannel summary
  Aggregator pol 100001
```

```

Aggregator Type: Layer2
Admin Key: 0001 - Oper Key 0001
  Link: ge44 (5043) sync: 1
  Link: ge45 (5046) sync: 1

```

CE1#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
ge44	363.65	710252	772.76	1420506
ge45	363.63	710222	0.00	0
ge46	772.77	1420525	727.31	1420526
po1	728.56	1422971	774.09	1422966

CE2#show mac address-table count bridge 1

MAC Entries for all vlans:

Dynamic Address Count: 2001

Static (User-defined) Unicast MAC Address Count: 0

Static (User-defined) Multicast MAC Address Count: 0

Total MAC Addresses in Use: 2001

CE2#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
ge43	774.26	1423267	784.17	1361411
ge44	774.26	1423268	364.36	711634
ge45	0.00	0	364.36	711634
po1	774.26	1423267	728.71	1423267

CE2#show etherchannel summary

Aggregator po1 100001

Aggregator Type: Layer2

Admin Key: 0001 - Oper Key 0001

Link: ge44 (5020) sync: 1

Link: ge45 (5022) sync: 1

On server side (PE1) to make LAG down you can unconfigure the channel-group 1 configurations and verify force-up is getting enabled in PE2.

To simulate the force-up

PE1(config)#interface ge44	Enter interface mode.
PE1(config-if)#no channel-group	Removing channel-group configurations from interface.
PE1(config-if)#exit	Exit interface mode.
PE1(config)#interface ge45	Enter interface mode.
PE1(config-if)#no channel-group	Removing channel-group configurations from interface.
PE1(config-if)#exit	Exit interface mode.
PE1(config)#commit	Commit the candidate configuration to the running Configuration.



**PE2**

```
PE2#show interface brief | include pol
pol          AGG    1      customer-edge    up      none    1g
```

```
PE2#show etherchannel summary
Aggregator pol 100001
Aggregator Type: Layer2
Admin Key: 0001 - Oper Key 0001
  Link: ge44 (5020) sync: 0 (force-up)
  Link: ge45 (5022) sync: 0
```

```
PE2#show etherchannel detail
Aggregator pol 100001
Aggregator Type: Layer2
Mac address: b8:6a:97:4d:65:d5
Admin Key: 0001 - Oper Key 0001
  Actor LAG ID- 0x8000,b8-6a-97-28-a5-c0,0x0001
  Receive link count: 0 - Transmit link count: 0
  Individual: 0 - Ready: 1
  Partner LAG ID- 0x0000,00-00-00-00-00-00,0x0000
  Link: ge44 (5020) sync: 0 (force-up)
  Link: ge45 (5022) sync: 0
Collector max delay: 5
```

To forward traffic from ge44 of PE1

PE1(config)#interface ge44	Enter interface mode.
PE1(config-if)#switchport	Make the interface as switch port.
PE1(config-if)#bridge-group 1	Associate the interface to bridge.
PE1(config-if)#switchport mode hybrid	Configure the mode as hybrid.
PE1(config-if)#switchport hybrid allowed vlan all	Configure allowed vlan all for the hybrid mode.
PE1(config-if)#load-interval 30	Configure load period in multiple of 30 seconds.
PE1(config-if)#exit	Exit interface mode.
PE1(config)#commit	Commit the candidate configuration to the running Configuration.

```
PE2#show interface counters rate mbps
```

```
+-----+-----+-----+-----+-----+
| Interface | Rx mbps | Rx pps | Tx mbps | Tx pps |
+-----+-----+-----+-----+-----+
ge43       774.25    1423257    784.17    1361400
ge44       774.25    1423258    728.71    1423257
ge45        0.00         0         0.00         0
pol        774.25    1423247    728.70    1423245
CE2#
```

```
PE1#show interface counters rate mbps
```

```
+-----+-----+-----+-----+-----+
```

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
ge44	657.67	1284505	640.77	1177884
ge45	0.00	0	0.00	0
ge46	772.71	1420426	603.08	1177886

## LACP force-up with McLAG

### Topology

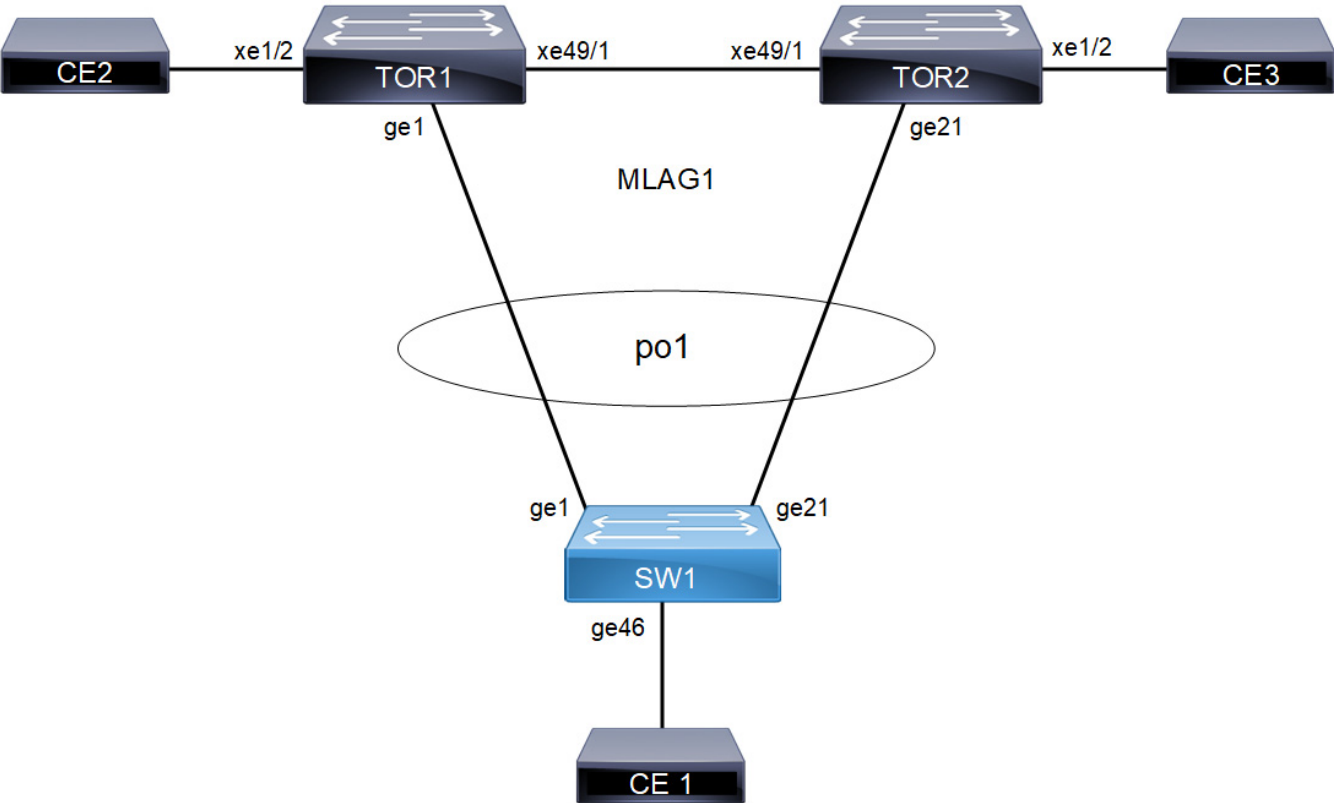


Figure 6-14: LACP force-up with McLAG

### TOR1

(config)#bridge 1 protocol provider-rstp edge	Create provider rstp bridge.
(config)#vlan database	Enter vlan database mode
(config-vlan)#vlan 2-10 type customer bridge 1 state enable	Enabling customer vlan for bridge

(config-vlan)#vlan 2-10 type service point-point bridge 1 state enable	Enabling service vlan for bridge
(config-vlan)#exit	Exit vlan configuration mode.
(config)#cvlan registration table map1 bridge 1	Creating registration table
(config-cvlan-registration)#cvlan 2 svlan 2	Mapping cvlan to svlan
(config-cvlan-registration)#cvlan 10 svlan 2	Mapping cvlan to svlan
(config-cvlan-registration)#exit	Exit cvlan registration mode.
(config)#commit	Commit the candidate configuration to the running configuration.
(config)#interface xe49/1	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
(config-if)#exit	Exit interface mode.
(config)#interface mlag1	Entering mlag interface
(config-if)#switchport	Configuring interface as switchport
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1 and disabling spanning-tree
(config-if)#switchport mode customer-edge hybrid	Set the switching characteristics of this interface to customer-edge hybrid
(config-if)#switchport customer-edge hybrid vlan 2	Set the switching characteristics of this interface to customer-edge hybrid and allow vlan 2
(config-if)#switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer-edge hybrid and allow vlan all
(config-if)#switchport customer-edge vlan registration map1	Configuring the registration table mapping on mlag interface
(config-if)#exit	Exit interface mode.
(config)#interface pol	Entering dynamic lag interface
(config-if)#switchport	Configuring interface as switchport
(config-if)#mlag 1	Enabling mlag group number
(config-if)#exit	Exit interface mode.
(config)#interface gel	Entering interface mode
(config-if)#lacp force-up	Enable lacp force-up for the member port interface
(config-if)#channel-group 1 mode active	Add this interface to channel group 1
(config-if)#exit	Exit the interface mode
(config)#mcec domain configuration	Entering MCEC mode
(config-mcec-domain)#domain-address 2222.2222.2222	Domain address for the mlag domain
(config-mcec-domain)#domain-system-number 1	Number to identify the node in a domain
(config-mcec-domain)#intra-domain-link xe49/1	Intra domain line between mlag domain

(config-mcec-domain) #exit	Exit mcec domain mode.
(config) #commit	Commit the candidate configuration to the running configuration.

## TOR2

(config) #bridge 1 protocol provider-rstp edge	Create provider rstp bridge.
(config) #vlan database	Enter vlan database mode
(config-vlan) #vlan 2-10 type customer bridge 1 state enable	Enabling customer vlan for bridge
(config-vlan) #vlan 2-10 type service point-point bridge 1 state enable	Enabling service vlan for bridge
(config-vlan) #exit	Exit vlan database mode.
(config) #cvlan registration table map1 bridge 1	Creating registration table
(config-cvlan-registration) #cvlan 2 svlan 2	Mapping cvlan to svlan
(config-cvlan-registration) #cvlan 10 svlan 2	Mapping cvlan to svlan
(config-cvlan-registration) #exit	Exit cvlan registration mode.
(config) #commit	Commit the candidate configuration to the running configuration.
(config) #interface xe49/1	Entering interface mode
(config-if) #switchport	Configuring interface as switchport
(config-if) #exit	Exit interface mode.
(config) #interface mlag1	Entering mlag interface
(config-if) #switchport	Configuring interface as switchport
(config-if) #bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1 and disabling spanning-tree
(config-if) #switchport mode customer-edge hybrid	Set the switching characteristics of this interface to customer-edge hybrid
(config-if) #switchport customer-edge hybrid vlan 2	Set the switching characteristics of this interface to customer-edge hybrid and allow vlan 2
(config-if) #switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer-edge hybrid and allow vlan all
(config-if) #switchport customer-edge vlan registration map1	Configuring the registration table mapping on mlag interface
(config-if) #exit	Exit interface mode.
(config) #interface po1	Entering dynamic lag interface
(config-if) #switchport	Configuring interface as switchport
(config-if) #mlag 1	Enabling mlag group number
(config-if) #exit	Exit interface mode.
(config) #interface ge21	Entering interface mode

(config-if)#lacp force-up	Enable lacp force-up for the member port interface
(config-if)#channel-group 1 mode active	Add this interface to channel group 1
(config-if)#exit	Exit the interface mode
(config)#mcec domain configuration	Entering MCEC mode
(config-mcec-domain)#domain-address 2222.2222.2222	Domain address for the mlag domain
(config-mcec-domain)#domain-system-number 2	Number to identify the node in a domain
(config-mcec-domain)#intra-domain-link xe49/1	Intra domain line between mlag domain
(config-mcec-domain)#exit	Exit mcec domain mode.
(config)#commit	Commit the candidate configuration to the running configuration.

## SW1

(config)#config t	Enter configure terminal.
(config)#bridge 1 protocol rstp vlan-bridge	Configuring the rstp vlan bridge
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2-10 bridge 1 state enable	Configure customer vlan.
(config-vlan)#exit	Exit vlan configuration mode.
(config)#interface po1	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1 and disabling spanning-tree
(config-if)#switchport mode access	Configure switchport mode as access
(config-if)#switchport access vlan 2,10	Configure access vlan 2,10
(config-if)#exit	Exit interface mode.
(config)#interface ge1	Entering interface mode
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 .
(config-if)#exit	Exit interface mode.
(config)#interface ge21	Entering interface mode
(config-if)#channel-group 1 mode active	Add this interface to channel group 1.
(config-if)#exit	Exit interface mode.
(config-if)#interface ge46	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1and disabling spanning-tree
(config-if)#switchport mode hybrid	Set the switching characteristics of this interface to hybrid
(config-if)#switchport hybrid allowed vlan all	Set the switching characteristics of this interface to hybrid and allow vlan all

(config-if)#exit	Exit interface mode.
(config)#commit	Commit the candidate configuration to the running configuration.

## Validation

TOR1#show etherchannel summary

```

Aggregator po1 100001
Aggregator Type: Layer2
Admin Key: 32769 - Oper Key 16385
Link: ge1 (5026) sync: 1

```

TOR2#show etherchannel summary

```

Aggregator po1 100001
Aggregator Type: Layer2
Admin Key: 16385 - Oper Key 16385
Link: ge21 (5046) sync: 1

```

SW1#show etherchannel summary

```

Aggregator po2 100002
Aggregator Type: Layer2
Admin Key: 0002 - Oper Key 0002
Link: ge2 (5001) sync: 1
Link: ge22 (5021) sync: 1

```

TOR1#show mlag domain summary

-----  
Domain Configuration  
-----

```

Domain System Number      : 2
Domain Address             : 1111.2222.3333
Domain Priority            : 32768
Intra Domain Interface    : po99
Domain Adjacency          : UP

```

-----  
MLAG Configuration  
-----

MLAG-1

```

Mapped Aggregator         : po1
Physical properties Digest : 1 ef 71 4b 7f 37 5b 6a a5 8c e1 2f 95 9a fe cf
Total Bandwidth           : 2g
Mlag Sync                 : IN_SYNC
Mode                      : Active-Active
Current Mlag state        : Active

```

---

```
TOR2#show mlag domain summary
```

```
-----  
Domain Configuration  
-----
```

```
Domain System Number      : 1  
Domain Address            : 1111.2222.3333  
Domain Priority           : 32768  
Intra Domain Interface    : po99  
Domain Adjacency         : UP  
-----
```

```
MLAG Configuration  
-----
```

```
MLAG-1
```

```
  Mapped Aggregator       : po1  
  Physical properties Digest : 1 ef 71 4b 7f 37 5b 6a a5 8c e1 2f 95 9a fe cf  
  Total Bandwidth         : 2g  
  Mode                    : Active-Active  
  Current Mlag state      : Activ
```

```
TOR1#show mac address-table count bridge 1 interface mlag1
```

```
MAC Entries for all vlans:
```

```
Dynamic Address Count: 1001
```

```
Static (User-defined) Unicast MAC Address Count: 0
```

```
Static (User-defined) Multicast MAC Address Count: 0
```

```
Total MAC Addresses in Use: 1001
```

```
TOR1#show mac address-table 1 count bridge 1 interface mlag1
```

```
MAC Entries for all vlans:
```

```
Total MAC Addresses in Use: 500
```

```
TOR1#show mac address-table r count bridge 1 interface mlag1
```

```
MAC Entries for all vlans:
```

```
Total MAC Addresses in Use: 501
```

```
TOR2#show mac address-table count bridge 1 interface mlag1
```

```
MAC Entries for all vlans:
```

```
Dynamic Address Count: 1001
```

```
Static (User-defined) Unicast MAC Address Count: 0
```

```
Static (User-defined) Multicast MAC Address Count: 0
```

```
Total MAC Addresses in Use: 1001
```

```
TOR2#show mac address-table 1 count bridge 1 interface mlag1
```

```
MAC Entries for all vlans:
```

```
Total MAC Addresses in Use: 501
```

```
TOR2#show mac address-table r count bridge 1 interface mlag1
```

```
MAC Entries for all vlans:
```

```
Total MAC Addresses in Use: 500
```

Note: For MLAG case, admin should configure 'force-up' port either on master node or slave node only.

Example: In a static trunk environment, Preboot eXecution Environment (PXE) images are too small for most operating systems to leverage LACP during the boot process. As a result, during a PXE build process, traffic sent by the server is dropped, and the build process can fail.

To correct this situation, a port on an ICX 7750 device connected to a server that is configured as an MCT client can be set to a "force-up" state so that even if the LACPDU is not received from the server, the connected port is up and forwards packets.

To simulate this scenario we can remove channel-group configurations from the server side switch SW1 and check LACP force-up is getting enabled on TOR1:

SW1(config)#interface ge1	Enter interface mode.
SW1(config-if)#no channel-group	Removing channel-group configurations from interface.
SW1(config-if)#exit	Exit interface mode.
SW1(config)#interface ge21	Enter interface mode.
SW1(config-if)#no channel-group	Removing channel-group configurations from interface.
SW1(config-if)#exit	Exit interface mode.
SW1(config)#commit	Commit the candidate configuration to the running Configuration.

```
TOR1#show etherchannel summary
  Aggregator pol 100001
  Aggregator Type: Layer2
  Admin Key: 32769 - Oper Key 16385
    Link: ge1 (5026) sync: 0 (force-up)
```

```
TOR2#show etherchannel summary
  Aggregator pol 100001
  Aggregator Type: Layer2
  Admin Key: 16385 - Oper Key 16385
    Link: ge21 (5046) sync: 0
```

```
TOR1#show mlag domain summary
-----
Domain Configuration
-----
Domain System Number      : 2
Domain Address             : 1111.2222.3333
Domain Priority            : 32768
Intra Domain Interface    : po99
Domain Adjacency          : UP
-----
MLAG Configuration
-----
MLAG-1
  Mapped Aggregator        : pol
  Physical properties Digest : 1 ef 71 4b 7f 37 5b 6a a5 8c e1 2f 95 9a fe cf
```



```

Total Bandwidth      : 1g
Mlag Sync            : IN_SYNC
Mode                 : Active-Active
Current Mlag state   : Active

```

TOR2#show mlag domain summary

-----  
Domain Configuration  
-----

```

Domain System Number : 1
Domain Address        : 1111.2222.3333
Domain Priority        : 32768
Intra Domain Interface : po99
Domain Adjacency       : UP

```

-----  
MLAG Configuration  
-----

```

MLAG-1
Mapped Aggregator      : po1
Physical properties Digest : 1 ef 71 4b 7f 37 5b 6a a5 8c e1 2f 95 9a fe cf
Total Bandwidth        : 1g
Mlag Sync              : IN_SYNC
Mode                   : Active-Active
Current Mlag state     : Active

```

To forward traffic from ge1 of SW2:

SW1(config)#interface ge1	Enter interface mode.
SW1(config-if)#switchport	Make the interface as switch port.
SW1(config-if)#bridge-group 1 spanning-tree disable	Associate the interface to bridge.
SW1(config-if)#switchport mode access	Configure the mode as access.
SW1(config-if)#switchport access vlan 4001	Configure allowed vlan 4001 for the access mode.
SW1(config-if)#load-interval 30	Configure load period in multiple of 30 seconds.
SW1(config-if)#commit	Commit the candidate configuration to the running configuration.
SW1(config-if)#exit	Exit interface mode.

```

TOR1#show mac address-table count bridge 1 interface mlag1
MAC Entries for all vlans:
Dynamic Address Count: 999
Static (User-defined) Unicast MAC Address Count: 0
Static (User-defined) Multicast MAC Address Count: 0
Total MAC Addresses in Use: 999
TOR1#show mac address-table 1 count bridge 1 interface mlag1
MAC Entries for all vlans:

```

```
Total MAC Addresses in Use: 999
TOR1#show mac address-table r count bridge 1 interface mlag1
MAC Entries for all vlans:
Total MAC Addresses in Use: 0
```

```
TOR2#show mac address-table count bridge 1 interface mlag1
MAC Entries for all vlans:
Dynamic Address Count: 0
Static (User-defined) Unicast MAC Address Count: 0
Static (User-defined) Multicast MAC Address Count: 0
Total MAC Addresses in Use: 0
```

```
TOR2#show mac address-table l count bridge 1 interface mlag1
MAC Entries for all vlans:
Total MAC Addresses in Use: 0
TOR2#show mac address-table r count bridge 1 interface mlag1
MAC Entries for all vlans:
Total MAC Addresses in Use: 0
```

```
TOR1#show etherchannel summary
  Aggregator po1 100001
  Aggregator Type: Layer2
  Admin Key: 32769 - Oper Key 16385
    Link: ge1 (5026) sync: 0 (force-up)
```

```
TOR1#show etherchannel detail
  Aggregator po1 100001
  Aggregator Type: Layer2
  Mac address: 14:02:ec:1c:31:5b
  Admin Key: 32769 - Oper Key 16385
    Actor LAG ID- 0x8000,11-11-22-22-33-33,0x4001
    Receive link count: 0 - Transmit link count: 0
    Individual: 0 - Ready: 1
  Partner LAG ID- 0x0000,00-00-00-00-00-00,0x0000
    Link: ge1 (5026) sync: 0 (force-up)
  Collector max delay: 5
```

```
SW1#show interface counters rate mbps
```

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
ge1	0.00	0	726.53	1418994
ge46	772.68	1420362	0.00	0

TOR1#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
ge1	729.42	1424656	0.00	0
mlag1	729.42	1424655	0.00	0
po1	729.43	1424658	0.00	0

---

## CHAPTER 7 LACP Aggregator Force-up

---

### Overview

Link Aggregation Control Protocol (LACP) facilitates the bundling of multiple physical interfaces into a single logical link, enhancing bandwidth and providing redundancy. Aggregator Force-Up extends LACP functionality by enabling links to be forced into an active state without successful LACP negotiation. This is crucial in environments where connected devices, such as servers during boot stages, might not support LACP or have temporary configuration limitations.

---

### Feature Characteristics

- Allows all interfaces within a Link Aggregation Group (LAG) or MLAG to be manually set to an active state without requiring successful LACP negotiation.
- In force-up state, each physical interface in a LAG or MLAG acts as an independent bridge-port, handling MAC learning and L2 traffic independently rather than as part of the aggregated link.
- LACP agg force-up can be enabled in LAG or MLAG interface not in physical interface.
- Interfaces automatically transition out of force-up state and resume normal LACP-based operations when LACP communication is successfully established on any of the links.

---

### Benefits

- Keeps network traffic flowing even when there's a synchronization issue, preventing data loss and maintaining connectivity.
- Automatically switches the links to independent operation mode without manual intervention, simplifying network management.
- When synchronization is restored on any link, the LAG returns to its efficient, aggregated state.

---

## LACP Aggregator Force-up for Dynamic LAG Configuration

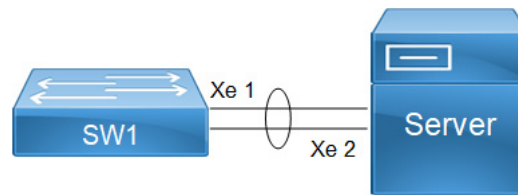
Set up LACP Aggregator Force-Up to maintain network connectivity even when synchronization with the LACP partner is lost all member links in the LAG.

---

### Topology

The provided topology diagram consists of a switch and a server (SW1 and server) connected to each other.

SW1: This the central switch in the topology. They are connected through two interfaces (xe1 and xe2).



**Figure 7-15: LACP Aggregator Force-up for Dynamic LAG**

To configure LACP Aggregator Force-up for LAG on switch SW1 and Server, follow the steps:

1. Create VLANs and Bridge:

1. Establish a bridge instance (`bridge 1`) with RSTP as the spanning tree protocol for VLAN-based bridging.
2. Define VLANs 2 to 100 and associate it with (`bridge 1`) to enable the VLANs for bridging operations, and commit the changes.

```
SW1(config)# bridge 1 protocol rstp vlan-bridge
SW1(config)# vlan database
SW1(config-vlan)# vlan 2-100 bridge 1 state enable
SW1(config-vlan)# commit
SW1(config-vlan)# exit
```

2. Configure Port-channel Interface (`po1`) Aggregate Link between SW1 and Server:

1. Enter configuration mode for Port-channel interface 1 (`po1`).
2. Configure (`po1`) as a Layer 2 switchport.
3. Associate (`po1`) with `bridge group 1` so that it operates within the defined bridging context.
4. Set (`po1`) to trunk mode to carry traffic for multiple VLANs.
5. Configure (`po1`) to carry traffic for all VLANs, facilitating communication across different VLANs within the network.
6. Configure channel-group 1 for (`po1`) in active mode for LACP operation:

```
SW1(config)# interface po1
SW1(config-if)# switchport
SW1(config-if)# bridge-group 1
SW1(config-if)# switchport mode trunk
SW1(config-if)# switchport trunk allowed vlan all
SW1(config-if)# commit
SW1(config-if)# exit
```

3. Configure the Interfaces (`xe1` and `xe2`):

1. Enter configuration mode for each interface (`xe1` and `xe2`).
2. Assign (`xe1` and `xe2`) to channel-group 1 to participate in the LACP bundle formed by `po1`, ensuring load balancing and redundancy across member links.

**Note:** Follow similar steps for SW2, adjusting interface names and configurations accordingly to maintain consistency across the network.

```
SW1(config)# interface xe1
SW1(config-if)# channel-group 1 mode active
SW1(config-if)# exit
```

```
SW1(config)# interface xe2
SW1(config-if)# channel-group 1 mode active
SW1(config-if)# exit
```

#### 4. Enable LACP Aggregator Force-Up on po1.

```
SW1(config)# interface po1
SW1(config-if)# lacp agg force-up
SW1(config-if)# commit
SW1(config-if)# exit
```

## LACP Aggregator Force-up for MLAG Configuration

Set up LACP Aggregator Force-Up to maintain network connectivity even when synchronization with the LACP partner is lost on all member links in the MLAG.

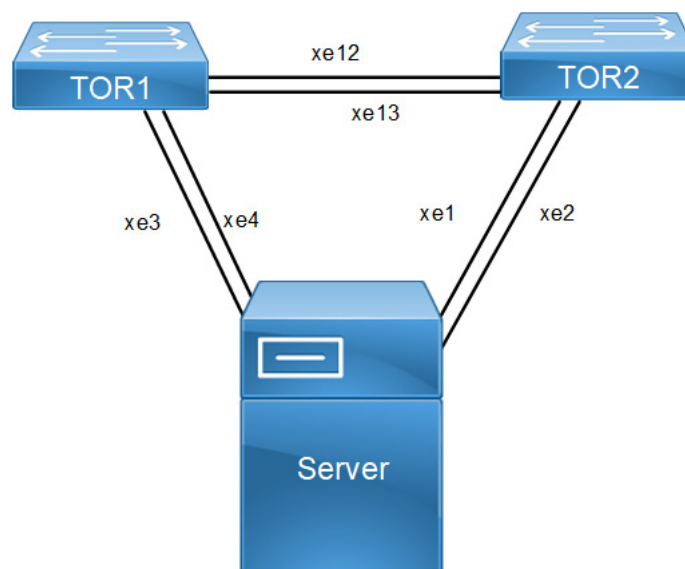
### Topology

This topology showcases a network setup designed to maximize redundancy, load balancing, and fault tolerance using MLAG and LACP with a Force-Up feature. The network is structured around top-of-rack switches (TOR1 and TOR2).

TOR1 and TOR2 operate as MLAG peers. This setup allows to appear as a single logical switch to connected device (Server).

Traffic can be distributed across the (TOR1 and TOR2), and if one switch fails, the other can handle the load without service interruption. The LACP Aggregator Force-Up feature is enabled to keep port channel member ports operationally up if all member links go down.

This ensures that the remains up, facilitating immediate traffic redirection and avoiding delays associated with LACP negotiation. Both TOR1 and TOR2 connect to server through multiple links, providing path redundancy. If any link or switch fails, the remaining links and switches maintain network connectivity and balance the load, thus avoiding single points of failure.



**Figure 7-16: LACP Aggregator Force-up for MLAG**

To configure LACP Aggregator Force-up for MLAG on switches TOR1, and TOR2, follow the steps:

1. Create VLANs and Bridge on TOR1, and TOR2:

1. Establish a bridge instance (`bridge 1`) with RSTP as the spanning tree protocol for VLAN-based bridging.
2. Define required vlans for example: VLANs 2 to 100 and associate it with (`bridge 1`) to enable the VLANs for bridging operations, and commit the changes.

```
TOR1(config)# bridge 1 protocol rstp vlan-bridge
TOR1(config)# vlan database
TOR1(config-vlan)# vlan 2-100 bridge 1 state enable
TOR1(config-vlan)# commit
TOR1(config-vlan)# exit
```

2. Configure Port Channels (`po`) as trunk ports allowing all VLANs, and commit the changes: For TORs: Configure interface `mlag1`, `po1`, `po3` as needed:

1. Enter configuration mode for (`mlag1`).
2. Configure (`mlag1`) as a Layer 2 switchport.
3. Associate (`mlag1`) with bridge group 1 so that it operates within the defined bridging context.
4. Set (`mlag1`) to trunk mode to carry traffic for multiple VLANs.

```
TOR1(config)#interface mlag1
TOR1(config-if)#switchport
TOR1(config-if)#bridge-group 1
TOR1(config-if)#switchport mode trunk
TOR1(config-if)#switchport trunk allowed vlan all
TOR1(config-if)#mode active-active
TOR1(config-if)#commit
TOR1(config-if)#exit
```

5. Configure `po1` and map to `mlag1`.

```
TOR1(config)#interface po1
TOR1(config-if)#switchport
TOR1(config-if)#mlag 1
TOR1(config-if)#commit
```

6. Configure `po3`.

```
TOR1(config)#interface po3
TOR1(config-if)#switchport
TOR1(config-if)#commit
```

3. Configure the Interfaces (For TOR1 `xe3`, `xe4`, `xe12`, and `xe13`, and For TOR2 `xe1`, `xe2`, `xe12`, and `xe13`):

1. Enter configuration mode for each interface.
2. Assign to channel-group 1 to participate in the LACP bundle formed by `po1`, ensuring load balancing and redundancy across member links.
3. Configure as a Layer 2 switchport with trunk mode and allow all VLANs to facilitate communication across different VLANs within the network.

```
TOR1(config)#interface xe3
TOR1(config-if)#channel-group 1 mode active
TOR1(config-if)#exit
TOR1(config)#interface xe4
```

```

TOR1(config-if)#channel-group 1 mode active
TOR1(config-if)#commit
TOR1(config-if)#exit
TOR1(config)#interface xe12
TOR1(config-if)#channel-group 3 mode active
TOR1(config-if)#exit
TOR1(config)#interface xe13
TOR1(config-if)#channel-group 3 mode active
TOR1(config-if)#commit
TOR1(config) Enable LACP Aggregator Force-up on MLAG interfaces in TOR1 and
TOR2:
TOR1(config)#interface mlag1
TOR1(config-if)#lacp agg force-up
TOR1(config-if)#commit
TOR1(config-if)#exit

```

**Note:** Similarly, follow the steps to configure `mlag1` for TOR2.

## Configuration Snapshot

### Dynamic LAG:

```

bridge 1 protocol rstp vlan-bridge
vlan database
vlan 2-4000 bridge 1 state enable
!
interface po1
switchport
bridge-group 1
switchport mode trunk
switchport trunk allowed vlan all
load-interval 30
port-channel load-balance rtag7
lacp agg force-up
!
interface xe1
channel-group 1 mode active
!
interface xe2
channel-group 1 mode active
!
exit

```

### MLAG:

```

bridge 1 protocol rstp vlan-bridge
vlan database
vlan 2-4000 bridge 1 state enable
!
interface mlag1
switchport
bridge-group 1
switchport mode trunk
switchport trunk allowed vlan all
load-interval 30
lacp agg force-up
!
interface po1

```



```

    port-channel load-balance rtag7
    switchport
    mlag 1
    !
interface po3
    switchport
    port-channel load-balance rtag7
    !
interface xe3
    channel-group 1 mode active
    !
interface xe4
    channel-group 1 mode active
    !
interface xe12
    channel-group 3 mode active
    !
interface xe13
    channel-group 3 mode active
    !
exit
    !
mcec domain configuration
    domain-address 1111.2222.3333
    domain-system-number 1
    intra-domain-link po3

```

---

## Dynamic LAG Validation

- Verify agg force-up is enabled in SW1.

```

SW1#show etherchannel summary
Aggregator po1 100001
Port-channel Force-Up Mode : Activated
Aggregator Type: Layer2
Admin Key: 0001 - Oper Key 0001
    Link: xe1 (5034) sync: 0 (agg-force-up)
    Link: xe2 (5035) sync: 0 (agg-force-up)

```

---

## MLAG Validation

- Verify agg force-up is enabled in TOR1.

```
TOR1#show mlag domain summary
```

```

-----
Domain Configuration
-----

```

```

Domain System Number      : 1
Domain Address             : 1111.2222.3333
Domain Priority            : 32768
Intra Domain Interface    : po3
Domain Adjacency          : UP

```

```

MCEC PDU local version      : 1
MCEC PDU peer version      : 1
Domain Sync via            : Intra-domain-interface
Peer SVI interface MAC Address : 5C.07.58.6F.83.5E

```

---

#### MLAG Configuration

---

##### MLAG-1

```

Mapped Aggregator          : po1
Physical properties Digest  : 54 a9 3a 2a 2b 50 65 bb 3c bc 3d bd c2 43 d6 22
Total Bandwidth            : 0
Mlag Sync                  : IN_SYNC
Mode                       : Active-Active
Current Mlag state         : Standby
Aggregator Force-Up Mode   : Activated

```

##### TOR1#show etherchannel summary

```

Aggregator po1 100001
Mlag Force-Up Mode : Activated
Aggregator Type: Layer2
Parent Aggregator : Active mlag1
Admin Key: 16385 - Oper Key 16385
  Link: xe3 (5004) sync: 0 (agg-force-up) (Mlag-active-link)
  Link: xe4 (5008) sync: 0 (agg-force-up) (Mlag-active-link)

```

```

Aggregator po3 100003
Aggregator Type: Layer2
Admin Key: 0003 - Oper Key 0003
  Link: xe12 (5011) sync: 1
  Link: xe13 (5015) sync: 1

```

---

## Implementation Examples

### Dynamic Port-Channel configuration:

Both interfaces in the dynamic port-channel must support force-up to allow the server to boot using any connected link.

During the server's boot stage, the force-up feature ensures that any one of the connected interfaces can be used to initiate and complete the boot process, while the other interface remains inactive until LACP communication is established.

### MLAG Configuration Requirement:

To support network booting, the MLAG domain is configured with LACP force-up. This allows at least one link to become active, ensuring the server can boot over the network.

Typically, all interfaces (xe1, xe2, xe3, xe4) need to be prepared to provide force-up capabilities to handle server booting flexibility.

### Traffic Management:

When in force-up state, each interface operates as an individual bridge-port.

---

## CLI Commands

The LACP aggregator force-up feature introduces the `lacp agg force-up` configuration command.

---

### lacp agg force-up

Use this command to configure Aggregator Force-up on Dynamic LAG or Dynamic MLAG interface.

If this command is enabled and LACP Partner sync is not established on any of the member links in Aggregator then, all the member links will enter Aggregator Force-up state in which they will act like individual bridge ports with respect to Layer2 Learning, Flooding, or Forwarding. Once LACP Partner sync is established on atleast one member link, the members will exit Aggregator Force-up and become part of the LAG that is normal LAG functioning is retained.

Use `no lacp agg force-up` parameter of this command to disable the aggregator force-up state.

#### Command Syntax

```
lacp agg force-up
no lacp agg force-up
```

#### Parameters

None

#### Default

Disabled

#### Command Mode

Interface mode

#### Applicability

Introduced the `lacp agg force-up` parameter in the OcNOS version 6.5.2.

#### Example

The following sequence of commands is used to configure the LACP Aggregator Force-Up feature in MLAG:

```
#configure terminal
(config)#interface mlag1
(config-if)#lacp agg force-up
(config-if)#exit
```

The following sequence of commands is used to configure the LACP Aggregator Force-Up feature in Dynamic LAG:

```
#configure terminal
(config)#interface po1
(config-if)#lacp agg force-up
(config-if)#exit
```

---

## Glossary

The following provides definitions for key terms or abbreviations and their meanings used throughout this document:

Key Terms/Acronym	Description
Link Aggregation Control Protocol (LACP)	A protocol provides a way to bundle several physical ports together to form a single logical channel for the purpose of increasing bandwidth and providing redundancy.
Aggregator	A group of physical interfaces that are combined into a single logical interface (known as a port channel or link aggregation group) for load balancing and redundancy.
Aggregator Force-Up	A feature that keeps the members of LACP aggregator (port channel) operationally up, even if all member links are down. This is typically used in scenarios where there is server boot up.
Multi-Chassis Link Aggregation Group (MLAG)	Creation of a single logical link aggregation group across two separate switches, providing redundancy and load balancing across multiple chassis.
Port Channel (Po)	A logical grouping of multiple physical network interfaces, combined to act as a single interface. This allows for increased bandwidth and redundancy.
Active Mode	In LACP, active mode means the device actively initiates LACP negotiations and participates in the formation of LACP port channels.
Passive Mode	In LACP, passive mode means the device only responds to LACP packets but does not initiate the formation of LACP port channels.

# CHAPTER 8 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.

Note: The `lldp-agent` command is not supported for SVLAN, VLAN, and loop-back interfaces.

## Topology

Figure 8-17 displays a sample LLDP topology.



Figure 8-17: LLDP Topology

## LLDPv2 (Interface Mode TLV)

### Default Agent

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

<code>#configure terminal</code>	Enter configure mode.
<code>(config)#bridge 1 protocol ieee vlan-bridge</code>	Configure an IEEE VLAN-aware bridge.
<code>(config)#vlan database</code>	Enter VLAN configure mode.
<code>(config-vlan)#vlan 2 bridge 1 state enable</code>	Configure a VLAN and add it to the bridge.
<code>(config-vlan)#exit</code>	Exit the VLAN configuration mode.
<code>(config)#interface eth1</code>	Enter interface mode.
<code>(config-if)#switchport</code>	Set switching characteristics on the port.
<code>(config-if)#bridge-group 1</code>	Associate the interface to the bridge.
<code>(config-if)#lldp-agent</code>	Enter into the default agent
<code>(if-lldp-agent)#set lldp enable txrx</code>	Enable an LLDP agent on the port.
<code>(if-lldp-agent)#set lldp chassis-id-tlv ip-address</code>	Configure the subtype for chassis-id TLV
<code>(if-lldp-agent)#set lldp port-id-tlv mac-address</code>	Configure the subtype for port-id TLV

(if-lldp-agent)# lldp tlv basic-mgmt port-description select	Enable the port-description TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv basic-mgmt system-name select	Enable the system-name TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv basic-mgmt system-capabilities select	Enable the system-capabilities TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv basic-mgmt system-description select	Enable the system-description TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv basic-mgmt management-address select	Enable the management-address TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific port-vlanid select	Enable the VLAN-id TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific vlan-name select	Enable the VLAN-NAME TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific port-ptcl-vlanid select	Enable the Port and Protocol VLAN id TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific ptcl-identity select	Enable the Protocol Identity TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific vid-digest select	Enable the VID Usage Digest TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific mgmt-vid select	Enable the Management VID TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific link-agg select	Enable the Link Aggregation TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8023-org-specific mac-phy select	Enable the MAC/PHY Configuration/Status TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8023-org-specific max-mtu-size select	Enable the Maximum Frame Size TLV to be transmitted on the port
(if-lldp-agent)#set lldp timer msg-fast-tx 5	Defines the time interval during fast transmission periods
(if-lldp-agent)#set lldp tx-fast-init 6	Defines the number of LLDPDUs that are transmitted during a fast transmission period
(if-lldp-agent)#exit	Exit the lldp agent mode
(config-if)#commit	Commit the transaction.
(config-if)#exit	Exit interface mode.

## Validation

1. Verify the LLDP configurations in the local machine

```
#show running-config lldp
!
interface eth0
  lldp-agent
!
interface eth1
  lldp-agent
```

```

set lldp enable txrx
set lldp chassis-id-tlv ip-address
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 max-mtu-size
set lldp timer msg-fast-tx 5
set lldp tx-fast-init 6
!
interface eth2
  lldp-agent
!
interface eth3
  lldp-agent

```

## 2. Verify the LLDP port statistics

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

```

Agent Mode                : Nearest bridge
Enable (tx/rx)            : Y/Y
Message fast transmit time : 5
Message transmit interval : 30
Message fast transmit interval : 6
Maximum transmit credit    : 5
Reinitialisation delay     : 2
MED Enabled                : N
Device Type                : Not Defined
Traffic statistics         :
Total frames transmitted    : 0
Total entries aged         : 0
Total frames received       : 5
Total error frames received : 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 machine.

#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)#switchport	Set switching characteristics on the port.
(config-if)#bridge-group 1	Associate the interface to the bridge.
(config-if)#lldp-agent customer-bridge	Enter into the Customer Bridge agent
(if-lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(if-lldp-agent)#set lldp chassis-id-tlv ip-address	Configure the subtype for chassis-id TLV
(if-lldp-agent)#set lldp port-id-tlv mac-address	Configure the subtype for port-id TLV
(if-lldp-agent)# lldp tlv basic-mgmt port-description select	Enable the port-description TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv basic-mgmt system-name select	Enable the system-name TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv basic-mgmt system-capabilities select	Enable the system-capabilities TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv basic-mgmt system-description select	Enable the system-description TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv basic-mgmt management-address select	Enable the management-address TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv ieee-8021-org-specific port-vlanid select	Enable the VLAN-id TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv ieee-8021-org-specific vlan-name select	Enable the VLAN-NAME TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv ieee-8021-org-specific port-ptcl-vlanid select	Enable the Port and Protocol VLAN id TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv ieee-8021-org-specific ptcl-identity select	Enable the Protocol Identity TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv ieee-8021-org-specific vid-digest select	Enable the VID Usage Digest TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific mgmt-vid select	Enable the Management VID TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv ieee-8021-org-specific link-agg select	Enable the Link Aggregation TLV to be transmitted on the port.
(if-lldp-agent)# lldp tlv ieee-8023-org-specific mac-phy select	Enable the MAC/PHY Configuration/Status TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8023-org-specific max-mtu-size select	Enable the Maximum Frame Size TLV to be transmitted on the port.
(if-lldp-agent)#set lldp timer msg-fast-tx 5	Defines the time interval during fast transmission periods.
(if-lldp-agent)#set lldp tx-fast-init 6	Defines the number of LLD PDUs that are transmitted during a fast transmission period.



(if-lldp-agent) #exit	Exit the lldp agent mode
(config-if) #commit	Commit the transaction.
(config-if) #exit	Exit interface mode.

## Validation

### 1. Verify the LLDP configurations in the local machine

```
#show running-config lldp
!
interface eth1
  lldp-agent customer-bridge
  set lldp enable txrx
  set lldp chassis-id-tlv ip-address
  set lldp port-id-tlv mac-address
  lldp tlv basic-mgmt port-description select
  lldp tlv basic-mgmt system-name select
  lldp tlv basic-mgmt system-description select
  lldp tlv basic-mgmt system-capabilities select
  lldp tlv basic-mgmt management-address select
  lldp tlv ieee-8021-org-specific port-vlanid select
  lldp tlv ieee-8021-org-specific port-ptcl-vlanid select
  lldp tlv ieee-8021-org-specific vlan-name select
  lldp tlv ieee-8021-org-specific ptcl-identity select
  lldp tlv ieee-8021-org-specific vid-digest select
  lldp tlv ieee-8021-org-specific mgmt-vid select
  lldp tlv ieee-8021-org-specific link-agg select
  lldp tlv ieee-8023-org-specific mac-phy select
  lldp tlv ieee-8023-org-specific max-mtu-size select
  set lldp timer msg-fast-tx 5
  set lldp tx-fast-init 6
!
```

### 2. Verify the LLDP port statistics

```
#show lldp interface eth1 customer-bridge

Agent Mode                               : Customer-bridge
Enable (tx/rx)                           : Y/Y
Message fast transmit time                : 5
Message transmit interval                 : 30
Message fast transmit interval            : 6
Maximum transmit credit                   : 5
Reinitialisation delay                    : 2
MED Enabled                              : N
Device Type                              : Not Defined
Traffic statistics                         :
Total frames transmitted                   : 5
Total entries aged                        : 0
Total frames received                     : 0
Total error frames received                : 0
Total frames discarded                     : 0
Total discarded TLVs                      : 0
Total unrecognised TLVs                   : 0
```

## Non-Tpmr-Bridge

The below configurations 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)#switchport	Set switching characteristics on the port.
(config-if)#bridge-group 1	Associate the interface to the bridge.
(config-if)#lldp-agent non-tpmr-bridge	Enter into the Non tpmr Bridge agent
(if-lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(if-lldp-agent)#set lldp chassis-id-tlv ip-address	Configure the subtype for chassis-id TLV
(if-lldp-agent)#set lldp port-id-tlv mac-address	Configure the subtype for port-id TLV
(if-lldp-agent)# lldp tlv basic-mgmt port-description select	Enable the port-description TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv basic-mgmt system-name select	Enable the system-name TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv basic-mgmt system-capabilities select	Enable the system-capabilities TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv basic-mgmt system-description select	Enable the system-description TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv basic-mgmt management-address select	Enable the management-address TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific port-vlanid select	Enable the VLAN-id TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific vlan-name select	Enable the VLAN-NAME TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific port-ptcl-vlanid select	Enable the Port and Protocol VLAN id TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific ptcl-identity select	Enable the Protocol Identity TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific vid-digest select	Enable the VID Usage Digest TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8021-org-specific mgmt-vid select	Enable the Management VID TLV to be transmitted on the port

(if-lldp-agent)# lldp tlv ieee-8021-org-specific link-agg select	Enable the Link Aggregation TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8023-org-specific mac-phy select	Enable the MAC/PHY Configuration/Status TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv ieee-8023-org-specific max-mtu-size select	Enable the Maximum Frame Size TLV to be transmitted on the port
(if-lldp-agent)#set lldp timer msg-fast-tx 5	Defines the time interval during fast transmission periods
(if-lldp-agent)#set lldp tx-fast-init 6	Defines the number of LLD PDUs that are transmitted during a fast transmission period
(if-lldp-agent)#exit	Exit the lldp agent mode
(config-if)#commit	Commit the transaction.
(config-if)#exit	Exit interface mode.

## Validation

### 1. Verify the LLDP configurations in the local machine

```
#show running-config lldp
!
interface eth1
lldp-agent non-tpmr-bridge
set lldp enable txrx
set lldp chassis-id-tlv ip-address
set lldp port-id-tlv mac-address
lldp tlv basic-mgmt port-description select
lldp tlv basic-mgmt system-name select
lldp tlv basic-mgmt system-description select
lldp tlv basic-mgmt system-capabilities select
lldp tlv basic-mgmt management-address select
lldp tlv ieee-8021-org-specific port-vlanid select
lldp tlv ieee-8021-org-specific port-ptcl-vlanid select
lldp tlv ieee-8021-org-specific vlan-name select
lldp tlv ieee-8021-org-specific ptcl-identity select
lldp tlv ieee-8021-org-specific vid-digest select
lldp tlv ieee-8021-org-specific mgmt-vid select
lldp tlv ieee-8021-org-specific link-agg select
lldp tlv ieee-8023-org-specific mac-phy select
lldp tlv ieee-8023-org-specific max-mtu-size select
set lldp timer msg-fast-tx 5
set lldp tx-fast-init 6
!
```

### 2. Verify the LLDP port statistics

```
#show lldp interface eth1 non-tpmr-bridge
```

```
Agent Mode                : Non-TPMR-bridge
Enable (tx/rx)            : Y/Y
Message fast transmit time : 5
Message transmit interval : 30
Message fast transmit interval : 6
Maximum transmit credit   : 5
Reinitialisation delay    : 2
```

```

MED Enabled                : N
Device Type                 : Not Defined
Traffic statistics          :
Total frames transmitted    : 6
Total entries aged         : 0
Total frames received       : 0
Total error frames received : 0
Total frames discarded      : 0
Total discarded TLVs        : 0
Total unrecognised TLVs    : 0

```

## LLDPV2 (Global Mode TLV)

LLDPv2 TLVs can be configured globally, making it applicable for all interfaces where LLDP is enabled.

### Topology

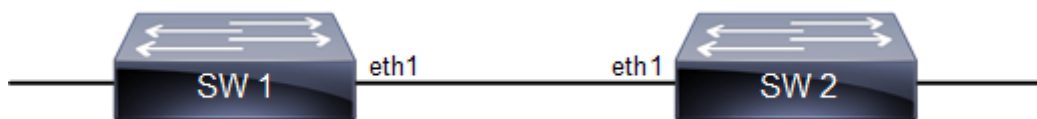


Figure 8-18: LLDP topology

### SW1

SW1#configure terminal	Enter Configure mode
SW1(config)#lldp tlv-select basic-mgmt port-description	Enable LLDP port description TLV in global mode
SW1(config)#lldp tlv-select basic-mgmt system-name	Enable LLDP system name TLV in global mode
SW1(config)#lldp tlv-select basic-mgmt system-capabilities	Enable LLDP system capabilities TLV in global mode
SW1(config)#lldp tlv-select basic-mgmt system-description	Enable LLDP system description TLV in global mode
SW1(config)#lldp tlv-select basic-mgmt management-address	Enable LLDP port description TLV in global mode
SW1(config)#interface eth1	Enter interface mode
SW1(config-if)#lldp-agent	Enter LLDP interface mode
SW1(if-lldp-agent)#set lldp enable txrx	Enable LLDP TLV transmit and receive for the nearest bridge
SW1(if-lldp-agent)#exit	Exit LLDP mode
SW1(config-if)#commit	Commit the transaction.
SW1(config-if)#exit	Exit the configure mode

## SW2

SW2(config)#lldp tlv-select basic-mgmt port-description	Enable LLDP port description TLV in global mode
SW2(config)#lldp tlv-select basic-mgmt system-name	Enable LLDP system name TLV in global mode
SW2(config)#lldp tlv-select basic-mgmt system-capabilities	Enable LLDP system capabilities TLV in global mode
SW2(config)#lldp tlv-select basic-mgmt system-description	Enable LLDP system description TLV in global mode
SW2(config)#lldp tlv-select basic-mgmt management-address	Enable LLDP management address TLV in global mode
SW2(config)#interface eth1	Enter interface mode
SW2(config-if)#lldp-agent	Enter LLDP interface mode
SW2(if-lldp-agent)#set lldp enable txrx	Enable LLDP TLV transmit and receive for the nearest bridge
SW2(if-lldp-agent)#exit	Exit LLDP mode
SW2(config-if)#commit	Commit the transaction.
SW2(config)#end	Exit the configure mode

## Validation

```
SW1#show running-config lldp
!
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
!
```

```
SW1#show lldp neighbors
Loc PortID    Rem Host Name    Rem Chassis Id    Rem Port Id    Agent Mode
-----
Eth1          OcNOS            cc37.ab56.6d80    cc37.abbb.ed81  Nearest bridge
```

```
SW1#show lldp neighbors detail
```

```
-----
--

Nearest bridge Neighbors
Interface Name      : eth1
Mandatory TLVs
Chassis id type     : MAC address [cc37.ab56.6d80]
Port id type        : MAC address [cc37.abbb.ed81]
```

```
Time to live                : 121
Basic Management TLVs
System Name                 : SW2
System Description          : Hardware Model:CEL_BELGITE_E1070, Software
version: Oc
NOS,6.3.2.47
Port Description            : eth1
Remote System Capabilities : Bridge
                           Router
Capabilities Enabled        : Router
Management Address         : MAC Address [cc37.abbb.ed81]
Interface Number subtype   : ifindex
Interface Number           : 10046
OID Number                  : 0
802.1 Org specific TLVs
Port vlan id                : 0
Port & Protocol vlan id    : 0
Remote Configured VLANs    : None
Remote Protocols Advertised: None
Remote VID Usage Digest    : 0
Remote Management Vlan     : 0
Link Aggregation Capability: not capable of being aggregated
Link Aggregation Status    : not currently in aggregation
Link Aggregation Port ID   :
802.3 Org specific TLVs
AutoNego Support           : Not-Supported
AutoNego Status            : Disabled
AutoNego Capability        : 0
Operational MAU Type       : 0 [unknown]
Max Frame Size             :
SW1#
```

---

## 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)

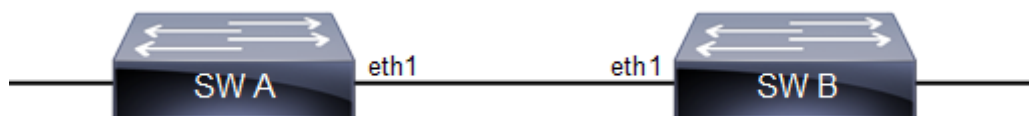
The LLDP-MED Communication Endpoint (Class III) definition is applicable to all endpoint products that act as end user communication appliances supporting IP media. Capabilities include all of the capabilities defined for the previous Generic Endpoint (Class I) and Media Endpoint (Class II) classes, 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
```

---

## Topology



---

## SW 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)#switchport	Set switching characteristics on the port.
(config-if)#bridge-group 1	Associate the interface to the bridge.
(config-if)#lldp-agent	Enter into the default agent
(if-lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(if-lldp-agent)# lldp tlv med media-capabilities select	Enable the med media capabilities TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv med network-policy select	Enable the med network policy TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv med location select	Enable the med location TLV to be transmitted on the port
(if-lldp-agent)#exit	Exit the lldp agent mode
(if-config-if)#lldp-agent customer-bridge	Enter into the customer-bridge agent
(if-lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(if-lldp-agent)# lldp tlv med media-capabilities select	Enable the med media capabilities TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv med network-policy select	Enable the med network policy TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv med location select	Enable the med location TLV to be transmitted on the port
(if-lldp-agent)#exit	Exit the lldp agent mode
(config-if)#lldp-agent non-tpmr-bridge	Enter into the non-tpmr-bridge agent
(if-lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(if-lldp-agent)# lldp tlv med media-capabilities select	Enable the med media capabilities TLV to be transmitted on the port
(if-lldp-agent)# lldp tlv med network-policy select	Enable the med network policy TLV to be transmitted on the port



(if-lldp-agent)# lldp tlv med location select	Enable the med location TLV to be transmitted on the port
(if-lldp-agent)#exit	Exit the lldp agent mode
(config-if)#set lldp med-devtype net-connect	Configure the med device type
(config-if)#exit	Exit interface mode.
(config)#commit	Commit the transaction.

## SW 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)#switchport	Set switching characteristics on the port.
(config-if)#bridge-group 1	Associate the interface to the bridge.
(config-if)#lldp-agent	Enter into the default agent
(if-lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(if-lldp-agent)#exit	Exit the lldp agent mode
(config-if)#lldp-agent customer-bridge	Enter into the customer-bridge agent
(if-lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(if-lldp-agent)#exit	Exit the lldp agent mode
(config-if)#lldp-agent non-tpmr-bridge	Enter into the non-tpmr-bridge agent
(if-lldp-agent)#set lldp enable txrx	Enable an LLDP agent on the port.
(if-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)#exit	Exit interface mode.
(config)#commit	Commit the transaction.

## Validation

1. Verify the LLDP configurations on Machine A

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

```

!
interface eth1
lldp-agent
set lldp enable txrx
lldp tlv med media-capabilities select
lldp tlv med network-policy select
lldp tlv med location select
set lldp med-devtype net-connect
lldp-agent non-tpmr-bridge
set lldp enable txrx
lldp tlv med media-capabilities select
lldp tlv med network-policy select
lldp tlv med location select
lldp-agent customer-bridge
set lldp enable txrx
lldp tlv med media-capabilities select
lldp tlv med network-policy select
lldp tlv med location select
!

```

## 2. Verify the LLDP port statistics on machine A

```
#show lldp interface eth1
```

```

Agent Mode                : Customer-bridge
  Enable (tx/rx)           : Y/Y
  Message fast transmit time : 1
  Message transmit interval : 30
  Message fast transmit interval : 4
  Maximum transmit credit   : 5
  Reinitialisation delay    : 2
  MED Enabled               : Y
  Device Type               : Network Connectivity
  Traffic statistics        :
    Total frames transmitted : 33
    Total entries aged       : 0
    Total frames received    : 34
    Total error frames received : 0
    Total frames discarded   : 0
    Total discarded TLVs     : 0
    Total unrecognised TLVs  : 0
Agent Mode                : Non-TPMR-bridge
  Enable (tx/rx)           : Y/Y
  Message fast transmit time : 1
  Message transmit interval : 30
  Message fast transmit interval : 4
  Maximum transmit credit   : 5
  Reinitialisation delay    : 2
  MED Enabled               : Y
  Device Type               : Network Connectivity
  Traffic statistics        :
    Total frames transmitted : 30
    Total entries aged       : 0
    Total frames received    : 31
    Total error frames received : 0
    Total frames discarded   : 0
    Total discarded TLVs     : 0

```

```

    Total unrecognised TLVs      : 0
Agent Mode                      : Nearest bridge
  Enable (tx/rx)                : Y/Y
  Message fast transmit time    : 1
  Message transmit interval     : 30
  Message fast transmit interval : 4
  Maximum transmit credit       : 5
  Reinitialisation delay        : 2
  MED Enabled                   : Y
  Device Type                   : Network Connectivity
Traffic statistics              :
  Total frames transmitted      : 30
  Total entries aged            : 0
  Total frames received         : 31
  Total error frames received   : 0
  Total frames discarded        : 0
  Total discarded TLVs         : 0
  Total unrecognised TLVs      : 0

```

```
#show lldp interface eth1 non-tpmr-bridge
```

```

Agent Mode                      : Non-TPMR-bridge
  Enable (tx/rx)                : Y/Y
  Message fast transmit time    : 1
  Message transmit interval     : 30
  Message fast transmit interval : 4
  Maximum transmit credit       : 5
  Reinitialisation delay        : 2
  MED Enabled                   : Y
  Device Type                   : Network Connectivity
Traffic statistics              :
  Total frames transmitted      : 32
  Total entries aged            : 0
  Total frames received         : 33
  Total error frames received   : 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 eth0
  lldp-agent
!
interface eth1
  lldp-agent
    set lldp enable txrx
    set lldp chassis-id-tlv ip-address
  set lldp med-devtype ep-class3
  lldp-agent non-tpmr-bridge
    set lldp enable txrx
    set lldp chassis-id-tlv ip-address
  lldp-agent customer-bridge

```

```

set lldp enable txrx
set lldp chassis-id-tlv ip-address
!
```

#### 4. Verify the LLDP port statistics on machine B

```

#show lldp interface eth1
Agent Mode                               : Customer-bridge
Enable (tx/rx)                           : Y/Y
Message fast transmit time                : 1
Message transmit interval                 : 30
Message fast transmit interval            : 4
Maximum transmit credit                   : 5
Reinitialisation delay                    : 2
MED Enabled                              : Y
Device Type                              : End Point Class-3
Traffic statistics                         :
Total frames transmitted                   : 0
Total entries aged                        : 0
Total frames received                      : 8
Total error frames received                : 0
Total frames discarded                     : 0
Total discarded TLVs                      : 0
Total unrecognised TLVs                   : 0
Agent Mode                               : Non-TPMR-bridge
Enable (tx/rx)                           : Y/Y
Message fast transmit time                : 1
Message transmit interval                 : 30
Message fast transmit interval            : 4
Maximum transmit credit                   : 5
Reinitialisation delay                    : 2
MED Enabled                              : Y
Device Type                              : End Point Class-3
Traffic statistics                         :
Total frames transmitted                   : 0
Total entries aged                        : 0
Total frames received                      : 8
Total error frames received                : 0
Total frames discarded                     : 0
Total discarded TLVs                      : 0
Total unrecognised TLVs                   : 0
Agent Mode                               : Nearest bridge
Enable (tx/rx)                           : Y/Y
Message fast transmit time                : 1
Message transmit interval                 : 30
Message fast transmit interval            : 4
Maximum transmit credit                   : 5
Reinitialisation delay                    : 2
MED Enabled                              : Y
Device Type                              : End Point Class-3
Traffic statistics                         :
Total frames transmitted                   : 0
Total entries aged                        : 0
Total frames received                      : 8
Total error frames received                : 0
Total frames discarded                     : 0
Total discarded TLVs                      : 0
```

Total unrecognised TLVs : 0

## CHAPTER 9 MLAG Configuration

This chapter contains a complete example of Multi-Chassis Link Aggregation (MLAG) configuration.

MLAG (also called DRNI, Distributed Resilient Network Interconnect) expands the concept of link aggregation so that it provides node-level redundancy by allowing two or more nodes to share a common LAG endpoint. MLAG emulates multiple nodes to represent as a single logical node to the remote node running link aggregation. As a result even if one of the nodes is down there exists a path to reach the destination through the other nodes.

Note:

- MLAG is compatible only with a RSTP VLAN-aware bridge or a spanning tree disabled bridge.
- All MLAG nodes must have the same MAC table size as specified by each node's switching ASIC forwarding profile limit.
- For multi-ASIC boards, performing measurements (as either sender or reflector) on LAG interfaces requires all LAG members to be located on the same ASIC.
- More than one IDL is not supported in single node under mcec configuration.
- IDL and IDP configurations are allowed together, IDP will provide a Layer 3 communication path which will be used as a Secondary test to determine the state of MLAG Peer, however It is recommended not to use IDP without IDL for MLAG Active-Active.
- The `idl-higig` CLI is not supported on Tomahawk3 series platforms.

### Dynamic Configuration

#### Topology

As shown in [Figure 9-19](#), switches 3 and 4 form an MLAG domain. Switches 3 and 4 are a single logical switch to switches 1 and 2. Even if either switch 3 or 4 is down, there exists a path to reach other destinations.

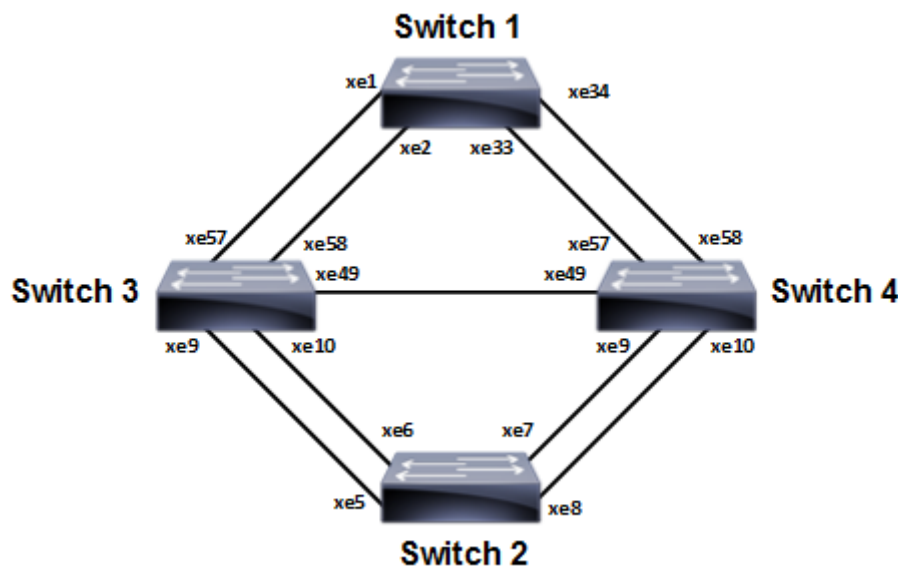


Figure 9-19: MLAG Topology

**Switch 1**

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Create RSTP bridge 1.
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Create VLAN 2.
(config-vlan)#exit	Exit vlan database mode.
(config)#interface po2	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#exit	Exit interface mode.
(config)#interface xe1	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe2	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe33	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe34	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#commit	Commit the transaction.

**Switch 2**

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Create RSTP bridge 1.
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Create VLAN 2.
(config-vlan)#exit	Exit vlan database mode.
(config)#interface po1	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#exit	Exit interface mode.
(config)#interface xe5	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe6	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe7	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe8	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#commit	Commit the transaction.



**Switch 3**

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Create RSTP bridge 1.
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Create VLAN 2.
(config-vlan)#exit	Exit vlan database mode.
(config)#interface mlag1	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#exit	Exit interface mode.
(config)#interface mlag2	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#exit	Exit interface mode.
(config)#interface po1	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#mlag 1	Enabling Mlag group number
(config-if)#exit	Exit interface mode.
(config)#interface po2	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#mlag 2	enabling Mlag group number
(config-if)#exit	Exit interface mode.
(config)#interface xe9	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe57	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe58	Enter interface mode.

(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe10	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe49	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#exit	Exit interface mode.
(cosnfig)#commit	Commit the transaction.
(config)#mcec domain configuration	Entering MCEC mode
(config-mcec-domain)#domain-address 1111.2222.3333	Domain address for the mlag domain
(config-mcec-domain)#intra-domain link xe49	Intra domain line between mlag domain
(config-mcec-domain)#domain-system-number 1	Number to identify the node in a domain
(config-mcec-domain)#exit	Exit MCEC mode
(config)#commit	Commit the transaction.

**Switch 4**

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Create RSTP bridge 1.
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Create VLAN 2.
(config-vlan)#exit	Exit vlan database mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#exit	Exit interface mode.
(config)#interface mlag2	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#exit	Exit interface mode.
(config)#interface po1	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#mlag 1	Enabling Mlag group number
(config-if)#exit	Exit interface mode.
(config)#interface po2	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#mlag 2	enabling Mlag group number
(config-if)#exit	Exit interface mode.
(config)#interface xe9	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe10	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe57	Enter interface mode.

(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe58	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe49	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#exit	Exit interface mode.
(config)#commit	Commit the transaction.
(config)#mcec domain configuration	Entering MCEC mode
(config-mcec-domain)#domain-address 1111.2222.3333	Domain address for the Mlag domain
(config-mcec-domain)#intra-domain link xe49	Intra domain Link between Mlag domains
(config-mcec-domain)#domain-system-number 2	Number to identify the node in domain
(config-mcec-domain)#exit	Exit MCEC mode
(config)#commit	Commit the transaction.

## Validation

### Switch 3

```
#sh mlag domain details
```

```
-----
Domain Configuration
-----

Domain System Number      : 1
Domain Address            : 1111.2222.3333
Domain Priority            : 1000
Intra Domain Interface    : xe49

Hello RCV State           : Current
Hello Periodic Timer State : Fast Periodic
Domain Sync               : IN_SYNC
Neigh Domain Sync         : IN_SYNC
Domain Adjacency          : UP

-----
MLAG Configuration
-----
```

## MLAG-1

```
Mapped Aggregator      : po1
Admin Key               : 16385
Oper Key               : 16385
Physical properties Digest : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc 82

Neigh Admin Key        : 32769
Neigh Physical Digest  : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc 82
Info RCV State         : Current
Info Periodic Time State : Standby
Mlag Sync              : IN_SYNC
Mode                   : Active-Active
Current Mlag State     : Active
```

## MLAG-2

```
Mapped Aggregator      : po2
Admin Key               : 16386
Oper Key               : 16386
Physical properties Digest : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc 82

Neigh Admin Key        : 32770
Neigh Physical Digest  : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc 82
Info RCV State         : Current
Info Periodic Time State : Standby
Mlag Sync              : IN_SYNC
Mode                   : Active-Active
Current Mlag State     : Active
```

## #sh etherchannel summary

```
% Aggregator po1 0
% Aggregator Type: Layer2
% Admin Key: 16385 - Oper Key 16385
%   Link: xe57 (5057) sync: 1 (Mlag-active-link)
%   Link: xe58 (5058) sync: 1 (Mlag-active-link)
% Aggregator po2 0
% Aggregator Type: Layer2
% Admin Key: 16386 - Oper Key 16386
%   Link: xe9 (5009) sync : 1 (Mlag-active-link)
%   Link: xe10 (5010) sync: 1 (Mlag-active-link)
```

## #sh mlag 1 detail

## MLAG-1

```
Mapped Aggregator      : po1
Admin Key               : 16385
Oper Key               : 16385
Physical properties Digest : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc 82
```

```
Neigh Admin Key          : 32769
Neigh Physical Digest    : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc 82
Info RCV State           : Current
Info Periodic Time State : Standby
Total Bandwidth          : 20g
Mlag Sync                : IN_SYNC
Mode                    : Active-Active
Current Mlag State       : Active
```

```
sh mcec statistics
```

```
Unknown MCCPDU received on the system : 0
```

```
-----
IDP xe49
-----
```

```
Valid RX Hello PDUs      : 398
Valid TX Hello PDUs      : 417
Valid RX Info PDUs       : 16
Valid TX Info PDUs       : 6

Valid RX Mac Sync PDUs   : 3
Valid TX Mac Sync PDUs   : 4
```

```
MLAG 1
```

```
Valid RX Info PDUs      : 8
Valid TX Info PDUs      : 3
```

```
MLAG 2
```

```
Valid RX Info PDUs      : 8
Valid TX Info PDUs      : 3
```

```
sh mlag domain summary
```

```
-----
Domain Configuration
-----
```

```
Domain System Number    : 1
Domain Address           : 1111.2222.3333
Domain Priority          : 1000
Intra Domain Interface   : xe49
Domain Adjacency         : UP
```

```
-----
MLAG Configuration
-----
```

```
MLAG-1
```

```
Mapped Aggregator       : po1
```

Physical properties Digest : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc 82  
Total Bandwidth : 40g  
Mlag Sync : IN\_SYNC  
Mode : Active-Active  
Current Mlag State : Active

**MLAG-2**

Mapped Aggregator : po2  
Physical properties Digest : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc 82  
Total Bandwidth : 40g  
Mlag Sync : IN\_SYNC  
Mode : Active-Active  
Current Mlag State : Active

---

## Static Configuration

Static MLAG provides node-level redundancy by allowing two or more nodes in the network to share a common static-LAG endpoint. It emulates multiple nodes to represent as a single logical node to the remote node having static Link aggregation. As a result, even if one of the nodes is down there exists a path to reach the destination via other nodes.

---

## Topology

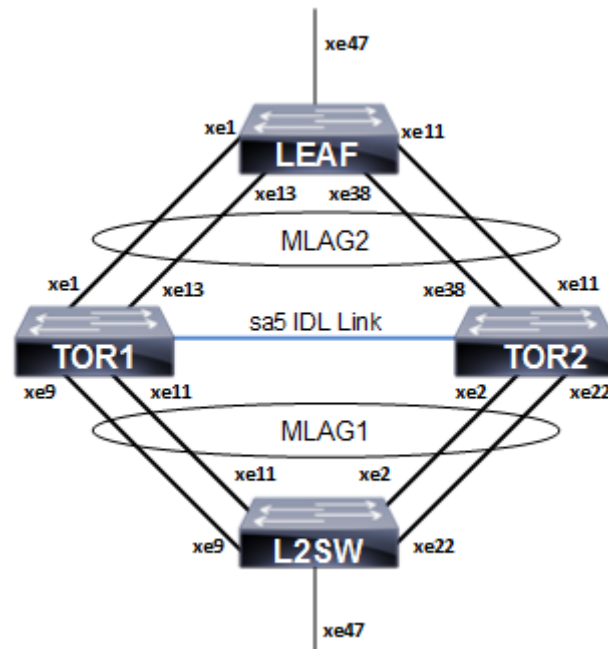


Figure 9-20: Static MLAG topology



**L2SW**

#configure terminal	Enter configure mode.
(config)#hostname L2SW	Configuring host name
(config)#bridge 1 protocol rstp vlan-bridge	Create a RSTP VLAN bridge on customer side
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure VLAN for the bridge
(config-vlan)#exit	Exit vlan database mode.
(config)#interface sa1	Enter the interface mode
(config-if)#switchport	Configure the interface as Layer 2
(config-if)# bridge-group 1 spanning-tree disable	Disable the spanning-tree for the interface
(config-if)#switchport mode hybrid	Configure the mode as hybrid
(config-if)#switchport hybrid allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe2	Enter the interface mode
(config-if)# static-channel-group 1	Map static channel to the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe9	Enter the interface mode
(config-if)# static-channel-group 1	Map static channel to the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe11	Enter the interface mode
(config-if)# static-channel-group 1	Map static channel to the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe22	Enter the interface mode
(config-if)# static-channel-group 1	Map static channel to the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe47	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)# bridge-group 1 spanning-tree disable	Disable the spanning-tree for the interface
(config-if)#switchport mode hybrid	Configure the mode as hybrid
(config-if)#switchport hybrid allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#exit	Exit the interface mode
(config)#commit	Commit the transaction.

**TOR1**

#configure terminal	Enter configure mode.
(config)#hostname TOR1	Configuring host name
(config)#bridge 1 protocol provider-rstp edge	Create a PROVIDER-RSTP EDGE bridge
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 type customer bridge 1 state enable	Configure VLAN for the bridge
(config-vlan)# vlan 200 type service point-point bridge 1 state enable	Configure SVLAN for the bridge
(config-vlan)#exit	Exit vlan database mode.
(config)# #cvlan registration table map1 bridge 1	Configure cvlan-svlan mapping registration table for the bridge.
(config-cvlan-registration)#cvlan 2 svlan 200	Map CVLAN to SVLAN
(config-cvlan-registration)#exit	Exit the config-cvlan-registration mode
(config)#interface mlag1	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface to bridge and disable the spanning tree.
(config-if)# switchport mode customer-edge hybrid	Configure the mode as customer-edge hybrid
(config-if)# switchport customer-edge hybrid allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#switchport customer-edge vlan registration map1	Map the cvlan registration table into the MLAG interface
(config-if)#mode active-standby	Configuring MLAG mode
(config-if)#exit	Exit the interface mode
(config)#interface mlag2	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface to bridge and disable the spanning-tree.
(config-if)# switchport mode provider-network	Configure the mode as provider-network
(config-if)# switchport provider-network allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#mode active-standby	Configuring MLAG mode
(config-if)#exit	Exit the interface mode
(config)#interface sa1	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#mlag 1	Map MLAG on SA interface

(config-if)#exit	Exit the interface mode
(config)#interface sa2	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#mlag 2	Map MLAG on SA interface
(config-if)#exit	Exit the interface mode
(config)#interface xe1	Enter the interface mode
(config-if)# static-channel-group 2	Map static channel-group to the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe13	Enter the interface mode
(config-if)# static-channel-group 2	Map static channel-group to the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe9	Enter the interface mode
(config-if)# static-channel-group 1	Map static channel-group to the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe11	Enter the interface mode
(config-if)# static-channel-group 1	Map static channel to the interface
(config-if)#exit	Exit the interface mode
(config)#interface sa5	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#exit	Exit the interface mode
(config)#interface xe3	Enter the interface mode
(config-if)#static-channel-group 5	Map static channel-group to the interface
(config)#interface xe5	Enter the interface mode
(config-if)#static-channel-group 5	Map static channel-group to the interface
(config-if)#exit	Exit the interface mode
(config)#commit	Commit the transaction.
(config)#mcec domain configuration	Enter the MLAG domain configuration mode
(config-mcec-domain)#domain-address 1111.2222.3333	Configure the MLAG domain address
(config-mcec-domain)#domain-system-number 1	Configure MLAG domain system number
(config-mcec-domain)#intra-domain-link sa5	Configure the intra domain link
(config-mcec-domain)#exit	Exit from mcec domain mode.
(config)#commit	Commit the transaction.

## TOR2

#configure terminal	Enter configure mode.
(config)#hostname TOR2	Configuring host name

(config)#bridge 1 protocol provider-rstp edge	Create a PROVIDER-RSTP EDGE bridge
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure VLAN for the bridge
(config-vlan)# vlan 200 type service point-point bridge 1 state enable	Configure SVLAN for the bridge
(config-vlan)#exit	Exit vlan database mode.
(config)#cvlan registration table map1 bridge 1	Configure cvlan-svlan mapping registration table for the bridge
(config-cvlan-registration)#cvlan 2 svlan 200	Map CVLAN to SVLAN
(config-cvlan-registration)#exit	Exit the config-cvlan-registration mode
(config)#interface mlag1	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface to bridge and disable the spanning-tree.
(config-if)# switchport mode customer-edge hybrid	Configure the mode as customer-edge hybrid
(config-if)# switchport customer-edge hybrid allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#switchport customer-edge vlan registration map1	Map the cvlan registration table into the MLAG interface
(config-if)#mode active-standby	Configuring MLAG mode
(config-if)#exit	Exit the interface mode
(config)#interface mlag2	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface to bridge and disable the spanning-tree.
(config-if)# switchport mode provider-network	Configure the mode as provider-network
(config-if)# switchport provider-network allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#mode active-standby	Configuring MLAG mode
(config-if)#exit	Exit the interface mode
(config)#interface sa1	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#mlag 1	Map MLAG on SA interface
(config-if)#exit	Exit the interface mode
(config)#interface sa2	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#mlag 2	Map MLAG on SA interface

(config-if)#exit	Exit the interface mode
(config)#interface xe11	Enter the interface mode
(config-if)# static-channel-group 2	Map static channel to the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe38	Enter the interface mode
(config-if)# static-channel-group 2	Map static channel to the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe2	Enter the interface mode
(config-if)# static-channel-group 1	Create static channel group
(config-if)#exit	Exit the interface mode
(config)#interface xe22	Enter the interface mode
(config-if)# static-channel-group 1	Create static channel group
(config-if)#exit	Exit the interface mode
(config)#interface sa5	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)#exit	Exit the interface mode
(config)#interface xe3	Enter the interface mode
(config-if)#static-channel-group 5	Map static channel-group to the interface
(config)#interface xe5	Enter the interface mode
(config-if)#static-channel-group 5	Map static channel-group to the interface
(config-if)#exit	Exit the interface mode
(config)#commit	Commit the transaction.
(config)#mcec domain configuration	Enter the MLAG domain configuration mode
(config-mcec-domain)#domain-address 1111.2222.3333	Configure the MLAG domain address
(config-mcec-domain)#domain-system-number 2	Configure MLAG domain system number
(config-mcec-domain)#intra-domain-link sa5	Configure the intera domain link
(config-if)#exit	Exit the interface mode
(config)#commit	Commit the transaction.

## LEAF

#configure terminal	Enter configure mode.
(config)#hostname LEAF	Configuring host name
(config)#bridge 1 protocol provider-rstp edge	Create a PROVIDER-RSTP EDGE bridge
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Configure VLAN for the bridge

(config-vlan)# vlan 200 type service point- point bridge 1 state enable	Configure SVLAN for the bridge
(config-vlan)#exit	Exit vlan database mode.
(config)#cvlan registration table map1 bridge 1	Configure cvlan-svlan mapping registration table for the bridge
(config-cvlan-registration)#cvlan 2 svlan 200	Map CVLAN to SVLAN
(config-cvlan-registration)#exit	Exit the config-cvlan-registration mode
(config)#interface sa2	Enter the interface mode
(config-if)#switchport	Make the interface a switch port
(config-if)# bridge-group 1 spanning-tree disable	Disable the spanning-tree for the interface
(config-if)#switchport mode provider- network	Configure the mode as provider-network
(config-if)# switchport provider-network allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#exit	Exit the interface mode
(config)#interface xe1	Enter the interface mode
(config-if)# static-channel-group 2	Map the interface to the static channel-group
(config-if)#exit	Exit the interface mode
(config)#interface xe13	Enter the interface mode
(config-if)# static-channel-group 2	Create static channel group
(config-if)#exit	Exit the interface mode
(config)#interface xe11	Enter the interface mode
(config-if)# static-channel-group 2	Map the interface to the static channel-group
(config-if)#exit	Exit the interface mode
(config)#interface xe38	Enter the interface mode
(config-if)# static-channel-group 2	Create static channel group
(config-if)#exit	Exit the interface mode
(config)#interface xe47	Enter the interface mode
(config-if)#switchport	Make the interface as switch port
(config-if)# bridge-group 1 spanning-tree disable	Disable the spanning-tree for the interface
(config-if)# switchport mode customer-edge hybrid	Configure the mode as customer-edge hybrid
(config-if)# switchport customer-edge hybrid allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#switchport customer-edge vlan registration map1	Map the cvlan registration table into the MLAG interface

(config-if)#exit	Exit the interface mode
(config)#commit	Commit the transaction.

## Validation

TOR1#show mlag 1 detail

MLAG-1

```

Mapped Aggregator          : sa1
Admin Key                  : 16385
Oper Key                   : 16385
Physical properties Digest  : d a6 26 2d fa 9a 5c 7b e6 15 79 c2 d5 9c 57 cc

Neigh Admin Key            : 32769
Neigh Physical Digest      : d a6 26 2d fa 9a 5c 7b e6 15 79 c2 d5 9c 57 cc
Info RCV State             : Current
Info Periodic Time State   : Standby
Total Bandwidth            : 40g
Mlag Sync                  : IN_SYNC
Mode                       : Active-Standby
Current Mlag State         : Active

```

TOR1#

TOR1#show mlag domain summary

-----  
Domain Configuration  
-----

```

Domain System Number       : 1
Domain Address              : 1111.2222.3333
Domain Priority             : 32768
Intra Domain Interface     : sa5
Domain Adjacency           : UP

```

-----  
MLAG Configuration  
-----

MLAG-1

```

Mapped Aggregator          : sa1
Physical properties Digest  : d a6 26 2d fa 9a 5c 7b e6 15 79 c2 d5 9c 57 cc
Total Bandwidth            : 40g
Mlag Sync                  : IN_SYNC
Mode                       : Active-Standby
Current Mlag State         : Active

```

## MLAG-2

```
Mapped Aggregator      : sa2
Physical properties Digest : ae 56 a1 c5 b9 dc 46 a4 5d 97 dc 79 9c 6f a5 c8

Total Bandwidth        : 40g
Mlag Sync              : IN_SYNC
Mode                   : Active-Standby
Current Mlag State     : Active
```

TOR1#

TOR1#show mlag domain detail

-----  
Domain Configuration  
-----

```
Domain System Number   : 1
Domain Address         : 1111.2222.3333
Domain Priority        : 32768
Intra Domain Interface : sa5

Hello RCV State        : Current
Hello Periodic Timer State : Slow Periodic
Domain Sync            : IN_SYNC
Neigh Domain Sync      : IN_SYNC
Domain Adjacency       : UP
```

-----  
MLAG Configuration  
-----

## MLAG-1

```
Mapped Aggregator      : sa1
Admin Key              : 16385
Oper Key               : 16385
Physical properties Digest : d a6 26 2d fa 9a 5c 7b e6 15 79 c2 d5 9c 57 cc

Neigh Admin Key        : 32769
Neigh Physical Digest  : d a6 26 2d fa 9a 5c 7b e6 15 79 c2 d5 9c 57 cc
Info RCV State         : Current
Info Periodic Time State : Standby
Total Bandwidth        : 40g
Mlag Sync              : IN_SYNC
Mode                   : Active-Standby
Current Mlag State     : Active
```



## MLAG-2

```
Mapped Aggregator      : sa2
Admin Key               : 16386
Oper Key                : 16386
Physical properties Digest : ae 56 a1 c5 b9 dc 46 a4 5d 97 dc 79 9c 6f a5 c8

Neigh Admin Key         : 32770
Neigh Physical Digest   : ae 56 a1 c5 b9 dc 46 a4 5d 97 dc 79 9c 6f a5 c8

Info RCV State          : Current
Info Periodic Time State : Standby
Total Bandwidth          : 40g
Mlag Sync                : IN_SYNC
Mode                     : Active-Standby
Current Mlag State       : Active
```

TOR1#

## ARP ACL Configuration

### Topology

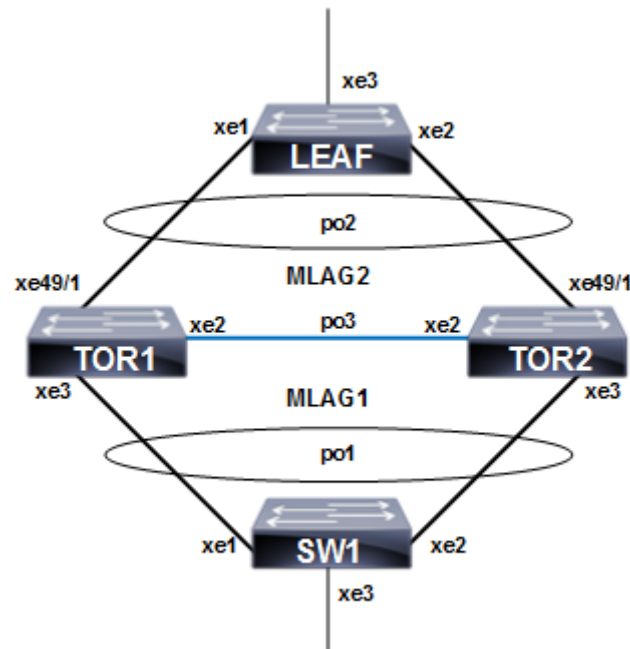


Figure 9-21: ARP ACL configuration with MC LAG

### TOR1

TOR1(config)#bridge 1 protocol provider-rstp edge	Create provider rstp bridge
TOR1(config)#vlan database	Enter vlan database mode.
TOR1(config-vlan)#vlan 2-3990 type customer bridge 1 state enable	Enable customer vlan for bridge
TOR1(config-vlan)#vlan 2-3990 type service point-point bridge 1 state enable	Enable service vlan for bridge
TOR1(config-vlan)#exit	Exit vlan database mode.
TOR1(config)#cvlan registration table map1 bridge 1	Create registration table
TOR1(config-cvlan-registration)#cvlan 2-3990 svlan 3990	Map cvlan to svlan
TOR1(config-cvlan-registration)#exit	Exit the cvlan registration table mode
TOR1(config)#interface mlag1	Enter mlag interface
TOR1(config-if)#switchport	Configure interface as switchport

TOR1(config-if)#bridge-group 1 spanning-tree disable	Associate the interface to bridge and disable the spanning-tree.
TOR1(config-if)# switchport mode customer-edge hybrid	Configure the mode as customer-edge hybrid
TOR1(config-if)# switchport customer-edge hybrid allowed vlan all	Configure allowed VLAN all on the interface
TOR1(config-if)#switchport customer-edge vlan registration map1	Map the cvlan registration table into the MLAG interface
TOR1(config-if)#exit	Exit interface mode.
TOR1(config)#interface mlag2	Enter mlag interface mode.
TOR1(config-if)#switchport	Configure interface as switchport
TOR1(config-if)#bridge-group 1 spanning-tree disable	Associate the interface to bridge and disable the spanning-tree.
TOR1(config-if)#switchport mode provider-network	Set the switching characteristics of this interface to provider network
TOR1(config-if)#switchport provider-network allowed vlan all	Set the switching characteristics of this interface to provider network and allow all vlan
TOR1(config-if)#exit	Exit the interface mode
TOR1(config)#interface po1	Enter dynamic lag interface
TOR1(config-if)#switchport	Configure interface as switchport
TOR1(config-if)#mlag 1	Enable mlag group number
TOR1(config-if)#exit	Exit the interface mode
TOR1(config-if)#interface po2	Enter dynamic lag interface
TOR1(config-if)#switchport	Configure interface as switchport
TOR1(config-if)#mlag 2	Enable mlag group number
TOR1(config-if)#exit	Exit the interface mode
TOR1(config)#interface po3	Enter dynamic lag interface
TOR1(config-if)#switchport	Configure interface as switchport
TOR1(config-if)#exit	Exit the interface mode
TOR1(config)#interface xe2	Enter interface mode
TOR1(config-if)#channel-group 3 mode active	Make part of channel group 3
TOR1(config-if)#exit	Exit the interface mode
TOR1(config)#interface xe3	Enter interface mode
TOR1(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system
TOR1(config-if)#exit	Exit the interface mode
TOR1(config-if)#interface xe49/1	Enter interface mode
TOR1(config-if)#channel-group 2 mode active	Enable channel-group 2
TOR1(config-if)#exit	Exit the interface mode
TOR1(config)#commit	Commit the transaction.

TOR1(config)#mcec domain configuration	Enter MCEC mode
TOR1(config-mcec-domain)#domain-address 2222.3333.4444	Domain address for the mlag domain
TOR1(config-mcec-domain)#domain-system- number 1	Number to identify the node in a domain
TOR1(config-mcec-domain)#intra-domain-link po3	Intra domain line between mlag domain
TOR1(config-mcec-domain)#exit	Exit mcec domain mode.
TOR1(config)#commit	Commit the transaction.
TOR1(config)#hardware-profile filter ingress-arp enable	Enable globally hardware profile for arp
TOR1(config)#arp access-list cep	Create access list with name as cep
TOR1(config-arp-acl)# 30 permit request ip any mac host 0000.2A6C.668D vlan 3990 inner- vlan 2	Create permit rule for particular arp request
TOR1(config-arp-acl)# 40 permit response ip any any mac host 0000.2A6C.668D host 0000.2A6C.7202 vlan 3990 inner-vlan 2	Create permit rule for particular arp response
TOR1(config-arp-acl)#exit	Exit ARP ACL mode.
TOR1(config)#arp access-list pnp	Create access list with name as pnp
TOR1(config-arp-acl)#20 permit request ip any mac host 0000.2A6C.7202 vlan 3990 inner- vlan 2	Create permit rule for particular arp request
TOR1(config-arp-acl)#30 permit response ip any any mac host 0000.2A6C.7202 host 0000.2A6C.668D vlan 3990 inner-vlan 2	Create permit rule for particular arp response
TOR1(config-arp-acl)#exit	Exit ARP ACL mode.
TOR1(config)#interface mlag1	Enter mlag1 interface
TOR1(config-if)#arp access-group cep in	Attach rule with access-group cep
TOR1(config-if)#interface mlag2	Enter mlag2 interface
TOR1(config-if)#arp access-group pnp in	Attach rule with access-group pnp
TOR1(config-if)#exit	Exit interface mode.
TOR1(config)#commit	Commit the transaction.

## TOR2

TOR2(config)#bridge 1 protocol provider-rstp edge	Create provider rstp bridge
TOR2(config)#vlan database	Enter vlan database mode.

TOR2(config-vlan)#vlan 2-3990 type customer bridge 1 state enable	Enable customer vlan for bridge
TOR2(config-vlan)#vlan 2-3990 type service point-point bridge 1 state enable	Enable service vlan for bridge
TOR2(config-vlan)#exit	Exit vlan database mode.
TOR2(config)#cvlan registration table map1 bridge 1	Create registration table
TOR2(config-cvlan-registration)#cvlan 2- 3990 svlan 3990	Map cvlan to svlan
TOR2(config-cvlan-registration)#exit	Exit the cvlan registration table mode
TOR2(config)#interface mlag1	Enter mlag interface mode.
TOR2(config-if)#switchport	Configure interface as a switch.
TOR2(config-if)#bridge-group 1 spanning- tree disable	Associate the interface with bridge group 1 and disabling spanning-tree
TOR2(config-if)#switchport mode customer- edge hybrid	Set the switching characteristics of this interface to customer- edge hybrid
TOR2(config-if)#switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer- edge hybrid and allow vlan all
TOR2(config-if)#switchport customer-edge vlan registration map1	Configure the registration table mapping on mlag interface
TOR2(config-if)#exit	Exit the interface mode
TOR2(config)#interface mlag2	Enter mlag interface
TOR2(config-if)#switchport	Configure interface as switchport
TOR2(config-if)#bridge-group 1	Associate the interface with bridge group 1
TOR2(config-if)#switchport mode provider- network	Set the switching characteristics of this interface to provider network
TOR2(config-if)#switchport provider-network allowed vlan all	Set the switching characteristics of this interface to provider network and allow all vlan
TOR2(config-if)#exit	Exit the interface mode
TOR2(config)#interface po1	Enter dynamic lag interface
TOR2(config-if)#switchport	Configure interface as switchport
TOR2(config-if)#mlag 1	Enable mlag group number
TOR2(config-if)#exit	Exit the interface mode
TOR2(config)#interface po2	Enter dynamic lag interface
TOR2(config-if)#switchport	Configure interface as switchport
TOR2(config-if)#mlag 2	Enable mlag group number
TOR2(config-if)#exit	Exit the interface mode
TOR2(config)#interface po3	Enter dynamic lag interface
TOR2(config-if)#switchport	Configure interface as switchport
TOR2(config-if)#exit	Exit the interface mode
TOR2(config)#interface xe2	Enter interface mode

TOR2(config-if)#channel-group 3 mode active	Make part of channel group 3
TOR2(config-if)#interface xe3	Enter interface mode
TOR2(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system
TOR2(config-if)#exit	Exit the interface mode
TOR2(config)#Interface xe49/1	Enter interface mode
TOR2(config-if)#channel-group 2 mode active	Enable channel-group 2
TOR2(config-if)#exit	Exit interface mode.
TOR2(config)#commit	Commit the transaction.
TOR2(config)#mcec domain configuration	Configure mcec domain information
TOR2(config-mcec-domain)#domain-address 2222.3333.4444	Domain address for the mlag domain
TOR2(config-mcec-domain)#domain-system-number 2	Number to identify the node in a domain
TOR2(config-mcec-domain)#intra-domain-link po3	Intra domain line between mlag domain
TOR2(config-mcec-domain)#exit	Exit mcec domain mode.
TOR2(config)#commit	Commit the transaction.
TOR2(config)#hardware-profile filter ingress-arp enable	Enable globally hardware profile for arp
TOR2(config)#arp access-list cep	Create access list with name as cep
TOR2(config-arp-acl)# 30 permit request ip any mac host 0000.2A6C.668D vlan 3990 inner-vlan 2	Create permit rule for particular arp request
TOR2(config-arp-acl)# 40 permit response ip any any mac host 0000.2A6C.668D host 0000.2A6C.7202 vlan 3990 inner-vlan 2	Create permit rule for particular arp response
TOR2(config-arp-acl)#exit	Exit ARP ACL mode.
TOR2(config)#arp access-list pnp	Create access list with name as pnp
TOR2(config-arp-acl)#20 permit request ip any mac host 0000.2A6C.7202 vlan 3990 inner-vlan 2	Create permit rule for particular arp request
TOR2(config-arp-acl)#30 permit response ip any any mac host 0000.2A6C.7202 host 0000.2A6C.668D vlan 3990 inner-vlan 2	Create permit rule for particular arp response
TOR2(config-arp-acl)#exit	Exit ARP ACL mode.
TOR2(config-if)#interface mlag1	Enter mlag1 interface
TOR2(config-if)#arp access-group cep in	Attach rule with access-group cep

TOR2(config-if)#interface mlag2	Enter mlag2 interface
TOR2(config-if)#arp access-group pnp in	Attach rule with access-group pnp
TOR2(config-if)#exit	Exit interface mode.
TOR2(config)#commit	Commit the transaction.

**SW1**

SW1(config)#bridge 1 protocol rstp vlan-bridge	Configure the rstp vlan bridge
SW1(config)#vlan database	Enter vlan database mode.
SW1(config-vlan)#vlan 2-3990 type customer bridge 1 state enable	Enable customer vlan for bridge
SW1(config-vlan)#exit	Exit vlan database mode.
SW1(config)#interface po1	Enter dynamic lag interface
SW1(config-if)#switchport	Configure interface as switchport
SW1(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1and disabling spanning-tree
SW1(config-if)#switchport mode hybrid	Set the switching characteristics of this interface hybrid
SW1(config-if)#switchport hybrid allowed vlan all	Set the switching characteristics of this interface hybrid and allowing all vlan
SW1(config-if)#exit	Exit the interface mode
SW1(config)#interface xe1	Enter interface mode
SW1(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
SW1(config-if)#exit	Exit the interface mode
SW1(config)#interface xe2	Enter interface mode
SW1(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
SW1(config-if)#exit	Exit the interface mode
SW1(config)#interface xe3	Enter interface mode
SW1(config-if)#switchport	Configure interface as switchport
SW1(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1and disabling spanning-tree
SW1(config-if)#switchport mode hybrid	Set the switching characteristics of this interface hybrid
SW1(config-if)#switchport hybrid allowed vlan all	Set the switching characteristics of this interface hybrid and allowing all vlan
SW1(config-if)#exit	Exit the interface mode
SW1(config)#commit	Commit the transaction.

**LEAF**

Leaf(config)#bridge 1 protocol provider-rstp edge	Configure the rstp vlan bridge
Leaf(config)#vlan database	Enter vlan database
Leaf(config-vlan)#vlan 2-3990 type customer bridge 1 state enable	Enable customer vlan for bridge
Leaf(config)#vlan 2-3990 type service point-point bridge 1 state enable	Enable service vlan for bridge
Leaf(config-vlan)#exit	Exit vlan database mode.
Leaf(config)#cvlan registration table map1 bridge 1	Create registration table
Leaf(config-cvlan-registration)#cvlan 2-3990 svlan 3990	Map cvlan to svlan
Leaf(config-cvlan-registration)#exit	Exit the cvlan registration table mode
Leaf(config)#interface po2	Enter interface mode
Leaf(config-if)#switchport	Configure interface as switchport
Leaf(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1and disabling spanning-tree
Leaf(config-if)#switchport mode provider-network	Set the switching characteristics of this interface provider network
Leaf(config-if)#switchport provider-network allowed vlan all	Set the switching characteristics of this interface provider and allowing all vlan
Leaf(config-if)#exit	Exit the interface mode
Leaf(config)#interface xe1	Enter interface mode
Leaf(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
Leaf(config-if)#exit	Exit the interface mode
Leaf(config)#interface xe2	Enter interface mode
Leaf(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
Leaf(config-if)#exit	Exit the interface mode
Leaf(config)#Interface xe3	Enter interface mode
Leaf(config-if)#switchport	Configure interface as switchport
Leaf(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1and disabling spanning-tree
Leaf(config-if)#switchport mode customer-edge hybrid	Set the switching characteristics of this interface to customer-edge hybrid
Leaf(config-if)#switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer-edge hybrid and allow vlan all



Leaf(config-if)#switchport customer-edge vlan registration map1	Configure the registration table mapping on mlag interface
Leaf(config-if)#exit	Exit the interface mode
Leaf(config)#commit	Commit the transaction.

## Validation

```
TOR1#show access-lists
ARP access list cep
    30 permit request ip any mac host 0000.2A6C.668D vlan 3990 inner-vlan 2
    40 permit response ip any any mac host 0000.2A6C.668D host 0000.2A6C.7202 vlan
3990 inner-vlan 2
    default deny-all
ARP access list pnp
    20 permit request ip any mac host 0000.2A6C.7202 vlan 3990 inner-vlan 2 [match=1]
    30 permit response ip any any mac host 0000.2A6C.7202 host 0000.2A6C.668D vlan
3990 inner-vlan 2 [match=1]
    default deny-all log

TOR2#show access-lists
ARP access list cep
    30 permit request ip any mac host 0000.2A6C.668D vlan 3990 inner-vlan 2 [match=1]
    40 permit response ip any any mac host 0000.2A6C.668D host 0000.2A6C.7202 vlan
3990 inner-vlan 2 [match=1]
    default deny-all log
ARP access list pnp
    20 permit request ip any mac host 0000.2A6C.7202 vlan 3990 inner-vlan 2
    30 permit response ip any any mac host 0000.2A6C.7202 host 0000.2A6C.668D vlan
3990 inner-vlan 2
    default deny-all
```

## Disabling STP for MLAG

The command `no bridge 1 provider-rstp enable bridge-forward` is used to disable the spanning tree globally.

## Enabling Provider RSTP

OcNOS#configure terminal	Enter Configure mode.
OcNOS(config)# bridge 1 protocol provider-rstp edge	Configure Provider-rstp edge bridge.
OcNOS(config)# interface xe13/2	Configure interface xe13/2\
OcNOS(config-if)# switchport	Configure the interface as switchport
OcNOS(config-if)# bridge-group 1	Assign the above created bridge to this port.
OcNOS(config-vrf)#exit	Exit from interface mode to config mode
OcNOS(config)# interface po1	Configure interface po1

OcNOS(config-if)# switchport	Configure the interface as switchport
OcNOS(config-if)# bridge-group 1	Assign the above created bridge to this port.
OcNOS(config-vrf)#exit	Exit from interface mode to config mode
OcNOS(config)# interface mlag2	Configure interface mlag1
OcNOS(config-if)# switchport	Configure the interface as switchport
OcNOS(config-if)# bridge-group 1 spanning-tree disable	Assign the above created bridge to this port and disable the spanning tree.
OcNOS(config-vrf)#exit	Exit from interface mode to config mode
OcNOS(config)#commit	Commit the transaction.

## Validation

```
OcNOS#show spanning-tree
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 1: Root Id 8000ecf4bbfc6928
% 1: Bridge Id 8000ecf4bbfc6928
% 1: last topology change Tue Jul 30 06:47:37 2019
% 1: 2 topology change(s) - last topology change Tue Jul 30 06:47:37 2019

% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% xe13/2: Port Number 942 - Ifindex 5038 - Port Id 0x83ae - Role Designated - State Forwarding
% xe13/2: Designated Path Cost 0
% xe13/2: Configured Path Cost 2000 - Add type Explicit ref count 1
% xe13/2: Designated Port Id 0x83ae - Priority 128 -
% xe13/2: Root 8000ecf4bbfc6928
% xe13/2: Designated Bridge 8000ecf4bbfc6928
% xe13/2: Message Age 0 - Max Age 20
% xe13/2: Hello Time 2 - Forward Delay 15
% xe13/2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
% xe13/2: forward-transitions 3
% xe13/2: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP
% xe13/2: No portfast configured - Current portfast off
% xe13/2: bpdu-guard default - Current bpdu-guard off
% xe13/2: bpdu-filter default - Current bpdu-filter off
% xe13/2: no root guard configured - Current root guard off
% xe13/2: Configured Link Type point-to-point - Current point-to-point
% xe13/2: No auto-edge configured - Current port Auto Edge off
%
% pol: Port Number 1697 - Ifindex 100001 - Port Id 0x86a1 - Role Designated - State Forwarding
% pol: Designated Path Cost 0
% pol: Configured Path Cost 2000 - Add type Explicit ref count 1
% pol: Designated Port Id 0x86a1 - Priority 128 -
% pol: Root 8000ecf4bbfc6928
% pol: Designated Bridge 8000ecf4bbfc6928
```

```
% pol: Message Age 0 - Max Age 20
% pol: Hello Time 2 - Forward Delay 15
% pol: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
% pol: forward-transitions 1
% pol: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP
% pol: No portfast configured - Current portfast off
% pol: bpdu-guard default - Current bpdu-guard off
% pol: bpdu-filter default - Current bpdu-filter off
% pol: no root guard configured - Current root guard off
% pol: Configured Link Type point-to-point - Current point-to-point
% pol: No auto-edge configured - Current port Auto Edge off
%
% mlag2: Port Number 2690 - Ifindex 400002 - Port Id 0x8a82 - Role Disabled - State Forwarding
% mlag2: Designated Path Cost 0
% mlag2: Configured Path Cost 20000000 - Add type Explicit ref count 1
% mlag2: Designated Port Id 0x0 - Priority 128 -
% mlag2: Message Age 0 - Max Age 0
% mlag2: Hello Time 0 - Forward Delay 0
% mlag2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
% mlag2: forward-transitions 1
% mlag2: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP
% mlag2: No portfast configured - Current portfast off
% mlag2: bpdu-guard default - Current bpdu-guard off
% mlag2: bpdu-filter default - Current bpdu-filter off
% mlag2: no root guard configured - Current root guard off
% mlag2: Configured Link Type point-to-point - Current point-to-point
% mlag2: No auto-edge configured - Current port Auto Edge off
%
```

## Disabling RSTP Globally

OcNOS#configure terminal	Enter Configure mode.
OcNOS(config)# no bridge 1 rapid-spanning-tree enable bridge-forward	Disable spanning tree globally for Provider-RSTP and keeping the ports in Forwarding state.
OcNOS(config)# interface mlag1	Configure interface mlag1
OcNOS(config-if)# switchport	Configure the interface as switchport
OcNOS(config-if)# bridge-group 1	Assign the above created bridge to this port.
OcNOS(config-vrf)#exit	Exit from interface mode to config mode
OcNOS(config)#commit	Commit the transaction.

## Validation

```
OcNOS#sh run int mlag2-
!
interface mlag2
  switchport
  bridge-group 1 spanning-tree disable
  switchport mode provider-network
```

```
!  
OcNOS#sh run int mlag1  
!  
interface mlag1  
  switchport  
  bridge-group 1  
  switchport mode provider-network  
!  
OcNOS#  
OcNOS#sh spanning-tree  
% 1: Bridge up - Spanning Tree Disabled - topology change detected  
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768  
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6  
% 1: Root Id 8000000000000000  
% 1: Bridge Id 8000000000000000  
% 1: 2 topology change(s) - last topology change Tue Jul 30 06:47:37 2019  
  
% 1: portfast bpdu-filter disabled  
% 1: portfast bpdu-guard disabled  
% xe13/2: Port Number 942 - Ifindex 5038 - Port Id 0x83ae - Role Disabled - State  
Forwarding  
% xe13/2: Designated Path Cost 0  
% xe13/2: Configured Path Cost 2000 - Add type Explicit ref count 1  
% xe13/2: Designated Port Id 0x83ae - Priority 128 -  
% xe13/2: Message Age 0 - Max Age 20  
% xe13/2: Hello Time 2 - Forward Delay 15  
% xe13/2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0  
% xe13/2: forward-transitions 4  
% xe13/2: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP  
% xe13/2: No portfast configured - Current portfast off  
% xe13/2: bpdu-guard default - Current bpdu-guard off  
% xe13/2: bpdu-filter default - Current bpdu-filter off  
% xe13/2: no root guard configured - Current root guard off  
% xe13/2: Configured Link Type point-to-point - Current point-to-point  
% xe13/2: No auto-edge configured - Current port Auto Edge off  
%  
% pol: Port Number 1697 - Ifindex 100001 - Port Id 0x86a1 - Role Disabled - State  
Forwarding  
% pol: Designated Path Cost 0  
% pol: Configured Path Cost 2000 - Add type Explicit ref count 1  
% pol: Designated Port Id 0x86a1 - Priority 128 -  
% pol: Message Age 0 - Max Age 20  
% pol: Hello Time 2 - Forward Delay 15  
% pol: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0  
% pol: forward-transitions 2  
% pol: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP  
% pol: No portfast configured - Current portfast off  
% pol: bpdu-guard default - Current bpdu-guard off  
% pol: bpdu-filter default - Current bpdu-filter off  
% pol: no root guard configured - Current root guard off  
% pol: Configured Link Type point-to-point - Current point-to-point
```

```
% pol: No auto-edge configured - Current port Auto Edge off
%
% mlag1: Port Number 2689 - Ifindex 400001 - Port Id 0x8a81 - Role Disabled - State Forwarding
% mlag1: Designated Path Cost 0
% mlag1: Configured Path Cost 20000000 - Add type Explicit ref count 1
% mlag1: Designated Port Id 0x0 - Priority 128 -
% mlag1: Message Age 0 - Max Age 0
% mlag1: Hello Time 0 - Forward Delay 0
% mlag1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
% mlag1: forward-transitions 2
% mlag1: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP
% mlag1: No portfast configured - Current portfast off
% mlag1: bpdu-guard default - Current bpdu-guard off
% mlag1: bpdu-filter default - Current bpdu-filter off
% mlag1: no root guard configured - Current root guard off
% mlag1: Configured Link Type point-to-point - Current point-to-point
% mlag1: No auto-edge configured - Current port Auto Edge off
%
% mlag2: Port Number 2690 - Ifindex 400002 - Port Id 0x8a82 - Role Disabled - State Forwarding
% mlag2: Designated Path Cost 0
% mlag2: Configured Path Cost 20000000 - Add type Explicit ref count 1
% mlag2: Designated Port Id 0x0 - Priority 128 -
% mlag2: Message Age 0 - Max Age 0
% mlag2: Hello Time 0 - Forward Delay 0
% mlag2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
% mlag2: forward-transitions 2
% mlag2: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP
% mlag2: No portfast configured - Current portfast off
% mlag2: bpdu-guard default - Current bpdu-guard off
% mlag2: bpdu-filter default - Current bpdu-filter off
% mlag2: no root guard configured - Current root guard off
% mlag2: Configured Link Type point-to-point - Current point-to-point
% mlag2: No auto-edge configured - Current port Auto Edge off
%
```

---

## Port-isolation for MLAG

The feature is to prohibit communication between Isolated ports across MLAG switches. Protected port can communicate with an unprotected port and vice-versa. The use of protected ports ensures that there is no exchange of unicast, broadcast, or multicast data traffic between ports on the same switch so that one neighbor does not see the traffic generated by another neighbor.

---

## Topology

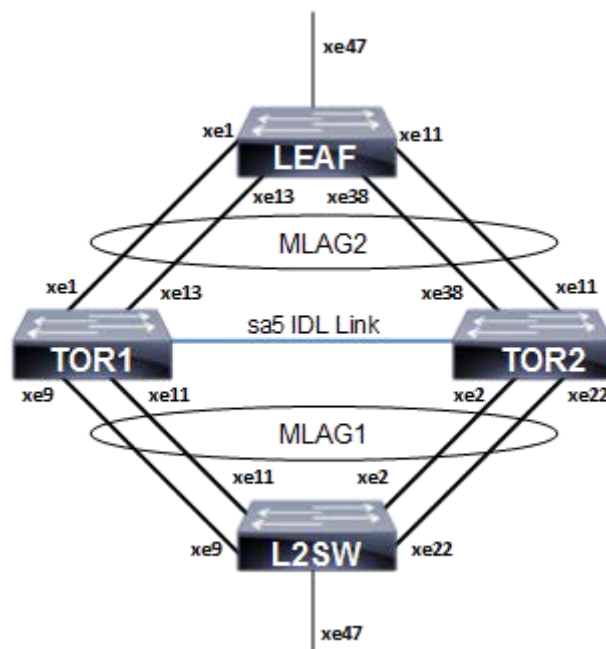


Figure 9-22: Static MLAG Topology

## L2SW

#configure terminal	Enter configure mode.(config)#bridge 1 protocol rstp vlan-bridge
(config)#bridge 1 protocol rstp vlan-bridge	Create RSTP bridge 1.
(config)#vlan database	Enter VLAN database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Create VLAN 2.
(config-vlan)#exit	Exit vlan database mode.
(config)#interface po1	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#exit	Exit interface mode.
(config)#interface xe2	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe9	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.

(config)#interface xe11	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe22	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#commit	Commit the transaction.

## TOR1

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Create RSTP bridge 1.
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Create VLAN 2.
(config-vlan)#exit	Exit vlan database mode.
(config)#hardware-profile filter port-isolation enable	Enable the hardware profile filter globally
(config)#interface mlag1	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#switchport protected promiscuous	Configure interface as promiscuous port
(config-if)#exit	Exit interface mode.
(config)#interface mlag2	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#switchport protected isolated	Configure interface as isolated port
(config-if)#exit	Exit interface mode.
(config)#interface po1	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#mlag 1	Enabling Mlag group number
(config-if)#exit	Exit interface mode.
(config)#interface po2	Enter interface mode.

(config-if)#switchport	Configure the interface as Layer 2
(config-if)#mlag 2	enabling Mlag group number
(config-if)#exit	Exit interface mode.
(config)#interface po3	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#exit	Exit interface mode.
(config)#interface xe9	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xel1	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xel1	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xel3	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe49	Enter interface mode.
(config-if)#channel-group 3 mode active	Add this interface to channel group 3 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(cosnfig)#commit	Commit the transaction.
(config)#mcec domain configuration	Entering MCEC mode
(config-mcec-domain)#domain-address 1111.2222.3333	Domain address for the mlag domain
(config-mcec-domain)# domain-system-number 1	Number to identify the node in a domain
(config-mcec-domain)# intra-domain link po3	Intra domain line between mlag domain
(config-mcec-domain)#idl-higig	Enable the idl-higig on mlag idl
(config-mcec-domain)#exit	Exit MCEC mode
(config)#commit	Commit the transaction.

## TOR2

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Create RSTP bridge 1.



(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Create VLAN 2.
(config-vlan)#exit	Exit vlan database mode.
(config)#hardware-profile filter port-isolation enable	Enable the hardware profile filter globally
(config)#interface mlag1	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#switchport protected promiscuous	Configure interface as promiscuous port
(config-if)#exit	Exit interface mode.
(config)#interface mlag2	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#switchport protected isolated	Configure interface as isolated port
(config-if)#exit	Exit interface mode.
(config)#interface po1	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#mlag 1	Enabling Mlag group number
(config-if)#exit	Exit interface mode.
(config)#interface po2	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#mlag 2	Enabling Mlag group number
(config-if)#exit	Exit interface mode.
(config)#interface po3	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#exit	Exit interface mode.
(config)#interface xe2	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe22	Enter interface mode.
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.

(config)#interface xe11	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe38	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe49	Enter interface mode.
(config-if)#channel-group 3 mode active	Add this interface to channel group 3 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#commit	Commit the transaction.
(config)#mcec domain configuration	Entering MCEC mode
(config-mcec-domain)#domain-address 1111.2222.3333	Domain address for the mlag domain
(config-mcec-domain)# domain-system-number 2	Number to identify the node in a domain
(config-mcec-domain)# intra-domain link po3	Intra domain line between mlag domain
(config-mcec-domain)#idl-higig	Enable the idl-higig on mlag idl.
(config-mcec-domain)#exit	Exit MCEC mode
(config)#commit	Commit the transaction.

## LEAF

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol rstp vlan-bridge	Create RSTP bridge 1.
(config)#vlan database	Enter vlan database mode.
(config-vlan)#vlan 2 bridge 1 state enable	Create VLAN 2.
(config-vlan)#exit	Exit vlan database mode.
(config)#interface po2	Enter interface mode.
(config-if)#switchport	Configure the interface as Layer 2
(config-if)#bridge-group 1	Associate the interface 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	Enable all VLAN identifiers on this interface.
(config-if)#exit	Exit interface mode.
(config)#interface xe1	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.

(config)#interface xe11	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe13	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#interface xe38	Enter interface mode.
(config-if)#channel-group 2 mode active	Add this interface to channel group 2 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#exit	Exit interface mode.
(config)#commit	(config)#commit

## Validation

### TOR1

```
#sh mlag domain details
```

#### Domain Configuration

```
Domain System Number      :1
Domain Address             :1111.2222.3333
Domain Priority            :1000
Intra Domain Interface    :po3
  Hello RCV State         :Current
  Hello Periodic Timer State :Fast Periodic
Domain Sync               :IN_SYNC
Neigh Domain Sync         :IN_SYNC
Domain Adjacency          :UP
```

#### MLAG Configuration

```
MLAG-1
Mapped Aggregator         :po1
Admin Key                 : 16385
Oper Key                  : 16385
Physical properties Digest : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96
fc 82

Neigh Admin Key           : 32769
Neigh Physical Digest     : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96
fc 82
Info RCV State            : Current
Info Periodic Time State  : Standby
Mlag Sync                 : IN_SYNC
Mode                      : Active-Active
```

```
Current Mlag State           : Active

MLAG-2
Mapped Aggregator           : po2
Admin Key                    : 16386
Oper Key                     : 16386
Physical properties Digest   : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc
82

Neigh Admin Key              : 32770
Neigh Physical Digest        : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc
82
Info RCV State               : Current
Info Periodic Time State     : Standby
Mlag Sync                    : IN_SYNC
Mode                          : Active-Active
Current Mlag State           : Active

#sh etherchannel summary
  Aggregator po1 100001
  Aggregator Type: Layer2
  Admin Key: 16385 - Oper Key 16385
    Link: xe9 (5007) sync: 1 (Mlag-active-link)
    Link: xe11 (5008) sync: 1 (Mlag-active-link)
  -----
  Aggregator po2 100002
  Aggregator Type: Layer2
  Admin Key: 16386 - Oper Key 16386
    Link: xe1 (5005) sync: 1 (Mlag-active-link)
    Link: xe13 (5006) sync: 1 (Mlag-active-link)
  -----
  Aggregator po3 100003
  Aggregator Type: Layer2
  Admin Key: 0003 - Oper Key 0003
    Link: xe49 (5002) sync: 1

#sh mlag 1 detail
MLAG-1
Mapped Aggregator           :po1
Admin Key                    : 16385
Oper Key                     : 16385
Physical properties Digest   : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96
fc 82

Neigh Admin Key              : 32769
Neigh Physical Digest        : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96
fc 82
Info RCV State               : Current
Info Periodic Time State     : Standby
Mlag Sync                    : IN_SYNC
Mode                          : Active-Active
Current Mlag State           : Active

#sh mcec statistics

Unknown MCCPDU received on the system           : 0
```

---

IDP xe49

Valid RX Hello PDUs : 398  
Valid TX Hello PDUs : 417  
Valid RX Info PDUs : 16  
Valid TX Info PDUs : 6

Valid RX Mac Sync PDUs : 3  
Valid TX Mac Sync PDUs : 4

MLAG 1  
Valid RX Info PDUs : 8  
Valid TX Info PDUs : 3

MLAG 2  
Valid RX Info PDUs : 8  
Valid TX Info PDUs : 3

#sh mlag domain summary

Domain Configuration

Domain System Number :1  
Domain Address :1111.2222.3333  
Domain Priority :1000  
Intra Domain Interface :xe49  
Domain Adjacency :UP

MLAG Configuration

MLAG-1  
Mapped Aggregator :po1  
Physical properties Digest : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96  
fc 82

Total Bandwidth : 40g  
Mlag Sync : IN\_SYNC  
Mode : Active-Active  
Current Mlag State : Active

MLAG-2  
Mapped Aggregator : po2  
Physical properties Digest : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc  
82

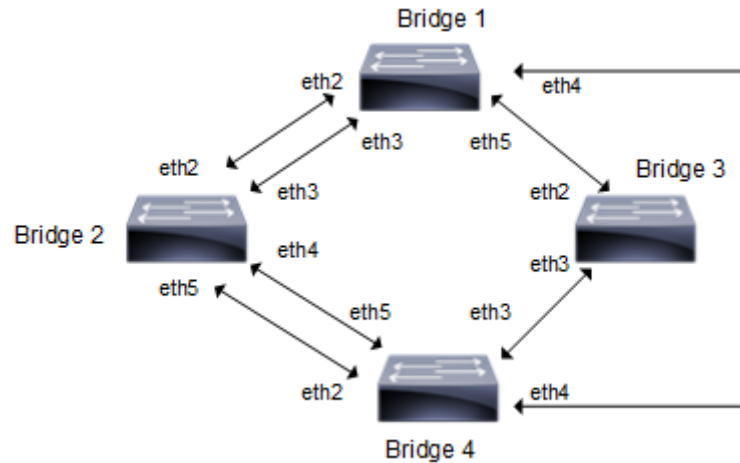
Total Bandwidth : 40g  
Mlag Sync : IN\_SYNC  
Mode : Active-Active  
Current Mlag State : Active

## CHAPTER 10 MSTP Configuration

This chapter contains a complete sample Multiple Spanning Tree Protocol (MSTP) configuration. MSTP allows multiple VLANs to be grouped into one spanning-tree instance. Every MST instance has a spanning-tree that is independent of other spanning-tree instances providing multiple forwarding paths for data traffic.

### Topology

This example gives a simple multi-bridge topology and its configuration.



**Figure 10-23: MSTP Topology**

Note: Run the `switchport` command on each port to change to Layer-2 mode.

### Configuration

#### Bridge 1

<code>Bridge1#configure terminal</code>	Enter configure mode.
<code>Bridge1(config)#bridge 1 protocol mstp</code>	Add a bridge (1) to the multiple spanning tree table.
<code>Bridge1(config)#vlan database</code>	Enter the VLAN configuration mode.
<code>Bridge1(config-vlan)#vlan 2 bridge 1 state enable</code>	Enable the state of VLAN 2 on bridge 1. Specifying an enable state allows forwarding of frames over VLAN 2 on bridge 1.
<code>Bridge1(config-vlan)#vlan 3 bridge 1 state enable</code>	Enable the state of VLAN 3 on bridge 1. Specifying an enable state allows forwarding of frames over VLAN 3 on bridge 1.
<code>Bridge1(config-vlan)#vlan 4 bridge 1 state enable</code>	Enable the state of VLAN 4 on bridge 1. Specifying an enable state allows forwarding of frames over VLAN 4 on bridge 1.
<code>Bridge1(config-vlan)#vlan 5 bridge 1 state enable</code>	Enable the state of VLAN 5 on bridge 1. Specifying an enable state allows forwarding of frames over VLAN 5 on bridge 1.
<code>Bridge1(config-vlan)#commit</code>	Commit candidate configuration to be running configuration
<code>Bridge1(config-vlan)#exit</code>	Exit the VLAN configuration mode.
<code>Bridge1(config)#spanning-tree mst configuration</code>	Enter the Multiple Spanning Tree

Bridgel (config-mst)#bridge 1 instance 2 vlan 2	Create an instance of VLAN. The VLANs must be created before being associating with an MST instance (MSTI). If the VLAN range is not specified the MSTI will not be created.
Bridgel (config-mst)#bridge 1 instance 3 vlan 3	Create another instance of VLAN. The VLANs must be created before being associating with an MST instance (MSTI). If the VLAN range is not specified the MSTI will not be created.
Bridgel (config-mst)#bridge 1 instance 4 vlan 4	same as mention above.
Bridgel (config-mst)#bridge 1 instance 5 vlan 5	same as mention above.
Bridgel (config-mst)#commit	Commit candidate configuration to be running configuration
Bridgel (config-mst)#exit	Exit MST Configuration mode.
Bridgel (config)#interface eth2	Enter interface mode for eth2
Bridgel (config-if)#bridge-group 1	Associating the interface to bridge-group 1
Bridgel (config-if)#bridge-group 1 instance 2	Assigning bridge-group 1 to this instance
Bridgel (config-if)#bridge-group 1 instance 3	Assigning bridge-group 1 to this instance
Bridgel (config-if)#bridge-group 1 instance 4	Assigning bridge-group 1 to this instance
Bridgel (config-if)#bridge-group 1 instance 5	Assigning bridge-group 1 to this instance
Bridgel (config-if)#commit	Commit candidate configuration to be running configuration
Bridgel (config-if)#exit	Exit interface mode.
Bridgel (config)#interface eth3	Enter interface mode for eth3.
Bridgel (config-if)#bridge-group 1	Associating the interface to bridge-group 1
Bridgel (config-if)#bridge-group 1 instance 2	Assigning bridge-group 1 to this instance
Bridgel (config-if)#bridge-group 1 instance 3	Assigning bridge-group 1 to this instance
Bridgel (config-if)#bridge-group 1 instance 4	Assigning bridge-group 1 to this instance
Bridgel (config-if)#bridge-group 1 instance 5	Assigning bridge-group 1 to this instance
Bridgel (config-if)#commit	Commit candidate configuration to be running configuration
Bridgel (config-if)#exit	Exit interface mode.
Bridgel (config)#interface eth4	Enter interface mode for eth4.
Bridgel (config-if)#bridge-group 1	Associating the interface to bridge-group 1
Bridgel (config-if)#bridge-group 1 instance 2	Assigning bridge-group 1 to this instance
Bridgel (config-if)#bridge-group 1 instance 3	Assigning bridge-group 1 to this instance
Bridgel (config-if)#bridge-group 1 instance 4	Assigning bridge-group 1 to this instance
Bridgel (config-if)#bridge-group 1 instance 5	Assigning bridge-group 1 to this instance

Bridge1(config-if)#commit	Commit candidate configuration to be running configuration
Bridge1(config-if)#exit	Exit interface mode.
Bridge1(config)#interface eth5	Enter interface mode for eth5.
Bridge1(config-if)#bridge-group 1	Associating the interface to bridge-group 1
Bridge1(config-if)#bridge-group 1 instance 2	Assigning bridge-group 1 to this instance
Bridge1(config-if)#bridge-group 1 instance 3	Assigning bridge-group 1 to this instance
Bridge1(config-if)#bridge-group 1 instance 4	Assigning bridge-group 1 to this instance
Bridge1(config-if)#bridge-group 1 instance 5	Assigning bridge-group 1 to this instance
Bridge1(config-if)#commit	Commit candidate configuration to be running configuration
Bridge1(config-if)#exit	Exit interface mode.

## Bridge 2

Bridge2#configure terminal	Enter configure mode.
Bridge2(config)#bridge 2 protocol mstp	Add a bridge (2) to the multiple spanning
Bridge2(config)#bridge 2 priority 4096	Assign priority to this bridge.
Bridge2(config)#vlan database	Enter the VLAN configuration mode.
Bridge2(config-vlan)#vlan 2 bridge 2 state enable	Enable the state of VLAN 2 on bridge 2. Specifying an enable state allows forwarding of frames over VLAN 2 on bridge 2.
Bridge2(config-vlan)#vlan 3 bridge 2 state enable	Enable the state of VLAN 3 on bridge 2. Specifying an enable state allows forwarding of frames over VLAN 3 on bridge 2
Bridge2(config-vlan)#vlan 4 bridge 2 state enable	Enable the state of VLAN 4 on bridge 2. Specifying an enable state allows forwarding of frames over VLAN 4 on bridge 2
Bridge2(config-vlan)#vlan 5 bridge 2 state enable	Enable the state of VLAN 5 on bridge 2. Specifying an enable state allows forwarding of frames over VLAN 5 on bridge 2
Bridge2(config-vlan)#commit	Commit candidate configuration to be running configuration
Bridge2(config-vlan)#exit	Exit the VLAN configuration mode.
Bridge2(config)#spanning-tree mst configuration	Enter the Multiple Spanning Tree configuration mode
Bridge2(config-mst)#bridge 2 instance 2 vlan 2	Create an instance of VLAN. The VLANs must be created before being associating with an MST instance (MSTI). If the VLAN range is not specified the MSTI will not be created.
Bridge2(config-mst)#bridge 2 instance 3 vlan 3	same as mention above.
Bridge2(config-mst)#bridge 2 instance 4 vlan 4	same as mention above.
Bridge2(config-mst)#bridge 2 instance 5 vlan 5	same as mention above.
Bridge2(config-mst)#commit	Commit candidate configuration to be running configuration
Bridge2(config-mst)#exit	Exit MST Configuration mode.
Bridge2(config)#interface eth2	Enter interface mode for eth2



Bridge2 (config-if) #bridge-group 2	Associating the interface to bridge-group 2
Bridge2 (config-if) #bridge-group 2 instance 2	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #bridge-group 2 instance 3	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #bridge-group 2 instance 4	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #bridge-group 2 instance 5	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #commit	Commit candidate configuration to be running configuration
Bridge2 (config-if) #exit	Exit interface mode.
Bridge2 (config) #interface eth3	Enter interface mode for eth3
Bridge2 (config-if) #bridge-group 2	Associating the interface to bridge-group 2
Bridge2 (config-if) #bridge-group 2 instance 2	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #bridge-group 2 instance 3	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #bridge-group 2 instance 3 priority 16	Assign bridge-group 2 to this instance and set a port priority in order of 16 for it. MSTP uses port priority as a tiebreaker to determine which port should forward frames for a particular instance on a LAN, or which port should be the root port for an instance. A lower value implies better priority.
Bridge2 (config-if) #bridge-group 2 instance 4	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #bridge-group 2 instance 4 priority 16	Assign bridge-group 2 to this instance and set a port priority in order of 16 for it. MSTP uses port priority as a tiebreaker to determine which port should forward frames for a particular instance on a LAN, or which port should be the root port for an instance. A lower value implies better priority
Bridge2 (config-if) #bridge-group 2 instance 5	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #commit	Commit candidate configuration to be running configuration
Bridge2 (config-if) #exit	Exit interface mode
Bridge2 (config) #interface eth4	Enter interface mode for eth4
Bridge2 (config-if) #bridge-group 2	Associating the interface to bridge-group 2
Bridge2 (config-if) #bridge-group 2 instance 2	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #bridge-group 2 instance 3	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #bridge-group 2 instance 4	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #bridge-group 2 instance 5	Assigning bridge-group 2 to this instance
Bridge2 (config-if) #commit	Commit candidate configuration to be running configuration
Bridge2 (config-if) #exit	Exit interface mode.
Bridge2 (config) #interface eth5	Enter interface mode for eth5
Bridge2 (config-if) #bridge-group 2	Associating the interface to bridge-group 2

Bridge2(config-if)#bridge-group 2 instance 2	Assigning bridge-group 2 to this instance
Bridge2(config-if)#bridge-group 2 instance 3	Assigning bridge-group 2 to this instance
Bridge2(config-if)#bridge-group 2 instance 4	Assigning bridge-group 2 to this instance
Bridge2(config-if)#bridge-group 2 instance 5	Assigning bridge-group 2 to this instance
Bridge2(config-if)#commit	Commit candidate configuration to be running configuration
Bridge2(config-if)#exit	Exit interface mode.

### Bridge 3

Bridge3#configure terminal	Enter configure mode.
Bridge3(config)#bridge 3 protocol mstp	Add a bridge (3) to the multiple spanning tree table
Bridge3(config)#vlan database	Enter the VLAN configuration mode.
Bridge3(config-vlan)#vlan 2 bridge 3 state enable	Enable the state of VLAN 2 on bridge 3. Specifying an enable state allows forwarding of frames over VLAN 2 on bridge 3.
Bridge3(config-vlan)#vlan 3 bridge 3 state enable	Enable the state of VLAN 3 on bridge 3. Specifying an enable state allows forwarding of frames over VLAN 3 on bridge 3.
Bridge3(config-vlan)#vlan 4 bridge 3 state enable	Enable the state of VLAN 4 on bridge 3. Specifying an enable state allows forwarding of frames over VLAN 4 on bridge 3.
Bridge3(config-vlan)#vlan 5 bridge 3 state enable	Enable the state of VLAN 5 on bridge 3. Specifying an enable state allows forwarding of frames over VLAN 5 on bridge 3.
Bridge3(config-vlan)#commit	Commit candidate configuration to be running configuration
Bridge3(config-vlan)#exit	Exit the VLAN configuration mode.
Bridge3(config)#spanning-tree mst configuration	Enter the Multiple Spanning Tree Configuration mode.
Bridge3(config-mst)#bridge 3 instance 2 vlan 2	Create an instance of VLAN. The VLANs must be created before being associating with an MST instance (MSTI). If the VLAN range is not specified the MSTI will not be created.
Bridge3(config-mst)#bridge 3 instance 3 vlan 3	same as mention above.
Bridge3(config-mst)#bridge 3 instance 4 vlan 4	same as mention above.
Bridge3(config-mst)#bridge 3 instance 5 vlan 5	same as mention above.
Bridge3(config-mst)#commit	Commit candidate configuration to be running configuration
Bridge3(config-mst)#exit	Exit MST Configuration mode.
Bridge3(config)#interface eth2	Enter interface mode for eth2

Bridge3(config-if)#bridge-group 3	Associating the interface to bridge-group 3
Bridge3(config-if)#bridge-group 3 instance 2	Assigning bridge-group 3 to this instance
Bridge3(config-if)#bridge-group 3 instance 3	Assigning bridge-group 3 to this instance
Bridge3(config-if)#bridge-group 3 instance 4	Assigning bridge-group 3 to this instance
Bridge3(config-if)#bridge-group 3 instance 5	Assigning bridge-group 3 to this instance
Bridge3(config-if)#commit	Commit candidate configuration to be running configuration
Bridge3(config-if)#exit	Exit interface mode.
Bridge3(config)#interface eth3	Enter interface mode for eth3
Bridge3(config-if)#bridge-group 3	Associating the interface to bridge-group 3
Bridge3(config-if)#bridge-group 3 instance 2	Assigning bridge-group 3 to this instance
Bridge3(config-if)#bridge-group 3 instance 3	Assigning bridge-group 3 to this instance
Bridge3(config-if)#bridge-group 3 instance 4	Assigning bridge-group 3 to this instance
Bridge3(config-if)#bridge-group 3 instance 5	Assigning bridge-group 3 to this instance
Bridge3(config-if)#commit	Commit candidate configuration to be running configuration
Bridge3(config-if)#exit	Exit interface mode.

## Bridge 4

Bridge4#configure terminal	Enter configure mode.
Bridge4(config)#bridge 4 protocol mstp	Add a bridge (4) to the multiple spanning tree table
Bridge4(config)#vlan database	Enter the VLAN configuration mode.
Bridge4(config-vlan)#vlan 2 bridge 4 state enable	Enable the state of VLAN 2 on bridge 4. Specifying an enable state allows forwarding of frames over VLAN 2 on bridge 4.
Bridge4(config-vlan)#vlan 3 bridge 4 state enable	Enable the state of VLAN 3 on bridge 4. Specifying an enable state allows forwarding of frames over VLAN 3 on bridge 4.
Bridge4(config-vlan)#vlan 4 bridge 4 state enable	Enable the state of VLAN 4 on bridge 4. Specifying an enable state allows forwarding of frames over VLAN 4 on bridge 4.
Bridge4(config-vlan)#vlan 5 bridge 4 state enable	Enable the state of VLAN 5 on bridge 4. Specifying an enable state allows forwarding of frames over VLAN 5 on bridge 4.
Bridge4(config-vlan)#commit	Commit candidate configuration to be running configuration
Bridge4(config-vlan)#exit	Exit the VLAN configuration mode.
Bridge4(config)#spanning-tree mst configuration	Enter the Multiple Spanning Tree Configuration mode.
Bridge4(config-mst)#bridge 4 instance 2 vlan 2	Create an instance of VLAN. The VLANs must be created before being associating with an MST instance (MSTI). If the VLAN range is not specified the MSTI will not be created.
Bridge4(config-mst)#bridge 4 instance 3 vlan 3	same as mention above.

Bridge4(config-mst)#bridge 4 instance 4 vlan 4	same as mention above.
Bridge4(config-mst)#bridge 4 instance 5 vlan 5	same as mention above.
Bridge4(config-mst)#commit	Commit candidate configuration to be running configuration
Bridge4(config-mst)#exit	Exit MST Configuration mode.
Bridge4(config)#interface eth2	Enter interface mode for eth2
Bridge4(config-if)#bridge-group 4	Associating the interface to bridge-group 4
Bridge4(config-if)#bridge-group 4 instance 2	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 3	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 4	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 5	Assigning bridge-group 4 to this instance
Bridge4(config-if)#commit	Commit candidate configuration to be running configuration
Bridge4(config-if)#exit	Exit interface mode.
Bridge4(config)#interface eth3	Enter interface mode for eth3
Bridge4(config-if)#bridge-group 4	Associating the interface to bridge-group 4
Bridge4(config-if)#bridge-group 4 instance 2	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 3	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 4	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 5	Assigning bridge-group 4 to this instance
Bridge4(config-if)#commit	Commit candidate configuration to be running configuration
Bridge4(config-if)#exit	Exit interface mode.
Bridge4(config)#interface eth4	Enter interface mode for eth4
Bridge4(config-if)#bridge-group 4	Associating the interface to bridge-group 4
Bridge4(config-if)#bridge-group 4 instance 2	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 3	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 4	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 5	Assigning bridge-group 4 to this instance
Bridge4(config-if)#commit	Commit candidate configuration to be running configuration
Bridge4(config-if)#exit	Exit interface mode.
Bridge4(config)#interface eth5	Enter interface mode for eth5
Bridge4(config-if)#bridge-group 4	Associating the interface to bridge-group 4
Bridge4(config-if)#bridge-group 4 instance 2	Assigning bridge-group 4 to this instance

Bridge4(config-if)#bridge-group 4 instance 3	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 4	Assigning bridge-group 4 to this instance
Bridge4(config-if)#bridge-group 4 instance 5	Assigning bridge-group 4 to this instance
Bridge4(config-if)#commit	Commit candidate configuration to be running configuration
Bridge4(config-if)#exit	Exit interface mode.

## Validation

show spanning-tree, show spanning-tree mst detail

```
#show spanning-tree mst detail
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: CIST Root Path Cost 0 - CIST Root Port 3 - CIST Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6 -
Max-hops 20
% 1: CIST Root Id 1000525400d15789
% 1: CIST Reg Root Id 1000525400d15789
% 1: CIST Bridge Id 8000525400244323
% 1: 26 topology change(s) - last topology change Mon Mar  4 12:58:35 2019

% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Rootport - State
Forwarding
% eth1: Designated External Path Cost 0 -Internal Path Cost 20000
% eth1: Configured Path Cost 20000 - Add type Explicit ref count 5
% eth1: Designated Port Id 0x8003 - CIST Priority 128 -
% eth1: CIST Root 1000525400d15789
% eth1: Regional Root 1000525400d15789
% eth1: Designated Bridge 1000525400d15789
% eth1: Message Age 0 - Max Age 20
% eth1: CIST Hello Time 2 - Forward Delay 15
% eth1: CIST Forward Timer 0 - Msg Age Timer 5 - Hello Timer 0 - topo change
timer 0
% eth1: forward-transitions 1
% eth1: Version Multiple Spanning Tree Protocol - Received MSTP - Send MSTP
% 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
%
% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Alternate - State
Discarding
% eth2: Designated External Path Cost 0 -Internal Path Cost 20000
% eth2: Configured Path Cost 20000 - Add type Explicit ref count 5
% eth2: Designated Port Id 0x8004 - CIST Priority 128 -
% eth2: CIST Root 1000525400d15789
% eth2: Regional Root 1000525400d15789
```

```
% eth2: Designated Bridge 1000525400d15789
% eth2: Message Age 0 - Max Age 20
% eth2: CIST Hello Time 2 - Forward Delay 15
% eth2: CIST Forward Timer 0 - Msg Age Timer 5 - Hello Timer 1 - topo change
timer 0
% eth2: forward-transitions 2
% eth2: Version Multiple Spanning Tree Protocol - Received MSTP - 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
%
% eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - Role Designated - State
Forwarding
% eth3: Designated External Path Cost 0 -Internal Path Cost 20000
% eth3: Configured Path Cost 20000 - Add type Explicit ref count 5
% eth3: Designated Port Id 0x8005 - CIST Priority 128 -
% eth3: CIST Root 1000525400d15789
% eth3: Regional Root 1000525400d15789
% eth3: Designated Bridge 8000525400244323
% eth3: Message Age 0 - Max Age 20
% eth3: CIST Hello Time 2 - Forward Delay 15
% eth3: CIST Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change
timer 0
% eth3: forward-transitions 3
% eth3: Version Multiple Spanning Tree Protocol - Received None - Send MSTP
% eth3: No portfast configured - Current portfast off
% eth3: bpdu-guard default - Current bpdu-guard off
% eth3: bpdu-filter default - Current bpdu-filter off
% eth3: no root guard configured - Current root guard off
% eth3: Configured Link Type point-to-point - Current point-to-point
% eth3: No auto-edge configured - Current port Auto Edge off
%
% eth4: Port Number 6 - Ifindex 6 - Port Id 0x8006 - Role Designated - State
Forwarding
% eth4: Designated External Path Cost 0 -Internal Path Cost 20000
% eth4: Configured Path Cost 20000 - Add type Explicit ref count 5
% eth4: Designated Port Id 0x8006 - CIST Priority 128 -
% eth4: CIST Root 1000525400d15789
% eth4: Regional Root 1000525400d15789
% eth4: Designated Bridge 8000525400244323
% eth4: Message Age 0 - Max Age 20
% eth4: CIST Hello Time 2 - Forward Delay 15
% eth4: CIST Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change
timer 0
% eth4: forward-transitions 3
% eth4: Version Multiple Spanning Tree Protocol - Received None - Send MSTP
% eth4: No portfast configured - Current portfast off
% eth4: bpdu-guard default - Current bpdu-guard off
% eth4: bpdu-filter default - Current bpdu-filter off
% eth4: no root guard configured - Current root guard off
% eth4: Configured Link Type point-to-point - Current point-to-point
% eth4: No auto-edge configured - Current port Auto Edge off
%
% Instance 2: Vlans: 2
```

```
% 1: MSTI Root Path Cost 0 -MSTI Root Port 0 - MSTI Bridge Priority 32768
% 1: MSTI Root Id 8002525400244323
% 1: MSTI Bridge Id 8002525400244323
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State
Forwarding
% eth1: Designated Internal Path Cost 0 - Designated Port Id 0x8003
% eth1: Configured Internal Path Cost 20000
% eth1: Configured CST External Path cost 20000
% eth1: CST Priority 128 - MSTI Priority 128
% eth1: Designated Root 8002525400244323
% eth1: Designated Bridge 8002525400244323
% eth1: Message Age 0
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0

% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State
Forwarding
% eth2: Designated Internal Path Cost 0 - Designated Port Id 0x8004
% eth2: Configured Internal Path Cost 20000
% eth2: Configured CST External Path cost 20000
% eth2: CST Priority 128 - MSTI Priority 128
% eth2: Designated Root 8002525400244323
% eth2: Designated Bridge 8002525400244323
% eth2: Message Age 0
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - Role Designated - State
Forwarding
% eth3: Designated Internal Path Cost 0 - Designated Port Id 0x8005
% eth3: Configured Internal Path Cost 20000
% eth3: Configured CST External Path cost 20000
% eth3: CST Priority 128 - MSTI Priority 128
% eth3: Designated Root 8002525400244323
% eth3: Designated Bridge 8002525400244323
% eth3: Message Age 0
% eth3: Hello Time 2 - Forward Delay 15
% eth3: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% eth4: Port Number 6 - Ifindex 6 - Port Id 0x8006 - Role Designated - State
Forwarding
% eth4: Designated Internal Path Cost 0 - Designated Port Id 0x8006
% eth4: Configured Internal Path Cost 20000
% eth4: Configured CST External Path cost 20000
% eth4: CST Priority 128 - MSTI Priority 128
% eth4: Designated Root 8002525400244323
% eth4: Designated Bridge 8002525400244323
% eth4: Message Age 0
% eth4: Hello Time 2 - Forward Delay 15
% eth4: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% Instance 3: Vlans: 3

% 1: MSTI Root Path Cost 0 -MSTI Root Port 0 - MSTI Bridge Priority 32768
% 1: MSTI Root Id 8003525400244323
```

```
% 1: MSTI Bridge Id 8003525400244323
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Masterport - State
Forwarding
% eth1: Designated Internal Path Cost 0 - Designated Port Id 0x8003
% eth1: Configured Internal Path Cost 20000
% eth1: Configured CST External Path cost 20000
% eth1: CST Priority 128 - MSTI Priority 128
% eth1: Designated Root 8003525400244323
% eth1: Designated Bridge 8003525400244323
% eth1: Message Age 0
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0

% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State
Forwarding
% eth2: Designated Internal Path Cost 0 - Designated Port Id 0x8004
% eth2: Configured Internal Path Cost 20000
% eth2: Configured CST External Path cost 20000
% eth2: CST Priority 128 - MSTI Priority 128
% eth2: Designated Root 8003525400244323
% eth2: Designated Bridge 8003525400244323
% eth2: Message Age 0
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - Role Designated - State
Forwarding
% eth3: Designated Internal Path Cost 0 - Designated Port Id 0x8005
% eth3: Configured Internal Path Cost 20000
% eth3: Configured CST External Path cost 20000
% eth3: CST Priority 128 - MSTI Priority 128
% eth3: Designated Root 8003525400244323
% eth3: Designated Bridge 8003525400244323
% eth3: Message Age 0
% eth3: Hello Time 2 - Forward Delay 15
% eth3: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% eth4: Port Number 6 - Ifindex 6 - Port Id 0x8006 - Role Designated - State
Forwarding
% eth4: Designated Internal Path Cost 0 - Designated Port Id 0x8006
% eth4: Configured Internal Path Cost 20000
% eth4: Configured CST External Path cost 20000
% eth4: CST Priority 128 - MSTI Priority 128
% eth4: Designated Root 8003525400244323
% eth4: Designated Bridge 8003525400244323
% eth4: Message Age 0
% eth4: Hello Time 2 - Forward Delay 15
% eth4: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% Instance 4: Vlan: 4

% 1: MSTI Root Path Cost 0 -MSTI Root Port 0 - MSTI Bridge Priority 32768
% 1: MSTI Root Id 8004525400244323
% 1: MSTI Bridge Id 8004525400244323
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Masterport - State
Forwarding
% eth1: Designated Internal Path Cost 0 - Designated Port Id 0x8003
```



```
% eth1: Configured Internal Path Cost 20000
% eth1: Configured CST External Path cost 20000
% eth1: CST Priority 128 - MSTI Priority 128
% eth1: Designated Root 8004525400244323
% eth1: Designated Bridge 8004525400244323
% eth1: Message Age 0
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0

% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State
Forwarding
% eth2: Designated Internal Path Cost 0 - Designated Port Id 0x8004
% eth2: Configured Internal Path Cost 20000
% eth2: Configured CST External Path cost 20000
% eth2: CST Priority 128 - MSTI Priority 128
% eth2: Designated Root 8004525400244323
% eth2: Designated Bridge 8004525400244323
% eth2: Message Age 0
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - Role Designated - State
Forwarding
% eth3: Designated Internal Path Cost 0 - Designated Port Id 0x8005
% eth3: Configured Internal Path Cost 20000
% eth3: Configured CST External Path cost 20000
% eth3: CST Priority 128 - MSTI Priority 128
% eth3: Designated Root 8004525400244323
% eth3: Designated Bridge 8004525400244323
% eth3: Message Age 0
% eth3: Hello Time 2 - Forward Delay 15
% eth3: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% eth4: Port Number 6 - Ifindex 6 - Port Id 0x8006 - Role Designated - State
Forwarding
% eth4: Designated Internal Path Cost 0 - Designated Port Id 0x8006
% eth4: Configured Internal Path Cost 20000
% eth4: Configured CST External Path cost 20000
% eth4: CST Priority 128 - MSTI Priority 128
% eth4: Designated Root 8004525400244323
% eth4: Designated Bridge 8004525400244323
% eth4: Message Age 0
% eth4: Hello Time 2 - Forward Delay 15
% eth4: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% Instance 5: Vlans: 5

% 1: MSTI Root Path Cost 0 -MSTI Root Port 0 - MSTI Bridge Priority 32768
% 1: MSTI Root Id 8005525400244323
% 1: MSTI Bridge Id 8005525400244323
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Masterport - State
Forwarding
% eth1: Designated Internal Path Cost 0 - Designated Port Id 0x8003
% eth1: Configured Internal Path Cost 20000
% eth1: Configured CST External Path cost 20000
% eth1: CST Priority 128 - MSTI Priority 128
```

```
% eth1: Designated Root 8005525400244323
% eth1: Designated Bridge 8005525400244323
% eth1: Message Age 0
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0

% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State
Forwarding
% eth2: Designated Internal Path Cost 0 - Designated Port Id 0x8004
% eth2: Configured Internal Path Cost 20000
% eth2: Configured CST External Path cost 20000
% eth2: CST Priority 128 - MSTI Priority 128
% eth2: Designated Root 8005525400244323
% eth2: Designated Bridge 8005525400244323
% eth2: Message Age 0
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - Role Designated - State
Forwarding
% eth3: Designated Internal Path Cost 0 - Designated Port Id 0x8005
% eth3: Configured Internal Path Cost 20000
% eth3: Configured CST External Path cost 20000
% eth3: CST Priority 128 - MSTI Priority 128
% eth3: Designated Root 8005525400244323
% eth3: Designated Bridge 8005525400244323
% eth3: Message Age 0
% eth3: Hello Time 2 - Forward Delay 15
% eth3: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

% eth4: Port Number 6 - Ifindex 6 - Port Id 0x8006 - Role Designated - State
Forwarding
% eth4: Designated Internal Path Cost 0 - Designated Port Id 0x8006
% eth4: Configured Internal Path Cost 20000
% eth4: Configured CST External Path cost 20000
% eth4: CST Priority 128 - MSTI Priority 128
% eth4: Designated Root 8005525400244323
% eth4: Designated Bridge 8005525400244323
% eth4: Message Age 0
% eth4: Hello Time 2 - Forward Delay 15
% eth4: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

#show spanning-tree
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: CIST Root Path Cost 0 - CIST Root Port 3 - CIST Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6 -
Max-hops 20
% 1: CIST Root Id 1000525400d15789
% 1: CIST Reg Root Id 1000525400d15789
% 1: CIST Bridge Id 8000525400244323
% 1: 26 topology change(s) - last topology change Mon Mar 4 12:58:35 2019

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

```
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Rootport - State
Forwarding
% eth1: Designated External Path Cost 0 -Internal Path Cost 20000
% eth1: Configured Path Cost 20000 - Add type Explicit ref count 5
% eth1: Designated Port Id 0x8003 - CIST Priority 128 -
% eth1: CIST Root 1000525400d15789
% eth1: Regional Root 1000525400d15789
% eth1: Designated Bridge 1000525400d15789
% eth1: Message Age 0 - Max Age 20
% eth1: CIST Hello Time 2 - Forward Delay 15
% eth1: CIST Forward Timer 0 - Msg Age Timer 5 - Hello Timer 1 - topo change
timer 0
% eth1: forward-transitions 1
% eth1: Version Multiple Spanning Tree Protocol - Received MSTP - Send MSTP
% 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
%
% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Alternate - State
Discarding
% eth2: Designated External Path Cost 0 -Internal Path Cost 20000
% eth2: Configured Path Cost 20000 - Add type Explicit ref count 5
% eth2: Designated Port Id 0x8004 - CIST Priority 128 -
% eth2: CIST Root 1000525400d15789
% eth2: Regional Root 1000525400d15789
% eth2: Designated Bridge 1000525400d15789
% eth2: Message Age 0 - Max Age 20
% eth2: CIST Hello Time 2 - Forward Delay 15
% eth2: CIST Forward Timer 0 - Msg Age Timer 5 - Hello Timer 0 - topo change
timer 0
% eth2: forward-transitions 2
% eth2: Version Multiple Spanning Tree Protocol - Received MSTP - 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
%
% eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - Role Designated - State
Forwarding
% eth3: Designated External Path Cost 0 -Internal Path Cost 20000
% eth3: Configured Path Cost 20000 - Add type Explicit ref count 5
% eth3: Designated Port Id 0x8005 - CIST Priority 128 -
% eth3: CIST Root 1000525400d15789
% eth3: Regional Root 1000525400d15789
% eth3: Designated Bridge 8000525400244323
% eth3: Message Age 0 - Max Age 20
% eth3: CIST Hello Time 2 - Forward Delay 15
% eth3: CIST Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change
timer 0
% eth3: forward-transitions 3
% eth3: Version Multiple Spanning Tree Protocol - Received None - Send MSTP
% eth3: No portfast configured - Current portfast off
% eth3: bpdu-guard default - Current bpdu-guard off
```

```
% eth3: bpdu-filter default - Current bpdu-filter off
% eth3: no root guard configured - Current root guard off
% eth3: Configured Link Type point-to-point - Current point-to-point
% eth3: No auto-edge configured - Current port Auto Edge off
%
% eth4: Port Number 6 - Ifindex 6 - Port Id 0x8006 - Role Designated - State
Forwarding
% eth4: Designated External Path Cost 0 -Internal Path Cost 20000
% eth4: Configured Path Cost 20000 - Add type Explicit ref count 5
% eth4: Designated Port Id 0x8006 - CIST Priority 128 -
% eth4: CIST Root 1000525400d15789
% eth4: Regional Root 1000525400d15789
% eth4: Designated Bridge 8000525400244323
% eth4: Message Age 0 - Max Age 20
% eth4: CIST Hello Time 2 - Forward Delay 15
% eth4: CIST Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change
timer 0
% eth4: forward-transitions 3
% eth4: Version Multiple Spanning Tree Protocol - Received None - Send MSTP
% eth4: No portfast configured - Current portfast off
% eth4: bpdu-guard default - Current bpdu-guard off
% eth4: bpdu-filter default - Current bpdu-filter off
% eth4: no root guard configured - Current root guard off
% eth4: Configured Link Type point-to-point - Current point-to-point
% eth4: No auto-edge configured - Current port Auto Edge off%
#
```

## CHAPTER 11 Port Security Configuration

The Port Security feature allows network administrators to block unauthorized access to the network. Network administrators can configure each port of the switch to allow network access from only secured MACs, so that the switch forwards traffic from only secured MACs.

Users can limit each port's ingress traffic by limiting MAC addresses (source MACs) that are used to send traffic into ports. Port Security enables users to configure the maximum number of secured MACs for each port. Switches learn secured MAC dynamically (learned by switch during traffic inflow) or statically (User configured MACs). Dynamically Learned or statically programmed MAC addresses cannot exceed the maximum number of secured MACs configured for a particular port. Once the switch reaches the maximum limit for secured MACs, traffic from all other MAC addresses are dropped.

The violated MACs are logged in syslog messages. Refer to `cpu queue portsec-drop` using the command `show interface cpu counter queue-stats` for information on the number of violated MACs.

### Secured MACs Learned Dynamically



**Figure 11-24: Secured MACs learned dynamically**

Send Layer-2 traffic with incremental source MAC of 100 and with VLAN 100 from Edge Network node and since max limit is configured as 3 – only 3 secure MAC addresses will be learned by SW1.

#### SW1

#configure terminal	Enter configure mode.
(config)#hostname SW1	Set the host name
(config)#bridge 1 protocol rstp vlan-bridge	Create a RSTP VLAN bridge on customer side
(config)#vlan 2-200 bridge 1 state enable	Configure VLAN for the bridge
(config)#interface ge1	Enter interface mode
(config-if)#switchport	Make the interface Layer 2
(config-if)#bridge-group 1	Associate the interface to bridge
(config-if)#switchport mode hybrid	Configure the mode as trunk
(config-if)#switchport hybrid allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#switchport port-security	Enable port security mode dynamic
(config-if)#switchport port-security maximum 3	Limit secure MAC to 3 mac addresses.
(config-if)#commit	Commit candidate configuration to be running configuration

(config-if)#exit	Exit interface mode
(config)#interface ge2	Enter interface mode
(config-if)#switchport	Make the interface Layer 2
(config-if)#bridge-group 1	Associate the interface to bridge
(config-if)#switchport mode hybrid	Configure the mode as trunk
(config-if)#switchport hybrid allowed vlan all	Configure allowed VLAN all on the interface
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#logging monitor 7	Enable logging level as 7 for debugging

## Validation

Validation commands are "show port-security," "show port-security interface <ifname>," "show mac address-table count bridge 1," "show bridge," and "show mac address-table bridge 1."

```
SW1#show port-security
Port      port-security mode  MAC limit  CVLAN   SVLAN   static secure MAC
-----+-----+-----+-----+-----+-----
ge1       dynamic                  3
```

```
SW1#show port-security interface ge1
Port Security Mode      : Dynamic
Secure MAC limit       : 3
Static Secure MAC list :
CVLAN  SVLAN  MAC Address
-----+-----+-----
```

```
SW1#show mac address-table count bridge 1
MAC Entries for all vlans:
Dynamic Address Count: 3
Static (User-defined) Unicast MAC Address Count: 0
Static (User-defined) Multicast MAC Address Count: 0
Total MAC Addresses in Use: 3
```

```
SW1#show bridge
Ageout time is global and if something is configured for vxlan then it will be affected here also
```

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1	100			ge1	0000.0300.0500	1	100
1	100			ge1	0000.0300.055b	1	100
1	100			ge1	0000.0300.055c	1	100

```
SW1#show mac address-table bridge 1
VLAN  MAC Address      Type      Ports      Port-security
-----+-----+-----+-----+-----
100    0000.0300.0500    dynamic   ge1         Enable
100    0000.0300.055b    dynamic   ge1         Enable
```

---

100	0000.0300.055c	dynamic	ge1	Enable
-----	----------------	---------	-----	--------

SW1#

## Secured MAC Addresses Learned Statically

1. Stop the traffic from Edge Network node and do “clear mac address-table dynamic bridge 1” on SW1.
2. Verify all dynamic secured MAC addresses are cleared.
3. Configure 3 static secure MAC addresses using the commands below in port security configured interface.
4. Try to add a fourth static secure MAC address.
5. Verify operator log message is displayed, saying “port security mac limit reached.”

(config)#interface gel	Enter interface mode
(config-if)#switchport port-security mac-address 0000.0000.aaaa vlanId 100	Add static secure MAC address for VLAN 100 in interface mode
(config-if)#switchport port-security mac-address 0000.0000.aaab vlanId 100	Add static secure MAC address for VLAN 100 in interface mode
(config-if)#switchport port-security mac-address 0000.0000.aaac vlanId 100	Add static secure MAC address for VLAN 100 in interface mode
(config-if)#commit	Commit candidate configuration to be running configuration

## Validation

```
SW1#show port-security
Port      port-security mode  MAC limit  CVLAN  SVLAN  static secure MAC
-----+-----+-----+-----+-----+-----
gel       dynamic              3          100    100    0000.0000.aaaa
              100    0000.0000.aaab
              100    0000.0000.aaac
```

```
SW1#show port-security interface gel
Port Security Mode      : Dynamic
Secure MAC limit       : 3
Static Secure MAC list :
CVLAN  SVLAN  MAC Address
-----+-----+-----
100    0000.0000.aaaa
100    0000.0000.aaab
100    0000.0000.aaac
```

```
SW1#show mac address-table count bridge 1
MAC Entries for all vlans:
Dynamic Address Count: 0
Static (User-defined) Unicast MAC Address Count: 3
Static (User-defined) Multicast MAC Address Count: 0
Total MAC Addresses in Use: 3
```

```
SW1#show bridge
```



Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1	100			ge1	0000.0000.aaaa	1	-
1	100			ge1	0000.0000.aaab	1	-
1	100			ge1	0000.0000.aaac	1	-

```
SW1#show mac address-table bridge 1
```

VLAN	MAC Address	Type	Ports	Port-security
100	0000.0000.aaaa	static	ge1	Enable
100	0000.0000.aaab	static	ge1	Enable
100	0000.0000.aaac	static	ge1	Enable

```
SW1#
```

Remove the port-security configuration method using the two commands below:

(	
config)#interface ge1	Enter interface mode
(config-if)#no switchport port-security	Set the port-security method to static.
(config-if)#commit	Commit candidate configuration to be running configuration

## Static Mode

Use the below command to configure the port-security method to static and configure static secure MAC addresses using the commands the in static port-security method, below.

(config)#interface ge1	Enter interface mode
(config-if)#switchport port-security static	Set the port-security method as static.
(config-if)#switchport port-security max 3	Limit static secure MAC to 3 mac addresses.
(config-if)#switchport port-security mac-address 0000.0000.aaaa vlanId 100	Add static secure MAC address for VLAN 100 in interface mode.
(config-if)#switchport port-security mac-address 0000.0000.aaab vlanId 100	Add static secure MAC address for VLAN 100 in interface mode.
(config-if)#switchport port-security mac-address 0000.0000.aaac vlanId 100	Add static secure MAC address for VLAN 100 in interface mode .
(config-if)#commit	Commit candidate configuration to be running configuration

Verify the 3 secure static MAC addresses are added in interface ge1 using show running-config and also verify the port-security method should be static using below show commands.

## Validation

```
SW1#show running-config interface ge1
interface ge1
  switchport
  bridge-group 1
  switchport mode hybrid
```

```

switchport hybrid allowed vlan all
switchport port-security static
switchport port-security maximum 3
switchport port-security mac-address 0000.0000.aaaa vlanId 100
switchport port-security mac-address 0000.0000.aaab vlanId 100
switchport port-security mac-address 0000.0000.aaac vlanId 100

```

SW1#show port-security

Port	port-security mode	MAC limit	CVLAN	SVLAN	static secure MAC
ge1	static	3	100		0000.0000.aaaa
			100		0000.0000.aaab
			100		0000.0000.aaac

SW1#show port-security interface ge1

```

Port Security Mode      : Static
Secure MAC limit       : 3
Static Secure MAC list :
CVLAN  SVLAN  MAC Address
-----+-----+-----

```

100		0000.0000.aaaa
100		0000.0000.aaab
100		0000.0000.aaac

SW1#show mac address-table count bridge 1

MAC Entries for all vlans:

Dynamic Address Count: 0

Static (User-defined) Unicast MAC Address Count: 3

Static (User-defined) Multicast MAC Address Count: 0

Total MAC Addresses in Use: 3

SW1#show bridge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1	100			ge1	0000.0000.aaaa	1	-
1	100			ge1	0000.0000.aaab	1	-
1	100			ge1	0000.0000.aaac	1	-

SW1#show mac address-table bridge 1

VLAN	MAC Address	Type	Ports	Port-security
100	0000.0000.aaaa	static	ge1	Enable
100	0000.0000.aaab	static	ge1	Enable
100	0000.0000.aaac	static	ge1	Enable

SW1#

Configure one more static secure MAC address on interface ge1 and try to verify "port security mac limit reached" operator log message is displayed.

Start sending Layer-2 traffic with incremental source MAC of 100 and with VLAN 100 from Edge Network node, and verify no dynamic secure MAC addresses are being learned using all the validation commands used.

## Port Security using MLAG

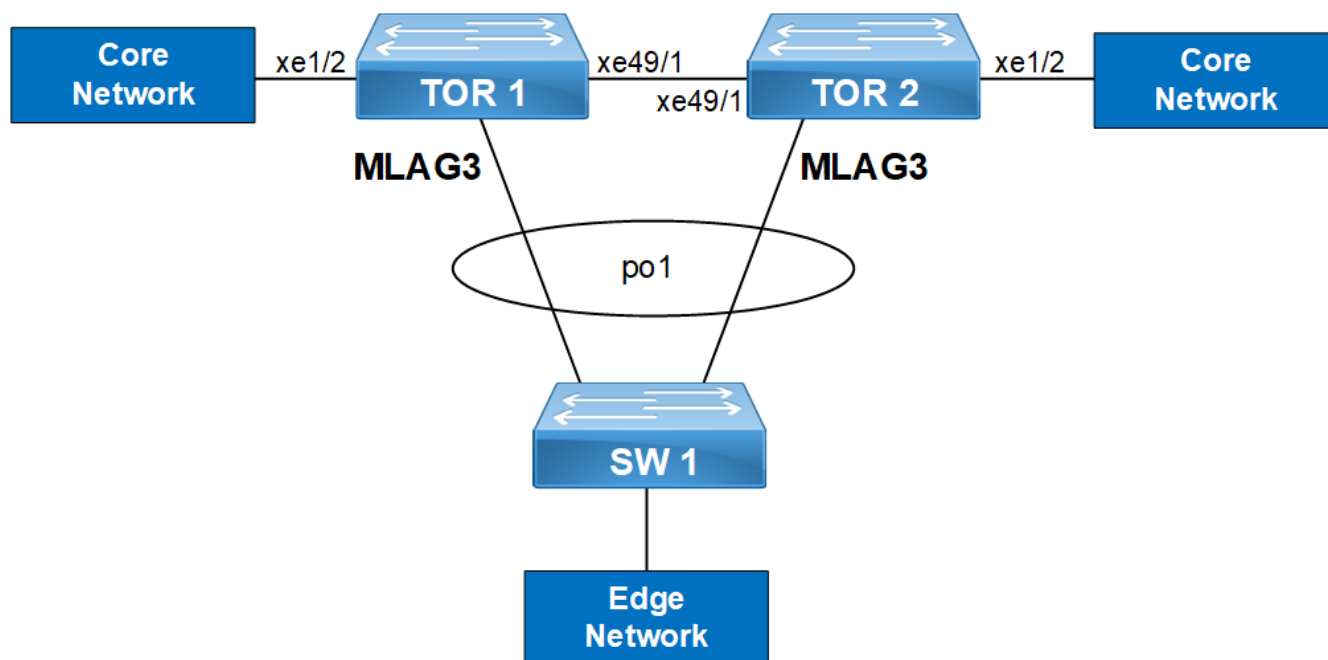


Figure 11-25: Port security with MLAG

### TOR1

#configure terminal	Enter configure mode
(config)#bridge 1 protocol provider-rstp edge	Create provider RSTP bridge
(config)#vlan 2-10 type customer bridge 1 state enable	Enabling customer vlan for bridge
(config)#vlan 2-10 type service point-point bridge 1 state enable	Enabling service vlan for bridge
(config)#cvlan registration table map1 bridge 1	Creating registration table
(config-cvlan-registration)#cvlan 2 svlan 2	Mapping CVLAN to SVLAN
(config-cvlan-registration)#cvlan 10 svlan 2	Mapping CVLAN to SVLAN
(config-cvlan-registration)#commit	Commit candidate configuration to be running configuration
(config-cvlan-registration)#exit	Exit registration table mode
(config)#interface mlag3	Entering MLAG interface
(config-if)#switchport	Configuring interface as switchport
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface po1	Entering dynamic lag interface
(config-if)#switchport	Configuring interface as switchport

(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1 and disabling spanning-tree
(config-if)#switchport mode customer-edge hybrid	Set the switching characteristics of this interface to customer edge hybrid
(config-if)#switchport customer-edge hybrid vlan 2	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN 2
(config-if)#switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN all
(config-if)#mlag 3	Enabling mlag group number
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface xe49/1	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
(config-if)#bridge-group 1	Associate the interface with bridge group 1.
(config-if)#switchport mode provider-network	Set the switching characteristics of this interface to provider network
(config-if)#switchport provider-network allowed vlan all	Set the switching characteristics of this interface to provider network and allow all VLAN
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Enter interface mode
(config)#interface xe3	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
(config-if)#bridge-group 1	Associate the interface with bridge group 1.
(config-if)#switchport mode customer-edge hybrid	Set the switching characteristics of this interface to customer edge hybrid
(config-if)#switchport customer-edge hybrid vlan 2	Set the switching characteristics of this interface to customer edge hybrid and allow vlan 2
(config-if)#switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN all
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface mlag3	Entering MLAG interface
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1 and disabling spanning-tree
(config-if)#switchport mode customer-edge hybrid	Set the switching characteristics of this interface to customer edge hybrid
(config-if)#switchport customer-edge hybrid vlan 2	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN 2
(config-if)#switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN all
(config-if)#switchport customer-edge vlan registration map1	Configuring the registration table mapping on MLAG interface
(config-if)#switchport port-security	Enabling port security

(config-if)#switchport port-security maximum 10	Limiting the maximum mac to 10
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#mcec domain configuration	Entering MCEC mode
(config-mcec-domain)#domain-address 2222.2222.2222	Domain address for the MLAG domain
(config-mcec-domain)#domain-system-number 1	Number to identify the node in a domain
(config-if)#commit	Commit candidate configuration to be running configuration
(config-mcec-domain)#exit	Exit MCEC mode
(config)#intra-domain-link xe49/1	Intra domain line between MLAG domain
(config-if)#domain-priority 333	Domain priority for MCEC
(config-if)#commit	Commit candidate configuration to be running configuration

## TOR2

(config-if)#	
#configure terminal	Enter configure mode
(config)#bridge 1 protocol provider-rstp edge	Create provider RSTP bridge
(config)#vlan 2-10 type customer bridge 1 state enable	Enabling customer VLAN for bridge
(config)#vlan 2-10 type service point-point bridge 1 state enable	Enabling service VLAN for bridge
(config)#cvlan registration table map1 bridge 1	Creating registration table
(config-cvlan-registation)#cvlan 2 svlan 2	Mapping CVLAN to SVLAN
(config-cvlan-registation)#cvlan 10 svlan 2	Mapping CVLAN to SVLAN
(config-cvlan-registation)#commit	Commit candidate configuration to be running configuration
(config-cvlan-registation)#exit	Exit registration table mode
(config)#interface mlag3	Entering MLAG interface
(config-if)#switchport	Configuring interface as switchport
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface po1	Entering dynamic lag interface
(config-if)#Switchport	Configuring interface as switchport
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1and disabling spanning-tree
(config-if)#switchport mode customer-edge hybrid	Set the switching characteristics of this interface to customer edge hybrid
(config-if)#switchport customer-edge hybrid vlan 2	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN 2
(config-if)#switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN all
(config-if)#mlag 3	Enabling MLAG group number
(config-if)#commit	Commit candidate configuration to be running configuration

(config-if)#exit	Exit interface mode
(config)#interface xe49/1	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
(config-if)#bridge-group 1	Associate the interface with bridge group 1.
(config-if)#switchport mode provider-network	Set the switching characteristics of this interface to provider network
(config-if)#switchport provider-network allowed vlan all	Set the switching characteristics of this interface to provider network and allow all VLAN
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface xe3	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
bridge-group 1	Associate the interface with bridge group 1
(config-if)#switchport mode customer-edge hybrid	Set the switching characteristics of this interface to customer edge hybrid
(config-if)#switchport customer-edge hybrid vlan 2	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN 2
(config-if)#switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN all
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface mlag3	Entering MLAG interface
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1 and disabling spanning-tree
(config-if)#switchport mode customer-edge hybrid	Set the switching characteristics of this interface to customer edge hybrid
(config-if)#switchport customer-edge hybrid vlan 2	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN 2
(config-if)#switchport customer-edge hybrid allowed vlan all	Set the switching characteristics of this interface to customer edge hybrid and allow VLAN all
(config-if)#switchport customer-edge vlan registration map1	Configuring the registration table mapping on MLAG interface
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
mcec domain configuration	Entering MCEC mode
(config-mcec-domain)#domain-address 2222.2222.2222	Domain address for the MLAG domain
(config-mcec-domain)#domain-system-number 2	Number to identify the node in a domain
(config-mcec-domain)#intra-domain-link xe49/1	Intra domain line between MLAG domain
(config-mcec-domain)#domain-priority 333	Domain priority for MCEC
(config-mcec-domain)#commit	Commit candidate configuration to be running configuration

**SW1**

configure terminal	Enter configuration mode
(config)#bridge 1 protocol rstp vlan-bridge	Configuring the RSTP vlan bridge
(config)#interface po1	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1 and disabling spanning-tree
(config-if)#switchport mode hybrid	Set the switching characteristics of this interface hybrid
(config-if)#switchport hybrid allowed vlan all	Set the switching characteristics of this interface hybrid and allowing all vlan
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface xe1/3	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1 and disabling spanning-tree
(config-if)#switchport mode hybrid	Set the switching characteristics of this interface hybrid
(config-if)#switchport hybrid allowed vlan all	Set the switching characteristics of this interface hybrid and allowing all vlan
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface xe1/1	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
(config-if)#bridge-group 1 spanning-tree disable	Associate the interface with bridge group 1 and disabling spanning-tree
(config-if)#switchport mode hybrid	Set the switching characteristics of this interface hybrid
(config-if)#switchport hybrid allowed vlan all	Set the switching characteristics of this interface hybrid and allowing all vlan
(config-if)#channel-group 1 mode active	Add this interface to channel group 1 and enable link aggregation so that it can be selected for aggregation by the local system.
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface xe3/3	Entering interface mode
(config-if)#switchport	Configuring interface as switchport
(config-if)#bridge-group 1	Associate the interface with bridge group 1 and disabling spanning-tree
(config-if)#switchport mode hybrid	Set the switching characteristics of this interface hybrid
(config-if)#switchport hybrid allowed vlan all	Set the switching characteristics of this interface hybrid and allowing all VLAN
(config-if)#commit	Commit candidate configuration to be running configuration



Validation

TOR1#show bridge  
Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		2		mlag3	0000.0500.0200	1	54
1		2		mlag3	0000.0500.0201	1	60
1		2		mlag3	0000.0500.0202	1	54
1		2		mlag3	0000.0500.0203	1	60
1		2		mlag3	0000.0500.0204	1	54
1		2		mlag3	0000.0500.0205	1	60
1		2		mlag3	0000.0500.0207	1	60
1		2		mlag3	0000.0500.0208	1	54
1		2		mlag3	0000.0500.0209	1	60
1		2		mlag3	0000.0500.020a	1	54
1		2		mlag3	0000.0500.020b	1	60
1		2		mlag3	0000.0500.020c	1	54
1		2		mlag3	0000.0500.020d	1	60
1		2		mlag3	0000.0500.020e	1	54
1		2		mlag3	0000.0500.020f	1	60
1		2		mlag3	0000.0500.0210	1	54
1		2		mlag3	0000.0500.0211	1	60
1		2		mlag3	0000.0500.0212	1	54
1		2		mlag3	cc37.abbb.ed9b	1	40

TOR1#sh port-security  
Port port-security mode MAC limit CVLAN SVLAN static secure MAC  
-----+-----+-----+-----+-----+-----+-----  
Mlag3 dynamic 10  
TOR1#  
TOR1#show mac address-table count bridge 1 interface mlag3  
MAC Entries for all vlans:  
Dynamic Address Count: 20  
Static (User-defined) Unicast MAC Address Count: 0  
Static (User-defined) Multicast MAC Address Count: 0  
Total MAC Addresses in Use: 20  
TOR1#

# CHAPTER 12 Traffic Segmentation-Protected Port

The protected port is a feature that does not forward any traffic (unicast, multicast, or broadcast) to any other port that is also a protected port. However, a protected port can communicate with an unprotected port and vice-versa.

The protected port is a feature that does not forward any traffic (unicast, multicast, or broadcast) to any other port that is also a protected port. However, a protected port can communicate with an unprotected port and vice-versa.

- Protected port(isolated) to protected port(isolated) - communication is not allowed.
- Protected port(isolated) to protected port(community) - communication is not allowed.
- Protected port(isolated) to protected port(promiscuous) - communication is allowed.
- Protected port(community) to protected port(community) - communication is allowed.
- Protected port(community) to protected port(promiscuous) - communication is allowed.
- Protected port(promiscuous) to protected port(promiscuous) - communication is allowed.
- Unprotected port to protected port(any type) - communication is allowed.

The protected port configuration is local to the switch. This information is not propagated outside the switch. Protected ports across switches can still be able to communicate with each other.

The use of protected ports ensures that there is no exchange of unicast, broadcast, or multicast data traffic between ports on the same switch so that one neighbor does not see the traffic generated by another neighbor.

## Topology

Figure 12-26 displays Traffic Segmentation-Protected Port Topology

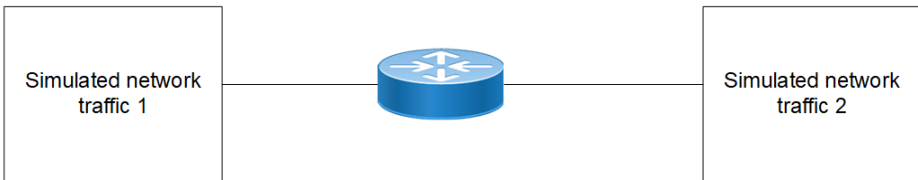


Figure 12-26: Traffic Segmentation-Protected Port Topology

## Isolated-Promiscuous Configuration

### RTR1

Bridge Configuration:

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol ieee vlan-bridge	Configure bridge
(config)#commit	Commit candidate configuration to be running configuration

**VLAN Configuration:**

#configure terminal	Enter configterminal mode
(config)#vlan database	Enter into the vlan database
(config-vlan)# vlan 30 bridge 1 state enable	Configure vlan 30 to bridge 1
(config-vlan)#commit	Commit candidate configuration to be running configuration
(config-vlan)#exit	Exit from the vlan database.
(config)#int xe1	Enter interface configuration mode for xe1
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Associate interface with bridge-group 1
(config-if)#switchport mode trunk	Set the switching characteristics of this interface as trunk
(config-if)#switchport trunk allowed vlan add 30	Configure vlan 30
(config-if)#switchport protected isolated	Configure interface as isolated port
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit from interface
(config)#int xe2	Enter interface configuration mode for xe2
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Associate interface with bridge-group 1
(config-if)#switchport mode trunk	Set the switching characteristics of this interface as trunk
(config-if)#switchport trunk allowed vlan add 30	Configure vlan 30
(config-if)#switchport protected promiscuous	Configure interface as promiscuous port
(config-if)#exit	Exit from interface mode
(config)#commit	Commit the configure on the node.

---

**Validation****RTR1**

```
#show running-config interface xe1
!
interface xe1
switchport
    switchport protected isolated
    bridge-group 1
    switchport mode trunk
    switchport trunk allowed vlan add 30
!
#show running-config interface xe2
!
interface xe2
switchport
switchport protected promiscuous
bridge-group 1
```

```
switchport mode trunk
switchport trunk allowed vlan add 30
```

```
#show interface xe1
```

```
Interface xe1
```

```
Flexport: Non Control Port (Active)
Hardware is ETH Current HW addr: 80a2.353f.edb7
Physical:80a2.353f.edb7 Logical:(not set)
Forward Error Correction (FEC) configured is Auto (default)
FEC status is N/A
Port Mode is trunk
Protected Mode is Isolated
Interface index: 5001
Metric 1 mtu 1500 duplex-full link-speed 10g
Debounce timer: disable
<UP,BROADCAST,RUNNING,MULTICAST>
VRF Binding: Not bound
Label switching is disabled
No Virtual Circuit configured
Administrative Group(s): None
Bandwidth 10g
DHCP client is disabled.
Last Flapped: 2022 Jan 06 13:13:42 (00:24:53 ago)
Statistics last cleared: 2022 Jan 06 13:13:42 (00:24:53 ago)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 256 bits/sec, 0 packets/sec
RX
  unicast packets 0 multicast packets 7 broadcast packets 0
  input packets 7 bytes 814
  jumbo packets 0
  undersize 0 oversize 0 CRC 0 fragments 0 jabbers 0
  input error 0
  input with dribble 0 input discard 7
  Rx pause 0
TX
  unicast packets 0 multicast packets 749 broadcast packets 0
  output packets 749 bytes 47944
  jumbo packets 0
  output errors 0 collision 0 deferred 0 late collision 0
  output discard 0
  Tx pause 0
```

```
#show interface xe2
```

```
Interface xe2
```

```
Flexport: Non Control Port (Active)
Hardware is ETH Current HW addr: 80a2.353f.edb9
Physical:80a2.353f.edb9 Logical:(not set)
Forward Error Correction (FEC) configured is Auto (default)
FEC status is N/A
Port Mode is trunk
```

```

Protected Mode is Promiscuous
Interface index: 5003
Metric 1 mtu 1500 duplex-full link-speed 10g
Debounce timer: disable
<UP,BROADCAST,RUNNING,MULTICAST>
VRF Binding: Not bound
Label switching is disabled
No Virtual Circuit configured
Administrative Group(s): None
Bandwidth 10g
DHCP client is disabled.
Last Flapped: Never
Statistics last cleared: 2022 Jan 06 13:15:32 (00:23:52 ago)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec

```

RX

```

unicast packets 0 multicast packets 0 broadcast packets 0
input packets 0 bytes 0
jumbo packets 0
undersize 0 oversize 0 CRC 0 fragments 0 jabbers 0
input error 0
input with dribble 0 input discard 0
Rx pause 0

```

TX

```

unicast packets 0 multicast packets 4569 broadcast packets 0
input packets 4569 bytes 327802
jumbo packets 0
output errors 0 collision 0 deferred 0 late collision 0
output discard 0
Tx pause 0

```

Send the vlan 30 tagged traffic from traffic 1 to traffic 2,  
#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
Xe1	100.01	20	0.00	0
Xe2	0.00	0	100.01	20

Send the vlan 30 tagged traffic from traffic 1 to traffic 2,  
#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
Xe1	0.00	20	100.00	0
Xe2	100.00	0	0.00	20

## Isolated-Isolated Configuration

### RTR1

#### Bridge Configuration:

#configure terminal	Enter configure mode.
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#bridge 1 protocol ieee vlan-bridge	Configure bridge

#### VLAN Configuration:

#configure terminal	Enter configterminal mode
(config)#vlan database	Enter into the vlan database
(config-vlan)# vlan 30 bridge 1 state enable	Configure vlan 30 to bridge 1
(config-vlan)#commit	Commit candidate configuration to be running configuration
(config-vlan)#exit	Exit from the vlan database.
(config)#int xe1	Enter interface configuration mode for xe1
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Associate interface with bridge-group 1
(config-if)#switchport mode trunk	Set the switching characteristics of this interface as trunk
(config-if)#switchport trunk allowed vlan add 30	Configure vlan 30
(config-if)#switchport protected isolated	Configure interface as isolated port
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit from interface
(config)#int xe2	Enter interface configuration mode for xe2
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Associate interface with bridge-group 1
(config-if)#switchport mode trunk	Set the switching characteristics of this interface as trunk
(config-if)#switchport trunk allowed vlan add 30	Configure vlan 30
(config-if)#switchport protected isolated	Configure interface as isolated port
(config-if)#exit	Exit from interface mode
(config)#commit	Commit the configure on the node.

## Validation

### RTR1

```
#show running-config interface xe1
!
```

```
interface xe1
switchport
    switchport protected isolated
    bridge-group 1
    switchport mode trunk
    switchport trunk allowed vlan add 30
!
#show running-config interface xe2
!
interface xe2
switchport
switchport protected isolated
bridge-group 1
switchport mode trunk
switchport trunk allowed vlan add 30

#show interface xe1
Interface xe1
  Flexport: Non Control Port (Active)
  Hardware is ETH Current HW addr: 80a2.353f.edb7
  Physical:80a2.353f.edb7 Logical:(not set)
  Forward Error Correction (FEC) configured is Auto (default)
  FEC status is N/A
  Port Mode is trunk
  Protected Mode is Isolated
  Interface index: 5001
  Metric 1 mtu 1500 duplex-full link-speed 10g
  Debounce timer: disable
  <UP,BROADCAST,RUNNING,MULTICAST>
  VRF Binding: Not bound
  Label switching is disabled
  No Virtual Circuit configured
  Administrative Group(s): None
  Bandwidth 10g
  DHCP client is disabled.
  Last Flapped: 2022 Jan 06 13:13:42 (00:24:53 ago)
  Statistics last cleared: 2022 Jan 06 13:13:42 (00:24:53 ago)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 256 bits/sec, 0 packets/sec
  RX
    unicast packets 0 multicast packets 7 broadcast packets 0
    input packets 7 bytes 814
    jumbo packets 0
    undersize 0 oversize 0 CRC 0 fragments 0 jabbers 0
    input error 0
    input with dribble 0 input discard 7
    Rx pause 0
  TX
    unicast packets 0 multicast packets 749 broadcast packets 0
    output packets 749 bytes 47944
```

```
jumbo packets 0
output errors 0 collision 0 deferred 0 late collision 0
output discard 0
Tx pause 0
```

```
#show interface xe2
```

```
Interface xe2
```

```
Flexport: Non Control Port (Active)
Hardware is ETH Current HW addr: 80a2.353f.edb9
Physical:80a2.353f.edb9 Logical:(not set)
Forward Error Correction (FEC) configured is Auto (default)
FEC status is N/A
Port Mode is trunk
Protected Mode is Isolated
Interface index: 5003
Metric 1 mtu 1500 duplex-full link-speed 10g
Debounce timer: disable
<UP,BROADCAST,RUNNING,MULTICAST>
VRF Binding: Not bound
Label switching is disabled
No Virtual Circuit configured
Administrative Group(s): None
Bandwidth 10g
DHCP client is disabled.
Last Flapped: Never
Statistics last cleared: 2022 Jan 06 13:15:32 (00:23:52 ago)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
RX
```

```
unicast packets 0 multicast packets 0 broadcast packets 0
input packets 0 bytes 0
jumbo packets 0
undersize 0 oversize 0 CRC 0 fragments 0 jabbers 0
input error 0
input with dribble 0 input discard 0
Rx pause 0
```

```
TX
```

```
unicast packets 0 multicast packets 0 broadcast packets 0
output packets 0 bytes 0
jumbo packets 0
output errors 0 collision 0 deferred 0 late collision 0
output discard 0
Tx pause 0
```

```
Send the vlan 30 tagged traffic from traffic 1 to traffic 2,
```

```
#show interface counters rate mbps
```

```
+-----+-----+-----+-----+-----+
| Interface | Rx mbps | Rx pps | Tx mbps | Tx pps |
+-----+-----+-----+-----+-----+
| Xe1       | 100.01  | 20     | 0.00    | 0      |
```



---

xe2	0.00	0	0.00	0
-----	------	---	------	---

## CHAPTER 13 RPVST+ Configuration

This chapter contains a complete example of an RPVST+ configuration.

### Topology



Figure 13-27: RPVST+ configuration

### Configuration

#### Switch 2

#configure terminal	Enter configure mode for the switch.
(config)#bridge 1 protocol rpvst+	Configure bridge 1 as an RPVST+ bridge.
(config)#vlan 2-3 bridge 1	Configure VLAN 2 and 3 and associate it to bridge 1.
(config)#spanning-tree rpvst+ configuration	Enter Rapid Per-VLAN Spanning Tree configuration mode.
(config-rpvst+)#bridge 1 vlan 2	Associate a configured VLAN with bridge 1.
(config-rpvst+)#bridge 1 vlan 3	Associate a configured VLAN with bridge 1,.
(config-rvpst+)#exit	Exit RPVST+ configuration mode.
(config)#interface eth1	Enter interface mode for eth1.
(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 add 2,3	Configure VLAN 2 and VLAN 3 on interface.
(config-if)#bridge-group 1 vlan 2	Configure bridge group to interface with VLAN 2.
(config-if)#bridge-group 1 vlan 3	Configure bridge group to interface with VLAN 3.
(config-if)#exit	Exit interface mode.
(config)#interface eth2	Enter interface mode for eth2.
(config-if)#switchport	Configure eth2 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 add 2,3	Configure VLAN 2 and VLAN 3 on interface.
(config-if)#bridge-group 1 vlan 2	Configure bridge group to interface with VLAN 2.
(config-if)#bridge-group 1 vlan 3	Configure bridge group to interface with VLAN3.
(config-if)#exit	Exit interface mode.

## Switch 1

#configure terminal	Enter configure mode for the switch.
(config)#bridge 1 protocol rpvst+	Configure bridge 1 as an rpvst+ bridge.
(config)#vlan 2-3 bridge 1	Configure VLAN 2 and 3 and associate it to bridge 1.
(config)#spanning-tree rpvst+ configuration	Enter Rapid Per-VLAN Spanning Tree configuration mode.
(config-rpvst+)#bridge 1 vlan 2	Associate a configured VLAN with bridge 1.
(config-rpvst+)#bridge 1 vlan 3	Associate a configured VLAN with bridge 1.
(config-rpvst+)#exit	Exit RPVST+ configuration mode.
(config)#interface eth1	Enter interface mode for eth1.
(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 add 2,3	Configure VLAN 2 and VLAN 3 on interface.
(config-if)#bridge-group 1 vlan 2	Configure bridge group to interface with VLAN 2.
(config-if)#bridge-group 1 vlan 3	Configure bridge group to interface with VLAN3.
(config-if)#exit	Exit interface mode.

## Switch 3

#configure terminal	Enter configure mode for the switch.
(config)#bridge 1 protocol rpvst+	Configure bridge 1 as an rpvst+ bridge
(config)#vlan 2-3 bridge 1	Configure VLAN 2 and 3 and associate it to bridge 1.
(config)#interface eth1	Enter interface mode for eth1.
(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 add 2,3	Configure VLAN 2 and VLAN 3 on interface.
(config-if)#exit	Exit interface mode.

## Validation

### Switch2

```
#show spanning-tree rpvst+ vlan 2
% vlan 2 Instance 1 configured
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 1: Root Id 8002525400b7bfa7
% 1: Bridge Id 8002525400b7bfa7
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State Forwarding
```

```
% eth1: Designated Internal Path Cost 0 - Designated Port Id 0x8003
% eth1: Configured Internal Path Cost 200000
% eth1: Configured External Path cost 200000
% eth1: Configured Internal Priority 128
% eth1: Configured External Priority 128
% eth1: Designated Root 8002525400b7bfa7
% eth1: Designated Bridge 8002525400b7bfa7
% 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
%
% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State
Forwarding
% eth2: Designated Internal Path Cost 0 - Designated Port Id 0x8004
% eth2: Configured Internal Path Cost 200000
% eth2: Configured External Path cost 200000
% eth2: Configured Internal Priority 128
% eth2: Configured External Priority 128
% eth2: Designated Root 8002525400b7bfa7
% eth2: Designated Bridge 8002525400b7bfa7
% eth2: Message Age 0 - Max Age 20
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1
%

#show spanning-tree rpvst+ interface eth1
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 1: Root Id 8001525400b7bfa7
% 1: Bridge Id 8001525400b7bfa7
% 1: last topology change Wed Mar 28 15:33:06 2018
% 1: 2 topology change(s) - last topology change Wed Mar 28 15:33:06 2018

% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State
Forwarding
% eth1: Designated External Path Cost 0 -Internal Path Cost 0
% eth1: Configured Path Cost 200000 - Add type Explicit ref count 3
% eth1: Designated Port Id 0x8003 - Priority 128 -
% eth1: Root 8001525400b7bfa7
% eth1: Designated Bridge 8001525400b7bfa7
% eth1: Message Age 0 - Max Age 20
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 2 - topo change timer 0
% eth1: forward-transitions 1
% 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
%
%
% Instance          VLAN
% 0:                1
% 1:                2
% 2:                3

#show spanning-tree rpvst+ detail
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 1: Root Id 8001525400b7bfa7
% 1: Bridge Id 8001525400b7bfa7
% 1: last topology change Wed Mar 28 15:33:06 2018
% 1: 2 topology change(s) - last topology change Wed Mar 28 15:33:06 2018

% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State Forwarding
% eth1: Designated External Path Cost 0 -Internal Path Cost 0
% eth1: Configured Path Cost 200000 - Add type Explicit ref count 3
% eth1: Designated Port Id 0x8003 - Priority 128 -
% eth1: Root 8001525400b7bfa7
% eth1: Designated Bridge 8001525400b7bfa7
% 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 1
% 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
%
% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State Forwarding
% eth2: Designated External Path Cost 0 -Internal Path Cost 0
% eth2: Configured Path Cost 200000 - Add type Explicit ref count 3
% eth2: Designated Port Id 0x8004 - Priority 128 -

```

```
% eth2: Root 8001525400b7bfa7
% eth2: Designated Bridge 8001525400b7bfa7
% eth2: Message Age 0 - Max Age 20
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change timer 0
% eth2: forward-transitions 1
% eth2: Version Rapid Spanning Tree Protocol - Received None - Send RSTP
% 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
%
```

```
% Instance 1: Vlans: 2
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State Forwarding
% eth1: Designated Internal Path Cost 0 - Designated Port Id 0x8003
% eth1: Configured Internal Path Cost 200000
% eth1: Configured External Path cost 200000
% eth1: Configured Internal Priority 128
% eth1: Configured External Priority 128
% eth1: Designated Root 8002525400b7bfa7
% eth1: Designated Bridge 8002525400b7bfa7
% 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
```

```
% Instance 1: Vlans: 2
% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State Forwarding
% eth2: Designated Internal Path Cost 0 - Designated Port Id 0x8004
% eth2: Configured Internal Path Cost 200000
% eth2: Configured External Path cost 200000
% eth2: Configured Internal Priority 128
% eth2: Configured External Priority 128
% eth2: Designated Root 8002525400b7bfa7
% eth2: Designated Bridge 8002525400b7bfa7
% eth2: Message Age 0 - Max Age 20
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1
```

```
% Instance 2: Vlans: 3
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State Forwarding
% eth1: Designated Internal Path Cost 0 - Designated Port Id 0x8003
% eth1: Configured Internal Path Cost 200000
% eth1: Configured External Path cost 200000
```

```
% eth1: Configured Internal Priority 128
% eth1: Configured External Priority 128
% eth1: Designated Root 8003525400b7bfa7
% eth1: Designated Bridge 8003525400b7bfa7
% 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

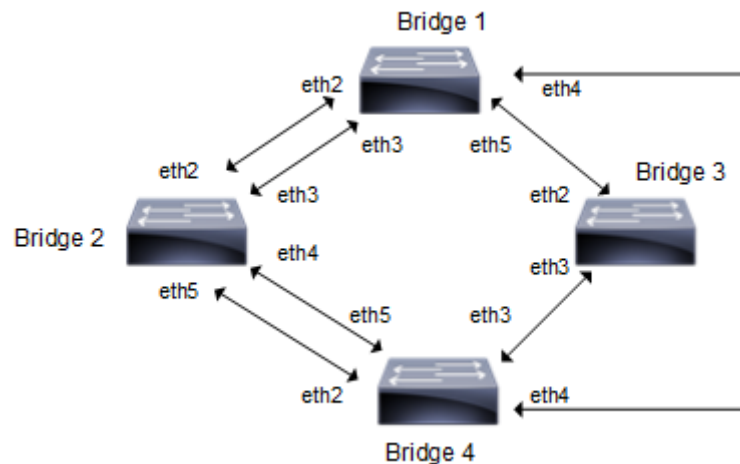
% Instance 2: Vlan: 3
% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State
Forwarding
% eth2: Designated Internal Path Cost 0 - Designated Port Id 0x8004
% eth2: Configured Internal Path Cost 200000
% eth2: Configured External Path cost 200000
% eth2: Configured Internal Priority 128
% eth2: Configured External Priority 128
% eth2: Designated Root 8003525400b7bfa7
% eth2: Designated Bridge 8003525400b7bfa7
% eth2: Message Age 0 - Max Age 20
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1
```

## CHAPTER 14 RSTP Configuration

This chapter contains a complete sample Rapid Spanning Tree Protocol (RSTP) configuration. RSTP provides rapid convergence of a spanning tree. It speeds up the reconfiguration of the tree after a change by using alternate ports.

### Topology

The following example is a simple multi-bridge topology.



**Figure 14-28: RSTP Topology**

Note: Run the `switchport` command on each port to change to Layer-2 mode.

### Configuration

#### Bridge 1

<code>Bridge1#configure terminal</code>	Enter configure mode.
<code>Bridge1(config)#bridge 1 protocol rstp</code>	Add a bridge (1) to the rapid spanning tree table
<code>Bridge1(config)#interface eth2</code>	Enter interface mode.
<code>Bridge1(config-if)#switchport</code>	Configure interface as a layer 2 port.
<code>Bridge1(config-if)#bridge-group 1</code>	Associate the interface with bridge group 1.
<code>Bridge1(config-if)#commit</code>	Commit the transaction.
<code>Bridge1(config-if)#exit</code>	Exit interface mode.
<code>Bridge1(config)#interface eth3</code>	Enter interface mode.
<code>Bridge1(config-if)#switchport</code>	Configure interface as a layer 2 port.
<code>Bridge1(config-if)#bridge-group 1</code>	Associate the interface with bridge group 1.
<code>Bridge1(config-if)#commit</code>	Commit the transaction.
<code>Bridge1(config-if)#exit</code>	Exit interface mode.
<code>Bridge1(config)#interface eth4</code>	Enter interface mode.
<code>Bridge1(config-if)#switchport</code>	Configure interface as a layer 2 port.



Bridge1(config-if)#bridge-group 1	Associate the interface with bridge group 1.
Bridge1(config-if)#commit	Commit the transaction.
Bridge1(config-if)#exit	Exit interface mode.
Bridge1(config)#interface eth5	Enter interface mode
Bridge1(config-if)#switchport	Configure interface as a layer 2 port.
Bridge1(config-if)#bridge-group 1	Associate the interface with bridge group 1.
Bridge1(config-if)#commit	Commit the transaction.
Bridge1(config-if)#exit	Exit interface mode.

## Bridge 2

Bridge2#configure terminal	Enter configure mode.
Bridge2(config)#bridge 2 protocol rstp	Add a bridge (2) to the rapid spanning tree table
Bridge2(config)#interface eth2	Enter interface mode.
Bridge2(config-if)#switchport	Configure interface as a layer 2 port.
Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#commit	Commit the transaction.
Bridge2(config-if)#exit	Exit interface mode.
Bridge2(config)#interface eth3	Enter interface mode.
Bridge2(config-if)#switchport	Configure interface as a layer 2 port.
Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#commit	Commit the transaction.
Bridge2(config-if)#exit	Exit interface mode.
Bridge2(config)#interface eth4	Enter interface mode.
Bridge2(config-if)#switchport	Configure interface as a layer 2 port.
Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#commit	Commit the transaction.
Bridge2(config-if)#exit	Exit interface mode.
Bridge2(config)#interface eth5	Enter interface mode
Bridge2(config-if)#switchport	Configure interface as a layer 2 port.
Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#commit	Commit the transaction.
Bridge2(config-if)#exit	Exit interface mode.

## Bridge 3

Bridge3#configure terminal	Enter configure mode.
Bridge3(config)#bridge 3 protocol rstp	Add a bridge (3) to the rapid spanning tree table
Bridge3(config)#interface eth2	Enter interface mode.
Bridge3(config-if)#switchport	Configure interface as a layer 2 port.
Bridge3(config-if)#bridge-group 3	Associate the interface with bridge group 3.
Bridge3(config-if)#commit	Commit the transaction.

Bridge3(config-if)#exit	Exit interface mode.
Bridge3(config-if)#switchport	Configure interface as a layer 2 port.
Bridge3(config)#interface eth3	Enter interface mode.
Bridge3(config-if)#bridge-group 3	Associate the interface with bridge group 3.
Bridge3(config-if)#commit	Commit the transaction.
Bridge3(config-if)#exit	Exit interface mode.

## Bridge 4

Bridge4#configure terminal	Enter configure mode.
Bridge4(config)#bridge 4 protocol rstp	Add a bridge (4) to the rapid spanning tree table
Bridge4(config)#interface eth2	Enter interface mode.
Bridge4(config-if)#switchport	Configure interface as a layer 2 port.
Bridge4(config-if)#bridge-group 4	Associate the interface with bridge group 4.
Bridge4(config-if)#commit	Commit the transaction.
Bridge4(config-if)#exit	Exit interface mode.
Bridge4(config)#interface eth3	Enter interface mode.
Bridge4(config-if)#switchport	Configure interface as a layer 2 port.
Bridge4(config-if)#bridge-group 4	Associate the interface with bridge group 4.
Bridge4(config-if)#commit	Commit the transaction.
Bridge4(config-if)#exit	Exit interface mode.
Bridge4(config)#interface eth4	Enter interface mode.
Bridge4(config-if)#switchport	Configure interface as a layer 2 port.
Bridge4(config-if)#bridge-group 4	Associate the interface with bridge group 4.
Bridge4(config-if)#commit	Commit the transaction.
Bridge4(config-if)#exit	Exit interface mode.
Bridge4(config)#interface eth5	Enter interface mode
Bridge4(config-if)#switchport	Configure interface as a layer 2 port.
Bridge4(config-if)#bridge-group 4	Associate the interface with bridge group 4.
Bridge4(config-if)#commit	Commit the transaction.
Bridge3(config-if)#exit	

## Validation

show spanning-tree, show spanning-tree interface <if-name>

### Bridge 1

```
#show spanning-tree
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: Root Path Cost 200000 - Root Port 6 - Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 1: Root Id 800052540046f549
% 1: Bridge Id 80005254009cb7e6
% 1: last topology change Tue Aug 11 02:25:01 2020
```

```
% 1: 30 topology change(s) - last topology change Tue Aug 11 02:25:01 2020

% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Alternate - State
Discarding
% eth2: Designated Path Cost 200000
% eth2: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth2: Designated Port Id 0x8004 - Priority 128 -
% eth2: Root 800052540046f549
% eth2: Designated Bridge 8000525400751db5
% eth2: Message Age 1 - Max Age 20
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 4 - Hello Timer 0 - topo change
timer 0
% eth2: forward-transitions 2
% eth2: Restricted-role OFF
% eth2: Version Rapid Spanning Tree Protocol - Receive RSTP - Send RSTP
% 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
%
% eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - Role Alternate - State
Discarding
% eth3: Designated Path Cost 200000
% eth3: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth3: Designated Port Id 0x8005 - Priority 128 -
% eth3: Root 800052540046f549
% eth3: Designated Bridge 8000525400751db5
% eth3: Message Age 1 - Max Age 20
% eth3: Hello Time 2 - Forward Delay 15
% eth3: Forward Timer 0 - Msg Age Timer 3 - Hello Timer 0 - topo change
timer 0
% eth3: forward-transitions 3
% eth3: Restricted-role OFF
% eth3: Version Rapid Spanning Tree Protocol - Receive RSTP - Send RSTP
% eth3: No portfast configured - Current portfast off
% eth3: bpdu-guard default - Current bpdu-guard off
% eth3: bpdu-filter default - Current bpdu-filter off
% eth3: no root guard configured - Current root guard off
% eth3: Configured Link Type point-to-point - Current point-to-point
% eth3: No auto-edge configured - Current port Auto Edge off
%
% eth4: Port Number 6 - Ifindex 6 - Port Id 0x8006 - Role Rootport - State
Forwarding
% eth4: Designated Path Cost 0
% eth4: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth4: Designated Port Id 0x8006 - Priority 128 -
% eth4: Root 800052540046f549
% eth4: Designated Bridge 800052540046f549
% eth4: Message Age 0 - Max Age 20
% eth4: Hello Time 2 - Forward Delay 15
% eth4: Forward Timer 0 - Msg Age Timer 3 - Hello Timer 0 - topo change
timer 0
% eth4: forward-transitions 6
```

```
% eth4: Restricted-role OFF
% eth4: Version Rapid Spanning Tree Protocol - Receive RSTP - Send RSTP
% eth4: No portfast configured - Current portfast off
% eth4: bpdu-guard default - Current bpdu-guard off
% eth4: bpdu-filter default - Current bpdu-filter off
% eth4: no root guard configured - Current root guard off
% eth4: Configured Link Type point-to-point - Current point-to-point
% eth4: No auto-edge configured - Current port Auto Edge off
%
% eth5: Port Number 7 - Ifindex 7 - Port Id 0x8007 - Role Alternate - State
Discarding
% eth5: Designated Path Cost 200000
% eth5: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth5: Designated Port Id 0x8004 - Priority 128 -
% eth5: Root 800052540046f549
% eth5: Designated Bridge 800052540065fd8c
% eth5: Message Age 1 - Max Age 20
% eth5: Hello Time 2 - Forward Delay 15
% eth5: Forward Timer 0 - Msg Age Timer 3 - Hello Timer 0 - topo change
timer 0
% eth5: forward-transitions 4
% eth5: Restricted-role OFF
% eth5: Version Rapid Spanning Tree Protocol - Receive RSTP - Send RSTP
% eth5: No portfast configured - Current portfast off
% eth5: bpdu-guard default - Current bpdu-guard off
% eth5: bpdu-filter default - Current bpdu-filter off
% eth5: no root guard configured - Current root guard off
% eth5: Configured Link Type point-to-point - Current point-to-point
% eth5: No auto-edge configured - Current port Auto Edge off
%
#
```

## Bridge 2

```
#show spanning-tree
% 2: Bridge up - Spanning Tree Enabled - topology change detected
% 2: Root Path Cost 200000 - Root Port 7 - Bridge Priority 32768
% 2: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 2: Root Id 800052540046f549
% 2: Bridge Id 8000525400751db5
% 2: last topology change Tue Aug 11 02:25:00 2020
% 2: 22 topology change(s) - last topology change Tue Aug 11 02:25:00 2020

% 2: portfast bpdu-filter disabled
% 2: portfast bpdu-guard disabled
% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State
Forwarding
% eth2: Designated Path Cost 200000
% eth2: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth2: Designated Port Id 0x8004 - Priority 128 -
% eth2: Root 800052540046f549
% eth2: Designated Bridge 8000525400751db5
% eth2: Message Age 1 - Max Age 20
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change
timer 0
% eth2: forward-transitions 3
% eth2: Restricted-role OFF
```

```
% eth2: Version Rapid Spanning Tree Protocol - Receive RSTP - Send RSTP
% 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
%
% eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - Role Designated - State
Forwarding
% eth3: Designated Path Cost 200000
% eth3: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth3: Designated Port Id 0x8005 - Priority 128 -
% eth3: Root 800052540046f549
% eth3: Designated Bridge 8000525400751db5
% eth3: Message Age 1 - Max Age 20
% eth3: Hello Time 2 - Forward Delay 15
% eth3: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change
timer 0
% eth3: forward-transitions 3
% eth3: Restricted-role OFF
% eth3: Version Rapid Spanning Tree Protocol - Receive RSTP - Send RSTP
% eth3: No portfast configured - Current portfast off
% eth3: bpdu-guard default - Current bpdu-guard off
% eth3: bpdu-filter default - Current bpdu-filter off
% eth3: no root guard configured - Current root guard off
% eth3: Configured Link Type point-to-point - Current point-to-point
% eth3: No auto-edge configured - Current port Auto Edge off
%
% eth4: Port Number 6 - Ifindex 6 - Port Id 0x8006 - Role Alternate - State
Discarding
% eth4: Designated Path Cost 0
% eth4: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth4: Designated Port Id 0x8007 - Priority 128 -
% eth4: Root 800052540046f549
% eth4: Designated Bridge 800052540046f549
% eth4: Message Age 0 - Max Age 20
% eth4: Hello Time 2 - Forward Delay 15
% eth4: Forward Timer 0 - Msg Age Timer 4 - Hello Timer 0 - topo change
timer 0
% eth4: forward-transitions 3
% eth4: Restricted-role OFF
% eth4: Version Rapid Spanning Tree Protocol - Receive RSTP - Send RSTP
% eth4: No portfast configured - Current portfast off
% eth4: bpdu-guard default - Current bpdu-guard off
% eth4: bpdu-filter default - Current bpdu-filter off
% eth4: no root guard configured - Current root guard off
% eth4: Configured Link Type point-to-point - Current point-to-point
% eth4: No auto-edge configured - Current port Auto Edge off
%
% eth5: Port Number 7 - Ifindex 7 - Port Id 0x8007 - Role Rootport - State
Forwarding
% eth5: Designated Path Cost 0
% eth5: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth5: Designated Port Id 0x8004 - Priority 128 -
% eth5: Root 800052540046f549
% eth5: Designated Bridge 800052540046f549
% eth5: Message Age 0 - Max Age 20
```

```
% eth5: Hello Time 2 - Forward Delay 15
% eth5: Forward Timer 0 - Msg Age Timer 4 - Hello Timer 0 - topo change
timer 0
% eth5: forward-transitions 2
% eth5: Restricted-role OFF
% eth5: Version Rapid Spanning Tree Protocol - Receive RSTP - Send RSTP
% eth5: No portfast configured - Current portfast off
% eth5: bpdu-guard default - Current bpdu-guard off
% eth5: bpdu-filter default - Current bpdu-filter off
% eth5: no root guard configured - Current root guard off
% eth5: Configured Link Type point-to-point - Current point-to-point
% eth5: No auto-edge configured - Current port Auto Edge off
%
#
```

### Bridge 3

```
#show spanning-tree
% 3: Bridge up - Spanning Tree Enabled - topology change detected
% 3: Root Path Cost 200000 - Root Port 5 - Bridge Priority 32768
% 3: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 3: Root Id 800052540046f549
% 3: Bridge Id 800052540065fd8c
% 3: last topology change Tue Aug 11 02:25:00 2020
% 3: 16 topology change(s) - last topology change Tue Aug 11 02:25:00 2020

% 3: portfast bpdu-filter disabled
% 3: portfast bpdu-guard disabled
% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State
Forwarding
% eth2: Designated Path Cost 200000
% eth2: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth2: Designated Port Id 0x8004 - Priority 128 -
% eth2: Root 800052540046f549
% eth2: Designated Bridge 800052540065fd8c
% eth2: Message Age 1 - Max Age 20
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change
timer 0
% eth2: forward-transitions 2
% eth2: Restricted-role OFF
% eth2: Version Rapid Spanning Tree Protocol - Receive RSTP - Send RSTP
% 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
%
% eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - Role Rootport - State
Forwarding
% eth3: Designated Path Cost 0
% eth3: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth3: Designated Port Id 0x8005 - Priority 128 -
% eth3: Root 800052540046f549
% eth3: Designated Bridge 800052540046f549
% eth3: Message Age 0 - Max Age 20
% eth3: Hello Time 2 - Forward Delay 15
```

```
% eth3: Forward Timer 0 - Msg Age Timer 3 - Hello Timer 0 - topo change timer 0
% eth3: forward-transitions 2
% eth3: Restricted-role OFF
% eth3: Version Rapid Spanning Tree Protocol - Receive RSTP - Send RSTP
% eth3: No portfast configured - Current portfast off
% eth3: bpdu-guard default - Current bpdu-guard off
% eth3: bpdu-filter default - Current bpdu-filter off
% eth3: no root guard configured - Current root guard off
% eth3: Configured Link Type point-to-point - Current point-to-point
% eth3: No auto-edge configured - Current port Auto Edge off
#
```

## Bridge 4

```
#show spanning-tree
% 4: Bridge up - Spanning Tree Enabled - topology change detected
% 4: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 4: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 4: Root Id 800052540046f549
% 4: Bridge Id 800052540046f549
% 4: last topology change Tue Aug 11 02:24:58 2020
% 4: 6 topology change(s) - last topology change Tue Aug 11 02:24:58 2020

% 4: portfast bpdu-filter disabled
% 4: portfast bpdu-guard disabled
% eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 - Role Designated - State Forwarding
% eth2: Designated Path Cost 0
% eth2: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth2: Designated Port Id 0x8004 - Priority 128 -
% eth2: Root 800052540046f549
% eth2: Designated Bridge 800052540046f549
% eth2: Message Age 0 - Max Age 20
% eth2: Hello Time 2 - Forward Delay 15
% eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
% eth2: forward-transitions 1
% eth2: Restricted-role OFF
% eth2: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP
% 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
%
% eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - Role Designated - State Forwarding
% eth3: Designated Path Cost 0
% eth3: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth3: Designated Port Id 0x8005 - Priority 128 -
% eth3: Root 800052540046f549
% eth3: Designated Bridge 800052540046f549
% eth3: Message Age 0 - Max Age 20
% eth3: Hello Time 2 - Forward Delay 15
% eth3: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
```

```
% eth3: forward-transitions 1
% eth3: Restricted-role OFF
% eth3: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP
% eth3: No portfast configured - Current portfast off
% eth3: bpdu-guard default - Current bpdu-guard off
% eth3: bpdu-filter default - Current bpdu-filter off
% eth3: no root guard configured - Current root guard off
% eth3: Configured Link Type point-to-point - Current point-to-point
% eth3: No auto-edge configured - Current port Auto Edge off
%
% eth4: Port Number 6 - Ifindex 6 - Port Id 0x8006 - Role Designated - State
Forwarding
% eth4: Designated Path Cost 0
% eth4: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth4: Designated Port Id 0x8006 - Priority 128 -
% eth4: Root 800052540046f549
% eth4: Designated Bridge 800052540046f549
% eth4: Message Age 0 - Max Age 20
% eth4: Hello Time 2 - Forward Delay 15
% eth4: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change
timer 0
% eth4: forward-transitions 1
% eth4: Restricted-role OFF
% eth4: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP
% eth4: No portfast configured - Current portfast off
% eth4: bpdu-guard default - Current bpdu-guard off
% eth4: bpdu-filter default - Current bpdu-filter off
% eth4: no root guard configured - Current root guard off
% eth4: Configured Link Type point-to-point - Current point-to-point
% eth4: No auto-edge configured - Current port Auto Edge off
%
% eth5: Port Number 7 - Ifindex 7 - Port Id 0x8007 - Role Designated - State
Forwarding
% eth5: Designated Path Cost 0
% eth5: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth5: Designated Port Id 0x8007 - Priority 128 -
% eth5: Root 800052540046f549
% eth5: Designated Bridge 800052540046f549
% eth5: Message Age 0 - Max Age 20
% eth5: Hello Time 2 - Forward Delay 15
% eth5: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change
timer 0
% eth5: forward-transitions 1
% eth5: Restricted-role OFF
% eth5: Version Rapid Spanning Tree Protocol - Receive None - Send RSTP
% eth5: No portfast configured - Current portfast off
% eth5: bpdu-guard default - Current bpdu-guard off
% eth5: bpdu-filter default - Current bpdu-filter off
% eth5: no root guard configured - Current root guard off
% eth5: Configured Link Type point-to-point - Current point-to-point
% eth5: No auto-edge configured - Current port Auto Edge off
%
#
```



## CHAPTER 15 Spanning Tree Protocol Configuration

This chapter contains a complete sample Spanning Tree Protocol (STP) configuration.

Spanning Tree Protocol (STP) is a network protocol that ensures a loop-free topology for Ethernet networks. The basic function of STP is to prevent bridge loops. Spanning tree also allows a network design to include redundant links to provide automatic backup paths if an active link fails, thus, eliminating the need to manually enable or disable the backup links.

### Topology

The following example is a simple multi-bridge topology.

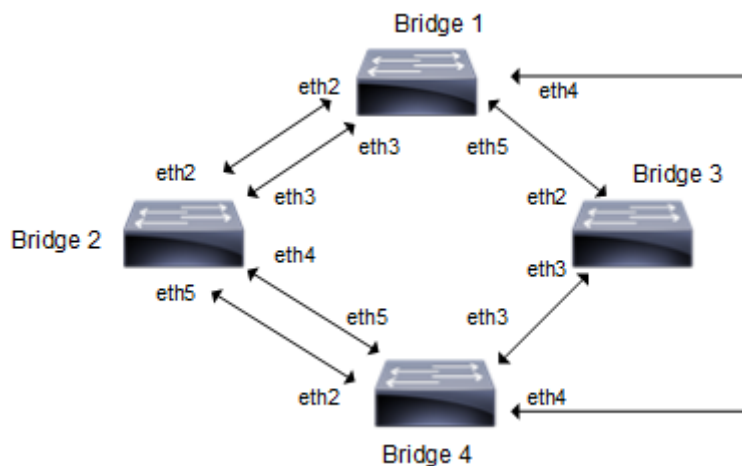


Figure 15-29: STP Topology

Note: Run the `switchport` command on each port to change to Layer-2 mode.

### Configurations

#### Bridge 1

<code>Bridge1#configure terminal</code>	Enter configure mode.
<code>Bridge1(config)#bridge 1 protocol ieee</code>	Add a bridge (1) to the spanning tree table
<code>Bridge1(config)#interface eth2</code>	Enter interface mode.
<code>Bridge1(config-if)#bridge-group 1</code>	Associate the interface with bridge group 1.
<code>Bridge1(config-if)#commit</code>	Commit the transaction.
<code>Bridge1(config-if)#exit</code>	Exit interface mode.
<code>Bridge1(config)#interface eth3</code>	Enter interface mode.
<code>Bridge1(config-if)#bridge-group 1</code>	Associate the interface with bridge group 1.
<code>Bridge1(config-if)#commit</code>	Commit the transaction.
<code>Bridge1(config-if)#exit</code>	Exit interface mode.
<code>Bridge1(config)#interface eth4</code>	Enter interface mode.

Bridge1(config-if)#bridge-group 1	Associate the interface with bridge group 1.
Bridge1(config-if)#commit	Commit the transaction.
Bridge1(config-if)#exit	Exit interface mode.
Bridge1(config)#interface eth5	Enter interface mode
Bridge1(config-if)#bridge-group 1	Associate the interface with bridge group 1.
Bridge1(config-if)#commit	Commit the transaction.

## Bridge 2

Bridge2#configure terminal	Enter configure mode.
Bridge2(config)#bridge 2 protocol ieee	Add a bridge (2) to the spanning tree table
Bridge2(config)#interface eth2	Enter interface mode.
Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#commit	Commit the transaction.
Bridge2(config-if)#exit	Exit interface mode.
Bridge2(config)#interface eth3	Enter interface mode.
Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#commit	Commit the transaction.
Bridge2(config-if)#exit	Exit interface mode.
Bridge2(config)#interface eth4	Enter interface mode.
Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#commit	Commit the transaction.
Bridge2(config-if)#exit	Exit interface mode.
Bridge2(config)#interface eth5	Enter interface mode
Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#commit	Commit the transaction.

## Bridge 4

Bridge4#configure terminal	Enter configure mode.
Bridge4(config)#bridge 4 protocol ieee	Add a bridge (4) to the spanning tree table
Bridge4(config)#interface eth2	Enter interface mode.
Bridge4(config-if)#bridge-group 4	Associate the interface with bridge group 4.
Bridge4(config-if)#commit	Commit the transaction.
Bridge4(config-if)#exit	Exit interface mode.
Bridge4(config)#interface eth3	Enter interface mode.
Bridge4(config-if)#bridge-group 4	Associate the interface with bridge group 4.
Bridge1(config-if)#commit	Commit the transaction.
Bridge4(config-if)#exit	Exit interface mode.
Bridge4(config)#interface eth4	Enter interface mode.
Bridge4(config-if)#bridge-group 4	Associate the interface with bridge group 4.
Bridge4(config-if)#commit	Commit the transaction.

Bridge4(config-if)#exit	Exit interface mode.
Bridge4(config)#interface eth5	Enter interface mode
Bridge4(config-if)#bridge-group 4	Associate the interface with bridge group 4.
Bridge4(config-if)#commit	Commit the transaction.

### Bridge 3

Bridge3#configure terminal	Enter configure mode.
Bridge3(config)#bridge 3 protocol ieee	Add a bridge (3) to the spanning tree table
Bridge3(config)#interface eth2	Enter interface mode.
Bridge3(config-if)#bridge-group 3	Associate the interface with bridge group 3.
Bridge3(config-if)#commit	Commit the transaction.
Bridge3(config-if)#exit	Exit interface mode.
Bridge3(config)#interface eth3	Enter interface mode.
Bridge3(config-if)#bridge-group 3	Associate the interface with bridge group 3.
Bridge3(config-if)#commit	Commit the transaction.

## Validation

show spanning-tree, show spanning-tree interface <if-name>

### Bridge 1

```
#show spanning-tree
1: Bridge up - Spanning Tree Enabled - topology change detected
1: Root Path Cost 19 - Root Port 6 - Bridge Priority 32768
1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
1: Root Id 800052540046f549
1: Bridge Id 80005254009cb7e6
1: last topology change Tue Aug 11 02:25:01 2020
1: 30 topology change(s) - last topology change Tue Aug 11 02:25:01 2020
1: portfast bpdu-filter disabled
1: portfast bpdu-guard disabled
eth2: Port Number 4 - Ifindex 4 - Port Id 0x8004 -State Blocked
eth2: Designated Path Cost 19
eth2: Configured Path Cost 19 - Add type Explicit ref count 1
eth2: Designated Port Id 0x8004 - Priority 128 -
eth2: Root 800052540046f549
eth2: Designated Bridge 8000525400751db5
eth2: Message Age 1 - Max Age 20
eth2: Hello Time 2 - Forward Delay 15
eth2: Forward Timer 0 - Msg Age Timer 4 - Hello Timer 0 - topo change timer 0
eth3: Port Number 5 - Ifindex 5 - Port Id 0x8005 - State blocked
eth3: Designated Path Cost 19
eth3: Configured Path Cost 19 - Add type Explicit ref count 1
eth3: Designated Port Id 0x8005 - Priority 128 -
eth3: Root 800052540046f549
eth3: Designated Bridge 8000525400751db5
eth3: Message Age 1 - Max Age 20
eth3: Hello Time 2 - Forward Delay 15
eth3: Forward Timer 0 - Msg Age Timer 3 - Hello Timer 0 - topo change timer 0
```

```
eth3: forward-transitions 3
eth3: Restricted-role OFF
eth3: No portfast configured - Current portfast off
eth3: bpdu-guard default - Current bpdu-guard off
eth3: bpdu-filter default - Current bpdu-filter off
eth3: no root guard configured - Current root guard off
eth3: Configured Link Type point-to-point - Current point-to-point
eth3: No auto-edge configured - Current port Auto Edge off
eth4: Port Number 6-Ifindex 6-Port Id 0x8006-Role Rootport-State Forwarding
eth4: Designated Path Cost 0
eth4: Configured Path Cost 19 - Add type Explicit ref count 1
eth4: Designated Port Id 0x8006 - Priority 128 -
eth4: Root 800052540046f549
eth4: Designated Bridge 800052540046f549
eth4: Message Age 0 - Max Age 20
eth4: Hello Time 2 - Forward Delay 15
eth4: Forward Timer 0 - Msg Age Timer 3-Hello Timer 0 - topo changen timer 0
eth4: forward-transitions 6
eth4: Restricted-role OFF
eth4: No portfast configured - Current portfast off
eth4: bpdu-guard default - Current bpdu-guard off
eth4: bpdu-filter default - Current bpdu-filter off
eth4: no root guard configured - Current root guard off
eth4: Configured Link Type point-to-point - Current point-to-point
eth4: No auto-edge configured - Current port Auto Edge off
eth5: Port Number 7 - Ifindex 7 - Port Id 0x8007 - State Blocked
eth5: Designated Path Cost 19
eth5: Configured Path Cost 19 - Add type Explicit ref count 1
eth5: Designated Port Id 0x8004 - Priority 128 -
eth5: Root 800052540046f549
eth5: Designated Bridge 800052540065fd8c
eth5: Message Age 1 - Max Age 20
eth5: Hello Time 2 - Forward Delay 15
eth5: Forward Timer 0 - Msg Age Timer 3 - Hello Timer 0 - topo change timer 0
eth5: forward-transitions 4
eth5: Restricted-role OFF
eth5: No portfast configured - Current portfast off
eth5: bpdu-guard default - Current bpdu-guard off
eth5: bpdu-filter default - Current bpdu-filter off
eth5: no root guard configured - Current root guard off
eth5: Configured Link Type point-to-point - Current point-to-point
eth5: No auto-edge configured - Current port Auto Edge off
```

## Bridge 2

```
#show spanning-tree
2: Bridge up - Spanning Tree Enabled - topology change detected
2: Root Path Cost 19 - Root Port 7 - Bridge Priority 32768
2: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
2: Root Id 800052540046f549
2: Bridge Id 8000525400751db5
2: last topology change Tue Aug 11 02:25:00 2020
2: 22 topology change(s) - last topology change Tue Aug 11 02:25:00 2020
2: portfast bpdu-filter disabled
2: portfast bpdu-guard disabled
eth2: Port Number 4-Ifindex 4-Port Id 0x8004-Role Designated-State Forwarding
eth2: Designated Path Cost 19
```

---

```
eth2: Configured Path Cost 19 - Add type Explicit ref count 1
eth2: Designated Port Id 0x8004 - Priority 128 -
eth2: Root 800052540046f549
eth2: Designated Bridge 8000525400751db5
eth2: Message Age 1 - Max Age 20
eth2: Hello Time 2 - Forward Delay 15
eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
eth2: forward-transitions 3
eth2: Restricted-role OFF
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
eth3: Port Number 5-Ifindex 5-Port Id 0x8005-Role Designated-State Forwarding
eth3: Designated Path Cost 19
eth3: Configured Path Cost 19 - Add type Explicit ref count 1
eth3: Designated Port Id 0x8005 - Priority 128 -
eth3: Root 800052540046f549
eth3: Designated Bridge 8000525400751db5
eth3: Message Age 1 - Max Age 20
eth3: Hello Time 2 - Forward Delay 15
eth3: Forward Timer 0-Msg Age Timer 0-Hello Timer 0-topo change timer 0
eth3: forward-transitions 3
eth3: Restricted-role OFF
eth3: No portfast configured - Current portfast off
eth3: bpdu-guard default - Current bpdu-guard off
eth3: bpdu-filter default - Current bpdu-filter off
eth3: no root guard configured - Current root guard off
eth3: Configured Link Type point-to-point - Current point-to-point
eth3: No auto-edge configured - Current port Auto Edge off
eth4: Port Number 6 - Ifindex 6 - Port Id 0x8006 ---State Blocked
eth4: Designated Path Cost 0
eth4: Configured Path Cost 19 - Add type Explicit ref count 1
eth4: Designated Port Id 0x8007 - Priority 128 -
eth4: Root 800052540046f549
eth4: Designated Bridge 800052540046f549
eth4: Message Age 0 - Max Age 20
eth4: Hello Time 2 - Forward Delay 15
eth4: Forward Timer 0-Msg Age Timer 4-Hello Timer 0-topo change timer 0
eth4: forward-transitions 3
eth4: Restricted-role OFF
eth4: No portfast configured - Current portfast off
eth4: bpdu-guard default - Current bpdu-guard off
eth4: bpdu-filter default - Current bpdu-filter off
eth4: no root guard configured - Current root guard off
eth4: Configured Link Type point-to-point - Current point-to-point
eth4: No auto-edge configured - Current port Auto Edge off
eth5: Port Number 7-Ifindex 7-Port Id 0x8007-Role Rootport-State Forwarding
eth5: Designated Path Cost 0
eth5: Configured Path Cost 19 - Add type Explicit ref count 1
eth5: Designated Port Id 0x8004 - Priority 128 -
eth5: Root 800052540046f549
eth5: Designated Bridge 800052540046f549
eth5: Message Age 0 - Max Age 20
eth5: Hello Time 2 - Forward Delay 15
```

---

```
eth5: Forward Timer 0-Msg Age Timer 4-Hello Timer 0-topo change timer 0
eth5: forward-transitions 2
eth5: Restricted-role OFF
eth5: No portfast configured - Current portfast off
eth5: bpdu-guard default - Current bpdu-guard off
eth5: bpdu-filter default - Current bpdu-filter off
eth5: no root guard configured - Current root guard off
eth5: Configured Link Type point-to-point - Current point-to-point
eth5: No auto-edge configured - Current port Auto Edge off
```

### Bridge 3

```
#show spanning-tree
3: Bridge up - Spanning Tree Enabled - topology change detected
3: Root Path Cost 19 - Root Port 5 - Bridge Priority 32768
3: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
3: Root Id 800052540046f549
3: Bridge Id 800052540065fd8c
3: last topology change Tue Aug 11 02:25:00 2020
3: 16 topology change(s) - last topology change Tue Aug 11 02:25:00 2020
3: portfast bpdu-filter disabled
3: portfast bpdu-guard disabled
eth2: Port Number 4-Ifindex 4-Port Id 0x8004-Role Designated-State Forwarding
eth2: Designated Path Cost 19
eth2: Configured Path Cost 19 - Add type Explicit ref count 1
eth2: Designated Port Id 0x8004 - Priority 128 -
eth2: Root 800052540046f549
eth2: Designated Bridge 800052540065fd8c
eth2: Message Age 1 - Max Age 20
eth2: Hello Time 2 - Forward Delay 15
eth2: Forward Timer 0-Msg Age Timer 0-Hello Timer 1-topo change timer 0
eth2: forward-transitions 2
eth2: Restricted-role OFF
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
eth3: Port Number 5-Ifindex 5-Port Id 0x8005-Role Rootport - State Forwarding
eth3: Designated Path Cost 0
eth3: Configured Path Cost 19 - Add type Explicit ref count 1
eth3: Designated Port Id 0x8005 - Priority 128 -
eth3: Root 800052540046f549
eth3: Designated Bridge 800052540046f549
eth3: Message Age 0 - Max Age 20
eth3: Hello Time 2 - Forward Delay 15
eth3: Forward Timer 0 - Msg Age Timer 3 - Hello Timer 0 - topo change timer 0
eth3: forward-transitions 2
eth3: Restricted-role OFF
eth3: No portfast configured - Current portfast off
eth3: bpdu-guard default - Current bpdu-guard off
eth3: bpdu-filter default - Current bpdu-filter off
eth3: no root guard configured - Current root guard off
eth3: Configured Link Type point-to-point - Current point-to-point
eth3: No auto-edge configured - Current port Auto Edge off
```

**Bridge 4**

```
#show spanning-tree
4: Bridge up - Spanning Tree Enabled - topology change detected
4: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
4: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
4: Root Id 800052540046f549
4: Bridge Id 800052540046f549
4: last topology change Tue Aug 11 02:24:58 2020
4: 6 topology change(s) - last topology change Tue Aug 11 02:24:58 2020
4: portfast bpdu-filter disabled
4: portfast bpdu-guard disabled
eth2: Port Number 4-Ifindex 4-Port Id 0x8004-Role Designated-State Forwarding
eth2: Designated Path Cost 0
eth2: Configured Path Cost 19 - Add type Explicit ref count 1
eth2: Designated Port Id 0x8004 - Priority 128 -
eth2: Root 800052540046f549
eth2: Designated Bridge 800052540046f549
eth2: Message Age 0 - Max Age 20
eth2: Hello Time 2 - Forward Delay 15
eth2: Forward Timer 0-Msg Age Timer 0-Hello Timer 0-topo change timer 0
eth2: forward-transitions 1
eth2: Restricted-role OFF
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
eth3: Port Number 5-Ifindex 5-Port Id 0x8005-Role Designated-State Forwarding
eth3: Designated Path Cost 0
eth3: Configured Path Cost 19 - Add type Explicit ref count 1
eth3: Designated Port Id 0x8005 - Priority 128 -
eth3: Root 800052540046f549
eth3: Designated Bridge 800052540046f549
eth3: Message Age 0 - Max Age 20
eth3: Hello Time 2 - Forward Delay 15
eth3: Forward Timer 0-Msg Age Timer 0-Hello Timer 0-topo change timer 0
eth3: forward-transitions 1
eth3: Restricted-role OFF
eth3: No portfast configured - Current portfast off
eth3: bpdu-guard default - Current bpdu-guard off
eth3: bpdu-filter default - Current bpdu-filter off
eth3: no root guard configured - Current root guard off
eth3: Configured Link Type point-to-point - Current point-to-point
eth3: No auto-edge configured - Current port Auto Edge off
eth4: Port Number 6-Ifindex 6-Port Id 0x8006-Role Designated-State Forwarding
eth4: Designated Path Cost 0
eth4: Configured Path Cost 19 - Add type Explicit ref count 1
eth4: Designated Port Id 0x8006 - Priority 128 -
eth4: Root 800052540046f549
eth4: Designated Bridge 800052540046f549
eth4: Message Age 0 - Max Age 20
eth4: Hello Time 2 - Forward Delay 15
eth4: Forward Timer 0-Msg Age Timer 0-Hello Timer 0-topo change timer 0
```

```
eth4: forward-transitions 1
eth4: Restricted-role OFF
eth4: No portfast configured - Current portfast off
eth4: bpdu-guard default - Current bpdu-guard off
eth4: bpdu-filter default - Current bpdu-filter off
eth4: no root guard configured - Current root guard off
eth4: Configured Link Type point-to-point - Current point-to-point
eth4: No auto-edge configured - Current port Auto Edge off
eth5: Port Number 7-Ifindex 7-Port Id 0x8007-Role Designated-State Forwarding
eth5: Designated Path Cost 0
eth5: Configured Path Cost 19 - Add type Explicit ref count 1
eth5: Designated Port Id 0x8007 - Priority 128 -
eth5: Root 800052540046f549
eth5: Designated Bridge 800052540046f549
eth5: Message Age 0 - Max Age 20
eth5: Hello Time 2 - Forward Delay 15
eth5: Forward Timer 0-Msg Age Timer 0-Hello Timer 0-topo change timer 0
eth5: forward-transitions 1
eth5: Restricted-role OFF
eth5: No portfast configured - Current portfast off
eth5: bpdu-guard default - Current bpdu-guard off
eth5: bpdu-filter default - Current bpdu-filter off
eth5: no root guard configured - Current root guard off
eth5: Configured Link Type point-to-point - Current point-to-point
eth5: No auto-edge configured - Current port Auto Edge off
```



## CHAPTER 16 VLAN Configuration

This chapter contains a complete VLAN configuration.

### Configuring VLAN Tags

#### Topology

This shows configuring a VLAN bridge with VLAN tags on forwarding frames. Link between Bridge 1 and Bridge 2 is configured as VLAN 5 and link between Bridge 3 and Bridge 1 is configured as VLAN 10. Link between Bridge 2 and Bridge 3 is configured with VLAN 5 and VLAN 10. Link between Bridge 1 and Host 1 is configured as VLAN 10 and link between Bridge 1 and Host 2 is configured as VLAN 5. Link between Bridge 3 and Host 3 is configured as VLAN 10.

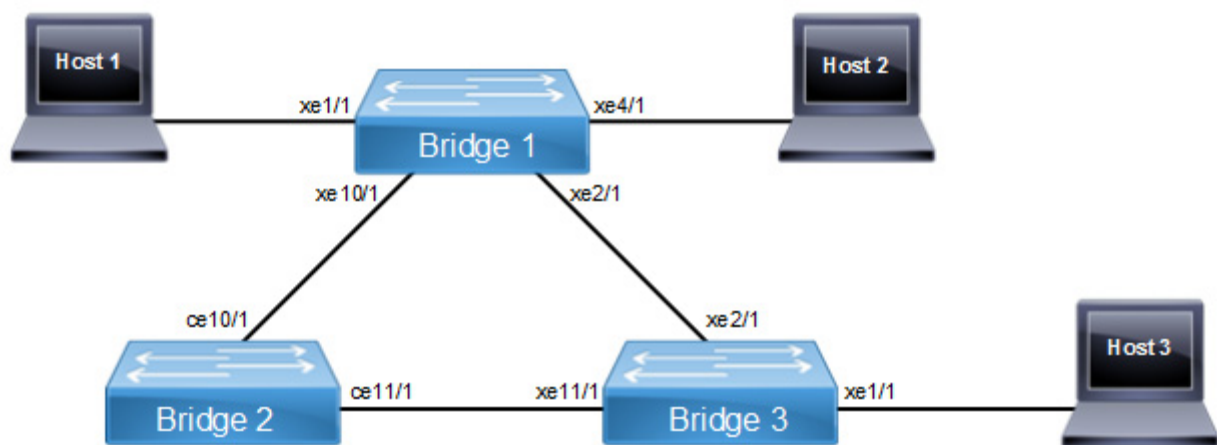


Figure 16-30: VLAN Topology

Note: Run the `switchport` command on each port to change to Layer-2 mode.

#### Bridge 1

<code>Bridgel#configure terminal</code>	Enter configuration mode
<code>Bridgel(config)#bridge 1 protocol ieee vlan-bridge</code>	Specify VLAN for bridge 1.
<code>Bridgel(config)#vlan database</code>	Enter the VLAN configuration mode.
<code>Bridgel(config-if)#vlan 5 bridge 1 state enable</code>	Enable VLAN (5) on bridge 1. Specifying the enable state allows forwarding of frames on this VLAN-aware bridge.
<code>Bridgel(config-if)#vlan 10 bridge 1 state enable</code>	Enable VLAN (10) on bridge 1. Specifying the enable state allows forwarding of frames on this VLAN-aware bridge.
<code>Bridgel(config-if)#commit</code>	Commit candidate configuration to be running configuration
<code>Bridgel(config-if)#exit</code>	Exit the VLAN configuration mode.
<code>Bridgel(config)#interface xe1/1</code>	Enter interface mode.
<code>Bridgel(config-if)#switchport</code>	Configure port as L2.
<code>Bridgel(config-if)#bridge-group 1</code>	Associate the interface with bridge group 1.
<code>Bridgel(config-if)#switchport mode access</code>	Set the switching characteristics of this interface to access mode.

Bridge1(config-if)#switchport access vlan 5	Enable VLAN ID 5 on this port.
Bridge1(config-if)#commit	Commit candidate configuration to be running configuration
Bridge1(config-if)#exit	Exit from the interface mode and go config mode.
Bridge1(config)#interface xe2/1	Enter interface mode.
Bridge1(config-if)#switchport	Configure port as L2.
Bridge1(config-if)#bridge-group 1	Associate the interface with bridge group 1.
Bridge1(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
Bridge1(config-if)#switchport trunk allowed vlan add 10	Enable VLAN ID 10 on this port.
Bridge1(config-if)#commit	Commit candidate configuration to be running configuration
Bridge1(config-if)#exit	Exit from the interface mode and go config mode.
Bridge1(config)#interface xe4/1	Enter interface mode.
Bridge1(config-if)#switchport	Configure port as L2.
Bridge1(config-if)#bridge-group 1	Associate the interface with bridge group 1.
Bridge1(config-if)#switchport mode access	Set the switching characteristics of this interface to access mode.
Bridge1(config-if)#switchport access vlan 10	Enable VLAN ID 10 on this port.
Bridge1(config-if)#commit	Commit candidate configuration to be running configuration
Bridge1(config-if)#exit	Exit from the interface mode and go config mode.
Bridge1(config)#interface xe10/1	Enter interface mode.
Bridge1(config-if)#switchport	Configure port as L2.
Bridge1(config-if)#bridge-group 1	Associate the interface with bridge group 1.
Bridge1(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
Bridge1(config-if)#switchport trunk allowed vlan add 5	Enable VLAN ID 5 on this port.
Bridge1(config-if)#commit	Commit candidate configuration to be running configuration
Bridge1(config-if)#exit	Exit from the interface mode and go config mode.

## Bridge 2

Bridge2#configure terminal	Enter configure mode.
Bridge2(config)#bridge 2 protocol ieee vlan-bridge	Specify VLAN for bridge 2.
Bridge2(config)#vlan database	Enter the VLAN configuration mode.
Bridge2(config-vlan)#vlan 5 bridge 2 state enable	Enable VLAN (5) on bridge 2. Specifying the enable state allows forwarding of frames on this VLAN-aware bridge.
Bridge2(config-vlan)#vlan 10 bridge 2 state enable	Specifying the enable state allows forwarding of frames on this VLAN-aware bridge.
Bridge2(config-vlan)#commit	Commit candidate configuration to be running configuration
Bridge2(config-vlan)#exit	Exit the VLAN configuration mode.
Bridge2(config)#interface ce10/1	Enter interface mode.
Bridge2(config-if)#switchport	

Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
Bridge2(config-if)#switchport access vlan 5	Enable VLAN port access by specifying the VLAN ID 5 on this interface.
Bridge2(config-if)#switchport trunk allowed vlan add 10	Enable VLAN ID 10 on this port.
Bridge2(config-if)#switchport	Configure port as L2.
Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
Bridge2(config-if)#switchport trunk allowed vlan add 5	Enable VLAN ID 5 on this port.
Bridge2(config-if)#switchport trunk allowed vlan add 10	Enable VLAN ID 10 on this port.
Bridge2(config-if)#commit	Commit candidate configuration to be running configuration
Bridge2(config-if)#exit	Exit from the interface mode and go config mode.
Bridge2(config)#interface cell1/1	Enter interface mode.
Bridge2(config-if)#switchport	Configure port as L2.
Bridge2(config-if)#bridge-group 2	Associate the interface with bridge group 2.
Bridge2(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
Bridge2(config-if)#switchport trunk allowed vlan add 5	Enable VLAN ID 5 on this port.
Bridge2(config-if)#switchport trunk allowed vlan add 10	Enable VLAN ID 10 on this port.
Bridge2(config-if)#commit	Commit candidate configuration to be running configuration
Bridge2(config-if)#exit	Exit from the interface mode and go config mode.

### Bridge 3

Bridge3#configure terminal	Enter configure mode.
Bridge3(config)#bridge 3 protocol ieee vlan-bridge	Specify VLAN for bridge 3.
Bridge3(config)#vlan database	Enter the VLAN configuration mode.
Bridge3(config-vlan)#vlan 5 bridge 3 state enable	Enable VLAN (5) on bridge 3. Specifying the enable state allows forwarding of frames on this VLAN-aware bridge.
Bridge3(config-vlan)#vlan 10 bridge 3 state enable	Enable VLAN (10) on bridge 3. Specifying the enable state allows forwarding of frames on this VLAN-aware bridge.
Bridge3(config-vlan)#commit	Commit candidate configuration to be running configuration
Bridge3(config-vlan)#exit	Exit the VLAN configuration mode.
Bridge3(config)#interface xe1/1	Enter interface mode.
Bridge3(config-if)#switchport	Configure port as L2.
Bridge3(config-if)#bridge-group 3	Associate the interface with bridge group 3.

Bridge3(config-if)#switchport mode access	Set the switching characteristics of this interface to access mode.
Bridge3(config-if)#switchport access vlan 5	Enable VLAN ID 5 on this port.
Bridge3(config-if)#switchport access vlan 10	Enable VLAN ID 10 on this port.
Bridge3(config-if)#commit	Commit candidate configuration to be running configuration
Bridge3(config-if)#exit	Exit from the interface mode and go config mode.
Bridge3(config)#interface xe2/1	Enter interface mode.
Bridge3(config-if)#switchport	Configure port as L2.
Bridge3(config-if)#bridge-group 3	Associate the interface with bridge group 3.
Bridge3(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
Bridge3(config-if)#switchport trunk allowed vlan add 10	Enable VLAN ID 10 on this port.
Bridge3(config-if)#commit	Commit candidate configuration to be running configuration
Bridge3(config-if)#exit	Exit from the interface mode and go config mode.
Bridge3(config)#interface xe11/1	Enter interface mode.
Bridge3(config-if)#switchport	Configure port as L2.
Bridge3(config-if)#bridge-group 3	Associate the interface with bridge group 3.
Bridge3(config-if)#switchport mode trunk	Set the switching characteristics of this interface to trunk mode.
Bridge3(config-if)#switchport trunk allowed vlan add 5	Enable VLAN ID 5 on this port.
Bridge3(config-if)#commit	Commit candidate configuration to be running configuration
Bridge3(config-if)#exit	Exit from the interface mode and go config mode.

## Validation

### Bridge 1

```

Bridge1#show spanning-tree
% 1: Bridge up - Spanning Tree Enabled
% 1: Root Path Cost 1 - Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6 - Root port 909
% 1: Root Id 8000001823304db6
% 1: Bridge Id 8000001823305244
% 1: 6 topology changes - last topology change Fri Apr 19 12:32:26 2019
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% xe1/1: Port Number 905 - Ifindex 5001 - Port Id 0x8389 - path cost 4 - designated cost 1
% xe1/1: Designated Port Id 0x8389 - state Forwarding -Priority 128
% xe1/1: Designated root 8000001823304db6
% xe1/1: Designated Bridge 8000001823305244
% xe1/1: Message Age 1 - Max Age 20
% xe1/1: Hello Time 2 - Forward Delay 15

```

```
% xe1/1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
% xe1/1: forward-transitions 1
% xe1/1: No portfast configured - Current portfast off
% xe1/1: bpdu-guard default - Current bpdu-guard off
% xe1/1: bpdu-filter default - Current bpdu-filter off
% xe1/1: no root guard configured - Current root guard off
%
% xe2/1: Port Number 909 - Ifindex 5005 - Port Id 0x838d - path cost 1 - designated
cost 0
% xe2/1: Designated Port Id 0x838d - state Forwarding -Priority 128
% xe2/1: Designated root 8000001823304db6
% xe2/1: Designated Bridge 8000001823304db6
% xe2/1: Message Age 0 - Max Age 20
% xe2/1: Hello Time 2 - Forward Delay 15
% xe2/1: Forward Timer 0 - Msg Age Timer 19 - Hello Timer 0 - topo change timer 0
% xe2/1: forward-transitions 2
% xe2/1: No portfast configured - Current portfast off
% xe2/1: bpdu-guard default - Current bpdu-guard off
% xe2/1: bpdu-filter default - Current bpdu-filter off
% xe2/1: no root guard configured - Current root guard off
%
% xe4/1: Port Number 917 - Ifindex 5013 - Port Id 0x8395 - path cost 4 - designated
cost 1
% xe4/1: Designated Port Id 0x8395 - state Forwarding -Priority 128
% xe4/1: Designated root 8000001823304db6
% xe4/1: Designated Bridge 8000001823305244
% xe4/1: Message Age 1 - Max Age 20
% xe4/1: Hello Time 2 - Forward Delay 15
% xe4/1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change timer 0
% xe4/1: forward-transitions 1
% xe4/1: No portfast configured - Current portfast off
% xe4/1: bpdu-guard default - Current bpdu-guard off
% xe4/1: bpdu-filter default - Current bpdu-filter off
% xe4/1: no root guard configured - Current root guard off
%
% xe10/1: Port Number 941 - Ifindex 5037 - Port Id 0x83ad - path cost 2 - designated
cost 1
% xe10/1: Designated Port Id 0x83ad - state Forwarding -Priority 128
% xe10/1: Designated root 8000001823304db6
% xe10/1: Designated Bridge 8000001823305244
% xe10/1: Message Age 1 - Max Age 20
% xe10/1: Hello Time 2 - Forward Delay 15
% xe10/1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change timer 0
% xe10/1: forward-transitions 2
% xe10/1: No portfast configured - Current portfast off
% xe10/1: bpdu-guard default - Current bpdu-guard off
% xe10/1: bpdu-filter default - Current bpdu-filter off
% xe10/1: no root guard configured - Current root guard off
%
Bl#show bridge
```

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1	1			xe2/1	0018.23cb.fb5c	1	300
1	1			xe10/1	cc37.ab97.37d8	1	300
1	5			xe1/1	0000.11bc.5dec	1	300
1	10			xe4/1	0000.2d50.205c	1	300

Bridge1#

Bridge1#show vlan all bridge 1

Bridge	VLAN ID	Name	State	H/W Status	Member ports (u)-Untagged, (t)-Tagged
1	1	default	ACTIVE	Success	xe1/1 (u) xe2/1 (u) xe4/1 (u) xe10/1 (u)
1	5	VLAN0005	ACTIVE	Success	xe1/1 (t) xe10/1 (t)
1	10	VLAN0010	ACTIVE	Success	xe2/1 (t) xe4/1 (t)

Bridge1#show bridge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1	1			xe2/1	0018.23cb.fb5c	1	300
1	1			xe10/1	cc37.ab97.37d8	1	300
1	5			xe1/1	0000.11bc.5dec	1	300
1	10			xe4/1	0000.2d50.205c	1	300

Bridge1#

## Bridge 2

Bridge2#show bridge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
2	1			ce10/1	0018.2326.166a	1	300
2	1			ce11/1	0018.23cb.fbe0	1	300
2	1			ce11/1	cc37.ab97.37d8	1	300
2	5			ce10/1	0000.11bc.5dec	1	300

Bridge2#show vlan all bridge 2

Bridge	VLAN ID	Name	State	H/W Status	Member ports (u)-Untagged, (t)-Tagged
2	1	default	ACTIVE	Success	ce10/1 (u) ce11/1 (u)
2	5	VLAN0005	ACTIVE	Success	ce10/1 (t) ce11/1 (t)
2	10	VLAN0010	ACTIVE	Success	ce10/1 (t) ce11/1 (t)

```
Bridge2#show bridge
```

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
2	1			ce10/1	0018.2326.166a	1	300
2	1			ce11/1	0018.23cb.fbe0	1	300
2	1			ce11/1	cc37.ab97.37d8	1	300
2	5			ce10/1	0000.11bc.5dec	1	300

### Bridge 3

```
Bridge3# show bridge
```

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
3	1			xe2/1	cc37.ab97.37d8	1	300
3	5			xe11/1	0000.11bc.5dec	1	300
3	10			xe2/1	0000.2d50.205c	1	300

```
Bridge3#show vlan all bridge 3
```

Bridge	VLAN ID	Name	State	H/W Status	Member ports (u)-Untagged, (t)-Tagged
3	1	default	ACTIVE	Success	xe1/1(u) xe2/1(u) xe11/1(u)
3	5	VLAN0005	ACTIVE	Success	xe1/1(t) xe11/1(t)
3	10	VLAN0010	ACTIVE	Success	xe1/1(t) xe2/1(t)

```
Bridge3#show bridge
```

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
3	1			xe2/1	cc37.ab97.37d8	1	300
3	5			xe11/1	0000.11bc.5dec	1	300
3	10			xe2/1	0000.2d50.205c	1	300

```
Bridge3#
```

# CHAPTER 17 Private VLAN Configuration

A private VLANs (PVLAN) splits a primary VLAN domain into multiple isolated broadcast sub-domains. PVLAN, also known as port isolation, is a technique where a VLAN contains switch ports that are restricted such that they can only communicate with a given uplink.

## Topology

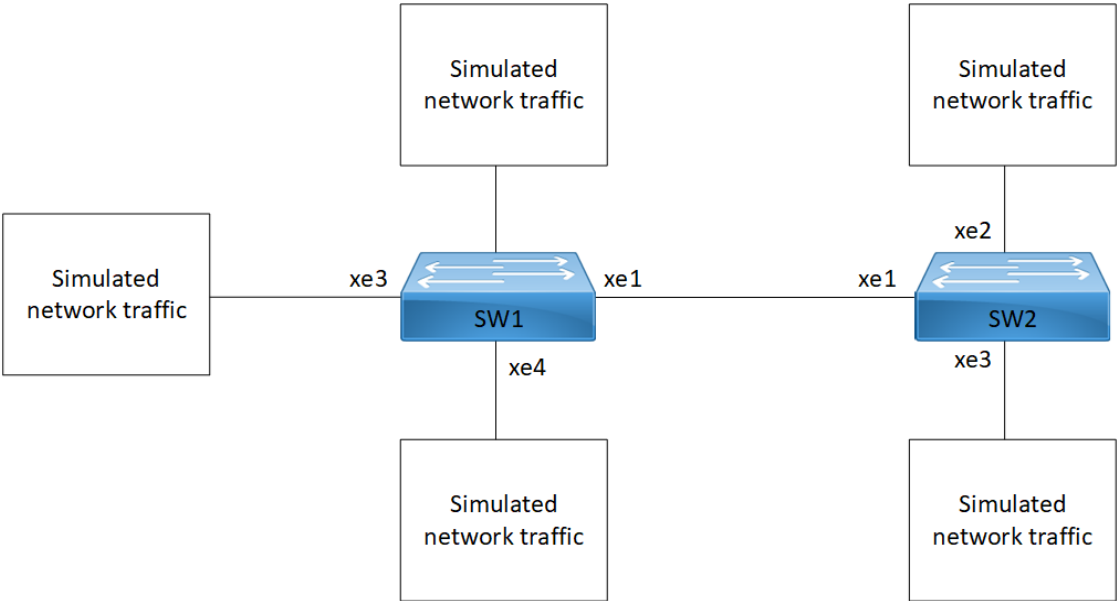


Figure 17-31: PVLAN configuration

## Configure PVLAN Trunk and Promiscuous Trunk Port

### SW1

SW1#configure terminal	Enter configuration mode
SW1(config)#bridge 1 protocol ieee vlan-bridge	Create bridge
SW1(config)#vlan database	Enter VLAN configuration mode
SW1(config-vlan)#vlan 10 bridge 1 state enable	Create VLAN 10
SW1(config-vlan)#vlan 20 bridge 1 state enable	Create VLAN 20
SW1(config-vlan)#vlan 100 bridge 1 state enable	Create VLAN 100
SW1(config-vlan)#private-vlan 10 isolated bridge 1	Configure VLAN 10 as isolated VLAN



SW1(config-vlan)#private-vlan 20 community bridge 1	Configure VLAN 20 as community VLAN
SW1(config-vlan)#private-vlan 100 primary bridge 1	Configure VLAN 100 as primary VLAN
SW1(config-vlan)#private-vlan 100 association add 10 bridge 1	Associate secondary isolated VLAN 10 with primary VLAN 100
SW1(config-vlan)#private-vlan 100 association add 20 bridge 1	Associate secondary community VLAN 20 with primary VLAN 100
SW1(config-vlan)#exit	Exit VLAN configuration mode
SW1(config)#interface xe1	Enter interface configuration mode for xe1
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode trunk	Set the switching characteristics of this interface as trunk
SW1(config-if)#switchport trunk allowed vlan add 10,20,100	Configure VLAN 10,20,100 (primary, secondary VLANs)
SW1(config-if)#exit	Exit interface mode
SW1(config)#interface xe3	Enter interface configuration mode for xe3
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode trunk	Set the switching characteristics of this interface as trunk
SW1(config-if)#switchport mode private-vlan promiscuous	Configure the interface as promiscuous port for private-vlan
SW1(config-if)#switchport trunk allowed vlan add 100	Configure VLAN 100 (primary VLAN)
SW1(config-if)#switchport private-vlan mapping 100 add 10	Associate port with primary and secondary VLAN of private-vlan
SW1(config-if)#switchport private-vlan mapping 100 add 20	Associate port with primary and secondary VLAN of private-vlan
SW1(config-if)#exit	Exit interface mode
SW1(config)#interface xe4	Enter interface configuration mode for xe4
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode access	Set the switching characteristics of this interface as access
SW1(config-if)#switchport mode private-vlan host	Configure the interface as host port for private-vlan
SW1(config-if)#switchport access vlan 20	Configure VLAN 20 (community VLAN)
SW1(config-if)#switchport private-vlan host-association 100 add 20	Associate port with primary and secondary VLAN of private-vlan
SW1(config-if)#exit	Exit interface mode
SW1(config)#interface xe2	Enter interface configuration mode for xe2
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode access	Set the switching characteristics of this interface as access
SW1(config-if)#switchport mode private-vlan host	Configure the interface as host port for private-vlan

SW1(config-if)#switchport access vlan 10	Configure VLAN 10 (isolated VLAN)
SW1(config-if)#switchport private-vlan host-association 100 add 10	Associate port with primary and secondary VLAN of private-vlan
SW1(config-if)#exit	Exit interface mode
SW1(config)#commit	Commit the configure on the node.
SW1(config)#exit	Exit configuration mode

## SW2

SW2#configure terminal	Enter configuration mode
SW2(config)#bridge 1 protocol ieee vlan-bridge	Create bridge
SW2(config)#vlan database	Enter VLAN configuration mode
SW2(config-vlan)#vlan 10 bridge 1 state enable	Create VLAN 10
SW2(config-vlan)#vlan 20 bridge 1 state enable	Create VLAN 20
SW2(config-vlan)#vlan 100 bridge 1 state enable	Create VLAN 100
SW2(config-vlan)#private-vlan 10 isolated bridge 1	Configure VLAN 10 as isolated VLAN
SW2(config-vlan)#private-vlan 20 community bridge 1	Configure VLAN 20 as community VLAN
SW2(config-vlan)#private-vlan 100 primary bridge 1	Configure VLAN 100 as primary VLAN
SW1(config-vlan)#private-vlan 100 association add 10 bridge 1	Associate secondary isolated VLAN 10 with primary VLAN 100
SW1(config-vlan)#private-vlan 100 association add 20 bridge 1	Associate secondary community VLAN 20 with primary VLAN 100
SW2(config-vlan)#exit	Exit VLAN configuration mode
SW2(config)#interface xe1	Enter interface configuration mode for xe1
SW2(config-if)#switchport	Configure switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode trunk	Set the switching characteristics of this interface as trunk
SW2(config-if)#switchport trunk allowed vlan add 10,20,100	Configure VLAN 10,20,100 (primary, secondary VLANs)
SW2(config-if)#exit	Exit interface mode
SW2(config)#interface xe2	Enter interface configuration mode for xe2
SW2(config-if)#switchport	Configure switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode access	Set the switching characteristics of this interface as access
SW2(config-if)#switchport mode private-vlan host	Configure the interface as host port for private-vlan
SW2(config-if)#switchport access vlan 10	Configure VLAN 10 (isolated VLAN)
SW2(config-if)#switchport private-vlan host-association 100 add 10	Associate port with primary and secondary VLAN of private-vlan

SW2(config-if)#exit	Exit interface mode
SW2(config)#interface xe3	Enter interface configuration mode for xe3
SW2(config-if)#switchport	Configure switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode access	Set the switching characteristics of this interface as access
SW2(config-if)#switchport mode private-vlan host	Configure the interface as host port for private-vlan
SW2(config-if)#switchport access vlan 20	Configure VLAN 20 (community VLAN)
SW2(config-if)#switchport private-vlan host-association 100 add 20	Associate port with primary and secondary VLAN of private-vlan
SW2(config-if)#exit	Exit interface mode
SW2(config)#commit	Commit the configure on the node.
SW2(config)#exit	Exit configuration mode

## Validation

```
SW1#show vlan private-vlan bridge 1
PRIMARY          SECONDARY          TYPE          INTERFACES
-----
      100              10      isolated      xe1,xe2,
      100              20      community      xe1,xe4,
SW1#
SW2#show vlan private-vlan bridge 1
PRIMARY          SECONDARY          TYPE          INTERFACES
-----
      100              10      isolated      xe1,xe2,
      100              20      community      xe1,xe3,
SW2#
```

## Configure PVLAN Trunk and Promiscuous Access Port

### SW1

SW1#configure terminal	Enter configuration mode
SW1(config)#bridge 1 protocol ieee vlan-bridge	Create bridge
SW1(config)#vlan database	Enter VLAN configuration mode
SW1(config-vlan)#vlan 10 bridge 1 state enable	Create VLAN 10
SW1(config-vlan)#vlan 20 bridge 1 state enable	Create VLAN 20
SW1(config-vlan)#vlan 100 bridge 1 state enable	Create VLAN 100

SW1(config-vlan)#private-vlan 10 isolated bridge 1	Configure VLAN 10 as isolated VLAN
SW1(config-vlan)#private-vlan 20 community bridge 1	Configure VLAN 20 as community VLAN
SW1(config-vlan)#private-vlan 100 primary bridge 1	Configure VLAN 100 as primary VLAN
SW1(config-vlan)#private-vlan 100 association add 10 bridge 1	Associate secondary isolated VLAN 10 with primary VLAN 100
SW1(config-vlan)#private-vlan 100 association add 20 bridge 1	Associate secondary community VLAN 20 with primary VLAN 100
SW1(config-vlan)#exit	Exit VLAN configuration mode
SW1(config)#interface xe1	Enter interface configuration mode for xe1
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode trunk	Set the switching characteristics of this interface as trunk
SW1(config-if)#switchport trunk allowed vlan add 10,20,100	Configure VLAN 10,20,100 (primary, secondary VLANs)
SW1(config-if)#exit	Exit interface mode
SW1(config)#interface xe3	Enter interface configuration mode for xe3
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode access	Set the switching characteristics of this interface as access
SW1(config-if)#switchport mode private-vlan promiscuous	Configure the interface as promiscuous port for private-vlan
SW1(config-if)#switchport access vlan 100	Configure VLAN 100 (primary VLAN)
SW1(config-if)#switchport private-vlan mapping 100 add 10	Associate port with primary and secondary VLAN of private-vlan
SW1(config-if)#switchport private-vlan mapping 100 add 20	Associate port with primary and secondary VLAN of private-vlan
SW1(config-if)#exit	Exit interface mode
SW1(config)#interface xe4	Enter interface configuration mode for xe4
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode access	Set the switching characteristics of this interface as access
SW1(config-if)#switchport mode private-vlan host	Configure the interface as host port for private-vlan
SW1(config-if)#switchport access vlan 20	Configure VLAN 20 (community VLAN)
SW1(config-if)#switchport private-vlan host-association 100 add 20	Associate port with primary and secondary VLAN of private-vlan
SW1(config-if)#exit	Exit interface mode
SW1(config)#interface xe2	Enter interface configuration mode for xe2
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode access	Set the switching characteristics of this interface as access

SW1(config-if)#switchport mode private-vlan host	Configure the interface as host port for private-vlan
SW1(config-if)#switchport access vlan 10	Configure VLAN 10 (isolated VLAN)
SW1(config-if)#switchport private-vlan host-association 100 add 10	Associate port with primary and secondary VLAN of private-vlan
SW1(config-if)#exit	Exit interface mode
SW1(config)#commit	Commit the configure on the node.
SW1(config)#exit	Exit configuration mode

## SW2

SW2#configure terminal	Enter configuration mode
SW2(config)#bridge 1 protocol ieee vlan-bridge	Create bridge
SW2(config)#vlan database	Enter VLAN configuration mode
SW2(config-vlan)#vlan 10 bridge 1 state enable	Create VLAN 10
SW2(config-vlan)#vlan 20 bridge 1 state enable	Create VLAN 20
SW2(config-vlan)#vlan 100 bridge 1 state enable	Create VLAN 100
SW2(config-vlan)#private-vlan 10 isolated bridge 1	Configure VLAN 10 as isolated VLAN
SW2(config-vlan)#private-vlan 20 community bridge 1	Configure VLAN 20 as community VLAN
SW2(config-vlan)#private-vlan 100 primary bridge 1	Configure VLAN 100 as primary VLAN
SW1(config-vlan)#private-vlan 100 association add 10 bridge 1	Associate secondary isolated VLAN 10 with primary VLAN 100
SW1(config-vlan)#private-vlan 100 association add 20 bridge 1	Associate secondary community VLAN 20 with primary VLAN 100
SW2(config-vlan)#exit	Exit VLAN configuration mode
SW2(config)#interface xe1	Enter interface configuration mode for xe1
SW2(config-if)#switchport	Configure switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode trunk	Set the switching characteristics of this interface as trunk
SW2(config-if)#switchport trunk allowed vlan add 10,20,100	Configure VLAN 10,20,100 (primary, secondary VLANs)
SW2(config-if)#exit	Exit interface mode
SW2(config)#interface xe2	Enter interface configuration mode for xe2
SW2(config-if)#switchport	Configure switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode access	Set the switching characteristics of this interface as access
SW2(config-if)#switchport mode private-vlan host	Configure the interface as host port for private-vlan
SW2(config-if)#switchport access vlan 10	Configure VLAN 10 (isolated VLAN)

SW2(config-if)#switchport private-vlan host-association 100 add 10	Associate port with primary and secondary VLAN of private-vlan
SW2(config-if)#exit	Exit interface mode
SW2(config)#interface xe3	Enter interface configuration mode for xe3
SW2(config-if)#switchport	Configure switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode access	Set the switching characteristics of this interface as access
SW2(config-if)#switchport mode private-vlan host	Configure the interface as host port for private-vlan
SW2(config-if)#switchport access vlan 20	Configure VLAN 20 (community VLAN)
SW2(config-if)#switchport private-vlan host-association 100 add 20	Associate port with primary and secondary VLAN of private-vlan
SW2(config-if)#exit	Exit interface mode
SW2(config)#commit	Commit the configure on the node.
SW2(config)#exit	Exit configuration mode

## Validation

SW1#show vlan private-vlan bridge 1

PRIMARY	SECONDARY	TYPE	INTERFACES
-----	-----	-----	-----
100	10	isolated	xe1, xe2,
100	20	community	xe1, xe4,

SW2#show vlan private-vlan bridge 1

PRIMARY	SECONDARY	TYPE	INTERFACES
-----	-----	-----	-----
100	10	isolated	xe1, xe2,
100	20	community	xe1, xe3,

SW2#

## Traffic Validation

Configure Host trunk and promiscuous trunk configurations on SW1 and SW2

1. Send untagged traffic from SW1 xe3 (promiscuous port), traffic should forward to interfaces xe1,xe2, and xe4. On SW2, traffic should receive from xe1 and forward through xe2 and xe3.

SW1#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
-----	-----	-----	-----	-----
xe1	0.00	0	86.49	84462
xe2	0.00	0	86.49	84462
xe3	86.49	84462	0.00	0
xe4	0.00	0	86.49	84462

SW2#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
xe1	86.49	84462	0.00	0
xe2	0.00	0	86.49	84462
xe3	0.00	0	86.49	84462

2. Send untagged traffic from SW1 xe2 (isolated port), traffic should forward to interfaces xe3 and xe1. On SW2, traffic should receive from xe1 and remaining ports should be 0.

SW1#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
xe1	0.00	0	86.49	84462
xe2	86.49	84462	0.00	0
xe3	0.00	0	86.49	84462
xe4	0.00	0	0.00	0

SW2#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
xe1	86.49	84462	0.00	0
xe2	0.00	0	0.00	0
xe3	0.00	0	0.00	0

3. Send untagged traffic from SW1 xe4 (community port), traffic should forward through interfaces xe3 and xe1. On SW2, traffic should receive from xe1 and forward to xe3.

SW1#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
xe1	0.00	0	86.49	84462
xe2	0.00	0	0.00	0
xe3	0.00	0	86.49	84462
xe4	86.49	84462	0.00	0

SW2#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
xe1	86.49	84462	0.00	0
xe2	0.00	0	0.00	0
xe3	0.00	0	86.49	84462

## CHAPTER 18 MAC Authentication Bypass

MAC Authentication Bypass (MAB) is used for a non-authenticating device (a device without an 802.1X supplicant running on it) connecting to a network with 802.1X enabled. Since there is no supplicant to answer the EAP identity requests from the authenticator (switch, wireless controller, etc.) the authenticator will generate the authentication request for the endpoint using the endpoint's MAC address as the username/password for the Access-Request message.

Note: Multicast address is not accepted for host address of radius-server.

### Topology

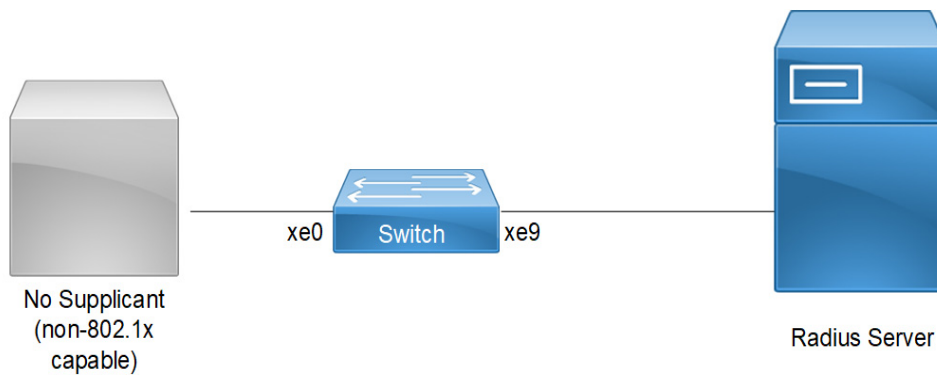


Figure 18-32: MAB Topology

### Configuration

#### Switch Configuration for MAC Authentication Bypass (MAB)

Switch#configure terminal	Enter configure mode
Switch(config)#bridge 1 protocol ieee vlan-bridge	Create bridge 1
OcNOS(config)#commit	Commit candidate configuration to be running configuration
Switch(config)#port-security disable	Disable port security
Switch(config)#dot1x system-auth-ctrl	Enable dot1x authentication globally
Switch(config)#auth-mac system-auth-ctrl	Enable MAC authentication bypass globally
Switch(config)#radius-server dot1x host 10.1.1.1 key 0 testing123	Specify the host IP and key with string name between radius server and client.
Switch(config)#commit	Commit transaction
Switch(config)#interface xe0	Configure interface xe0
Switch(config-if)#switchport	Enable switch port on interface.
Switch(config-if)#bridge-group 1	Associate bridge to an interface.
Switch(config-if)#switchport mode access	Configure port as access
Switch(config-if)#dot1x port-control auto	Enable authentication (via Radius) on port (xe0)
Switch(config-if)#dot1x mac-auth-bypass enable	Enable MAC authentication bypass on interface



OcNOS (config) #commit	Commit candidate configuration to be running configuration
Switch (config) #interface xe9	Configure interface xe9
Switch (config-if) #ip address 10.1.1.2/24	Set the IP address on interface xe9
Switch (config-if) #commit	Commit transaction
Switch (config-if) #end	Exit config mode.

## Validation

### Verify MAB on Switch

```
Switch#show mab all
Global MAC Authentication Enabled
  RADIUS server address: 10.1.1.1:1812
  Next radius message id: 4
  RADIUS client address: not configured
```

```
MAB info for interface xe0
  Dot1x timer: Expired
  MAB Authentication Enabled
  Supplicant name: 00:07:E9:A5:3D:FA
  Status: MAC Authorized
  Last rejected MAC:
```

## Configuration

### MAC Authentication Configuration

Switch#configure terminal	Enter configure mode
Switch (config) #bridge 1 protocol ieee vlan-bridge	Create bridge 1
Switch (config) #port-security disable	Disable port security
Switch (config) #dot1x system-auth-ctrl	Enable dot1x authentication globally
Switch (config) #auth-mac system-auth-ctrl	Enable MAC authentication bypass globally
Switch (config) #radius-server dot1x host 10.1.1.1 key 0 testing123	Specify the host IP and key with string name between radius server and client.
Switch (config) #commit	Commit transaction
Switch (config) #interface xe0	Configure interface xe0
Switch (config-if) #switchport	Enable switch port on interface.
Switch (config-if) #bridge-group 1	Associate bridge to an interface.
Switch (config-if) #switchport mode access	Configure port as access
Switch (config-if) #auth-mac enable	Enable MAC authentication on interface
OcNOS (config) #commit	Commit candidate configuration to be running configuration
Switch (config) #interface xe9	Configure interface xe9
Switch (config-if) #ip address 10.1.1.2/24	Set the IP address on interface xe9

---

Switch(config-if)#commit	Commit transaction
Switch(config-if)#end	Exit config mode.

---

**Note:** When AUTH-MAC is enabled on the interface MAC-AUTH bypass cannot be enabled and vice-versa.

---

## Validation

### Verify MAB on Switch

```
Switch#show mab all
Global MAC Authentication Enabled
  RADIUS server address: 10.1.1.1:1812
  Next radius message id: 9
  RADIUS client address: not configured

MAB info for interface xe0
  Dot1x timer: Expired
  MAB Authentication Disabled
  Supplicant name: 00:07:E9:A5:3D:FA
  Status: MAC Authorized
  Last rejected MAC: 00:07:E9:A5:4E:25
```

# CHAPTER 19 Unidirectional Link Detection Configuration

This chapter shows a complete configuration to enable UDLD in a simple network topology.

## Overview

The purpose of Unidirectional Link Detection protocol (UDLD) is to monitor the physical links and detect when a unidirectional link exists. Upon detection user can either block the port or notify the link status based on the network administrator's configuration.

UDLD works in two different modes:

- Normal mode
- Aggressive mode

## Topology

Figure 19-33 shows the topology of the UDLD configuration.

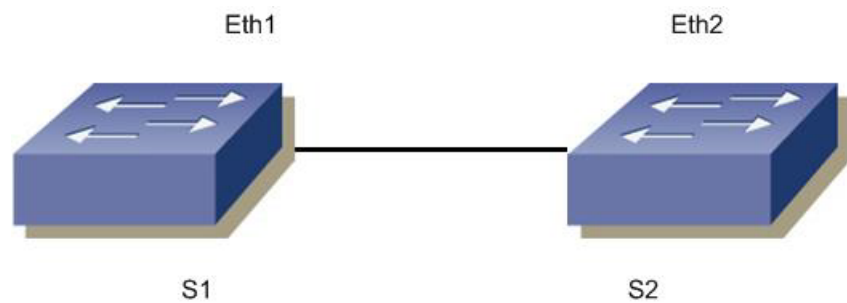


Figure 19-33: UDLD Configuration

### S1

#configure terminal	Enter configure mode
(config)#udld enable	Enable UDLD globally
(config)#udld message-time 7	Configure message time for UDLD packets
(config)#interface eth1	Enter interface mode
(config-if)#switchport	Configure the interface as switch port
(config-if)#udld state enable	Enable UDLD on the interface
(config-if)#udld mode normal	Configure udld mode as normal or aggressive
(config-if)#commit	Commit config.
(config-if)#exit	Exit from the interface mode

### S2

#configure terminal	Enter configure mode.
(config)#udld enable	Enable UDLD globally.
(config)#udld message-time 7	Configure message time for UDLD packets

(config)#interface eth2	Enter interface mode
(config-if)#switchport	Configure the interface as switch port.
(config-if)#udld state enable	Enable UDLD on the interface.
(config-if)#udld mode normal	Configure udld mode as normal or aggressive
(config-if)#commit	Commit config.
(config-if)#exit	Exit from the interface mode

Validation

```
#show udld
UDLD: Enable
Message Interval(sec) : 7
```

Port	UDLD Status	Mode	Link-Status
-----			
Eth1	Enable	Normal	Bi-directional
Eth2	Disable	Normal	Unknown
Eth3	Disable	Normal	Unknown
Eth4	Disable	Normal	Unknown
Eth5	Disable	Normal	Unknown
Eth6	Disable	Normal	Unknown

Once the links is made Uni-directional, the output of the command Show udld is as follows:

```
#show udld
UDLD: Enable
Message Interval(sec) : 7
```

Port	UDLD Status	Mode	Link-Status
-----			
Eth1	Enable	Normal	Unidirectional
Eth2	Disable	Normal	Unknown
Eth3	Disable	Normal	Unknown
Eth4	Disable	Normal	Unknown
Eth5	Disable	Normal	Unknown
Eth6	Disable	Normal	Unknown

```
#sh running-config
udld Enable
udld message-time 7

#sh running-config in eth1
!
interface eth1
  switchport
  udld state Enable
```

!

```
#sh udld interface eth1
UDLD Status      : Enable
UDLD Mode        : Normal
Link-State       : Unknown
```

For aggressive mode, udld output is as follows:

```
#show udld
    UDLD  : Enable
    Message Interval(sec) : 7
```

Port	UDLD Status	Mode	Link-Status
-----			
eth1	Enable	Aggressive	Bi-Directional

```
#sh running config
udld Enable
udld message-time 7
```

```
#sh running-config in eth1
    interface eth1
switchport
udld mode Aggressive
udld state Enable
```

## CHAPTER 20 Provider Bridging Configuration

This chapter contains sample provider bridging configurations.

A provider bridged network is a virtual bridged Local Area Network that comprises provider bridges (SVLAN bridges and provider edge bridges) and attached LANs, 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 that provide customer interfaces for each service instance.

### Single Provider Bridge Configuration

#### Topology



**Figure 20-34: Single provider bridge configuration**

#### Configuration

##### SW1 (PEB)

SW1#configure terminal	Enter configuration mode
SW1(config)#bridge 1 protocol provider-rstp edge	Create bridge
SW1(config)#vlan database	Enter VLAN configuration mode
SW1(config-vlan)#vlan 2 type customer bridge 1 state enable	Create customer vlan VLAN 2
SW1(config-vlan)#vlan 200 type service point-point bridge 1 state enable	Create service vlan VLAN200
SW1(config-vlan)#exit	Exit VLAN configuration mode
SW1(config)#cvlan registration table map1 bridge 1	Create cvlan registration table map1
SW1(config-cvlan-registration)#cvlan 2 svlan 200	Map cvlan2 with svlan 200
SW1(config-cvlan-registration)#exit	Exit registration table
SW1(config)#interface eth1	Enter interface configuration mode for eth1
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode customer-edge access	Configure switchport mode customer edge
SW1(config-if)#switchport customer-edge access vlan 2	Associate customer vlan2 with interface

SW1(config-if)#switchport customer-edge vlan registration map1	Attach registration table map1 with interface
SW1(config-if)#exit	Exit interface mode
SW1(config)#interface eth2	Enter interface configuration mode for eth2
SW1(config-if)#switchport	Make interface as switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode provider-network	Configure switchport pnp port
SW1(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW1(config-if)#exit	Exit interface configuration mode
SW1(config)#commit	Commit the transaction.

**SW2 (PB)**

SW2#configure terminal	Enter configuration mode
SW2(config)#bridge 1 protocol provider-rstp	Create provider bridge
SW2(config)#vlan database	Enter VLAN configuration mode
SW2(config-vlan)#vlan 200 type service point-point bridge 1 state enable	Create service vlan VLAN200
SW2(config-vlan)#exit	Exit VLAN configuration mode
SW2(config)#interface eth1	Enter interface configuration mode for eth1
SW2(config-if)#switchport	Make interface as switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode provider-network	Configure switchport pnp port
SW2(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW2(config-if)#exit	Exit interface configuration mode
SW2(config)#interface eth2	Enter interface configuration mode for eth2
SW2(config-if)#switchport	Make interface as switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode provider-network	Configure switchport pnp port
SW2(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW2(config-if)#exit	Exit interface configuration mode
SW2(config)#commit	Commit the transaction.

**SW3 (PEB)**

SW3#configure terminal	Enter configuration mode
SW3(config)#bridge 1 protocol provider-rstp edge	Create bridge
SW3(config)#vlan database	Enter VLAN configuration mode

SW3(config-vlan)#vlan 2 type customer bridge 1 state enable	Create customer vlan VLAN 2
SW3(config-vlan)#vlan 200 type service point-point bridge 1 state enable	Create service vlan VLAN200
SW3(config-vlan)#exit	Exit VLAN configuration mode
SW3(config)#cvlan registration table map1 bridge 1	Create cvlan registration table map1
SW3(config-cvlan-registration)#cvlan 2 svlan 200	Map cvlan2 with svlan 200
SW3(config-cvlan-registration)#exit	Exit registration table
SW3(config)#interface eth1	Enter interface configuration mode for eth1
SW3(config-if)#switchport	Configure switchport
SW3(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW3(config-if)#switchport mode customer-edge access	Configure switchport mode customer edge
SW3(config-if)#switchport customer-edge access vlan 2	Associate customer vlan2 with interface
SW3(config-if)#switchport customer-edge vlan registration map1	Attach registration table map1 with interface
SW3(config-if)#exit	Exit interface mode
SW3(config)#interface eth2	Enter interface configuration mode for eth2
SW3(config-if)#switchport	Make interface as switchport
SW3(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW3(config-if)#switchport mode provider-network	Configure switchport pnp port
SW3(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW3(config-if)#exit	Exit interface configuration mode
SW3(config)#commit	Commit the transaction.

## Validation

SW3#sh br  
 bridge 1 is running on provider-rstp edge  
 Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		200		eth1	0000.0000.0f00	1	300
1		200		eth2	0001.0000.0800	1	300

SW1#sh br  
 bridge 1 is running on provider-rstp edge  
 Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		200		eth2	0000.0000.0f00	1	300



```
1                200          eth1      0001.0000.0800    1        300
```

```
SW1#sh cvlan registration table
```

```
Bridge          Table Name      Port List
```

```
=====
```

```
1              map1          eth1
```

```
CVLAN ID      SVLAN ID
```

```
=====
```

```
2            200
```

## Two Provider Bridge Configuration

### Topology

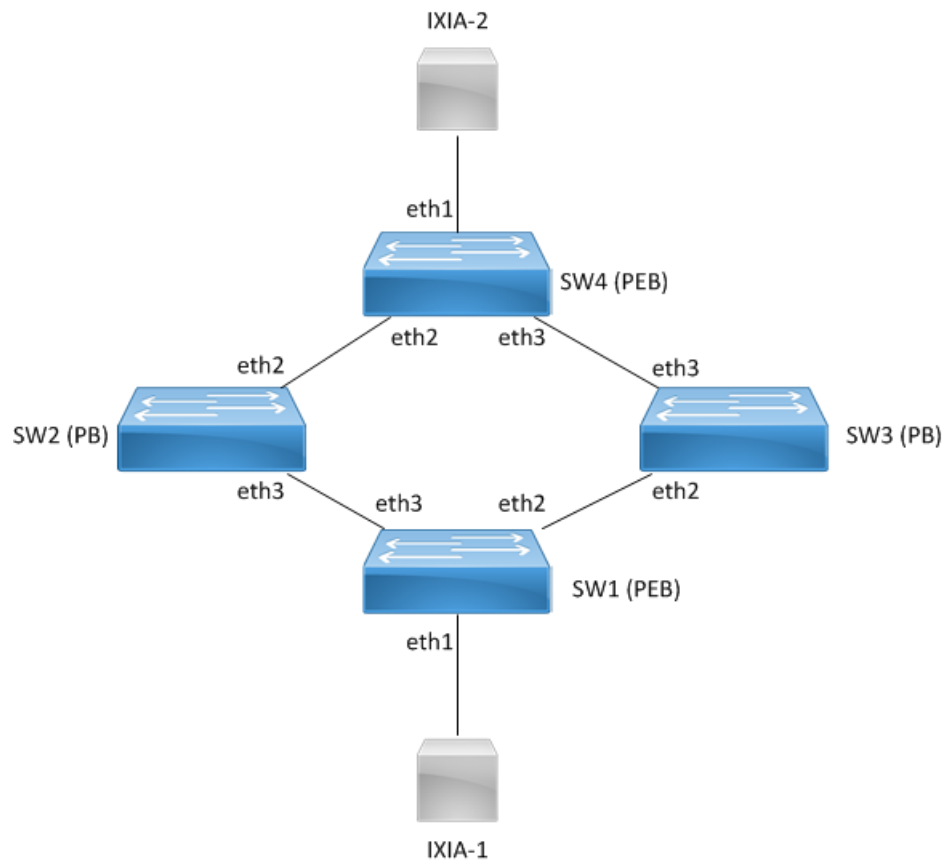


Figure 20-35: Two provider bridge configuration

## Configuration

### SW1 (PEB)

SW1#configure terminal	Enter configuration mode
SW1(config)#bridge 1 protocol provider-rstp edge	Create bridge
SW1(config)#vlan database	Enter VLAN configuration mode
SW1(config-vlan)#vlan 2 type customer bridge 1 state enable	Create customer vlan VLAN 2
SW1(config-vlan)#vlan 200 type service point-point bridge 1 state enable	Create service vlan VLAN200
SW1(config-vlan)#exit	Exit VLAN configuration mode
SW1(config)#cvlan registration table map1 bridge 1	Create cvlan registration table map1
SW1(config-cvlan-registration)#cvlan 2 svlan 200	Map cvlan2 with svlan 200
SW1(config-cvlan-registration)#exit	Exit registration table
SW1(config)#interface eth1	Enter interface configuration mode for eth1
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode customer-edge access	Configure switchport mode customer edge
SW1(config-if)#switchport customer-edge access vlan 2	Associate customer vlan2 with interface
SW1(config-if)#switchport customer-edge vlan registration map1	Attach registration table map1 with interface
SW1(config-if)#exit	Exit interface mode
SW1(config)#interface eth2	Enter interface configuration mode for eth2
SW1(config-if)#switchport	Make interface as switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode provider-network	Configure switchport pnp port
SW1(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW1(config-if)#exit	Exit interface mode
SW1(config)#interface eth3	Enter interface configuration mode for eth2
SW1(config-if)#switchport	Make interface as switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode provider-network	Configure switchport pnp port
SW1(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW1(config-if)#exit	Exit interface configuration mode
SW1(config)#commit	Commit the transaction.

**SW2 (PB)**

SW2#configure terminal	Enter configuration mode
SW2(config)#bridge 1 protocol provider-rstp	Create provider bridge
SW2(config)#vlan database	Enter VLAN configuration mode
SW2(config-vlan)#vlan 200 type service point-point bridge 1 state enable	Create service vlan VLAN200
SW2(config-vlan)#exit	Exit VLAN configuration mode
SW2(config)#interface eth3	Enter interface configuration mode for eth1
SW2(config-if)#switchport	Make interface as switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode provider-network	Configure switchport pnp port
SW2(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW2(config-if)#exit	Exit interface configuration mode
SW2(config)#interface eth2	Enter interface configuration mode for eth2
SW2(config-if)#switchport	Make interface as switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode provider-network	Configure switchport pnp port
SW2(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW2(config-if)#exit	Exit interface configuration mode
SW2(config)#commit	Commit the transaction.

**SW3 (PB)**

SW3#configure terminal	Enter configuration mode
SW3(config)#bridge 1 protocol provider-rstp	Create provider bridge
SW3(config)#vlan database	Enter VLAN configuration mode
SW3(config-vlan)#vlan 200 type service point-point bridge 1 state enable	Create service vlan VLAN200
SW3(config-vlan)#exit	Exit VLAN configuration mode
SW3(config)#interface eth3	Enter interface configuration mode for eth1
SW3(config-if)#switchport	Make interface as switchport
SW3(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW3(config-if)#switchport mode provider-network	Configure switchport pnp port
SW3(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW3(config-if)#exit	Exit interface configuration mode
SW3(config)#interface eth2	Enter interface configuration mode for eth2
SW3(config-if)#switchport	Make interface as switchport

SW3(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW3(config-if)#switchport mode provider-network	Configure switchport pnp port
SW3(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW3(config-if)#exit	Exit interface configuration mode
SW3(config)#commit	Commit the transaction.

## SW4 (PEB)

SW4#configure terminal	Enter configuration mode
SW4(config)#bridge 1 protocol provider-rstp edge	Create bridge
SW4(config)#vlan database	Enter VLAN configuration mode
SW4(config-vlan)#vlan 2 type customer bridge 1 state enable	Create customer vlan VLAN 2
SW4(config-vlan)#vlan 200 type service point-point bridge 1 state enable	Create service vlan VLAN200
SW4(config-vlan)#exit	Exit VLAN configuration mode
SW4(config)#cvlan registration table map1 bridge 1	Create cvlan registration table map1
SW4(config-cvlan-registration)#cvlan 2 svlan 200	Map cvlan2 with svlan 200
SW4(config-cvlan-registration)#exit	Exit registration table
SW4(config)#interface eth1	Enter interface configuration mode for eth1
SW4(config-if)#switchport	Configure switchport
SW4(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW4(config-if)#switchport mode customer-edge access	Configure switchport mode customer edge
SW4(config-if)#switchport customer-edge access vlan 2	Associate customer vlan2 with interface
SW4(config-if)#switchport customer-edge vlan registration map1	Attach registration table map1 with interface
SW4(config-if)#exit	Exit interface mode
SW4(config)#interface eth2	Enter interface configuration mode for eth2
SW4(config-if)#switchport	Make interface as switchport
SW4(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW4(config-if)#switchport mode provider-network	Configure switchport pnp port
SW4(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW4(config-if)#interface eth3	Enter interface configuration mode for eth2
SW4(config-if)#switchport	Make interface as switchport
SW4(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW4(config-if)#switchport mode provider-network	Configure switchport pnp port

SW4(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW4(config-if)#exit	Exit interface configuration mode
SW4(config)#commit	Commit the transaction.

## Validation

```
SW4#sh br
bridge 1 is running on provider-rstp edge
Ageout time is global and if something is configured for vxlan then it will be affected here also
```

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		200		eth1	0000.0000.0a00	1	300
1		200		eth2	0001.0000.0b00	1	300

```
SW1#sh br
bridge 1 is running on provider-rstp edge
Ageout time is global and if something is configured for vxlan then it will be affected here also
```

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		200		eth1	0000.0000.0b00	1	300
1		200		eth3	0001.0000.0a00	1	300

```
SW1#sh cvlan registration table
```

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

CVLAN ID	SVLAN ID
=====	=====
2	200

## Layer 2 Protocol Tunneling (L2PT/L2CP Tunneling)

L2CP tunneling provides support for tunneling Control plane frames between CE nodes.

When control frames received at CEP port of PE bridge, predefined multicast address (01-00-C2-CD-CD-D0) is used for tunneling the packets across service provider network. If control packets are customer vlan tagged or untagged, then PE bridge will append corresponding service vlan tag to the control packet as per registration table / vlan translation table mapped to the port and send it across the service provider as a data packet.

When tunneled control packet with multicast address (01-00-C2-CD-CD-D0) received on PNP port, the multicast address is replaced with corresponding control packet multicast address and cvlan/svlan removal or updating is done as per registration table / vlan translation table.

## Topology

Figure 20-36 displays a sample Provider Bridged topology with customer equipment.

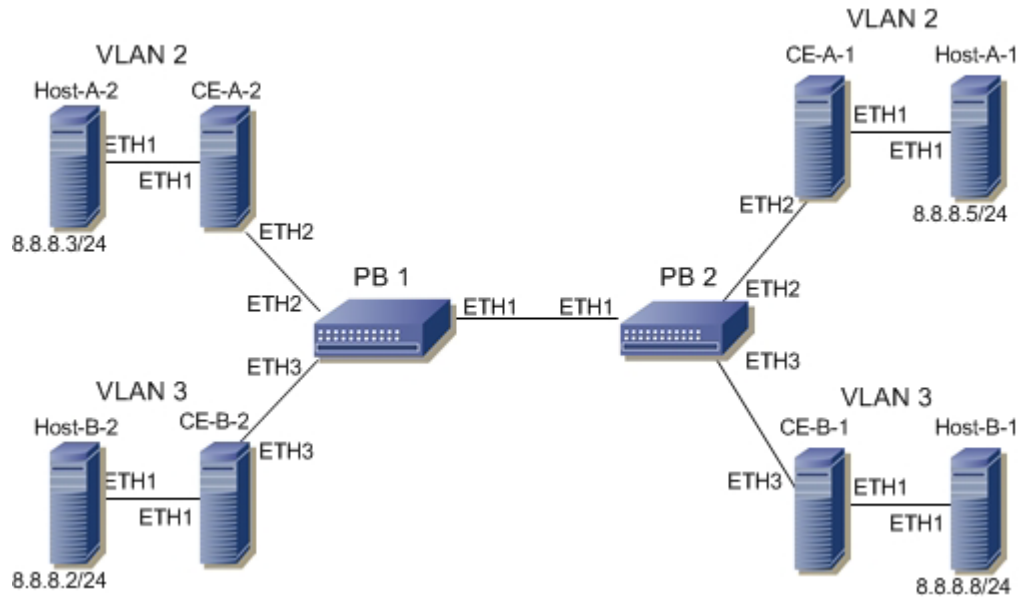


Figure 20-36: Provider Bridging with Customer Equipment Topology

## Configuring the L2PT Protocol on the Interface

The following L2PT protocols are supported:

- EFM: Ethernet first mile (Link OAM)
- ELMI: Ethernet Local Management Interface
- LACP: Link Aggregation Control Protocol
- LLDP: Link Layer Discovery Protocol
- STP: Spanning Tree Protocols

### PB1

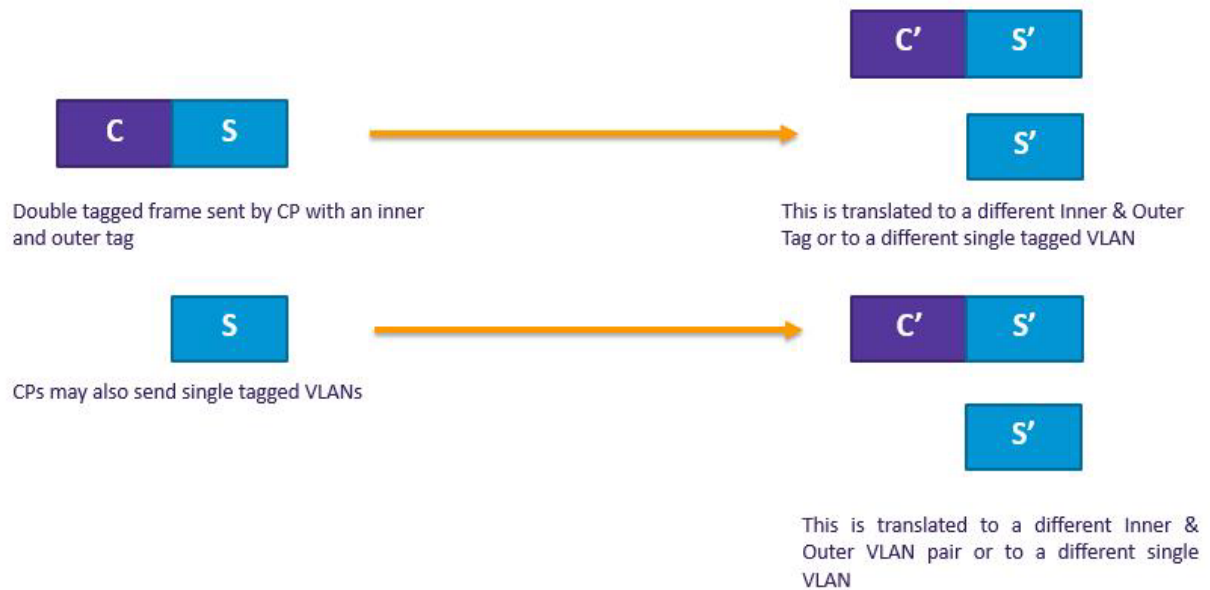
PB1#configure terminal	Enter Configure mode.
PB1(config)#interface eth2	Enter Interface mode
PB1(config-if)#l2protocol stp peer	Configure STP protocol as peer
PB1(config-if)#l2protocol elmi tunnel	Configure Elmi protocol as tunnel
PB1(config-if)#l2protocol lldp tunnel	Configure LLDP protocol as tunnel
PB1(config-if)#l2protocol lacp discard	Configure LACP protocol as discard
PB1(config-if)#l2protocol efm discard	Configure EFM protocol as discard
PB1(config-if)#exit	Exit of the interface
PB1(config)#commit	Commit the transaction.

## Validation

```
PB1#show l2protocol processing interface eth2
Bridge      Interface Name      Protocol      Processing Status
=====
1           eth2                 stp           Peer
1           eth2                 gmrp          Peer
1           eth2                 gvrp          Peer
1           eth2                 mmrp          Peer
1           eth2                 mvrp          Peer
1           eth2                 lacp          Discard
1           eth2                 lldp          Tunnel
1           eth2                 efm           Discard
1           eth2                 elmi          Tunnel
1           eth2                 ptp           Peer
```

## Provider Bridging with VLAN Translation

This is a sample configurations to verify functionality to support provider-bridging feature with extended SVLAN translation as below:



## Topology

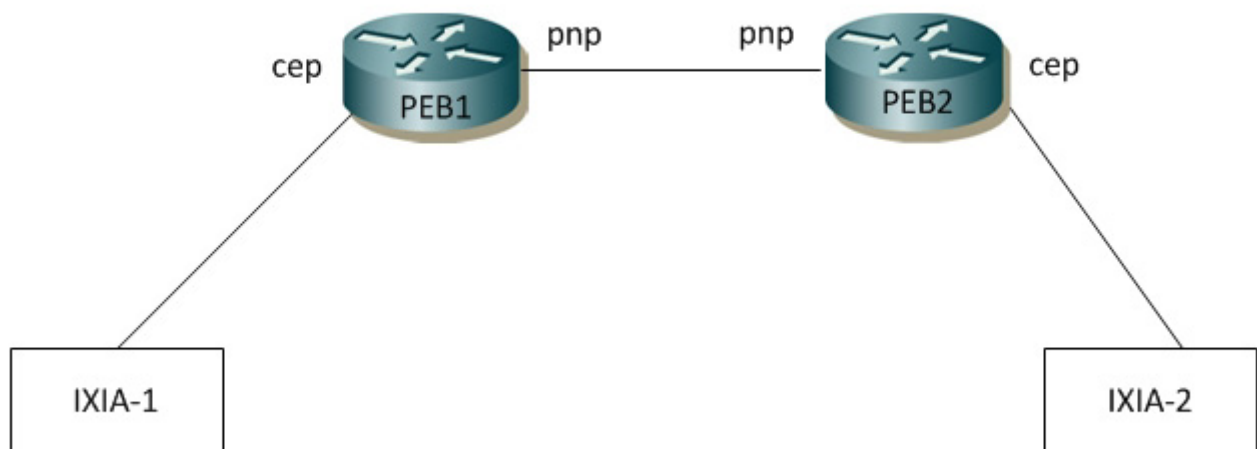


Figure 20-37: Provider Bridging with VLAN Translation Topology



## PEB1

### Bridge Configuration

#configure terminal	Enter configure mode.
(config)#bridge 1 protocol provider-rstp edge	Enter Configure bridge type as provider-RSTP edge bridge
(config)#exit	Exit configure mode.
(config)#commit	Commit the transaction.

### VLAN Configuration

#configure terminal	Enter configure mode.
(config)#vlan database	Enter VLAN database
(config-vlan)# vlan 2-500 type customer bridge 1 state enable	Configure customer VLANs on bridge 1
(config-vlan)#vlan 501-1005 type service point-point bridge 1 state enable	Configure service VLANs on bridge 1
(config-vlan)#commit	Commit the transaction.
(config-vlan)#end	Exit VLAN database and configure mode.

### CVLAN Registration Table Configuration

#configure terminal	Enter configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table as map1
(config-cvlan-registration)#cvlan 2 svlan 1000	Map CVLAN to SVLAN
(config-cvlan-registration)#cvlan 3 svlan 1005	Map CVLAN to SVLAN
(config-cvlan-registration)#commit	Commit the transaction.
(config-cvlan-registration)#end	End the CVLAN registration mode

### CEP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge3	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode customer-edge hybrid	Configure port as customer-edge hybrid port
(config-if)#switchport customer-edge hybrid allowed vlan all	Add all VLANs configured above to this CEP port
(config-if)#switchport customer-edge vlan registration map1	Attach the Map1 to CEP port

(config-if) #commit	Commit the transaction.
(config-if) #end	Exit interface and configure mode.

## PNP Port Configuration

#configure terminal	Enter configure mode.
(config) #interface ge9	Enter the interface mode
(config-if) #switchport	Configure switchport
(config-if) #bridge-group 1	Attach port to bridge
(config-if) #switchport mode provider-network	Configure port as Provider Network Port (PNP)
(config-if) #switchport provider-network allowed vlan all	Add all VLANs configured above to this PNP port
(config-if) #commit	Commit the configuration
(config-if) #end	Exit interface and configure mode.

## PEB2

### Bridge Configuration

#configure terminal	Enter configure mode.
(config) # bridge 1 protocol provider-rstp edge	Enter configure bridge type as provider-RSTP edge bridge
(config) #commit	Commit the configuration
(config) #exit	Exit configure mode.

### VLAN Configuration

#configure terminal	Enter configure mode.
(config) #vlan database	Enter VLAN database
(config-vlan) #vlan 2-500 type customer bridge 1 state enable	Configure customer VLANs on bridge 1
(config-vlan) #vlan 501-1005 typeservice point-point bridge 1 state enable	Configure service VLANs on bridge 1
(config-vlan) #commit	Commit the configuration
(config-vlan) #end	Exit VLAN database and configure mode.

### CVLAN Registration Table Configuration

#configure terminal	Enter configure mode.
(config) #cvlan registration table map1 bridge 1	Configure CVLAN registration table as map1
(config-cvlan-registration) #cvlan 2 svlan 1000	Map CVLAN to SVLAN
(config-cvlan-registration) #cvlan 3 svlan 1005	Map CVLAN to SVLAN

(config-cvlan-registration)#commit	Commit the configuration
(config-cvlan-registration)#end	End the CVLAN registration mode

## CEP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge3	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode customer-edge hybrid	Configure port as customer-edge hybrid port
(config-if)#switchport customer-edge hybrid allowed vlan all	Add all VLANs configured above to this CEP port
(config-if)#switchport customer-edge vlan registration map1	Attach the Map1 to CEP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## PNP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge9	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode provider-network	Configure port as Provider Network Port (PNP)
(config-if)#switchport provider-network allowed vlan all	Add all VLANs configured above to this PNP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## Translation Cases

### Case1 - (C S - C' S')

#### Configuration on PEB2

#configure terminal	Enter configure mode.
(config)#interface ge9	Enter the interface mode
(config-if)#switchport provider-network vlan translation cvlan 2 svlan 1000 cvlan 3 svlan 1005	Translate CVLAN and SVLAN to new CVLAN and new SVLAN on PNP port

## Validation for Case 1

When tagged traffic with CVLAN 2 is sent from IXIA-1 to IXIA-2 with both CTAG and STAG entering provider network and gets translated to new CVLAN and SVLAN as per Case1.

```
PEB2#show bridge
Bridge      CVLAN  SVLAN  BVLAN  Port      MAC Address      FWD  Time-out
-----+-----+-----+-----+-----+-----+-----+-----+
1           1      1      ge27    1402.ec1c.3144  1      300
1           1000   1000   ge9     6400.6a1e.d9a5  1      300
1           1005   1005   ge9     0000.0500.0400  1      300
1           1005   1005   ge9     6400.6a1e.d9a5  1      300
```

New SVLAN 1005 is observed on PEB2 after translation. Also, captured packets on CEP show new CVLAN 3.

When tagged traffic for CVLAN 3 is sent from IXIA-2 to IXIA-1

```
PEB1#show bridge
Bridge      CVLAN  SVLAN  BVLAN  Port      MAC Address      FWD  Time-out
-----+-----+-----+-----+-----+-----+-----+-----+
1           1      1      ge9     74e6.e2af.598b  1      300
1           1000   1000   ge3     0000.0500.0400  1      300
1           1000   1000   ge9     0000.0500.0700  1      300
```

When traffic is reversed and traffic has both new CVLAN 3 and SVLAN 1005 on provider network from IXIA-2, translation to old CVLAN 2 and SVLAN 1000 happens. Also, captured packets have CVLAN as 2.

## Case2 - (C S - S')

### Configuration on PEB2

#### CVLAN Registration Table Configuration

#configure terminal	Enter configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table as map1
(config-cvlan-registration)#cvlan 2 svlan 1000	Map CVLAN to SVLAN
(config-cvlan-registration)#cvlan 3 svlan 1005 untagged-pep	Map CVLAN to SVLAN
(config-cvlan-registration)#commit	Commit the configuration
(config-cvlan-registration)#end	End the CVLAN registration mode

#### CEP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge3	Enter the interface mode
(config-if)#switchport customer-edge hybrid vlan 3	Allow access VLAN 3 configured above to this CEP port
(config-if)#switchport customer-edge hybrid allowed vlan add 2-3	Allow other VLANs configured to this CEP port
(config-if)#switchport customer-edge vlan registration map1	Attach the Map1 to CEP port

(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## PNP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge9	Enter the interface mode
(config-if)#no switchport provider-network vlan translation cvlan 2 svlan 1000	Unconfigure Translation Case1 from PNP port
(config-if)#switchport provider-network vlan translation cvlan 2 svlan 1000 svlan 1005	Configure Translation Case2 on PNP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## Validation for Case 2

When tagged traffic with CVLAN 2 is sent from IXIA-1 to IXIA-2 with both CTAG and STAG entering provider network and translated to new SVLAN as per Case2.

```
PEB2#show bridge
```

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		1		ge27	1402.ec1c.3144	1	300
1		1005		ge9	0000.0500.0400	1	300

New SVLAN 1005 is observed on PEB2 after translation. At CEP port connected to IXIA-2, untagged traffic should be received.

When tagged traffic for CVLAN 3 is sent from IXIA-2 to IXIA-1.

```
PEB1#show bridge
```

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		1		ge9	74e6.e2af.598b	1	300
1		1000		ge3	0000.0500.0400	1	300
1		1000		ge9	0000.0500.0700	1	300

When traffic is reversed and traffic has both new CVLAN 3 and SVLAN 1005 from IXIA-2, translation to old CVLAN 2 and SVLAN 1000 happens. Also, captured packets have CVLAN as 2.

## Case3 - (S - S')

### Configuration on PEB1

#### CVLAN Registration Table Configuration

#configure terminal	Enter configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table as map1
(config-cvlan-registration)#cvlan 2 svlan 1000	Map CVLAN to SVLAN

(config-cvlan-registration)#cvlan 3 svlan 1005	Map CVLAN to SVLAN
(config-cvlan-registration)#commit	Commit the configuration
(config-cvlan-registration)#end	End the CVLAN registration mode

## CEP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge3	Enter the interface mode
(config-if)#switchport customer-edge hybrid vlan 2	Allow access VLAN 2 configured above to this CEP port
(config-if)#switchport customer-edge hybrid allowed vlan add 2-3	Allow other VLANs configured to this CEP port
(config-if)#switchport customer-edge vlan registration map1	Attach the Map1 to CEP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## Configuration on PEB2

### CEP Port Configuration (should be configured as PNP in this case)

#configure terminal	Enter configure mode.
(config)#interface ge3	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#switchport mode provider-network	Configure port as Provider Network Port (PNP)
(config-if)#switchport provider-network allowed vlan all	Add all VLANs configured above to this PNP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## PNP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge9	Enter the interface mode
(config-if)#no switchport provider-network vlan translation cvlan 2 svlan 1000	Unconfigure Translation Case2 from PNP port
(config-if)#switchport provider-network vlan translation svlan 1000 svlan 1005	Configure Translation Case3 on PNP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## Validation for Case 3

When tagged traffic with CVLAN 2 is sent from IXIA-1 to IXIA-2 with only STAG entering provider network and translation happens to new SVLAN as per Case3.

```
PEB2#show bridge
Bridge      CVLAN  SVLAN  BVLAN  Port      MAC Address      FWD  Time-out
-----+-----+-----+-----+-----+-----+-----+-----+
1           1      1      1      ge27      1402.ec1c.3144   1    300
1           1000   1000   1000   ge9       0000.0500.0400   1    300
1           1000   1000   1000   ge9       6400.6a1e.d9a5   1    300
```

New SVLAN 7 is observed on PEB2 At PNP port connected to IXIA-2.

When double tagged traffic of CVLAN 2 and SVLAN 1005 is sent from IXIA-2 to IXIA-1:

```
PEB1#show bridge
Bridge      CVLAN  SVLAN  BVLAN  Port      MAC Address      FWD  Time-out
-----+-----+-----+-----+-----+-----+-----+-----+
1           1      1      1      ge9       74e6.e2af.598b   1    300
1           1005   1005   1005   ge3       0000.0500.0400   1    300
1           1000   1000   1000   ge9       0000.0500.0700   1    300
```

Here we get a tagged traffic of CVALN 2 when the captured at IXIA-1.

## Case4 - (S - C' S')

### Configuration on PEB1

#### CVLAN Registration Table Configuration

#configure terminal	Enter configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table as map1
(config-cvlan-registration)#cvlan 2 svlan 1000 untagged-pep	Map CVLAN to SVLAN
(config-cvlan-registration)#cvlan 3 svlan 1005	Map CVLAN to SVLAN
(config-cvlan-registration)#commit	Commit the configuration
(config-cvlan-registration)#end	End the CVLAN registration mode

#### CEP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge3	Enter the interface mode
(config-if)#switchport customer-edge hybrid vlan 2	Allow access VLAN 2 configured above to this CEP port
(config-if)#switchport customer-edge hybrid allowed vlan add 2-3	Allow other VLANs configured to this CEP port
(config-if)#switchport customer-edge vlan registration map1	Attach the Map1 to CEP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## Configuration on PEB2

### CEP Port Configuration (should be configured as PNP in this case)

#configure terminal	Enter configure mode.
(config)#interface ge3	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode provider-network	Configure port as Provider Network Port (PNP)
(config-if)#switchport provider-network allowed vlan all	Add all VLANs configured above to this PNP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

### PNP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge9	Enter the interface mode
(config-if)#no switchport provider-network vlan translation svlan 1000 svlan 1005	Unconfigure Translation Case2 from PNP port
(config-if)#switchport provider-network vlan translation svlan 1000 cvlan 3 svlan 1005	Configure Translation Case3 on PNP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## Validation for Case 4

When tagged traffic with CVLAN 2 is sent from IXIA-1 to IXIA-2 enters provider network and translation happens to new CVLAN and new SVLAN as per Case4.

```
PEB2#show bridge
Bridge      CVLAN  SVLAN  BVLAN  Port      MAC Address      FWD  Time-out
-----+-----+-----+-----+-----+-----+-----+-----+
1           1      1      ge27    1402.ec1c.3144  1      300
1           1000   1000   ge9     0000.0500.0400  1      300
1           1000   1000   ge9     6400.6a1e.d9a5  1      300
```

When you observe the traffic received in IXIA-2, you can observe that new CVLAN 3 and SVLAN 1005 tags can be seen. Here the VLAN 2 will be a data packet.

When tagged traffic for CVLAN 3 and SVLAN 1005 is sent from IXIA-2 to IXIA-1:

```
PEB1#show bridge
Bridge      CVLAN  SVLAN  BVLAN  Port      MAC Address      FWD  Time-out
-----+-----+-----+-----+-----+-----+-----+-----+
1           3      1005   ge27    1402.ec1c.3144  1      300
1           1000   1000   ge9     0000.0500.0400  1      300
1           1000   1000   ge9     6400.6a1e.d9a5  1      300
```



1	1000	ge3	0000.0500.0400	1	300
1	1005	ge9	0000.0500.0700	1	300

When you observe, in PEB1 the packets will be dropped at the CEP port since only a single S tagged packets is obtained in the PNP.

### Case5 - (C - C' S')

#### Configuration on PEB1

##### CVLAN Registration Table Configuration

#configure terminal	Enter configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table as map1
(config-cvlan-registration)#cvlan 2 cvlan 3 svlan 500	Map CVLAN to C'VLAN and SVLAN
(config-cvlan-registration)#cvlan 5 cvlan 6 svlan 1500	Map CVLAN to C'VLAN and SVLAN
(config-cvlan-registration)#commit	Commit the configuration
(config-cvlan-registration)#end	End the CVLAN registration mode

##### CEP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge3	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode customer-edge hybrid	Configure port as customer-edge hybrid port
(config-if)#switchport customer-edge hybrid allowed vlan all	Allow other VLANs configured to this CEP port
(config-if)#switchport customer-edge vlan registration map1	Attach the Map1 to CEP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

#### Configuration on PEB2

##### CEP Port Configuration (should be configured as PNP in this case)

#configure terminal	Enter configure mode.
(config)#interface ge3	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode provider-network	Configure port as Provider Network Port (PNP)
(config-if)#switchport provider-network allowed vlan all	Add all VLANs configured above to this PNP port

(config-if) #commit	Commit the configuration
(config-if) #end	Exit interface and configure mode.

## PNP Port Configuration

#configure terminal	Enter configure mode.
(config) #interface ge9	Enter the interface mode
(config-if) #switchport	Configure switchport
(config-if) #bridge-group 1	Attach port to bridge
(config-if) #switchport mode provider-network	Configure port as Provider Network Port (PNP)
(config-if) #switchport provider-network allowed vlan all	Add all VLANs configured above to this PNP port
(config-if) #commit	Commit the configuration
(config-if) #end	Exit interface and configure mode.

## Validation for Case 5

When tagged traffic with CVLAN 2 is sent from IXIA-1 to IXIA-2 with both CTAG and STAG entering provider network and gets translated to new CVLAN and SVLAN as per Case1.

```
PEB2#show bridge
```

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		1		ge27	1402.ec1c.3144	1	300
1		1000		ge9	0000.0500.0400	1	300
1		1000		ge9	6400.6a1e.d9a5	1	300

When the packet is captured at PNP port of PEB2 CVLAN of 3 and SVLAN of 4 is seen.

When tagged traffic for CVLAN 6 and SVLAN 1005 is sent from IXIA-2 to IXIA-1:

```
PEB1#show bridge
```

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		1		ge9	74e6.e2af.598b	1	300
1		1000		ge3	0000.0500.0400	1	300
1		1005		ge9	0000.0500.0700	1	300

When traffic is reversed and traffic has both new CVLAN 6 and SVLAN 1005 on provider network from IXIA-2, translation to CVLAN 5 and SVLAN 1005 happens. Also, captured packets have CVLAN as 2 based on the entry in the cvlan registration table.

## Switchport ethertype

### Bridge Configuration (for 0x88a8)

#### Configuration on PEB1

#### CVLAN Registration Table Configuration

#configure terminal	Enter configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table as map1
(config-cvlan-registration)#cvlan 2 svlan 1000	Map CVLAN to SVLAN
(config-cvlan-registration)#cvlan 3 svlan 1005	Map CVLAN to SVLAN
(config-cvlan-registration)#commit	Commit the configuration
(config-cvlan-registration)#end	End the CVLAN registration mode

#### Configuration on PEB2

### CEP Port Configuration (should be configured as PNP in this case)

#### CEP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge3	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode provider-network	Configure port as Provider Network Port (PNP)
(config-if)#switchport provider-network allowed vlan all	Add all VLANs configured above to this PNP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

#### PNP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface ge9	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode provider-network	Configure port as Provider Network Port (PNP)
(config-if)#switchport provider-network vlan allowed vlan all	Add all VLANs configured above to this PNP port
(config-if)#switchport dot1ad ethertype 0x88a8	Change the TPID of the SVLAN to 0x88a8

<code>(config-if) #commit</code>	Commit the configuration
<code>(config-if) #end</code>	Exit interface and configure mode.

## Validation for Switchport ethertype

To validate, send tagged traffic of VLAN 2 from IXIA-1.

Now at eth9 of PB2, capture the packets through IXIA-2 and verify that the traffic is received with double tag.

If the 2 tags CVLAN tag 2 will have the TPID of 0x8100 and SVLAN tag 4 will have a TPID of 0x88a8.

## Provider Bridging QoS Configuration

This chapter contains sample provider bridging configurations for QoS.

### Scenario: 1 Traffic flow from CEP to PNP

## Topology



Figure 20-38: Provider Bridging with QoS Topology

### Bridge Configuration

<code>#configure terminal</code>	Enter configure mode.
<code>(config) # bridge 1 protocol provider-rstp edge</code>	Enter configure bridge type as provider-RSTP edge bridge
<code>(config) #commit</code>	Commit the configuration
<code>(config) #exit</code>	Exit configure mode.

### VLAN Configuration

<code>#configure terminal</code>	Enter configure mode.
<code>(config) #vlan database</code>	Enter VLAN database

(config-vlan)#vlan 2-500 type customer bridge 1 state enable	Configure customer VLANs on bridge 1
(config-vlan)#vlan 501-1005 type service point-point bridge 1 state enable	Configure service VLANs on bridge 1
(config-vlan)#commit	Commit the configuration
(config-vlan)#end	Exit VLAN database and configure mode.

## CVLAN Registration Table Configuration

#configure terminal	Enter configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table as map1
(config-cvlan-registration)#cvlan 2 svlan 501	Map CVLAN to SVLAN
(config-cvlan-registration)#commit	Commit the configuration
(config-cvlan-registration)#end	End the CVLAN registration mode

## CEP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface xe2	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode customer-edge hybrid	Configure port as customer-edge hybrid port
(config-if)#switchport customer-edge hybrid allowed vlan all	Add all VLANs configured above to this CEP port
(config-if)#switchport customer-edge vlan registration map1	Attach the Map1 to CEP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## PNP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface xe3	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode provider-network	Configure port as Provider Network Port (PNP)
(config-if)#switchport provider-network allowed vlan add 501	Add all VLANs configured above to this PNP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## QoS Configurations

#configure terminal	Enter configure mode.
(config)#hardware-profile filter qos-ext enable	Enabling Ingress extended QoS group for QoS support with statistics
(config)#qos enable	Enabling QoS
(config)#qos statistics	Enabling QoS statistics
(config)#qos profile cos-to-queue cosq-cust1	Configure QoS map profile
config-ingress-cos-map)#cos 0 queue 1	Configuring the cos value to be mapped to queue
(config-ingress-cos-map)#exit	Exit configure mode.
(config)#qos profile queue-color-to-cos cosq-service1	Configuring profile for queue color to cos map
(config-egress-cos-map)#queue 1 cos 3	Configuring the queue value to be cos remarked.
(config-egress-cos-map)#exit	Exit configure mode
(config)#cvlan registration table map1 bridge 1	Enter CVLAN registration mode
(config-cvlan-registration)#cvlan 2 svlan 501 cos-to-queue cosq-cust1	Map CVLAN to SVLAN with QoS map profile. Eg: when vlan 2 customer traffic with cos 0 value is received, queue will be assigned to 1 based on mapping.
(config-cvlan-registration)#exit	Exit the CVLAN registration mode
(config)#interface xe3	Enter the interface mode
(config-if)#qos map-profile queue-color-to-cos cosq-service1	Map the profile to the PNP port. Eg: when traffic goes out of queue 1, cos value on service vlan header will be modified to 3 as remarking is enabled on the interface.
(config-if)#qos remark cos enable	Enabling Cos Remark on the Network Interface.
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## Validation for Scenario 1

```
#show cvlan registration table map1
Bridge      Table Name      Port List
=====
1           map1            xe2
```

CVLAN ID	T-CVLAN ID	SVLAN ID	Profile Name	Egress remark-
Cos				
=====	=====	=====	=====	
2	-	501	cosq-cust1	No

```
#show qos-profile interface xe2
profile name: default
profile type: cos-to-queue (Ingress)
mapping:
```

INPUT				OUTPUT	INPUT				OUTPUT
-----+-----				-----	-----+-----				-----
COS	DEI	Queue	Color		COS	DEI	Queue	Color	
-----+-----+-----+-----		-----+-----+-----+-----			-----+-----+-----+-----		-----+-----+-----+-----		

0	0	0	green		0	1	0	yellow
1	0	1	green		1	1	1	yellow
2	0	2	green		2	1	2	yellow
3	0	3	green		3	1	3	yellow
4	0	4	green		4	1	4	yellow
5	0	5	green		5	1	5	yellow
6	0	6	green		6	1	6	yellow
7	0	7	green		7	1	7	yellow

profile name: default  
 profile type: queue-color-to-cos (Egress)  
 Status: Inactive  
 mapping:

INPUT			OUTPUT			INPUT			OUTPUT			INPUT			OUTPUT		
Queue	Color	COS	Queue	Color	COS	Queue	Color	COS	Queue	Color	COS	Queue	Color	COS	Queue	Color	COS
0	green	0	0	yellow	0	0	red	0	0	red	0	0	red	0	0	red	0
1	green	1	1	yellow	1	1	red	1	1	red	1	1	red	1	1	red	1
2	green	2	2	yellow	2	2	red	2	2	red	2	2	red	2	2	red	2
3	green	3	3	yellow	3	3	red	3	3	red	3	3	red	3	3	red	3
4	green	4	4	yellow	4	4	red	4	4	red	4	4	red	4	4	red	4
5	green	5	5	yellow	5	5	red	5	5	red	5	5	red	5	5	red	5
6	green	6	6	yellow	6	6	red	6	6	red	6	6	red	6	6	red	6
7	green	7	7	yellow	7	7	red	7	7	red	7	7	red	7	7	red	7

#show qos-profile interface xe3  
 profile name: default  
 profile type: cos-to-queue (Ingress)  
 mapping:

INPUT				OUTPUT				INPUT				OUTPUT			
COS	DEI	Queue	Color	COS	DEI	Queue	Color	COS	DEI	Queue	Color	COS	DEI	Queue	Color
0	0	0	green	0	1	0	yellow	0	1	0	yellow	0	1	0	yellow
1	0	1	green	1	1	1	yellow	1	1	1	yellow	1	1	1	yellow
2	0	2	green	2	1	2	yellow	2	1	2	yellow	2	1	2	yellow
3	0	3	green	3	1	3	yellow	3	1	3	yellow	3	1	3	yellow
4	0	4	green	4	1	4	yellow	4	1	4	yellow	4	1	4	yellow
5	0	5	green	5	1	5	yellow	5	1	5	yellow	5	1	5	yellow
6	0	6	green	6	1	6	yellow	6	1	6	yellow	6	1	6	yellow
7	0	7	green	7	1	7	yellow	7	1	7	yellow	7	1	7	yellow

profile name: cosq-service1  
 profile type: queue-color-to-cos (Egress)  
 Status: Active  
 mapping:

INPUT			OUTPUT			INPUT			OUTPUT			INPUT			OUTPUT		
Queue	Color	COS	Queue	Color	COS	Queue	Color	COS	Queue	Color	COS	Queue	Color	COS	Queue	Color	COS

-----+-----				-----+-----				-----+-----		
Queue	Color	COS		Queue	Color	COS		Queue	Color	COS
-----+-----				-----+-----				-----+-----		
0	green	0		0	yellow	0		0	red	0
1	green	3		1	yellow	3		1	red	3
2	green	2		2	yellow	2		2	red	2
3	green	3		3	yellow	3		3	red	3
4	green	4		4	yellow	4		4	red	4
5	green	5		5	yellow	5		5	red	5
6	green	6		6	yellow	6		6	red	6
7	green	7		7	yellow	7		7	red	7

## Scenario: 2 Traffic flow from PNP to CEP

### Topology



Figure 20-39: Provider Bridging with QoS Topology

### Bridge Configuration

#configure terminal	Enter configure mode.
(config)# bridge 1 protocol provider-rstp edge	Enter configure bridge type as provider-RSTP edge bridge
(config)#commit	Commit the configuration
(config)#exit	Exit configure mode.

### VLAN Configuration

#configure terminal	Enter configure mode.
(config)#vlan database	Enter VLAN database
(config-vlan)#vlan 2-500 type customer bridge 1 state enable	Configure customer VLANs on bridge 1
(config-vlan)#vlan 501-1005 type service point-point bridge 1 state enable	Configure service VLANs on bridge 1



(config-vlan)#commit	Commit the configuration
(config-vlan)#end	Exit VLAN database and configure mode.

## CVLAN Registration Table Configuration

#configure terminal	Enter configure mode.
(config)#cvlan registration table map1 bridge 1	Configure CVLAN registration table as map1
(config-cvlan-registration)#commit	Commit the configuration
(config-cvlan-registration)#end	End the CVLAN registration mode

## CEP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface xe2	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode customer-edge hybrid	Configure port as customer-edge hybrid port
(config-if)#switchport customer-edge hybrid allowed vlan all	Add all VLANs configured above to this CEP port
(config-if)#switchport customer-edge vlan registration map1	Attach the Map1 to CEP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## PNP Port Configuration

#configure terminal	Enter configure mode.
(config)#interface xe3	Enter the interface mode
(config-if)#switchport	Configure switchport
(config-if)#bridge-group 1	Attach port to bridge
(config-if)#switchport mode provider-network	Configure port as Provider Network Port (PNP)
(config-if)#switchport provider-network allowed vlan add 501	Add all VLANs configured above to this PNP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode.

## QoS Configurations

#configure terminal	Enter configure mode.
(config)#hardware-profile filter qos-ext enable	Enabling Ingress extended QoS group for QoS support with statistics
(config)#qos enable	Enabling QoS
(config)#qos statistics	Enabling QoS statistics

(config)#qos profile cos-to-queue cosq-cust1	Configure QoS map profile
config-ingress-cos-map)#cos 2 queue 5	Configuring the cos value to be mapped to queue. Eg: when double tagged traffic with cos 2 for outer vlan is received, queue will be assigned to 5 based on mapping.
(config-ingress-cos-map)#exit	Exit configure mode.
(config)#cvlan registration table map1 bridge 1	Enter CVLAN registration mode
(config-cvlan-registration)#cvlan 2 svlan 501 remark-cos	Map CVLAN to SVLAN with remark cos enabled. Eg: when double tagged traffic with cos 2 for outer vlan is received, queue will be assigned to 5 based on mapping and cos value will be changed to 5 when it goes out of cep port since remark cos is enabled.
(config-cvlan-registration)#cvlan 3 svlan 501 remark-cos	Map CVLAN to SVLAN without remark cos. Eg: when double tagged traffic with cos 2 for outer vlan is received, and cos value will be forwarded as it is when it goes out of cep port since remark cos is not enabled for customer2.
(config-cvlan-registration)#commit	Commit the configuration
(config-cvlan-registration)#end	End the CVLAN registration mode
(config)#configure terminal	Enter configure mode
(config)#interface xe3	Enter the interface mode
(config-if)#qos map-profile cos-to-queue cosq-service	Map the profile to the PNP port
(config-if)#commit	Commit the configuration
(config-if)#end	Exit interface and configure mode

## Validation for Scenario 2

```
#show cvlan registration table map1
Bridge          Table Name      Port List
=====
1               map1           xe2

CVLAN ID        T-CVLAN ID      SVLAN ID        Profile Name      Egress remark-
Cos
=====
2               -               501             N/A              Yes
3               -               501             N/A              No
```

```
#show qos-profile interface xe2
profile name: default
profile type: cos-to-queue (Ingress)
mapping:
```

INPUT				OUTPUT			
COS	DEI	Queue	Color	COS	DEI	Queue	Color
0	0	0	green	0	1	0	yellow
1	0	1	green	1	1	1	yellow
2	0	2	green	2	1	2	yellow
3	0	3	green	3	1	3	yellow

4	0	4	green		4	1	4	yellow
5	0	5	green		5	1	5	yellow
6	0	6	green		6	1	6	yellow
7	0	7	green		7	1	7	yellow

profile name: default  
 profile type: queue-color-to-cos (Egress)  
 Status: Inactive  
 mapping:

INPUT			OUTPUT	INPUT			OUTPUT	INPUT			OUTPUT
Queue	Color	COS		Queue	Color	COS		Queue	Color	COS	
0	green	0		0	yellow	0		0	red	0	
1	green	1		1	yellow	1		1	red	1	
2	green	2		2	yellow	2		2	red	2	
3	green	3		3	yellow	3		3	red	3	
4	green	4		4	yellow	4		4	red	4	
5	green	5		5	yellow	5		5	red	5	
6	green	6		6	yellow	6		6	red	6	
7	green	7		7	yellow	7		7	red	7	

#show qos-profile interface xe3  
 profile name: cosq-service  
 profile type: cos-to-queue (Ingress)  
 mapping:

INPUT				OUTPUT	INPUT				OUTPUT
COS	DEI	Queue	Color		COS	DEI	Queue	Color	
0	0	0	green		0	1	0	yellow	
1	0	1	green		1	1	1	yellow	
2	0	5	green		2	1	5	yellow	
3	0	3	green		3	1	3	yellow	
4	0	4	green		4	1	4	yellow	
5	0	5	green		5	1	5	yellow	
6	0	6	green		6	1	6	yellow	
7	0	7	green		7	1	7	yellow	

profile name: default  
 profile type: queue-color-to-cos (Egress)  
 Status: Inactive  
 mapping:

INPUT			OUTPUT	INPUT			OUTPUT	INPUT			OUTPUT
Queue	Color	COS		Queue	Color	COS		Queue	Color	COS	
0	green	0		0	yellow	0		0	red	0	
1	green	1		1	yellow	1		1	red	1	
2	green	2		2	yellow	2		2	red	2	
3	green	3		3	yellow	3		3	red	3	
4	green	4		4	yellow	4		4	red	4	
5	green	5		5	yellow	5		5	red	5	
6	green	6		6	yellow	6		6	red	6	
7	green	7		7	yellow	7		7	red	7	

---

0	green	0		0	yellow	0		0	red	0
1	green	1		1	yellow	1		1	red	1
2	green	2		2	yellow	2		2	red	2
3	green	3		3	yellow	3		3	red	3
4	green	4		4	yellow	4		4	red	4
5	green	5		5	yellow	5		5	red	5
6	green	6		6	yellow	6		6	red	6
7	green	7		7	yellow	7		7	red	7

---

## Provider Bridging Untagged-pep Configuration

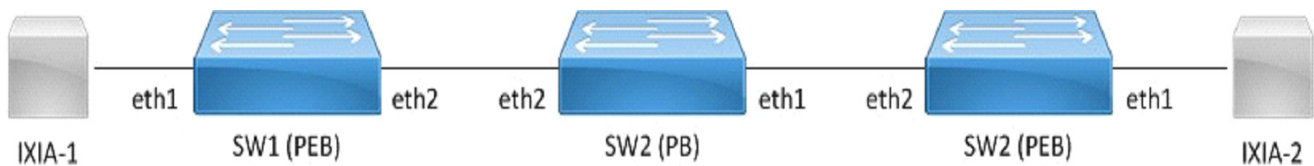
This is a sample configuration to verify functionality to support provider-bridging with untagged-pep feature.

For the below topology configuration,

1. While sending tagged traffic untagged-pep CVLAN 2, it should drop in provider edge bridge.
2. And while sending tagged traffic CVLAN 3 to the provider network, will egress with CVLAN 3 and SVLAN 12 tag and the same CVLAN and SVLAN tag from provider network, will egress with only CVLAN tag
3. And also for untagged traffic to the provider network, will egress with SVLAN 11 tag

---

### Topology



**Figure 20-40: provider bridge untagged-pep configuration**

## Configuration

### SW1 (PEB)

SW1#configure terminal	Enter configuration mode
SW1(config)#bridge 1 protocol provider-rstp edge	Create bridge
SW1(config)#vlan database	Enter VLAN configuration mode
SW1(config-vlan)#vlan 2-10 type customer bridge 1 state enable	Create customer vlan VLAN 2-10
SW1(config-vlan)#vlan 11-15 type service point-point bridge 1 state enable	Create service vlan VLAN 11-15
SW1(config-vlan)#exit	Exit VLAN configuration mode
SW1(config)#cvlan registration table map1 bridge 1	Create cvlan registration table map1
SW1(config-cvlan-registration)#cvlan 2 svlan 11 untagged-pep	Map cvlan2 with svlan 11
SW1(config-cvlan-registration)#cvlan 3 svlan 12	Map cvlan3 with svlan 12
SW1(config-cvlan-registration)#cvlan 4 svlan 14	Map cvlan4 with svlan 14
SW1(config-cvlan-registration)#exit	Exit registration table
SW1(config)#interface eth1	Enter interface configuration mode for eth1
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode customer-edge access	Configure switchport mode customer edge
SW1(config-if)#switchport customer-edge hybrid vlan 2	Associate customer vlan2 with interface
SW1(config-if)#switchport customer-edge hybrid allowed vlan all	Associate all customer vlan with interface
SW1(config-if)#switchport customer-edge vlan registration map1	Attach registration table map1 with interface
SW1(config-if)#exit	Exit interface mode
SW1(config)#interface eth2	Enter interface configuration mode for eth2
SW1(config-if)#switchport	Make interface as switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode provider-network	Configure switchport pnp port
SW1(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW1(config-if)#exit	Exit interface configuration mode
SW1(config)#commit	Apply the commit
SW1(config)#end	Exit configuration mode

## SW2 (PB)

SW2#configure terminal	Enter configuration mode
SW2(config)#bridge 1 protocol provider-rstp	Create provider bridge
SW2(config)#vlan database	Enter VLAN configuration mode
SW2(config-vlan)# vlan 2-15 type service point-point bridge 1 state enable	Create service vlan VLAN2-15
SW2(config-vlan)#exit	Exit VLAN configuration mode
SW2(config)#interface eth1	Enter interface configuration mode for eth1
SW2(config-if)#switchport	Make interface as switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode provider-network	Configure switchport pnp port
SW2(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW2(config-if)#exit	Exit interface configuration mode
SW2(config)#interface eth2	Enter interface configuration mode for eth2
SW2(config-if)#switchport	Make interface as switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode provider-network	Configure switchport pnp port
SW2(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW2(config-if)#exit	Exit interface configuration mode
SW2(config)#commit	Apply the commit
SW2(config)#end	Exit configuration mode

## SW3 (PEB)

SW3#configure terminal	Enter configuration mode
SW3(config)#bridge 1 protocol provider-rstp edge	Create bridge
SW3(config)#vlan database	Enter VLAN configuration mode
SW3(config-vlan)#vlan 2-10 type customer bridge 1 state enable	Create customer vlan VLAN 2-10
SW3(config-vlan)#vlan 11-15 type service point-point bridge 1 state enable	Create service vlan VLAN11-15
SW3(config-vlan)#exit	Exit VLAN configuration mode
SW3(config)#cvlan registration table map1 bridge 1	Create cvlan registration table map1
SW3(config-cvlan-registration)#cvlan 2 svlan 11 untagged-pep	Map cvlan 2 with svlan 11
SW3(config-cvlan-registration)#cvlan 3 svlan 12	Map cvlan 3 with svlan 12
SW3(config-cvlan-registration)#cvlan 4 svlan 14	Map cvlan 4 with svlan 14
SW3(config-cvlan-registration)#exit	Exit registration table

SW3(config)#interface eth1	Enter interface configuration mode for eth1
SW3(config-if)#switchport	Configure switchport
SW3(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW3(config-if)#switchport mode customer-edge access	Configure switchport mode customer edge
SW3(config-if)#switchport customer-edge hybrid vlan 2	Associate customer vlan2 with interface
SW3(config-if)#switchport customer-edge hybrid allowed vlan all	Associate all customer vlan with interface
SW3(config-if)#switchport customer-edge vlan registration map1	Attach registration table map1 with interface
SW3(config-if)#exit	Exit interface mode
SW3(config)#interface eth2	Enter interface configuration mode for eth2
SW3(config-if)#switchport	Make interface as switchport
SW3(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW3(config-if)#switchport mode provider-network	Configure switchport pnp port
SW3(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW3(config-if)#exit	Exit interface configuration mode
SW3(config)#commit	Apply the commit
SW3(config)#end	Exit configuration mode

## Validation

SW3#sh bridge

bridge 1 is running on provider-rstp edge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1	4	14		eth2	0000.0100.0007	1	300

SW1#sh bridge

bridge 1 is running on provider-rstp edge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		14		eth1	0000.0100.0007	1	300

SW1#sh cvlan registration table map1

Bridge	Table Name	Port List
1	map1	eth1



CVLAN ID	T-CVLAN ID	SVLAN ID	CCOS	SCOS	CCFI	SCFI
=====	=====	=====	=====	=====	=====	=====
3	-	12				
2	-	11				
4	-	14				

## CHAPTER 21 Provider Bridging Configuration (SVLAN)

---

This chapter contains sample provider bridging configurations for Customer-Network Port (CNP).

A provider bridged network is a virtual bridged Local Area Network that comprises provider bridges (SVLAN bridges and provider edge bridges) and attached LANs, 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 that provide customer interfaces for each service instance.

---

### Customer-Network Port (CNP)

In Q-in-Q, the customer network port is similar to provider network port, which can be present in provider-edge bridge (PEB) or provider bridge core (PB), where it can be directly connected to a dedicated customer network. Only SVLAN ids are configurable on Customer network port and learning and forwarding occurs based on SVLAN.

---

### STAG-based Interface

In this case, the customer will be sending traffic with SVLAN, which will be learnt and forwarded via provider network.

In this example, the xe1 interface allows S-TAG 100-200 and 400 traffic from customer.

```
(config)#interface xe1
(config-if)#switchport
(config-if)#dot1ad ethertype 0x88a8
(config-if)#bridge-group 1
(config-if)#switchport mode customer-network
(config-if)#switchport customer-network allowed vlan add 100-200,400
```

---

### Port-based Interface

In this case, the customer traffic with C-VLAN/untagged, received on interface will be stacked with a customer-network SVLAN ID and will be forwarded via provider network. While egressing out of customer-network port for the default SVLAN, the outer SVLAN id will be stripped and the packet will be sent as C-TAG or untagged to customer device.

In this example, the xe1 interface allows C-TAG/untagged traffic from customers, adding an SVLAN ID 100 before forwarding to the provider network. While egressing out, the SVLAN ID100 will be stripped.

```
(config)#interface xe1
(config-if)#switchport
(config-if)#dot1ad ethertype 0x88a8
(config-if)#bridge-group 1
(config-if)#switchport mode customer-network
(config-if)#switchport customer-network allowed vlan add 100
(config-if)#switchport customer-network vlan 100
```

## Topology



**Figure 21-41: Single provider bridge configuration**

## Configuration

### SW1 (PEB)

SW1#configure terminal	Enter configuration mode
SW1(config)#bridge 1 protocol provider-rstp edge	Create bridge
SW1(config)#vlan database	Enter VLAN configuration mode
SW1(config-vlan)#vlan 100,200 type service point-point bridge 1 state enable	Create service vlan VLAN 100, 200
SW1(config-vlan)#exit	Exit VLAN configuration mode
SW1(config)#interface eth1	Enter interface configuration mode for eth1
SW1(config-if)#switchport	Configure switchport
SW1(config-if)#dot1ad ethertype 0x88a8	Add Provider Bridging Service VLAN tag identifier
SW1(config-if)#switchport mode customer-network	Configure switchport mode for CNP(customer network port)
SW1(config-if)#switchport customer-network allowed vlan add 200	Associate vlan 200 with interface
SW1(config-if)#switchport customer-network vlan 200	Add vlan 200 as default SVLAN-ID for traffic with CVLAN/untagged
SW1(config-if)#exit	Exit interface mode
SW1(config-if)#interface eth2	Enter interface configuration mode for eth2
SW1(config-if)#switchport	Make interface as switchport
SW1(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW1(config-if)#switchport mode provider-network	Configure switchport pnp port
SW1(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW1(config-if)#commit	Commit the configuration.
SW1(config-if)#exit	Exit interface configuration mode

**SW2 (PB)**

SW2#configure terminal	Enter configuration mode
SW2(config)#bridge 1 protocol provider-rstp	Create provider bridge
SW2(config)#vlan database	Enter VLAN configuration mode
SW2(config-vlan)#vlan 200 type service point-point bridge 1 state enable	Create service vlan VLAN200
SW2(config-vlan)#exit	Exit VLAN configuration mode
SW2(config)#interface eth1	Enter interface configuration mode for eth1
SW2(config-if)#switchport	Make interface as switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode provider-network	Configure switchport pnp port
SW2(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW2(config-if)#exit	Exit interface configuration mode
SW2(config-if)#interface eth2	Enter interface configuration mode for eth2
SW2(config-if)#switchport	Make interface as switchport
SW2(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW2(config-if)#switchport mode provider-network	Configure switchport pnp port
SW2(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW2(config-if)#commit	Commit the configuration.
SW2(config-if)#exit	Exit interface configuration mode

**SW3 (PEB)**

SW3#configure terminal	Enter configuration mode
SW3(config)#bridge 1 protocol provider-rstp edge	Create bridge
SW3(config)#vlan database	Enter VLAN configuration mode
SW3(config-vlan)#vlan 200 type service point-point bridge 1 state enable	Create service vlan VLAN200
SW3(config-vlan)#exit	Exit VLAN configuration mode
SW3(config)#interface eth1	Enter interface configuration mode for eth1
SW3(config-if)#switchport	Configure switchport
SW3(config-if)#dot1ad ethertype 0x88a8	Add Provider Bridging Service VLAN tag identifier
SW3(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW3(config-if)#switchport mode customer-network	Configure switchport CNP port
SW3(config-if)#switchport customer-network allowed vlan add 200	Associate vlan 200 with interface
SW3(config-if)#switchport customer-network vlan 200	Add vlan 200 as default SVLAN-ID for traffic with CVLAN/untagged

SW3(config-if)#exit	Exit interface mode
SW3(config-if)#interface eth2	Enter interface configuration mode for eth2
SW3(config-if)#switchport	Make interface as switchport
SW3(config-if)#bridge-group 1	Associate interface with bridge-group 1
SW3(config-if)#switchport mode provider-network	Configure switchport pnp port
SW3(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
SW3(config-if)#commit	Commit the configuration.
SW3(config-if)#exit	Exit interface configuration mode

## Validation

SW3#show bridge

bridge 1 is running on provider-rstp edge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		200		eth1	0000.0000.0f00	1	300
1		200		eth2	0001.0000.0800	1	300

SW1#show bridge

bridge 1 is running on provider-rstp edge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		200		eth2	0000.0000.0f00	1	300
1		200		eth1	0001.0000.0800	1	300

## CHAPTER 22 MLAG with Provider Bridging Configuration

This chapter contains sample MLAG with Provider bridging configuration.

A provider bridged network is a virtual bridged Local Area Network that comprises provider bridges (SVLAN bridges and provider edge bridges) and attached LANs, 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 that provide customer interfaces for each service instance.

MLAG (also called DRNI, Distributed Resilient Network Interconnect) expands the concept of link aggregation so that it provides node-level redundancy by allowing two or more nodes to share a common LAG endpoint. MLAG emulates multiple nodes to represent as a single logical node to the remote node running link aggregation. As a result, even if one of the nodes is down there exists a path to reach the destination through the other nodes.

Note: For MLAG with PB, use provider rstp edge bridge on TOR (PEB) nodes and LEAF (PB) node.

### Topology

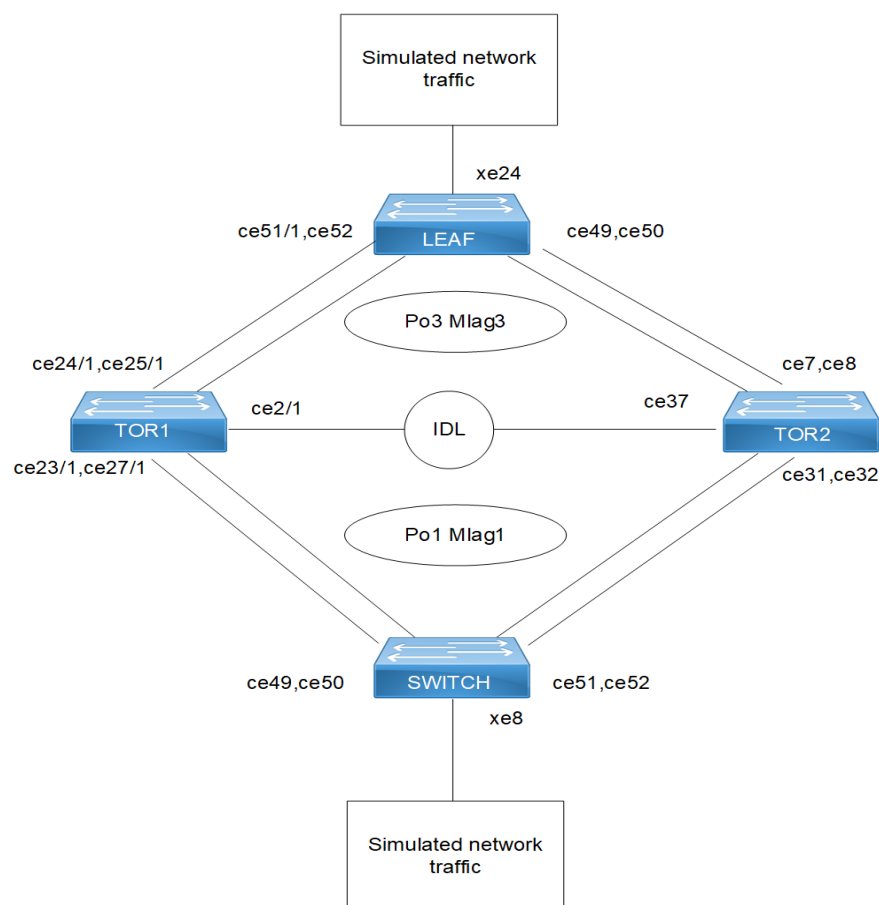


Figure 22-42: MLAG with Provider Bridging

## Configuration

### Switch

SWITCH#configure terminal	Enter configuration mode
SWITCH(config)#bridge 1 protocol rstp vlan-bridge	Configure the rstp vlan bridge
SWITCH(config)#vlan database	Enter VLAN configuration mode
SWITCH(config-vlan)#vlan 2-2000 bridge 1 state enable	Create vlan for bridge
SWITCH(config-vlan)#exit	Exit VLAN configuration mode
SWITCH(config)#interface po1	Enter interface configuration mode for po1
SWITCH(config-if)#switchport	Configure switchport
SWITCH(config-if)#bridge-group 1 spanning-tree disable	Associate interface with bridge-group 1 by disabling spanning tree
SWITCH(config-if)#switchport mode trunk	Configure switchport mode as trunk
SWITCH(config-if)#switchport trunk allowed vlan all	Associate created vlans to po1 interface
SWITCH(config-if)#exit	Exit from interface mode
SWITCH(config)#interface xe8	Enter interface configuration mode for xe8
SWITCH(config-if)#switchport	Configure switchport
SWITCH(config-if)#bridge-group 1 spanning-tree disable	Associate interface with bridge-group 1 by disabling spanning tree
SWITCH(config-if)#switchport mode trunk	Configure switchport mode as trunk
SWITCH(config-if)#switchport trunk allowed vlan all	Associate created vlans to xe8 interface
SWITCH(config-if)#exit	Exit from interface mode
SWITCH(config)#interface ce49	Enter interface configuration mode for ce49
SWITCH(config-if)# channel-group 1 mode active	Configure interface as member port for po1- port channel
SWITCH(config-if)#exit	Exit from interface mode
SWITCH(config)#interface ce50	Enter interface configuration mode for ce49
SWITCH(config-if)#channel-group 1 mode active	Configure interface as member port for po1- port channel
SWITCH(config-if)#exit	Exit from interface mode
SWITCH(config)#interface ce51	Enter interface configuration mode for ce49
SWITCH(config-if)#channel-group 1 mode active	Configure interface as member port for po1- port channel
SWITCH(config-if)#exit	Exit from interface mode
SWITCH(config)#interface ce52	Enter interface configuration mode for ce49
SWITCH(config-if)#channel-group 1 mode active	Configure interface as member port for po1- port channel
SWITCH(config-if)#exit	Exit from interface mode

SWITCH(config)#commit	Commit the candidate configuration to the running configuration.
SWITCH(config)#exit	Exit from config mode

**TOR1 (PEB)**

TOR1#configure terminal	Enter configuration mode
TOR1(config)#bridge 1 protocol provider-rstp edge	Create provider rstp edge bridge
TOR1(config)#vlan database	Enter VLAN configuration mode
TOR1(config-vlan)#vlan 2-500 type customer bridge 1 state enable	Create customer vlan VLAN 2-500
TOR1(config-vlan)#vlan 501-1005 type service point-point bridge 1 state enable	Create service vlan VLAN 501-1005
TOR1(config-vlan)#exit	Exit VLAN configuration mode
TOR1(config)#cvlan registration table cvlan100 bridge 1	Create cvlan registration table with name cvlan100
TOR1(config-cvlan-registration)#cvlan 100 svlan 1000	Map cvlan100 with svlan 1000
TOR1(config-cvlan-registration)#exit	Exit registration table
TOR1(config)#interface mlag1	Enter interface configuration mode for mlag1
TOR1(config-if)#switchport	Configure switchport
TOR1(config-if)#bridge-group 1 spanning-tree disable	Associate interface with bridge-group 1 and disable spanning-tree
TOR1(config-if)#switchport mode customer-edge trunk	Configure switchport mode customer edge
TOR1(config-if)# switchport customer-edge trunk allowed vlan add 100	Associate customer vlan100 to interface
TOR1(config-if)#switchport customer-edge vlan registration cvlan100	Attach registration table cvlan100 to interface
TOR1(config-if)#mode active-active	Configure mlag mode as active-active
TOR1(config-if)#exit	Exit interface mode
TOR1(config)#interface mlag3	Enter interface configuration mode for mlag3
TOR1(config-if)#switchport	Make interface as switchport
TOR1(config-if)# bridge-group 1 spanning-tree disable	Associate interface with bridge-group 1 and disable spanning-tree
TOR1(config-if)#switchport mode provider-network	Configure switchport pnp port
TOR1(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
TOR1(config-if)#mode active-active	Configure mlag mode as active-active
TOR1(config-if)#exit	Exit interface configuration mode
TOR1(config)#interface po1	Enter interface configuration mode for po1
TOR1(config-if)#switchport	Make interface as switchport
TOR1(config-if)#mlag 1	Associate mlag1 interface to po1
TOR1(config-if)#exit	Exit interface configuration mode



TOR1 (config) #interface po3	Enter interface configuration mode for po3
TOR1 (config-if) #switchport	Make interface as switchport
TOR1 (config-if) #dot1ad ethertype 0x88a8	Configure TPID with 88a8 to send and receive double tag (Q in Q)
TOR1 (config-if) #mlag 3	Associate mlag3 interface to po3
TOR1 (config-if) #exit	Exit interface configuration mode
TOR1 (config) #interface ce2/1	Enter interface configuration mode for ce2/1 which is an IDL link
TOR1 (config-if) #switchport	Make interface as switchport
TOR1 (config-if) #exit	Exit interface configuration mode
TOR1 (config) #interface ce24/1	Enter interface configuration mode for ce24/1
TOR1 (config-if) #channel-group 3 mode active	Configure interface as member port for po3- port channel
TOR1 (config-if) #exit	Exit interface configuration mode
TOR1 (config) # interface ce25/1	Enter interface configuration mode for ce25/1
TOR1 (config-if) #channel-group 3 mode active	Configure interface as member port for po3- port channel
TOR1 (config-if) #exit	Exit interface configuration mode
TOR1 (config) #interface ce23/1	Enter interface configuration mode for ce23/1
TOR1 (config-if) #channel-group 1 mode active	Configure interface as member port for po1- port channel
TOR1 (config-if) #exit	Exit interface configuration mode
TOR1 (config) #interface ce27/1	Enter interface configuration mode for ce2471
TOR1 (config-if) #channel-group 1 mode active	Configure interface as member port for po1- port channel
TOR1 (config-if) #exit	Exit interface configuration mode
TOR1 (config) #mcec domain configuration	Enter mcec domain configuration mode
TOR1 (config-mcec-domain) #domain-address 2222.3333.4444	Configure domain address for mlag domain
TOR1 (config-mcec-domain) #domain-system-number 1	Configure domain number to identify node in a domain
TOR1 (config-mcec-domain) #intra-domain-link ce2/1	Configure intra domain link between tor nodes mlag domain
TOR1 (config-mcec-domain) #exit	Exit from mcec domain mode
TOR1 (config) #commit	Commit the candidate configuration to the running configuration.
TOR1 (config) #exit	Exit from config mode

## TOR2 (PEB)

TOR2#configure terminal	Enter configuration mode
TOR2 (config) #bridge 1 protocol provider-rstp edge	Create provider rstp edge bridge
TOR2 (config) #vlan database	Enter VLAN configuration mode
TOR2 (config-vlan) #vlan 2-500 type customer bridge 1 state enable	Create customer vlan VLAN 2-500
TOR2 (config-vlan) #vlan 501-1005 type service point-point bridge 1 state enable	Create service vlan VLAN 501-1005
TOR2 (config-vlan) #exit	Exit VLAN configuration mode

TOR2(config)#cvlan registration table cvlan100 bridge 1	Create cvlan registration table with name cvlan100
TOR2(config-cvlan-registration)#cvlan 100 svlan 1000	Map cvlan100 with svlan 1000
TOR2(config-cvlan-registration)#exit	Exit registration table
TOR2(config)#interface mlag1	Enter interface configuration mode for mlag1
TOR2(config-if)#switchport	Configure switchport
TOR2(config-if)#bridge-group 1 spanning-tree disable	Associate interface with bridge-group 1 and disable spanning-tree
TOR2(config-if)#switchport mode customer- edge trunk	Configure switchport mode customer edge
TOR2(config-if)# switchport customer-edge trunk allowed vlan add 100	Associate customer vlan 100 to interface
TOR2(config-if)#switchport customer-edge vlan registration cvlan100	Attach registration table cvlan100 to interface
TOR2(config-if)#mode active-active	Configure mlag mode as active-active
TOR2(config-if)#exit	Exit interface mode
TOR2(config)#interface mlag3	Enter interface configuration mode for mlag3
TOR2(config-if)#switchport	Make interface as switchport
TOR2(config-if)# bridge-group 1 spanning- tree disable	Associate interface with bridge-group 1 and disable spanning-tree
TOR2(config-if)#switchport mode provider- network	Configure switchport pnp port
TOR2(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
TOR2(config-if)#mode active-active	Configure mlag mode as active-active
TOR2(config-if)#exit	Exit interface configuration mode
TOR2(config)#interface po1	Enter interface configuration mode for po1
TOR2(config-if)#switchport	Make interface as switchport
TOR2(config-if)#mlag 1	Associate mlag1 interfacce to po1
TOR2(config-if)#exit	Exit interface configuration mode
TOR2(config)#interface po3	Enter interface configuration mode for po3
TOR2(config-if)#switchport	Make interface as switchport
TOR2(config-if)#dot1ad ethertype 0x88a8	Configure TPID with 88a8 to send and receive double tag (Q in Q)
TOR2(config-if)#mlag 3	Associate mlag1 interfacce to po3
TOR2(config-if)#exit	Exit interface configuration mode
TOR2(config)#interface ce37	Enter interface configuration mode for ce2/1 which is an IDL link
TOR2(config-if)#switchport	Make interface as switchport
TOR2(config-if)#exit	Exit interface configuration mode
TOR2(config)#interface ce7	Enter interface configuration mode for ce7
TOR2(config-if)#channel-group 3 mode active	Configure interface as member port for po3- port channel
TOR2(config-if)#exit	Exit interface configuration mode
TOR2(config)# interface ce8	Enter interface configuration mode for ce8

TOR2(config-if)#channel-group 3 mode active	Configure interface as member port for po3- port channel
TOR2(config-if)#exit	Exit interface configuration mode
TOR2(config)#interface ce31	Enter interface configuration mode for ce31
TOR2(config-if)#channel-group 1 mode active	Configure interface as member port for po1- port channel
TOR2(config-if)#exit	Exit interface configuration mode
TOR2(config)#interface ce32	Enter interface configuration mode for ce32
TOR2(config-if)#channel-group 1 mode active	Configure interface as member port for po1- port channel
TOR2(config-if)#exit	Exit interface configuration mode
TOR2(config)#mcec domain configuration	Enter mcec domain configuration mode
TOR2(config-mcec-domain)#domain-address 2222.3333.4444	Configure domain address for mlag domain
TOR2(config-mcec-domain)#domain-system-number 2	Configure domain number to identify node in a domain
TOR2(config-mcec-domain)#intra-domain-link ce37	Configure intra domain link between tor nodes mlag domain
TOR2(config-mcec-domain)#exit	Exit interface configuration mode
TOR2(config)#commit	Commit the candidate configuration to the running configuration.
TOR2(config)#exit	Exit interface configuration mode

## LEAF(PB)

LEAF#configure terminal	Enter configuration mode
LEAF(config)# bridge 1 protocol provider-rstp edge	Create provider rstp edge bridge
LEAF(config)#vlan database	Enter VLAN configuration mode
LEAF(config-vlan)#vlan 2-500 type customer bridge 1 state enable	Create customer vlan VLAN 2-500
LEAF(config-vlan)#vlan 501-1005 type service point-point bridge 1 state enable	Create service vlan VLAN 501-1005
LEAF(config-vlan)#exit	Exit VLAN configuration mode
LEAF(config)#interface po3	Enter interface configuration mode for po3
LEAF(config-if)#switchport	Make interface as switchport
LEAF(config-if)#dot1ad ethertype 0x88a8	Configure TPID with 88a8 to send and receive double tag (Q in Q)
LEAF(config-if)#bridge-group 1 spanning-tree disable	Associate interface with bridge-group 1 and disable spanning-tree
LEAF(config-if)#switchport mode provider-network	Configure switchport pnp port
LEAF(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
LEAF(config-if)#exit	Exit interface configuration mode
LEAF(config)#interface xe24	Enter interface configuration mode for xe24
LEAF(config-if)#switchport	Make interface as switchport
LEAF(config-if)#dot1ad ethertype 0x88a8	Configure TPID with 88a8 to send and receive double tag (Q in Q)

LEAF(config-if)#bridge-group 1 spanning-tree disable	Associate interface with bridge-group 1 and disable spanning-tree
LEAF(config-if)#switchport mode provider-network	Configure switchport pnp port
LEAF(config-if)#switchport provider-network allowed vlan all	Associate all svlan to the port
LEAF(config-if)#exit	Exit interface configuration mode
LEAF(config)#interface ce49	Enter interface configuration mode for ce49
LEAF(config-if)# channel-group 3 mode active	Configure interface as member port for po3- port channel
LEAF(config-if)#exit	Exit interface configuration mode
LEAF(config)#interface ce50	Enter interface configuration mode for ce50
LEAF(config-if)# channel-group 3 mode active	Configure interface as member port for po3- port channel
LEAF(config-if)#exit	Exit interface configuration mode
LEAF(config)#interface ce51	Enter interface configuration mode for ce51
LEAF(config-if)# channel-group 3 mode active	Configure interface as member port for po3- port channel
LEAF(config-if)#exit	Exit interface configuration mode
LEAF(config)#interface ce52	Enter interface configuration mode for ce52
LEAF(config-if)# channel-group 3 mode active	Configure interface as member port for po3- port channel
LEAF(config-if)#exit	Exit interface configuration mode
LEAF(config)#commit	Commit the candidate configuration to the running configuration.
LEAF(config)#exit	Exit from config mode

## Validation

**Validation commands are:** show mlag domain summary , show mlag domain details, show ether-channel summary, show bridge, Show mac address-table bridge <bridge-id>, show cvlan registration table bridge <bridge-id>

For below show mac table output sending cvlan 100 traffic from SWITCH to LEAF, for which TOR nodes add svlan 1000 and egress same to LEAF and LEAF ixia also receives double tag.

```
TOR1#show mlag domain details
```

```
-----  
Domain Configuration  
-----
```

```
Domain System Number      : 1  
Domain Address             : 2222.3333.4444  
Domain Priority            : 32768  
Intra Domain Interface    : ce2/1  
  
Hello RCV State           : Current  
Hello Periodic Timer State : Slow Periodic  
Domain Sync               : IN_SYNC
```

```
Neigh Domain Sync      : IN_SYNC
Domain Adjacency       : UP
Domain Sync via        : Intra-domain-interface
```

---

MLAG Configuration

---

MLAG-1

```
Mapped Aggregator      : po1
Admin Key              : 16385
Oper Key               : 16385
Physical status        : 1
Physical properties Digest : 1b bc c2 24 5a 1c cf 6 88 32 a1 4b 62 c2 c0 2
```

```
Neigh Admin Key        : 32769
Neigh Physical status   : 1
Neigh Physical Digest   : 1b bc c2 24 5a 1c cf 6 88 32 a1 4b 62 c2 c0 2
Info RCV State          : Current
Info Periodic Time State : Standby
Mlag Sync               : IN_SYNC
Mode                    : Active-Active
Current Mlag state      : Active
```

MLAG-3

```
Mapped Aggregator      : po3
Admin Key              : 16387
Oper Key               : 16387
Physical status        : 1
Physical properties Digest : 46 51 95 9d e2 90 81 47 d0 51 d9 de 4f 8 48 93
```

```
Neigh Admin Key        : 32771
Neigh Physical status   : 1
Neigh Physical Digest   : 46 51 95 9d e2 90 81 47 d0 51 d9 de 4f 8 48 93
Info RCV State          : Current
Info Periodic Time State : Standby
Mlag Sync               : IN_SYNC
Mode                    : Active-Active
Current Mlag state      : Active
```

TOR1#

TOR1#show mlag domain summary

---

Domain Configuration

---

```
Domain System Number    : 1
Domain Address          : 2222.3333.4444
```

```
Domain Priority           : 32768
Intra Domain Interface   : ce2/1
Domain Adjacency         : UP
Domain Sync via          : Intra-domain-interface
-----
```

#### MLAG Configuration

-----

##### MLAG-1

```
Mapped Aggregator       : po1
Physical properties Digest : 1b bc c2 24 5a 1c cf 6 88 32 a1 4b 62 c2 c0 2
Total Bandwidth          : 400g
Mlag Sync                : IN_SYNC
Mode                     : Active-Active
Current Mlag state       : Active
```

##### MLAG-3

```
Mapped Aggregator       : po3
Physical properties Digest : 46 51 95 9d e2 90 81 47 d0 51 d9 de 4f 8 48 93
Total Bandwidth          : 400g
Mlag Sync                : IN_SYNC
Mode                     : Active-Active
Current Mlag state       : Active
```

##### TOR1#

##### TOR1#show etherchannel summary

```
Aggregator po1 100001
Aggregator Type: Layer2
Admin Key: 16385 - Oper Key 16385
  Link: ce23/1 (5001) sync: 1 (Mlag-active-link)
  Link: ce27/1 (5029) sync: 1 (Mlag-active-link)
-----
```

```
Aggregator po3 100003
Aggregator Type: Layer2
Admin Key: 16387 - Oper Key 16387
  Link: ce25/1 (5005) sync: 1 (Mlag-active-link)
  Link: ce24/1 (5117) sync: 1 (Mlag-active-link)
```

##### TOR1#

##### TOR2#show mlag domain details

#### Domain Configuration

-----

```
Domain System Number     : 2
Domain Address            : 2222.3333.4444
```

```
Domain Priority           : 32768
Intra Domain Interface   : ce37

Hello RCV State          : Current
Hello Periodic Timer State : Slow Periodic
Domain Sync              : IN_SYNC
Neigh Domain Sync        : IN_SYNC
Domain Adjacency         : UP
Domain Sync via          : Intra-domain-interface
```

---

MLAG Configuration

---

MLAG-1

```
Mapped Aggregator       : po1
Admin Key                : 32769
Oper Key                 : 16385
Physical status          : 1
Physical properties Digest : 1b bc c2 24 5a 1c cf 6 88 32 a1 4b 62 c2 c0 2

Neigh Admin Key          : 16385
Neigh Physical status    : 1
Neigh Physical Digest    : 1b bc c2 24 5a 1c cf 6 88 32 a1 4b 62 c2 c0 2
Info RCV State           : Current
Info Periodic Time State : Standby
Mlag Sync                : IN_SYNC
Mode                     : Active-Active
Current Mlag state       : Active
```

MLAG-3

```
Mapped Aggregator       : po3
Admin Key                : 32771
Oper Key                 : 16387
Physical status          : 1
Physical properties Digest : 46 51 95 9d e2 90 81 47 d0 51 d9 de 4f 8 48 93

Neigh Admin Key          : 16387
Neigh Physical status    : 1
Neigh Physical Digest    : 46 51 95 9d e2 90 81 47 d0 51 d9 de 4f 8 48 93
Info RCV State           : Current
Info Periodic Time State : Standby
Mlag Sync                : IN_SYNC
Mode                     : Active-Active
Current Mlag state       : Active
```

TOR2# show mlag domain summary

---

Domain Configuration

```

-----
Domain System Number      : 2
Domain Address            : 2222.3333.4444
Domain Priority            : 32768
Intra Domain Interface    : ce37
Domain Adjacency          : UP
Domain Sync via           : Intra-domain-interface
-----

```

#### MLAG Configuration

##### MLAG-1

```

Mapped Aggregator        : po1
Physical properties Digest : 1b bc c2 24 5a 1c cf 6 88 32 a1 4b 62 c2 c0 2
Total Bandwidth          : 400g
Mlag Sync                : IN_SYNC
Mode                     : Active-Active
Current Mlag state       : Active

```

##### MLAG-3

```

Mapped Aggregator        : po3
Physical properties Digest : 46 51 95 9d e2 90 81 47 d0 51 d9 de 4f 8 48 93
Total Bandwidth          : 400g
Mlag Sync                : IN_SYNC
Mode                     : Active-Active
Current Mlag state       : Active

```

##### TOR2#

##### TOR2#show etherchannel summary

```

Aggregator po1 100001
Aggregator Type: Layer2
Admin Key: 32769 - Oper Key 16385
  Link: ce31 (5062) sync: 1 (Mlag-active-link)
  Link: ce32 (5064) sync: 1 (Mlag-active-link)

```

```

-----
Aggregator po3 100003
Aggregator Type: Layer2
Admin Key: 32771 - Oper Key 16387
  Link: ce7 (5029) sync: 1 (Mlag-active-link)
  Link: ce8 (5031) sync: 1 (Mlag-active-link)

```

##### TOR2#

##### SWITCH2#show bridge

bridge 1 is running on rstp vlan-bridge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
-----	-----	-----	-----	-----	-----	-----	-----



```

1          100          xe8          0000.2223.2425    1      300

```

```
SWITCH2#
```

```
SWITCH2#
```

```
SWITCH2#show mac address-table bridge 1
```

CVLAN	SVLAN	MAC Address	Type	Ports	Port-security
100		0000.2223.2425	dynamic	xe8	Disable

```
SWITCH2#
```

```
TOR1# show bridge
```

```
bridge 1 is running on provider-rstp edge
```

```
Ageout time is global and if something is configured for vxlan then it will be affected here also
```

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		1000		m1ag1	0000.2223.2425	1	300

```
TOR1#show mac address-table bridge 1
```

CVLAN	SVLAN	MAC Address	Type	Ports	Port-security
	1000	0000.2223.2425	dynamic	m1ag1	Disable

```
TOR1#
```

```
TOR2#show bridge
```

```
bridge 1 is running on provider-rstp edge
```

```
Ageout time is global and if something is configured for vxlan then it will be affected here also
```

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		1000		m1ag1	0000.2223.2425	1	300

```
TOR2#
```

```
TOR2#
```

```
TOR2#show mac address-table bridge 1
```

CVLAN	SVLAN	MAC Address	Type	Ports	Port-security
	1000	0000.2223.2425	dynamic	m1ag1	Disable

```
TOR2#
```

```
LEAF#show mac address-table bridge 1
```

CVLAN	SVLAN	MAC Address	Type	Ports	Port-security
	1000	0000.2223.2425	dynamic	po3	Disable

LEAF#

LEAF#show bridge

bridge 1 is running on provider-rstp edge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		1000		po3	0000.2223.2425	1	300

LEAF#

Now send traffic with svlan-1000 and c-vlan 100 from LEAF to SWITCH,Tor removes svlan and send only cvlan to SWITCH

LEAF#show bridge

bridge 1 is running on provider-rstp edge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		1000		po3	0000.2223.2425	1	300
1		1000		xe24	0000.2425.2627	1	300

LEAF#

LEAF#show mac address-table bridge 1

CVLAN	SVLAN	MAC Address	Type	Ports	Port-security
	1000	0000.2223.2425	dynamic	po3	Disable
	1000	0000.2425.2627	dynamic	xe24	Disable

LEAF#

TOR1#show bridge

bridge 1 is running on provider-rstp edge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		1000		m1ag1	0000.2223.2425	1	300
1		1000		m1ag3	0000.2425.2627	1	300

TOR1#

TOR1#show mac address-table bridge 1

CVLAN	SVLAN	MAC Address	Type	Ports	Port-security
	1000	0000.2223.2425	dynamic	m1ag1	Disable
	1000	0000.2425.2627	dynamic	m1ag3	Disable

TOR1#

TOR2#show bridge

bridge 1 is running on provider-rstp edge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1		1000		m1ag1	0000.2223.2425	1	300
1		1000		m1ag3	0000.2425.2627	1	300

TOR2#

TOR2#show mac address-table bridge 1

CVLAN	SVLAN	MAC Address	Type	Ports	Port-security
	1000	0000.2223.2425	dynamic	m1ag1	Disable
	1000	0000.2425.2627	dynamic	m1ag3	Disable

TOR2#

SWITCH2#show bridge

bridge 1 is running on rstp vlan-bridge

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1	100			xe8	0000.2223.2425	1	300
1	100			po1	0000.2425.2627	1	300

SWITCH2#

SWITCH2#show mac address-table bridge 1

CVLAN	SVLAN	MAC Address	Type	Ports	Port-security
100		0000.2223.2425	dynamic	xe8	Disable
100		0000.2425.2627	dynamic	po1	Disable

SWITCH2#

## L2CP with MLAG-Provider Bridging Configuring

### Switch

SWITCH#configure terminal	Enter configuration mode
SWITCH(config)#interface xe8	Enter interface configuration mode for xe8
SWITCH(config-if)#switchport	Configure switchport
SWITCH(config-if)#bridge-group 1 spanning-tree disable	Associate interface with bridge-group 1 by disabling spanning tree
SWITCH(config-if)#switchport mode trunk	Configure switchport mode as trunk
SWITCH(config-if)#switchport trunk allowed vlan all	Associate created vlans to xe8 interface
SWITCH(config-if)#l2protocol stp/lldp/elmi/efm/dot1x tunnel	Configure STP/LLDP/ELMI/EFM/dot1x protocol as Tunnel
SWITCH(config-if)#l2protocol stp tunnel	Configure STP protocol as Tunnel
SWITCH(config-if)#l2protocol lldp tunnel	Configure LLDP protocol as Tunnel
SWITCH(config-if)#l2protocol elmi tunnel	Configure ELMI protocol as Tunnel
SWITCH(config-if)#l2protocol efm tunnel	Configure EFM protocol as Tunnel
SWITCH(config-if)#l2protocol dot1x tunnel	Configure dot1x protocol as Tunnel
SWITCH(config-if)#exit	Exit from interface mode
SWITCH(config)#commit	Commit the candidate configuration to the running configuration.

### TOR1 (PEB)

TOR1#configure terminal	Enter configuration mode
TOR1(config)#interface mlag1	Enter interface configuration mode for mlag1
TOR1(config-if)#switchport	Configure switchport
TOR1(config-if)#bridge-group 1 spanning-tree disable	Associate interface with bridge-group 1 and disable spanning-tree
TOR1(config-if)#switchport mode customer-edge trunk	Configure switchport mode customer edge
TOR1(config-if)# switchport customer-edge trunk allowed vlan add 100	Associate customer vlan100 to interface
TOR1(config-if)#switchport customer-edge vlan registration cvlan100	Attach registration table cvlan100 to interface
TOR1(config-if)#mode active-active	Configure mlag mode as active-active
TOR1(config-if)#l2protocol stp/lldp/elmi/efm/dot1x tunnel/peer/discard	Configure STP/LLDP/ELMI/EFM/dot1x protocol as tunnel/peer/discard

SWITCH(config-if)#l2protocol stp tunnel	Configure STP protocol as Tunnel
SWITCH(config-if)#l2protocol lldp tunnel	Configure LLDP protocol as Tunnel
SWITCH(config-if)#l2protocol elmi tunnel	Configure ELMI protocol as Tunnel
SWITCH(config-if)#l2protocol efm tunnel	Configure EFM protocol as Tunnel
SWITCH(config-if)#l2protocol dot1x tunnel	Configure dot1x protocol as Tunnel
TOR1(config-if)#exit	Exit interface mode
TOR1(config)#commit	Commit the candidate configuration to the running configuration.

## TOR2 (PEB)

TOR2#configure terminal	Enter configuration mode
TOR2(config)#interface mlag1	Enter interface configuration mode for mlag1
TOR2(config-if)#switchport	Configure switchport
TOR2(config-if)#bridge-group 1 spanning-tree disable	Associate interface with bridge-group 1 and disable spanning-tree
TOR2(config-if)#switchport mode customer-edge trunk	Configure switchport mode customer edge
TOR2(config-if)# switchport customer-edge trunk allowed vlan add 100	Associate customer vlan100 to interface
TOR2(config-if)#switchport customer-edge vlan registration cvlan100	Attach registration table cvlan100 to interface
TOR2(config-if)#mode active-active	Configure mlag mode as active-active
TOR2(config-if)#l2protocol stp/lldp/elmi/efm/dot2x tunnel/peer/discard	Configure STP/LLDP/ELMI/EFM/dot1x protocol as tunnel/peer/discard
SWITCH(config-if)#l2protocol stp tunnel	Configure STP protocol as Tunnel
SWITCH(config-if)#l2protocol lldp tunnel	Configure LLDP protocol as Tunnel
SWITCH(config-if)#l2protocol elmi tunnel	Configure ELMI protocol as Tunnel
SWITCH(config-if)#l2protocol efm tunnel	Configure EFM protocol as Tunnel
SWITCH(config-if)#l2protocol dot1x tunnel	Configure dot1x protocol as Tunnel
TOR2(config-if)#exit	Exit interface mode
TOR2(config)#commit	Commit the candidate configuration to the running configuration.

## Validation

### Switch:

```
SWITCH#show l2protocol processing interface xe8
```

Bridge	Interface Name	Protocol	Processing Status	Hardware Status
--------	----------------	----------	-------------------	-----------------

=====	=====	=====	=====	=====
1	xe8	stp	Tunnel	Tunnel
1	xe8	lacp	None	Peer
1	xe8	dot1x	Tunnel	Tunnel
1	xe8	lldp	Tunnel	Tunnel
1	xe8	efm	Tunnel	Tunnel
1	xe8	elmi	Tunnel	Tunnel

**TOR1:**

TOR1#show l2protocol processing interface mlag1

Bridge	Interface Name	Protocol	Processing Status	Hardware Status
=====	=====	=====	=====	=====
1	mlag1	stp	Tunnel	-
1	mlag1	lacp	None	-
1	mlag1	dot1x	Discard	-
1	mlag1	lldp	Tunnel	-
1	mlag1	efm	Discard	-
1	mlag1	elmi	Peer	-
1	mlag1	synce	None	-

TOR1#show l2protocol processing interface ce23/1

Bridge	Interface Name	Protocol	Processing Status	Hardware Status
=====	=====	=====	=====	=====
1	ce23/1	stp	Tunnel	Tunnel
1	ce23/1	lacp	None	Peer
1	ce23/1	dot1x	Discard	Discard
1	ce23/1	lldp	Tunnel	Tunnel
1	ce23/1	efm	Discard	Discard
1	ce23/1	elmi	Peer	Peer
1	ce23/1	synce	None	Peer

TOR1#show l2protocol interface mlag1 counters

Interface mlag1

Tunnel : stp : 241782

**TOR2:**

TOR2#show l2protocol processing interface mlag1

Bridge	Interface Name	Protocol	Processing Status	Hardware Status
=====	=====	=====	=====	=====
1	mlag1	stp	Tunnel	-
1	mlag1	lacp	None	-
1	mlag1	dot1x	Discard	-
1	mlag1	lldp	Tunnel	-

1	mlag1	efm	Discard	-
1	mlag1	elmi	Peer	-
1	mlag1	synce	None	-

TOR2#show l2protocol processing interface ce32

Bridge	Interface Name	Protocol	Processing Status	Hardware Status
=====	=====	=====	=====	=====
1	ce32	stp	Tunnel	Tunnel
1	ce32	lacp	None	Peer
1	ce32	dot1x	Discard	Discard
1	ce32	lldp	Tunnel	Tunnel
1	ce32	efm	Discard	Discard
1	ce32	elmi	Peer	Peer
1	ce32	synce	None	Peer

## CHAPTER 23 Support IGMP Snooping for Provider Bridge

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### Overview

In Layer-2 switches, multicast IP traffic is handled in the same manner as broadcast traffic and forwards frames received on one interface to all other interfaces. This creates excessive traffic on the network, and affects network performance. The Internet Group Management Protocol (IGMP) Snooping allows switches to monitor network traffic, and determine hosts to receive multicast traffic. Thus, at a time only an host's membership report is relayed from a group instead of a report from each host in the group.

A Provider Bridge (PB) network is a virtual bridge Local Area Network (LAN) that comprises of Service provider bridges (SVLAN and PB) and attached LANs controlled under a single service provider administration. Provider bridges interconnect the MACs of the IEEE 802 LANs separately. This combined provider bridged network relay frames to all the connected LANs that provide customer interfaces for each service instance.

---

### Feature Characteristics

The existing IGMP Snooping extended to support in the Provider Bridged (PB) network. The PB connects customer LANs using the switched provider network consisting of SVLAN bridges and provider edge bridges. Each customer LAN is connected to a separate service VLAN inside the provider network. Current release supports the IGMPv1/IGMPv2/IGMPv3.

The following are supported:

- Snooping entries are captured in provider bridge network
- Egress traffic from router is tagged with single SVLAN ID
- IGMP snooping feature supported only in SVLAN

---

### Benefits

This feature enables a Provider bridging network service provider to conserve bandwidth by efficiently switching the multicast packets.

---

### Prerequisites

IGMP snooping is available over a number of network underlays. In this chapter, it is assumed that Provider Bridge support is configured.



# Configuration

## Topology

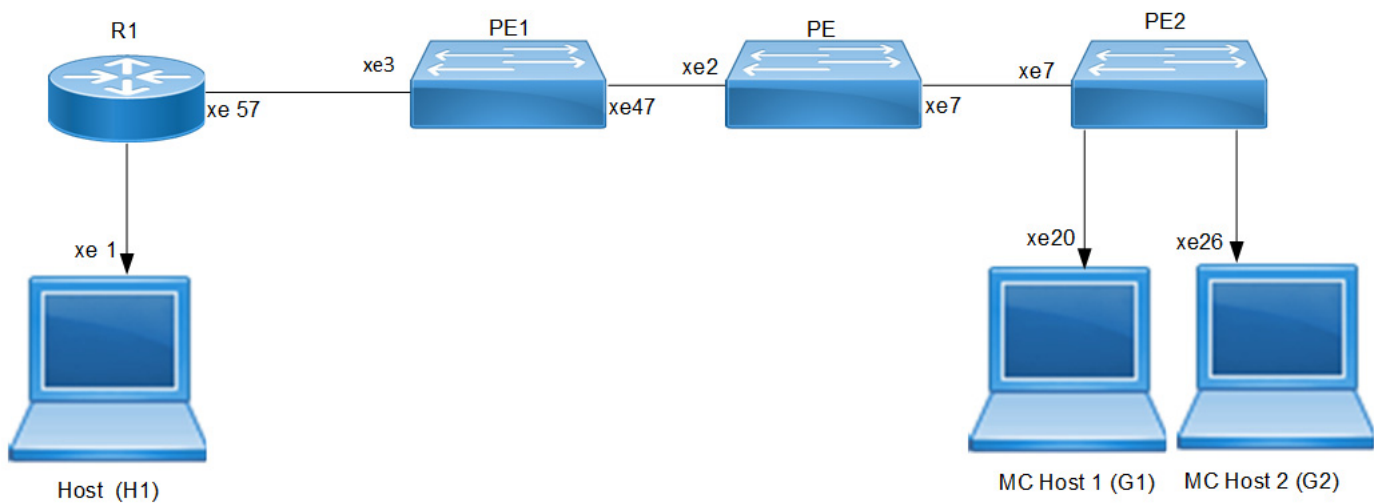


Figure 23-43: IGMP Snooping Provider Bridge Topology

**R1**

#configure terminal	Enter the configure mode.
R1(config)#bridge 1 protocol provider-rstp edge	Configure bridge 1 to the spanning-tree table.
R1(config)#vlan database	Configure the VLAN database.
R1(config)#vlan 2 type service point-point bridge 1 state enable	Configure the SVLAN 2 to bridge 1.
R1(config)#ip multicast-routing	Configure the multicast routing on the router.
R1(config)#ip pim rp-address 1.1.1.1	Configure Rendezvous Point (RP) address for multicast groups.
R1(config)#interface lo	Enter into lo interface.
R1(config-if)#ip address 1.1.1.1/24 secondary	Configure rp address as secondary.
R1(config-if)#ip pim sparse-mode	Enable the PIM sparse mode.
R1(config-if)#exit	Exit the loopback interface mode.
R1(config)#interface svlan1.2	Create the SVLAN interface.
R1(config-if)#ip address 20.1.1.1/24	Configure IPv4 address to VLAN interface.
R1(config-if)#ip pim sparse-mode	Configure PIM sparse mode.
R1(config-if)#exit	Exit the SVLAN interface mode.
R1(config)#interface xe1	Enter interface mode.
R1(config-if)#ip address 10.1.1.1/24	Configure IPv4 address to interface
R1(config-if)#ip pim sparse-mode	Configure PIM sparse mode.
R1(config-if)#commit	Commit the configurations.
R1(config-if)#exit	Exit the interface mode.
R1(config)#interface xe57	Enter interface mode.
R1(config-if)#switchport	Configure switchport.
R1(config-if)#dot1ad ethertype 0x8100	Configure ether type 0x8100.
R1(config-if)#bridge-group 1 spanning-tree disable	Configure bridge group.
R1(config-if)#switchport mode provider-network	Configure switchport trunk mode.
R1(config-if)#switchport provider-network allowed vlan add 2	Configure the VLAN to switchport trunk mode.
R1(config-if)#commit	Commit configurations

**PE1**

#configure terminal	Enter the configure mode.
PE1(config)#bridge 1 protocol provider-rstp edge	Configure bridge 1 to the spanning-tree table.

PE1(config)#vlan database	Configure the VLAN database.
PE1(config)#vlan 2 type service point-point bridge 1 state enable	Configure the SVLAN 2 to bridge 1.
PE1(config)#ip multicast-routing	Configure the multicast routing on the router.
PE1(config)#interface svlan1.2	Create VLAN interface.
PE1(config-if)#igmp snooping enable	Configure IPv4 address to VLAN interface .
PE1PE1(config-if)#exit	Exit the interface mode.
PE1(config)#interface xe3	Enter interface mode.
PE1(config-if)#switchport	Configure Switchport.
PE1(config-if)#dot1ad ethertype 0x8100	Configure ethertype.
PE1(config-if)#bridge-group 1 spanning-tree disable	Configure bridge group spanning tree disable .
PE1(config-if)#switchport mode provider- network	Configure provider network .
PE1(config-if)#switchport provider-network allowed vlan add 2	Configure the SVLAN to interface .
PE1(config-if)#commit	Commit configurations.
PE1(config-if)#exit	Exit the interface mode.
PE1(config)#interface xe47	Enter interface mode.
PE1(config-if)#switchport	Configure switchport
PE1(config-if)#dot1ad ethertype 0x8100	Configure ethertype.
PE1(config-if)#bridge-group 1 spanning-tree disable	Configure bridge group spanning tree disable.
PE1(config-if)#switchport mode provider- network	Configure provider network.
PE1(config-if)#switchport provider-network allowed vlan add 2	Configure service vlan to provider network.
PE1(config-if)#commit	Commit configurations.
PE1(config-if)#exit	Exit the interface mode.

**PE**

#configure terminal	Enter the configure mode.
PE(config)#bridge 1 protocol provider-rstp edge	Configure bridge 1 to the spanning-tree table.
PE(config)#vlan database	Configure the VLAN database
PE(config)#vlan 2 type service point-point bridge 1 state enable	Configure the SVLAN 2 to bridge 1.
PE(config)#ip multicast-routing	Configure the multicast routing on the router.
PE(config)#interface svlan1.2	Create VLAN interface.
PE(config-if)#igmp snooping enable	Configure IPv4 address to VLAN interface.
PE(config-if)#exit	Exit the interface mode.
PE(config)#interface xe2	Enter interface mode.
PE(config-if)#switchport	Configure Switchport
PE(config-if)#dot1ad ethertype 0x8100	Configure ethertype
PE(config-if)#bridge-group 1 spanning-tree disable	Configure bridge group spanning tree disable.
PE(config-if)#switchport mode provider-network	Configure provider network.
PE(config-if)#switchport provider-network allowed vlan add 2	Configure the SVLAN to interface.
PE(config-if)#commit	Commit configurations.
PE(config-if)#exit	Exit the interface mode.
PE(config)#interface xe7	Enter interface mode.
PE(config-if)#switchport	Configure switchport.
PE(config-if)#dot1ad ethertype 0x8100	Configure ethertype.
PE(config-if)#bridge-group 1 spanning-tree disable	Configure bridge group spanning tree disable.
PE(config-if)#switchport mode provider-network	Configure provider network.
PE(config-if)#switchport provider-network allowed vlan add 2	Configure service vlan to provider network.
PE(config-if)#commit	Commit configurations.
PE(config-if)#exit	Exit the interface mode.

**PE2**

#configure terminal	Enter the configure mode.
PE2(config)#bridge 1 protocol provider-rstp edge	Configure bridge 1 to the spanning-tree table.
PE2(config)#vlan database	Configure the VLAN database.
PE2(config)#vlan 2 type service point-point bridge 1 state enable	Configure the SVLAN 2 to bridge 1.
PE2(config)#ip multicast-routing	Configure the multicast routing on the router.
PE2(config)#interface svlan1.2	Create VLAN interface.
PE2(config-if)#igmp snooping enable	Enable the IGMP snooping on VLAN interface.
PE2(config-if)#exit	Exit the VLAN interface mode.
PE2(config)#interface xe7	Enter interface mode.
PE2(config-if)#switchport	Configure Switchport.
PE2(config-if)#dot1ad ethertype 0x8100	Configure ethertype.
PE2(config-if)#bridge-group 1 spanning-tree disable	Configure bridge group spanning tree disable.
PE2(config-if)#switchport mode provider-network	Configure provider network.
PE2(config-if)#switchport provider-network allowed vlan add 2	Configure the SVLAN to interface.
PE2(config-if)#commit	Commit configurations.
PE2(config-if)#exit	Exit the interface mode.
PE2(config)#interface xe20	Enter interface mode.
PE2(config-if)#switchport	Configure switchport.
PE2(config-if)#dot1ad ethertype 0x8100	Configure ethertype.
PE2(config-if)#bridge-group 1 spanning-tree disable	Configure bridge group spanning tree disable.
PE2(config-if)#switchport mode provider-network	Configure provider network.
PE2(config-if)#switchport provider-network allowed vlan add 2	Configure service VLAN to provider network.
PE2(config-if)#commit	Commit configurations.
PE2(config-if)#exit	Exit the interface mode.
PE2(config)#interface xe22	Enter interface mode.
PE2(config-if)#switchport	Configure switchport.
PE2(config-if)#dot1ad ethertype 0x8100	Configure ethertype.
PE2(config-if)#bridge-group 1 spanning-tree disable	Configure bridge group spanning tree disable.

PE2(config-if)#switchport mode provider-network	Configure provider network.
PE2(config-if)#switchport provider-network allowed vlan add 2	Configure service VLAN to provider network.
PE2(config-if)#commit	Commit configurations.
PE2(config-if)#exit	Exit the interface mode.

## Validation

### R1

MCRTR#show ip igmp groups

IGMP Instance wide G-Recs Count is: 2

IGMP Connected Group Membership

Group Address	Interface	Uptime	Expires	State	Last Reporter
231.1.1.1	svlan1.2	00:00:12	00:04:07	Active	0.0.0.0
231.1.1.2	svlan1.2	00:00:12	00:04:07	Active	0.0.0.0

MCRTR#

MCRTR#show ip pim mroute

IP Multicast Routing Table

(\*,\* ,RP) Entries: 0

G/prefix Entries: 0

(\* ,G) Entries: 2

(S,G) Entries: 0

(S,G,rpt) Entries: 0

FCR Entries: 0

(\* , 231.1.1.1)

RP: 1.1.1.1

RPF nbr: 0.0.0.0

RPF idx: None

Upstream State: JOINED

Local	..i.....
Joined	.....
Asserted	.....

FCR:

(\* , 231.1.1.2)

RP: 1.1.1.1

RPF nbr: 0.0.0.0

RPF idx: None

Upstream State: JOINED

Local	..i.....
Joined	.....
Asserted	.....

FCR:

MCRTR#

**PE1**

```
PEB1-7014#show igmp snooping interface
```

```
Global IGMP Snooping information
```

```
IGMP Snooping Enabled
IGMPv1/v2 Report suppression Enabled
IGMPv3 Report suppression Enabled
```

```
IGMP Snooping information for svlan1.2
```

```
IGMP Snooping enabled
Snooping Querier none
IGMP Snooping other querier timeout is 255 seconds
Group Membership interval is 260 seconds
IGMPv2 fast-leave is disabled
IGMPv1/v2 Report suppression enabled
IGMPv3 Report suppression enabled
Router port detection using IGMP Queries
Number of router-ports: 1
Number of Groups: 0
Number of v1-reports: 0
Number of v2-reports: 0
Number of v2-leaves: 0
Number of v3-reports: 0
Active Ports:
  xe3
  xe47
```

```
PEB1-7014#show igmp snooping groups
```

```
IGMP Instance wide G-Recs Count is: 2
```

```
IGMP Snooping Group Membership
```

```
Group source list: (R - Remote, S - Static, > - Hw Installed)
```

Vlan	Group/Source Address	Interface	Flags	Uptime	Expires	Last Reporter	Version
2	231.1.1.1	xe47	R >	00:07:15	00:03:48	0.0.0.0	V3
2	231.1.1.2	xe47	R >	00:07:15	00:03:48	0.0.0.0	V3

```
PEB1-7014#
```

**PE**

```
PB-7024#show igmp snooping interface
```

```
Global IGMP Snooping information
```

```
IGMP Snooping Enabled
IGMPv1/v2 Report suppression Enabled
IGMPv3 Report suppression Enabled
```

```
IGMP Snooping information for svlan1.2
```

```
IGMP Snooping enabled
Snooping Querier none
IGMP Snooping other querier timeout is 255 seconds
Group Membership interval is 260 seconds
IGMPv2 fast-leave is disabled
IGMPv1/v2 Report suppression enabled
IGMPv3 Report suppression enabled
```

Router port detection using IGMP Queries

Number of router-ports: 1

Number of Groups: 0

Number of v1-reports: 0

Number of v2-reports: 0

Number of v2-leaves: 0

Number of v3-reports: 0

Active Ports:

xe7

xe2

PB-7024#

PB-7024#show igmp snooping groups

IGMP Instance wide G-Recs Count is: 2

IGMP Snooping Group Membership

Group source list: (R - Remote, S - Static, > - Hw Installed)

Vlan	Group/Source Address	Interface	Flags	Uptime		
Expires	Last Reporter	Version				
2	231.1.1.1	xe7	R	> 00:07:15	00:03:45	20.1.1.2 V3
2	231.1.1.2	xe7	R	> 00:07:15	00:03:51	20.1.1.3 V3

PB-7024#

## PE2

PEB2-7019#show igmp snooping interface

Global IGMP Snooping information

IGMP Snooping Enabled

IGMPv1/v2 Report suppression Disabled

IGMPv3 Report suppression Disabled

IGMP Snooping information for svlan1.2

IGMP Snooping enabled

Snooping Querier none

IGMP Snooping other querier timeout is 255 seconds

Group Membership interval is 260 seconds

IGMPv2 fast-leave is disabled

IGMPv1/v2 Report suppression disabled

IGMPv3 Report suppression disabled

Router port detection using IGMP Queries

Number of router-ports: 1

Number of Groups: 0

Number of v1-reports: 0

Number of v2-reports: 0

Number of v2-leaves: 0

Number of v3-reports: 0

Active Ports:

xe20

xe26

xe7

PEB2-7019#

PEB2-7019#show igmp snooping groups

IGMP Instance wide G-Recs Count is: 2

IGMP Snooping Group Membership



Group source list: (R - Remote, S - Static, > - Hw Installed)

Vlan	Group/Source Address	Interface	Flags	Uptime	Expires	Last Reporter	Version
2	231.1.1.1	xe20	R	>	00:07:14	00:03:45 20.1.1.2	V3
2	231.1.1.2	xe26	R	>	00:07:15	00:03:51 20.1.1.3	V3

PEB2-7019#

---

## Abbreviations

Table 23-1:

Acronym	Description
IGMP	Internet Group Management Protocol
PB	Provider Bridged
SVLAN	Service Provider VLAN

## CHAPTER 24 ErrDisable for Link-Flapping Configuration

If a link flaps continuously, the interface goes into ErrDisable state. When a port is the ErrDisable state, it is effectively shut down and no traffic is sent or received on that port. The port can be recovered from the ErrDisable state manually (shutting down the interface) or automatically (setting a timeout value).

Note:

- An interface should change state as up-down to complete one cycle of a link flap.
- The LED does not glow when an interface is in the errdisable state.
- Errdisable is supported only on physical interfaces.
- A LAG interface does not go into the errdisable state when all of its member ports are in the errdisable state
- The error disable computation is based on a sliding window of time. The window size is configurable in seconds. This window is taken as the current time to the last <t> second, where <t> is the configured window size. If the accumulated link flap count reaches the maximum flap count for a particular sliding window, a link flap error disable fault is triggered.

### Topology



Figure 24-44: ErrDisable

### Automatic Recovery

By default, an interface goes into the ErrDisable state when a link flaps 5 times in 10 seconds. An interface is recovered from the ErrDisable state when the configured non-zero errdisable time-out interval value expires.

#### RTR1

#configure terminal	Enter configure mode.
(config)#errdisable cause link-flap	Enable ErrDisable due to link-flap
(config)#errdisable link-flap-setting max-flaps 2 time 30	Configure Link flap settings. Max link flap count and interval for linkFlap Timer
(config)#errdisable timeout interval 50	Configure interval to recover from error disable state

Note: Automatic recovery timeout is disabled, if you configure `errdisable timeout interval 0`

### Validation

```
#show errdisable details
```

```
Error Disable Recovery Timeout Interval : 50 secs
Link Flap Timer Interval : 30 secs
Link Flaps allowed Max. count : 2
```

ErrDisable Cause	Status
Link-Flap	Enabled
Lag-Mismatch	Disabled
Stp-Bpdu-Guard	Enabled

**Note:** Stp-Bpdu-Guard is enabled by default.

```
#show interface errdisable status
```

Interfaces that will be enabled at the next timeout

Interface	ErrDisable Cause	Time left(secs)
xe11	link-flap	38

```
#show interface brief | include ED
```

ED - ErrDisabled, PD - Protocol Down, AD - Admin Down, IA - InActive

xe11	ETH	--	--	down	ED	10g	--	No	No
------	-----	----	----	------	----	-----	----	----	----

**Note:** Interface xe11 went into the ErrDisable state after flapping 2 times in 30 seconds.

## Log Message

Edge1-SiteX#configure terminal	Enter configure mode.
Edge1-SiteX(config)#logging level nsm 4	Enable Operational log to display recovery message

```
2017 Sep 18 11:52:12 : NSM : CRITI : [IFMGR_IF_DOWN_2]: Interface xe11 changed state to
down
(config-if)#no shut
(config-if)#2017 Sep 18 11:52:15 : NSM : CRITI : [IFMGR_IF_UP_2]: Interface xe11 changed
state to up
2017 Sep 18 11:52:15 : NSM : WARN : [VXLAN_OPR_ACCESSPORT_UP_4]: VXLAN Access port on
xe11 is up
2017 Sep 18 11:52:15 : NSM : CRITI : [IFMGR_ERR_DISABLE_DOWN_2]: Interface xe11 moved to
errdisable state due to link-flap
2017 Sep 18 11:52:15 : NSM : CRITI : [IFMGR_IF_DOWN_2]: Interface xe11 changed state to
down
```

**Note:** Interface xe11 recovered from the ErrDisable state after a 50 second time-out.

To get the log messages displayed, change the logging level to same on the console/monitor.

## Manual Recovery

An interface can be recovered manually from the Errdisable state, when configure shutdown followed by no shutdown using CLI. Shutdown will recover the interface from errdisable state and No shutdown will make the interface up state.

**RTR1**

#configure terminal	Enter configure mode.
(config)#errdisable cause link-flap	Enable errdisable due to link-flap
(config)#errdisable link-flap-setting max-flaps 3 time 20	Configure Link flap settings. Max link flap count and interval for linkFlap Timer

```
#show running-config | include errdisable
errdisable cause link-flap
errdisable link-flap-setting max-flaps 3 time 20
errdisable cause stp-bpdu-guard

#show errdisable details
Error Disable Recovery Timeout Interval : 50 secs
Link Flap Timer Interval : 20 secs
Link Flaps allowed Max. count : 3
```

ErrDisable Cause	Status
Link-Flap	Enabled
Lag-Mismatch	Disabled
Stp-Bpdu-Guard	Enabled

**Note:** Interface xe11 went into the ErrDisable state after flapping 3 times in 20 seconds.

```
(config)#do show interface errdisable status
Interfaces that will be enabled at the next timeout
Interface      ErrDisable Cause    Time left(secs)
-----
xe11           link-flap            NA
(config)#do show int brief | include ED
          ED - ErrDisabled, PD - Protocol Down, AD - Admin Down, IA - InActive
xe11      ETH  --   --                down   ED    10g  --       No   No
```

**Note:** Interface xe11 recovered from the ErrDisable state after entering shutdown followed by no shutdown.

```
(config)#interface xe11
(config-if)#shutdown
2017 Sep 18 13:02:20 : NSM : WARN : [IFMGR_ERR_DISABLE_UP_4]: Interface xe11 recovered
from link-flap errdisable
(config-if)#no shut
2017 Sep 18 13:02:21 : NSM : CRITI : [IFMGR_IF_UP_2]: Interface xe11 changed
state to up
2017 Sep 18 13:02:21 : NSM : WARN : [VXLAN_OPR_ACCESSPORT_UP_4]: VXLAN Access port on
xe11 is up

config)#do show interface errdisable
(config)#do show interface brief | include ED
          ED - ErrDisabled, PD - Protocol Down, AD - Admin Down, IA - InActive
```

---

```
(config)#
```

If you configure no errdisable cause link-flap, at the global level, it recovers all the interfaces from the ErrDisable state

For transaction clients (such as NetConf), to recover a port from an error disable state manually, use this command/RPC call:

- Command: `clear interface IFNAME error-disable`
- NetConf RPC: `interface-clear-interface-error-disable`

Note: This command/RPC applies only for an error disable state caused by an administrative shutdown. For an error disable state due to peer flapping or any other reason, recover from the error disable state by entering `shutdown` followed by `no shutdown`.

---

## Errdisable at the Interface Level

If you enable errdisable globally, by default all physical interfaces enable link-flap errdisable. To turn off errdisable for an interface, configure the commands below.

<code>#configure terminal</code>	Enter configure mode.
<code>(config)#interface xel1</code>	Enter into interface level
<code>(config-if)#no link-flap errdisable</code>	Disable link-flap errdisable for interface

Note: If you configure “no link-flap errdisable” in interface level, either it won’t allow the interface move to errdisable state or it will recover interface from errdisable state

---

## Validation

```
#show run int xel1
!
interface xel1
 description *1/2 member of PO3 - Connected to IXIA 6/6*
 channel-group 3 mode active
 no link-flap errdisable
!
```

## CHAPTER 25 ErrDisable for Storm-Control Configuration

An interface port state becomes ErrDisable when it continuously receives BUM traffic which is discarded due to storm control settings. Consequently, the port is down and does not allow or receive any traffic. The ErrDisable state is changed either manually by shut/no shut the interface or automatically through setting timeout value.

Note:

- An interface discards BUM traffic during the specified interval to complete one discard-hit cycle.
- The LED does not glow when an interface is in the ErrDisable state.
- ErrDisable is supported only on physical interfaces.
- A LAG interface does not go into the ErrDisable state when all of its member ports are in the ErrDisable state
- The error disable computation is based on a sliding window of time. The window size is configurable in seconds. This window is taken as the current time to the last <t> second, where <t> is the configured window size. Every 5 seconds, a discard hit count increases if there is BUM traffic being discarded in that period. If the accumulated discard hit count reaches the maximum count for a particular configurable sliding window, a storm control error disable fault is triggered.

### Topology



Figure 25-45: ErrDisable

### Automatic Recovery

By default, an interface goes into the ErrDisable state when there is 1 discard hit in 5 seconds. An interface is recovered from the ErrDisable state when the configured non-zero `errdisable time-out` interval value expires.

#### RTR1

#configure terminal	Enter configure mode.
(config)#errdisable cause storm-control	Enable ErrDisable due to storm-control
(config)#errdisable storm-control discard-hit 2 time 30	Configure Storm control settings. Max discard hit count and interval for stormControl Timer
(config)#errdisable timeout interval 50	Configure interval to recover from error disable state
(config)#commit	Commit the candidate configuration to the running configuration.
(config)#exit	Exit interface mode

Note: Automatic recovery timeout is disabled, if you configure `errdisable timeout interval 0`.

## Validation

```
#show errdisable details
Storm Control Timer Interval : 30 secs
Storm Control allowed Max. discard-hit count : 2
```

ErrDisable Cause	Status
Link-Flap	Disabled
Storm-Control	Enabled
Lag-Mismatch	Disabled
Stp-Bpdu-Guard	Enabled
Mac-move-limit	Disabled

**Note:** Stp-Bpdu-Guard is enabled by default on the global level configuration.

```
#show interface errdisable status
Interfaces that will be enabled at the next timeout
```

Interface	ErrDisable Cause	Time left(secs)
xe11	storm-control	38

```
#show interface brief | include ED
ED - ErrDisabled, PD - Protocol Down, AD - Admin Down, IA - InActive
xe11      ETH  --  --  down  ED  10g  --  No  No
#
```

**Note:** Interface xe11 went into the ErrDisable state after discarding packets 2 times (5 second windows are considered) in 30 seconds.

## Log Message

Edge1-SiteX#configure terminal	Enter configure mode.
Edge1-SiteX(config)#logging level nsm 4	Enable Operational log to display recovery message
Edge1-SiteX(config)#commit	Commit the candidate configuration to the running configuration.
Edge1-SiteX(config)#exit	Exit interface mode

```
2017 Sep 18 11:52:12 : NSM : CRITI : [IFMGR_IF_DOWN_2]: Interface xe11 changed state to
down
(config-if)#no shut
(config-if)#2017 Sep 18 11:52:15 : NSM : CRITI : [IFMGR_IF_UP_2]: Interface xe11 changed
state to up
```

```

2017 Sep 18 11:52:15 : NSM : WARN : [VXLAN_OPR_ACCESSPORT_UP_4]: VXLAN Access port on
xe11 is up
2017 Sep 18 11:52:15 : NSM : CRITI : [IFMGR_ERstorm-controlR_DISABLE_DOWN_2]: Interface
xe11 moved to errdisable state due to storm-control
2017 Sep 18 11:52:15 : NSM : CRITI : [IFMGR_IF_DOWN_2]: Interface xe11 changed state to
down

```

Note: Interface xe11 recovered from the ErrDisable state after a 50 second time-out.

## Manual Recovery

An interface can be recovered manually from the ErrDisable state, by executing the CLIS `shutdown` which recovers the interface from ErrDisable state, followed by `no shutdown` that brings the interface to an up state.

### RTR1

#configure terminal	Enter configure mode.
(config)#errdisable cause storm-control	Enable errdisable due to storm-control
(config)#errdisable storm-control discard-hit 3 time 20	Configure Storm control settings. Max discard hit count and interval for StormControl Timer
(config)#commit	Commit the candidate configuration to the running configuration.
(config)#exit	Exit interface mode

## Validation

```

#show running-config | include errdisable
errdisable cause storm-control
errdisable storm-control-setting max-flaps 3 time 20
errdisable cause stp-bpdu-guard

```

```
#show errdisable details
```

```

Link Flap Timer Interval : 20 secs
Link Flaps allowed Max. count : 3

```

ErrDisable Cause	Status
Link-Flap	Disabled
Storm-Control	Enabled
Lag-Mismatch	Disabled
Stp-Bpdu-Guard	Disabled
Mac-move-limit	Disabled

Note: Interface xe11 went into the ErrDisable state after discarding packets 3 times (5 second windows are considered) in 20 seconds.



```
(config)#do show interface errdisable status
Interfaces that will be enabled at the next timeout
Interface      ErrDisable Cause      Time left(secs)
-----
xe11           storm-control           NA
(config)#do show int brief | include ED
          ED - ErrDisabled, PD - Protocol Down, AD - Admin Down, IA - InActive
xe11      ETH    --    --                down    ED      10g    --        No    No
```

**Note:** Interface xe11 recovered from the ErrDisable state after entering shutdown followed by no shutdown.

```
(config)#interface xe11
(config-if)#shutdown
2017 Sep 18 13:02:20 : NSM : WARN : [IFMGR_ERR_DISABLE_UP_4]: Interface xe11 recovered
from storm-control errdisable
(config-if)#no shut
2017 Sep 18 13:02:21 : NSM : CRITI : [IFMGR_IF_UP_2]: Interface xe11 changed
state to up
2017 Sep 18 13:02:21 : NSM : WARN : [VXLAN_OPR_ACCESSPORT_UP_4]: VXLAN Access port on
xe11 is up
```

```
config)#do show interface errdisable
(config)#do show interface brief | include ED
          ED - ErrDisabled, PD - Protocol Down, AD - Admin Down, IA - InActive
(config)#
```

If you configure no errdisable cause storm-control, at the global level, it recovers all the interfaces from the ErrDisable state

## Errdisable at the Interface Level

If you enable errdisable globally, by default all physical interfaces enable storm-control errdisable. To turn off errdisable for an interface, configure the commands below.

#configure terminal	Enter configure mode.
(config)#interface xe11	Enter into interface level
(config-if)#no storm-control errdisable	Disable storm-control errdisable for interface
(config)#commit	Commit the candidate configuration to the running configuration.
(config)#exit	Exit interface mode

**Note:** If you configure “no storm-control errdisable” in interface level, either it won’t allow the interface move to errdisable state or it will recover interface from errdisable state

## Validation

```
#show run int xe11
!
interface xe11
```

```

description *1/2 member of PO3 - Connected to IXIA 6/6*
channel-group 3 mode active
no storm-control errdisable
!
```

---

## Sample show running-config Output

### Global level configuration

```

ocnos#
ocnos#con t
Enter configuration commands, one per line. End with CNTL/Z.
ocnos(config)#
ocnos(config)#errdisable cause storm-control
ocnos(config)#commit
ocnos(config)#end
ocnos#
ocnos#show errdisable details

Storm Control Timer Interval : 5 secs
Storm Control Max. discard-hit count : 1
```

ErrDisable Cause	Status
-----	-----
Link-Flap	Disabled
Storm-Control	Enabled
Lag-Mismatch	Disabled
Stp-Bpdu-Guard	Enabled
Mac-move-limit	Disabled

```

ocnos#
ocnos#show running-config | include err
errdisable cause storm-control
errdisable cause stp-bpdu-guard
ocnos#

ocnos(config)#no errdisable cause storm-control
ocnos(config)#commit
ocnos(config)#end
ocnos#
ocnos#show running-config | include err
errdisable cause stp-bpdu-guard
```

## Interface level configuration

```

ocnos#
ocnos(config)#
ocnos(config)#errdisable cause storm-control
ocnos(config)#commit
ocnos(config)#end
ocnos#
ocnos#
Enter configuration commands, one per line. End with CNTL/Z.
ocnos(config)#
ocnos(config)#interface ce21
ocnos(config-if)#no in
ocnos(config-if)#no storm-control errdisable
ocnos(config-if)#commit
ocnos(config-if)#ssto
ocnos(config-if)#storm-control errdisable
ocnos(config-if)#commit
ocnos(config-if)#end
ocnos#
ocnos#
ocnos#show running-config interface ce21
!
interface ce21
storm-control errdisable
!
ocnos#
ocnos#
ocnos#
ocnos#show running-config | include err
errdisable cause storm-control
errdisable cause stp-bpdu-guard
ocnos#
ocnos#
ocnos#
ocnos#
ocnos#con t
Enter configuration commands, one per line. End with CNTL/Z.
ocnos(config)#
ocnos(config)#no sto
ocnos(config)#no errdisable et
ocnos(config)#no errdisable cause storm-control
ocnos(config)#commit
ocnos(config)#end
ocnos#
ocnos#
ocnos#
ocnos#show running-config | include err
errdisable cause stp-bpdu-guard
ocnos#

```

## Discardhit configuration

```
ocnos#
ocnos#con t
Enter configuration commands, one per line. End with CNTL/Z.
ocnos(config)#errdisable cause storm-control
ocnos(config)#commit
ocnos(config)#end
ocnos#
ocnos#show running-config | include err
errdisable cause storm-control
errdisable cause stp-bpdu-guard
ocnos#
ocnos#con t
Enter configuration commands, one per line. End with CNTL/Z.
ocnos(config)#errdisable storm-control discard-hit 3 time 30
ocnos(config)#commit
%Warning: Err-disable setting has being updated, previous flaps won't be
considered
ocnos(config)#end
ocnos#
ocnos#show running-config | include err
errdisable cause storm-control
errdisable cause stp-bpdu-guard
errdisable storm-control discard-hit 3 time 30
ocnos#
ocnos#con t
Enter configuration commands, one per line. End with CNTL/Z.
ocnos(config)#no errdisable cause storm-control
ocnos(config)#commit
ocnos(config)#end
ocnos#
ocnos#show running-config | include err
errdisable cause stp-bpdu-guard
ocnos#
```

## Time interval Comnfiguration

```
ocnos#con t
Enter configuration commands, one per line. End with CNTL/Z.
ocnos(config)#errdisable to
ocnos(config)#errdisable timeout interval 10
ocnos(config)#commit
ocnos(config)#end
ocnos#

ocnos#show running-config | include err
errdisable cause stp-bpdu-guard
errdisable timeout interval 10
ocnos#
```

```
ocnos#con t
Enter configuration commands, one per line.  End with CNTL/Z.
ocnos(config)#no errdisable timeout im
ocnos(config)#no errdisable timeout interval
ocnos(config)#commit
ocnos(config)#end
ocnos#
```

```
ocnos#show running-config | include err
errdisable cause stp-bpdu-guard
ocnos#
```

```
ocnos#con t
Enter configuration commands, one per line.  End with CNTL/Z.
ocnos(config)#errdisable timeout interval 50
ocnos(config)#commit
ocnos(config)#end
ocnos#
```

```
ocnos#show running-config | include err
errdisable cause stp-bpdu-guard
errdisable timeout interval 50
ocnos#
```

```
ocnos#con t
Enter configuration commands, one per line.  End with CNTL/Z.
ocnos(config)#
ocnos(config)#no errdisable timeout im
ocnos(config)#no errdisable timeout interval
ocnos(config)#commit
ocnos(config)#end
ocnos#
```

```
ocnos#show running-config | include err
errdisable cause stp-bpdu-guard
ocnos#
```

---

## CHAPTER 26 Traffic Mirroring Configuration

This chapter contains a sample local and remote switched port analyzer feature configuration.

---

### SPAN Overview

Switched Port Analyzer (SPAN) refers to selecting network traffic for analysis by a network analyzer. SPAN feature is introduced on switches as the switch forwards traffic that is destined for a MAC address directly to the corresponding port leaving no scope to analyze the traffic.

SPAN monitors the traffic on source port and sends a copy of the traffic to a destination port. The network analyzer, which is attached to the destination port, analyzes the received traffic. Source port can be a single port or multiple ports. A replication of the packets is sent to the destination port for analysis.

SPAN is originally referred to port mirroring or port monitoring where all the network traffic on the source port is mirrored to destination port. Port mirroring has three subdivisions.

- Ingress mirroring: Traffic received on the source port will be monitored
- Egress mirroring: Traffic transmitted from the source port will be monitored
- Ingress and egress mirroring: Both received and transmitted traffic on the source port will be monitored.

With enhancements to SPAN, mirroring can be classified into three categories.

---

### Port Mirroring

In port mirroring, source will be a port which could be a physical interface or a port channel. All the traffic on the source port will be mirrored to destination port. Either traffic received on the source port or traffic transmitted from the source port or both can be monitored.

**Note:** If monitor session configured with two or more source interfaces in the Egress direction (tx) then the destination mirror port will receive only one copy of the non-unicast packet.

Also, the mirrored packet would be having default TPID of the mirror destination port i.e. 0x8100.

---

### VLAN Mirroring

In VLAN mirroring, the source is a VLAN identifier and the traffic received on all ports with the VLAN identifier matching source VLAN identifier are mirrored to destination port.

---

### Rule Based Mirroring

In rule based mirroring, there is a set of matching criteria for the ingress traffic such as matching destination MAC address, matching frame type, and so on. The traffic matching the rules is mirrored to the destination port.

## Topology

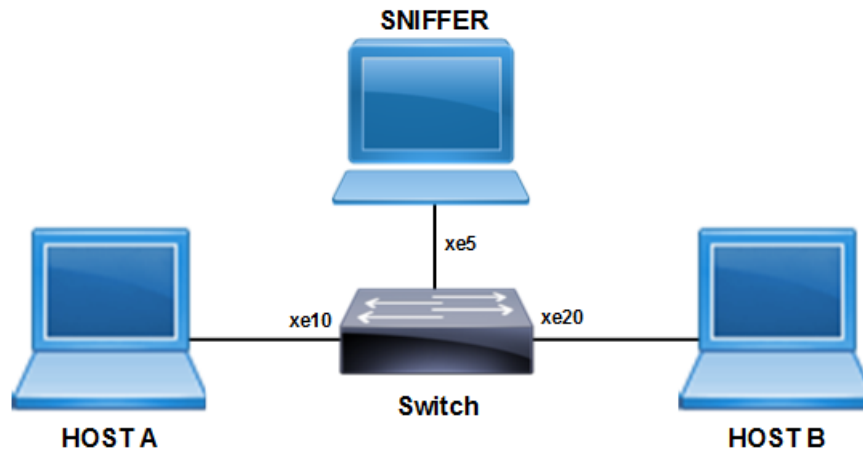


Figure 26-46: SPAN Topology

## Port Mirroring Configuration

This example shows detailed configuration of port mirroring.

#configure terminal	Enter configure mode.
(config)# bridge 1 protocol mstp	Configure bridge 1 as MSTP bridge.
(config)# vlan 101-110 bridge 1 state enable	Configure VLANs.
(config)#interface xe10	Enter interface mode.
(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up.
(config-if)#exit	Exit interface mode.
(config)#interface xe20	Enter interface mode.
(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up.
(config-if)#exit	Exit interface mode.
(config)#interface xe5	Enter interface mode.
(config-if)# switchport	Configure interface as a layer 2 port.
(config-if)#exit	Exit interface mode.
(config)# monitor session 1	Enter monitor session configuration mode

(config-monitor)# destination interface xe5	Configure the interface as destination port
(config-monitor)# source interface xe10 both	Configure the source interface to mirror ingress as well as egress direction traffic
(config-monitor)# no shut	Activate monitor session
(config-monitor)#end	Exit monitor session configuration mode

## Validation

Enter the below commands to confirm the configurations.

```
#show running-config monitor
!
monitor session 1
  source interface xe10 both
  destination interface xe5
  no shut
```

```
#show monitor session all
  session 1
```

```
-----
type           : local
state          : up
source intf    :
  tx           : xe10
  rx           : xe10
  both         : xe10
source VLANs   :
  rx           :
destination ports : xe5
filter count   :
```

Legend: f = forwarding enabled, l = learning enabled

If monitor session configured with two source interface as egress direction (tx) then the destination port will receive only one copy of the egressed packet.

#configure terminal	Enter configure mode.
(config)# bridge 1 protocol mstp	Configure bridge 1 as MSTP bridge.
(config)# vlan 101-110 bridge 1 state enable	Configure VLANs.
(config)#interface xe10	Enter interface mode.
(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up.
(config-if)#exit	Exit interface mode.
(config)#interface xe20	Enter interface mode.



(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up.
(config-if)#exit	Exit interface mode.
(config)#interface xe30	Enter interface mode.
(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up.
(config-if)#exit	Exit interface mode.
(config)#interface xe5	Enter interface mode.
(config-if)# switchport	Configure interface as a layer 2 port.
(config-if)#exit	Exit interface mode.
(config)# monitor session 1	Enter monitor session configuration mode
(config-monitor)# destination interface xe5	Configure the interface as destination port
(config-monitor)# source interface xe10 tx	Configure the source interface to mirror egress direction traffic
(config-monitor)# source interface xe30 tx	Configure the source interface to mirror egress direction traffic
(config-monitor)# no shut	Activate monitor session
(config-monitor)#end	Exit monitor session configuration mode

## Validation

```
#show running-config monitor
!
```

```
monitor session 1
source interface xe10 tx
source interface xe30 tx
destination interface xe5
no shut
```

```
#show monitor session all
    session 1
```

```
-----
Type           : local
State          : up
source intf    :
    tx         : xe10  xe30
    rx         :
    both       :
source VLANs   :
    rx         :
```

```
destination ports    : xe5
filter count        :
Legend: f = forwarding enabled, l = learning enable
```

If you send 10 frames from xe20 packets egress via xe10 and xe30, then on mirror destination port only 10 packets are received.

## VLAN and Rule Based Mirroring

This example shows detailed configuration of VLAN with rule based mirroring.

#configure terminal	Enter configure mode.
(config)# bridge 1 protocol mstp	Configure bridge 1 as MSTP bridge.
(config)# vlan 101-110 bridge 1 state enable	Configure VLANs
(config)#interface xe10	Enter interface mode.
(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up
(config-if)#exit	Exit interface mode.
(config)#interface xe20	Enter interface mode.
(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up
(config-if)#exit	Exit interface mode.
(config)#interface xe5	Enter interface mode.
(config-if)# switchport	Configure interface as a layer 2 port.
(config-if)#exit	Exit interface mode.
(config)# monitor session 1	Enter monitor session configuration mode
(config-monitor)# destination interface xe5	Configure the interface as destination port
(config-monitor)# source vlan 101	Configure source VLAN to be mirrored
(config-monitor)# filter src-mac host 0000.0000.0005	Configure the rule to match the source MAC
(config-monitor)# no shut	Activate monitor session
(config-monitor)#end	Exit monitor session configuration mode

---

## Validation

Enter the below commands to confirm the configurations.

```
#show running-config monitor
!
monitor session 1
  source vlan 101
  destination interface xe5
  10 filter src-mac host 0000.0000.0005
  no shut
```

```
#show monitor session all
  session 1
-----
type           : local
state          : up
source intf    :
  tx           :
  rx           :
  both         :
source VLANs   :
  rx           : 101
destination ports : xe5
filter count   : 1
```

Legend: f = forwarding enabled, l = learning enabled

```
#show monitor session 1 filter
  session 1
-----
filter count    : 1

-----
match set 1
-----
source mac address : 0000.0000.0005 (host)
```

---

## RSPAN Overview

When several switches need to be analyzed with a single centralized sniffer, remote switched port analyzer (RSPAN) is used. In RSPAN, all the mirrored traffic will be tagged with a RSPAN VLAN ID and forwarded to remote destination via a port called reflector port. Reflector port will have the same characteristics of a local destination port. RSPAN VLAN ID will be a dedicated VLAN for the monitoring purpose and will not participate in bridging. RSPAN destination switch will strip the RSPAN VLAN tag and send it the sniffer for analysis. RSPAN will have the same sub-categories as SPAN except that the mirrored traffic will be tagged with RSPAN VLAN header and forwarded to destination switch for analysis.

## Topology

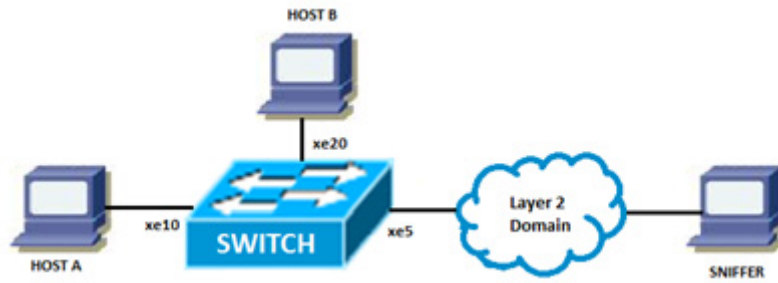


Figure 26-47: RSPAN Topology

## Port Mirroring Configuration

This example shows detailed configuration of port mirroring.

#configure terminal	Enter configure mode.
(config)# bridge 1 protocol mstp	Configure bridge 1 as MSTP bridge.
(config)# vlan 101-110 bridge 1 state enable	Configure VLANs.
(config)#interface xe10	Enter interface mode.
(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up.
(config-if)#exit	Exit interface mode.
(config)#interface xe20	Enter interface mode.
(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up.
(config-if)#exit	Exit interface mode.
(config)#interface xe5	Enter interface mode.
(config-if)# switchport	Configure interface as a layer 2 port.
(config-if)#exit	Exit interface mode.
(config)# monitor session 1 type remote	Enter monitor session configuration mode.
(config-monitor)# destination remote vlan 100 reflector-port xe5	Configure the interface as remote destination port
(config-monitor)# source interface xe10 both	Configure the source interface to mirror ingress as well as egress direction traffic.

(config-monitor)# no shut	Activate monitor session.
(config-monitor)#end	Exit monitor session configuration mode.

## Validation

Enter the commands below to confirm the configurations

```
#show running-config monitor
!
monitor session 1 type remote
  source interface xe10 both
  destination remote vlan 100 reflector-port xe5
  no shut
```

```
#show monitor session all
  session 1
-----
```

```
type           : remote
state          : up
source intf    :
  tx           : xe10
  rx           : xe10
  both         : xe10
source VLANs   :
  rx           :
rspan VLAN     : 100
reflector ports : xe5
filter count   :
```

Legend: f = forwarding enabled, l = learning enabled

## VLAN and Rule Based Mirroring Configuration

This example shows detailed configuration of VLAN with rule based mirroring.

#configure terminal	Enter configure mode.
(config)# bridge 1 protocol mstp	Configure bridge 1 as MSTP bridge.
(config)# vlan 101-110 bridge 1 state enable	Configure VLANs.
(config)#interface xe10	Enter interface mode.
(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up.
(config-if)#exit	Exit interface mode.
(config)#interface xe20	Enter interface mode.
(config-if)# switchport	Configure interface 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 add 101-110	Allow VLANs 101-110 on the interface.
(config-if)# no shutdown	Make interface admin up.
(config-if)#exit	Exit interface mode.
(config)#interface xe5	Enter interface mode.
(config-if)# switchport	Configure interface as a layer 2 port.
(config-if)#exit	Exit interface mode.
(config)# monitor session 1 type remote	Enter monitor session configuration mode.
(config-monitor)# destination remote vlan 100 reflector-port xe5	Configure the interface as remote destination port.
(config-monitor)# source vlan 101	Configure source VLAN to be mirrored.
(config-monitor)# filter src-mac host 0000.0000.0005	Configure the rule to match the source MAC.
(config-monitor)# no shut	Activate monitor session.
(config-monitor)#end	Exit monitor session configuration mode.

## Validation

Enter the commands below to confirm the configuration.

```
#show running-config monitor
!
monitor session 1 type remote
  source vlan 101
  destination remote vlan 100 reflector-port xe5
  10 filter src-mac host 0000.0000.0005
  no shut
```

```
#show monitor session all
  session 1
-----
type           : remote
state          : up
source intf    :
  tx           :
  rx           :
```

```

    both          :
source VLANs     :
    rx           : 101
rspan VLAN       : 100
reflector ports  : xe5
filter count     : 1

```

Legend: f = forwarding enabled, l = learning enabled

```

#show monitor session 1 filter
  session 1
-----
filter count      : 1

-----
match set 1
-----
source mac address : 0000.0000.0005 (host)

```

---

## VLAN Mirroring Using VLAN Ranges Configuration

The Switch Port Analyzer (SPAN) monitors the traffic on source port and sends a copy of the traffic to a destination port. The network analyzer, which is attached to the destination port, analyzes the received traffic. The source port can either be a single port or multiple ports. A replication of the packets is sent to the destination port for analysis.

The SPAN is also referred to as port mirroring or port monitoring. It is installed in Layer 2 Access Control List (ACL) group by default. It is used for monitoring Ingress MAC ACL or VLAN group. Any packet received can be monitored based on source port including Physical or MAC or VLAN port.

This is an existing VLAN monitor session feature in the OcNOS DC, enhanced in current release to support VLAN ranges.

The following two CLIs are updated to support the VLAN ranges:

- [hardware-profile filter \(XGS\)](#)
- [filter](#)

---

## Feature Characteristics

The VLAN range is supported only for ingress traffic.

### LIMITATIONS

The ingress port mirroring is not supported for sub-interface and Switched Virtual Interface (SVI) interface.

---

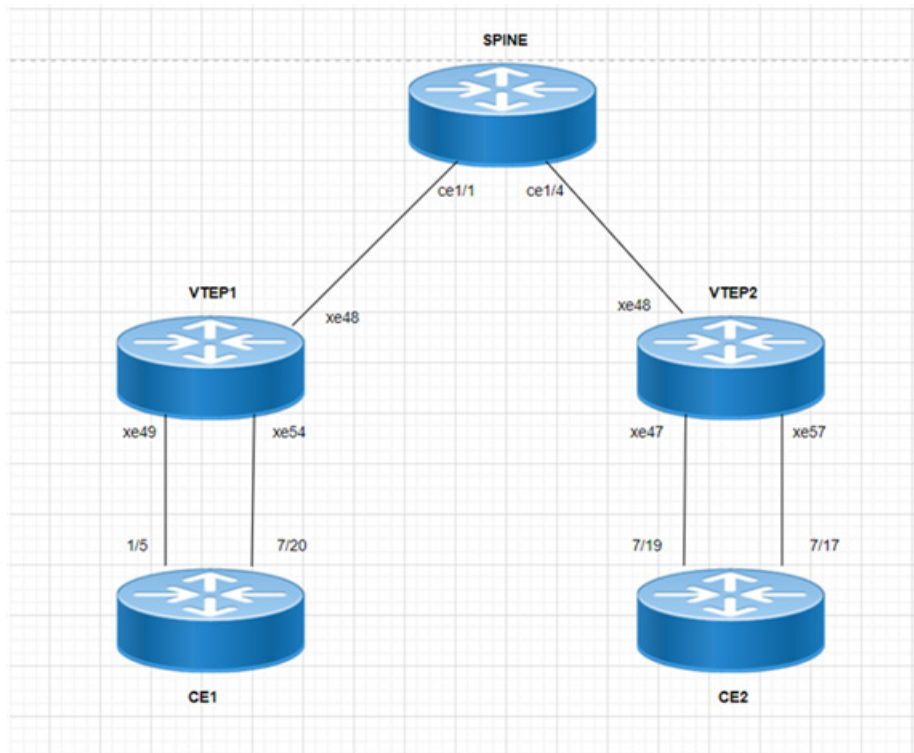
## Benefits

Users can apply port monitoring rules for multiple source ports, multiple VLANs, and a combination of port and VLAN ranges.

## Configuration

To configure an ingress VLAN monitor session using VLAN ranges, perform the following configurations:

## Topology



**SPAN Topology**

### VTEP1

VTEP1#configure terminal	Enter configure mode.
VTEP1(config)#hardware-profile filter ingress-mirror enable	Enable hardware profile ingress mirror.
VTEP1(config)#nvo vxlan enable	Enable vxlan.
VTEP1(config)#evpn esi hold-time 60	Configure esi hold timer.
VTEP1(config)#evpn vxlan multihoming enable	Enable VxLAN multihoming.
VTEP1(config)#mac vrf VRF1	Configure MAC VRF as VRF1.
VTEP1(config-vrf)#rd 1.1.1.1:11	Configure route distinguisher value.
VTEP1(config-vrf)#route-target both 9.9.9.9:100	Configure route-target import and export.



VTEP1(config)#mac vrf VRF2	Configure MAC VRF as VRF2.
VTEP1(config-vrf)#rd 1.1.1.1:21	Configure route distinguisher value.
VTEP1(config-vrf)#route-target both 90.90.90.90:100	Configure route-target import and export.
VTEP1(config)#mac vrf VRF3	Configure MAC VRF as VRF3.
VTEP1(config-vrf)#rd 1.1.1.1:22	Configure route distinguisher value.
VTEP1(config-vrf)#route-target both 90.90.90.90:101	Configure route-target import and export.
VTEP1(config)#mac vrf VRF4	Configure MAC VRF as VRF4.
VTEP1(config-vrf)#rd 1.1.1.1:23	Configure route distinguisher value.
VTEP1(config-vrf)#route-target both 10.10.10.10:100	Configure route-target import and export.
VTEP1(config)#mac vrf VRF5	Configure MAC VRF as VRF5.
VTEP1(config-vrf)#rd 1.1.1.1:24	Configure route distinguisher value.
VTEP1(config-vrf)#route-target both 20.20.20.20:100	Configure route-target import and export.
VTEP1(config)#mac vrf VRF6	Configure MAC VRF as VRF6.
VTEP1(config-vrf)#rd 1.1.1.1:25	Configure route distinguisher value.
VTEP1(config-vrf)#route-target both 30.30.30.30:100	Configure route-target import and export.
VTEP1(config)#mac vrf VRF7	Configure MAC VRF as VRF7.
VTEP1(config-vrf)#rd 1.1.1.1:26	Configure route distinguisher value.
VTEP1(config-vrf)#route-target both 40.40.40.40:100	Configure route-target import and export.
VTEP1(config-vrf)#exit	Exit from VRF mode
VTEP1(config)#mac vrf VRF8	Configure MAC VRF as VRF8
VTEP1(config-vrf)#rd 1.1.1.1:27	Configure route distinguisher value.
VTEP1(config-vrf)#route-target both 50.50.50.50:100	Configure route-target import and export.
VTEP1(config-vrf)#exit	Exit from VRF mode.
VTEP1(config)#mac vrf VRF9	Configure MAC VRF as VRF2.
VTEP1(config-vrf)#rd 1.1.1.1:28	Configure route distinguisher value.
VTEP1(config-vrf)#route-target both 60.60.60.60:100	Configure route-target import and export.
VTEP1(config-vrf)#exit	Exit from VRF mode.
VTEP1(config)#mac vrf VRF10	Configure MAC VRF as VRF2.
VTEP1(config-vrf)#rd 1.1.1.1:29	Configure route distinguisher value.
VTEP1(config-vrf)#route-target both 70.70.70.70:100	Configure route-target import and export.
VTEP1(config-vrf)#exit	Exit from VRF mode.
VTEP1(config)#nvo vxlan vtep-ip-global 1.1.1.1	Enable VxLAN Source VTEP IPp address global configuration.

VTEP1(config)#nvo vxlan id 10 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP1(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF1	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP1(config-nvo)#exit	Exit from the VxLAN mode.
VTEP1(config)#nvo vxlan id 20 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP1(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF2	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP1(config-nvo)#exit	Exit from the VxLAN mode.
VTEP1(config)#nvo vxlan id 21 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP1(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF3	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP1(config-nvo)#exit	Exit from the VxLAN mode.
VTEP1(config)#nvo vxlan id 23 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP1(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF4	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP1(config-nvo)#exit	Exit from the VxLAN mode.
VTEP1(config)#nvo vxlan id 24 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP1(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF5	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP1(config-nvo)#exit	Exit from the VxLAN mode.
VTEP1(config)#nvo vxlan id 25 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP1(config-nvo)#VxLAN host-reachability-protocol evpn-bgp VRF6	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP1(config-nvo)#exit	Exit from the VxLAN mode.
VTEP1(config)#nvo VxLAN id 26 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP1(config-nvo)#VxLAN host-reachability-protocol evpn-bgp VRF7	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP1(config-nvo)#exit	Exit from the VxLAN mode.
VTEP1(config)#nvo VxLAN id 27 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP1(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF8	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP1(config-nvo)#exit	Exit from the VxLAN mode.
VTEP1(config)#nvo vxlan id 28 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP1(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF9	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP1(config-nvo)#exit	Exit from the VxLAN mode.
VTEP1(config)#nvo vxlan id 29 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.

VTEP1(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF10	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP1(config-nvo)#exit	Exit from the VxLAN mode.
VTEP1(config)#qos enable	Enable QoS.
VTEP1(config)#hostname VTEP1	Configure system's network name as VTEP1
VTEP1(config)#interface lo	Enter loopback interface mode.
VTEP1(config-if)#ip address 1.1.1.1/32 secondary	Configure the secondary IP address of the- loopback interface
VTEP1(config)#interface xe48	Enter interface mode.
VTEP1(config-if)#load-interval 30	Configure load interval.
VTEP1(config-if)#ip address 10.10.10.1/24	Configure the IP address of the interface.
VTEP1(config-if)#exit	Exit from interface mode.
VTEP1(config)#interface xe49	Enter interface mode.
VTEP1(config-if)#switchport	Enter the switchport mode.
VTEP1(config-if)#load-interval 30	Configure load interval.
VTEP1(config-if)#exit	Exit from interface mode.
VTEP1(config)#interface xe54	Enter interface mode.
VTEP1(config-if)#switchport	Enter the switchport mode.
VTEP1(config-if)#load-interval 30	Configure load interval.
VTEP1(config-if)#exit	Exit from interface mode.
VTEP1(config)#router ospf 100	Configure router ospf process ID.
VTEP1(config-router)#ospf router-id 1.1.1.1	Configure OSPF router id
VTEP1(config-router)#bfd all-interfaces	Enable BFD all interfaces
VTEP1(config-router)#network 1.1.1.1/32 area 0.0.0.0	Configure network and area as 0
VTEP1(config-router)#network 10.10.10.0/24 area 0.0.0.0	Configure network and area as 0
VTEP1(config-router)#exit	Exit from router ospf mode
VTEP1(config)#router bgp 500	Configure router bgp AS number
VTEP1(config-router)#bgp router-id 1.1.1.1	Configure BGP router ID.
VTEP1(config-router)#neighbor 2.2.2.2 remote-as 500	Configure a neighbor router and Peer AS Specify AS number of BGP neighbor.
VTEP1(config-router)#neighbor 2.2.2.2 update-source lo	Configure a neighbor router and Source of routing updates as loopbacl
VTEP1(config-router)#neighbor 2.2.2.2 advertisement-interval 0	Configure a neighbor router and minimum interval between sending BGP routing updates
VTEP1(config-router)#address-family ipv4 unicast	Enter Address Family command mode
VTEP1(config-router-af)#network 1.1.1.1/32	Configure a network to announce via BGP
VTEP1(config-router-af)#neighbor 2.2.2.2 activate	Activate the neighbor
VTEP1(config-router-af)#exit-address-family	Exit from address family mode
VTEP1(config-router)#address-family l2vpn evpn	Enter Address Family with l2vpn evpn Identifier

VTEP1(config-router-af)#neighbor 2.2.2.2 activate	Activate the neighbor
VTEP1(config-router-af)#exit-address-family	Exit from address family mode
VTEP1(config-router)#exit	Exit from router bgp mode
VTEP1(config)#monitor session 1	Configure Ethernet SPAN session with preferences
VTEP1(config-monitor)#source interface xe49 rx	Configure source interface as Ingress
VTEP1(config-monitor)#destination interface xe54	Configure destination interface.
VTEP1(config-monitor)#10 filter vlan 2-6	Configure sequence number with filter option and specify the vlan ranges.
VTEP1(config-monitor)#no shut	Unshut a monitor session.
VTEP1(config-monitor)#exit	Exit from monitor session.
VTEP1(config)#nvo vxlan max-cache-disable 2500	Configure vxlan Max number of ARP/ND cache disable allowed for port-vlan
VTEP1(config)#nvo vxlan access-if port-vlan xe49 2	Configure VxLAN access-if single tagged interface name with VLAN id
VTEP1(config-nvo-acc-if)#map vnid 22	Map access port attribute with VxLAN Identifier.
VTEP1(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP1(config)#nvo vxlan access-if port-vlan xe49 3	Configure VxLAN access-if single tagged interface name with VLAN id
VTEP1(config-nvo-acc-if)#map vnid 23	Map access port attribute with VxLAN Identifier.
VTEP1(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP1(config)#nvo vxlan access-if port-vlan xe49 4	Configure VxLAN access-if single tagged interface name with VLAN id
VTEP1(config-nvo-acc-if)#map vnid 24	Map access port attribute with VxLAN Identifier.
VTEP1(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP1(config)#nvo vxlan access-if port-vlan xe49 5	Configure VxLAN access-if single tagged interface name with VLAN id
VTEP1(config-nvo-acc-if)#map vnid 25	Map access port attribute with VxLAN Identifier.
VTEP1(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP1(config)#nvo vxlan access-if port-vlan xe49 6	Configure VxLAN access-if single tagged interface name with VLAN id
VTEP1(config-nvo-acc-if)#map vnid 26	Map access port attribute with VxLAN Identifier.
VTEP1(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP1(config)#nvo vxlan access-if port-vlan xe49 7	Configure VxLAN access-if single tagged interface name with VLAN id
VTEP1(config-nvo-acc-if)#map vnid 27	Map access port attribute with VxLAN Identifier.
VTEP1(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP1(config)#nvo vxlan access-if port-vlan xe49 8	Configure VxLAN access-if single tagged interface name with VLAN id
VTEP1(config-nvo-acc-if)#map vnid 28	Map access port attribute with VxLAN Identifier.
VTEP1(config-nvo-acc-if)#exit	Exit from access-if mode.

VTEP1(config)#nvo vxlan access-if port-vlan xe49 9	Configure VxLAN access-if single tagged interface name with VLAN id
VTEP1(config-nvo-acc-if)#map vnid 29	Map access port attribute with VxLAN Identifier.
VTEP1(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP1(config)#nvo vxlan access-if port-vlan xe49 10	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP1(config-nvo-acc-if)#map vnid 10	Map access port attribute with VxLAN Identifier.
VTEP1(config)#nvo vxlan access-if port-vlan xe49 11	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP1(config-nvo-acc-if)#map vnid 21	Map access port attribute with VxLAN Identifier.
VTEP1(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP1(config)#nvo vxlan access-if port-vlan xe49 12	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP1(config-nvo-acc-if)#map vnid 20	Map access port attribute with VxLAN Identifier.
VTEP1(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP1(config)#commit	Commit the candidate configuration to the running configuration.

**VTEP2**

VTEP2#configure terminal	Enter configure mode.
VTEP2(config)#hardware-profile filter ingress-mirror enable	Enable hardware profile ingress mirror
VTEP2(config)#nvo vxlan enable	Enable vxlan
VTEP2(config)#evpn esi hold-time 60	Config esi hold timer
VTEP2(config)#evpn vxlan multihoming enable	Enable vxlan multihoming
VTEP2(config)#mac vrf VRF1	Configure mac vrf as VRF1
VTEP2(config-vrf)#rd 2.2.2.2:11	Configure route distinguisher value.
VTEP2(config-vrf)#route-target both 9.9.9.9:100	Configure route-target import and export
VTEP2(config-vrf)#exit	Exit from vrf mode
VTEP2(config)#mac vrf VRF2	Configure mac vrf as VRF2
VTEP2(config-vrf)#rd 2.2.2.2:21	Configure route distinguisher value.
VTEP2(config-vrf)#route-target both 90.90.90.90:100	Configure route-target import and export
VTEP2(config-vrf)#exit	Exit from vrf mode
VTEP2(config)#mac vrf VRF3	Configure mac vrf as VRF3
VTEP2(config-vrf)#rd 2.2.2.2:22	Configure route distinguisher value.
VTEP2(config-vrf)#route-target both 90.90.90.90:101	Configure route-target import and export
VTEP2(config-vrf)#exit	Exit from vrf mode
VTEP2(config)#mac vrf VRF4	Configure mac vrf as VRF4
VTEP2(config-vrf)#rd 2.2.2.2:23	Configure route distinguisher value.
VTEP2(config-vrf)#route-target both 10.10.10.10:100	Configure route-target import and export
VTEP2(config-vrf)#exit	Exit from vrf mode
VTEP2(config)#mac vrf VRF5	Configure mac vrf as VRF5
VTEP2(config-vrf)#rd 2.2.2.2:24	Configure route distinguisher value.
VTEP2(config-vrf)#route-target both 20.20.20.20:100	Configure route-target import and export
VTEP2(config-vrf)#exit	Exit from vrf mode

VTEP2(config)#mac vrf VRF6	Configure mac vrf as VRF6
VTEP2(config-vrf)#rd 2.2.2.2:25	Configure route distinguisher value.
VTEP2(config-vrf)#route-target both 30.30.30.30:100	Configure route-target import and export
VTEP2(config-vrf)#exit	Exit from vrf mode
VTEP2(config)#mac vrf VRF7	Configure mac vrf as VRF7
VTEP2(config-vrf)#rd 2.2.2.2:26	Configure route distinguisher value.
VTEP2(config-vrf)#route-target both 40.40.40.40:100	Configure route-target import and export
VTEP2(config-vrf)#exit	Exit from vrf mode
VTEP2(config)#mac vrf VRF8	Configure mac vrf as VRF8
VTEP2(config-vrf)#rd 2.2.2.2:27	Configure route distinguisher value.
VTEP2(config-vrf)#route-target both 50.50.50.50:100	Configure route-target import and export
VTEP2(config-vrf)#exit	Exit from vrf mode
VTEP2(config)#mac vrf VRF9	Configure mac vrf as VRF9
VTEP2(config-vrf)#rd 2.2.2.2:28	Configure route distinguisher value.
VTEP2(config-vrf)#route-target both 60.60.60.60:100	Configure route-target import and export
VTEP2(config-vrf)#exit	Exit from vrf mode
VTEP2(config)#mac vrf VRF10	Configure mac vrf as VRF10
VTEP2(config-vrf)#rd 2.2.2.2:29	Configure route distinguisher value.
VTEP2(config-vrf)#route-target both 70.70.70.70:100	Configure route-target import and export
VTEP2(config-vrf)#exit	Exit from vrf mode
VTEP2(config)#nvo vxlan vtep-ip-global 2.2.2.2	Enable vxlan Source Vtep Ip address global configuration
VTEP2(config)#nvo vxlan id 10 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF1	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#nvo vxlan id 20 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.

VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF2	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#nvo vxlan id 21 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF3	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#nvo vxlan id 22 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF3	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#nvo vxlan id 23 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF4	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#nvo vxlan id 24 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF5	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#nvo vxlan id 25 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF6	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#nvo vxlan id 26 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF7	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#nvo vxlan id 27 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF8	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#nvo vxlan id 28 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF9	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.



VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#nvo vxlan id 29 ingress-replication	Enable VxLAN Network Identifier Head End Replication tenant type.
VTEP2(config-nvo)#vxlan host-reachability-protocol evpn-bgp VRF10	Host reachability protocol multiprotocol BGP VRF to carry EVPN routes.
VTEP2(config-nvo)#exit	Exit from the VxLAN mode.
VTEP2(config)#qos enable	Enable QoS.
VTEP2(config)#hostname VTEP2	Configure system's network name as VTEP2.
VTEP2(config)#interface lo	Enter loopback interface mode.
VTEP2(config-if)#ip address 2.2.2.2/32 secondary	Configure the secondary IP address of the loopback interface.
VTEP2(config-if)#exit	Exit from interface mode.
VTEP2(config)#interface xe47	Enter interface mode.
VTEP2(config-if)#switchport	Enter the switchport mode.
VTEP2(config-if)#load-interval 30	Configure load interval.
VTEP2(config-if)#exit	Exit from interface mode.
VTEP2(config)#interface xe48	Enter interface mode.
VTEP2(config-if)#ip address 30.30.30.1/24	Configure the IP address of the interface.
VTEP2(config-if)#exit	Enter interface mode.
VTEP2(config)#interface xe57	Enter interface mode.
VTEP2(config-if)#switchport	Enter the switchport mode.
VTEP2(config-if)#load-interval 30	Configure load interval.
VTEP2(config-if)#exit	Exit from interface mode.
VTEP2(config)#router ospf 100	Configure router ospf process ID.
VTEP2(config-router)#ospf router-id 2.2.2.2	Configure OSPF router ID.
VTEP2(config-router)#bfd all-interfaces	Enable BFD all interfaces.
VTEP2(config-router)#network 2.2.2.2/32 area 0.0.0.0	Configure network and area as 0.
VTEP2(config-router)#network 30.30.30.0/24 area 0.0.0.0	Configure network and area as 0.

VTEP2 (config-router) #exit	Exit from router OSPF mode.
VTEP2 (config) #router bgp 500	Configure router BGP AS number.
VTEP2 (config-router) #bgp router-id 2.2.2.2	Configure BGP router ID.
VTEP2 (config-router) #neighbor 1.1.1.1 remote-as 500	Configure a neighbor router and Peer AS Specify AS number of BGP neighbor.
VTEP2 (config-router) #neighbor 1.1.1.1 update-source lo	Configure a neighbor router and Source of routing updates as loopback.
VTEP2 (config-router) #neighbor 1.1.1.1 advertisement-interval 0	Configure a neighbor router and minimum interval between sending BGP routing updates.
VTEP2 (config-router) #address-family ipv4 unicast	Enter Address Family command mode.
VTEP2 (config-router-af) #network 2.2.2.2/32	Configure a network to announce via BGP.
VTEP2 (config-router-af) #neighbor 1.1.1.1 activate	Activate the neighbor.
VTEP2 (config-router-af) #exit-address-family	Exit from address family mode.
VTEP2 (config-router) #address-family l2vpn evpn	Enter Address Family with l2vpn evpn Identifier.
VTEP2 (config-router-af) #neighbor 1.1.1.1 activate	Activate the neighbor.
VTEP2 (config-router-af) #exit-address-family	Exit from address family mode.
VTEP2 (config-router) #exit	Exit from router bgp mode.
VTEP2 (config) #nvo vxlan max-cache-disable 2500	Configure vxlan Max number of ARP/ND cache disable allowed for port-vlan.
VTEP2 (config) #nvo vxlan access-if port-vlan xe47 2	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP2 (config-nvo-acc-if) #map vnid 22	Map access port attribute with VxLAN Identifier.
VTEP2 (config-nvo-acc-if) #exit	Exit from access-if mode.
VTEP2 (config) #nvo vxlan access-if port-vlan xe47 3	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP2 (config-nvo-acc-if) #map vnid 23	Map access port attribute with VxLAN Identifier.
VTEP2 (config-nvo-acc-if) #exit	Exit from access-if mode.
VTEP2 (config) #nvo vxlan access-if port-vlan xe47 4	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP2 (config-nvo-acc-if) #map vnid 24	Map access port attribute with VxLAN Identifier.
VTEP2 (config-nvo-acc-if) #exit	Exit from access-if mode.

VTEP2(config)#nvo vxlan access-if port-vlan xe47 5	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP2(config-nvo-acc-if)#map vnid 25	Map access port attribute with VxLAN Identifier.
VTEP2(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP2(config)#nvo vxlan access-if port-vlan xe47 6	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP2(config-nvo-acc-if)#map vnid 26	Map access port attribute with VxLAN Identifier.
VTEP2(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP2(config)#nvo vxlan access-if port-vlan xe47 7	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP2(config-nvo-acc-if)#map vnid 27	Map access port attribute with VxLAN Identifier.
VTEP2(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP2(config)#nvo vxlan access-if port-vlan xe47 8	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP2(config-nvo-acc-if)#map vnid 28	Map access port attribute with VxLAN Identifier.
VTEP2(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP2(config)#nvo vxlan access-if port-vlan xe47 9	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP2(config-nvo-acc-if)#map vnid 29	Map access port attribute with VxLAN Identifier.
VTEP2(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP2(config)#nvo vxlan access-if port-vlan xe47 10	Configure VxLAN access-if single tagged interface name with VLAN id.
VTEP2(config-nvo-acc-if)#map vnid 10	Map access port attribute with VxLAN Identifier.
VTEP2(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP2(config)#nvo vxlan access-if port-vlan xe47 11	Configure VxLAN access-if single tagged interface name with VLAN id
VTEP2(config-nvo-acc-if)#map vnid 21	Map access port attribute with VxLAN Identifier.
VTEP2(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP2(config)#nvo vxlan access-if port-vlan xe47 12	Configure VxLAN access-if single tagged interface name with VLAN id
VTEP2(config-nvo-acc-if)#map vnid 20	Map access port attribute with VxLAN Identifier.

VTEP2(config-nvo-acc-if)#exit	Exit from access-if mode.
VTEP2(config)#commit	Commit the candidate configuration to the running configuration.

## Validation

### Verify OSPF neighbors

```
VTEP1#show ip ospf neighbor
```

```
Total number of full neighbors: 1
```

```
OSPF process 100 VRF(default):
```

Neighbor ID Instance ID	Pri	State	Dead Time	Address	Interface	
11.11.11.11	1	Full/DR	00:00:29	10.10.10.2	xe48	0

```
VTEP1#
```

### Checking the IP Routes

```
VTEP1#show ip route
```

```
Codes: K - kernel, C - connected, S - static, R - RIP, B - BGP
```

```
O - OSPF, IA - OSPF inter area
```

```
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
```

```
E1 - OSPF external type 1, E2 - OSPF external type 2
```

```
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2,
```

```
ia - IS-IS inter area, E - EVPN,
```

```
v - vrf leaked
```

```
* - candidate default
```

```
IP Route Table for VRF "default"
```

```
C          1.1.1.1/32 is directly connected, lo, 01:21:26
O          2.2.2.2/32 [110/3] via 10.10.10.2, xe48, 01:15:25
C          10.10.10.0/24 is directly connected, xe48, 01:16:11
O          11.11.11.11/32 [110/2] via 10.10.10.2, xe48, 01:15:25
C          20.20.20.0/24 is directly connected, xe52, 01:20:42
O          30.30.30.0/24 [110/2] via 10.10.10.2, xe48, 01:15:25
C          127.0.0.0/8 is directly connected, lo, 01:21:26
```

```
Gateway of last resort is not set
```

```
VTEP1#
```

```
VTEP1#
```

```
VTEP1#
```

**Verify the BGP neighbors**

```
VTEP1#show ip bgp neighbors
BGP neighbor is 2.2.2.2, remote AS 500, local AS 500, internal link, peer index: 12
  BGP version 4, local router ID 1.1.1.1, remote router ID 2.2.2.2
  BGP state = Established, up for 01:15:26
  Last read 00:00:18, hold time is 90, keepalive interval is 30 seconds
  Neighbor capabilities:
    Route refresh: advertised and received (old and new)
    Address family IPv4 Unicast: advertised and received
    Address family L2VPN EVPN: advertised and received
  Received 527 messages, 0 notifications, 0 in queue
  Sent 502 messages, 0 notifications, 0 in queue
  Route refresh request: received 0, sent 0
  Minimum time between advertisement runs is 0 seconds
  Update source is lo

For address family: IPv4 Unicast  BGP table version 2, neighbor version 2
  Index 1, Offset 0, Mask 0x2
  AIGP is enabled
  Community attribute sent to this neighbor (both)
  Large Community attribute sent to this neighbor
  1 accepted prefixes
  1 announced prefixes

For address family: L2VPN EVPN  BGP table version 96, neighbor version 95
  Index 1, Offset 0, Mask 0x2
  Community attribute sent to this neighbor (both)

.skipping 1 line
  31 accepted prefixes
  Accepted AD:0 MACIP:20 MCAST:11 ESI:0 PREFIX:0
  21 announced prefixes

Connections established 1; dropped 0
Local host: 1.1.1.1, Local port: 179
Foreign host: 2.2.2.2, Foreign port: 38227
TCP MSS: (0), Advertise TCP MSS: (1460), Send TCP MSS: (1460),  Receive TCP MSS: (1460)
Sock FD : (22)
Nexthop: 1.1.1.1
Nexthop global: ::
Nexthop local: ::
BGP connection: non shared network
```

**Verify the VxLAN access-if**

```
VTEP1#show nvo vxlan access-if brief
```

Interface	Vlan	Inner vlan	Ifindex	Vnid	Admin status	Link status
xe49	2	---	0x7a120	22	up	up
xe49	3	---	0x7a121	23	up	up
xe49	4	---	0x7a122	24	up	up
xe49	5	---	0x7a123	25	up	up
xe49	6	---	0x7a124	26	up	up
xe49	7	---	0x7a125	27	up	up
xe49	8	---	0x7a126	28	up	up
xe49	9	---	0x7a127	29	up	up
xe49	10	---	0x7a128	10	up	up
xe49	11	---	0x7a129	21	up	up
xe49	12	---	0x7a12a	20	up	up

Total number of entries are 11

**Note:** Refer sub-interface config for VLAN information.

**Verify the VxLAN tunnel**

```
VTEP1#
```

```
VTEP1#
```

```
VTEP1#show nvo vxlan tunnel
```

```
VXLAN Network tunnel Entries
```

Source	Destination	Status	Up/Down	Update
1.1.1.1	2.2.2.2	Installed	01:15:37	01:15:37

Total number of entries are 1

```
VTEP1#
```

**Verify the VxLAN**

```
VTEP1#show nvo vxlan
```

```
VXLAN Information
```

```
=====
```

```
Codes: NW - Network Port
```

```
AC - Access Port
```

```
(u) - Untagged
```

VNID	VNI-Name	VNI-Type	Type	Interface	ESI	VLAN	DF-
Status	Src-Addr		Dst-Addr				

10	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
10	----	--	AC	xe49	--- Single Homed Port ---	10	-
---	----		----				
20	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
20	----	--	AC	xe49	--- Single Homed Port ---	12	-
---	----		----				
21	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
21	----	--	AC	xe49	--- Single Homed Port ---	11	-
---	----		----				
22	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
22	----	--	AC	xe49	--- Single Homed Port ---	2	-
---	----		----				
23	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
23	----	--	AC	xe49	--- Single Homed Port ---	3	-
---	----		----				
24	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
24	----	--	AC	xe49	--- Single Homed Port ---	4	-
---	----		----				
25	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
25	----	--	AC	xe49	--- Single Homed Port ---	5	-
---	----		----				
26	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
26	----	--	AC	xe49	--- Single Homed Port ---	6	-
---	----		----				
27	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
27	----	--	AC	xe49	--- Single Homed Port ---	7	-
---	----		----				
28	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
28	----	--	AC	xe49	--- Single Homed Port ---	8	-
---	----		----				
29	----	L2	NW	----	----	----	-
---	1.1.1.1		2.2.2.2				
29	----	--	AC	xe49	--- Single Homed Port ---	9	-
---	----		----				

Total number of entries are 22

Note: Refer sub-interface config for VLAN information.

**Verify the interface counters**

VTEP1#

VTEP1#show interface counters rate mbps

Interface	Rx mbps	Rx pps	Tx mbps	Tx pps
xe48	42.73	30012	14.25	10011
<b>xe49</b>	<b>41.60</b>	<b>40625</b>	<b>10.24</b>	<b>10000</b>
<b>xe54</b>	<b>0.00</b>	<b>0</b>	<b>20.80</b>	<b>20312</b>

VTEP1#

**Validation for Port Mirroring****Verify the monitor**

VTEP1#show monitor

Session	State	Reason	Description
1	<b>up</b>	<b>The session is up</b>	

VTEP1#

Verify the monitor session

VTEP1#show monitor session 1  
session 1

```
-----
type                : local
state              : up
source intf         :
    tx              :
    rx              : xe49
    both            :
source VLANs        :
    rx              :
destination ports : xe54
filter count     : 1
```

Legend: f = forwarding enabled, l = learning enabled

VTEP1#

VTEP1#show monitor session 1 brief  
session 1

```
-----
type              : local
state              : up
source intf        :
    tx             :
```



```

    rx          : xe49
    both        :
destination ports : xe54
filter count    : 1

```

```
VTEP1#
```

```
VTEP1#show monitor session 1 filter
      session 1
-----
```

```
filter count      : 1
```

```

-----
match set 1
-----

```

```
Sequence number : 10 vlan : 2-6
```

```
VTEP1#
```

```
END
```

---

## Revised CLI Commands

---

### hardware-profile filter (XGS)

The existing hardware-profile filter CLI syntax is updated as follows:

```
hardware-profile filter port-isolation (ingress-ipv4|ingress-ipv6|egress-ipv6|ingress-
arp|bfd-group) (enable|disable)
```

to

```
hardware-profile filter port-isolation (ingress-mirror|ingress-ipv4|ingress-ipv6|egress-
ipv6|ingress-arp|bfd-group) (enable|disable)
```

Refer to [hardware-profile filter \(XGS\)](#) CLI section for more details.

Use the new filter ingress-mirror profile for port mirroring when monitor session is installed with filters. when the specified filter profile is not enabled, port mirror uses default L2 group.

---

### filter

The existing filter CLI syntax is updated as follows:

```
filter {vlan <2-4094> | cos <0-7> ...
```

```

(<1-268435453>/<1-4294967294> |) filter {vlan <2-4094>| cos <0-7> | dest-mac (host
XXXX.XXXX.XXXX | XXXX.XXXX.XXXX XXXX.XXXX.XXXX) | src-mac (host XXXX.XXXX.XXXX |
XXXX.XXXX.XXXX XXXX.XXXX.XXXX) | frame-type (ETHTYPE | arp (req | resp|) (sender-ip
A.B.C.D|) (target-ip A.B.C.D|) | ipv4 (src-ip (A.B.C.D | A.B.C.D/M)|) (dest-ip (A.B.C.D
| A.B.C.D/M)|) | ipv6 (src-ip X:X::X:X/M |) (dest-ip X:X::X:X/M |))}

```

to

```
(<1-268435453>/<1-4294967294> |) filter {vlan VLAN_RANGE|inner-vlan VLAN_RANGE| cos <0-7> | dest-mac (host XXXX.XXXX.XXXX | XXXX.XXXX.XXXX XXXX.XXXX.XXXX) | src-mac (host XXXX.XXXX.XXXX | XXXX.XXXX.XXXX XXXX.XXXX.XXXX) | frame-type (ETHTYPE | arp (req | resp|) (sender-ip A.B.C.D|) (target-ip A.B.C.D|) | ipv4 (src-ip (A.B.C.D | A.B.C.D/M)|) (dest-ip (A.B.C.D | A.B.C.D/M)|) | ipv6 (src-ip X:X::X:X/M |) (dest-ip X:X::X:X/M |))}
```

Refer to [filter](#) CLI section for more details.

## Abbreviations

Acronym	Expansion
ACL	Access Control List
MAC	Media Access Control
SPAN	Switch Port Analyzer
VLAN	Virtual LAN
VxLAN	Virtual eXtensible Local Area Network

# Cross-Connect (XC) Configuration

## CHAPTER 1 Cross-Connect (XC)

This chapter contains the cross-connect configuration examples to connect the two cross connection ports.

The cross connect is bi-directional. The traffic which is received on the first interface is transmitted out to the second interface and the traffic which is received on the second interface is transmitted out to the first interface.

It is point-to-point and same end points (EP) cannot be used for another cross connect.

The following are the types of end points supported by this port based on cross connect.

1. Native Ethernet interface
2. LAG interface

### Topology

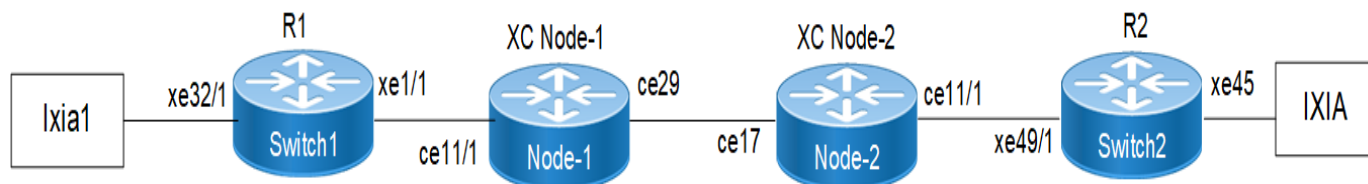


Figure 1-48: Cross-connect Topology-1

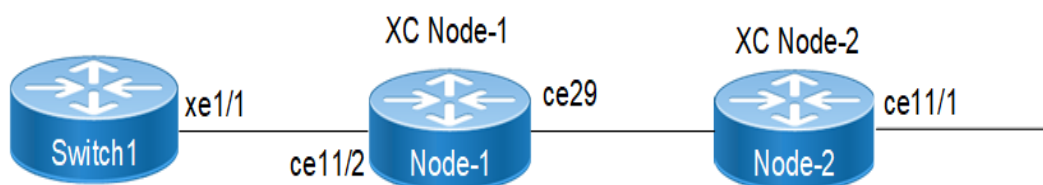


Figure 1-49: Cross-connect Topology-2

### Configuration using Topology-1

The following configuration example will illustrate OSPF, BFD and BGP session establishments via Cross-connect:

**R1**

OcNOS#configure terminal	Enter into configure terminal
OcNOS (config)#hostname R1	Configure the host name
R1 (config)#in xe1/1	Enter into interface level
R1 (config-if)#ip address 10.10.10.1/24	Configure ip address to the interface
R1 (config-if)#exit	Exiting from interface level
R1 (config)#in xe32/1	Enter into interface mode
R1 (config-if)#ip address 20.20.20.1/24	Configure ip address to the interface
R1 (config-if)#exit	Exiting from interface level
R1 (config)#interface lo	Enter into loop-back interface
R1 (config-if)#ip address 1.1.1.1/24 secondary	Configuring secondary ip address
R1 (config-if)#	Exiting the loop-back interface level
R1 (config)#bfd interval 3 minrx 3 multiplier 3	Configuring bfd options
R1 (config)#router ospf 10	Configuring OSPF process
R1 (config-router)#router-id 1.1.1.1	Configuring router-id
R1 (config-router)#network 10.10.10.0 0.0.0.255 area 0	Configuring Network id and Area id
R1 (config-router)#redistribute connected	Configuring redistribute connected
R1 (config-router)#bfd all-interfaces	Configuring bfd on all-interfaces
R1 (config-router)#exit	Exiting the OSPF process
R1 (config)#router bgp 100	Configuring bgp process
R1 (config-router)#neighbor 10.10.10.2 remote-as 200	Configuring neighbor details
R1 (config-router)#end	Exiting from the bgp process

**XC Node-1**

OcNOS#configure terminal	Entering into the configure terminal mode
OcNOS (config)#hostname Xc Node-1	Configuring the hostname
Xc Node-1 (config)#interface ce29	Entering into interface level
Xc Node-1 (config-if)#switchport	Configuring switchport
Xc Node-1 (config-if)#exit	Exiting the interface level
Xc Node-1 (config)#in ce11/1	Entering the interface level
Xc Node-1 (config-if)#switchport	Configuring the switchport
Xc Node-1 (config-if)#exit	Exiting the interface level
Xc Node-1 (config)#cross-connect OSPF_BFD_BGP	Configuring the Cross-connect
Xc Node-1 (config-XC)#ep1 ce11/1 ep2 ce29	Creating endpoints
Xc Node-1 (config-XC)#end	Exiting cross-connect mode

**Xc Node-2**

OcNOS#configure terminal	Entering into the configure terminal mode
OcNOS (config)#hostname Xc Node-2	Configuring the hostname
Xc Node-2 (config)#interface ce17	Entering into interface level
Xc Node-2 (config-if)#switchport	Configuring switchport
Xc Node-2 (config-if)#exit	Exiting the interface level
Xc Node-2 (config)#interface ce11/1	Entering the interface level
Xc Node-2 (config-if)#switchport	Configuring the switchport
Xc Node-2 (config-if)#exit	Exiting the interface level
Xc Node-2 (config)#cross-connect OSPF_BFD_BGP-1	Configuring the Cross-connect
Xc Node-2 (config-XC)#ep1 ce17 ep2 ce11/1	Creating endpoints
Xc Node-2 (config-XC)#end	Exiting cross-connect mode

**R2**

OcNOS#conf terminal	Enter into configure terminal
OcNOS (config)#hostname R2	Configure the host name
R2 (config)#in xe49/1	Enter into interface level
R2 (config-if)#ip address 10.10.10.2/24	Configure ip address to the interface
R2 (config-if)#exit	Exiting from interface level
R2 (config)#int xe45	Enter into interface mode
R2 (config-if)#ip address 30.30.30.1/24	Configure ip address to the interface
R2 (config-if)#exit	Exiting from interface level
R2 (config)#interface lo	Enter into loop-back interface
R2 (config-if)#ip address 2.2.2.2/24 secondary	Configuring secondary ip address
R2 (config-if)#exit	Exiting the loop-back interface level
R2 (config)#bfd interval 3 minrx 3 multiplier 3	Configuring bfd options
R2 (config)#router ospf 10	Configuring OSPF process
R2 (config-router)#router-id 2.2.2.2	Configuring router-id
R2 (config-router)#network 10.10.10.0 0.0.0.255 area 0	Configuring Network id and Area id
R2 (config-router)#redistribute connected	Configuring redistribute connected
R2 (config-router)#bfd all-interfaces	Configuring bfd on all-interfaces
R2 (config-router)#exit	Exiting the OSPF process
R2 (config)#router bgp 200	Configuring bgp process
R2 (config-router)#neighbor 10.10.10.1 remote-as 100	Configuring neighbor details
R2 (config-router)#end	Exiting from the bgp process

**Validation**

## Cross-connect Validation

Xc Node-1#sh cross-connect

cross-connect status

XC name	o-vlan	i-vlan	Ep1	Ep2	Admin-Status
OSPF_BFD_BGP	-	-	cell1/1	ce29	UP

cross-connect summary

Total : 1

Up : 1

Down : 0

Xc Node-1#

Xc Node-1#show running-config cross-connect

cross-connect OSPF\_BFD\_BGP

ep1 cell1/1 ep2 ce29

Xc Node-2#sh cross-connect

cross-connect status

XC name	o-vlan	i-vlan	Ep1	Ep2	Admin-Status
OSPF_BFD_BGP-1	-	-	cel17	cell1/1	UP

cross-connect summary

Total : 1

Up : 1

Down : 0

Xc Node-2#

Xc Node-2#show running-config cross-connect

cross-connect OSPF\_BFD\_BGP-1

ep1 cel17 ep2 cell1/1

## OSPF Validation

R1#show ip ospf neighbor

Total number of full neighbors: 1

OSPF process 10 VRF(default):

Neighbor ID	Pri	State	Dead Time	Address	Interface
2.2.2.2	1	Full/Backup	00:00:37	10.10.10.2	xe1/1

R1#

R2#show ip ospf neighbor

Total number of full neighbors: 1

OSPF process 10 VRF(default):

Neighbor ID	Pri	State	Dead Time	Address	Interface
1.1.1.1	1	Full/Backup	00:00:38	10.10.10.1	xe49/1

0

R2#

**BFD Validation**

R1#show bfd interface xe1/1

Interface: xe1/1 ifindex: 10001 state: UP

Interface level configuration: NO ECHO, NO SLOW TMR

Min Tx: 3 Min Rx: 3 Multiplier: 3

R1#

R1#show bfd session

BFD process for VRF: (DEFAULT VRF)

```
=====
```

Sess-Idx	Remote-Disc	Lower-Layer	Sess-Type	Sess-State	UP-Time	Interface
	Down-Reason	Remote-Addr				
1	1	IPv4	Single-Hop	Up	00:02:54	xe1/1
	NA	10.10.10.2/32				

Number of Sessions: 1

R1#show bfd session

BFD process for VRF: (DEFAULT VRF)

```
=====
```

Sess-Idx	Remote-Disc	Lower-Layer	Sess-Type	Sess-State	UP-Time	Interface
	Down-Reason	Remote-Addr				
1	1	IPv4	Single-Hop	Up	00:02:54	xe1/1
	NA	10.10.10.2/32				

Number of Sessions: 1

R1#show bfd session detail

BFD process for VRF: (DEFAULT VRF)

```
=====
```

Session Interface Index : 10001	Interface name :xe1/1
Session Index : 1	
Lower Layer : IPv4	Version : 1
Session Type : Single Hop	Session State : Up
Local Discriminator : 1	Local Address : 10.10.10.1/32
Remote Discriminator : 1	Remote Address : 10.10.10.2/32
Local Port : 49152	Remote Port : 3784
Options :	

Diagnostics : None



## Timers in Milliseconds :

Min Tx: 3                      Min Rx: 3                      Multiplier: 3  
Neg Tx: 3                      Neg Rx: 3                      Neg detect mult: 3  
Min echo Tx: 1000              Min echo Rx: 1000              Neg echo intrvl: 0  
Storage type : 2  
Sess down time : 00:00:00  
Sess Down Reason : NA  
Bfd GTSM Disabled  
Bfd Authentication Disabled

## Counters values:

Pkt In : 000000000000000117138              Pkt Out : 000000000000000117172  
Pkts Drop : 000000000000000000000000              Auth Pkts Drop : 000000000000000000000000  
Echo Out : 000000000000000000000000              IPv6 Echo Out : 000000000000000000000000  
IPv6 Pkt In : 000000000000000000000000              IPv6 Pkt Out : 000000000000000000000000  
UP Count : 1                      UPTIME : 00:05:42

## Protocol Client Info:

OSPF-> Client ID: 4              Flags: 4

-----  
Number of Sessions:      1  
R1#

## R2#show bfd interface xe49/1

Interface:      xe49/1   ifindex: 10049 state:    UP  
Interface level configuration: NO ECHO, NO SLOW TMR  
Min Tx: 3   Min Rx: 3   Multiplier: 3

## R2#show bfd session

BFD process for VRF: (DEFAULT VRF)

=====

Sess-Idx	Remote-Disc	Lower-Layer	Sess-Type	Sess-State	UP-Time	Interface
	Down-Reason	Remote-Addr				
1	1	IPv4	Single-Hop	Up	00:04:12	xe49/1
	NA	10.10.10.1/32				

Number of Sessions:      1

## R2#sh bfd session detail

BFD process for VRF: (DEFAULT VRF)

=====

Session Interface Index : 10049	Interface name :xe49/1
Session Index : 1	
Lower Layer : IPv4	Version : 1
Session Type : Single Hop	Session State : Up
Local Discriminator : 1	Local Address : 10.10.10.2/32
Remote Discriminator : 1	Remote Address : 10.10.10.1/32

Local Port : 49152 Remote Port : 3784  
Options :

Diagnostics : None

Timers in Milliseconds :

Min Tx: 3	Min Rx: 3	Multiplier: 3
Neg Tx: 3	Neg Rx: 3	Neg detect mult: 3
Min echo Tx: 1000	Min echo Rx: 1000	Neg echo intrvl: 0
Storage type : 2		
Sess down time : 00:00:00		
Sess Down Reason : NA		
Bfd GTSM Disabled		
Bfd Authentication Disabled		

Counters values:

Pkt In : 000000000000000044905	Pkt Out : 000000000000000044905
Pkts Drop : 00000000000000000000	Auth Pkts Drop : 00000000000000000000
Echo Out : 00000000000000000000	IPv6 Echo Out : 00000000000000000000
IPv6 Pkt In : 00000000000000000000	IPv6 Pkt Out : 00000000000000000000
UP Count : 1	UPTIME : 00:02:11

Protocol Client Info:

OSPF-> Client ID: 4 Flags: 4

-----  
Number of Sessions: 1

## BGP Validation

R1#sh bgp neighbors

BGP neighbor is 10.10.10.2, remote AS 200, local AS 100, external link  
BGP version 4, local router ID 10.10.10.1, remote router ID 2.2.2.2  
BGP state = Established, up for 00:04:00  
Last read 00:00:08, hold time is 90, keepalive interval is 30 seconds  
Neighbor capabilities:  
Route refresh: advertised and received (old and new)  
Address family IPv4 Unicast: advertised and received  
Received 11 messages, 0 notifications, 0 in queue  
Sent 12 messages, 0 notifications, 0 in queue  
Route refresh request: received 0, sent 0  
Minimum time between advertisement runs is 30 seconds  
For address family: IPv4 Unicast  
BGP table version 1, neighbor version 1  
Index 1, Offset 0, Mask 0x2  
Community attribute sent to this neighbor (both)  
0 accepted prefixes  
0 announced prefixes

Connections established 1; dropped 0  
Local host: 10.10.10.1, Local port: 179

```

Foreign host: 10.10.10.2, Foreign port: 58033
Nexthop: 10.10.10.1
Nexthop global: ::
Nexthop local: ::
BGP connection: non shared network

```

```

R2#sh ip bgp neighbors
BGP neighbor is 10.10.10.1, remote AS 100, local AS 200, external link
  BGP version 4, local router ID 2.2.2.2, remote router ID 10.10.10.1
  BGP state = Established, up for 00:00:03
  Last read 00:00:03, hold time is 90, keepalive interval is 30 seconds
  Neighbor capabilities:
    Route refresh: advertised and received (old and new)
    Address family IPv4 Unicast: advertised and received
  Received 2 messages, 0 notifications, 0 in queue
  Sent 2 messages, 0 notifications, 0 in queue
  Route refresh request: received 0, sent 0
  Minimum time between advertisement runs is 30 seconds
For address family: IPv4 Unicast
  BGP table version 1, neighbor version 1
  Index 1, Offset 0, Mask 0x2
  Community attribute sent to this neighbor (both)
  0 accepted prefixes
  0 announced prefixes

  Connections established 1; dropped 0
Local host: 10.10.10.2, Local port: 58033
Foreign host: 10.10.10.1, Foreign port: 179
Nexthop: 10.10.10.2
Nexthop global: ::
Nexthop local: ::
BGP connection: non shared network
R2#

```

### Show interface counters

```
R1#sh interface counters rate gbps
```

Interface	Rx gbps	Rx pps	Tx gbps	Tx pps
xe1/1	6.91	13082945	6.91	13082949
xe32/1	6.91	13082325	6.91	13082325

```
R1#
```

```
Xc Node-1#sh interface counters rate gbps
```

Interface	Rx gbps	Rx pps	Tx gbps	Tx pps
cell/1	6.91	13082437	6.91	13082437

```

ce29          6.91          13082457          6.91          13082458
Xc Node-1#
Xc Node-1# sh cross-connect
cross-connect status
XC name          o-vlan i-vlan Ep1          Ep2          Admin-Status
-----+-----+-----+-----+-----+-----+
OSPF_BFD_BGP      -      -      cell1/1          ce29          UP
-----+-----+-----+-----+-----+
cross-connect summary
Total : 1
Up    : 1
Down  : 0
Xc Node-1#

Xc Node-2#sh interface counters rate gbps
+-----+-----+-----+-----+-----+
| Interface | Rx gbps | Rx pps | Tx gbps | Tx pps |
+-----+-----+-----+-----+-----+
cell1/1      6.91    13082428  6.91    13082429
cel7         6.91    13082381  6.91    13082378

Xc Node-2#sh cross-connect
cross-connect status
XC name          o-vlan i-vlan Ep1          Ep2          Admin-Status
-----+-----+-----+-----+-----+
OSPF_BFD_BGP-1    -      -      cel7         cel11/1      UP
-----+-----+-----+-----+-----+
cross-connect summary
Total : 1
Up    : 1
Down  : 0
Xc Node-2#

R2#sh interface counters rate gbps
+-----+-----+-----+-----+-----+
| Interface | Rx gbps | Rx pps | Tx gbps | Tx pps |
+-----+-----+-----+-----+-----+
xe45         6.91    13081988  6.91    13081988
xe49/1       6.91    13082339  6.91    13082339
R2#

```

## Configuration using Topology-2

The following configuration example illustrates configuration of cross-connect using LAG interfaces on Xc Node:

**Configuration on R1 Node**

R1# configure terminal	Enter configure mode
R1(config)#interface po100	Creating port channel interface
R1(config-if)#exit	Exit the interface level
R1(config)#interface xe1/1	Enter interface level
R1(config-if)# channel-group 100 mode active	Adding member port to the port channel interface
R1(config-if)#exit	Exit the interface level
R1(config)#interface xe1/2	Enter interface level
R1(config-if)# channel-group 100 mode active	Adding member port to the port channel interface
R1(config-if)#exit	Exit the interface level

**Configuring Cross connect using dynamic lag interfaces on XC\_node1**

XC_node1# configure terminal	Enter configure mode
XC_node1(config)#interface po100	Creating port channel interface
XC_node1(config-if)#switchport	Configuring Switchport to the interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#interface po200	Creating port channel interface
XC_node1(config-if)#switchport	Configuring Switchport to the interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#interface ce11/1	Enter interface level
XC_node1(config-if)# channel-group 100 mode active	Adding member port to the port channel interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#interface ce11/2	Enter interface level
XC_node1(config-if)# channel-group 100 mode active	Adding member port to the port channel interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#interface ce29	Enter interface level
XC_node1(config-if)# channel-group 200 mode active	Adding member port to the port channel interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#interface ce30	Enter interface level
XC_node1(config-if)# channel-group 200 mode active	Adding member port to the port channel interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#cross-connect lag	Create cross-connect by providing the name
XC_node1(config-XC)#ep1 po100 ep2 po200	Adding end-points ep1 and ep2 as lag interfaces
XC_node1(config-XC)#exit	Exit Cross-connect mode
XC_node1(config)#exit	Exit Configure terminal mode

## Configuring Cross connect using dynamic lag interfaces on XC\_node2

XC_node2# configure terminal	Enter configure mode
XC_node2(config)#interface po200	Creating port channel interface
XC_node2(config-if)#switchport	Configuring Switchport to the interface
XC_node2(config-if)#exit	Exit the interface level
XC_node2(config)#interface ce29	Enter interface level
XC_node2(config-if)# channel-group 200 mode active	Adding member port to the port channel interface
XC_node2(config-if)#exit	Exit the interface level
XC_node2(config)#interface ce30	Enter interface level
XC_node2(config-if)# channel-group 200 mode active	Adding member port to the port channel interface
XC_node2(config-if)#exit	Exit the interface level
XC_node2(config)#interface ce11/1	Enter interface level
XC_node2(config-if)#Switchport	Configure switchport to the interface
XC_node2(config-if)#exit	Exit the interface level
XC_node2(config)#cross-connect lag	Create cross-connect by providing the name
XC_node2(config-XC)#ep1 po100 ep2 ce11/1	Adding end-points ep1 and ep2 as lag interfaces
XC_node2(config-XC)#exit	Exit Cross-connect mode
XC_node2(config)#exit	Exit Configure terminal mode

## Validation

### Cross-connect using Dynamic lag on XC\_node1

```

XC_node1#sh cross-connect
cross-connect status
XC name          o-vlan i-vlan Ep1                Ep2                Admin-Status
-----+-----+-----+-----+-----+-----+-----
lag              -      -      po100            po200              UP
-----+-----+-----+-----+-----+-----+-----

cross-connect summary
Total : 1
Up    : 1
Down  : 0

XC_node1#sh running-config cross-connect
!
cross-connect lag
  ep1 po100 ep2 po200
!
XC_node1#sh etherchannel summary
  Aggregator po100 100100
  Aggregator Type: Layer2
  Admin Key: 0100 - Oper Key 0100

```

Link: ce11/1 (5073) sync: 1

Link: ce11/2 (5074) sync: 1

-----  
 Aggregator po200 100200

Aggregator Type: Layer2

Admin Key: 0200 - Oper Key 0200

Link: ce30 (5005) sync: 1

Link: ce29 (5006) sync: 1

## Cross-connect using Dynamic lag on XC\_node2

XC\_node2#sh cross-connect

cross-connect status

XC name	o-vlan	i-vlan	Ep1	Ep2	Admin-Status
lag	-	-	po200	ce11/1	UP

cross-connect summary

Total : 1

Up : 1

Down : 0

XC Node-2#show running-config cross-connect

!

cross-connect lag

ep1 po200 ep2 ce11/1

XC Node-2#sh etherchannel summary

Aggregator po200 100200

Aggregator Type: Layer2

Admin Key: 0200 - Oper Key 0200

Link: ce18 (5009) sync: 1

Link: ce17 (5010) sync: 1

## Configuring Cross connect using Static lag interfaces

### Configuration on R1 Node

R1# configure terminal	Enter configure mode
R1(config)#interface sa100	Creating Static lag interface
R1(config-if)#exit	Exit the interface level
R1(config)#interface xe1/1	Enter interface level
R1(config-if)# static-channel-group 100	Adding member port to the static lag interface
R1(config-if)#exit	Exit the interface level
R1(config)#interface xe1/2	Enter interface level
R1(config-if)# static-channel-group 100	Adding member port to the static lag interface
R1(config-if)#exit	Exit the interface level

### Configuring Cross connect using static lag interfaces on XC\_node1

XC_node1# configure terminal	Enter configure mode
XC_node1(config)#interface sa100	Creating static lag interface
XC_node1(config-if)#switchport	Configuring Switchport to the interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#interface sa200	Creating static lag interface
XC_node1(config-if)#switchport	Configuring Switchport to the interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#interface ce11/1	Enter interface level
XC_node1(config-if)# static-channel-group 100	Adding member port to the static lag interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#interface ce11/2	Enter interface level
XC_node1(config-if)# static-channel-group 100	Adding member port to the static interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#interface ce29	Enter interface level
XC_node1(config-if)# static-channel-group 200	Adding member port to the static lag interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#interface ce30	Enter interface level
XC_node1(config-if)# static-channel-group 200	Adding member port to the static lag interface
XC_node1(config-if)#exit	Exit the interface level
XC_node1(config)#cross-connect static-lag	Create cross-connect by providing the name
XC_node1(config-XC)#ep1 sa100 ep2 sa200	Adding end-points ep1 and ep2 as lag interfaces
XC_node1(config-XC)#exit	Exit Cross-connect mode
XC_node1(config)#exit	Exit Configure terminal mode



## Configuring Cross connect using static lag interfaces on XC\_node2

XC_node2# configure terminal	Enter configure mode
XC_node2(config)#interface sa200	Creating static lag interface
XC_node2(config-if)#switchport	Configuring Switchport to the interface
XC_node2(config-if)#exit	Exit the interface level
XC_node2(config)#interface ce29	Enter interface level
XC_node2(config-if)# static-channel-group 200	Adding member port to the static lag interface
XC_node2(config-if)#exit	Exit the interface level
XC_node2(config)#interface ce30	Enter interface level
XC_node2(config-if)# static-channel-group 200	Adding member port to the static lag interface
XC_node2(config-if)#exit	Exit the interface level
XC_node2(config)#interface ce11/1	Enter interface level
XC_node2(config-if)#Switchport	Configure switchport to the interface
XC_node2(config-if)#exit	Exit the interface level
XC_node2(config)#cross-connect static-lag	Create cross-connect by providing the name
XC_node2(config-XC)#ep1 po200 ep2 ce11/1	Adding end-points ep1 and ep2 interfaces
XC_node2(config-XC)#exit	Exit Cross-connect mode
XC_node2(config)#exit	Exit Configure terminal mode

## Validation

### Cross-connect using Static Lag on XC\_node1

```
XC_node1#sh cross-connect
cross-connect status
XC name          o-vlan i-vlan Ep1          Ep2          Admin-Status
-----+-----+-----+-----+-----+-----+
static-lag       -      -      sa100        sa200        UP
-----+-----+-----+-----+-----+
cross-connect summary
Total : 1
Up    : 1
Down  : 0
```

### Cross-connect using Static Lag on XC\_node2

```
XC_node2#sh cross-connect
cross-connect status
XC name          o-vlan i-vlan Ep1          Ep2          Admin-Status
-----+-----+-----+-----+-----+
static-lag       -      -      sa200        ce11/1       UP
-----+-----+-----+-----+-----+
```

```
cross-connect summary
```

```
Total : 1
Up      : 1
Down    : 0
```

### Disable the Cross-connect on XC node1

Xc Node-1# configure terminal	Enter configure mode
Xc Node-1(config)#cross-connect lag	Enter into cross-connect mode
Xc Node-1(config-XC)#disable	Disabling the cross-connect
Xc Node-1(config-XC)# exit	Exit the cross-connect

### Validation

#### Disable the cross-connect on XC node1

```
Xc Node-1#sh cross-connect
```

```
cross-connect status
```

XC name	o-vlan	i-vlan	Ep1	Ep2	Admin-Status
lag	-	-	po100	po200	DOWN

```
cross-connect summary
```

```
Total : 1
Up      : 0
Down    : 1
```

### Enable the Cross-connect XC\_node1

Xc Node-1# configure terminal	Enter configure mode
Xc Node-1(config)#cross-connect lag	Enter into cross-connect mode
Xc Node-1(config-XC)#no disable	Enable the cross-connect
Xc Node-1(config-XC)#exit	Exit the cross-connect

### Validation

#### Cross-connect after enable on XC\_node1

```
Xc Node-1#sh cross-connect
```

```
cross-connect status
```

XC name	o-vlan	i-vlan	Ep1	Ep2	Admin-Status
lag	-	-	po100	po200	UP

```
cross-connect summary
```

```
Total : 1
Up      : 1
Down    : 0
```

## CHAPTER 2 Cross-Connect (XC) Resiliency

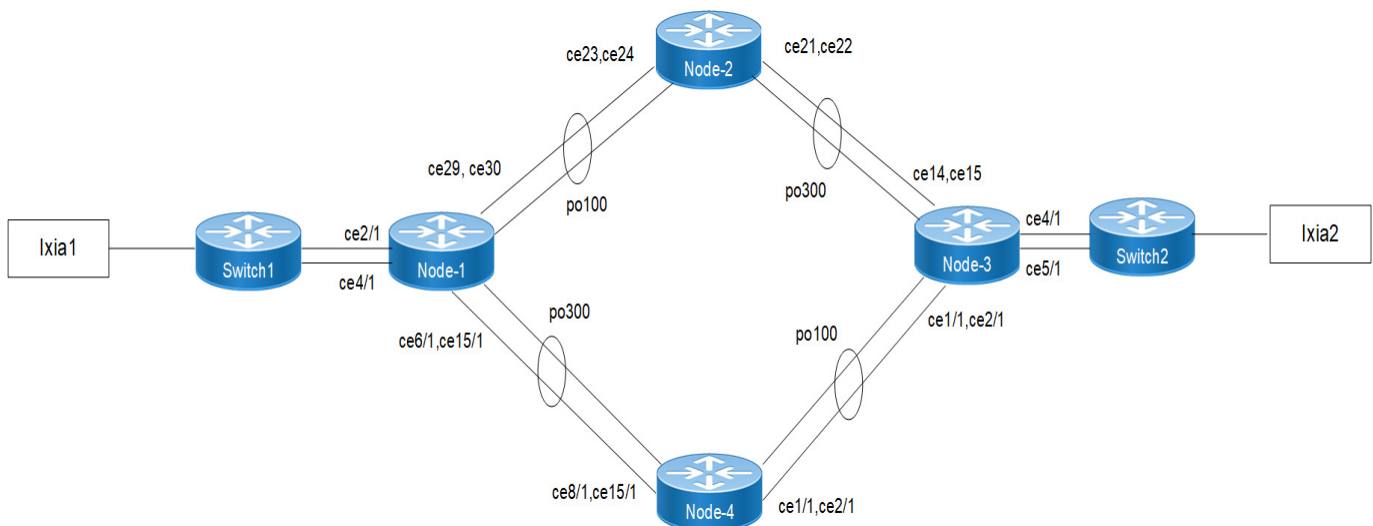
This Chapter contains the cross-connect resiliency configuration example.

This feature provides resiliency support for port level cross connect when primary link goes down. Whenever, any of the endpoint (EP) of cross-connect goes down, pre-configured backup EP will be chosen and cross-connect will be up with backup EP. Same backup EP cannot be used in another cross-connect link.

The following are the types of EPs supported as backup EPs.

1. Native Ethernet interface
2. LAG interface

### Topology



**Figure 2-50: Cross-connect Resiliency Topology**

### LFPT (Link-Fault-Pass-Through)

If one endpoint goes down, other endpoint of the link is notified and port status is shown as DOWN.

**Example:** If po100 interface of Node-1 goes down, then Node-2 will inform to Node-3 via LFPT to down the po300 interface.

### Revertive

When primary EP comes up, then traffic need to switch from backup EP to Primary EP.

**Example:** Suppose po100 is down on Node-1, the traffic flow is send to backup EP po300. Whenever the po100 comes up on Node-1 then the traffic flow is switched from backup EP po300 to primary EP po100.

**Node-1**

#configure terminal	Enter configure mode
(config)#hostname Node-1	Configure the hostname
(config)#interface po100	Create port channel interface
(config-if)#switchport	Configure switchport on LAG port
(config-if)#exit	Exit the interface level
(config)#interface ce29	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce30	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface po300	Create port channel interface
(config-if)#switchport	Configure switchport on LAG interface
(config-if)#exit	Exit the interface level
(config)#interface ce6/1	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce15/1	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce2/1	Enter interface level
(config-if)#switchport	Configure switchport
(config)#interface ce4/1	Enter interface level
(config-if)#switchport	Configure switchport
(config-if)#exit	Exit the interface level
(config)#cross-connect sample	Create cross-connect by providing the name
(config-XC)#ep1 po100 ep2 ce2/1	Add end-points end-point1 and end-point2
(config-XC)#backup ep1 po300	Add backup end-point1
(config-XC)#backup ep2 ce4/1	Add backup end-point2
(config-XC)#cross-connect switchover type revertive	Configure revertive mode
(config-XC)#link-fault-pass-through enable	Configure LFPT

**Node-2**

#configure terminal	Enter configure mode
(config)#hostname Node-2	Configure the hostname
(config)#interface po100	Create port channel interface
(config-if)#switchport	Configure switchport on LAG port
(config-if)#exit	Exit the interface level
(config)#interface ce23	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce24	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface po300	Create port channel interface
(config-if)#switchport	Configure switchport on LAG interface
(config-if)#exit	Exit the interface level
(config)#interface ce21	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce22	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#cross-connect sample2	Create cross-connect by providing the name
(config-XC)#ep1 po100 ep2 po300	Add end-points end-point1 and end-point2
(config-XC)#link-fault-pass-through enable	Configure LFPT

**Node-3**

#configure terminal	Enter configure mode
(config)#hostname Node-3	Configure the hostname
(config)#interface po300	Create port channel interface
(config-if)#switchport	Configure switchport on LAG port
(config-if)#exit	Exit the interface level
(config)#interface ce13	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level

(config)#interface ce14	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface po100	Create port channel interface
(config-if)#switchport	Configure switchport on LAG interface
(config-if)#exit	Exit the interface level
(config)#interface ce1/1	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce2/1	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce4/1	Enter interface level
(config-if)#switchport	Configure switchport
(config)#interface ce5/1	Enter interface level
(config-if)#switchport	Configure switchport
(config-if)#exit	Exit the interface level
(config)#cross-connect sample3	Create cross-connect by providing the name
(config-XC)#ep1 po300 ep2 ce4/1	Add end-points end-point1 and end-point2
(config-XC)#backup ep1 po100	Add backup end-point1
(config-XC)#backup ep2 ce5/1	Add backup end-point2
(config-XC)#cross-connect switchover type revertive	Configure revertive mode
(config-XC)#link-fault-pass-through enable	Configure LFPT

## Node-4

#configure terminal	Enter configure mode
(config)#hostname Node-4	Configure the hostname
(config)#interface po100	Create port channel interface
(config-if)#switchport	Configure switchport on LAG port
(config-if)#exit	Exit the interface level
(config)#interface ce1/1	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce2/1	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short

(config-if)#exit	Exit the interface level
(config)#interface po300	Create port channel interface
(config-if)#switchport	Configure switchport on LAG interface
(config-if)#exit	Exit the interface level
(config)#interface ce8/1	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce15/1	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#cross-connect sample4	Create cross-connect by providing the name
(config-XC)#ep1 po300 ep2 po100	Add end-points end-point1 and end-point2
(config-XC)#link-fault-pass-through enable	Configure LFPT

## Validation

### Cross-connect using Dynamic LAG on Node-1

```

Node-1#sh etherchannel summary
  Aggregator po100 100100
  Aggregator Type: LayeNode-2
  Admin Key: 0100 - Oper Key 0100
    Link: ce29 (5073) sync: 1
    Link: ce30 (5074) sync: 1
-----
  Aggregator po300 100300
  Aggregator Type: LayeNode-2
  Admin Key: 0300 - Oper Key 0300
    Link: ce6/1 (5005) sync: 1
    Link: ce15/1 (5006) sync: 1

Node-1#sh running-config cross-connect
!
cross-connect sample
ep1 po100 ep2 ce2/1
cross-connect switchover type revertive
link-fault-pass-through enable
backup ep1 po300
backup ep2 ce4/1
!

Node-1#sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
      * - Active Endpoint, none - not configured
Cross-connect name : sample

```

```

EP1:po100      EP2:ce2/1      Revertive:Yes      Bkp_EP1:po300      Bkp_EP2:ce4/1
Admin Status:UP      Oper Status:UP
=====
+=====+
| EP      | OVID    | IVID    | Rx packets  | Rx bytes    | Tx packets  | Tx bytes
|Interface Status|
+=====+
=====+
| EP1*    | -      | -      | 0           | 0           | 5974137342
|764688374912 |UP      |
| EP2*    | -      | -      | 5973605019  | 764619747456 | 0           | 0
|UP       |
| bkp_EP1 | -      | -      | 5973879754  | 764654827904 | 0           | 0
|UP       |
| bkp_EP2 | -      | -      | 0           | 0           | 0           | 0
|UP       |
+=====+
=====+

```

#### cross-connect summary

```

Total XC      : 1
Admin Up      : 1
Admin Down    : 0
Total Rules   : 1

```

### Cross-connect using Dynamic LAG on Node-2

```

Node-2#sh etherchannel summary
  Aggregator po100 100100
  Aggregator Type: LayeNode-2
  Admin Key: 0100 - Oper Key 0100
    Link: ce23 (5067) sync: 1
    Link: ce24 (5068) sync: 1

```

```

-----
  Aggregator po300 100300
  Aggregator Type: LayeNode-2
  Admin Key: 0300 - Oper Key 0300
    Link: ce21 (5063) sync: 1
    Link: ce22 (5064) sync: 1

```

```

Node-2#show running-config cross-connect

```

```

!
cross-connect sample2
!
cross-connect sample2
  ep1 po100 ep2 po300
  link-fault-pass-through enable
!

```

```

Node-2#sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
      * - Active Endpoint, none - not configured
Cross-connect name : sample2

```



```

EP1:po100      EP2:po300      Revertive:No      Bkp_EP1:None      Bkp_EP2:None
Admin Status:UP      Oper Status:UP
=====
| EP      | OVID    | IVID     | Rx packets  | Rx bytes    | Tx packets  | Tx bytes
|Interface Status|
=====
| EP1*    | -       | -        | 3710        | 470780      | 723         | 90626
|UP       |         |          |             |             |             |
| EP2*    | -       | -        | 72          | 6468        | 14          | 1548
|UP       |         |          |             |             |             |
=====

```

#### cross-connect summary

```

Total XC      : 1
Admin Up      : 1
Admin Down    : 0
Total Rules   : 1

```

### Cross-connect using Dynamic LAG on Node-3

```

Node-3#sh etherchannel summary
  Aggregator po100 100100
  Aggregator Type: LayeNode-2
  Admin Key: 0100 - Oper Key 0100
    Link: ce1/1 (5005) sync: 1
    Link: ce2/1 (5006) sync: 1

```

```

-----
  Aggregator po300 100300
  Aggregator Type: LayeNode-2
  Admin Key: 0300 - Oper Key 0300
    Link: ce13 (5011) sync: 1
    Link: ce14 (5012) sync: 1

```

```
Node-3#sh running-config cross-connect
```

```

!
cross-connect sample3
  ep1 po300 ep2 ce4/1
  cross-connect switchover type revertive
  link-fault-pass-through enable
  backup ep1 po100
  backup ep2 ce5/1
!

```

```
Node-3#sh cross-connect
```

```

Codes: EP - Endpoint, Bkp_EP - Backup endpoint
      * - Active Endpoint, none - not configured

```

```
Cross-connect name : sample3
```

```

EP1:po300      EP2:ce4/1      Revertive:Yes      Bkp_EP1:po100      Bkp_EP2:ce5/1
Admin Status:UP      Oper Status:UP

```

```

+=====+
=====+
| EP      | OVID    | IVID    | Rx packets | Rx bytes   | Tx packets | Tx bytes
|Interface Status|
+=====+
=====+
| EP1*    | -       | -       | 201        | 13536      | 83318167485
|10664725404928 |UP      |
| EP2*    | -       | -       | 93501105144 | 11968141426060 | 2          | 128
|UP       |
| bkp_EP1 | -       | -       | 0          | 0          | 10171776397
|1301987373312 |UP      |
| bkp_EP2 | -       | -       | 93501187674 | 11968152089344 | 0          | 0
|UP       |
+=====+
=====+

```

#### cross-connect summary

```

Total XC      : 1
Admin Up      : 1
Admin Down    : 0
Total Rules   : 1

```

### Cross-connect using Dynamic LAG on Node-4

Node-4#sh etherchannel summary

```

Aggregator po100 100100
Aggregator Type: LayeNode-2
Admin Key: 0100 - Oper Key 0100
  Link: ce1/1 (5005) sync: 1
  Link: ce2/1 (5006) sync: 1

```

```

-----
Aggregator po300 100300
Aggregator Type: LayeNode-2
Admin Key: 0300 - Oper Key 0300
  Link: ce8/1 (5009) sync: 1
  Link: ce15/1 (5012) sync: 1

```

Node-4#sh running-config cross-connect

```

!
cross-connect sample4
ep1 po300 ep2 po100
link-fault-pass-through enable
!

```

### Disable the Cross-connect on Node-1

#configure terminal	Enter configure mode
(config)#cross-connect sample	Enter into cross-connect mode
(config-XC)#disable	Disabling the cross-connect
(config-XC)#exit	Exit the cross-connect

**Validation****Disable the cross-connect on Node-1**

```

Node-1#sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
      * - Active Endpoint, none - not configured
Cross-connect name : sample
EP1:po100      EP2:ce2/1      Revertive:Yes      Bkp_EP1:po300      Bkp_EP2:ce4/1
Admin Status:DOWN      Oper Status:DOWN
+=====+
| EP      | OVID    | IVID    | Rx packets  | Rx bytes    | Tx packets  | Tx bytes
|Interface Status|
+=====+
| EP1*    | -       | -       | 0           | 0           | 5974137342
|764688374912 |UP
| EP2*    | -       | -       | 5973605019  | 764619747456 | 0           | 0
|UP
| bkp_EP1 | -       | -       | 5973879754  | 764654827904 | 0           | 0
|UP
| bkp_EP2 | -       | -       | 0           | 0           | 0           | 0
|UP
+=====+

cross-connect summary
Total XC      : 1
Admin Up      : 0
Admin Down    : 1
Total Rules   : 0

```

**Enable the Cross-connect Node-1**

#configure terminal	Enter configure mode
(config)#cross-connect sample	Enter into cross-connect mode
(config-XC)#no disable	Enable the cross-connect
(config-XC)#exit	Exit the cross-connect

**Validation****Cross-connect after enable on Node-1**

```

Node-1#sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
      * - Active Endpoint, none - not configured
Cross-connect name : sample
EP1:po100      EP2:ce2/1      Revertive:Yes      Bkp_EP1:po300      Bkp_EP2:ce4/1
Admin Status:UP      Oper Status:UP
+=====+
| EP      | OVID    | IVID    | Rx packets  | Rx bytes    | Tx packets  | Tx bytes
|Interface Status|
+=====+

```

## CHAPTER 3 CFM over xConnect Configuration

This chapter contains a complete example of CFM over xConnect configuration.

The main objective of this feature is to achieve L2 resiliency using CFM over xConnect where the traffic is switched to the next available link within xConnect when CFM detects errors or link failure on the monitored link in DC platforms.

### Topology

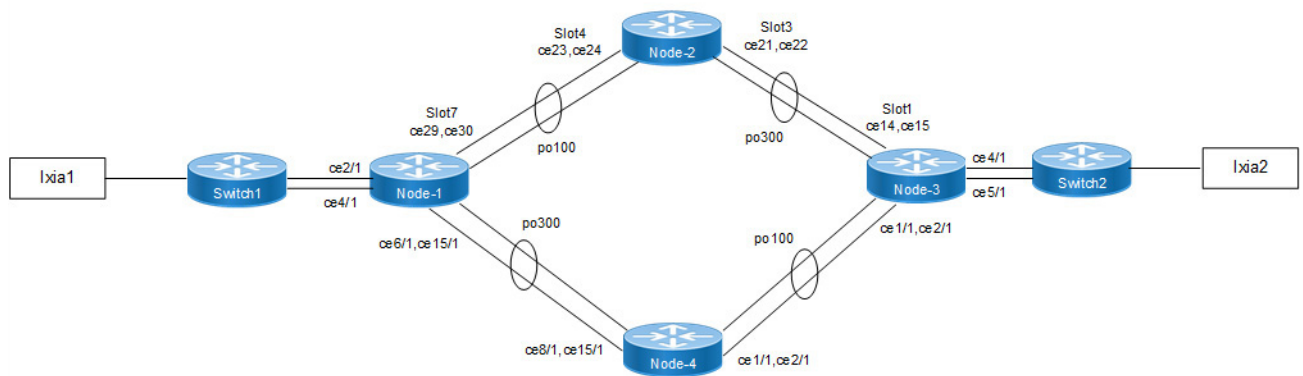


Figure 3-51: CFM over xConnect Topology

### Configuration

#### Node-1

#configure terminal	Enter configure mode
(config)# hostname Node-1	Configure the hostname.
(config)#interface po100	Create port channel interface.
(config-if)#switchport	Configure switchport on LAG port
(config-if)#exit	Exit the interface level
(config)#interface ce29	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface.
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce30	Enter interface level

(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface po300	Create port channel interface
(config-if)#switchport	Configure switchport on LAG interface
(config-if)#exit	Exit the interface level
(config)#interface ce6/1	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce15/1	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce2/1	Enter interface level
(config-if)#switchport	Configure switchport
(config)#interface ce4/1	Enter interface level
(config-if)#switchport	Configure switchport
(config-if)#exit	Exit the interface level
(config)#cross-connect xc1	Create cross-connect by providing the name
(config-XC)#ep1 po100 ep2 ce2/1	Add end-points end-point1 and end-point2
(config-XC)#backup ep1 po300	Add backup end-point1
(config-XC)#backup ep2 ce4/1	Add backup end-point2
(config-XC)#exit	Exit XC mode
(config)#ethernet cfm domain-type character-string domain-name mdnam1 level 0 mip-creation none	Create CFM domain with type as character string with level 0 and set MIP creation criteria to none.
(config-ether-cfm)#service ma-type string ma-name test1	Create ma type as string
(config-ether-cfm-ma)#link-level-ma	Configure link-level-ma
(config-ether-cfm-ma)#ethernet cfm mep down mpid 1 active true po100	Create down MEP for local-VID on po100
(config-ether-cfm-ma-mep)#cc multicast state enable	Enable cc multicast
(config-ether-cfm-ma-mep)#exit-ether-ma-mep-mode	Exit ethernet cfm ma-mep mode
(config-ether-cfm-ma)#mep crosscheck mpid 2	Configure crosscheck to remote MEP
(config-ether-cfm-ma)#cc interval 10ms	Enable cc interval for 10 millisecond
(config-ether-cfm-ma)#exit-ether-ma-mode	Exit ethernet ma mode
(config-ether-cfm)#exit	Exit ethernet CFM mode
(config)#ethernet cfm domain-type character-string domain-name mdnam2 level 0 mip-creation none	Create CFM domain with type as character string with level 0 and set MIP creation criteria to none.

(config-ether-cfm)#service ma-type string ma-name test2	Create MA type as string
(config-ether-cfm-ma)#link-level-ma	Configure link-level-ma
(config-ether-cfm-ma)#ethernet cfm mep down mpid 3 active true po300	Create down MEP for local-VID on po300
(config-ether-cfm-ma-mep)#cc multicast state enable	Enable CC multicast
(config-ether-cfm-ma-mep)#exit-ether-ma- mep-mode	Exit ethernet CFM MA-MEP mode
(config-ether-cfm-ma)#mep crosscheck mpid 4	Configure crosscheck to remote MEP
(config-ether-cfm-ma)#cc interval 10ms	Enable CC interval for 10 millisecond
(config-ether-cfm-ma)#exit-ether-ma-mode	Exit ethernet MA mode
(config-ether-cfm)#exit	Exit ethernet CFM mode

## Node-2

#configure terminal	Enter configure mode
(config)#hostname Node-2	Configure the hostname
(config)#interface po100	Create port channel interface
(config-if)#switchport	Configure switchport on LAG port
(config-if)#exit	Exit the interface level
(config)#interface ce23	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level.
(config)#interface ce24	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface po300	Create port channel interface
(config-if)#switchport	Configure switchport on LAG interface
(config-if)#exit	Exit the interface level
(config)#interface ce21	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce22	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#cross-connect xc1	Create cross-connect by providing the name
(config-XC)#ep1 po100 ep2 po300	Add end-points end-point1 and end-point2

**Node-3**

#configure terminal	Enter configure mode
(config)#hostname Node-3	Configure the hostname
(config)#interface po300	Create port channel interface
(config-if)#switchport	Configure switchport on LAG port
(config-if)#exit	Exit the interface level
(config)#interface ce13	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level.
(config)#interface ce14	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface po100	Create port channel interface
(config-if)#switchport	Configure switchport on LAG interface
(config-if)#exit	Exit the interface level
(config)#interface ce1/1	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce2/1	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce4/1	Enter interface level
(config-if)#switchport	Configure switchport
(config)#interface ce5/1	Enter interface level
(config-if)#switchport	Configure switchport
(config-if)#exit	Exit the interface level
(config)#cross-connect xc1	Create cross-connect by providing the name
(config-XC)#ep1 po300 ep2 ce4/1	Add end-points end-point1 and end-point2
(config-XC)#backup ep1 po100	Add backup end-point1
(config-XC)#backup ep2 ce5/1	Add backup end-point2
(config-XC)#exit	Exit XC mode
(config)#ethernet cfm domain-type character-string domain-name mdnam1 level 0 mip-creation none	Create cfm domain with type as character string with level 0 and set mip creation criteria to none.
(config-ether-cfm)#service ma-type string ma-name test1	Create ma type as string
(config-ether-cfm-ma)#link-level-ma	Configure link-level-ma

(config-ether-cfm-ma)#ethernet cfm mep down mpid 2 active true po300	Create down mep for local-vid on po100
(config-ether-cfm-ma-mep)#cc multicast state enable	Enable cc multicast
(config-ether-cfm-ma-mep)#exit-ether-ma-mep-mode	Exit ethernet cfm ma-mep mode
(config-ether-cfm-ma)#mep crosscheck mpid 1	Configure crosscheck to remote MEP
(config-ether-cfm-ma)#cc interval 10ms	Enable cc interval for 10 millisecond
(config-ether-cfm-ma)#exit-ether-ma-mode	Exit ethernet ma mode
(config-ether-cfm)#exit	Exit ethernet CFM mode
(config)#ethernet cfm domain-type character-string domain-name mdnam2 level 0 mip-creation none	Create cfm domain with type as character string with level 0 and set mip creation criteria to none.
(config-ether-cfm)#service ma-type string ma-name test2	Create ma type as string
(config-ether-cfm-ma)#link-level-ma	Configure link-level-ma
(config-ether-cfm-ma)#ethernet cfm mep down mpid 4 active true po100	Create down mep for local-vid on po300
(config-ether-cfm-ma-mep)#cc multicast state enable	Enable cc multicast
(config-ether-cfm-ma-mep)#exit-ether-ma-mep-mode	Exit ethernet cfm ma-mep mode
(config-ether-cfm-ma)#mep crosscheck mpid 3	Configure crosscheck to remote MEP
(config-ether-cfm-ma)#cc interval 10ms	Enable cc interval for 10 millisecond
(config-ether-cfm-ma)#exit-ether-ma-mode	Exit ethernet ma mode
(config-ether-cfm)#exit	Exit ethernet CFM mode

#### Node-4

#configure terminal	Enter configure mode
(config)#hostname Node-4	Configure the hostname
(config)#interface po100	Create port channel interface
(config-if)#switchport	Configure switchport on LAG port
(config-if)#exit	Exit the interface level
(config)#interface ce1/1	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level.
(config)#interface ce2/1	Enter interface level
(config-if)#channel-group 100 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface po300	Create port channel interface
(config-if)#switchport	Configure switchport on LAG interface
(config-if)#exit	Exit the interface level



(config)#interface ce8/1	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#interface ce15/1	Enter interface level
(config-if)#channel-group 300 mode active	Add member port to the port channel interface
(config-if)#lacp timeout short	Configure LACP timeout as short
(config-if)#exit	Exit the interface level
(config)#cross-connect xc1	Create cross-connect by providing the name
(config-XC)#ep1 po300 ep2 po100	Add end-points end-point1 and end-point2

## Validation

### Node-1

```
#sh ethernet cfm maintenance-points local mep domain mdnam2 ma-name test2
```

```
MPID Dir Lvl VLAN CC-Stat CC-Intvl MAC-Address Def Port MD Name
```

```
-----
3      Dn  0   0      Enable  10 ms      34ef.b689.e05a T    po300 mdnam2
```

```
#sh ethernet cfm maintenance-points local mep domain mdnam1 ma-name test1
```

```
MPID Dir Lvl VLAN CC-Stat CC-Intvl MAC-Address Def Port MD Name
```

```
-----
1      Dn  0   0      Enable  10 ms      34ef.b689.e020 F    po100 mdnam1
```

```
#sh ethernet cfm maintenance-points remote mpid 3 domain mdnam2
```

```
MEPID      RMEPID      LEVEL      VLAN      Rx CCM      RDI      PEER-MAC      TYPE
-----
3           4           0           0           Yes          False    5cff.35b7.54b3 Configured
```

```
#sh ethernet cfm maintenance-points remote mpid 1 domain mdnam1
```

```
MEPID      RMEPID      LEVEL      VLAN      Rx CCM      RDI      PEER-MAC      TYPE
-----
1           2           0           0           Yes          False    5cff.35b7.54bb Configured
```

```
#sh ethernet cfm errors domain mdnam1
```

```
Domain Name      Level      Vlan      MEPID      Defects
-----
mdnam1           0           0           1           .....
```

```
1. defRDICCM      2. defMACstatus  3. defRemoteCCM
4. defErrorCCM    5. defXconCCM
```

```
#sh ethernet cfm errors domain mdnam2
```

```
Domain Name      Level      Vlan      MEPID      Defects
-----
mdnam2           0           0           3           .....
```

```
1. defRDICCM      2. defMACstatus  3. defRemoteCCM
4. defErrorCCM    5. defXconCCM
```

### Node-3

```
#sh ethernet cfm maintenance-points local mep domain mdnam1 ma-name test1
```

MPID	Dir	Lvl	VLAN	CC-Stat	CC-Intvl	MAC-Address	Def	Port	MD Name
------	-----	-----	------	---------	----------	-------------	-----	------	---------

2	Dn	0	0	Enable	10 ms	5cff.35b7.54bb	F	po300	mdnam1
---	----	---	---	--------	-------	----------------	---	-------	--------

```
#sh ethernet cfm maintenance-points local mep domain mdnam2 ma-name test2
```

MPID	Dir	Lvl	VLAN	CC-Stat	CC-Intvl	MAC-Address	Def	Port	MD Name
------	-----	-----	------	---------	----------	-------------	-----	------	---------

4	Dn	0	0	Enable	10 ms	5cff.35b7.54b3	F	po100	mdnam2
---	----	---	---	--------	-------	----------------	---	-------	--------

```
#sh ethernet cfm maintenance-points remote mpid 4 domain mdnam2
```

MEPID	RMEPID	LEVEL	VLAN	Rx CCM	RDI	PEER-MAC	TYPE
4	3	0	0	Yes	False	34ef.b689.e05a	Configured

```
#sh ethernet cfm maintenance-points remote mpid 2 domain mdnam1
```

MEPID	RMEPID	LEVEL	VLAN	Rx CCM	RDI	PEER-MAC	TYPE
2	1	0	0	Yes	False	34ef.b689.e020	Configured

```
#sh ethernet cfm errors domain mdnam1
```

Domain Name	Level	Vlan	MEPID	Defects
mdnam1	0	0	2	.....

```
1. defRDICCM      2. defMACstatus  3. defRemoteCCM
4. defErrorCCM    5. defXconCCM
```

```
#sh ethernet cfm errors domain mdnam2
```

Domain Name	Level	Vlan	MEPID	Defects
mdnam2	0	0	4	.....

```
1. defRDICCM      2. defMACstatus  3. defRemoteCCM
4. defErrorCCM    5. defXconCCM
```

## CHAPTER 4 VLAN Cross-Connect (XC)

### Overview

VLAN cross connect creates a L2 bridge between two given endpoints on the same device. Once configured, every packets arriving at one of the endpoints with specific VLAN tag will be sent to another endpoint directly. In current implementation it matches VLAN tag as per configuration in device. If device is configured to match single tag then only outer most tagged will be matched whether packet is double tagged. If device is configured to match double tag then outer tag as well as inner tag will match If the packet is double tagged.

Note:

1. End point or source point could be a physical (Native Ethernet) port or logical port (po, vlan etc).
2. Same Vlan ID cannot be used in 2 cross connects.
3. Different type of L2, L3 and subscriber services are supported over cross.
4. The XC implementation will forward all packets and MAC address learning is disabled.

### Topology

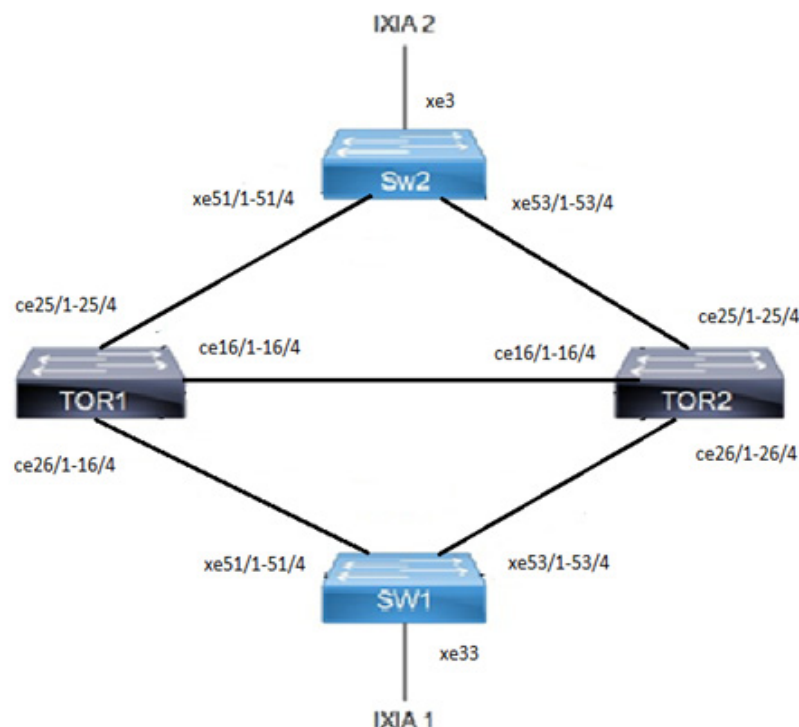


Figure 4-52: Cross-connect topology

## Configuration - Single-tagged VLAN

### TOR1

#configure terminal	Enter Configure mode.
(config)#interface ce25/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface ce16/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#cross-connect VC1	Create cross-connect (XC)
(config-XC)# vlan ep1 ce25/1 ep2 ce16/1	Add Endpoints to XC
(config-VXC)# outer-vlan 100	Outer-vlanId associated with the XC
(config-VXC)#commit	Commit candidate configuration to be running configuration
(config-VXC)#end	Return to privilege mode

### TOR2

#configure terminal	Enter Configure mode.
(config)#interface ce16/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface ce26/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#cross-connect VC1	Create cross-connect (XC)
(config-XC)# vlan ep1 ce16/1 ep2 ce26/1	Add Endpoints to XC
(config-VXC)# outer-vlan 100	Outer-vlanId associated with the XC
(config-VXC)#commit	Commit candidate configuration to be running configuration
(config-VXC)#end	Return to privilege mode

**SW2**

#configure terminal	Enter Configure mode.
(config)#bridge 1 protocol mstp	Add a bridge (1) to the multiple spanning tree table
(config)#vlan database	Enter the VLAN configuration mode
(config-vlan)#vlan 100 bridge 1 state enable	Enable the state of VLAN 100 on bridge 1. Specifying an enable state allows forwarding of frames over VLAN 100 on bridge 1
(config-vlan)#commit	Commit candidate configuration to be running configuration
(config-vlan)#exit	Exit the VLAN configuration mode
(config)#interface xe51/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#bridge-group 1	Associating the interface to bridge-group 1
(config-if)#switchport mode trunk	set the switching characteristics of the Layer 2 interface
(config-if)#switchport trunk allowed vlan all	Allow all VLANs to transmit and receive through the interface
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface xe3	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#bridge-group 1	Associating the interface to bridge-group 1
(config-if)#switchport mode trunk	set the switching characteristics of the Layer 2 interface
(config-if)#switchport trunk allowed vlan all	Allow all VLANs to transmit and receive through the interface
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode

**SW1**

#configure terminal	Enter Configure mode.
(config)#bridge 1 protocol mstp	Add a bridge (1) to the multiple spanning tree table
(config)#vlan database	Enter the VLAN configuration mode
(config-vlan)#vlan 100 bridge 1 state enable	Enable the state of VLAN 100 on bridge 1. Specifying an enable state allows forwarding of frames over VLAN 100 on bridge 1
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit the VLAN configuration mode
(config)#interface xe53/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#bridge-group 1	Associating the interface to bridge-group 1
(config-if)#switchport mode trunk	set the switching characteristics of the Layer 2 interface
(config-if)#switchport trunk allowed vlan all	Allow all VLANs to transmit and receive through the interface
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode

(config)#interface xe33	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#bridge-group 1	Associating the interface to bridge-group 1
(config-if)#switchport mode trunk	set the switching characteristics of the Layer 2 interface
(config-if)#switchport trunk allowed vlan all	Allow all VLANs to transmit and receive through the interface
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode

Validation

TOR1

```
#show cross-connect
Cross-connect name : VC1
EP1:ce25/1          EP2:ce16/1          Admin Status:UP          OperStatus:UP
=====
+
| EP  | OVID      | IVID      | Rx packets | Rx bytes  | Tx packets | Tx bytes  |
+=====+
| EP1 |100        | -         |6572258    |9858387000|0          |0          |
| EP2 |100        | -         |0          |0          |6572224    |9858336000|
+=====+
+
Cross-connect summary Total XC      : 1
Admin Up      : 1
Admin Down    : 0
Total Rules   : 1
```

TOR2

```
#show cross-connect
Cross-connect name : VC1
EP1:ce16/1          EP2:ce26/1          Admin Status:UP          OperStatus:UP
=====
+
| EP  | OVID      | IVID      | Rx packets | Rx bytes  | Tx packets | Tx bytes  |
+=====+
| EP1 |100        | -         |616588     |924882000 |0          |0          |
| EP2 |100        | -         |0          |0          |618615     |927922500 |
+=====+
+
Cross-connect summary Total XC      : 1
Admin Up      : 1
Admin Down    : 0
Total Rules   : 1
```

## Double-tagged VLAN

### TOR1

#configure terminal	Enter Configure mode.
(config)#interface ce25/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface ce16/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#cross-connect VC2	Create cross-connect (XC)
(config-XC)# vlan ep1 ce25/1 ep2 ce16/1	Add Endpoints to XC
(config-VXC)# outer-vlan 200-300 inner-vlan 20-30	Outer-vlanId and Inner-vlanId with range associated with the XC
(config-VXC)#commit	Commit candidate configuration to be running configuration
(config-VXC)#end	Return to privilege mode

### TOR2

#configure terminal	Enter Configure mode.
(config)#interface ce16/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface ce26/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#cross-connect VC2	Create cross-connect (XC)
(config-XC)# vlan ep1 ce16/1 ep2 ce26/1	Add Endpoints to XC
(config-VXC)# outer-vlan 200-300 inner-vlan 20-30	Outer-vlanId and Inner-vlanId with range associated with the XC
(config-VXC)#commit	Commit candidate configuration to be running configuration
(config-VXC)#end	Return to privilege mode

**SW2**

#configure terminal	Enter Configure mode.
(config)#bridge 1 protocol mstp	Add a bridge (1) to the multiple spanning tree table
(config)#vlan database	Enter the VLAN configuration mode
(config-vlan)#vlan 200-300 bridge 1 state enable	Enable the state of VLANs 200-300 on bridge 1. Specifying an enable state allows forwarding of frames over VLANs 200-300 on bridge 1
(config-vlan)#commit	Commit candidate configuration to be running configuration
(config-vlan)#exit	Exit the VLAN configuration mode
(config)#interface xe51/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#bridge-group 1	Associating the interface to bridge-group 1
(config-if)#switchport mode trunk	set the switching characteristics of the Layer 2 interface
(config-if)#switchport trunk allowed vlan all	Allow all VLANs to transmit and receive through the interface
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface xe3	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#bridge-group 1	Associating the interface to bridge-group 1
(config-if)#switchport mode trunk	set the switching characteristics of the Layer 2 interface
(config-if)#switchport trunk allowed vlan all	Allow all VLANs to transmit and receive through the interface
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode



SW1

#configure terminal	Enter Configure mode.
(config)#bridge 1 protocol mstp	Add a bridge (1) to the multiple spanning tree table
(config)#vlan database	Enter the VLAN configuration mode
(config-vlan)#vlan 200-300 bridge 1 state enable	Enable the state of VLANs 200-300 on bridge 1. Specifying an enable state allows forwarding of frames over VLANs 200-300 on bridge 1
(config-vlan)#commit	Commit candidate configuration to be running configuration
(config-vlan)#exit	Exit the VLAN configuration mode
(config)#interface xe53/1	Enter Interface mode
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#bridge-group 1	Associating the interface to bridge-group 1
(config-if)#switchport mode trunk	Set the switching characteristics of the Layer 2 interface
(config-if)#switchport trunk allowed vlan all	Allow all VLANs to transmit and receive through the interface
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode
(config)#interface xe33	Enter Interface mode
(config-if)#no shutdown	Bring interface up
(config-if)#switchport	Configure interface as a layer 2 port
(config-if)#bridge-group 1	Associating the interface to bridge-group 1
(config-if)#switchport mode trunk	Set the switching characteristics of the Layer 2 interface
(config-if)#switchport trunk allowed vlan all	Allow all VLANs to transmit and receive through the interface
(config-if)#commit	Commit candidate configuration to be running configuration
(config-if)#exit	Exit interface mode

Validation

TOR1

```
#show cross-connect
Cross-connect name : VC2
EP1:ce25/1                EP2:ce16/1                Admin Status:UP                OperStatus:UP
+=====+
+
| EP  | OVID      | IVID      | Rx packets | Rx bytes  | Tx packets | Tx bytes  |
+=====+
+
| EP1 | 200-300   | 20-30     | 442089     | 663133500 | 0          | 0         |
| EP2 | 200-300   | 20-30     | 0          | 0         | 444123     | 666184500 |
+=====+
+
Cross-connect summary
Total XC      : 1
```

Admin Up : 1  
Admin Down : 0  
Total Rules : 1

TOR2

```
#show cross-connect
Cross-connect name : VC2
EP1:ce16/1          EP2:ce26/1          Admin Status:UP          OperStatus:UP
=====
+
| EP  | OVID      | IVID      | Rx packets | Rx bytes   | Tx packets | Tx bytes   |
+=====
+
| EP1 | 200-300   | 20-30     | 267607     | 401410500 | 0          | 0          |
| EP2 | 200-300   | 20-30     | 0           | 0          | 269640     | 404460000  |
+=====
+
Cross-connect summary
Total XC      : 1
Admin Up     : 1
Admin Down   : 0
Total Rules  : 1
```

# Data Center Bridging Configuration

Data Centre Bridging (DCB) is a set of enhancements for Ethernet that enables both LANs and Storage Area Networks (SANs) to utilize a single integrated infrastructure within a data center. The Data Centre Bridging (DCB) technology enables the transportation of Fiber Channel, TCP/IP, and inter-process communication data across a unified Ethernet network. The features of DCB includes the following:

- [Priority-based Flow Control Configuration](#) (PFC)
- [Data Centre Bridging Capability Exchange Configuration](#) (DCBx)
- [PFC with QOS Configuration](#)

# CHAPTER 1    Priority-based Flow Control Configuration

This chapter shows how to:

- Enable PFC on a bridge and interface
- Configure priorities and link delay allowance for PFC

## Topology



Figure 1-53: PFC Enabled Bridge

## Configuring a Bridge and Interface for PFC

#configure terminal	Enter configure mode
(config)#bridge 1 protocol ieee vlan-bridge	Create bridge 1 as an IEEE VLAN-enabled bridge
(config)#data-center-bridging enable bridge 1	Enables DCB on the bridge
(config)#priority-flow-control enable bridge 1	Enables PFC on the bridge
(config)#interface eth1	Configure interface eth1
(config-if)#switchport	Configure eth1 as a layer 2 port
(config-if)#bridge-group 1	Configure eth1 in bridge group 1
(config-if)#lldp-agent	Enter into LLDP agent mode.
(lldp-agent)#set lldp enable txrx	Configure LLDP for transmit and receive mode on eth1
(lldp-agent)#lldp tlv ieee-8021-org-specific data-center-bridging select	Configure LLDP to send an IEEE 802.1 organizationally specific TLV set in the packet
(lldp-agent)#exit	Exit from LLDP mode.
(config-if)#priority-flow-control mode on	Configure the advertise flag and start sending DCBX TLVs in LLDP messages

## Configuring Priorities and Link Delay Allowance for PFC

#configure terminal	Enter Configure Mode.
(config)#bridge 1 protocol ieee vlan-bridge	Create bridge 1 as an IEEE VLAN-enabled bridge

(config)#data-center-bridging enable bridge 1	Enables DCB on the bridge
(config)#priority-flow-control enable bridge 1	Enables PFC on the bridge
(config)#interface eth1	Configure interface eth1
(config-if)#switchport	Configure eth1 as a layer 2 port
(config-if)#bridge-group 1	Configure eth1 in bridge group 1
(config-if)#lldp-agent	Enter into LLDP agent mode.
(lldp-agent)#set lldp enable txrx	Configure LLDP for transmit and receive mode on eth1
(lldp-agent)#lldp tlv ieee-8021-org-specific data-center-bridging select	Configure LLDP to send an IEEE 802.1 organizationally specific TLV set in the packet
(lldp-agent)#exit	Exit from LLDP mode.
(config-if)#priority-flow-control mode on	Configure the advertise flag and start sending DCBX TLVs in LLDP messages
(config-if)#priority-flow-control cap 4	Configure the maximum number of PFC priorities
(config-if)#priority-flow-control enable priority 2 4 5	Enable PFC on priorities 2, 4, and 5
(config-if)#priority-flow-control link-delay-allowance 34567	Configure the link delay allowance

## Validation

### 1. Verify the default data set.

```
#sh priority-flow-control statistics bridge 1
bridge : 1
interface pri pause sent      pause received
=====
eth1      0  00              00
eth1      1  00              00
eth1      2  00              00
eth1      3  00              00
eth1      4  00              00
eth1      5  00              00
eth1      6  00              00
eth1      7  00              00

#sh priority-flow-control details bridge 1

Admin Configuration
interface mode advertise willing  cap  link delay      priorities allowance
=====

eth1      on    on      off    4      34567          2 4 5

Operational Configuration
-----
interface state cap  link delay  priorities allowance
=====
eth1      on    4      34567          2 4 5
```

## CHAPTER 2 Data Centre Bridging Capability Exchange Configuration

This chapter show how to configure DCB parameter exchange.

### Topology



Figure 2-54: DCBx Configuration

### Configuring ETS Parameter Exchange

#### SW1

#configure terminal	Enter configure mode
(config)#bridge 1 protocol ieee vlan-bridge	Create bridge 1 as an IEEE VLAN-enabled bridge
(config)#data-center-bridging enable bridge 1	Enables DCB on the bridge
(config)#priority-flow-control enable bridge 1	Enables PFC on the bridge
(config)#interface eth1	Configure interface eth1
(config-if)#switchport	Configure eth1 as a layer 2 port
(config-if)#bridge-group 1	Configure eth1 in bridge group 1
(config-if)#lldp-agent	Enter into LLDP agent mode.
(lldp-agent)#set lldp enable txrx	Configure LLDP for transmit and receive mode on eth1
(lldp-agent)#lldp tlv ieee-8021-org- specific data-center-bridging select	Configure LLDP to send an IEEE 802.1 organizationally specific TLV set in the packet
(lldp-agent)#exit	Exit from LLDP mode.
(config-if)#priority-flow-control mode on	Configure the advertise flag and start sending DCBX TLVs in LLDP messages
(config-if)# priority-flow-control cap 4	Configure the maximum number of PFC priorities

(config-if)# priority-flow-control enable priority 2 3 4	Enables PFC on priorities 2,3, and 4
(config-if)# priority-flow-control linkdelay- allowance 34567	Configure the link delay allowance

**SW2**

#configure terminal	Enter configure mode
(config)#bridge 1 protocol ieee vlan-bridge	Create bridge 1 as an IEEE VLAN-enabled bridge
(config)#data-center-bridging enable bridge 1	Enables DCB on the bridge
(config)#priority-flow-control enable bridge 1	Enables PFC on the bridge
(config)#interface eth1	Configure interface eth1
(config-if)#switchport	Configure eth1 as a layer 2 port
(config-if)#bridge-group 1	Configure eth1 in bridge group 1
(config-if)#lldp-agent	Enter into LLDP agent mode.
(lldp-agent)#set lldp enable txrx	Configure LLDP for transmit and receive mode on eth1
(lldp-agent)#lldp tlv ieee-8021-org- specific data-center-bridging select	Configure LLDP to send an IEEE 802.1 organizationally specific TLV set in the packet
(lldp-agent)#exit	Exit from LLDP mode.
(config-if)#priority-flow-control mode auto	Configure the advertise flag and start sending DCBX TLVs in LLDP messages
(config-if)# priority-flow-control cap 4	Configure the maximum number of PFC priorities
(config-if)# priority-flow-control enable priority 2 3 4	Enables PFC on priorities 2,3, and 4
(config-if)# priority-flow-control linkdelay- allowance 34567	Configure the link delay allowance

**Validation****SW1**

Verify the data set.

```
OcNOS#sh priority-flow-control details interface xe31
```

```
bridge : 1
priority flow control : on
interface : eth1
```

Admin Configuration

```
-----
mode  advertise willing  cap  link delay  priorities
      allowance
=====
auto  on           on    4    34567          2 3 4
-----
```

Operational Configuration

```
-----
state cap  link delay  priorities
      allowance
=====
off   4    34567          2 3 4
-----
```

SW2

Verify the data set.  
OcNOS#sh priority-flow-control details interface xe31

bridge : 1  
priority flow control : on  
interface : eth1

Admin Configuration

```
-----
mode  advertise willing  cap  link delay  priorities
      allowance
=====
on    on           off   4    34567          2 3 4
-----
```

Operational Configuration

```
-----
state cap  link delay  priorities
      allowance
=====
on    4    34567          2 3 4
-----
```

Configuring PFC Parameter Exchange

SW2

#configure terminal	Enter configure mode
(config)#bridge 1 protocol ieee vlan-bridge	Create bridge 1 as an IEEE VLAN-enabled bridge
(config)#data-center-bridging enable bridge 1	Enable DCB on the bridge



(config)#priority-flow-control enable bridge 1	Enable PFC on the bridge
(config)#interface eth1	Configure interface eth1
(config-if)#switchport	Configure eth1 as a layer 2 port
(config-if)#bridge-group 1	Configure eth1 in bridge group 1
(config-if)#lldp-agent	Enter into LLDP agent mode.
(lldp-agent)#set lldp enable txrx	Configure LLDP for transmit and receive mode on eth1
(lldp-agent)#lldp tlv-select ieee-8021-org-specific	Configure LLDP to send an IEEE 802.1 organizationally specific TLV set in the packet
(lldp-agent)#exit	Exit from LLDP mode.
(config-if)#priority-flow-control mode on	Configure the advertise flag and start sending DCBx TLVs in LLDP messages
(config-if)#priority-flow-control cap 4	Configure the maximum number of PFC priorities
(config-if)#priority-flow-control enable priority 2 4 5	Enables PFC on priorities 2,4, and 5
(config-if)#priority-flow-control link-delay-allowance 34567	Configure the link delay allowance

**SW1**

#configure terminal	Enter configure mode
(config)#bridge 1 protocol ieee vlan-bridge	Create bridge 1 as an IEEE VLAN-enabled bridge
(config)#data-center-bridging enable bridge 1	Enable DCB on the bridge
(config)#priority-flow-control enable bridge 1	Enable PFC on the bridge
(config)#interface eth1	Configure interface eth1
(config-if)#switchport	Configure eth1 as a layer 2 port
(config-if)#bridge-group 1	Configure eth1 in bridge group 1
(config-if)#lldp-agent	Enter into LLDP agent mode.
(lldp-agent)#set lldp enable txrx	Configure LLDP for transmit and receive mode on eth1
(lldp-agent)#lldp tlv-select ieee-8021-org-specific	Configure LLDP to send an IEEE 802.1 organizationally specific TLV set in the packet
(lldp-agent)#exit	Exit from LLDP mode.
(config-if)#priority-flow-control mode on	Configure the advertise flag and start sending DCBx TLVs in LLDP messages
(config-if)#priority-flow-control cap 4	Configure the maximum number of PFC priorities
(config-if)#priority-flow-control enable priority 2 4 5	Enables PFC on priorities 2,4, and 5
(config-if)#priority-flow-control link-delay-allowance 34567	Configure the link delay allowance

Validation

SW1

Verify the data set.

```
#show priority-flow-control details interface eth1
bridge : 1
priority flow control : on
interface : eth1

Admin Configuration
mode  advertise willing  cap  link      priorities
                                delay
                                allowance
=====
on    on                off   4      34567      2 4 5

Operational Configuration
state cap  link      priorities
              delay
              allowance
=====
on    4      34567      2 4 5
```

SW2

Verify the data set.

```
#show priority-flow-control details interface eth1
bridge : 1
priority flow control : on
interface : eth1

Admin Configuration
mode  advertise willing  cap  link      priorities
                                delay
                                allowance
=====
==
on    on                off   4      34567      2 4 5

Operational Configuration
state cap  link      priorities
              delay
              allowance
=====
==
on    4      34567      2 4 5
```

## CHAPTER 3 PFC with QoS Configuration

Priority-based Flow Control (PFC) is a way which provides a link-level flow control mechanism that can be controlled independently for each frame priority. The goal of this mechanism is to ensure zero loss (lossless) under congestion in DCB networks.

Quality of Service (QoS) works by default with lossy behaviour, which is required for proper functioning of minimum bandwidth, shaping and scheduling.

The requirement is to support PFC when QoS is enabled, ability to control lossy/lossless setting of port queues.

Note: The PFC with QoS works only for known unicast traffic.

Note: To manage peer congestion effectively, the shaper rate should only be applied to the egress interface of the peer node. Applying congestion control to all interfaces would inhibit PFC generation in response to peer congestion.

### Topology

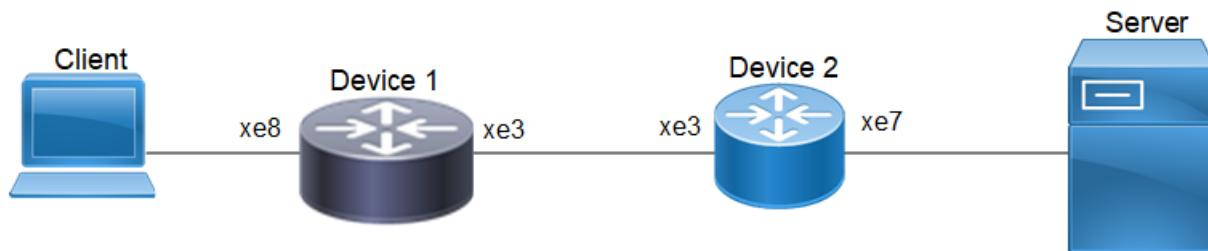


Figure 3-55: PFC with QoS

### PFC with QoS Configuration

PFC + QoS functionality: On setting lossless on queue, traffic should not be dropped at egress queue and on setting PFC on ingress, pause frames will be generated in order to reduce excess ingress traffic.

Note: The pause frame queue follows the VLAN priority of the source traffic. If it's necessary to adjust the VLAN priority on the switch, you can use the command `set cos` to make this change.

Note: When a pause frame is received in Device-1, congestion should be enforced on the egress interface of Device-2.

### Configuration on Device-1

OcNOS#conf ter	Enter configure mode
OcNOS(config)#hostname Device-1	Configure host name
OcNOS(config)#commit	Commit
Device-1(config)#qos enable	Enable QoS
Device-1(config)#qos statistics	Enable QoS Statistics

Device-1(config)#bridge 1 protocol rstp vlan-bridge	Configure bridge group
Device-1(config)#data-center-bridging enable bridge 1	Enable data-center-bridging
Device-1(config)#priority-flow-control enable bridge 1	Enable priority-flow-control
Device-1(config)#commit	Commit
Device-1(config)#class-map type qos match- all CLASS1	Configure QoS Class-map
Device-1(config-cmap-qos)#match layer4 udp source-port 4791	Define a classification criteria
Device-1(config-cmap-qos)#exit	Exit
Device-1(config)#commit	Commit
Device-1(config)#policy-map type qos POLICY1	Configure QoS Policy-map
Device-1(config-pmap-qos)#class type qos CLASS1	Configure class type and specify the class-map type
Device-1(config-pmap-c-qos)#set queue 4	Setting a new value in the packet Egress queue for matched traffic
Device-1(config-pmap-c-qos)#exit	Exit
Device-1(config-pmap-qos)#exit	Exit
Device-1(config)#commit	Commit
Device-1(config)#policy-map type queuing default DEFAULTPOLICY	Configure QoS Policy-map
Device-1(config-pmap-que-def)# class type queuing default q0	Configure class type and specify the class-map type
Device-1(config-pmap-c-que-def)# priority	Priority value of class-map attached to this policy-map
Device-1(config-pmap-c-que-def)# exit	Exit
Device-1(config-pmap-que-def)# class type queuing default q4	Configure class type and specify the class-map type
Device-1(config-pmap-c-que-def)# priority	Priority value of class-map attached to this policy-map
Device-1(config-pmap-c-que-def)# lossless	enable lossless settings on egress queue
Device-1(config-pmap-c-que-def)# exit	Exit
Device-1(config-pmap-que-def)#commit	Commit
Device-1(config-pmap-que-def)#exit	Exit
Device-1(config)#interface xe3	Configure Interface
Device-1(config-if)# switchport	Set the switching characteristics of interface
Device-1(config-if)# bridge-group 1	Bridge-group
Device-1(config-if)# switchport mode trunk	Set the mode of L2 interface as trunk

Device-1(config-if)# switchport trunk allowed vlan all	Set the VLAN's to be allowed
Device-1(config-if)# shape rate 100 mbps burst 1000	Configure QoS egress traffic shape
Device-1(config-if)# service-policy type queuing output DEFAULTPOLICY	Configure a service-policy of type queuing to the egress interface.
Device-1(config-if)#exit	Exit
Device-1(config)#commit	Commit
Device-1(config)#interface xe8	Configure Interface
Device-1(config-if)# switchport	Set the switching characteristics of interface
Device-1(config-if)# bridge-group 1	Bridge-group
Device-1(config-if)# switchport mode trunk	Set the mode of L2 interface as trunk
Device-1(config-if)# switchport trunk allowed vlan all	Set the VLAN's to be allowed
Device-1(config-if)# priority-flow-control mode on	Set priority-flow-control mode as ON
Device-1(config-if)# priority-flow-control enable priority 0 4	Set priority-flow-control mode's priority
Device-1(config-if)#service-policy type qos input POLICY1	Configure QoS service policy
Device-1(config-if)#exit	Exit
Device-1(config)#bridge 1 address 0000.0000.0101 forward xe3	Configure a static MAC forwarding for the bridge with Client's destination mac address / Ingress interface MAC of Device-1 to consider the traffic as known Unicast."
Device-1(config)#commit	Commit

## Configuration on Device-2

OcNOS#conf ter	Enter configure mode
OcNOS(config)#hostname Device-2	Configure host name
OcNOS(config)#commit	Commit
Device-2(config)#qos enable	Enable QOS
Device-2(config)#qos statistics	Enable QOS Statistics
Device-2(config)#bridge 1 protocol rstp vlan-bridge	Configure bridge group
Device-2(config)#data-center-bridging enable bridge 1	Enable data-center-bridging
Device-2(config)#priority-flow-control enable bridge 1	Enable priority-flow-control

Device-2(config)#commit	Commit
Device-2(config)#class-map type qos match-all CLASS1	Configure QOS Class-map
Device-2(config-cmap-qos)#match layer4 udp source-port 4791	Define a classification criteria
Device-2(config-cmap-qos)#exit	Exit
Device-2(config)#commit	Commit
Device-2(config)#policy-map type qos POLICY1	Configure QOS Policy-map
Device-2(config-pmap-qos)#class type qos CLASS1	Configure class type and specify the class-map type
Device-2(config-pmap-c-qos)#set queue 4	Setting a new value in the packet Egress queue for matched traffic
Device-2(config-pmap-c-qos)#exit	Exit
Device-2(config-pmap-qos)#commit	Commit
Device-2(config-pmap-qos)#policy-map type queuing default DEFAULTPOLICY	Configure QOS Policy-map
Device-2(config-pmap-que-def)# class type queuing default q0	Configure class type and specify the class-map type
Device-2(config-pmap-c-que-def)# priority	Priority value of class-map attached to this policy-map
Device-2(config-pmap-c-que-def)# exit	Exit
Device-2(config-pmap-que-def)# class type queuing default q4	Configure class type and specify the class-map type
Device-2(config-pmap-c-que-def)# priority	Priority value of class-map attached to this policy-map
Device-2(config-pmap-c-que-def)# lossless	enable lossless settings on egress queue
Device-2(config-pmap-c-que-def)# exit	Exit
Device-2(config-pmap-que-def)#commit	Commit
Device-2(config)#interface xe3	Configure Interface
Device-2(config-if)# switchport	Set the switching characteristics of interface
Device-2(config-if)# bridge-group 1	Bridge-group
Device-2(config-if)# switchport mode trunk	Set the mode of L2 interface as trunk
Device-2(config-if)# switchport trunk allowed vlan all	Set the VLAN's to be allowed
Device-2(config-if)#exit	Exit
Device-2(config)#commit	Commit
Device-2(config)#interface xe7	Configure Interface
Device-2(config-if)# switchport	Set the switching characteristics of interface
Device-2(config-if)# bridge-group 1	Bridge-group
Device-2(config-if)# switchport mode trunk	Set the mode of L2 interface as trunk

Device-2(config-if)# switchport trunk allowed vlan all	Set the VLAN's to be allowed
Device-2(config-if)# priority-flow-control mode on	Set priority-flow-control mode as ON
Device-2(config-if)# priority-flow-control enable priority 0 4	Set priority-flow-control mode's priority
Device-2(config-if)#service-policy type qos input POLICY1	Configure QoS service policy
Device-2(config-if)# shape rate 100 mbps burst 1000	Configure QoS egress traffic shape
Device-2(config-if)#exit	Exit
Device-2(config)#commit	Commit

## Validation

Verify Pause frames Sent from Device-1

```
Device-1#show priority-flow-control statistics bridge 1
bridge : 1
interface pri pause sent      pause received
=====
xe7          0  0              0
xe7          1  0              0
xe7          2  0              0
xe7          3  0              0
xe7          4 100265          0
xe7          5  0              0
xe7          6  0              0
xe7          7  0              0
```

Verify Pause frames Sent from peer node (Device-2)

```
Device-1#show priority-flow-control statistics bridge 1
bridge : 1
interface pri pause sent      pause received
=====
xe3          0  0              94731
xe3          1  0              0
xe3          2  0              0
xe3          3  0              0
xe3          4  0              0
xe3          5  0              0
xe3          6  0              0
xe3          7  0              0
xe8          0 181682          0
xe8          1  0              0
xe8          2  0              0
xe8          3  0              0
```

---

xe8	4	0	0
xe8	5	0	0
xe8	6	0	0
xe8	7	0	0



# Layer 2 Command Reference

## CHAPTER 1 Port Based xConnect Commands

---

This chapter contains the port based xConnect commands.

- [backup](#)
- [cross-connect](#)
- [cross-connect switchover type revertive](#)
- [disable](#)
- [ep1 ep2](#)
- [link-fault-pass-through enable](#)
- [show cross-connect](#)

---

## backup

Use this command to configure backup for primary endpoints.

Use `no` form of this command to unconfigure backup for primary endpoint.

### Command Syntax

```
backup (ep1|ep2) IFNAME
no backup (ep1|ep2)
```

### Parameters

IFNAME	Interface name for backup endpoint
--------	------------------------------------

### Default

None

### Command Mode

Configure-XC mode

### Applicability

This command was introduced in OcNOS-DC version 2.0.

### Example

```
#configure terminal
(config)#cross-connect temp
(config-XC)#backup ep1 xe35
(config-XC)#no backup ep1
```

---

## cross-connect

Use this command to provide name for a xConnect. This command will change mode from config to cross-connect mode.

### Command Syntax

```
cross-connect <xc-name>
```

### Parameters

<code>xc-name</code>	Cross-connect name
----------------------	--------------------

### Default

None

### Command Mode

Configure mode

### Applicability

This command was introduced in OcNOS-DC version 2.0

### Example

```
#configure terminal
(config)#cross-connect temp
(config-XC)#
```

---

## cross-connect switchover type revertive

Use this command to configure revertive mode for cross-connect.

Use the no form of this command to make it non-revertive mode for cross-connect.

### Command Syntax

```
cross-connect switchover type revertive
no cross-connect switchover type revertive
```

### Parameters

None

### Default

Non-revertive by default.

### Command Mode

Configure-XC mode

### Applicability

This command was introduced in OcNOS-DC version 2.0.

### Example

```
#configure terminal
(config)#cross-connect temp
(config-XC)#cross-connect switchover type revertive
(config-XC)#no cross-connect switchover type revertive
```

---

## disable

Use this command to do admin shutdown on a cross-connect.

Use the `no` form of this command to enable cross-connect.

### Command Syntax

```
disable
no disable
```

### Parameters

None

### Default

By default, the cross-connect will be enabled.

### Command Mode

Configure-XC mode

### Applicability

This command was introduced in OcNOS-DC version 2.0

### Example

```
#configure terminal
(config)#cross-connect temp
(config-XC)#disable
(config-XC)#no disable
```

---

## ep1 ep2

Use this command to configure xConnect between two endpoints.

### Command Syntax

```
ep1 IFNAME1 ep2 IFNAME2
```

### Parameters

IFNAME1	Interface name for ep1
IFNAME2	Interface name for ep2

### Default

None

### Command Mode

Configure-XC mode

### Applicability

This command was introduced in OcNOS-DC version 2.0.

### Example

```
#configure terminal
(config)#cross-connect temp
(config-XC)#ep1 xe33 ep2 xe34
```

---

## link-fault-pass-through enable

Use this command to enable LFPT in the cross-connect.

Use the `no` form of this command to disable LFPT.

### Command Syntax

```
link-fault-pass-through enable
no link-fault-pass-through enable
```

### Parameters

None

### Default

LFPT is disabled by default.

### Command Mode

Configure-XC mode

### Applicability

This command was introduced in OcNOS-DC version 2.0.

### Example

```
#configure terminal
(config)#cross-connect temp
(config-XC)#link-fault-pass-through enable
(config-XC)#no link-fault-pass-through enable
```



# show cross-connect

Use this command to show cross-connect entry.

## Command Syntax

```
show cross-connect (name WORD| count|)
```

## Parameters

WORD	Cross-connect name
count	Cross-connect count

## Default

None

## Command Mode

Exec mode

## Applicability

This command was introduced in OcNOS-DC version 2.0.

## Example

```
OcNOS#sh cross-connect

Cross-connect name : temp
EP1:ce13/1      EP2:ce4/1      Revertive:No      Bkp_EP1:ce14/1      Bkp_EP2:ce15/1
Admin Status:UP      Oper Status:UP

=====+
=====+
| EP      | OVID    | IVID    | Rx packets  | Rx bytes    | Tx packets  | Tx bytes
|Interface Status|
=====+
=====+
| EP1*    | -       | -       | 177629      | 12078772    | 0           | 0
|UP       |         |         |
| EP2*    | -       | -       | 0           | 0           | 177633      | 12079044
|UP       |         |         |
| bkp_EP1 | -       | -       | 0           | 0           | 0           | 0
|UP       |         |         |
| bkp_EP2 | -       | -       | 0           | 0           | 0           | 0
|UP       |         |         |
=====+
=====+

cross-connect summary
Total XC      : 1
Admin Up      : 1
Admin Down    : 0
Total Rules   : 1
```

OcNOS#sh cross-connect temp

Cross-connect name : temp

EP1:ce13/1      EP2:ce4/1      Revertive:No      Bkp\_EP1:ce14/1      Bkp\_EP2:ce15/1  
Admin Status:UP      Oper Status:UP

```

=====
=====+
| EP      | OVID    | IVID    | Rx packets | Rx bytes  | Tx packets | Tx bytes
|Interface Status|
=====+
| EP1*    | -       | -       | 177629     | 12078772  | 0          | 0
|UP       |         |         |
| EP2*    | -       | -       | 0          | 0         | 177633     | 12079044
|UP       |         |         |
| bkp_EP1 | -       | -       | 0          | 0         | 0          | 0
|UP       |         |         |
| bkp_EP2 | -       | -       | 0          | 0         | 0          | 0
|UP       |         |         |
=====
=====+

```

cross-connect summary

Total XC : 1  
Admin Up : 1  
Admin Down : 0  
Total Rules : 1

OcNOS#sh cross-connect count

cross-connect summary

Total XC : 1  
Admin Up : 1  
Admin Down : 0  
Total Rules : 1

## CHAPTER 2 Fundamental Layer 2 Commands

---

This chapter describes fundamental Layer 2 commands.

- [errdisable cause](#)
- [errdisable link-flap-setting](#)
- [errdisable storm-control](#)
- [errdisable timeout](#)
- [show errdisable details](#)
- [show interface errdisable status](#)
- [show running-config switch](#)
- [show tcp](#)
- [watch static-mac-movement](#)

---

## errdisable cause

Use this command to globally shut down a port when certain errors happen:

- BPDU guard puts an interface configured for Spanning Tree Protocol (STP) Port Fast into the ErrDisable state upon receipt of a STP BPDU to avoid a potential bridging loop.
- If one side of a link-access group (LAG) is configured as a static LAG and the other side as a dynamic LAG, the ports on the side receiving LACP BPDUs go into the ErrDisable state

Note: When link-flap ErrDisable is enabled globally, then all interfaces are enabled. Link-flap ErrDisable can be enabled globally, but disabled for a specific interface with the `no link-flap errdisable` command.

Note: Stp-Bpdu-Guard is enabled by default on the global level configuration.

Use `no` form of this command to not shut down a port when certain errors happen.

### Command Syntax

```
errdisable cause {stp-bpdu-guard|lag-mismatch|link-flap|storm-control}
no errdisable cause {stp-bpdu-guard|lag-mismatch|link-flap|storm-control}
```

### Parameters

<code>stp-bpdu-guard</code>	ErrDisable on stp-bpdu-guard
<code>lag-mismatch</code>	ErrDisable on lag-mismatch
<code>link-flap</code>	ErrDisable on link-flap
<code>storm-control</code>	ErrDisable on storm-control

### Default

No default value is specified

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#errdisable cause lag-mismatch
```

---

## errdisable link-flap-setting

Use this command to configure the link-flap errdisable feature:

- An interface should change state as up-down to complete one cycle of a link flap.
- The LED does not glow when an interface is in the errdisable state.
- Errdisable is supported only on physical interfaces.
- A LAG interface does not go into the errdisable state when all of its member ports are in the errdisable state
- The error disable computation is based on a sliding window of time. The window size is configurable in seconds. This window is taken as the current time to the last <t> second, where <t> is the configured window size. If the accumulated link flap count reaches the maximum flap count for a particular sliding window, a link flap error disable fault is triggered.

Note: Any previous flapping accumulated is flushed when you execute this command.

### Command Syntax

```
errdisable link-flap-setting max-flaps <1-100> time <1-1800>
```

### Parameters

<1-100>	Maximum flap count
<1-1800>	Sliding window size in seconds

### Default

Five flaps in ten seconds:

Maximum flap count: 5

Sliding window size: 10 seconds

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#errdisable link-flap-setting max-flaps 5 time 20
```

---

## errdisable storm-control

Use this command to configure the storm-control errdisable. Following are the limitation:

- An interface discards BUM traffic during the specified interval to complete one discard-hit cycle.
- The LED does not glow when an interface is in the errdisable state.
- Errdisable is supported only on physical interfaces.
- A LAG interface does not go into the errdisable state when all of its member ports are in the errdisable state.
- The error disable computation is based on a sliding window of time. The window size is configurable in seconds. This window is taken as the current time to the last <t> second, where <t> is the configured window size. Every 5 seconds, a discard hit count increases if there is BUM traffic being discarded in that period. If the accumulated discard hit count reaches the maximum count for a particular configurable sliding window, a storm control error disable fault is triggered.

Note: Any previous discard hits accumulated are flushed when you execute this command.

### Command Syntax

```
errdisable storm-control discard-hit <1-100> time <1-1800>
no errdisable cause storm-control
```

### Parameters

`discard-hit <1-100>`

The maximum number of times that BUM traffic can hit the configured bandwidth threshold in an interface within a certain time window before disabling the interface. During continuous storm control discards, this counter is increased approximately every 5 seconds. Default value is 1.

`time <1-1800>`

Sliding window size in seconds. The time window in seconds in which to consider storm control threshold hits for the purposes of disabling the interface if the discard-hit is overcome during that time. This value must have a minimum value of 6 times discard-hit. Default value is 5 seconds.

### Default

- One hit: ten seconds
- Maximum discard hit count: 1
- Sliding window size: 5 seconds

### Command Mode

Configure mode

### Applicability

This command was introduced in OcNOS version 6.5.1

### Examples

```
#configure terminal
(config)#errdisable storm-control discard-hit 3 time 20
```

---

## errdisable timeout

Use this command to set the ErrDisable auto-recovery timeout interval.

### Command Syntax

```
errdisable timeout interval <10-1000000>
```

### Parameters

<10-1000000>      Timeout interval in seconds

### Default

By default, zero: timer is disabled

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#errdisable timeout interval 1000
```

---

## show errdisable details

Use this command to display ErrDisable settings.

### Command Syntax

```
show errdisable details
```

### Parameters

None

### Default

None

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show errdisable details
```



---

## show interface errdisable status

Use this command to display ErrDisable conditions for an interface.

### Command Syntax

```
show interface errdisable status
```

### Parameters

None

### Default

None

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show interface errdisable status
ge1 lag-mismatch-errdisable
ge2 stp-bpdu-guard-errdisable
```

---

## show running-config switch

Use this command to display the running system switch configuration.

### Command Syntax

```
show running-config switch bridge
show running-config switch dot1x
show running-config switch gmrp
show running-config switch gvrp
show running-config switch lacp
show running-config switch lmi
show running-config switch mstp
show running-config switch radius-server
show running-config switch rpsvt+
show running-config switch rstp
show running-config switch ptp
show running-config switch stp
show running-config switch synce
show running-config switch vlan
```

### Parameters

bridge	Display Bridge group information.
dot1x	Display 802.1x port-based authentication information.
gmrp	Display GARP Multicast Registration Protocol (GMRP) information.
gvrp	Display GARP VLAN Registration Protocol (GVRP) information.
lacp	Display Link Aggregation Control Protocol (LACP) information.
lmi	Display Ethernet Local Management Interface Protocol (LMI) information.
mstp	Display Multiple Spanning Tree Protocol (MSTP) information.
radius-server	Display RADIUS server information.
rpvst+	Display Rapid Per-VLAN Spanning Tree (rpvst+) information.
rstp	Display Rapid Spanning Tree Protocol (RSTP) information.
ptp	Display Precision time Protocol (PTP)
stp	Display Spanning Tree Protocol (STP) information.
synce	Display synce information.
vlan	Display values associated with a single VLAN.

### Default

None

**Command Mode**

Privileged exec mode, configure mode, router-map mode

**Applicability**

This command was introduced before OcNOS version 1.3.

**Example**

```
(config)#show running-config switch stp
!  
bridge 6 ageing-time 45  
bridge 6 priority 4096  
bridge 6 max-age 7
```

# show tcp

Use this command to display the Transmission Control Protocol (TCP) connections details.

## Command Syntax

```
show tcp
```

## Parameters

None

## Command Mode

Exec mode and privileged exec mode

## Applicability

This command was introduced before OcNOS version 1.3.

## Example

```
#show tcp
Proto Recv-Q Send-Q Local Address          Foreign Address         State
tcp      0      0 0.0.0.0:22             0.0.0.0:*              LISTEN
tcp      0      0 127.0.0.1:25           0.0.0.0:*              LISTEN
tcp      0      1 10.12.44.1:57740       127.0.0.1:705          CLOSE_WAIT
tcp     52      0 10.12.44.21:22        10.12.7.89:705         ESTABLISHED
tcp     85      0 10.12.44.21:57742     10.12.44.21:57738      ESTABLISHED
```

Table 2-2: Show tcp output

Entry	Description
Proto	Protocol – TCP
Recv-Q	Number of TCP packets in the Receive Queue.
Send-Q	Number of TCP packets in the Send-Q.
Local Address and port number	Local IP address and the port number.

Table 2-2: Show tcp output

Entry	Description
Foreign Address and port number	Foreign (received) IP address and the port number.
State	Current state of TCP connections:  ESTABLISHED SYN_SENT SYN_RECV FIN_WAIT1 FIN_WAIT2 TIME_WAIT CLOSE CLOSE_WAIT LAST_ACK LISTEN CLOSING UNKNOWN

---

## watch static-mac-movement

Use this command to watch if any MAC movement is detected over static MAC entries for a time period. Notification will be displaying if static MAC movement happens before the timer expires.

The counters can be validated with `show interface cpu counters queue-stats` for the L2 movement queue (Tx pkts and Dropped pkts columns).

Without enabling `watch static-mac-movement`, the statistics are reflected in the Rx EGR Port Unavail of [show interface counters queue-drop-stats](#).

For VXLAN, `watch static-mac-movement` applies to all the MAC entries learned from the remote peer (remote dynamic or static remote), as these learned MACs are installed as static MAC entries in the hardware.

### Command Syntax

```
watch static-mac-movement (<1-300>|)
```

### Parameters

`<1-300>`                      Timer value in seconds.

### Default

By default, the timer is 10 seconds

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#watch static-mac-movement
```

---

## CHAPTER 3 Bridge Commands

---

This chapter provides a description, syntax, and examples of the bridge commands. It includes the following commands:

- `bridge acquire`
- `bridge address`
- `bridge ageing`
- `bridge forward-time`
- `bridge hello-time`
- `bridge mac-priority-override`
- `bridge max-age`
- `bridge max-hops`
- `bridge priority`
- `bridge shutdown`
- `bridge transmit-holdcount`
- `bridge-group`
- `bridge-group path-cost`
- `bridge-group priority`
- `clear allowed-ethertype`
- `clear mac address-table`
- `dot1ad ethertype`
- `mac ageing display`
- `show allowed-ethertype`
- `show bridge`
- `show interface switchport`
- `show mac address-table count bridge`
- `show mac address-table bridge`
- `show mac-address-table bridge 1 learning`
- `switchport`
- `switchport allowed ethertype`

---

## bridge acquire

Use this command to enable a bridge to learn station location information for an instance. This helps in making forwarding decisions.

Use the `no` parameter with this command to disable learning.

### Command Syntax

```
bridge <1-32> acquire
no bridge <1-32> acquire
```

### Parameter

<1-32>	Specify the bridge group ID.
--------	------------------------------

### Default

By default, learning is enabled for all instances.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#bridge 3 acquire
(config)#no bridge 3 acquire
```



## bridge address

Use this command to add a static forwarding table entry for the bridge.

Use the no parameter with this command to remove the entry for the bridge.

Note: Forward MAC must refer to the source MAC, and discard MAC must refer to the destination MAC.

### Command Syntax

```
bridge <1-32> address XXXX.XXXX.XXXX (forward|discard) IFNAME
bridge <1-32> address XXXX.XXXX.XXXX (forward|discard) IFNAME vlan <2-4094>
bridge <1-32> address XXXX.XXXX.XXXX (forward|discard) IFNAME vlan <2-4094>
no bridge <1-32> address XXXX.XXXX.XXXX
no bridge <1-32> address XXXX.XXXX.XXXX vlan <2-4094>
no bridge <1-32> address XXXX.XXXX.XXXX vlan <2-4094>
```

### Parameters

<1-32>	Bridge identifier
XXXX.XXXX.XXXX	Media Access Control (MAC) address in HHHH.HHHH.HHHH format.
forward	Forward matching frames.
discard	Discard matching frames.
IFNAME	Interface on which the frame comes out.
vlan	Identity of the VLAN in the range of <2-4094>.

### Default

By default, bridge address is disabled

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#bridge 1 address 0000.000a.0021 forward eth0
(config)#no bridge 1 address 0000.000a.0021
(config)#bridge 1 address 0011.2222.3333 forward xe5 vlan 23
(config)#no bridge 1 address 0011.2222.3333 vlan 23
(config)#bridge 1 address 0011.2222.3333 forward xe5 vlan 11
(config)#no bridge 1 address 0011.2222.3333 vlan 11 s
(config)#bridge 1 address 0011.2222.3334 discard xe6 vlan 12
(config)#no bridge 1 address 0011.2222.3334 vlan 12
```

---

## bridge ageing

Use this command to specify the aging time for a learned MAC address. A learned MAC address persists until this specified time.

Note: On XGS devices, it takes up to two ageing cycles to remove the mac entry from hardware, hence the timeout will be anywhere between mac-ageing-time to two times the mac-ageing-time. For example, if the MAC ageing time is set to 100 seconds, MAC ageing can happen anywhere between 100 to 199 seconds.

Note: The bridge aging time affects the ARP entries which are dependent upon the MAC addresses in hardware. If a MAC address ages out, it causes the corresponding ARP entry to refresh.

Use the `no` form of this command to set the MAC address aging time to its default (300).

### Command Syntax

```
bridge <1-32> ageing-time (<1-240>)
bridge <1-32> ageing disable
no bridge <1-32> ageing-time
```

### Parameters

0	Disable Ageing Time
<1-32>	Bridge group ID.
<1-240>	Aging time in minutes.
disable	Turn off MAC address aging completely.

### Default

By default, the aging time is 300 seconds.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#bridge 3 ageing-time 100
(config)#no bridge 3 ageing-time
```

---

## bridge forward-time

Use this command to set the time (in seconds) after which (if this bridge is the root bridge) each port changes states to learning and forwarding. This value is used by all instances.

Use the `no` parameter with this command to restore the default value of 15 seconds.

### Command Syntax

```
bridge <1-32> forward-time <4-30>
no bridge <1-32> forward-time
```

### Parameters

<1-32>	Specify the bridge group ID.
<4-30>	Specify the forwarding time delay in seconds.

Note: Care should be exercised if the value is to be made below 7 seconds.

### Default

By default, value is 15 seconds

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#bridge 3 forward-time 6
(config)#no bridge 3 forward-time
```

---

## bridge hello-time

Use this command to set the hello-time, the time in seconds after which (if this bridge is the root bridge) all the bridges in a bridged LAN exchange Bridge Protocol Data Units (BPDUs). A very low value of this parameter leads to excessive traffic on the network, while a higher value delays the detection of topology change. This value is used by all instances.

Configure the bridge instance name before using this command. The allowable range of values is 1-10 seconds. However, make sure that the value of hello time is always greater than the value of hold time (2 seconds by default).

Use the `no` parameter to restore the default value of the hello time.

Note: A Bridge shall enforce the following relationships for Hello-time, Max-age and Forward-delay.

- $2 \times (\text{Bridge\_Forward\_Delay} - 1.0 \text{ seconds}) \geq \text{Bridge\_Max\_Age}$
- $\text{Bridge\_Max\_Age} \geq 2 \times (\text{Bridge\_Hello\_Time} + 1.0 \text{ seconds})$

Note: Hello-time is allowed only on RSTP, IEEE and Provider-RSTP types of bridges. For MSTP and Provider-MSTP hello timer is restricted.

### Command Syntax

```
bridge <1-32> hello-time <1-10>
no bridge <1-32> hello-time
```

### Parameters

- |        |   |
|--------|---|
| <1-32> | Specify the bridge group ID.                |
| <1-10> | Specify the hello BPDU interval in seconds. |

### Default

By default, value is 2 seconds

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 3 hello-time 3

(config)#no bridge 3 hello-time
```

## bridge mac-priority-override

Use this command to set a MAC priority override.

Use the `no` parameter with this command to unset a MAC priority override.

### Command Syntax

```
bridge <1-32> mac-priority-override mac-address MAC interface IFNAME vlan VLANID
    (static|static-priority-override|static-mgmt|static-mgmt-priority-override)
    priority <0-7>

no bridge <1-32> mac-priority-override mac-address MAC interface IFNAME vlan VLANID
```

### Parameters

<code>&lt;1-32&gt;</code>	Specify the bridge group ID.
<code>mac-address</code>	Enter a MAC address in HHHH.HHHH.HHHH format.
<code>interface</code>	Interface information
<code>vlan</code>	Add the values associated with a single VLAN
<code>static</code>	The MAC is a static entry
<code>static-mgmt</code>	The MAC is a Static Management
<code>static-mgmt-priority-override</code>	The MAC is a Static Management with priority override
<code>static-priority-override</code>	The MAC is a static with priority override
<code>priority</code>	priority <0-7> priority value

### Default

No default address is specified

### Command Mode

Configuration Mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 1 mac-priority-override mac-address 1111.1111.1111 interface
eth1 vlan 2 static priority 2

(config)#no bridge 1 mac-priority-override mac-address 1111.1111.1111
interface eth1 vlan 2
```

---

## bridge max-age

Use this command to set the maximum age for a bridge. This value is used by all instances.

Maximum age is the maximum time in seconds for which (if a bridge is the root bridge) a message is considered valid. This prevents the frames from looping indefinitely. The value of maximum age should be greater than twice the value of hello time plus 1, but less than twice the value of forward delay minus 1. The allowable range for max-age is 6-40 seconds. Configure this value sufficiently high, so that a frame generated by root can be propagated to the leaf nodes without exceeding the maximum age.

Use the `no` parameter with this command to restore the default value of the maximum age.

Note: A Bridge shall enforce the following relationships for Hello-time, Max-age and Forward-delay.

- $2 \times (\text{Bridge\_Forward\_Delay} - 1.0 \text{ seconds}) \geq \text{Bridge\_Max\_Age}$
- $\text{Bridge\_Max\_Age} \geq 2 \times (\text{Bridge\_Hello\_Time} + 1.0 \text{ seconds})$

### Command Syntax

```
bridge <1-32> max-age <6-40>
no bridge <1-32> max-age
```

### Parameters

- |        |   |
|--------|---|
| <1-32> | Specify the bridge group ID.  |
| <6-40> | Specify the maximum time, in seconds, to listen for the root bridge <6-40>. |

### Default

By default, bridge maximum age is 20 seconds

### Command Mode

Configure Mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 2 max-age 12

(config)#no bridge 2 max-age
```

---

## bridge max-hops

Use this command to specify the maximum allowed hops for a BPDU in an MST region. This parameter is used by all the instances of the MST. Specifying the maximum hops for a BPDU prevents the messages from looping indefinitely in the network. When a bridge receives an MST BPDU that has exceeded the allowed maximum hops, it discards the BPDU.

Use the `no` parameter with this command to restore the default value.

### Command Syntax

```
bridge <1-32> max-hops <1-40>
```

```
no bridge <1-32> max-hops
```

### Parameters

<1-32> Specify the bridge-group ID.

<1-40> Specify the maximum hops for which the BPDU will be valid <1-40>.

### Default

By default, maximum hops in an MST region are 20

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 3 max-hops 25
```

```
#configure terminal
(config)#no bridge 3 max-hops
```

---

## bridge priority

Use this command to set the bridge priority for the common instance. Using a lower priority indicates a greater likelihood of the bridge becoming root. The priority values can be set only in increments of 4096.

Use the `no` form of the command to reset it to the default value.

### Command Syntax

```
bridge (<1-32> | ) priority <0-61440>
no bridge (<1-32> | )priority
```

### Parameters

<1-32>	Specify the bridge group ID.
<0-61440>	Specify the bridge priority in the range of <0-61440>.

### Default

By default, priority is 32768 (or hex 0x8000).

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 2 priority 4096

(config)#no bridge 2 priority
```



---

## bridge shutdown

Use this command to disable a bridge.

Use the `no` parameter to reset the bridge.

### Command Syntax

```
bridge shutdown <1-32>
bridge shutdown <1-32> ((bridge-blocked|bridge-forward) |)
no bridge shutdown <1-32>
```

### Parameters

<1-32>	Specify the bridge group ID.
bridge-forward	Put all ports of the bridge into forwarding state
bridge-blocked	Put all ports of the bridge into blocked state

### Default

No default value is specified

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#bridge shutdown 4
(config)#no bridge shutdown 4
```

---

## bridge transmit-holdcount

Use this command to set the maximum number of transmissions of BPDUs by the transmit state machine.

Use the `no` parameter with this command to restore the default transmit hold-count value.

### Command Syntax

```
bridge <1-32> transmit-holdcount <1-10>
no bridge <1-32> transmit-holdcount
```

### Parameters

<1-32>	Specify the bridge group ID.
<1-10>	Transmit hold-count value.

### Default

By default, transmit hold-count is 6

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 1 transmit-holdcount 5

(config)#no bridge 1 transmit-holdcount
```

---

## bridge-group

Use this command to bind an interface with a bridge specified by the parameter.

Use the `no` parameter with this command to disable this command.

### Command Syntax

```
bridge-group (<1-32>)
no bridge-group (<1-32>)
```

### Parameters

<1-32>	Specify the bridge group ID.
--------	------------------------------

### Default

By default, bridge-group is disabled

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#bridge-group 2

(config)#interface eth1
(config-if)#no bridge-group 2
```

---

## bridge-group path-cost

Use this command to set the cost of a path associated with a bridge group. The lower the path cost, the greater the likelihood of the bridge becoming root.

Use the `no` parameter with this command to restore the default priority value.

### Command Syntax

```
bridge-group <1-32> path-cost <1-200000000>
no bridge-group <1-32> path-cost
```

### Parameters

<1-32>	Specify the bridge group ID.
path-cost	Specify the path-cost of a port.
<1-200000000>	Specify the cost to be assigned to the group.

### Default

By default, bridge-group is disabled

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth1
(config-if)#bridge-group 3 path-cost 123

(config-if)#no bridge-group 3 path-cost
```

---

## bridge-group priority

Use this command to set the port priority for a bridge. A lower priority indicates a greater likelihood of the bridge becoming root.

### Command Syntax

```
bridge-group <1-32> priority <0-240>
no bridge-group <1-32> priority
```

### Parameters

<1-32>	Specify the bridge group ID.
<0-240>	Specify the port priority range (a lower priority indicates greater likelihood of the interface becoming a root). The priority values can only be set in increments of 16.

### Default

By default, priority is 1

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth1
(config-if)#bridge-group 4 priority 96

(config)#interface eth1
(config-if)#no bridge-group 4 priority
```

---

## clear allowed-ethertype

Use this command to clear statistics for each ethertype per interfaces.

```
clear allowed-ethertype statistics (IFNAME|)
```

### Parameters

IFNAME	Interface name.
--------	-----------------

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#clear allowed-ethertype statistics xe54/1

#show allowed-ethertype statistics xe54/1
Interface xe54/1
arp: 0 Packets, 0 Bytes
ipv4: 0 Packets, 0 Bytes
ipv6: 0 Packets, 0 Bytes
dropped: 0 Packets, 0 Bytes
```

## clear mac address-table

Use this command to clear the filtering database for the bridge. This command can be issued to do the following:

- clear the filtering database
- clear all filtering database entries configured through CLI
- clear all multicast filtering database entries
- clear all multicast filtering database entries for a given VLAN or interface
- clear all multicast database entries based on a mac address

### Command Syntax

```
clear mac address-table (dynamic|multicast) bridge <1-32>
clear mac address-table (dynamic|multicast) (address MACADDR | interface IFNAME |
vlan VID ) bridge <1-32>
clear mac address-table (dynamic|multicast) (address MACADDR | interface IFNAME |
vlan VID ) (instance INST) bridge <1-32>
```

### Parameters

dynamic	Clears all dynamic entries.
multicast	Clears all multicast filtering database entries.
address	Clear the specified MAC Address.
MACADDR	When filtering database, entries are cleared based on the MAC address.
bridge	Clears the bridge group ID. Value range is 1-32.
bridge	Clears the bridge group ID. Value range is 1-32.
cvlan	Clears all MAC address for the specified CVLAN. Value range is 1-4094.
svlan	Clears all mac address for the specified SVLAN. Value range is 1-4094.
interface	Clears all MAC address for the specified interface.
bridge	Clears the bridge group ID. Value range is 1-32.
instance	Clears MSTP instance ID. Value range is <1-63>.
vlan	Clears all MAC address for the specified VLAN. Value range is 1-4094.
bridge	Clears the bridge group ID. Value range is 1-32.

### Command Mode

Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

This example shows how to clear multicast filtering database entries:

```
#clear mac address-table multicast bridge 1
```

This example shows how to clear multicast filtering database entries for a given VLAN.

```
#clear mac address-table multicast vlan 2 bridge 1
```

This example shows how to clear all filtering database entries learned through bridge operation for a given MAC address.

```
#clear mac address-table dynamic address 0202.0202.0202 bridge 1
```



---

## dot1ad ethertype

Use this command to configure the service-tpid value on parent port of a subinterface. By this the tpid used for service tag for a subinterface may be inherited from the one applied to parent interface.

Use `no` form of this command to revert the value to default.

Note:

- For any dot1ad subinterface to be functional, `dot1ad ethertype` should be set to desired value as 0x88a8/0x9100/0x9200.
- The `dot1adethertype` command is not allowed on MLAG interfaces. Instead, configure this command on a mapped LAG interface.

### Command Syntax

```
dot1ad ethertype (0x8100 | 0x88a8 | 0x9100 | 0x9200)
no dot1ad ethertype
```

### Parameters

0x8100	IEEE 802.1Q VLAN-tagged frame
0x88a8	IEEE 802.1ad Provider Bridging Service VLAN tag identifier (S-Tag)
0x9100	Supported for interoperability with legacy devices
0x9200	Supported for interoperability with legacy devices

### Default

Default value is 0x8100

### Command Mode

Interface mode

### Applicability

This command was introduced in OcNOS version 3.0.

### Example

```
(config)#interface xe1
(config-if)#dot1ad ethertype 0x9100
(config-if)#exit
(config)#interface xe1
(config-if)#no dot1ad ethertype
(config-if)#exit
```

---

## mac ageing display

Use this command to enable the display of remaining age-time value for dynamically learnt mac address.

Note: When the mac ageing display is enabled the following points are applicable .

- a. The mac ageing display should be enabled in non-scaled case (i.e less than 25% of table size) .
- b. High cpu usage will occurs if mac-ageing-display is enabled in scaled case.
- c. When enabled ,the appropriate ageing time for each entry will only be displayed after the first iteration of the ageing thread is complete which starts after 10 seconds of the cli commit .
- d. For mac entries with no active traffic, the age of the entries will be displayed based on the timestamp when the entries were first learnt. if the entries learnt time is greater than the bridge-mac-age-time (default 300secs), the age of the mac entries will be displayed as zero.

Use the `no` form of this command to disable the display of MAC address aging timeout. When disabled the mac-address age will be the bridge-mac-age-time default 300secs.

### Command Syntax

```
mac-ageing-display
no mac-ageing-display
```

### Parameters

None

### Default

By default, mac ageing display is disabled.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS Version 5.0.

### Example

```
#configure terminal
(config)#mac-ageing-display
(config)#no mac-ageing-display
```

---

## show allowed-ethertype

Use this command to show allowed and denied traffic statistics.

Note: Dropped slow protocol packets provides the count of slow protocol packets among the total dropped count. Total drop count is fetched from hardware and slow protocol packet count is fetched from software. Hence there can be one or two packet difference.

### Command Syntax

```
show allowed-ethertype statistics (IFNAME|)
```

### Parameters

IFNAME                      Interface name.

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#show allowed-ethertype statistics
Interface pol
arp : 0 Packets, 0 Bytes
ipv4 : 511016709 Packets, 184897169366 Bytes
ipv6 : 0 Packets, 0 Bytes
dropped : 220 Packets, 28160 Bytes
dropped slow protocol pkts : lacp 220, efm 0, others 0
Interface xe47
arp : 0 Packets, 0 Bytes
ipv4 : 169763534 Packets, 61427990740 Bytes
ipv6 : 0 Packets, 0 Bytes
dropped : 0 Packets, 0 Bytes
Interface xe48
arp : 0 Packets, 0 Bytes
ipv4 : 0 Packets, 0 Bytes
ipv6 : 0 Packets, 0 Bytes
dropped : 0 Packets, 0 Bytes
```

## show bridge

Use this command to display the filtering database for the bridge. The filtering database is used by a switch to store the MAC addresses that have been learned and which ports that MAC address was learned on.

**Note:** The user is notified with an alert message when the MAC hardware table size is full. The notification is generated for the operator log, SNMP trap and NetConf. When the MAC table is free again due to ageing or flushing, the clear notification is generated. Table full trap is SNMP OID .1.3.6.1.4.1.36673.122.2.1.1 and table clear trap SNMP OID is .1.3.6.1.4.1.36673.122.2.1.2 .

### Command Syntax

```
show bridge (ieee|rpvst+|mstp|)
```

### Parameters

ieee	STP bridges.
rpvst+	RPVST+ bridges.
mstp	MSTP bridges.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show bridge
```

Ageout time is global and if something is configured for vxlan then it will be affected here also

Bridge	CVLAN	SVLAN	BVLAN	Port	MAC Address	FWD	Time-out
1	1			eth1	5254.0029.929c	1	0
1	2			eth1	5254.004c.dcc6	1	297
1	1			eth1	5254.004c.dcc6	1	291

[Table 3-3](#) explains the show command output fields.

**Table 3-3: show bridge output fields**

Field	Description
Bridge	Bridge identifier.
VLAN, SVLAN, BVLAN	CVLAN, SVLAN, and BVLAN identifiers.
Port	Interface name.
MAC Address	Learned MAC address.
FWD	Whether frames for the MAC addresses are forwarded.
Time-out	How long the learned MAC address persists.



# show interface switchport

Use this command to display the characteristics of the interface with the current VLAN.

## Command Syntax

```
show interface switchport bridge <1-32>
```

## Parameter

bridge                      Bridge name.

## Command Mode

Exec mode and Privileged Exec mode

## Applicability

This command was introduced before OcNOS version 1.3.

## Example

The following is an output of this command displaying the characteristics of this interface on bridge 2.

```
#show interface switchport bridge 2
Interface name      : eth5
Switchport mode     : access
Ingress filter      : disable
Acceptable frame types : all
Vid swap            : disable
Default vlan        : 2
Configured vlans    : 2
Interface name      : eth4
Switchport mode     : access
Ingress filter      : disable
Acceptable frame types : all
Vid swap            : disable
Default vlan        : 1
Configured vlans    : 1
```

Table 3-4 explains the show command output fields.

Table 3-4: show interface switchport output fields

Field	Description
Interface name	Display the name of interface.
Switchport mode	Port that used to connect between switches and access port.
Ingress filter	Ingress filtering examines all inbound packets and then permits or denies entry to the network.
Acceptable frame types	Type of acceptable frame in the interface.
VID swap	Displays the status of the VID swap.

Table 3-4: show interface switchport output fields (Continued)

Field	Description
Default vlan	Default value for the VLAN.
Configured vlans	Displays the information on configured VLANs.

# show mac address-table count bridge

Use this command to display a count of MAC entries from the filtering database.

## Command Syntax

```
show mac address-table (local|remote|) count bridge <1-32> ((dynamic | multicast | static) | address MAC | interface IFNAME | vlan <1-4094> |)
```

## Parameter

local	MAC entries learned locally
remote	MAC entries learned from MLAG MAC sync
<1-32>	Bridge group
dynamic	Dynamic entries
multicast	Multicast entries
static	Static entries
MAC	MAC address in HHHH.HHHH.HHHH format
IFNAME	Name of the interface
<1-4094>	VLAN identifier

## Command Mode

Exec mode

## Applicability

This command was introduced before OcNOS version 1.3.

## Example

```
#show mac address-table count bridge 1
MAC Entries for all vlans:
Total MAC Addresses in Use: 3
```

Table 3-5 explains the show command output fields.

Table 3-5: show mac address-table count output fields

Field	Description
Multicast MAC Address Count	Number of multicast addresses.
Total MAC Addresses	Total number of addresses.



## show mac address-table bridge

Use this command to display MAC entries from the filtering database.

### Command Syntax

```
show mac address-table (local|remote|) bridge <1-32> ({(dynamic | multicast |
static) | address MAC | interface IFNAME | vlan <1-4094> }|)
```

### Parameter

local	MAC entries learned locally
remote	MAC entries learned from MLAG MAC sync
<1-32>	Bridge group
dynamic	Dynamic entries
multicast	Multicast entries
static	Static entries
MAC	MAC address in HHHH.HHHH.HHHH format
IFNAME	Name of the interface
<1-4094>	VLAN identifier

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show mac address-table bridge 1 static interface ge14
VLAN      MAC Address      Type      Ports
-----+-----+-----+-----
1         3333.3333.3333      static    ge14

#show mac address-table bridge 1
VLAN      MAC Address      Type      Ports
-----+-----+-----+-----
1         3417.ebf6.0ace      dynamic    po1
1         6400.6a8e.48ab      dynamic    po1
1         a82b.b5b5.c37b      dynamic    po1
200        0000.5e00.0101      dynamic    po1
200        3417.ebf6.0ac5      dynamic    po1
200        3417.ebf6.0ace      dynamic    po1
200        6400.6a8e.48ab      dynamic    po1
200        a82b.b5b5.c375      dynamic    po1
200        a82b.b5b5.c37b      dynamic    po1
800        0000.5e00.0102      dynamic    po1
800        3417.ebf6.0ac5      dynamic    po1
800        3417.ebf6.0ace      dynamic    po1
800        6400.6a8e.48ab      dynamic    po1
800        a82b.b5b5.c375      dynamic    po1
```

---

```
800      a82b.b5b5.c37b    dynamic    po1
```

Table 3-6 explains the show command output fields.

Table 3-6: show mac address-table output fields

Field	Description
VLAN	VLAN identifier.
MAC Address	Media Access Control address.
Type	Dynamic, multicast, or static.
Ports	Interface name.

---

## show mac-address-table bridge 1 learning

Use this command to display if we have disabled mac learning in any of the interfaces.

### Command Syntax

show mac-address-table bridge <1-32> learning

### Parameter

<1-32>	Bridge group
Learning	mac learning

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#no mac-address-table learning bridge 1 ?

interface      Interface
vlan           range(s): 2-5 10 or 2-5 7-19
OcNOS(config)#no mac-address-table learning bridge 1 interface xe1/1
OcNOS#show mac-address-table bridge 1 learning
!
no mac-address-table learning bridge 1 interface xe1/1
!
```

---

## switchport

Use this command to set the mode of an interface to switched.

All interfaces are configured routed by default. To change the behavior of an interface from switched to routed, you must explicitly give the `no switchport` command.

**Note:** When you change the mode of an interface from switched to routed and vice-versa, all configurations for that interface are erased.

Use the `no` form of this command to set the mode to routed.

### Command Syntax

```
switchport
no switchport
```

### Parameters

None

### Default

All interfaces are configured routed by default. To change the behavior of an interface from switched to routed, you must explicitly give the `no switchport` command.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#switchport

(config)#interface eth0
(config-if)#no switchport
```

---

## switchport allowed ethertype

Use this command to allow a set of ethertype on the access port and deny remaining traffic.

Use the no command to remove ethertype configuration.

### Command Syntax

```
switchport allowed ethertype {arp|ipv4|ipv6|WORD|log}
no switchport allowed ethertype ({arp|ipv4|ipv6|WORD|log}|)
```

### Parameters

arp	Ethertype 0x0806.
ipv4	Ethertype 0x0800.
ipv6	Ethertype 0x086dd.
WORD	Any Ethertype value (0x600 - 0xFFFF).
log	Log unwanted ethertype packets.

### Default

No default value is specified

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface xe1
(config-if)#switchport allowed ethertype arp ipv4 ipv6 log

(config-if)#no switchport allowed ethertype ipv4
```

---

## CHAPTER 4 Spanning Tree Protocol Commands

---

This chapter provides a description, syntax, and examples of the Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP), and Provider RSTP commands.

- [bridge cisco-interoperability](#)
- [bridge instance](#)
- [bridge instance priority](#)
- [bridge instance vlan](#)
- [bridge multiple-spanning-tree](#)
- [bridge protocol ieee](#)
- [bridge protocol mstp](#)
- [bridge protocol rstp](#)
- [bridge provider-rstp](#)
- [bridge rapid-spanning-tree](#)
- [bridge region](#)
- [bridge revision](#)
- [bridge spanning-tree](#)
- [bridge spanning-tree errdisable-timeout](#)
- [bridge spanning-tree force-version](#)
- [bridge spanning-tree pathcost](#)
- [bridge spanning-tree portfast](#)
- [bridge te-msti](#)
- [bridge te-msti vlan](#)
- [bridge-group instance](#)
- [bridge-group instance path-cost](#)
- [bridge-group instance priority](#)
- [bridge-group path-cost](#)
- [bridge-group priority](#)
- [bridge-group spanning-tree](#)
- [clear spanning-tree detected protocols](#)
- [clear spanning-tree statistics](#)
- [customer-spanning-tree customer-edge path-cost](#)
- [customer-spanning-tree customer-edge priority](#)
- [customer-spanning-tree forward-time](#)
- [customer-spanning-tree hello-time](#)
- [customer-spanning-tree max-age](#)
- [customer-spanning-tree priority](#)
- [customer-spanning-tree provider-edge path-cost](#)
- [customer-spanning-tree provider-edge priority](#)

- [customer-spanning-tree transmit-holdcount](#)
- [debug mstp](#)
- [show debugging mstp](#)
- [show debugging mstp](#)
- [show debugging mstp](#)
- [show spanning-tree](#)
- [show spanning-tree mst](#)
- [show spanning-tree statistics](#)
- [snmp restart mstp](#)
- [spanning-tree autoedge](#)
- [spanning-tree edgeport](#)
- [spanning-tree edgeport](#)
- [spanning-tree guard](#)
- [spanning-tree instance restricted-role](#)
- [spanning-tree instance restricted-tcn](#)
- [spanning-tree link-type](#)
- [spanning-tree mst configuration](#)
- [spanning-tree restricted-domain-role](#)
- [spanning-tree restricted-role](#)
- [spanning-tree restricted-tcn](#)
- [spanning-tree te-msti configuration](#)
- [storm-control](#)
- [show storm-control](#)

---

## bridge cisco-interoperability

Use this command to enable/disable Cisco interoperability for MSTP (Multiple Spanning Tree Protocol).

If Cisco interoperability is required, all OcnOS devices in the switched LAN must be Cisco-interoperability enabled. When OcnOS inter operates with Cisco, the only criteria used to classify a region are the region name and revision level. VLAN-to-instance mapping is not used to classify regions when interoperating with Cisco.

### Command Syntax

```
bridge <1-32> cisco-interoperability (enable | disable)
```

### Parameters

<1-32>	Specify the bridge group ID
enable	Enable Cisco interoperability for MSTP bridge
disable	Disable Cisco interoperability for MSTP bridge

### Default

By default, cisco interoperability is disabled.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcnOS version 1.3.

### Examples

To enable Cisco interoperability on a switch for a bridge:

```
#configure terminal
(config)#bridge 2 cisco-interoperability enable
```

To disable Cisco interoperability on a switch for a particular bridge:

```
#configure terminal
(config)#bridge 2 cisco-interoperability disable
```



---

## bridge instance

Use this command to add an MST instance to a bridge.

Use the `no` form of this command to delete an MST instance identifier from a bridge.

### Command Syntax

```
bridge (<1-32> | backbone) instance (<1-62>)
no bridge (<1-32> | backbone) instance (<1-62>)
```

### Parameters

<1-32>	Bridge identifier.
backbone	Backbone bridge.
<1-62>	MST instance identifier.

### Default

The bridge instance default is 1.

### Command Mode

MST configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 4 protocol mstp
(config)#spanning-tree mst configuration
(config-mst)#bridge 4 instance 3
...
(config-mst)#no bridge 4 instance 3
```

---

## bridge instance priority

Use this command to set the bridge instance priority.

Use the `no` form of this command to reset the priority to its default.

### Command Syntax

```
bridge (<1-32>) instance <1-63> priority <0-61440>
no bridge (<1-32>) instance <1-63> priority
```

### Parameters

<1-32>	Specify the bridge identifier.
<1-63>	Specify the instance identifier.
priority	Specify the bridge priority for the instance. The lower the priority of the bridge, the better the chances is of the bridge becoming a root bridge or a designated bridge for the LAN. The priority values can be set only in increments of 4096. The default value is 32768.
<0-61440>	Specify the bridge priority.

### Default

By default, bridge instance priority is 32768

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#bridge 4 instance 3 priority 1
```

## bridge instance vlan

Use this command to simultaneously add multiple VLANs for the corresponding instance of a bridge. The VLANs must be created before being associated with an MST instance (MSTI). If the VLAN range is not specified, the MSTI will not be created.

Use the `no` form of this command to simultaneously remove multiple VLANs for the corresponding instance of a bridge.

### Command Syntax

```
bridge (<1-32>) instance (<1-63>) vlan VLANID
no bridge (<1-32>) instance (<1-63>) vlan VLANID
```

### Parameters

<1-32>	Bridge identifier.
<1-63>	MST instance identifier.
VLANID	VLAN identifier(s) <2-4094>. You can specify a single VLAN, a VLAN range, or a VLAN list.  For a VLAN range, specify two VLAN identifiers: the lowest and then the highest separated by a hyphen. For a VLAN list, specify the VLAN identifiers separated by commas. Do not enter spaces between the hyphens or commas.

### Default

The bridge instance VLAN ID Interfaces default-switch is VLAN100 100 ae0.0 ae1.0 ae2.0.

### Command Mode

MST configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

To associate multiple VLANs, in this case VLANs 10 and 20 to instance 1 of bridge 1:

```
#configure terminal
(config)#bridge 1 protocol mstp
(config)#spanning-tree mst configuration
(config-mst)#bridge 1 instance 1 vlan 10,20
```

To associate multiple VLANs, in this case, VLANs 10, 11, 12, 13, 14, and 15 to instance 1 of bridge 1:

```
#configure terminal
(config)#bridge 1 protocol mstp
(config)#spanning-tree mst configuration
(config-mst)#bridge 1 instance 1 vlan 10-15
```

To delete multiple VLANs, in this case, VLANs 10 and 11 from instance 1 of bridge 1:

```
#configure terminal
(config)#bridge 1 protocol mstp
(config)#spanning-tree mst configuration
(config-mst)#no bridge 1 instance 1 vlan 10,11
```

---

## bridge multiple-spanning-tree

Use this command to enable MSTP globally on a bridge.

Use the `no` form of this command to disable MSTP globally on a bridge.

### Command Syntax

```
bridge <1-32> multiple-spanning-tree enable
no bridge <1-32> multiple-spanning-tree enable (bridge-blocked|bridge-forward|)
```

### Parameters

<1-32>	Bridge-group ID.
bridge-blocked	Put ports of the bridge in the blocked state (default).
bridge-forward	Put ports of the bridge in the forwarding state.

### Default

By default, this feature is enabled.

For the `no` form of this command, `bridge-blocked` is the default.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 2 multiple-spanning-tree enable

#configure terminal
(config)#no bridge 2 multiple-spanning-tree enable bridge-forward
```

---

## bridge protocol ieee

Use this command to add a IEEE 802.1d Spanning Tree Protocol bridge.

After creating a bridge instance, add interfaces to the bridge using the `bridge-group` command. Bring the bridge instance into operation with the `no shutdown` command in interface mode.

Use the `no` parameter with this command to remove the bridge.

### Command Syntax

```
bridge <1-32> protocol ieee (vlan-bridge|)
no bridge <1-32>
```

### Parameters

<1-32>	Specify the bridge group ID.
vlan-bridge	Specify this as a VLAN-aware bridge.

### Default

The bridge protocol default value is 2 seconds.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#bridge 3 protocol ieee

(config)#bridge 4 protocol ieee vlan-bridge
```

---

## bridge protocol mstp

Use this command to create a multiple spanning-tree protocol (MSTP) bridge of a specified parameter. This command creates an instance of the spanning tree and associates the VLANs specified with that instance.

The MSTP bridges can have different spanning-tree topologies for different VLANs inside a region of “similar” MSTP bridges. The multiple spanning tree protocol, like the rapid spanning tree protocol, provides rapid reconfiguration capability, while providing load balancing ability. A bridge created with this command forms its own separate region unless it is added explicitly to a region using the `region name` command.

Use the `no` parameter with this command to remove the bridge.

### Command Syntax

```
bridge <1-32> protocol mstp (ring|)
no bridge <1-32>
```

### Parameters

`<1-32>` Specify the bridge group ID.

### Default

The bridge protocol mstp default value is 50 seconds

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 2 protocol mstp

#configure terminal
(config)#bridge 2 protocol mstp ring
```

---

## bridge protocol rstp

Use this command to add an IEEE 802.1w Rapid Spanning Tree Protocol (RSTP) bridge.

After creating a bridge instance, add interfaces to the bridge using the `bridge-group` command. Bring the bridge instance into operation with the `no shutdown` command in Interface mode.

Use the `no` parameter with this command to remove the bridge.

### Command Syntax

```
bridge <1-32> protocol rstp
bridge <1-32> protocol rstp (vlan-bridge|) (ring|)
no bridge <1-32>
```

### Parameters

<code>&lt;1-32&gt;</code>	Specify the bridge group ID.
<code>ring</code>	(Optional) Add an RSTP bridge for a ring topology.
<code>vlan-bridge</code>	(Optional) Adds a VLAN-aware bridge.

### Default

By default, `bridge protocol rstp` is enabled

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 2 protocol rstp

#configure terminal
(config)#bridge 3 protocol rstp vlan-bridge
```

---

## bridge provider-rstp

Use this command to enable Provider Rapid Spanning Tree Protocol (Provider RSTP) globally on a bridge.

Use the `no` form of this command to disable Provider RSTP globally on a bridge.

### Command Syntax

```
bridge <1-32> provider-rstp enable
no bridge <1-32> provider-rstp enable (bridge-blocked|bridge-forward|)
```

### Parameters

<1-32>	Bridge group ID.
bridge-blocked	Put ports of the bridge in the blocked state (default).
bridge-forward	Put ports of the bridge in the forwarding state.

### Default

By default, this feature is enabled.

For the `no` form of this command, `bridge-blocked` is the default.

### Command Mode

Configure mode

### Applicability

This command was introduced in OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 2 provider-rstp enable

#configure terminal
(config)#no bridge 1 provider-rstp enable bridge-block
```



---

## bridge rapid-spanning-tree

Use this command to enable Rapid Spanning Tree Protocol (RSTP) globally on a bridge.

Use the `no` form of the command to disable RSTP globally on a bridge.

### Command Syntax

```
bridge <1-32> rapid-spanning-tree enable
no bridge <1-32> rapid-spanning-tree enable (bridge-blocked|bridge-forward|)
```

### Parameters

<code>&lt;1-32&gt;</code>	Bridge group ID.
<code>bridge-blocked</code>	Put ports of the bridge in the blocked state (default).
<code>bridge-forward</code>	Put ports of the bridge in the forwarding state.

### Default

By default, this feature is enabled.

For the `no` form of this command, `bridge-blocked` is the default.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 2 rapid-spanning-tree enable

#configure terminal
(config)#no bridge 2 rapid-spanning-tree enable bridge-forward
```

---

## bridge region

Use this command to create an MST region and specify its name. MST bridges of a region form different spanning trees for different VLANs.

Use the `no` form of the command to disable the Rapid Spanning Tree protocol on a region.

### Command Syntax

```
bridge <1-32> region REGION_NAME
no bridge <1-32> region
```

### Parameters

<1-32>	Specify the bridge group ID.
REGION_NAME	Specify the name of the region.

### Default

By default, each MST bridge starts with the region name as its bridge address. This means each MST bridge is a region by itself, unless specifically added to one.

### Command Mode

MST configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#spanning-tree mst configuration
(config-mst)#bridge 3 region myRegion

(config)#spanning-tree mst configuration
(config-mst)#no bridge 3 region
```

---

## bridge revision

Use this command to specify the number for configuration information.

### Command Syntax

```
bridge <1-32> revision <0-65535>
```

### Parameters

<1-32>	Specify the bridge group ID in the range of <1-32>.
<0-65535>	Specify a revision number in the range of <0-65535>.

### Default

By default, revision number is 0

### Command Mode

MST configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#spanning-tree mst configuration
(config-mst)#bridge 3 revision 25
```

---

## bridge spanning-tree

Use this command to enable Spanning Tree Protocol (STP) globally on a bridge.

Use the `no` form of this command to disable STP globally on the bridge.

### Command Syntax

```
bridge <1-32> spanning-tree enable
no bridge <1-32> spanning-tree enable (bridge-blocked|bridge-forward|)
```

### Parameters

<1-32>	Bridge group ID.
bridge-blocked	Put ports of the bridge in the blocked state (default).
bridge-forward	Put ports of the bridge in the forwarding state.

### Default

By default, this feature is enabled.

For the `no` form of this command, `bridge-blocked` is the default.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 2 spanning-tree enable

#configure terminal
(config)#no bridge 2 spanning-tree enable bridge-forward
```

---

## bridge spanning-tree errdisable-timeout

Use this command to enable the error-disable-timeout facility, which sets a timeout for ports that are disabled due to the BPDU guard feature.

The BPDU guard feature shuts down the port on receiving a BPDU on a BPDU-guard enabled port. This command associates a timer with the feature such that the port gets enabled back without manual intervention after a set interval.

Use the `no` parameter to disable the error-disable-timeout facility.

### Command Syntax

```
bridge <1-32> spanning-tree errdisable-timeout enable
bridge <1-32> spanning-tree errdisable-timeout interval <10-1000000>
no bridge <1-32> spanning-tree errdisable-timeout enable
no bridge <1-32> spanning-tree errdisable-timeout interval
```

### Parameters

<1-32>	Specify the bridge group ID.
enable	Enable the timeout mechanism for the port to be enabled back
interval	Specify the interval after which port shall be enabled.
<10-1000000>	Specify the error-disable-timeout interval in seconds.

### Default

By default, the port is enabled after 300 seconds

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 1 spanning-tree errdisable-timeout enable

#configure terminal
(config)#bridge 4 spanning-tree errdisable-timeout interval 34
```

---

## bridge spanning-tree force-version

Use this command to set the version for the bridge. A version identifier of less than a value of 2 enforces the spanning tree protocol. Although the command supports an input range of 0-4, for RSTP, the valid range is 0-2. When the force-version is set for a bridge, all ports of the bridge have the same spanning tree version set.

Use the `show spanning tree` command to display administratively configured and currently running values of the BPDU filter parameter for the bridge and port (see [show spanning-tree](#)).

Use the `no` parameter with this command to disable the version for the bridge.

### Command Syntax

```
bridge <1-32> spanning-tree force-version <0-4>
no bridge <1-32> spanning-tree force-version
```

### Parameters

<1-32>	Specify the bridge group ID.
force-version	Specify a force version identifier:
0	STP
1	Not supported
2	RSTP
3	MSTP

### Default

By default, spanning tree force version is 0

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

Set the value to enforce the spanning tree protocol:

```
#configure terminal
(config)#bridge 1 spanning-tree force-version 0

(config)#no bridge 1 spanning-tree force-version
```

---

## bridge spanning-tree pathcost

Use this command to set a spanning-tree path cost method.

If the short parameter is used, the switch uses a value for the default path cost a number in the range 1 through 65,535. If the long parameter is used, the switch uses a value for the default path cost a number in the range 1 through 200,000,000. Refer to the [show spanning-tree](#) to view the administratively configured and current running pathcost method running on a bridge.

Use the no option with this command to return the path cost method to the default setting.

### Command Syntax

```
bridge <1-32> spanning-tree pathcost method (short|long)
no bridge <1-32> spanning-tree pathcost method
```

### Parameters

<1-32>	Specify the bridge group ID.
method	Method used to calculate default port path cost.
long	Use 16-bit based values for default port path costs.
short	Use 32-bit based values for default port path costs.

### Default

By default, path cost method for STP is short and for MSTP/RSTP is long.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 1 spanning-tree pathcost method short

(config)#no bridge 1 spanning-tree pathcost method
```

---

## bridge spanning-tree portfast

Use this command to set the portfast BPDU (Bridge Protocol Data Unit) guard or filter for the bridge.

Use the `show spanning tree` command to display administratively configured and currently running values of the BPDU filter parameter for the bridge and port (see [show spanning-tree](#)).

Use the `no` parameter with this command to disable the BPDU filter for the bridge.

### BPDU Filter

All ports that have their BPDU filter set to default take the same value of BPDU filter as that of the bridge. The Spanning Tree Protocol sends BPDUs from all ports. Enabling the BPDU Filter feature ensures that PortFast-enabled ports do not transmit or receive any BPDUs.

### BPDU Guard

When the BPDU guard feature is set for a bridge, all portfast-enabled ports of the bridge that have the BPDU guard set to default shut down the port on receiving a BPDU. In this case, the BPDU is not processed. You can either bring the port back up manually by using the `no shutdown` command, or configure the `errdisable-timeout` feature to enable the port after the specified time interval.

### Command Syntax

```
bridge <1-32> spanning-tree portfast bpdu-guard
bridge <1-32> spanning-tree portfast bpdu-filter
no bridge <1-32> spanning-tree portfast bpdu-guard
no bridge <1-32> spanning-tree portfast bpdu-filter
```

### Parameters

<1-32>	Specify the bridge group ID.
bpdu-filter	Specify to filter the BPDUs on portfast enabled ports.
bpdu-guard	Specify to guard the portfast ports against BPDU receive.

### Default

By default, portfast for STP is enabled

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#bridge 3 spanning-tree portfast bpdu-filter

#configure terminal
(config)#bridge 1 spanning-tree portfast bpdu-guard
```



---

## bridge te-msti

Use this command to enable or disable a Multiple Spanning Tree Instance (MSTI).

The `te-msti` always refers to the MST instance indexed by the pre-defined macro constant `MSTP_TE_MSTID` internally. This is the only MST instance which supports the disabling of spanning trees.

Use the `no` form of this command to remove the configuration.

### Command Syntax

```
bridge (<1-32>) te-msti
no bridge (<1-32>) te-msti
```

### Parameters

<code>&lt;1-32&gt;</code>	Specify the bridge group ID.
<code>te-msti</code>	MSTI to be the traffic engineering MSTI instance.

### Default

By default, bridge `te-msti` is disabled

### Command Mode

TE-MSTI Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#spanning-tree te-msti configuration
(config-te-msti)#bridge 2 te-msti

(config-te-msti)#no bridge 2 te-msti
```

---

## bridge te-msti vlan

Use this command to enable or disable a Multiple Spanning Tree Instance (MSTI). When an MSTI is shutdown (disabled) each VLAN in the MSTI is set to the forwarding state on all bridge ports which the VLAN as a member of. When and MSTI is enabled (no shutdown), normal MSTP operation is started for the MSTI.

The `te-msti` always refers to the MST instance indexed by the pre-defined macro constant `MSTP_TE_MSTID` internally. This is the only MST instance which supports the disabling of spanning trees. All VLANs that do not want spanning tree topology computation need to be assigned to this `te-msti` instance.

This command is intended for supporting Traffic Engineering (TE) Ethernet tunnels. All VLANs allocated for traffic engineering should be assigned to one MSTI. That MSTI can in turn shutdown the spanning tree operation so that each VLAN path through the network can be manually provisioned.

Use the `no` form of this command to remove the configuration.

### Command Syntax

```
bridge (<1-32>) te-msti vlan <1-4094>
no bridge (<1-32>) te-msti vlan <1-4094>
```

### Parameters

<code>&lt;1-32&gt;</code>	Specify the bridge group ID.
<code>vlan</code>	Specify a VLAN.
<code>&lt;1-4094&gt;</code>	Specify a VLAN identifier to be associated.

Note: This designated instance is defined in 802.1Qay clause 8.9 to be 0xFFE.

### Default

By default, `te-msti vlan` is `vlan1`.

### Command Mode

TE-MSTI Configure mode

### Applicability

This command was introduced before OcnOS version 1.3.

### Examples

```
#configure terminal
(config)#spanning-tree te-msti configuration
(config-te-msti)#bridge 2 te-msti vlan 10
(config-te-msti)#no bridge 2 te-msti vlan 10
```

---

## bridge-group instance

Use this command to assign a Multiple Spanning Tree (MST) instance to a port.

Use the `no` form of this command to remove the interface from the MST instance.

### Command Syntax

```
bridge-group (<1-32>) instance (<1-63> | te-msti)
no bridge-group (<1-32>) instance (<1-63> | te-msti)
```

### Parameters

<1-32>	Bridge identifier.
<1-63>	Multiple spanning tree instance identifier.
spbm	spbm
spbv	spbv
te-msti	Traffic engineering MSTI instance.

### Default

By default, the bridge port remains in the listening and learning states for 15 seconds before transitional to the forwarding state.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#bridge-group 1
(config-if)#bridge-group 1 instance te-msti
```

---

## bridge-group instance path-cost

Use this command to set a path cost for a multiple spanning tree instance.

Before you can give this command, you must explicitly add an MST instance to a port using the `bridge-group instance` command.

Use the `no` form of this command to set the path cost to its default which varies depending on bandwidth.

### Command Syntax

```
bridge-group (<1-32>) instance <1-63> path-cost <1-200000000>
no bridge-group ( <1-32>) instance <1-63> path-cost
```

### Parameters

<1-32>	Bridge identifier.
<1-63>	Set the MST instance identifier.
<1-200000000>	Path cost for a port (a lower path cost means greater likelihood of becoming root).

### Default

Assuming a 10 Mb/s link speed, the default value is 200,000.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#spanning-tree mst configuration
(config-mst)#bridge 4 instance 3 vlan 3
(config-mst)#exit
(config)#interface eth1
(config-if)#bridge-group 4 instance 3
(config-if)#bridge-group 4 instance 3 path-cost 1000
```

---

## bridge-group instance priority

Use this command to set the priority of a multiple spanning tree instance.

The Multiple Spanning Tree Protocol uses port priority as a tiebreaker to determine which port should forward frames for a particular instance on a LAN, or which port should be the root port for an instance. A lower value implies a better priority. In the case of the same priority, the interface index will serve as the tiebreaker, with the lower-numbered interface being preferred over others.

### Command Syntax

```
bridge-group (<1-32>) instance (<1-63>) priority <0-240>
no bridge-group (<1-32>) instance (<1-63>) priority
```

### Parameters

<1-32>	Bridge identifier.
<1-63>	Multiple spanning tree instance identifier.
<0-240>	Port priority. A lower value means greater likelihood of becoming root. Set the port priority in increments of 16.

### Default

By default, the port priority is 128

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
(config)#interface eth2
(config-if)#bridge-group 2
(config-if)#bridge-group 2 instance 4
(config-if)#bridge-group 2 instance 4 priority 64
```

---

## bridge-group path-cost

Use this command to set the cost of a path. Before you can use this command to set a path-cost in a VLAN configuration, you must explicitly add an MST instance to a port using the `bridge-group instance` command.

Use the `no` parameter with this command to restore the default cost value of the path which varies depending on the bandwidth.

### Command Syntax

```
bridge-group <1-32> path-cost <1-200000000>
no bridge-group <1-32> path-cost
```

### Parameters

<code>&lt;1-32&gt;</code>	Specify the bridge group ID.
<code>path-cost</code>	Specify the cost of path for a port.
<code>&lt;1-200000000&gt;</code>	Specify the cost of the path (a lower cost means a greater likelihood of the interface becoming root).

### Default

Assuming a 10 Mb/s link speed, the default value is 200,000.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#spanning-tree mst configuration
(config-mst)#bridge 4 instance 3 vlan 3
(config-mst)#exit
(config)#interface eth1
(config-if)#bridge-group 4
(config-if)#bridge-group 4 path-cost 1000
```

---

## bridge-group priority

Use this command to set the port priority for a bridge group.

The Multiple Spanning Tree Protocol uses port priority as a tiebreaker to determine which port should forward frames for a particular instance on a LAN, or which port should be the root port for an instance. A lower value implies a better priority. In the case of the same priority, the interface index will serve as the tiebreaker, with the lower-numbered interface being preferred over others.

### Command Syntax

```
bridge-group (<1-32>) priority <0-240>
no bridge-group (<1-32>) priority
```

### Parameters

<1-32>	Specify the bridge group ID.
<0-240>	Specify the port priority (a lower priority indicates greater likelihood of the interface becoming a root). The priority values can only be set in increments of 16.

### Default

By default, port priority for each instance is 128

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#bridge-group 4 priority 80
```

---

## bridge-group spanning-tree

Use this command to enable or disable spanning-tree on an interface.

### Command Syntax

```
bridge-group <1-32> spanning-tree (disable|enable)
```

### Parameters

<1-32>	Bridge group ID.
disable	Disable spanning tree on the interface.
enable	Enable spanning tree on the interface.

### Default

By default, spanning-tree is enabled

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
(config)#interface eth1
(config-if)#bridge-group 1 spanning-tree enable
```



---

## clear spanning-tree detected protocols

Use this command to clear the detected protocols for a specific bridge or interface. This command begins the port migration as per IEEE 802.1w-2001, Section 17.26. After issuing this command, the migration timer is started on the port, only if the force version is RSTP or MSTP (greater versions of RSTP).

### Command Syntax

```
clear spanning-tree detected protocols bridge <1-32>
```

### Parameters

<1-32>                      Specify the bridge group ID.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcnOS version 1.3.

### Example

```
#clear spanning-tree detected protocols bridge 2
```

---

## clear spanning-tree statistics

Use this command to clear all STP BPDU statistics.

### Command Syntax

```
clear spanning-tree statistics bridge <1-32>
clear spanning-tree statistics interface IFNAME (instance (<1-63>)| vlan <1-4094>)
    bridge <1-32>
clear spanning-tree statistics (interface IFNAME| (instance (<1-63>)| vlan <2-4094>)) bridge <1-32>
```

### Parameters

<1-32>	Specify the bridge identifier.
IFNAME	Specify the name of the interface on which protocols have to be cleared.
<1-63>	MST instance ID.
<1-4094>	VLAN identifier where spanning tree is located <2-4094>

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#clear spanning-tree statistics bridge 32
```

---

## customer-spanning-tree customer-edge path-cost

Use this command to set the cost of a path associated with a customer edge port on a customer edge spanning tree.

Use the `no` form of this command to remove the cost of a path associated with a customer edge port on a customer edge spanning tree.

### Command Syntax

```
customer-spanning-tree customer-edge path-cost <1-200000000>  
no customer-spanning-tree customer-edge path-cost
```

### Parameters

<code>path-cost</code>	Specify the path-cost of a port.
<code>&lt;1-200000000&gt;</code>	Specify the cost to be assigned to the group.

### Default

Assuming a 10 Mb/s link speed, the default value is 200,000

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal  
(config)#interface eth1  
(config-if)#customer-spanning-tree customer-edge path-cost 1000
```

---

## customer-spanning-tree customer-edge priority

Use this command to set the port priority for a customer-edge port in the customer spanning tree.

### Command Syntax

```
customer-spanning-tree customer-edge priority <0-240>
```

### Parameters

priority	Specify the port priority.
<0-240>	Specify the port priority range (a lower priority indicates greater likelihood of the interface becoming a root). The priority values can only be set in increments of 16.

### Default

By default, priority is 1

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth1
(config-if)#customer-spanning-tree customer-edge priority 100
```

---

## customer-spanning-tree forward-time

Use this command to set the time (in seconds) after which (if this bridge is the root bridge) each port changes states to learning and forwarding. This value is used by all instances.

Use the `no` form of this command to restore the default value of 15 seconds.

### Command Syntax

```
customer-spanning-tree forward-time <4-30>
no customer-spanning-tree forward-time
```

### Parameters

<4-30>                      Specify the forwarding time delay in seconds.

Note: Care should be exercised if the value is set to less than 7 seconds.

### Default

By default, priority is 15 seconds

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#customer-spanning-tree forward-time 6

(config-if)#no customer-spanning-tree forward-time
```

---

## customer-spanning-tree hello-time

Use this command to set the hello-time, the time in seconds after which (if this bridge is the root bridge) all the bridges in a bridged LAN exchange Bridge Protocol Data Units (BPDUs). Avoid a very low value of this parameter as this can lead to excessive traffic on the network; a higher value delays the detection of topology change. This value is used by all instances.

Use the `no` option with this command to restore the default value of the hello-time.

### Command Syntax

```
customer-spanning-tree hello-time <1-10>
no customer-spanning-tree hello-time
```

### Parameters

<1-10>                      Specify the hello BPDU interval in seconds.

### Default

By default, level is 2 seconds

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#customer-spanning-tree hello-time 3

(config-if)#no customer-spanning-tree hello-time
```

---

## customer-spanning-tree max-age

Use this command to set the max-age for a bridge.

Max-age is the maximum time in seconds for which (if a bridge is the root bridge) a message is considered valid. This prevents the frames from looping indefinitely. The value of max-age should be greater than twice the value of hello-time plus one, but less than twice the value of forward delay minus one. The allowable range for max-age is 6-40 seconds. Configure this value sufficiently high, so that a frame generated by a root can be propagated to the leaf nodes without exceeding the max-age.

Use the `no` parameter with this command to restore the default value of max-age.

### Command Syntax

```
customer-spanning-tree max-age <6-40>
no customer-spanning-tree max-age
```

### Parameters

<6-40>                      Specify the maximum time in seconds to listen for the root bridge.

### Default

By default, bridge max-age is 20 seconds

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#customer-spanning-tree max-age 12

(config-if)#no customer-spanning-tree max-age
```

---

## customer-spanning-tree priority

Use this command to set the bridge priority for the spanning tree on a customer edge port. Using a lower priority indicates a greater likelihood of the bridge becoming root. This command must be used to set the priority of the customer spanning tree running on the customer edge port.

Use the `no` form of the command to reset it to the default value.

### Command Syntax

```
customer-spanning-tree priority <0-61440>
no customer-spanning-tree priority
```

### Parameters

<0-61440>	Specify the bridge priority in the range <0-61440>. Priority values can be set only in increments of 4096.
-----------	--

### Default

By default, priority is 61440

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#customer-spanning-tree priority 4096

(config-if)#no customer-spanning-tree priority
```



---

## customer-spanning-tree provider-edge path-cost

Use this command to set the cost of a path associated with a provider edge port on a customer edge spanning tree.

Use the `no` form of this command to remove the cost of a path associated with a provider edge port on a customer edge spanning tree.

### Command Syntax

```
customer-spanning-tree provider-edge vlan <1-4094> path-cost <1-2000000000>
no customer-spanning-tree provider-edge vlan <1-4094> path-cost
```

### Parameters

<1-4094>	Specify the SVLAN identifier of provider edge port.
<1-2000000000>	Specify the cost to be assigned to the group.

### Default

Assuming a 10 Mb/s link speed, the default value is 200,000

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#customer-spanning-tree provider-edge vlan 2 path-cost 1000

(config-if)#no customer-spanning-tree provider-edge vlan 2 path-cost
```

---

## customer-spanning-tree provider-edge priority

Use this command to set the port priority for a provider-edge port in the customer spanning tree.

### Command Syntax

```
customer-spanning-tree provider-edge svlan <1-4094> priority <0-240>
```

### Parameters

<1-4094>	Specify the SVLAN identifier of provider edge port.
<0-240>	Specify the port priority (a lower priority means greater likelihood of the interface becoming root). The priority values can only be set in increments of 16.

### Default

By default, priority is 1

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth1
(config-if)#customer-spanning-tree provider-edge svlan 2 priority 0
```

---

## customer-spanning-tree transmit-holdcount

Use this command to set the transmit-holdcount for a bridge.

Use the `no` parameter with this command to restore the default value of `transmit-holdcount`.

### Command Syntax

```
customer-spanning-tree transmit-holdcount <1-10>
no customer-spanning-tree transmit-holdcount
```

### Parameters

`<1-10>` Specify the maximum number that can be transmitted per second.

### Default

By default, bridge transmit hold count is 6

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#customer-spanning-tree transmit-holdcount 3

(config-if)#no customer-spanning-tree transmit-holdcount
```

---

## debug mstp

Use this command to turn on, and turn off, debugging and echoing data to the console, at various levels.

Note: This command enables MSTP, RSTP, and STP debugging.

Use the `no` parameter with this command to turn off debugging.

### Command Syntax

```
debug mstp all
debug mstp cli
debug mstp packet rx
debug mstp packet tx
debug mstp protocol
debug mstp protocol detail
debug mstp timer
debug mstp timer detail
no debug mstp all
no debug mstp cli
no debug mstp packet rx
no debug mstp packet tx
no debug mstp protocol
no debug mstp protocol detail
no debug mstp timer
no debug mstp timer detail
```

### Parameters

<code>all</code>	Echoes all spanning-tree debugging levels to the console.
<code>cli</code>	Echoes spanning-tree commands to the console.
<code>packet</code>	Echoes spanning-tree packets to the console.
<code>rx</code>	Received packets.
<code>tx</code>	Transmitted packets.
<code>protocol</code>	Echoes protocol changes to the console.
<code>detail</code>	Detailed output.
<code>timer</code>	Echoes timer start to the console.
<code>detail</code>	Detailed output.

### Command Mode

Exec, Privileged Exec, and Configure modes

### Applicability

This command was introduced before OcNOS version 1.3.

**Examples**

```
#configure terminal
(config)#debug mstp all
(config)#debug mstp cli
(config)#debug mstp packet rx
(config)#debug mstp protocol detail
(config)#debug mstp timer
```

---

## show debugging mstp

Use this command to display the status of debugging of the MSTP system.

### Command Syntax

```
show debugging mstp
```

### Parameters

None

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#show debugging mstp
MSTP debugging status:
MSTP debugging status:
MSTP timer debugging is on
MSTP protocol debugging is on
MSTP detailed protocol debugging is on
MSTP cli echo debugging is on
MSTP transmitting packet debugging is on
MSTP receiving packet debugging is on
#
```

---

## show spanning-tree

Use this command to show the state of the spanning tree for all STP or RSTP bridge-groups, including named interface and VLANs.

### Command Syntax

```
show spanning-tree
show spanning-tree interface IFNAME
show spanning-tree mst
show spanning-tree mst config
show spanning-tree mst interface IFNAME
show spanning-tree mst detail
show spanning-tree mst detail interface IFNAME
show spanning-tree mst instance (<1-63>) interface IFNAME
show spanning-tree mst instance (<1-63> | te-msti)
show spanning-tree statistics bridge <1-32>
show spanning-tree statistics interface IFNAME (instance (<1-63>)| vlan <2-4094>)
    bridge <1-32>
show spanning-tree statistics (interface IFNAME | (instance (<1-63>) | vlan <1-
    4094>)) bridge <1-32>
show spanning-tree vlan range-index
```

### Parameters

interface	Display interface information
mst	Display MST information
statistics	Display statistics of the BPDUs
vlan range-index	Display a VLAN range-index value
config	Display configuration information
detail	Display detailed information
instance	Display instance information
<1-63>	Specify the instance identifier
te-msti	Display Traffic Engineering MSTI instance
<1-32>	Specify the bridge identifier
IFNAME	Display the interface name
<2-4094>	Specify a VLAN identifier, associated with the instance

### Command Mode

Exec mode and Privileged Exec mode

## Applicability

This command was introduced before OcNOS version 1.3.

## Example

The following is a sample output of this command displaying spanning tree information.

```
#show spanning-tree
% 1: Bridge up - Spanning Tree Enabled
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20
% 1: Root Id 80000002b328530a
% 1: Bridge Id 80000002b328530a
% 1: last topology change Wed Nov 19 22:39:18 2008
% 1: 11 topology change(s) - last topology change Wed Nov 19 22:39:18 2008
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
%eth2: Ifindex 5 - Port Id 8005 - Role Designated - State Forwarding
%eth2: Designated Path Cost 0
%eth2: Configured Path Cost 200000 - Add type Explicit ref count 1
%eth2: Designated Port Id 8005 - Priority 128 -
%eth2: Root 80000002b328530a
%eth2: Designated Bridge 80000002b328530a
%eth2: Message Age 0 - Max Age 20
%eth2: Hello Time 2 - Forward Delay 15
%eth2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change timer 0
%eth2: forward-transitions 4
%eth2: Version Rapid Spanning Tree Protocol - Received RSTP - Send RSTP
%eth2: No portfast configured - Current portfast off
%eth2: portfast bpdu-guard default - Current portfast bpdu-guard off
%eth2: portfast bpdu-filter default - Current portfast bpdu-filter off
%eth2: no root guard configured- Current root guard off
%eth2: Configured Link Type point-to-point - Current point-to-point
%eth1: Ifindex 4 - Port Id 8004 - Role Designated - State Forwarding
%eth1: Designated Path Cost 0
%eth1: Configured Path Cost 200000 - Add type Explicit ref count 1
%eth1: Designated Port Id 8004 - Priority 128 -
%eth1: Root 80000002b328530a
%eth1: Designated Bridge 80000002b328530a
%eth1: Message Age 0 - Max Age 20
%eth1: Hello Time 2 - Forward Delay 15
%eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change timer 0
%eth1: forward-transitions 4
%eth1: Version Rapid Spanning Tree Protocol - Received None - Send RSTP
%eth1: No portfast configured - Current portfast off
%eth1: portfast bpdu-guard default - Current portfast bpdu-guard off
%eth1: portfast bpdu-filter default - Current portfast bpdu-filter off
%eth1: no root guard configured- Current root guard off
%eth1: Configured Link Type point-to-point - Current point-to-point
%
%
```



The following is a sample output of this command displaying the state of the spanning tree for interface eth1.

```
#show spanning-tree interface eth1
% 1: Bridge up - Spanning Tree Enabled
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20
% 1: Root Id 80000002b328530a
% 1: Bridge Id 80000002b328530a
% 1: last topology change Wed Nov 19 22:39:18 2008
% 1: 11 topology change(s) - last topology change Wed Nov 19 22:39:18 2008
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% eth1: Ifindex 4 - Port Id 8004 - Role Designated - State Forwarding
% eth1: Designated Path Cost 0
% eth1: Configured Path Cost 200000 - Add type Explicit ref count 1
% eth1: Designated Port Id 8004 - Priority 128 -
% eth1: Root 80000002b328530a
% eth1: Designated Bridge 80000002b328530a
% eth1: Message Age 0 - Max Age 20
% eth1: Hello Time 2 - Forward Delay 15
% eth1: forward-transitions 4
% eth1: Version Rapid Spanning Tree Protocol - Received None - Send RSTP
% eth1: No portfast configured - Current portfast off
% eth1: portfast bpdu-guard default - Current portfast bpdu-guard off
% eth1: portfast bpdu-filter default - Current portfast bpdu-filter off
% eth1: no root guard configured- Current root guard off
```

Table 4-7 Explains the show command output fields.

**Table 4-7: show spanning-tree interface output fields**

Field	Description
Bridge up	A network bridge is a computer networking device that creates a single aggregate network from multiple communication networks or network segments.
Root Path Cost	Root cost for the interface.
Root Port	Interface that is the current elected root port for this bridge.
Bridge Priority	Used for the common instance.
Forward Delay	Configured time an STP bridge port remains in the listening and learning states before transitioning to the forwarding state.
Hello Time	Configured number of seconds between transmissions of configuration BPDUs.
Max Age	Maximum age of received protocol BPDUs.
Port Id	Logical interface identifier configured to participate in the MSTP instance.
Role Designated	Designated role for the packets in the interface.
State Forwarding	State of the forwarding packets in the interface.

---

Field	Description
Designated Path Cost	Designated cost for the interface.
Configured Path Cost	Configured cost for the interface.
Designated Port Id	Port ID of the designated port for the LAN segment this interface is attached to.
Priority	Specify the port priority.
Message Age	Number of seconds elapsed since the most recent BPDU was received.
Forward Timer	The forward delay timer is the time interval that is spent in the listening and learning state.
Msg Age Timer	The message age contains the length of time that has passed since the root bridge initially originated the BPDU.
Received RSTP	Number of times the received the RSTP.
Send RSTP	Number of times transmitted the RSTP.

---

## show spanning-tree mst

Use this command to display the filtering database values. This command displays the number of instances created, and VLANs associated with it.

### Command Syntax

```
show spanning-tree mst
show spanning-tree mst config
show spanning-tree mst detail
show spanning-tree mst detail interface IFNAME
show spanning-tree mst instance (<1-63>) interface IFNAME
show spanning-tree mst instance (<1-63> | te-msti)
show spanning-tree mst interface IFNAME
```

### Parameters

config	Display configuration information.
detail	Display detailed information.
interface	Display interface information.
instance	Display instance information.
<1-63>	Specify the instance identifier.
te-msti	Traffic Engineering MSTI instance.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#show spanning-tree mst
% 1: Bridge up - Spanning Tree Enabled
% 1: CIST Root Path Cost 0 - CIST Root Port 0 - CIST Bridge
Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Max-hops 20
% 1: CIST Root Id 80000002b328530a
% 1: CIST Reg Root Id 80000002b328530a
% 1: CIST Bridge Id 80000002b328530a
% 1: 2 topology change(s) - last topology change Wed Nov 19 22:43:21 2008
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
```

```
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec%
% Instance VLAN
% 0:      1
% 2:      3-4
```

Table 4-8 Explains the show command output fields.

**Table 4-8: show spanning-tree mst output fields**

Field	Description
Bridge up	A network bridge is networking process that creates a single aggregate network from multiple communication networks or network segments.
CIST Root Path Cost	Calculated cost to reach the regional root bridge from the bridge where the command is entered.
CIST Root Port	Interface that is the current elected CIST root port for this bridge.
CIST Bridge	A CIST bridge is networking process that creates a single aggregate network from multiple communication networks.
Priority	Specify the port priority.
Forward Delay	Configured time an STP bridge port remains in the listening and learning states before transitioning to the forwarding state.
Hello Time	Configured number of seconds between transmissions of configuration BPDUs.
Max Age	Maximum age of received protocol BPDUs.
Max-hops	Configured maximum number of hops a BPDU can be forwarded in the MSTP region.

## show spanning-tree statistics

Use this command to display detailed BPDU statistics for a spanning tree instance.

### Command Syntax

```
show spanning-tree statistics bridge <1-32>

show spanning-tree statistics interface IFNAME (instance (<1-63>)| vlan <2-4094>)
    bridge <1-32>

show spanning-tree statistics (interface IFNAME | (instance (<1-63>) | vlan <1-4094>)) bridge <1-32>
```

### Parameters

<1-32>	Bridge identifier.
<1-63>	MST instance identifier.
IFNAME	Displays the interface name.
<2-4094>	Specify a VLAN identifier, associated with the instance.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

In the following example, bridge-group 1 is configured for IEEE on the eth2 interface.

```
#show spanning-tree statistics interface eth2 bridge 1

% BPDU Related Parameters
% -----
% Port Spanning Tree           : Enable
% Spanning Tree Type           : Spanning Tree Protocol
% Current Port State           : Learning
% Port ID                      : 8004
% Port Number                  : 4
% Path Cost                    : 200000
% Message Age                  : 0
% Designated Root              : 00:02:b3:d5:91:ec
% Designated Cost              : 0
% Designated Bridge            : 00:02:b3:d5:91:ec
% Designated Port Id           : 8005
% Top Change Ack               : FALSE
% Configure Pending            : FALSE

% PORT Based Information & Statistics
% -----
% Configure Bpdu's xmitted      : 0
% Configure Bpdu's received    : 22
% TCN Bpdu's xmitted           : 0
```

```

% TCN Bpdu's received           : 8
% Forward Trans Count           : 0

% STATUS of Port Timers
% -----
% Hello Time Configured         : 2
% Hello timer                   : ACTIVE
% Hello Time Value              : 1
% Forward Delay Timer           : ACTIVE
% Forward Delay Timer Value     : 1
% Message Age Timer             : ACTIVE
% Message Age Timer Value       : 19
% Topology Change Timer         : INACTIVE
% Topology Change Timer Value   : 0
% Hold Timer                    : INACTIVE
% Hold Timer Value              : 0

% Other Port-Specific Info
% -----
% Max Age Transitions           : 1
% Msg Age Expiry                : 0
% Similar BPDUS Rcvd           : 14
% Src Mac Count                 : 0
% Total Src Mac Rcvd            : 15
% Next State                    : Blocked
% Topology Change Time          : 0

% Other Bridge information & Statistics
% -----
% STP Multicast Address         : 01:80:c2:00:00:00
% Bridge Priority                : 32768
% Bridge Mac Address            : 00:02:b3:d5:98:3f
% Bridge Hello Time             : 2
% Bridge Forward Delay          : 15
% Topology Change Initiator     : 0
% Last Topology Change Occurred : Wed Dec 31 16:00:00 1969
% Topology Change               : FALSE
% Topology Change Detected      : FALSE
% Topology Change Count         : 0
% Topology Change Last Recvd from : 00:00:00:00:00:00

```

Table 4-9 Explains the show command output fields.

**Table 4-9: show spanning-tree statistics output fields**

Field	Description
BPDU Related Parameters	Details of the BPDU related parameters.
PORT Based Information & Statistics	Information of the port and interface for which the statistics are being displayed.

---

Field	Description
STATUS of Port Timers	Status of the port timers.
Other Port-Specific Info	Specific information about the port.
Other Bridge information & Statistics	Information about bridge and statistics being displayed.

---

## snmp restart mstp

Use this command to restart SNMP in Multiple Spanning Tree Protocol (MSTP).

### Command Syntax

```
snmp restart mstp
```

### Parameters

None

### Default

No default value is specified

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#snmp restart mstp
```



---

## spanning-tree autoedge

Use this command to assist in automatic identification of the edge port.

Use the `no` parameter with this command to disable this feature.

### Command Syntax

```
spanning-tree autoedge
no spanning-tree autoedge
```

### Default

By default, spanning-tree autoedge is disabled

### Parameters

None

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree autoedge
```

---

## spanning-tree edgeport

Use this command to set a port as an edge-port and to enable rapid transitions.

Use the `no` parameter with this command to set a port to its default state (not an edge-port) and to disable rapid transitions.

Note: This command is an alias to the `spanning-tree portfast` command. Both commands can be used interchangeably.

### Command Syntax

```
spanning-tree edgeport
no spanning-tree edgeport
```

### Default

By default, spanning-tree edgeport is disabled

### Parameters

None

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree edgeport
```

---

## spanning-tree guard

Use this command to enable the root guard feature for the port. This feature disables reception of superior BPDUs.

The root guard feature makes sure that the port on which it is enabled is a designated port. If the root guard enabled port receives a superior BPDU, it goes to a Listening state (for STP) or discarding state (for RSTP and MSTP).

Use the `no` parameter with this command to disable the root guard feature for the port.

### Command Syntax

```
spanning-tree guard root
no spanning-tree guard root
```

### Parameters

<code>root</code>	Set to disable reception of superior BPDUs
-------------------	--

### Default

By default, spanning-tree guard root is enabled

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree guard root
```

---

## spanning-tree instance restricted-role

Use this command to set the restricted role value for the instance to TRUE.

Use the `no` parameter with this command to set the restricted role value for the instance to FALSE.

### Command Syntax

```
spanning-tree instance <1-63> restricted-role
no spanning-tree instance <1-63> restricted-role
```

### Parameters

<1-63>                      Specify the instance ID range.

### Default

By default, restricted-role value is FALSE

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree instance 2 restricted-role
```

---

## spanning-tree instance restricted-tcn

Use this command to set the restricted TCN value for the instance to TRUE.

### Command Syntax

```
spanning-tree instance <1-63> restricted-tcn
no spanning-tree instance <1-63> restricted
```

### Parameters

<1-63>                      Specify the instance ID range.

### Default

By default, restricted TCN value is FALSE

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree instance 2 restricted-tcn
```

---

## spanning-tree link-type

Use this command to enable or disable point-to-point or shared link types.

RSTP has a backward-compatible STP mode, `spanning-tree link-type shared`. An alternative is the `spanning-tree force-version 0`.

Use the `no` parameter with this command to disable rapid transition.

### Command Syntax

```
spanning-tree link-type auto
spanning-tree link-type point-to-point
spanning-tree link-type shared
no spanning-tree link-type
```

### Parameters

<code>auto</code>	Sets to either point-to-point or shared based on duplex state.
<code>point-to-point</code>	Enables rapid transition.
<code>shared</code>	Disables rapid transition.

### Default

By default, `spanning-tree link-type` is enabled.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree link-type point-to-point

(config-if)#no spanning-tree link-type
```

---

## spanning-tree mst configuration

Use this command to enter the Multiple Spanning Tree Configuration mode.

### Command Syntax

```
spanning-tree mst configuration
```

### Parameters

None

### Default

No default value is specified.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#spanning-tree mst configuration
(config-mst)#
```

---

## spanning-tree bpdu-filter

Use this command to set the BPDU filter value for individual ports. When the `enable` or `disable` parameter is used with this command, this configuration takes precedence over bridge configuration. However, when the `default` parameter is used with this command, the bridge level BPDU filter configuration takes effect for the port.

Use the `show spanning tree` command to display administratively configured and currently running values of the BPDU filter parameter for the bridge and port (see [show spanning-tree](#)).

Use the `no` parameter with this command to revert the port BPDU filter value to default.

### Command Syntax

```
spanning-tree bpdu-filter (enable|disable|default)
no spanning-tree bpdu-filter
```

### Parameters

<code>default</code>	Sets the bpdu-filter to the default level.
<code>disable</code>	Disables the BPDU-filter.
<code>enable</code>	Enables the BPDU-filter.

### Default

By default, `spanning-tree bpdu-filter` is default option

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree bpdu-filter enable

(config-if)#no spanning-tree bpdu-filter
```



---

## spanning-tree bpdu-guard

Use this command to enable or disable the BPDU Guard feature on a port.

This command supersedes the bridge level configuration for the BPDU Guard feature. When the `enable` or `disable` parameter is used with this command, this configuration takes precedence over bridge configuration. However, when the `default` parameter is used with this command, the bridge-level BPDU Guard configuration takes effect.

Use the `show spanning tree` command to display administratively configured and currently running values of the BPDU filter parameter for the bridge and port (see [show spanning-tree](#)).

Use the `no` parameter with this command to set the BPDU Guard feature on a port to default.

### Command Syntax

```
spanning-tree bpdu-guard (enable|disable|default)
no spanning-tree bpdu-guard
```

### Parameters

<code>default</code>	Sets the BPDU-guard to the default level.
<code>disable</code>	Disables the BPDU-guard.
<code>enable</code>	Enables the BPDU-guard.

### Default

By default, `spanning-tree bpdu-guard` is default

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree bpdu-guard enable

(config-if)#no spanning-tree bpdu-guard
```

---

## spanning-tree restricted-domain-role

Use this command to set the restricted-domain-role value of the port to TRUE.

Use the `no` parameter with this command to set the restricted-domain-role value of the port to FALSE.

### Command Syntax

```
spanning-tree restricted-domain-role
no spanning-tree restricted-domain-role
```

### Parameters

None

### Default

By default, restricted-role value is FALSE

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree restricted-domain-role
```

---

## spanning-tree restricted-role

Use this command to set the restricted-role value of the port to TRUE.

Use the `no` parameter with this command to set the restricted-role value of the port to FALSE.

### Command Syntax

```
spanning-tree restricted-role
no spanning-tree restricted-role
```

### Parameters

None

### Default

By default, restricted-role value is FALSE

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree restricted-role
```

---

## spanning-tree restricted-tcn

Use this command to set the restricted TCN value of the port to TRUE.

Use the `no` parameter with this command to set the restricted TCN value of the port to FALSE.

### Command Syntax

```
spanning-tree restricted-tcn
no spanning-tree restricted-tcn
```

### Parameters

None

### Default

By default, restricted TCN value is FALSE

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree restricted-tcn
```

---

## spanning-tree te-msti configuration

This command is used to put the terminal into the `te-msti` configuration mode.

After creating a bridge instance and adding VLAN to that bridge instance, use this command to enter `te-msti` configuration mode.

### Command Syntax

```
spanning-tree te-msti configuration
```

### Parameters

None

### Default

No default value is specified

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#spanning-tree te-msti configuration
(config-te-msti)#
```

## storm-control

Use this command to set the rising threshold level for broadcast, multicast, or destination lookup failure traffic. The storm control action occurs when traffic utilization reaches this level.

Storm control is used to block the forwarding of unnecessary flooded traffic. A packet storm occurs when a large number of broadcast packets are received on a port. Forwarding these packets can cause the network to slow down or time out.

Storm-control is a physical interface property and when configured on port-channel storm-control is applied on each physical member port and therefore the actual value is the configured value multiplied by the number of active member interfaces.

Use the `no` form of this command to disable storm control.

Note: Minimum granularity for storm-control is 64kbps.

Note: Storm Discard notification is sent in case of packet discards but not based on configuration.

### Command Syntax

```
storm-control (broadcast|multicast|dlf) (level LEVEL | <0-4294967294>
(kbps|mbps|gbps))
no storm-control (broadcast|multicast|dlf)
```

### Parameters

<code>broadcast</code>	Broadcast rate limiting.
<code>multicast</code>	Multicast rate limiting.
<code>dlf</code>	Destination lookup failure limiting.
<code>level</code>	Sets the percentage of the threshold.
<code>LEVEL</code>	The percentage of the threshold.
<code>&lt;0-4294967294&gt;</code>	Sets absolute threshold value <0-1000000000>
<code>kbps</code>	specifies the units of Kilobits per second.
<code>mbps</code>	specifies the units of Megabits per second.
<code>gbps</code>	specifies the units of Gigabits per second.
<code>fps</code>	specifies the units of Frames per second.

Note: Use value for absolute threshold value parameter in multiples of 64 kbps. Whether the unit of measure is kbps, mbps, or gbps, the value must be divisible by 64 (such as "99.968 mbps").

### Default

By default, storm control is disabled

### Limitations

Burst option is not supported with rate type "FPS" and FPS cannot be configured along with other types (KBPS,MBPS,GBPS).

### Command Mode

Interface mode

## Applicability

This command was introduced before OcNOS version 1.3.

## Examples

```
#configure terminal
(config)#interface eth0
(config-if)#storm-control broadcast level 30

(config)#interface eth0
(config-if)#storm-control multicast level 30

(config)#interface eth0
(config-if)#storm-control multicast 64 mbps

(config)#interface eth0
(config-if)#no storm-control multicast

OcNOS(config-if)#storm-control multicast 50 kbps
%% Value applicable in hardware is 64.000 kbps

OcNOS(config-if)#storm-control multicast 0 kbps

OcNOS(config-if)#storm-control multicast 64 kbps

OcNOS(config-if)#storm-control multicast 100 kbps
%% Value applicable in hardware is 64.000 kbps

OcNOS(config-if)#storm-control multicast 130 kbps
%% Value applicable in hardware is 128.000 kbps

OcNOS(config-if)#storm-control multicast 130 mbps
%% Value applicable in hardware is 129.984 mbps
(config)#int xe1/1
(config-if)#switchport
(config-if)#storm-control multicast 100 mbps
%% Value applicable in hardware is 99.968 mbps

#show storm-control xe1/1
*The hardware applicable value is displayed
Port          BcastLevel    McastLevel    DlfLevel      Discards
xe1/1          100.0000%     99.968 mbps   100.0000%     0

#show run int xe1/1
!
interface xe1/1
  switchport
  storm-control multicast 100 mbps

(config-if)#int po4
(config-if)#switchport
#show storm-control po4
*The hardware applicable value is displayed
Port          BcastLevel    McastLevel    DlfLevel      Discards
po4           219.968 mbps  100.0000%     100.0000%     0
#
OcNOS#con t
```

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

```
OcNOS(config)#int xe64/2
OcNOS(config-if)#switchport
OcNOS(config-if)#bridge-group 1
OcNOS(config-if)#switchport mode trunk
OcNOS(config-if)#switchport trunk allowed vlan add 2
OcNOS(config-if)#storm-control broadcast 1000 fps
OcNOS(config-if)#storm-control multicast 2000 fps
OcNOS(config-if)#storm-control dlf 5000 fps
OcNOS(config-if)#comm
%% Value applicable in hardware is 1000.000 fps

%% Value applicable in hardware is 2000.000 fps

%% Value applicable in hardware is 5000.000 fps

OcNOS(config-if)#end

OcNOS#show runn int xe64/2
!
interface xe64/2
  switchport
  bridge-group 1
  switchport mode trunk
  switchport trunk allowed vlan add 2
  storm-control broadcast 1000 fps
  storm-control multicast 2000 fps
  storm-control dlf 5000 fps
  load-interval 30
!
```

**Note:**

- The warning message appears only for the applicable value in multiples of 64 kbps.
- show running-config command displays the value that was entered by user.
- show storm-control displays the actual configured value. If the configured value is from 1-64 kbps, the configured value is treated as 64, similarly from 100-127 value the configured value is dropped to 64 kbps.
- For example, values configured from
  - 1-64 kbps becomes 64 kbps,
  - 100 kbps becomes 64 kbps,
  - 130 kbps becomes 128 kbps,
  - 200 kbps becomes 192 kbps so on.



---

## show storm-control

Use the command to verify the BUM rate limit configured.

### Command Syntax

```
show storm-control (INTERFACE-NAME|)
```

### Example

```
OcNOS#sh storm-control xe2
```

\*The hardware applicable value is displayed

Port	BcastLevel	McastLevel	DlfLevel	Discards
xe2	100.0000%	100.0000%	100.0000%	0

```
OcNOS#show storm-control
```

\*The hardware applicable value is displayed

Port	BcastLevel (burst)	McastLevel (burst)	DlfLevel (burst)	Discards
xe64/2	1000.000 fps	2000.000 fps	5000.000 fps	7144132

## CHAPTER 5 RPVST+ Commands

---

This chapter contains the commands used for Rapid Per VLAN Spanning Tree (RPVST+). RPVST+ enables a bridge to inter-operate with Cisco RPVST+ switches.

RPVST+ uses the Multiple Spanning Tree Protocol (MSTP) with a single VLAN for each Multiple Spanning Tree instance (MSTI). The MST bridges can have different spanning-tree topologies for different VLANs inside a region of similar MST bridges. MSTP, like the Rapid Spanning Tree Protocol (RSTP), provides rapid reconfiguration capabilities and supports load balancing.

This chapter includes the following commands:

- [bridge vlan](#)
- [bridge vlan priority](#)
- [bridge-group vlan](#)
- [bridge protocol rpvt+](#)
- [bridge rapid-pervlan-spanning-tree](#)
- [show spanning-tree rpvt+](#)
- [spanning-tree rpvt+ configuration](#)
- [spanning-tree vlan restricted-role](#)
- [spanning-tree vlan restricted-tcn](#)

---

## bridge vlan

This command creates or deletes a mapping between an MSTI (Multiple Spanning Tree Instance) and a VLAN for RPVST+ operation. There can be only one VLAN per MST instance if the bridge is configured to run in RPVST+ mode.

The VLAN must have already been created. Spanning tree is enabled on each configured VLAN, and one instance of spanning-tree runs on each configured VLAN.

Use the `no` form of the command to disable this functionality.

### Command Syntax

```
bridge <1-32> vlan <2-4094>
no bridge <1-32> vlan <2-4094>
```

### Parameters

<1-32>	Bridge identifier.
<2-4094>	VLAN identifier.

### Command Mode

RPVST+ configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#spanning-tree rpvst+ configuration
(config-rpvst+)#bridge 1 vlan 2
(config-rpvst+)#no bridge 1 vlan 2
```

---

## bridge vlan priority

This command sets the priority value for the spanning-tree on the bridge. The lower the priority of the VLAN on a bridge, the better the chances of the bridge becoming a root bridge, or a designated bridge for the VLAN.

Use the `no` form of this command to set the priority to its default (32,768).

### Command Syntax

```
bridge <1-32> vlan <2-4094> priority <0-61440>
no bridge <1-32> vlan <2-4094> priority
```

### Parameters

<1-32>	Bridge identifier.
<2-4094>	VLAN identifier.
<0-61440>	Bridge priority for the common instance. Set the priority in increments of 4096. A lower priority indicates greater likelihood of becoming root.

### Default

By default, priority for each VLAN is 32,768

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 1 vlan 2 priority 80
(config)#no bridge 1 vlan 10 priority
```

---

## bridge-group vlan

Use this command to assign a Rapid Per-VLAN Spanning Tree (RPVST+) instance to a port.

RPVST+ uses port priority as a tiebreaker to determine which port should forward frames for a particular LAN, or which port should be the root port for a VLAN. A lower value implies a better priority. In the case of the same priority, the interface index serves as the tiebreaker, with a lower-numbered interface being preferred over others.

Use the `no` parameter with this command to remove an RPVST+ instance from this port.

### Command Syntax

```
bridge-group <1-32> vlan <2-4094>
bridge-group <1-32> vlan <2-4094> path-cost <1-2000000000>
bridge-group <1-32> vlan <2-4094> priority <0-240>
no bridge-group <1-32> vlan <2-4094>
no bridge-group <1-32> vlan <2-4094> path-cost
no bridge-group <1-32> vlan <2-4094> priority
```

### Parameters

<1-32>	Bridge group identifier.
<2-4094>	VLAN identifier.
<1-2000000000>	Cost of a path associated with the interface.
<0-240>	Port priority. A lower priority indicates greater likelihood of the interface becoming a root. Set the priority only in increments of 16.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#bridge-group 1 vlan 10

(config)#interface eth1
(config-if)#bridge-group 1 vlan 10 path-cost 1000

(config-if)#no bridge-group 1 vlan 10 path-cost

(config)#interface eth1
(config-if)#bridge-group 1 vlan 10 priority 240

(config-if)#no bridge-group 1 vlan 10 priority
```

---

## bridge protocol rpvst+

Use this command to enable Rapid Per-VLAN Spanning Tree on a bridge.

### Command Syntax

```
bridge <1-32> protocol rpvst+
```

### Parameter

<1-32>                      Bridge identifier.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#bridge 1 protocol rpvst+
```

---

## bridge rapid-pervlan-spanning-tree

Use this command to enable Rapid Per-VLAN Spanning Tree (RPVST+) globally on a bridge.

Use the `no` form of this command to disable RPVST+ globally on a bridge.

### Command Syntax

```
bridge <1-32> rapid-pervlan-spanning-tree enable
no bridge <1-32> rapid-pervlan-spanning-tree enable (bridge-blocked|bridge-forward|)
```

### Parameters

<code>&lt;1-32&gt;</code>	Bridge identifier.
<code>bridge-blocked</code>	Put ports of the bridge in the blocked state (default).
<code>bridge-forward</code>	Put ports of the bridge in the forwarding state.

### Default

By default, this feature is enabled.

For the `no` form of this command, `bridge-blocked` is the default.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#bridge 1 rapid-pervlan-spanning-tree enable

(config)#no bridge 1 rapid-pervlan-spanning-tree enable bridge-forward
```

---

## show spanning-tree rpvst+

Use this command to display RPVST information.

### Command Syntax

```
show spanning-tree rpvst+
show spanning-tree rpvst+ config
show spanning-tree rpvst+ detail
show spanning-tree rpvst+ detail interface IFNAME
show spanning-tree rpvst+ interface IFNAME
show spanning-tree rpvst+ vlan <1-4094>
show spanning-tree rpvst+ vlan <1-4094> interface IFNAME
```

### Parameters

config	Display configuration information.
detail	Display detailed information.
IFNAME	Display interface information.
<1-4094>	Display VLAN information

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

The following displays output of this command without any parameters.

```
#show spanning-tree rpvst+
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 1: Root Id 8001525400b092de
% 1: Bridge Id 8001525400b092de
% 1: last topology change Wed Mar 28 02:31:50 2018
% 1: 1 topology change(s) - last topology change Wed Mar 28 02:31:50 2018

% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State Forwarding
% eth1: Designated External Path Cost 0 -Internal Path Cost 0
% eth1: Configured Path Cost 200000 - Add type Explicit ref count 2
% eth1: Designated Port Id 0x8003 - Priority 128 -
```



```
% eth1: Root 8001525400b092de
% eth1: Designated Bridge 8001525400b092de
% eth1: Message Age 0 - Max Age 20
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 3 - topo change timer 0
% eth1: forward-transitions 1
% 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
%
%
% Instance      VLAN
% 0:            1, 4-10
% 1:            2
% 2:            3
```

The following displays output of this command with the `config` parameter.

```
#show spanning-tree rpvst+ config
%
% RPVST Configuration Information for bridge 1 :
%-----
% Format Id      : 0
% Name          : Default
% Revision Level : 0
% Digest        : 0xB41829F9030A054FB74EF7A8587FF58D
%-----

#show spanning-tree rpvst+ detail
% 1: Bridge up - Spanning Tree Enabled - topology change detected
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Transmit Hold Count 6
% 1: Root Id 8001525400b092de
% 1: Bridge Id 8001525400b092de
% 1: last topology change Wed Mar 28 02:31:50 2018
% 1: 1 topology change(s) - last topology change Wed Mar 28 02:31:50 2018

% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State Forwarding
% eth1: Designated External Path Cost 0 -Internal Path Cost 0
% eth1: Configured Path Cost 200000 - Add type Explicit ref count 2
% eth1: Designated Port Id 0x8003 - Priority 128 -
% eth1: Root 8001525400b092de
```

```
% eth1: Designated Bridge 8001525400b092de
% eth1: Message Age 0 - Max Age 20
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change timer 0
% eth1: forward-transitions 1
% 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
%

% Instance 1: Vlan: 2
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State Forwarding
% eth1: Designated Internal Path Cost 0 - Designated Port Id 0x8003
% eth1: Configured Internal Path Cost 200000
% eth1: Configured External Path cost 200000
% eth1: Configured Internal Priority 128
% eth1: Configured External Priority 128
% eth1: Designated Root 8002525400b092de
% eth1: Designated Bridge 8002525400b092de
% eth1: Message Age 0 - Max Age 20
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1

#show spanning-tree rpvst+ vlan 2
% vlan 2 Instance 1 configured
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 1: Root Id 8002525400b092de
% 1: Bridge Id 8002525400b092de
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State Forwarding
% eth1: Designated Internal Path Cost 0 - Designated Port Id 0x8003
% eth1: Configured Internal Path Cost 200000
% eth1: Configured External Path cost 200000
% eth1: Configured Internal Priority 128
% eth1: Configured External Priority 128
% eth1: Designated Root 8002525400b092de
% eth1: Designated Bridge 8002525400b092de
% eth1: Message Age 0 - Max Age 20
% eth1: Hello Time 2 - Forward Delay 15
% eth1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1
%

%
#show spanning-tree rpvst+ vlan 2 interface eth1
% 1: Root Path Cost 0 - Root Port 0 - Bridge Priority 32768
% 1: Root Id 8002525400b092de
```

```
% 1: Bridge Id 8002525400b092de
% eth1: Port Number 3 - Ifindex 3 - Port Id 0x8003 - Role Designated - State
Forwarding
% eth1: Designated Internal Path Cost 0 - Designated Port Id 0x8003
% eth1: Configured Internal Path Cost 200000
% eth1: Configured External Path cost 200000
% eth1: Configured Internal Priority 128
% eth1: Configured External Priority 128
% eth1: Designated Root 8002525400b092de
% eth1: Designated Bridge 8002525400b092de
% 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
%
```

---

## spanning-tree rpvst+ configuration

Use this command to enter RPVST+ configuration mode after creating a bridge and adding a VLAN to that bridge. Internally, an RSTP Instance is created for each configured VLAN.

### Command Syntax

```
spanning-tree rpvst+ configuration
```

### Parameters

None

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#spanning-tree rpvst+ configuration
(config-rpvst+)#
```

---

## spanning-tree vlan restricted-role

Use this command to restrict the role of the interface.

Use the `no` form of this command to not restrict the role of the interface.

### Command Syntax

```
spanning-tree vlan <2-4094> restricted-role  
no spanning-tree vlan <2-4094> restricted-role
```

### Parameters

<2-4094>                      VLAN identifier.

### Default

The default is to not restrict the role of the interface

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal  
(config)#interface eth0  
(config-if)#spanning-tree vlan 10 restricted-role
```

---

## spanning-tree vlan restricted-tcn

Use this command to restrict propagating topology change notifications (TCNs) from the interface.

Use the `no` form of this command to not restrict propagating TCNs from the interface.

### Command Syntax

```
spanning-tree vlan <2-4094> restricted-tcn
no spanning-tree vlan <2-4094> restricted_tcn
```

### Parameters

<2-4094>            VLAN identifier.

### Default

The default is to not restrict propagating TCNs

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#spanning-tree vlan 10 restricted-tcn
(config-if)#no spanning-tree vlan 10 restricted_tcn
```

---

## CHAPTER 6 Link Aggregation Commands

---

This chapter describes the link aggregation commands.

- `channel-group mode`
- `clear lacp`
- `debug lacp`
- `interface po`
- `interface sa`
- `lacp destination-mac`
- `lacp force-up`
- `lacp port-priority`
- `lacp system-priority`
- `lacp timeout`
- `port-channel load-balance`
- `port-channel min-bandwidth - dynamic LAG min-bandwidth`
- `port-channel min-links - dynamic LAG min-links`
- `port-channel min-bandwidth - static LAG min-bandwidth`
- `port-channel min-links - static LAG min-links`
- `show debugging lacp`
- `show etherchannel`
- `show lacp sys-id`
- `show lacp-counter`
- `show port etherchannel`
- `show static-channel-group`
- `show static-channel load-balance`
- `snmp restart lacp`
- `static-channel-group`

---

## channel-group mode

Use this command to add an interface to an existing link aggregation group.

After you execute this command, the interface loses its properties and takes the properties of the aggregated interface.

Use the `no` parameter with this command to remove an interface from a dynamic link aggregation group. When you remove an interface from a LAG, the interface acquires the default interface properties.

### Command Syntax

```
channel-group <1-16383> mode (active|passive)
no channel-group
```

### Parameters

<1-16383>	Specify a channel group number (with DRNI).
mode	Specify a channel mode.
active	Enable LACP negotiation.
passive	Disable LACP negotiation.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface xe1
(config-if)#switchport
(config-if)#channel-group 1 mode active
(config-if)#exit
```

```
#sh run in po1
!
interface po1
switchport
port-channel load-balance src-dst-mac
```

The is an example of `no channel-group`:

```
#configure terminal
(config)#interface xe1
(config-if)#switchport
(config-if)#no channel-group
(config-if)#exit
```

```
#sh run in xe1
!
interface xe1
!
#sh run in po1
!
```



```
interface po1
  switchport
  port-channel load-balance src-dst-mac
!
```

---

## clear lacp

Use this command to clear the counters of all LACP aggregators or a given LACP aggregator.

### Command Syntax

```
clear lacp <1-16383> counters
clear lacp counters
```

### Parameters

<1-16383>            Clears a channel-group number.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#clear lacp 2 counters
```

---

## debug lacp

Use this command to enable LACP debugging.

Use the `no` parameter with this command to disable debugging.

### Command Syntax

```
debug lacp (event|cli|timer|packet|sync|ha|all|rx|tx)
no debug lacp (event|cli|timer|packet|sync|ha|allrx|tx)
undebug all
```

### Parameters

<code>all</code>	Enables all LACP debugging.
<code>cli</code>	Echo commands to console.
<code>event</code>	Sets the debug options for LACP events.
<code>ha</code>	Echo High availability events to console.
<code>packet</code>	Sets the debug option for LACP packets.
<code>sync</code>	Echo synchronization to console.
<code>timer</code>	Echo timer expiry to console.
<code>rx</code>	Echo receiving of lacpdus to console.
<code>tx</code>	Echo transmission of lacpdus to console.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#debug lacp all
```

---

## interface po

Use this command to create a dummy dynamic link aggregate interface (by default an L3 LAG interface).

Use the `no` form of this command to remove a dynamic link aggregate group and also it remove the properties of the po from all member ports.

Note: Switchport/routed mode needs to be set for the PO before adding member ports to it.

### Command Syntax

```
interface po<1-16383>
no interface po<1-16383>
```

### Parameters

<1-16383>            Channel group number

### Default

By default, interface po is L3 LAG interface

### Command Mode

Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface po1
(config-if)#switchport
(config-if)#exit
```

---

## interface sa

Use this command to create a dummy static link aggregate interface (by default an L3 LAG interface) and to add an interface to an existing static link aggregation group.

Use the `no` form of this command to remove a static link aggregate group and also remove the properties of the ports from all member ports.

### Command Syntax

```
interface sa<1-16383>
no interface sa<1-16383>
```

### Parameters

<1-16383>                      Channel group number.

### Default

By default, interface sa is L3 LAG interface

### Command Mode

Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface sa1
(config-if)#switchport
(config-if)#exit
```

---

## lacp destination-mac

Use this command to set the address type to use for sending LACPDU (Link Aggregation Control Protocol Data Units).

Note: The interface must be an aggregation port.

Use the `no` form of this command to set the address type to its default (multicast group address).

### Command Syntax

```
lacp destination-mac (customer-bridge-group-address | multicast-group-address |  
non-tmpr-group-address)  
no lacp destination-mac
```

### Parameters

customer-bridge-group-address	Customer bridge group address
multicast-group-address	Multicast group address (default)
non-TPMR-group-address	Non-Two-Port Media Access Control Relay (TPMR) group address

### Default

By default, `lacp destination-mac` is `multicast-group-address`.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#config terminal  
(config)#interface eth1  
(config-if)#lacp destination-mac customer-bridge-group-address
```

---

## lacp force-up

Use this command to make a port immediately begin forwarding packets and not wait for an LACPDU. After you execute this command, the member port is forcefully up even if LACP is not in sync (only if no other member in the aggregator is in sync).

If a force-up port stops receiving LACPDUs, the port ignores the time-out and remains in operation.

This command can be configured on one member interface of a port channel.

Note: This command can only be given after executing the [channel-group mode](#) command on an interface. Force-up mode is not supported for LACP passive mode.

Note: For MLAG, only configure a force-up port on either on the master node or the slave node to prevent traffic drops/loops.

Use the `no` form of this command to disable force-up mode.

### Command Syntax:

```
lacp force-up
no lacp force-up
```

### Parameters

None

### Default

By default, LACP force-up mode is disabled.

### Command Mode

Interface mode

### Applicability

This command was introduced in OcNOS version 1.3.6.

### Example

```
#configure terminal
(config)#interface xel
(config-if)#switchport
(config-if)#channel-group 1 mode active
(config-if)#lacp force-up
(config-if)#exit
```

---

## lacp port-priority

Use this command to set the priority of a channel. Channels are selected for aggregation based on their priority with the higher priority (numerically lower) channels selected first.

Use the `no` parameter with this command to set the priority of port to the default value (32768).

### Command Syntax

```
lacp port-priority <1-65535>
no lacp port-priority
```

### Parameters

<1-65535>            Specify the LACP port priority.

### Default

By default, lacp port priority is 32768

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#lacp port-priority 34
```



---

## lacp system-priority

Use this command to set the LACP system priority. This priority determines the system responsible for resolving conflicts in the choice of aggregation groups.

Note: A lower numerical value has a higher priority.

Use the `no` parameter with this command to set the system priority to its default value (32768).

### Command Syntax

```
lacp system-priority <1-65535>
no lacp system-priority
```

### Parameters

<1-65535>            System priority.

### Default

By default, system priority is 32768

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#lacp system-priority 6700
```

---

## lacp timeout

Use this command to set either a short or long timeout value on a port. The timeout value is the number of seconds before invalidating a received LACP data unit (DU).

### Command Syntax

```
lacp timeout (short|long)
```

### Parameters

short                    LACP short timeout. 3 seconds.

long                    LACP long timeout. 90 seconds.

Note: Short: With this mode, BPDU will be sent at Fast\_Periodic\_Time of 1 second interval. It will timeout, before invalidating received LACPDU, after 3xFast\_Periodic\_Time(3seconds),

Long: With this mode, BPDU will be sent at Slow\_Periodic\_Time of 30 seconds intervals. It will timeout, before invalidating received LACPDU, after 3xSlow\_Periodic\_Time(90seconds)

### Default

By default, lacp timeout is long

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

The following sets the LACP short timeout on a port.

```
#configure terminal
(config)#interface eth0
(config-if)#lacp timeout short
```

---

## port-channel load-balance

Use this command to configure LACP port-channel load-balancing and set port-selection criteria (PSC) for an interface. Use the `no` option with this command to remove the load-balancing configuration and unset PSC.

### Command Syntax

```
port-channel load-balance (dst-mac|src-mac|src-dst-mac|dst-ip|src-ip|src-dst-  
ip|dst-port|src-port|src-dst-port|rtag7)  
no port-channel load-balance
```

### Parameters

<code>dst-ip</code>	Destination IP address-based load balancing.
<code>dst-mac</code>	Destination MAC address-based load balancing.
<code>dst-port</code>	Destination TCP/UDP address-based load balancing.
<code>src-dst-ip</code>	Source and Destination IP address-based load balancing.
<code>src-dst-mac</code>	Source and Destination MAC address-based load balancing.
<code>src-dst-port</code>	Source and Destination TCP/UDP address-based load balancing.
<code>src-ip</code>	Source IP address-based load balancing.
<code>src-mac</code>	Source MAC address-based load balancing.
<code>src-port</code>	Source port address-based load balancing.
<code>rtag7</code>	Hashing is based on global rtag configuration.

### Default

By default load balance is `src-dst-ip` for L3 port and `src-dst-mac` for L2 port.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3. The port-channel load-balance CLI option is not applicable for Tomahawk 3 boards.

### Example

```
#configure terminal  
(config)#interface po1  
(config-if)#port-channel load-balance src-dst-mac
```

---

## port-channel min-bandwidth - dynamic LAG min-bandwidth

Use this command to set the minimum number of aggregated bandwidth that need to be up in the LAG(PO) interface. When the minimum number of bandwidth are configured for a LAG(PO), if the active links bandwidth for that interface become less than the configured value, then the whole LAG(PO) is brought down. When the number of active links bandwidth become the same or more than the configured value, then the whole LAG is restored.

Use the no form of this command to remove the minimum number of aggregated bandwidth that need to be up in the LAG interface.

Note: The minimum number of aggregated bandwidth should be same across both ends of an aggregation interface. If not configured, then on one of the nodes the LAG port will be treated as up and on the other as down and traffic will be discarded.

Note: When a LAG port is moved to the down state because it does not have the minimum number of required bandwidth up and running, then the traffic on the remaining interfaces in the LAG will be counted as port-block discards.

Note: The [port-channel min-links - dynamic LAG min-links](#) feature and this feature are mutually exclusive. Both configurations cannot exist at the same time.

### Command Syntax

```
port-channel min-bandwidth <1-1000>g
no port-channel min-bandwidth
```

### Parameters

<1-1000>g            for 1 to 1000 gigabits/s

### Default

By default, port channel min- bandwidth is disabled.

### Command Mode

Interface mode

### Applicability

This command was introduced from OcNOS version 1.3.8

### Example

```
#configure terminal
(config)#interface po1
(config-if)#port-channel min-bandwidth 10g
```

---

## port-channel min-links - dynamic LAG min-links

Use this command to set the minimum number of aggregated links that need to be up in the LAG(PO) interface. When the minimum number of links are configured for a LAG(PO), if the active links for that interface become less than the configured value, then the whole LAG(PO) is brought down. When the number of active links become the same or more than the configured value, then the whole LAG is restored.

Use the no form of this command to remove the minimum number of aggregated links that need to be up in the LAG interface.

**Note:** The minimum number of aggregated links should be same across both ends of an aggregation interface. If not configured, then on one of the nodes the LAG port will be treated as up and on the other as down and traffic will be discarded.

**Note:** When a LAG port is moved to the down state because it does not have the minimum number of required links up and running, then the traffic on the remaining interfaces in the LAG will be counted as port-block discards.

**Note:** The [show debugging lacp](#) feature and this feature are mutually exclusive. Both configurations cannot exist at the same time.

### Command Syntax

```
port-channel min-links <2-32>
no port-channel min-links
```

### Parameters

<2-32>	Minimum number of links
--------	-------------------------

### Default

By default, port channel min-link is disabled.

### Command Mode

Interface mode

### Applicability

This command was introduced from OcNOS version 1.3.8

### Example

```
#configure terminal
(config)#interface po1
(config-if)#port-channel min-links 10
(config-if)#exit
```

---

## port-channel min-bandwidth - static LAG min-bandwidth

Use this command to set the minimum number of aggregated bandwidth that need to be up in the LAG(SA) interface. When the minimum number of bandwidth are configured for a LAG(SA), if the active links bandwidth for that interface become less than the configured value, then the whole LAG(SA) is brought down. When the number of active links bandwidth become the same or more than the configured value, then the whole LAG is restored.

Use the no form of this command to remove the minimum number of aggregated bandwidth that need to be up in the LAG interface.

Note: The minimum number of aggregated bandwidth should be same across both ends of an aggregation interface. If not configured, then on one of the nodes the LAG port will be treated as up and on the other as down and traffic will be discarded.

Note: When a LAG port is moved to the down state because it does not have the minimum number of required bandwidth up and running, then the traffic on the remaining interfaces in the LAG will be counted as port-block discards.

Note: The [port-channel min-links - static LAG min-links](#) feature and this feature are mutually exclusive. Both configurations cannot exist at the same time.

### Command Syntax

```
port-channel min-bandwidth <1-1000>g
no port-channel min-bandwidth
```

### Parameters

<1-1000>g            for 1 to 1000 gigabits/s

### Default

By default, port channel min- bandwidth is disabled.

### Command Mode

Interface mode

### Applicability

This command was introduced from OcNOS version 1.3.8

### Example

```
#configure terminal
(config)#interface sa1
(config-if)#port-channel min-bandwidth 10g
```

---

## port-channel min-links - static LAG min-links

Use this command to set the minimum number of aggregated links that need to be up in the LAG(SA) interface. When the minimum number of links are configured for a LAG(SA), if the active links for that interface become less than the configured value, then the whole LAG(SA) is brought down. When the number of active links become the same or more than the configured value, then the whole LAG is restored.

Use the no form of this command to remove the minimum number of aggregated links that need to be up in the LAG interface.

**Note:** The minimum number of aggregated links should be same across both ends of an aggregation interface. If not configured, then on one of the nodes the LAG port will be treated as up and on the other as down and traffic will be discarded.

**Note:** When a LAG port is moved to the down state because it does not have the minimum number of required links up and running, then the traffic on the remaining interfaces in the LAG will be counted as port-block discards.

**Note:** The [port-channel min-bandwidth - static LAG min-bandwidth](#) feature and this feature are mutually exclusive. Both configurations cannot exist at the same time.

### Command Syntax

```
port-channel min-links <2-32>
no port-channel min-links
```

### Parameters

<2-32>	Minimum number of links
--------	-------------------------

### Default

By default, port channel min-link is disabled.

### Command Mode

Interface mode

### Applicability

This command was introduced from OcNOS version 1.3.8

### Example

```
#configure terminal
(config)#interface sa1
(config-if)#port-channel min-links 10
(config-if)#exit
```

---

## show debugging lacp

Use this command to display the status of the debugging of the LACP system.

### Command Syntax

```
show debugging lacp
```

### Parameters

None

### Command Mode

Exec and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show debugging lacp
```

```
LACP debugging status:  
LACP timer debugging is on
```



---

## show etherchannel

Use this command to display information about link aggregation groups.

### Command Syntax

```
show etherchannel
show etherchannel <1-16383>
```

With MLAG:

```
show etherchannel (<1-16383>|) detail
show etherchannel (<1-16383>|) limit
show etherchannel (<1-16383>|) load-balance
show etherchannel (<1-16383>|) summary
```

Without MLAG:

```
show etherchannel (<1-16383>|) detail
show etherchannel (<1-16383>|) limit
show etherchannel (<1-16383>|) load-balance
show etherchannel (<1-16383>|) summary
```

### Parameters

<1-16383>	Specify channel-group number.
detail	Specify detailed etherchannel information.
limit	Specify channel limit.
Max Aggregators	Maximum number of aggregators supported is 128.
Max Ports in Aggregator	Maximum number of ports supported in aggregator 16.
load-balance	Specify load balancing.
summary	Specify Etherchannel summary information.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
OcNOS#show etherchannel limit
Max Aggregators      : 256
Max Ports in Aggregator : 64

OcNOS#show etherchannel summary
% Aggregator po1 185
% Aggregator Type: Layer3
% Admin Key: 0001 - Oper Key 0001
%   Link: eth3 (5) sync: 0
```

```

-----
% Aggregator po4 186
% Admin Key: 0004 - Oper Key 0004
%   Link: eth2 (4) sync: 0
-----

% Aggregator po5 187
% Admin Key: 0005 - Oper Key 0005
%   Link: eth1 (3) sync: 0

OcNOS#show etherchannel detail
% Aggregator po1 185
% Aggregator Type: Layer3
% Mac address: 08:00:27:36:f5:7d
% Admin Key: 0001 - Oper Key 0001
% Actor LAG ID- 0x8000,08-00-27-fa-4b-0e,0x0001
% Receive link count: 0 - Transmit link count: 0
% Individual: 0 - Ready: 0
% Partner LAG ID- 0x0000,00-00-00-00-00-00,0x0000
%   Link: eth3 (5) sync: 0
% Collector max delay: 5
-----

% Aggregator po4 186
% Mac address: 08:00:27:76:0c:57
% Admin Key: 0004 - Oper Key 0004
% Actor LAG ID- 0x8000,08-00-27-fa-4b-0e,0x0004
% Receive link count: 0 - Transmit link count: 0
% Individual: 0 - Ready: 1
% Partner LAG ID- 0x0000,00-00-00-00-00-00,0x0000
%   Link: eth2 (4) sync: 0
% Collector max delay: 5
-----

% Aggregator po5 187
% Mac address: 08:00:27:2f:d5:ae
% Admin Key: 0005 - Oper Key 0005
% Actor LAG ID- 0x8000,08-00-27-fa-4b-0e,0x0005
% Receive link count: 0 - Transmit link count: 0
% Individual: 0 - Ready: 0
% Partner LAG ID- 0x0000,00-00-00-00-00-00,0x0000
%   Link: eth1 (3) sync: 0
% Collector max delay: 5

```

Table 6-10 explains the show command output fields.

**Table 6-10: show etherchannel detail output**

Field	Description
Aggregator	Link aggregators name and ID number.
Mac address	Unique MAC address for link identification.
Admin Key	LACP administrative key – automatically configured value on each port configured to use LACP.
Oper Key	LACP operator key on Partner – automatically configured value on each port configured to use LACP.

**Table 6-10: show etherchannel detail output (Continued)**

Field	Description
Actor LAG ID	LAG ID consisting of MAC address plus aggregator ID number for this Actor.
Receive link count	The number of link received from the peer LAG.
Transmit link count	The number of links contained transmitted to the peer LAG.
Individual	The individual physical network interfaces or ports contained in the LAG.
Ready	The number of links in the active state on this Actor.
Partner LAG ID	Partner LAG ID consisting of MAC address plus aggregator ID number.
Link	Interface and ID number of the link.
sync	MAC address synchronization enables a MLAG Partner to forward Layer 3 packets arriving on this interfaces with either its own MAC address or its Partner's.
Collector max delay	Maximum period of wait time between sending of two subsequent Ethernet frames on a link.

---

## show lacp sys-id

Use this command to display the LACP system identifier and priority.

### Command Syntax

```
show lacp sys-id
```

### Parameters

sys-id	Display LACP system ID and priority
--------	-------------------------------------

### Command Mode

Exec and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show lacp sys-id
% System 8000,00-0e-0c-83-37-27
```

---

## show lacp-counter

Use this command to display the packet traffic on all ports of all present LACP aggregators, or a given LACP aggregator.

### Command Syntax

```
show lacp-counte
show lacp-counter <1-16383>
```

### Parameters

<1-16383>            Channel-group number

### Command Mode

Exec and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show lacp-counter 555
```

Port	LACPDUs		Marker		Pckt err	
	Sent	Recv	Sent	Recv	Sent	Recv

## show port etherchannel

Use this command to display details about a PO and its members' interfaces or to display details of a single member interface of a PO.

### Command Syntax

```
show port etherchannel IFNAME
```

### Parameters

IFNAME                      Interface name

### Command Mode

Exec and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show port etherchannel ce29/1
LAG ID                               : 0x8000,cc-37-ab-a0-89-ca,0x0002
Partner oper LAG ID                  : 0x8000,a8-2b-b5-38-1e-48,0x0004
Aggregator ID                        : 100002
  LACP link info                      : ce29/1 - 10001
  Periodic Transmission
  machine state                       : Slow periodic
  Receive machine state               : Current
  Mux machine state                   : Collecting/Distributing
  Actor Info :
  =====
  Actor Port priority                 : 0x8000 (32768)
  Admin key                           : 0x0002 (2) Oper key: 0x0002 (2)
  Physical admin key                  : (2)
  Actor Oper state                    : ACT:1 TIM:0 AGG:1 SYN:1 COL:1 DIS:1 DEF:0 EXP:0
  Actor Admin state                   : ACT:1 TIM:0 AGG:1 SYN:0 COL:0 DIS:0 DEF:1 EXP:0
  Partner Info:
  =====
  Partner oper port                   : 10009
  Partner link info                   : admin port 0
  Partner admin LAG ID                : 0x0000-00:00:00:00:00:00
  Partner system priority              : admin:0x0000 - oper:0x8000
  Partner port priority                : admin:0x0000 - oper:0x8000
  Partner oper state                  : ACT:1 TIM:0 AGG:1 SYN:1 COL:1 DIS:1 DEF:0 EXP:0
  Partner admin state                 : ACT:0 TIM:0 AGG:1 SYN:0 COL:0 DIS:0 DEF:1 EXP:0

#show port etherchannel po2
LAG ID                               : 0x8000,cc-37-ab-a0-89-ca,0x0002
Partner oper LAG ID                  : 0x8000,a8-2b-b5-38-1e-48,0x0004
Aggregator ID                        : 100002
  LACP link info                      : ce29/1 - 10001
  Periodic Transmission
  machine state                       : Slow periodic
```

```

Receive machine state      : Current
Mux machine state        : Collecting/Distributing
Actor Info :
=====
Actor Port priority      : 0x8000 (32768)
Admin key                : 0x0002 (2) Oper key: 0x0002 (2)
Physical admin key       : (2)
Actor Oper state         : ACT:1 TIM:0 AGG:1 SYN:1 COL:1 DIS:1 DEF:0 EXP:0
Actor Admin state        : ACT:1 TIM:0 AGG:1 SYN:0 COL:0 DIS:0 DEF:1 EXP:0
Partner Info:
=====
Partner oper port        : 10009
Partner link info        : admin port 0
Partner admin LAG ID     : 0x0000-00:00:00:00:0000
Partner system priority  : admin:0x0000 - oper:0x8000
Partner port priority    : admin:0x0000 - oper:0x8000
Partner oper state       : ACT:1 TIM:0 AGG:1 SYN:1 COL:1 DIS:1 DEF:0 EXP:0
Partner admin state      : ACT:0 TIM:0 AGG:1 SYN:0 COL:0 DIS:0 DEF:1 EXP:0

LACP link info           : ce30/1 - 10005
Periodic Transmission
machine state            : Slow periodic
Receive machine state    : Current
Mux machine state        : Collecting/Distributing
Actor Info :
=====
Actor Port priority      : 0x8000 (32768)
Admin key                : 0x0002 (2) Oper key: 0x0002 (2)
Physical admin key       : (2)
Actor Oper state         : ACT:1 TIM:0 AGG:1 SYN:1 COL:1 DIS:1 DEF:0 EXP:0
Actor Admin state        : ACT:1 TIM:0 AGG:1 SYN:0 COL:0 DIS:0 DEF:1 EXP:0
Partner Info:
=====
Partner oper port        : 10013
Partner link info        : admin port 0
Partner admin LAG ID     : 0x0000-00:00:00:00:0000
Partner system priority  : admin:0x0000 - oper:0x8000
Partner port priority    : admin:0x0000 - oper:0x8000
Partner oper state       : ACT:1 TIM:0 AGG:1 SYN:1 COL:1 DIS:1 DEF:0 EXP:0
Partner admin state      : ACT:0 TIM:0 AGG:1 SYN:0 COL:0 DIS:0 DEF:1 EXP:0

```

**Note:** Most of the output of this command is duplicated in the [show etherchannel](#) command (see also the 802.3ad specification). The output of the `show port etherchannel` command is primarily a list of state machine values. An explanation of the state machine bits follows. See [Figure 6-56](#).

[Table 6-11](#) explains the `show` command output fields.

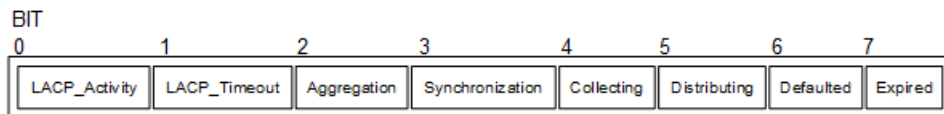
**Table 6-11: show port etherchannel detailed output**

Entry	Description
Actor/Partner state	The Actor's and Partner's state variables, encoded as individual bits within a single octet.
ACT	LACP_Activity is encoded in bit 0. Active LACP is encoded as a 1; Passive LACP as a 0.

**Table 6-11: show port etherchannel detailed output (Continued)**

Entry	Description
TIM	LACP_Timeout is encoded in bit 1. Short Timeout is encoded as a 1; Long Timeout as a 0.
AGG	Aggregability is encoded in bit 2. Aggregatable is encoded as a 1; Individual is encoded as a 0.
SYN	Synchronization is encoded in bit 3. In_Sync is encoded as a 1; Out_Of_Sync is encoded as a 0.
COL	Collecting is encoded in bit 4. True is encoded as a 1; False is encoded as a 0.
DIS	Distributing is encoded in bit 5. True is encoded as a 1; False is encoded as a 0.
DEF	Defaulted is encoded in bit 6.
EXP	Defaulted is encoded in bit 7.

Bits 7 and 8 are reserved; these are ignored on receipt and transmitted as zero. However, the received value of these bits is recorded on receipt to accurately reflect the actor's view of the partner's state in outgoing PDUs.

**Figure 6-56: Diagram of state machine octet**

a. `show static-channel-group`

Use this command to display the types of load-balancing port selection criteria (PSC) used on configured static aggregators.

### Command Syntax

```
show static-channel-group (<1-16383>|)
```

### Parameters

<1-16383> Specify channel-group number.

### Command Mode

Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

The following is an example of the output of this command:

```
#show static-channel-group 1
% Static Aggregator: sal
% Member:
  eth1
```



---

## show static-channel load-balance

Use this command to display information about static channel groups.

### Command Syntax

```
show static-channel (<1-16383>|) load-balance
```

### Parameters

<1-16383>                Specify static-channel-group number.

### Command Mode

Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

The following is an example of the output of this command:

```
#show static-channel load-balance
% Static Aggregator: sa5
Source and Destination Mac address
-----
% Static Aggregator: sa3
Source and Destination Mac address
-----
% Static Aggregator: sa1
Source and Destination Mac address

#show static-channel 1 load-balance
% Static Aggregator: sa1
Source and Destination Mac address
```

---

## snmp restart lacp

Use this command to restart SNMP in LACP.

### Command Syntax

```
snmp restart lacp
```

### Parameters

None

### Default

By default, snmp restart lacp is disabled

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#snmp restart lacp
```

---

## static-channel-group

Use this command to create a static link aggregation group or to add an interface to an existing link aggregation group.

Use the `no` form of this command to remove an interface from a static link aggregation group without removing the static link aggregation group itself.

### Command Syntax

```
static-channel-group <1-16383>
no static-channel-group
```

### Parameter

<1-16383>            Channel group number.

### Default

By default, static channel group is disabled

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface xe1
(config-if)#switchport
(config-if)#static-channel-group 1
(config-if)#exit

#sh run in sa1
!
interface sa1
switchport
port-channel load-balance src-dst-mac
```

This is an example of `no static-channel-group`:

```
#configure terminal
(config)#interface xe1
(config-if)#switchport
(config-if)#no static-channel-group
(config-if)#exit

#sh run in xe1
!
interface xe1
!
#sh run in sa1
!
interface sa1
switchport
```

```
port-channel load-balance src-dst-mac  
!
```

## CHAPTER 7 Multi-Chassis Link Aggregation Commands

---

This chapter describes the Multi-Chassis Link Aggregation commands.

Multi-Chassis Link Aggregation is also called MLAG, or Distributed Resilient Network Interconnect (DRNI). In this document, it is called MLAG.

- [clear mcec statistics](#)
- [debug mcec](#)
- [domain-address](#)
- [domain hello timeout](#)
- [domain priority](#)
- [domain-system-number](#)
- [idl-higig](#)
- [intra-domain-peer](#)
- [mcec domain configuration](#)
- [mlag](#)
- [mode](#)
- [show mcec statistics](#)
- [show mlag detail](#)
- [show mlag domain](#)
- [show mlag stp-synchronization status](#)
- [show spanning-tree mlag operational-config](#)
- [show spanning-tree mlag sync-detail](#)
- [switchover type](#)

---

## clear mcec statistics

Use this command to clear the statistics related to hello and information PDUs in the MCEC domain.

### Command Syntax

```
clear mcec statistics
```

### Parameters

None

### Command Mode

Privileged exec mode

### Applicability

This command was introduced in OcNOS version 1.3.6.

### Examples

```
#clear mcec statistics
```

---

## debug mcec

Use this command to view debugging logs for MLAG.

Use the `no` form of this command to remove debugging logs for MLAG.

### Command Syntax

```
debug mcec (timer|event|hello|info|cli|mac-sync|all)
no debug mcec (timer|event|hello|info|cli|mac-sync|all)
```

### Parameters

<code>all</code>	ALL
<code>cli</code>	CLI
<code>event</code>	Event
<code>hello</code>	Hello
<code>info</code>	Info
<code>mac-sync</code>	Mac Sync
<code>timer</code>	Timer

### Command Mode

Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#debug mcec all
#no debug mcec all
```

---

## domain-address

Use this command to configure domain address, which helps to identify the mcec domain.

Use the `no` form of this command to remove the domain address.

### Command Syntax

```
domain-address <domain-id>
no domain-address
```

### Parameters

`domain-id` domain address in HHHH.HHHH.HHHH format

### Command Mode

MCEC mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#config terminal
(config)#mcec domain configuration
(config-mcec-domain)#domain-address 1111.2222.3333
```



---

## domain hello timeout

Use this command to specify the domain hello-timeout value.

### Command Syntax

```
domain-hello-timeout (long|short)
```

### Parameters

long	Long Timeout
short	Short Timeout

### Command Mode

MCEC mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#config terminal
(config)#mcec domain configuration
(config-mcec-domain)#domain-hello-timeout long
```

---

## domain priority

Use this command to specify the priority value associated with mcec domain.

Use the `no` form of this command to remove the priority value associated with mcec domain.

### Command Syntax

```
domain-priority <1-65535>
no domain-priority
```

### Parameters

<1-65535>	Priority Value
-----------	----------------

### Default

The default value is 32768.

### Command Mode

MCEC mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#config terminal
(config)#mcec domain configuration
(config-mcec-domain)#domain-priority 2
```

---

## domain-system-number

Use this command to configure domain system number, which uniquely identifies domain system in mcec domain.

Use the `no` form of this command to configure domain system number.

### Command Syntax

```
domain-system-number <1-2>
no domain-system-number
```

### Parameters

<1-2>	Domain System Number
-------	----------------------

### Command Mode

MCEC mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#config terminal
(config)#mcec domain configuration
(config-mcec-domain)#domain-system-number 2
```

---

## idl-higig

Use this command to configure MLAG Inter domain link (IDL) to Higig mode. The Higig mode is required for MLAG port isolation to work when the MLAG link fails.

Use `no` form command to unconfigure the IDLHigig mode.

Note: The `idl-higig` CLI is not supported on Tomahawk3 series platforms.

### Command Syntax

```
idl-higig
no idl-higig
```

### Parameters

None

### Command Mode

MCEC mode

### Applicability

This command was introduced before OcNOS Version 6.0.

### Example

```
#config terminal
(config)#mcec domain configuration
(config-mcec-domain)#idl-higig
(config-mcec-domain)#no idl-higig
```

---

## intra-domain-peer

Use this command to map an interface as intra domain peer that connects the domain system with its neighbor in a mcec domain.

Use the `no` form of this command to unmap the interface configured as intra domain peer that connects the domain system with its neighbor in a mcec domain.

### Command Syntax

```
intra-domain-peer A.B.C.D source-address A.B.C.D (vrf VRF_NAME|)
no intra-domain-peer
```

### Parameters

Peer Address	Peer/Target IPv4 address
A.B.C.D	IPv4 address.
Source Address	Source IPv4 address
A.B.C.D	IPv4 address.
vrf-IFNAME	VRF Interface name

### Command Mode

MCEC mode

### Applicability

This command was introduced before OcNOS version 3.0.

### Example

```
#config terminal
(config)#mcec domain configuration
(config-mcec-domain)#intra-domain-peer 1.1.1.1 source-address 2.2.2.2 vrf
myvrf
```

---

## mcec domain configuration

Use this command to enter MCEC Domain configuration mode to configure mcec domain information.

### Command Syntax

```
mcec domain configuration
```

### Parameters

None

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#config terminal
(config)#mcec domain configuration
(config-mcec-domain)#
```

---

## mlag

Use this command to map a port-channel to an MLAG instance.

Note: The MLAG port-channel (interface) must be created before mapping.

Note: All MLAG nodes must use the same MAC table size.

Use the `no` form of this command to un-map the port channel from the MLAG instance.

### Command Syntax

```
mlag <1-255>
no mlag
```

### Parameters

<1-255>	MLAG identifier
---------	-----------------

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3 and updated for static channel groups in OcNOS version 1.3.6.

### Example

```
#config terminal
(config)#interface mlag1
(config-if)#switchport
(config-if)#bridge-group 1
(config-if)#switchport mode trunk
(config-if)#switchport mode trunk allowed vlan all
(config-if)#exit
(config)#interface sa1
(config-if)#switchport
(config-if)#mlag 1
(config-if)#exit

#configure terminal
(config)#interface sa1
(config-if)#no mlag
```

---

## mode

Use this command to set the MLAG mode.

Use the no form of this command to turn off this feature.

### Command Syntax

```
mode (active-active | active-standby)
no mode (active-active | active-standby)
```

### Parameters

active-active	The interface is the active interface that carries the traffic
active-standby	The interface is ready to transition to the active state should a failure occur in the other node

### Default

active-active

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#
(config)#interface mlag1
(config-if)#mode active-active

(config)#
(config)#interface mlag1
(config-if)#mode active-standby
```



# show mcec statistics

Use this command to display all the statistics related to hello and info pdu’s in mcec domain.

## Command Syntax

```
show mcec statistics
```

## Parameters

None

## Command Mode

Privileged Exec mode

## Applicability

This command was introduced before OcNOS version 1.3.

## Examples

```
#sh mcec statistics
Unknown MCCPDU received on the system : 0

-----
IDP xe49
-----
Valid RX Hello PDUs : 109
Valid TX Hello PDUs : 201
Valid RX Info PDUs: 23
Valid TX Info PDUs : 28
Valid RX Mac Sync PDUs : 5
Valid TX Mac Sync PDUs : 4
Valid RX Dhcps Sync PDUs : 2
Valid TX Dhcps Sync PDUs : 1

MLAG 1
Valid RX Info PDUs : 5
Valid TX Info PDUs : 7
```

Table 7-13 Shows the output details.

Table 7-12: Show mcec statistics details

Entry	Description
RX Hello PDUs	Total number of received hello PDUs.
TX Hello PDUs	Total number of transmitted hello PDUs.
RX Info PDUs	Total number of received Info PDUs.
TX Info PDUs	Total number of transmitted Info PDUs.

Table 7-12: Show mcec statistics details

Entry	Description
RX Mac Sync PDUs	Total number of received Mac Sync PDUs.
TX Mac Sync PDUs	Total number of transmitted Mac Sync PDUs.
RX Dhcps Sync PDUs	Total number of received Dhcps Sync PDUs
TX Dhcps Sync PDUs	Total number of transmitted Dhcps Sync PDUs

# show mlag detail

Use this command to display details about MLAG configuration and status.

## Command Syntax

```
show mlag <1-255> detail
```

## Parameters

<1-255> MLAG group number

## Command Mode

Privileged Exec mode

## Applicability

This command was introduced before OcNOS version 1.3 and updated for static channel groups in OcNOS version 1.3.6.

## Examples

```
#sh mlag 1 detail

MLAG-17
Mapped Aggregator : po1
Admin Key : 32769
Oper Key: 16385
Physical properties Digest : dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc 82

Neigh Admin Key: 16385
Neigh Physical Digest: dd 9c f 76 dd b6 5f 2f eb a1 d3 bb 8d 96 fc 82
Info RCV State : Current
Info Periodic Time State : Standby
Mlag Sync : IN_SYNC
Mode : Active
```

Table 7-13 Shows the output details.

Table 7-13: Show mlag output details

Entry	Description
Mapped Aggregator	Map the output of the aggregator in the interface which is active transformation.
Admin Key	Administrative key: automatically configured value on each port configured to use MLAG.
Oper Key	MLAG operator key on partner: automatically configured value on each port configured to use MLAG.
Physical properties Digest	Physical properties of the digest.
Neigh Admin Key	Neigh administrative key: automatically configured value on each port configured to use MLAG.

**Table 7-13: Show mlag output details**

Entry	Description
Neigh Physical Digest	Neighbor physical properties of the digest.
Info RCV State	Details of the RCV.
Info Periodic Time State	A simple state space formulation of a general digital periodic time series.
Mlag Sync	MAC address synchronization: enables a MLAG partner to forward Layer 3 packets arriving on this interfaces with either its own MAC address or its partner's.

---

## show mlag domain

Use this command to display MLAG configuration and status.

### Command Syntax

```
show mlag domain (summary|details)
```

### Parameters

summary	Summary
details	Details

### Command Mode

Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3 and updated for static channel groups in OcNOS version 1.3.6.

### Examples

```
#show mlag domain summary
```

```
-----  
Domain Configuration  
-----
```

```
Domain System Number      : 1  
Domain Address             : 1111.2222.3333  
Domain Priority            : 32768  
Intra Domain Interface    : sa5  
Domain Adjacency          : UP
```

```
-----  
MLAG Configuration  
-----
```

#### MLAG-1

```
Mapped Aggregator         : sa1  
Physical properties Digest : d a6 26 2d fa 9a 5c 7b e6 15 79 c2 d5 9c 57  
cc  
Total Bandwidth           : 40g  
Mlag Sync                 : IN_SYNC  
Mode                     : Active
```

#### MLAG-2

```
Mapped Aggregator         : sa2  
Physical properties Digest : ae 56 a1 c5 b9 dc 46 a4 5d 97 dc 79 9c 6f a5  
c8  
Total Bandwidth           : 40g  
Mlag Sync                 : IN_SYNC  
Mode                     : Active
```

```

# show mlag domain details
-----
Domain Configuration
-----
Domain System Number      : 1
Domain Address            : 1111.2222.3333
Domain Priority           : 32768
Intra Domain Interface    : sa5

Hello RCV State           : Current
Hello Periodic Timer State : Slow Periodic
Domain Sync               : IN_SYNC
Neigh Domain Sync         : IN_SYNC
Domain Adjacency          : UP
-----
MLAG Configuration
-----
MLAG-1
  Mapped Aggregator       : sa1
  Admin Key               : 16385
  Oper Key                : 16385
  Physical properties Digest : d a6 26 2d fa 9a 5c 7b e6 15 79 c2 d5 9c 57
cc

  Neigh Admin Key         : 32769
  Neigh Physical Digest   : d a6 26 2d fa 9a 5c 7b e6 15 79 c2 d5 9c 57
cc

  Info RCV State          : Current
  Info Periodic Time State : Standby
  Total Bandwidth         : 40g
  Mlag Sync               : IN_SYNC

MLAG-2
  Mapped Aggregator       : sa2
  Admin Key               : 16386
  Oper Key                : 16386
  Physical properties Digest : ae 56 a1 c5 b9 dc 46 a4 5d 97 dc 79 9c 6f a5
c8

  Neigh Admin Key         : 32770
  Neigh Physical Digest   : ae 56 a1 c5 b9 dc 46 a4 5d 97 dc 79 9c 6f a5
c8

  Info RCV State          : Current
  Info Periodic Time State : Standby
  Total Bandwidth         : 40g
  Mlag Sync               : IN_SYNC

```

Table 7-14 Shows the output details.

**Table 7-14: Show mlag summary details**

Entry	Description
Domain System Number	Number to identify the node in domain.
Domain Address	Domain address for the MLAG domain.

**Table 7-14: Show mlag summary details**

Entry	Description
Domain Priority	Domain priority for the MLAG domain.
Intra Domain Interface	Intra domain interface between MLAG domains.
Domain Adjacency	Domain adjacency details and configuration.
Physical properties Digest	physical properties of the digest algorithm.
Total Bandwidth	Total bandwidth available on the interface.
Domain System Number	Number of the domain system.
Domain Address	Domain address for the MLAG domain.
Domain Priority	Domain priority for the MLAG domain.
Intra Domain Interface	Details of the intra domain in the interface.
Hello RCV State	State of the hello RCV in the interface.
Hello Periodic Timer State	State of the hello periodic timer in the interface.
Domain Sync	Detail of the domain configuration synchronization.
Mapped Aggregator	Map the output of the aggregator in the interface which is active transformation.
Admin Key	Administrative key:automatically configured value on each port configured to use MLAG.
Oper Key	MLAG operator key on partner:automatically configured value on each port configured to use MLAG.
Physical properties Digest	Physical properties of the digest.
Neigh Admin Key	Neighbot administrative key: automatically configured value on each port configured to use MLAG.
Neigh Physical Digest	Neighbor physical properties of the digest.
Info RCV State	Details of the RCV.
Info Periodic Time State	A simple state space formulation of a general digital periodic time series.
Mlag Sync	MAC address synchronization: enables a MLAG partner to forward Layer 3 packets arriving on this interfaces with either its own MAC address or its partner's.

## show mlag stp-synchronization status

Use this command to display information about MLAG STP Synchronization status

### Command Syntax

```
show mlag stp-synchronization status
```

### Parameters

```
stp-synchronization STP synchronization related show commands
status              STP synchronization status
```

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
OcNOS#show mlag stp-synchronization status
```

```
Home STP Domain Digest      : 27 e7 22 79 76 b2 c8 4e 49 9f b4 45 4f 20 68 aa
Neighbor STP Domain Digest  : 27 e7 22 79 76 b2 c8 4e 49 9f b4 45 4f 20 68 aa
STP Sync Status             : IN_SYNC
```

```
-----
MLAG Interface Status:
```

```
MLAG1:
```

```
Home Interface Digest       : 76 88 b9 cd 43 c1 b0 9d b 86 64 e5 b7 d2 7f a7
Neighbor Interface Digest   : 76 88 b9 cd 43 c1 b0 9d b 86 64 e5 b7 d2 7f a7
STP Sync Status             : IN_SYNC
```

```
#
```

Entry	Description
Home STP Domain Digest	STP Domain properties of the digest
Neighbor STP Domain Digest	Neighbor STP Domain properties of the
digest	
STP Sync Status	Detail of configured STP
synchronization.	
Home Interface Digest	Interface properties of the digest.
Neighbor Interface Digest	Neigh Interface properties of the
digest.	



---

## show spanning-tree mlag operational-config

Use this command to display the operational information for MLAG.

### Command Syntax

```
show spanning-tree mlag operational-config
```

### Parameters

None

### Command Mode

Privilege exec mode

### Applicability

This command was introduced in OcNOS version 1.3.6.

### Examples

```
#show spanning-tree mlag operational-config  
Operational Configuration
```

```
-----  
Bridge Priority          : 32768  
Pathcost method         : Long  
  
Interface               : mlag1  
Pathcost                : 1000  
Priority                 : 0
```

---

## show spanning-tree mlag sync-detail

Use this command to display the spanning-tree properties shared with the domain peer node.

### Command Syntax

```
show spanning-tree mlag sync-detail
```

### Parameters

None

### Command Mode

Privilege exec mode

### Applicability

This command was introduced in OcNOS version 1.3.6.

### Examples

```
#show spanning-tree mlag sync-detail
Domain Digest Parameters
```

```
-----
Max Age           : 20
BPDU Filter       : Disabled
BPDU Guard        : Disabled
Hello time        : 2
Forward Delay     : 15
Force Version     : 2
Err-disable status : Disabled
Err-disable timeout : 300
MSTP Enabled      : Enabled
MSTP Bridge Forward : Disabled
```

```
Interface Digest parameters
```

```
-----
Port Name          : mlag1
Admin Root Guard    : Disabled
Admin Edge port     : Disabled
Portfast configuration : Disabled
Restricted TCN      : Disabled
Admin BPDU filter   : Default
Admin BPDU guard     : Default
```

---

## switchover type

Use this command to set the MLAG switchover type.

Use the `no` form of this command to turn off switchover.

### Command Syntax

```
switchover type revertive <1-255>
switchover type non-revertive
no switchover type (revertive | non-revertive)
```

### Parameters

<code>revertive</code>	If a failure happens that triggers a switchover, after failure recovery the initially-active node becomes active again
<code>&lt;1-255&gt;</code>	Switch back to the initially-active node this many seconds after failure recovery
<code>non-revertive</code>	Do not switch back to the initially-active node after failure recovery

### Default

`revertive` in 10 seconds

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#
(config)#interface mlag1
(config-if)#switchover type revertive 20

(config)#
(config)#interface mlag1
(config-if)#switchover type non-revertive
```

---

## CHAPTER 8 VLAN and Private VLAN Commands

---

This chapter has the commands used to manage VLANs and Private VLANs. A private VLAN contains switch ports that cannot communicate with each other, but can access other networks. This chapter includes the following commands:

- `global-bridge-vlan-check enable`
- `private-vlan association`
- `private-vlan community`
- `private-vlan isolated`
- `private-vlan primary`
- `show dtag vlan`
- `show vlan access-map`
- `show vlan`
- `show vlan brief`
- `show vlan classifier`
- `show vlan-reservation`
- `switchport access`
- `switchport hybrid`
- `switchport mode`
- `switchport mode access ingress-filter`
- `switchport mode hybrid ingress-filter`
- `switchport mode trunk ingress-filter`
- `switchport trunk allowed vlan dtag`
- `switchport mode (trunk) disable-native-vlan`
- `switchport mode hybrid acceptable-frame-type`
- `switchport trunk allowed`
- `switchport mode trunk disable-native-vlan`
- `switchport trunk native`
- `switchport mode private-vlan`
- `switchport private-vlan association-trunk`
- `switchport private-vlan host-association`
- `switchport private-vlan mapping`
- `feature vlan classifier`
- `vlan classifier activate`
- `vlan classifier group`
- `vlan classifier rule ipv4`
- `vlan classifier rule mac`
- `vlan classifier rule proto`
- `vlan database`
- `vlan-reservation`

- `vlan VLAN_RANGE bridge`
- `vlan VLAN_RANGE type customer`
- `vlan VLAN_RANGE type service`

---

## global-bridge-vlan-check enable

Use this command to establish a VLAN in the global VLAN database, ensuring that the same VLAN is not permitted to be encapsulated on a sub-interface.

### Command Syntax

```
global-bridge-vlan-check enable
no global-bridge-vlan-check enable
```

### Parameters

enable	Enable VLAN check validations
--------	-------------------------------

### Default

Disabled.

### Command Mode

VLAN Configuration mode

### Applicability

This command is introduced from OcNOS version 6.5.1.

### Example

1. Validating sub-interface encaps VLANs should not be overlapped with bridge VLANs.

```
#(config)#bridge 1 protocol rstp vlan-bridge
(config)#vlan 2-10 bridge 1
(config)#commit
(config)#
(config)#global-bridge-vlan-check enable
(config)#commit
(config)#
(config)#int xe2.2 switchport
(config-if)#encapsulation dot1q 2
(config-if)#commit
```

Bridge VLAN ids cannot be used for L2 sub-interface's encaps

Failed to commit. As error(s) encountered during commit operation.

2. Configure sub-interface encaps VLANs when not overlapping with bridge VLAN IDs.

```
#(config)#int xe5.5 switchport
(config-if)#encapsulation dot1q 11
(config-if)#commit
(config-if)#exit
(config)#end
```

---

## private-vlan association

Use this command to associate a secondary VLAN to a primary VLAN. Only one isolated VLAN can be associated to a primary VLAN. Multiple community VLANs can be associated to a primary VLAN.

Use the `no` form of this command to remove association of all the secondary VLANs to a primary VLAN.

### Command Syntax

```
private-vlan association add VLAN_RANGE
private-vlan association remove VLAN_RANGE
no private-vlan association
```

### Parameters

<code>add</code>	Add a VLAN to private VLAN list.
<code>remove</code>	Removes values associated with a single VLAN.
<code>VLAN_RANGE</code>	Specify VLAN ID 1-4094 or range(s): 1-5, 10 or 2-5,7-19 of the private VLANs to be configured

### Default

By default, functionality is disabled

### Command Mode

VLAN Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#vlan database
(config-vlan)#private-vlan association add 3-4
(config-vlan)#private-vlan association remove 3-4
(config-vlan)#no private-vlan association
```

---

## private-vlan community

Use this command to set a VLAN type for a private (community) VLAN.

Use the `no` form of this command to remove the specified private VLAN.

### Command Syntax

```
private-vlan <2-4094> community bridge <1-32>
no private-vlan <2-4094> bridge <1-32>
```

### Parameters

<code>&lt;2-4094&gt;</code>	Specify a private VLAN identifier.
<code>bridge</code>	Specify the bridge identifier.

### Default

By default, private vlan is disabled

### Command Mode

VLAN Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#vlan database
(config-vlan)#private-vlan 4 community bridge 1
```



---

## private-vlan isolated

Use this command to create an isolated private VLAN.

Use the `no` form of this command to remove the specified private VLAN.

### Command Syntax

```
private-vlan <2-4094> isolated bridge <1-32>
no private-vlan <2-4094> bridge <1-32>
```

### Parameters

<code>&lt;2-4094&gt;</code>	Specify a private VLAN identifier.
<code>bridge</code>	Specify the bridge identifier.

### Default

By default, private vlan is disabled

### Command Mode

VLAN Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#vlan database
(config-vlan)#private-vlan 3 isolated bridge 1
```

---

## private-vlan primary

Use this command to create a primary VLAN.

Use the `no` form of this command to remove the specified private VLAN.

### Command Syntax

```
private-vlan <2-4094> primary bridge <1-32>  
no private-vlan <2-4094> bridge <1-32>
```

### Parameters

<code>&lt;2-4094&gt;</code>	Specify a private VLAN identifier.
<code>bridge</code>	Specify the bridge identifier.

### Default

By default, private vlan is disabled

### Command Mode

VLAN Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal  
(config)#vlan database  
(config-vlan)#private-vlan 2 primary bridge 1
```

---

## show dtag vlan

Use this command to display information about VLAN double tagging.

### Command Syntax

```
show dtag vlan DTAG_VLAN_ID
```

### Parameters

**DTAG-VLAN-IDs** Outer-VLAN identifier and inner-VLAN identifier in the format 100.200, where 100 is the outer tag and 200 is the inner tag

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show dtag vlan 2000.3001
```

[Table 8-15](#) explains the output.

**Table 8-15: show dtag vlan output**

Field	Description
Bridge	Bridge number
VLAN ID	VLAN identifier
Name	Double tag-VLAN identifiers
State	VLAN state: ACTIVE, SUSPEND, or INVALID
H/W Status	Hardware status: UP or DOWN
Member ports	Interfaces that are part of the VLAN and whether untagged (u) or tagged (t)

---

## show vlan access-map

Use this command to display information for VLAN access maps.

### Command Syntax

```
show vlan access-map
```

### Parameters

None

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show vlan access-map
Vlan access-map myMap 10
    match ip: myMap
    action: drop
```

## show vlan

Use this command to display information about static, dynamic or all VLANs.

### Command Syntax

```
show vlan (all|static|dynamic|auto) bridge <1-32>
```

### Parameters

<1-32>	Displays the bridge group ID.
all	Displays all VLANs (static and dynamic).
static	Displays static VLANs.
dynamic	Displays dynamic VLANs.
auto	Displays auto configured VLANs.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#sh vlan all bridge 1
Bridge  VLAN ID      Name                State  H/W Status      Member ports
      (u)-Untagged, (t)-Tagged
=====
1         1         default            ACTIVE  Up              xe2(u) xe10(u)
1         2         vlan2              ACTIVE  Up              xe10(t)
1        10        VLAN0010           ACTIVE  Up              xe2(t) xe10(t)
1        20        VLAN0020           ACTIVE  Up              xe2(t) xe10(t)
1        30        VLAN0030           ACTIVE  Up              xe10(t)
1        40        VLAN0040           ACTIVE  Up              xe10(t)
1        50        VLAN0050           ACTIVE  Up              xe10(t)
1        60        VLAN0060           ACTIVE  Up              xe10(t)
#
```

[Table 8-16](#) Explains the show command output fields.

**Table 8-16: show vlan output fields**

Field	Description
Bridge	Number of bridge in the interface.
VLAN ID	VLAN identifier of the VLAN listed.
Name	Name of the VLAN.
State	Indicates whether the physical link is operational and can pass packets.

---

Field	Description
H/W Status	Indicates that the hardware is operational.
Member ports	The tagged interfaces to which a VLAN is associated.

---

## show vlan brief

Use this command to display brief VLAN information for all bridges.

### Command Syntax

```
show vlan (brief | <2-4094>)
```

### Parameters

None

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

The following is a sample output from this command when using the `all` parameter.

```
#show vlan brief
```

Bridge	VLAN ID	Name	State	Member ports (u)-Untagged, (t)-Tagged
=====	=====	=====	=====	=====
1	1	default	ACTIVE	eth2 (u)
0	1	default	ACTIVE	
0	2	new	ACTIVE	

[Table 8-17](#) Explains the show command output fields.

**Table 8-17: show vlan brief output fields**

Field	Description
Bridge	Number of bridge in the interface.
VLAN ID	VLAN identifier of the VLAN listed.
Name	Name of the VLAN.
State	Indicates whether the physical link is operational and can pass packets.
H/W Status	Indicates that the hardware is operational.
Member ports	The tagged interfaces to which a VLAN is associated.

---

## show vlan classifier

Use this command to display information on configured VLAN classifier groups, interfaces configured for a VLAN group or all the groups, or all configured VLAN classifier rules.

If either a group ID or rule ID is not specified, all configured VLAN classifier rules are shown. If either a group ID or rule ID is specified, a specific configured VLAN classifier rule is shown.

### Command Syntax

```
show vlan classifier group interface IFNAME
show vlan classifier group (<1-16>|)
show vlan classifier interface group (<1-16>|)
show vlan classifier rule(<1-256>|)
```

### Parameters

group	Displays group activated information.
<1-16>	Displays the group ID
interface	Displays interface information.
interface	Displays interface group information.
group	Displays group activated information.
<1-16>	Displays the group ID.
rule	Displays VLAN classifier rule ID.
<1-256>	Displays rule ID information.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

This example displays groups for VLAN classifier groups:

```
#show vlan classifier group 1
vlan classifier group 1 add rule 1
```

This example displays interfaces for all VLAN classifier groups:

```
#show vlan classifier interface group
vlan classifier group 1 interface fe2
vlan classifier group 1 interface fe3
vlan classifier group 2 interface fe5
vlan classifier group 3 interface fe7
```

This example displays interfaces for VLAN classifier group 1:

```
#show vlan classifier interface group 1
vlan classifier group 1 interface fe2
vlan classifier group 1 interface fe3
```



This example displays interfaces for VLAN classifier rule 1:

```
#show vlan classifier rule 1
vlan classifier rule 1 mac 0011.2222.3333 vlan 2
```

---

## show vlan-reservation

Use this command to display reserved vlans that are configured via vlan-reservation configuration on the switch.

### Command Syntax

```
show vlan-reservation
```

### Parameters

None

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS version 5.1.

### Example

```
OcNOS#show vlan-reservation
VLAN ID      Status
=====
500           free
501           free
502           free
503           free
504           free
505           free
506           free
507           free
508           free
509           free
510           free
OcNOS#
```

If user enables port breakout on any of the interface

```
OcNOS(config)#interface xe54/1
OcNOS(config-if)#port breakout enable
OcNOS(config-if)#commit
```

Each subsidiary ports 54/2, 54/3, 54/4 will get vlan-id from the vlan-reservation pool and the status of vlan-id changes to "allocated".

```
OcNOS#show vlan-reservation
VLAN ID      Status
=====
500           allocated
501           allocated
502           allocated
503           free
504           free
505           free
```

```
506          free
507          free
508          free
509          free
510          free
OcNOS#
```

Note: From OcNOS version 5.1, it is mandatory to configure vlan-reservation prior to port breakout configuration.

---

## switchport access

Use this command to change the default VLAN on the current interface.

Note: IP Infusion Inc. does not recommend using VLAN identifier 1 because of interoperability issues with other vendors' equipment.

Use the `no` parameter to remove an existing VLAN.

### Command Syntax

```
switchport access vlan <2-4094>
no switchport access vlan
```

### Parameter

<2-4094>                Specify the VLAN identifier.

### Default

The switchport access vlan default value is 3968.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

This example shows the steps of a typical VLAN session, creating and destroying a VLAN.

```
#configure terminal
(config)#interface eth0
(config-if)#switchport access vlan 3

(config)#interface eth0
(config-if)#no switchport access vlan
```

---

## switchport hybrid

Use this command to set the switching characteristics of the interface to hybrid. Both tagged and untagged frames will be classified over hybrid interfaces.

For a VLAN range, specify two VLAN identifiers: the lowest and then the highest separated by a hyphen. For a VLAN list, specify the VLAN identifiers separated by commas. Do not enter spaces between the hyphens or commas.

Use the `no` parameter to turn off allowed hybrid switching.

### Command Syntax

```
switchport hybrid allowed vlan all
switchport hybrid vlan <2-4094>
switchport hybrid allowed vlan none
switchport hybrid allowed vlan remove VLAN_ID
switchport hybrid allowed vlan add VLAN_ID
no switchport hybrid
no switchport hybrid vlan
```

### Parameters

<code>all</code>	Allow all VLANs to transmit and receive through the interface.
<code>none</code>	Allow no VLANs to transmit and receive through the interface.
<code>remove</code>	Remove these VLANs from the member set.
<code>VLAN_ID</code>	VLAN identifier(s) <2-4094>. You can specify a single VLAN, a VLAN range, or a VLAN list.
<code>add</code>	Add these VLANs to the member set.
<code>VLAN_ID</code>	VLAN identifier(s) <2-4094>. You can specify a single VLAN, a VLAN range, or a VLAN list.

### Default

By default, `switchport hybrid` is enabled.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

The following shows adding a single VLAN to the member set.

```
(config-if)#switchport hybrid allowed vlan add VLAN_RANGE2
eg switchport hybrid allowed vlan add 2
```

The following shows adding a range of VLANs to the member set.

```
(config-if)#switchport hybrid allowed vlan add VLAN_RANGE2
eg switchport hybrid allowed vlan add 2-4
```

---

## switchport mode

Use this command to set the switching characteristics of the Layer 2 interface.

### Command Syntax

```
switchport mode (access|hybrid|trunk|provider-network|customer-edge  
|customer-network|private-vlan)
```

### Parameters

access	Access.
hybrid	Hybrid.
trunk	Trunk.
provider-network	Provider network.
customer-network	Customer network.

### Default

By default, switchport mode access is enabled.

Configuring an interface to operate in trunk mode using the CLI command `switchport mode trunk` will automatically permit VLAN ID 1 on the trunk ports by default.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal  
(config)#interface eth0  
(config-if)#switchport mode access
```

---

## switchport mode access ingress-filter

Use this command to set the switching characteristics of the interface to access mode, and classify untagged frames only. Received frames are classified based on the VLAN characteristics, then accepted or discarded based on the specified filtering criteria.

### Command Syntax

```
switchport mode access ingress-filter (enable|disable)
```

### Parameters

<code>ingress-filter</code>	Set the ingress filtering for the received frames.
<code>enable</code>	Set the ingress filtering for received frames. Received frames that cannot be classified in the previous step based on the acceptable frame type parameter (access/trunk) are discarded. This is the default value.
<code>disable</code>	Turn off ingress filtering to accept frames that do not meet the classification criteria.

### Default

Received frames that cannot be classified in the previous step based on the acceptable frame type parameter (access/trunk) are discarded.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#switchport mode access ingress-filter enable
```

---

## switchport mode hybrid ingress-filter

Use this command to set the switching characteristics of the interface as hybrid, and classify both tagged and untagged frames. Received frames are classified based on the VLAN characteristics, then accepted or discarded based on the specified filtering criteria.

### Command Syntax

```
switchport mode hybrid ingress-filter (enable|disable)
```

### Parameters

enable	Set the ingress filtering for received frames. Received frames that cannot be classified in the previous step based on the acceptable frame type parameter (access/trunk) are discarded. This is the default value.
disable	Turn off ingress filtering to accept frames that do not meet the classification criteria.

### Default

Received frames that cannot be classified in the previous step based on the acceptable frame type parameter (access/trunk) are discarded.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#switchport mode hybrid ingress-filter enable
```



---

## switchport mode trunk ingress-filter

Use this command to set the switching characteristics of the interface as trunk, and specify only tagged frames. Received frames are classified based on the VLAN characteristics, then accepted or discarded based on the specified filtering criteria.

### Command Syntax

```
switchport mode trunk ingress-filter (enable|disable)
```

### Parameters

<code>ingress-filter</code>	Set the ingress filtering for the received frames.
<code>enable</code>	Set the ingress filtering for received frames. Received frames that cannot be classified in the previous step based on the acceptable frame type parameter (access/trunk) are discarded. This is the default value.
<code>disable</code>	Turn off ingress filtering to accept frames that do not meet the classification criteria.

### Default

Received frames that cannot be classified in the previous step based on the acceptable frame type parameter (access/trunk) are discarded.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#switchport mode trunk ingress-filter enable
```

---

## switchport trunk allowed vlan dtag

Use this command to maintain a mapping between the double-tagged logical interfaces with the physical interfaces for the purpose of enabling VLAN-translation on the port alone.

An example of when to use this command is in a GPON application, where an S-tag uniquely identifies an OLT channel partition and a C-tag uniquely identifies a subscriber/service on that channel partition.

### Command Syntax

```
switchport trunk allowed vlan add dtag DTAG-VLAN-IDs
switchport trunk allowed vlan remove dtag DTAG-VLAN-IDs
```

### Parameters

add	Add a mapping
remove	Remove a mapping
DTAG-VLAN-IDs	Outer-VLAN identifier and inner-VLAN identifier in the format 100.200, where 100 is the outer tag and 200 is the inner tag

### Default

None

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#int mlag1
(config-if)#switchport
(config-if)#bridge-group 1
(config-if)#switchport mode trunk
(config-if)#switchport trunk allowed vlan add 100,2000
(config-if)#switchport trunk allowed vlan add dtag 2000.3001
```

---

## switchport mode (trunk) disable-native-vlan

Use this command to create switchport mode trunk without any default native vlan (i.e. vlan 1).

Use the no form of this command to delete the CLI and add vlan-1 back as default-native-vlan(i.e. vlan 1) as untagged.

### Command Syntax

```
switchport mode (trunk) disable-native-vlan
no switchport mode (trunk) disable-native-vlan
```

### Parameters

switchport	Set the switching characteristics of interface
mode	Set the mode of the Layer-2 interface
trunk	Set the Layer-2 interface as trunk
disable-native-vlan	Disable native VLAN support

### Command Mode

Interface mode

### Applicability

This command is introduced in OcNOS version 5.1.

### Example

```
OcNOS(config)#int xe7
OcNOS(config-if)#switchport mode trunk disable-native-vlan
```

---

## switchport mode hybrid acceptable-frame-type

Use this command to set the interface acceptable frame types. This processing occurs after VLAN classification.

### Command Syntax

```
switchport mode hybrid acceptable-frame-type (all|vlan-tagged)
```

### Parameters

all	Set all frames can be received
vlan-tagged	Accept only classified frames that belong to the port's member set.

### Default

Received frames that cannot be classified in the previous step based on the acceptable frame type parameter (access/trunk) are discarded.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#switchport mode hybrid acceptable-frame-type vlan-tagged
```

---

## switchport trunk allowed

Use this command to set the switching characteristics of the interface to trunk.

For a VLAN range, specify two VLAN identifiers: the lowest and then the highest separated by a hyphen. For a VLAN list, specify the VLAN identifiers separated by commas. Do not enter spaces between the hyphens or commas.

Use the `no` parameter to remove all VLAN identifiers configured on this port.

### Command Syntax

```
switchport trunk allowed vlan all
switchport trunk allowed vlan none
switchport trunk allowed vlan add VLAN_ID
switchport trunk allowed vlan except VLAN_ID
switchport trunk allowed vlan remove VLAN_ID
no switchport trunk
```

### Parameters

<code>all</code>	Allow all VLANs to transmit and receive through the interface.
<code>none</code>	Allow no VLANs to transmit and receive through the interface.
<code>add</code>	Add these VLANs to the member set.
<code>VLAN_ID</code>	VLAN identifier(s) <2-4094>. You can specify a single VLAN, a VLAN range, or a VLAN list.
<code>except</code>	All VLANs except these VLANs are part of the member set.
<code>VLAN_ID</code>	VLAN identifier(s) <2-4094>. You can specify a single VLAN, a VLAN range, or a VLAN list.
<code>remove</code>	Remove these VLANs from the member set.
<code>VLAN_ID</code>	VLAN identifier(s) <2-4094>. You can specify a single VLAN, a VLAN range, or a VLAN list.

### Default

Received frames that cannot be classified in the previous step based on the acceptable frame type parameter (access/trunk) are discarded.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

The following shows adding a single VLAN to the port's member set.

```
(config)#interface eth0
(config-if)#switchport trunk allowed vlan add 2
```

The following shows adding a range of VLANs to the port's member set.

```
(config)#interface eth0  
(config-if)#switchport trunk allowed vlan add 2-4
```

---

## switchport mode trunk disable-native-vlan

Use this command to create a switchport mode trunk without any default native vlan (i.e. vlan 1).

Use the `no` form of this command to delete the CLI and add vlan-1 back as default-native-vlan (i.e. vlan 1) as untagged.

### Command Syntax

```
switchport mode trunk disable-native-vlan
no switchport mode trunk disable-native-vlan
```

### Parameters

None

### Command Mode

Interface mode

### Applicability

This command is introduced in OcNOS version 5.1.

### Example

```
(config)#int xe7
(config-if)#switchport mode trunk disable-native-vlan
```

---

## switchport trunk native

Use this command to configure native VLANs for this port. The native VLAN is used for classifying the incoming untagged packets.

Use the `no` parameter to revert the native VLAN to the default VLAN identifier 1.

### Command Syntax

```
switchport trunk native vlan VLAN_ID
no switchport trunk native vlan
```

### Parameter

VLAN_ID	VLAN identifier(s) <1-4094>. You can specify a single VLAN, or a VLAN list. For a VLAN list, specify the VLAN identifiers separated by commas. Do not enter spaces in between the hyphens or commas.
---------	---

### Default

The default is that ingress filtering is off and all frame types are classified and accepted.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#switchport trunk native vlan 2

(config)#interface eth0
(config-if)#no switchport trunk native vlan
```



---

## switchport mode private-vlan

Use this command to make a Layer 2 port a host port, promiscuous port, or trunk port.

Use the `no` form of this command to remove the configuration.

### Command Syntax

```
switchport mode private-vlan (host | promiscuous)
no switchport mode private-vlan
```

### Parameters

<code>host</code>	This port type can communicate with all other host ports assigned to the same community VLAN, but it cannot communicate with the ports in the same isolated VLAN. All communications outside of this VLAN must pass through a promiscuous port in the associated primary VLAN.
<code>promiscuous</code>	A promiscuous port can communicate with all interfaces, including the community and isolated ports within a private VLAN

### Default

By default, `switchport mode private-vlan` is `host`.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3 and changed in OcNOS version 3.0.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#switchport mode private-vlan host
(config)#interface eth1
(config-if)#switchport mode private-vlan promiscuous
(config)#interface eth2
(config-if)#no switchport mode private-vlan
```

---

## switchport private-vlan association-trunk

Use this command to associate primary vlan and secondary vlan under "switchport mode trunk" and "switchport mode private-vlan host".

**Note:** Each secondary VLAN on a host trunk port must be associated with a different primary VLAN. User cannot put two secondary VLANs that are associated with the same primary VLAN on a host trunk port. Each secondary vlan on the same port has to have the same type, ie isolated or community, there cannot be mixed type.

Use the no form of this command to remove the association.

### Command Syntax

```
switchport private-vlan association-trunk VLAN_ID VLAN_ID
no switchport private-vlan association-trunk VLAN_ID VLAN_ID
no switchport private-vlan association-trunk
```

### Parameters

VLAN_ID	VLAN ID 2-4094
---------	----------------

### Command Mode

Interface mode

### Applicability

This command was introduced in OcNOS version 5.1.

### Example

```
#configure terminal
(config)#interface xe2
(config-if)#speed 10g
(config-if)#switchport
(config-if)#bridge-group 1
(config-if)#switchport mode trunk
(config-if)#switchport trunk allowed vlan add 10 20
(config-if)#switchport mode private-vlan host
(config-if)#switchport private-vlan association-trunk 100 10
(config-if)#switchport private-vlan association-trunk 200 20
(config-if)#no switchport private-vlan association-trunk 100 10
(config-if)#no switchport private-vlan association-trunk
```

---

## switchport private-vlan host-association

Use this command to associate a primary VLAN and a secondary VLAN to a host port. Only one primary and secondary VLAN can be associated to a host port.

Use the `no` form of this command to remove the association.

### Command Syntax

```
switchport private-vlan host-association <2-4094> add <2-4094>
no switchport private-vlan host-association
```

### Parameters

<2-4094>	VLAN identifier of the primary VLAN.
add	Adds the secondary VLAN.
<2-4094>	VLAN identifier of the secondary VLAN (either isolated or community).

### Default

By default, switchport mode private-vlan value is 1

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#switchport private-vlan host-association 2 add 3

#configure terminal
(config)#interface eth0
(config-if)#no switchport private-vlan host-association
```

---

## switchport private-vlan mapping

Use this command to associate a primary VLAN and a set of secondary VLANs to a promiscuous port.

Use the `no` form of this to remove all the association of secondary VLANs to primary VLANs for a promiscuous port.

### Command Syntax

```
switchport private-vlan mapping <2-4094> add VLAN_ID
switchport private-vlan mapping <2-4094> remove VLAN_ID
no switchport private-vlan mapping
```

### Parameters

<2-4094>	VLAN identifier of the primary VLAN.
add	Adds the secondary VLAN.
remove	Removes the secondary VLAN.
VLAN_ID	VLAN identifier <2-4094> of the secondary VLAN (either isolated or community).

### Default

By default, switchport mode private-vlan mapping value is 1

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#switchport private-vlan mapping 2 add 3-4
(config-if)#switchport private-vlan mapping 2 remove 3-4

(config-if)#no switchport private-vlan mapping
```

---

## feature vlan classifier

Use this command to enable the feature VLAN classifier.

Use `no` form of this command to disable the feature VLAN classifier.

### Command Syntax

```
feature vlan classifier
no feature vlan classifier
```

### Parameters

<code>classifier</code>	VLAN Classifier Service
-------------------------	-------------------------

### Default

By default, feature vlan classifier is enable

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#feature vlan classifier
(config)#no feature vlan classifier
```

---

## vlan classifier activate

Use this command to activate the VLAN classifier.

Use no form of this command to deactivate the VLAN classifier.

### Command Syntax

```
vlan classifier activate <1-16> vlan <2-4096>  
no vlan classifier activate <1-16>
```

### Parameters

<1-16>	Indicates the VLAN classifier activate identifier.
<2-4094>	VLAN identifier of the primary VLAN.

### Default

By default, vlan classifier activate value is 1

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal  
(config)#interface eth2  
(config-if)#vlan classifier activate 1 vlan 2  
  
(config-if)#no vlan classifier activate 1
```

---

## vlan classifier group

Use this command to create a subnet-based VLAN classifier group. A group indicates a VLAN classifier group ID.

### Command Syntax

```
vlan classifier group <1-16> (add | delete) rule <1-256>
no vlan classifier group <1-16>
```

### Parameters

add	Adds a rule to a group.
delete	Deletes a rule from a group.
rule	Indicates the VLAN classifier rule identifier <1-256>.

### Default

By default, vlan classifier group value is 1

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#vlan classifier group 1 delete rule 1
(config)#no vlan classifier group 1
```

---

## vlan classifier rule ipv4

Use this command to create a subnet-based VLAN classifier rule and map it to a specific VLAN.

Use this command to create a MAC-based VLAN classifier rule and map it to a specific VLAN. If the source IP address matches the IP subnet specified in the VLAN classifier rule, received packets are mapped to the designated VLAN.

### Command Syntax

```
vlan classifier rule <1-256> ipv4 A.B.C.D/M
no vlan classifier rule <1-256>
```

### Parameters

A.B.C.D/M	Indicates the IPv4 address classification. Enter the address in A.B.C.D/M format.
-----------	---

### Default

By default, vlan classifier rule is VLAN1

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#vlan classifier rule 2 ipv4 20.20.20.2/24
(config)#no vlan classifier rule 2
```



---

## vlan classifier rule mac

Use this command to create a MAC-based VLAN classifier rule and map it to a specific VLAN.

If the source MAC address matches the MAC specified in the VLAN classifier rule, received packets are mapped to the designated VLAN.

### Command Syntax

```
vlan classifier rule <1-256> mac WORD
no vlan classifier rule <1-256>
```

### Parameters

WORD	MAC Address in HHHH.HHHH.HHHH format.
------	---------------------------------------

### Default

By default, vlan classifier rule value is VLAN1

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)##vlan classifier rule 2 mac 00D0.2331.AA1C
(config)#no vlan classifier rule 2
```

## vlan classifier rule proto

Use this command to create an Ethertype-based VLAN classifier rule for a protocol and map it to a specific VLAN. If the source Ethertype matches the Ethertype specified in the VLAN classifier rule, received packets are mapped to the designated VLAN.

### Command Syntax

```
vlan classifier rule <1-256> proto
    (ETHERTYPE|ip|x25|arp|g8bpqx25|ieeepup|ieeeaddrtrans|dec|decnadamload|decnare
    moteconsole|decnadrouting|declat|decdiagnostics|rarp|atalkddp|atalkarp|ipx|ipv6
    |atmmulti|pppdiscovery|pppsession|atmtransport)
no vlan classifier rule <1-256>
```

### Parameters

ETHERTYPE	Specify an Ethernet protocol number (0x600-0xFFFF)
arp	Address Resolution Protocol (0x0806)
atalkarp	Appletalk AARP (0x80F3)
atalkddp	Appletalk DDP (0x809B)
atmmulti	MultiProtocol Over ATM (0x884c)
atmtransport	Frame-based ATM Transport (0x8884)
dec	DEC Assigned (0x6000)
decdiagnostics	DEC Diagnostics (0x6005)
decnadamload	DEC DNA Dump/Load (0x6001)
decnaremateconsole	DEC DNA Remote Console (0x6002)
decnadrouting	DEC DNA Routing (0x6003)
declat	DEC LAT (0x6004)
g8bpqx25	G8BPQ AX.25 (0x08FF)
ieeeaddrtrans	Xerox IEEE802.3 PUP Address Translation (0x0a01)
ieeepup	Xerox IEEE802.3 PUP (0x0a00)
ip	IP (0x0800)
ipv6	IPv6 (0x86DD)
ipx	IPX (0x8137)
pppdiscovery	PPPoE discovery (0x8863)
pppsession	PPPoE session (0x8864)
rarp	Reverse Address Resolution Protocol (0x8035)
x25	CCITT X.25 (0x0805)

### Default

By default, vlan classifier rule value is VLAN1

**Command Mode**

Configure mode

**Applicability**

This command was introduced before OcNOS version 1.3.

**Example**

```
#configure terminal
(config)#vlan classifier rule 2 proto ip
(config)#no vlan classifier rule 2
(config)#vlan classifier rule 3 proto 0x0805
(config)#no vlan classifier rule 3
```

---

## vlan database

Use this command to enter the VLAN configuration mode to add, delete, or modify values associated with a single VLAN.

### Command Syntax

```
vlan database
```

### Parameters

None

### Default

No default value is specified

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

In the following example, note the change to VLAN configuration mode from Configure mode:

```
#configure terminal
(config)#vlan database
(config-vlan)#
```

---

## vlan-reservation

Use this command to create or delete VLAN reservation pool on the switch.

Note:

- The user-defined VLAN range must be contiguous with the system-defined VLANs. *Example:* If the system VLAN is 4066-4094, the user VLAN range must be 4040-4065 and not 4040-4064 or 100-200.
- Delete the VLAN-reservation range completely for the added user-defined VLAN range, as it is not possible to delete subsets.

### Command Syntax

```
vlan-reservation VLAN_RANGE  
no vlan-reservation VLAN_RANGE
```

### Parameters

VLAN\_RANGE      VLAN ID 2-4094 or range(s): 2-5,10 or 2-5,7-19

### Default

No default value is specified

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 5.1.

### Example

In the following example, note the change to VLAN configuration mode from Configure mode:

```
#configure terminal  
(config)#vlan database  
(config-vlan)#
```

---

## vlan VLAN\_RANGE bridge

This command allows you to create a single/range of VLAN's on the VLAN aware bridges.

Use the no form of this command to delete the VLAN.

### Command Syntax

```
vlan VLAN_RANGE bridge <1-32>
vlan <2-4094> bridge <1-32> (state (enable|disable)|)
vlan VLAN_RANGE bridge <1-32> (name WORD|) state (enable | disable)
no vlan VLAN_RANGE bridge <1-32>
```

### Parameters

VLAN_RANGE	The vlan-id or range of vlan-id's separated by ','&'-'
bridge	Specify the bridge group ID in the range <1-32>.
state	Indicates the operational state of the VLAN.
enable	Sets VLAN into an enable state.
disable	Sets VLAN into a disable state.

### Default

By default, vlan bridge state is disabled

### Command Mode

Configuration Mode

VLAN Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#vlan 3-40,56 bridge 4
(config)#no vlan 2-5 bridge 2
```

---

## vlan VLAN\_RANGE type customer

This command allows you to create a single/range of VLAN's of the type Customer VLAN in Provider Edge bridges.

Use the `no` form of this command to delete the VLAN.

### Command Syntax

```
vlan VLAN_RANGE (type (customer)|) bridge <1-32> (name WORD|) (state
(disable|enable)|)
no vlan VLAN_RANGE type (customer) bridge <1-32>
no vlan VLAN_RANGE bridge <1-32>
```

### Parameters

VLAN_RANGE	VLAN ID 2-4094 or range(s): 2-5,10 or 2-5,7-19
bridge	Specify the bridge group ID in the range <1-32>.
WORD	The ascii name of the VLAN
state	Indicates the operational state of the VLAN.
enable	Sets VLAN into an enable state.
disable	Sets VLAN into a disable state.
customer	Customer VLAN

### Default

By default, vlan customer state is disabled

### Command Mode

Configuration Mode

VLAN Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config-vlan)#vlan 15 type customer bridge 1 name abcde state enable
(config-vlan)#vlan 2-10,15 type customer bridge 1 state enable
(config-vlan)#no vlan 2-10,15 type customer bridge 1
(config-vlan)#
(config)#no vlan 2-10,15 br 1
(config)#end
#
```

## vlan VLAN\_RANGE type service

This command allows you to create a single/range of VLAN's of the type Service VLAN in Provider Edge & provider network bridges.

Use the no form of this command to delete the VLAN.

### Command Syntax

```
vlan VLAN_RANGE type service (point-point|multipoint-multipoint|rooted-multipoint)
    bridge <1-32> (state (disable|enable)|)

vlan VLAN_RANGE type service (point-point|multipoint-multipoint|rooted-multipoint)
    bridge <1-32> name WORD (state (disable|enable)|)

no vlan VLAN_RANGE type service bridge <1-32>
```

### Parameters

VLAN_RANGE	VLAN ID 2-4094 or range(s): 2-5,10 or 2-5,7-19
service	service VLAN
multipoint-multipoint	Service Multipoint to Multipoint Service VLAN
point-point	Service Point-to-Point Service VLAN
rooted-multipoint	Service Rooted Multipoint Service VLAN
bridge	Specify the bridge group ID in the range <1-32>.
WORD	The ascii name of the VLAN
state	Operational state of the VLAN
disable	Disable VLAN status on the bridge
enable	Enable VLAN status on the bridge

### Default

By default, with the name WORD this can only be given in "vlan database" mode.

### Command Mode

Configuration Mode

VLAN Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#vlan database
(config-vlan)#vlan 100 type service multipoint-multipoint bridge 1 name xxxx
state enable
(config-vlan)#vlan 101 type service point-point bridge 1 name afsa state
disable
```



```
(config-vlan)#vlan 102 type service rooted-multipoint bridge 1 state enable
(config)#vlan 104-107 type service multipoint-multipoint bridge 1 state enable
(config)#vlan 114-117,119 type service multipoint-multipoint bridge 1 state
enable
(config)#vlan 124-127,129 type service point-point bridge 1 state enable
(config)#no vlan 114-117,119 type service br 1
```

---

## CHAPTER 9 802.1x Commands

---

This chapter provides a description, syntax, and examples of the 802.1X commands. It includes the following commands:

- [auth-mac](#)
- [auth-mac mode](#)
- [auth-mac dynamic-vlan-creation](#)
- [auth-mac mac-aging](#)
- [auth-mac system-auth-ctrl](#)
- [auth-port](#)
- [auth-port](#)
- [dot1x port-control](#)
- [dot1x protocol-version](#)
- [dot1x quiet-period](#)
- [dot1x reauthMax](#)
- [dot1x reauthentication](#)
- [dot1x system-auth-ctrl](#)
- [dot1x timeout re-authperiod](#)
- [dot1x timeout server-timeout](#)
- [dot1x timeout supp-timeout](#)
- [dot1x timeout tx-period](#)
- [ip radius source-interface](#)
- [key-string](#)
- [key-string encrypted](#)
- [radius-server dot1x host](#)
- [retransmit](#)
- [show debugging dot1x](#)
- [show dot1x](#)
- [timeout](#)

---

## auth-mac

Use this command to enable MAC authentication on an interface.

Use the `no` parameter with this command to disable MAC authentication on an interface.

### Command Syntax

```
auth-mac
no auth-mac
```

### Parameters

None

### Default

No default value is specified.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#auth-mac
(config-if)#commit

#configure terminal
(config)#interface eth0
(config-if)#no auth-mac
(config-if)#commit
```

---

## auth-mac mode

Use this command to enable MAC authentication mode on an interface.

Use the `no` parameter with this command to disable MAC authentication mode on an interface.

### Command Syntax

```
auth-mac mode (filter|shutdown)
no auth-mac mode
```

### Parameters

<code>filter</code>	Filter the frames for the MAC when in an unauthorized state.
<code>shutdown</code>	Shut down the interface when the MAC is unauthenticated.

### Default

No default value is specified.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#auth-mac mode filter
(config-if)#commit

#configure terminal
(config)#interface eth0
(config-if)#no auth-mac mode
(config-if)#commit
```

---

## auth-mac dynamic-vlan-creation

Use this command to enable dynamic VLAN creation after successful MAC authentication. Use the no form of the command to disable dynamic VLAN creation.

### Command Syntax

```
auth-mac dynamic-vlan-creation
no auth-mac dynamic-vlan-creation
```

### Parameters

None.

### Default

Disabled

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#no auth-mac dynamic-vlan-creation

#configure terminal
(config)#interface eth0
(config-if)#auth-mac dynamic-vlan-creation
```

---

## auth-mac mac-aging

Use this command to enable MAC aging. When enabled, a MAC entry is added to the forwarding database, with aging time equal to the bridge aging time. Otherwise, the MAC entry will not be aged out. If MAC aging is disabled, the MAC entry will not be aged out.

Use `no` form of this command to disable MAC aging.

### Command Syntax

```
auth-mac mac-aging
no auth-mac mac-aging
```

### Parameters

None.

### Default

Disabled.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#no auth-mac mac-aging

#configure terminal
(config)#interface eth0
(config-if)#auth-mac mac-aging
```

---

## auth-mac system-auth-ctrl

Use this command to enable MAC authentication globally. If MAC authentication is not enabled, other MAC authentication related commands throw an error when issued.

Use the `no` parameter with this command to disable MAC authentication globally.

### Command Syntax

```
auth-mac system-auth-ctrl
no auth-mac system-auth-ctrl
```

### Parameters

None

### Default

Authentication system messages are not displayed.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#auth-mac system-auth-ctrl

(config)#no auth-mac system-auth-ctrl
```

---

## auth-port

Use this command to configure a RADIUS server and specify port for RADIUS authentication.

Use the `no` parameter with this command to disable this feature.

### Command Syntax

```
auth-port <1-65535>
no auth-port
```

### Parameters

<0-65535>            Port number.

### Default

The default value of `auth-port` is 1812.

### Command Mode

Configure Radius server mode

### Applicability

This command was introduced before OcNOS Version 6.0.

### Examples

```
#configure terminal
(config)#radius-server dot1x
(config-radius-server)#auth-port 1233
(config-radius-server)#no auth-port 1233
```



---

## debug dot1x

Use this command to turn on or turn off 802.1x debugging at various levels.

Use the `no` parameter with this command to turn off debugging.

### Command Syntax

```
debug dot1x (all|)
debug dot1x event
debug dot1x nsm
debug dot1x packet
debug dot1x timer
no debug dot1x (all|)
no debug dot1x event
no debug dot1x nsm
no debug dot1x packet
no debug dot1x timer
```

### Parameters

<code>all</code>	Sets debugging for all 802.1x levels.
<code>event</code>	Sets debugging for 802.1x events.
<code>nsm</code>	Sets debugging for 802.1x NSM information.
<code>packet</code>	Sets debugging for 802.1x packets.
<code>timer</code>	Sets debugging for 802.1x timer.

### Default

No default value is specified.

### Command Mode

Exec, Privileged Exec, and Configure modes

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#debug dot1x all
(config)#debug dot1x event
```

---

## dot1x port-control

Use this command to force a port state.

Use the `no` parameter with this command to remove a port from the 802.1x management.

### Command Syntax

```
dot1x port-control (force-unauthorized|force-authorized|auto)
no dot1x port-control
```

### Parameters

<code>auto</code>	Specify to enable authentication on port.
<code>force-authorized</code>	Specify to force a port to always be in an authorized state.
<code>force-unauthorized</code>	Specify to force a port to always be in an unauthorized state.

### Default

The dot1x port-control default is active.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#dot1x port-control auto

(config)#interface eth0
(config-if)#no dot1x port-control
```

---

## dot1x protocol-version

Use this command to set the protocol version of dot1x to 1 or 2. The protocol version must be synchronized with the Xsupplicant being used in that interface.

Use the `no` parameter with this command to set the protocol version to the default value (2).

### Command Syntax

```
dot1x protocol-version <1-2>
no dot1x protocol-version
```

### Parameters

<1-2>	Indicates the EAP Over LAN (EAPOL) version.
-------	---

### Default

The default dot1x protocol version is 2.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#dot1x protocol-version 2

(config)#interface eth0
(config-if)#no dot1x protocol-version
```

---

## dot1x quiet-period

Use this command to set the quiet-period time interval.

When a switch cannot authenticate a client, the switch remains idle for a quiet-period interval of time, then tries again. By administratively changing the quiet-period interval, by entering a lower number than the default, a faster response time can be provided.

Use the `no` parameter with this command to set the configured quiet period to the default (60 seconds).

### Command Syntax

```
dot1x quiet-period <1-65535>
no dot1x quiet-period
```

### Parameter

`<1-65535>`                Seconds between the retrial of authentication.

### Default

The default dot1x quiet-period is 60.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#dot1x quiet-period 200
```

---

## dot1x reauthMax

Use this command to set the maximum reauthentication value, which sets the maximum number of reauthentication attempts after which the port will be unauthorized.

Use the `no` parameter with this command to set the reauthentication maximum to the default value (2).

### Command Syntax

```
dot1x reauthMax <1-10>
no dot1x reauthMax
```

### Parameter

<1-10>	Indicates the maximum number of reauthentication attempts after which the port will be unauthorized.
--------	--

### Default

The default is 2.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

The following sets the maximum reauthentication value to 5.

```
#configure terminal
(config)#interface eth0
(config-if)#dot1x reauthMax 5
```

The following sets the reauthentication maximum to the default value.

```
#configure terminal
(config)#interface eth0
(config-if)#no dot1x reauthMax
```

---

## dot1x reauthentication

Use this command to enable reauthentication on a port.

Use the `no` parameter to disable reauthentication on a port.

### Command Syntax

```
dot1x reauthentication
no dot1x reauthentication
```

### Parameters

None

### Default

The dot1x reauthentication default is disabled.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#dot1x reauthentication
```

---

## dot1x system-auth-ctrl

Use this command to enable globally authentication.

Use the `no` parameter to disable globally authentication.

### Command Syntax

```
dot1x system-auth-ctrl
no dot1x system-auth-ctrl
```

### Parameters

None

### Default

Authentication is off by default.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#dot1x system-auth-ctrl
```

---

## dot1x timeout re-authperiod

Use this command to set the interval between reauthorization attempts.

Use the `no` parameter to disable the interval between reauthorization attempts.

### Command Syntax

```
dot1x timeout re-authperiod <1-4294967295>  
no dot1x timeout re-authperiod
```

### Parameter

<1-4294967295> Specify the seconds between reauthorization attempts.

### Default

Default time is 3600 seconds

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal  
(config)#interface eth0  
(config-if)#dot1x timeout re-authperiod 25
```



---

## dot1x timeout server-timeout

Use this command to set the authentication sever response timeout.

Use the `no` parameter to disable the authentication sever response timeout.

### Command Syntax

```
dot1x timeout server-timeout <1-65535>
no dot1x timeout server-timeout
```

### Parameter

`<1-65535>` Specify the authentication server response timeout.

### Default

Default timeout is 30 seconds.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#dot1x timeout server-timeout 555

(config)#interface eth0
(config-if)#no dot1x timeout server-timeout
```

---

## dot1x timeout supp-timeout

Use this command to set the interval for a supplicant to respond.

Use the `no` parameter to disable the authentication sever response timeout.

### Command Syntax

```
dot1x timeout supp-timeout <1-65535>  
no dot1x timeout supp-timeout
```

### Parameter

<1-65535>                Specify the authentication server response timeout.

### Default

Default timeout is 30 seconds.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal  
(config)#interface eth0  
(config-if)#dot1x timeout supp-timeout 40  
  
(config)#interface eth0  
(config-if)#no dot1x timeout supp-timeout
```

---

## dot1x timeout tx-period

Use this command to set the interval between successive attempts to request an ID.

Use the `no` parameter to disable the interval between successive attempts to request an ID.

### Command Syntax

```
dot1x timeout tx-period <1-65535>
no dot1x timeout tx-period
```

### Parameter

`<1-65535>` Specify the authentication server response timeout.

### Default

Default timeout is 30 seconds.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#dot1x timeout tx-period 34

(config)#interface eth0
(config-if)#no dot1x timeout tx-period
```

---

## ip radius source-interface

Use this command to set the local address sent in packets to the radius server.

Use the `no` parameter to clear the local address.

### Command Syntax

```
ip radius source-interface A.B.C.D <1-65535>
no ip radius source-interface
```

### Parameters

A.B.C.D	IPv4 address of the RADIUS server.
<1-65535>	Port number.

### Default

The default port number is 1812.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#ip radius source-interface myhost 1812

(config)#no ip radius source-interface
```

---

## key-string

Use this command to define a password in plain-text to be used by a key.

The password is stored as encrypted, and is displayed in encrypted text when show running-config command is executed.

Use the `no` parameter with this command to disable this feature.

### Command Syntax

```
key-string WORD
no key-string
```

### Parameter

WORD	Specify a string of characters to be used as a password by the key. The length of the string should be between 1-64 characters.
------	---

### Default

By default, password is not configured.

### Command Mode

Configure Radius server mode

### Applicability

This command was introduced in OcNOS Version 6.0.

### Examples

```
#configure terminal
(config)#radius-server dot1x host 1.1.1.1
(config-radius-server)#key-string 1234567890
(config-radius-server)#no key-string
```

---

## key-string encrypted

Use this command to define a password in its encrypted format to be used by a key.

Use the `no` parameter with this command to disable this feature.

### Command Syntax

```
key-string encrypted WORD
no key-string
```

### Parameter

WORD	Specify a string of characters to be used as a password by the key. The length of the string should be between 18-130 characters.
------	---

### Default

By default, password is not configured.

### Command Mode

Configure Radius server mode

### Applicability

This command was introduced in OcNOS Version 6.0.

### Examples

```
#configure terminal
(config)#radius-server dot1x host 1.1.1.1
(config-radius-server)#key-string encrypted 0x16176d21cc1688d995
(config-radius-server)#no key-string
```

---

## radius-server dot1x host

Use this command to specify the IP address or host name of the remote radius server host and assign authentication and accounting destination port numbers. Multiple radius-server host commands can be used to specify multiple hosts. The software searches for hosts in the order they are specified.

If no host-specific timeout, retransmit, or key values are specified, the global values apply to that host.

If the auth-port parameter is not specified, the default value of the auth-port is used. If the auth-port is not specified to unconfigure, and the default value of the auth-port does not match with the port you are trying to unconfigure, then the specified radius-server host will not be unconfigured.

Use the `no` form of the command to unconfigure a specified radius-server.

### Command Syntax

```
radius-server dot1x host (A.B.C.D)
no radius-server dot1x host (A.B.C.D)
```

### Parameters

<code>dot1x</code>	IEEE 802.1X Port-Based Access Control.
<code>A.B.C.D</code>	IPv4 address of the RADIUS server.

### Default

The default value of auth-port is 1812.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#radius-server dot1x host 1.1.1.1
(config-radius-server)#
(config)#no radius-server dot1x host 1.1.1.1
```

---

## retransmit

Use this command to specify the number of times the router transmits each radius request to the server before giving up.

Use the `no` form of this command to disable retransmission.

### Command Syntax

```
retransmit <0-100>
no retransmit
```

### Parameter

<code>&lt;0-100&gt;</code>	Specify the retransmit value. Enter a value in the range 0 to 100. If no retransmit value is specified, the global value is used.
----------------------------	---

### Default

The default value is 3.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#radius-server dot1x host 1.1.1.1
(config-radius-server)#retransmit 12
(config-radius-server)#no retransmit
```



---

## show debugging dot1x

Use this command to display the status of the debugging of the 802.1x system.

### Command Syntax

```
show debugging dot1x
```

### Parameters

None

### Command Mode

Privileged Exec mode

### Applicability

This command was introduced in OcNOS Version 6.0.

### Example

```
#show debugging dot1x
802.1X debugging status:
```

---

## show dot1x

Use this command to display IEEE 802.1x port-based access control information.

### Command Syntax

```
show dot1x
show dot1x all
show dot1x host
show dot1x diagnostics interface IFNAME
show dot1x interface IFNAME
show dot1x sessionstatistics interface IFNAME
show dot1x statistics interface IFNAME
```

### Parameters

all	Display all IEEE 802.1x port-based access control information.
host	Show operational radius-server dot1x host information for a specific host (IPv4 address) or for all hosts.
diagnostics	Display diagnostics information.
IFNAME	Interface name.
sessionstatistics	Display the statistics for a session.
statistics	Display the statistics.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

The following is an output of this command displaying the state of the system.

```
#show dot1x
% 802.1x authentication enabled
% Radius server address: 192.168.1.1.1812
% Radius client address: dhcp128.mySite.com.12103
% Next radius message id: 0
```

The following is an output of this command displaying detailed information for all ports.

```
#show dot1x all
% 802.1x authentication enabled
% Radius server address: 192.168.1.1.1812
% Radius client address: dhcp128.mySite.com.12103
% Next radius message id: 0
% Dot1x info for interface eth1 - 3
% portEnabled: true - portControl: auto
% portStatus: unauthorized - currentId: 11
```

```

% reAuthenticate: disabled
% abort:F fail:F start:F timeout:F success:F
% PAE: state: connecting - portMode: auto
% PAE: reAuthCount: 2 - rxRespId: 0
% PAE: quietPeriod: 60 - reauthMax: 2 - txPeriod: 30
% BE: state: idle - reqCount: 0 - idFromServer: 0
% BE: suppTimeout: 30 - serverTimeout: 30 - maxReq: 2
% CD: adminControlledDirections: in - operControlledDirections: in
% CD: bridgeDetected: false
% KR: rxKey: false
% KT: keyAvailable: false - keyTxEnabled: false

```

The following tables describes the output of the `show dot1x` command.

**Table 9-18: Port variables**

Entry	Description
portEnabled	Interface operational status (Up-true/down-false)
portControl	Current control status of the port for 802.1x control
portStatus	802.1x status of the port (authorized/unauthorized)
reAuthenticate	Reauthentication enabled/disabled status on port
reAuthPeriod	Reauthentication period

**Table 9-19: Supplicant PAE related global variables**

Entry	Description
abort	Abort authentication when true
fail	Failed authentication attempt when false
start	Start authentication when true
timeout	Authentication attempt timed out when true
success	Authentication successful when true

**Table 9-20: 802.1x Operational state of interface**

Entry	Description
mode	Configured 802.1x mode
reAuthCount	Reauthentication count
quietperiod	Time between reauthentication attempts
reAuthMax	Maximum reauthentication attempts

**Table 9-21: Backend authentication state machine variables and constants**

Entry	Description
state	State of the port.
reqCount	Number of requests sent to server
suppTimeout	Number of seconds the port waits for a response when relaying a request from the authentication server to the supplicant before resending the request.
serverTimeout	Number of seconds the port waits for a reply when relaying a response from the supplicant to the authentication server before timing out.
maxReq	Maximum number of times a request packet is retransmitted to the supplicant before the authentication session times out.

**Table 9-22: Controlled directions state machine**

Entry	Description
adminControlledDirections	Administrative value (Both/In)
operControlledDirections	Operational Value (Both/In)

**Table 9-23: KR -- Key receive state machine**

Entry	Description
rxKey	True when EAPOL-Key message is received by supplicant or authenticator. false when key is transmitted

**Table 9-24: Key Transmit state machine**

Entry	Description
keyAvailable	False when key has been transmitted by authenticator, true when new key is available for key exchange
keyTxEnabled	Key transmission enabled/disabled status

---

## timeout

Use this command to specify the number of seconds a router waits for a reply to a radius request before retransmitting the request.

Use the `no` parameter to use the default value.

### Command Syntax

```
timeout <0-60>
no timeout
```

### Parameter

<0-60>                      RADIUS server timeout period in seconds.

### Default

The default value is 5 seconds.

### Command Mode

Configure Radius server mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#radius-server dot1x host 1.1.1.1
(config-radius-server)#timeout 20
(config-radius-server)#no timeout
```

## CHAPTER 10 Link Layer Discovery Protocol Commands

---

This chapter describes the Link Layer Discovery Protocol (LLDP) commands.

- [lldp debug](#)
- [lldp \(disable|enable\) default-agent](#)
- [lldp ip](#)
- [lldp run](#)
- [lldp tlv](#)
- [lldp tlv-select](#)
- [set lldp chassis-id-tlv](#)
- [set lldp disable](#)
- [set lldp enable](#)
- [set lldp locally-assigned](#)
- [set lldp management-address-tlv](#)
- [set lldp msg-tx-hold](#)
- [set lldp timer](#)
- [set lldp too-many-neighbors](#)
- [show lldp](#)
- [snmp restart lldp](#)

---

## lldp debug

Use this command to turn on debugging functions for LLDP.

Use the `no` form of this command to turn off LLDP debugging functions

### Command Syntax

```
lldp debug (event|rx|tx|message)
no lldp debug (event|rx|tx|message)
```

### Parameters

event	Event debugging
message	NSM message debugging
rx	RX debugging
tx	TX debugging

### Command Mode

Exec mode and Privileged Exec mode

### Examples

```
#lldp debug event
#lldp debug messages
```

---

## lldp (disable|enable) default-agent

Use this command to exclude interface when LLDP enabled globally

### Command Syntax

```
lldp (disable|enable) default-agent
```

### Parameters

disable	Disables default LLDP agent
enable	Enables default LLDP agent

### Command Mode

Interface mode

### Applicability

This command is introduced from OcNOS version 5.0

### Example

```
#configure terminal
(config)#interface xel
(config-if)#lldp disable default-agent
(config-if)#lldp enable default-agent
```



---

## lldp ip

Use this command to set the Link Layer Discovery Protocol with an IP address to be used as a chassis and management ID.

Use the `no` form of this command to remove this value.

### Command Syntax

```
lldp ip address A.B.C.D
no lldp ip address
```

### Parameters

A.B.C.D	Enter the IP address value
---------	----------------------------

### Command Mode

Configure mode

### Examples

```
#configure terminal
(config)#lldp ip address 1.1.1.1
(config)#no lldp ip address
```

---

## lldp run

Use this command to start the Link Layer Discovery Protocol (LLDP).

Use the `no` form of this command to stop LLDP.

### Command Syntax

```
lldp run
no lldp run
```

### Parameters

None

### Command Mode

Configure mode

### Example

```
#configure terminal
(config)#lldp run

(config)#no lldp run
```

---

## lldp tlv

Use this command to set the TLVs enabled for transmission on a port. Make sure that the complete set of Type Length Values (TLVs) is specified when giving this command, because TLVs not specified are disabled.

### Command Syntax

```
lldp tlv {chassis-id|port-id|ttl|port-description|system-name|system-  
description|system-capabilities|management-address|ieee-8021-org-specific|ieee-  
8023-org-specific}
```

### Parameters

chassis-id	Chassis ID type length values (TLV)
port-id	Port ID TLV
ttl	Time to live TLV
port-description	Port description TLV
system-name	System name TLV
system-description	System Description
system-capabilities	System capabilities TLV
management-address	Management address TLV
ieee-8021-org-specific	IEEE 802.1 organizationally-specific TLV
ieee-8023-org-specific	IEEE 802.3 organizationally-specific TLV

### Command Mode

Interface mode

### Example

```
#configure terminal  
(config)#interface eth0  
(config-if)#lldp tlv chassis-id ieee-8021-org-specific ieee-8023-org-specific  
management-address port-description port-id system-capabilities system-  
description system-name ttl
```

## lldp tlv-select

Use this command to configure interface LLDP parameters.

This command can be executed globally for all ports (configure mode) or locally for a specific port (interface mode).

When you give this command globally on all ports:

- The `show running-config` command only displays the options in global mode.
- A global configuration overrides an interface-level configuration. For example, if you disable an option on an interface, it is enabled after enabling the same option globally. If the option was enabled previously, the show output is suppressed and only global mode is displayed (to avoid duplicating the same configuration).
- After enabling a global configuration, when a new LLDP agent is configured on a port, it inherits the global TLV configuration. However, show output does not appear per interface/agent.
- After enabling globally, if you disable an option on an interface, the "no" form for this command is shown for that interface.
- Enabling an already enabled option causes an error.

If you disable globally on all ports:

- The option is removed globally, as well as overrides configurations for all interfaces.
- If the option was not enabled globally, it causes an error.

When enabled locally on a port:

- If the same option was enabled globally, it causes an error.
- If not already enabled, the option is enabled for the given interface alone.

When disabled locally on a port:

- If the option was not present locally or globally, it causes an error.
- If the option was enabled globally, the option is removed from this interface alone. No command will be displayed in show output.

Use the *no* form of this command to remove interface LLDP parameter configurations.

### Command Syntax

```
lldp tlv-select (port-description|system-name| system-description|system-
capabilities|management-address| ieee-8021-org-specific | ieee-8023-org-specific)
no lldp tlv-select (port-description|system-name|system-description|system-
capabilities|management-address|ieee-8021-org-specific | ieee-8023-org-specific)
```

### Parameters

port-description	Port description TLV
system-name	System name TLV
system-description	System Description
system-capabilities	System capabilities TLV
management-address	

**Management address TLV**

ieee-8021-org-specific

**IEEE 802.1 organizationally-specific TLV**

ieee-8023-org-specific

**IEEE 802.3 organizationally-specific TLV****Command Mode**

Configure mode and interface mode

**Example**

```
#configure terminal
(config)#lldp tlv-select system-capabilities

#configure terminal
(config)#interface eth2
(config-if)#lldp-agent
(config-if-lldp-agent)#lldp tlv-select system-capabilities
```

---

## set lldp chassis-id-tlv

Use this command to set the chassis ID subtype for the LLDP agent on a port.

### Command Syntax

```
set lldp chassis-id-tlv (mac-address | ip-address)
```

### Parameters

mac-address	Use the MAC address as the chassis ID
ip-address	Use the management IP address as the chassis ID

### Command Mode

Interface mode

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#set lldp chassis-id-tlv ip-address
```

---

## set lldp disable

Use this command to disable the LLDP agent on a port.

### Command Syntax

```
set lldp disable
```

### Parameters

None

### Command Mode

Interface mode

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#set lldp disable
```

---

## set lldp enable

Use this command to enable an LLDP agent on a port and specify its type.

### Command Syntax

```
set lldp enable (txonly|txrx|rxonly)
```

### Parameters

rxonly	Receive-only
txonly	Transmit-only
txrx	Transmit and receive

### Default

By default, no LLDP agent is enabled for a port.

### Command Mode

Interface mode

### Examples

```
#configure terminal
(config)#interface eth 0
(config-if)#set lldp enable txrx
```



---

## set lldp locally-assigned

Use this command to locally set the LLDP port identifier.

### Command Syntax

```
set lldp locally-assigned NAME
```

### Parameters

NAME	Name of the port.
------	-------------------

### Command Mode

Interface mode

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#set lldp locally-assigned port1
```

---

## set lldp management-address-tlv

Use this command to set the management address subtype for the LLDP agent on a port.

### Command Syntax

```
set lldp management-address-tlv (mac-address | ip-address)
```

### Parameters

mac-address	Use the MAC address as the chassis ID
ip-address	Use the management IP address as the chassis ID

### Command Mode

Interface mode

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#set lldp management-address-tlv ip-address
```

---

## set lldp msg-tx-hold

Use this command to set the Time To Live (TTL) value for LLDPDUs to be transmitted by the port. The value set with this command is multiplied by the `msg-tx-interval` value (see [set lldp timer](#)), which determines the final TTL value.

### Command Syntax

```
set lldp msg-tx-hold VALUE
```

### Parameters

VALUE	Time in seconds
-------	-----------------

### Default

The default value of the TTL is 4 seconds.

### Command Mode

Interface mode

### Examples

```
#configure terminal
(config)#interface eth0
(config)#set lldp msg-tx-hold 3
```

---

## set lldp timer

Use this command to set the interval at which LLDP frames are transmitted.

### Command Syntax

```
set lldp timer msg-tx-interval <5-32768>
set lldp timer reinitDelay VALUE
set lldp timer tx-delay <1-8192>
```

### Parameters

<5-32768>	Message transmit interval value
VALUE	Reinit delay value
<1-8192>	Transmit delay value in range of: (1 <= tx-delay <= ((0.25)* msg-tx-interval))

### Default Values

The default value for `msg-tx-interval` is 30 seconds.

The default value for `reinitDelay` is 2 seconds.

The default value of the `tx-delay` is 2 seconds.

### Command Mode

Interface mode

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#set lldp timer msg-tx-interval 40

#configure terminal
(config)#interface eth0
(config-if)#set lldp timer reinitDelay 3

#configure terminal
(config)#interface eth0
(config-if)#set lldp timer tx-delay 3
```

---

## set lldp too-many-neighbors

Use this command to set the action to take when the remote table is full.

### Command Syntax

```
set lldp too-many-neighbors limit <1-65535> discard received-info timer <1-65535>
set lldp too-many-neighbors limit <1-65535> discard existing-info MAC
timer <1-65535>
```

### Parameters

limit	The limit on the number of LLDP neighbors.
<1-65535>	The limit on the number of LLDP neighbors.
received-info	The information received for this neighbor.
timer	The period after which received information is discarded.
<1-65535>	The period in seconds after which received information is discarded.
existing-info	The information for this neighbor.
MAC	Identifies the remote LLDP Agent for which information is discarded.
timer	The period in seconds after which existing information is discarded.
<1-65535>	The period in seconds after which existing information is discarded.

### Default Value

No upper limit is enforced for the number of remote LLDP agents.

### Command Mode

Interface mode

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#set lldp too-many-neighbors limit 20 disc existing-info 1.1.1.1.1
timer 1

(config)#interface eth1
(config-if)#set lldp too-many-neighbors limit 1 discard received-info timer 1
```

---

## show lldp

Use this command to display LLDP port information.

### Command Syntax

```
show lldp port IFNAME
show lldp port IFNAME statistics
```

### Parameters

IFNAME	Name of the interface
statistics	LLDP port statistics

### Command Mode

Exec mode and Privileged Exec mode

### Example

The following sample output from this command displays detailed information about an LLDP-enabled port.

```
#show lldp port eth0
Remote LLDP
MAC Address: 01:06:29:CF:79:A1
TTL: 60
Network Address: 192.168.1.0
Interface Name: eth1
Interface Locally Assigned String: Port-a
Interface Description: bridge
Interface Number: 2
Port Vlan ID: 1
Protocol ID: 274242030202
AutoNego Support: Supported
AutoNego Capability: 1
Operational MAU Type: 3
Link Aggregation Status: Capable
Link Aggregation Port ID: 0
Max Frame Size: 128
System name:
System Description: bridge
System Capabilities: 4
System Capabilities Enabled: 4
```

The following sample output from this command displays all LLDP statistics for a selected port.

```
#show lldp port eth0 statistics
LLDP Port statistics for eth0
Frames transmitted: 22
Frames Aged out: 0
Frames Discarded: 0
Frames with Error: 0
Frames Received: 5
TLVs discarded: 0
TLVs unrecognized 0
```

---

## snmp restart lldp

Use this command to restart SNMP in Link Layer Discovery Protocol (LLDP)

### Command Syntax

```
snmp restart lldp
```

### Parameters

None

### Command Mode

Configure mode

### Examples

```
#snmp restart lldp
```

---

## CHAPTER 11 Link Layer Discovery Protocol v2 Commands

---

The commands in this chapter support:

- Link Layer Discovery Protocol (LLDP) version 2 as described in IEEE 802.1AB 2009
- LLDP-MED protocol extension as per ANSI/TIA-1057 April 2006.

Note: To enable LLDPv2, LLDP (previous version) should be disabled or vice versa.

- [clear lldp counters](#)
- [lldp-agent](#)
- [lldp debug](#)
- [lldp run](#)
- [set lldp agt-circuit-id](#)
- [set lldp enable](#)
- [set lldp chassis-id-tlv](#)
- [set lldp chassis locally-assigned](#)
- [set lldp disable](#)
- [set lldp locally-assigned](#)
- [set lldp management-address-tlv](#)
- [set lldp med-devtype](#)
- [set lldp msg-tx-hold](#)
- [set lldp port-id-tlv](#)
- [set lldp timer](#)
- [set lldp too-many-neighbors](#)
- [lldp tlv-select](#)
- [lldp tlv-select med](#)
- [lldp tlv-select basic-mgmt](#)
- [lldp tlv-select ieee-8021-org-specific](#)
- [lldp tlv-select ieee-8023-org-specific](#)
- [set lldp system-description](#)
- [set lldp system-name](#)
- [set lldp tx-fast-init](#)
- [set lldp tx-max-credit](#)
- [show debugging lldp](#)
- [show lldp neighbors](#)
- [show lldp interface](#)
- [snmp restart lldp](#)



---

## clear lldp counters

Use this command to clear the LLDP statistics on all the interfaces.

### Command Syntax

```
clear lldp counters
```

### Parameters

counters	Reset the LLDP traffic counters to zero.
----------	--

### Command Mode

Exec Mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#clear lldp counters
```

---

## lldp-agent

Use this command to create an LLDP agent mode.

Note: This command is not supported in SVLAN, VLAN, and loopback interfaces.

Use the `no` parameter to revert to default settings.

### Command Syntax

```
lldp-agent (non-tpmr-bridge |customer-bridge| )
no lldp-agent (non-tpmr-bridge |customer-bridge| )
```

### Parameters

non-tpmr-bridge	
	non-tpmr-bridge
customer-bridge	
	customer-bridge

### Default

By default LLDP agent is disabled.

### Command Mode

Interface Mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#lldp-agent customer-bridge

(config-if)#no lldp-agent customer-bridge
(config-if)#exit
```

---

## lldp debug

Use this command to set the debugging functions for LLDP.

Use the no form of this command to turn off LLDP debugging functions

### Command Syntax

```
lldp debug (event|rx|tx|message)
no lldp debug (event|rx|tx|message)
```

### Parameters

event	Enable or disable event debugging
message	Enable or disable NSM message debugging
rx	Enable or disable RX debugging
tx	Enable or disable TX debugging

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#lldp debug event
#lldp debug message
```

---

## lldp run

Use this command to start the Link Layer Discovery Protocol (LLDP)

Use the no form of this command to stop LLDP

### Command Syntax

```
lldp run
no lldp run
```

### Parameters

None

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#lldp run

(config)#no lldp run
```

---

## set lldp agt-circuit-id

Use this command to configure LLDP agt-circuit-id.

### Command Syntax

```
set lldp agt-circuit-id  VALUE
```

### Parameters

VALUE	Specify LLDP global agt-circuit ID.
-------	-------------------------------------

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#interface eth0
(config-if)#set lldp agt-circuit-id sample
```

---

## set lldp enable

Use this command to set the admin status of a LLDP agent on a port.

### Command Syntax

```
set lldp enable (txonly|txrx|rxonly)
```

### Parameters

rxonly	Receive-only
txonly	Transmit-only
txrx	Transmit and receive

### Default

By default, no LLDP agent is enabled for a port.

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#lldp-agent
(lldp-agent)#set lldp enable txrx
(lldp-agent)#exit
```

---

## set lldp chassis-id-tlv

Use this command to set the chassis ID subtype for the LLDP agent on a port.

Use no form of this command to unset the chassis ID subtype.

### Command Syntax

```
set lldp chassis-id-tlv (if-alias | ip-address | mac-address | if-name | locally-
assigned)
no set lldp chassis-id-tlv
```

### Parameters

mac-address	Use the MAC address as the chassis ID
ip-address	Use the management IP address as the chassis ID
if-alias	Use the IP address as the chassis ID
if-name	Use the interface name as the chassis ID
locally-assigned	Use the locally assigned value as the chassis ID

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#lldp-agent
(lldp-agent)#set lldp chassis-id-tlv ip-address
(lldp-agent)#no set lldp chassis-id-tlv
```

---

## set lldp chassis locally-assigned

Use this command to set the locally assigned chassis name for the LLDP interface.

### Command Syntax

```
set lldp chassis locally-assigned NAME
```

### Parameters

NAME	Name assigned to the chassis.
------	-------------------------------

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#set lldp chassis locally-assigned box1
```



---

## set lldp disable

Use this command to disable the admin status of a LLDP agent on a port.

### Command Syntax

```
set lldp disable
```

### Parameters

None

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#lldp-agent
(lldp-agent)#set lldp disable
(lldp-agent)#exit
```

---

## set lldp locally-assigned

Use this command to set the locally assigned name for LLDP interface.

Use no form of this command to remove the locally assigned name for LLDP interface.

### Command Syntax

```
set lldp locally-assigned NAME
no set lldp locally-assigned NAME
```

### Parameters

NAME	Name assigned to the port.
------	----------------------------

### Command Mode

Interface Mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#lldp-agent
(config-if)#set lldp locally-assigned port1
(config-if)#no set lldp locally-assigned
```

---

## set lldp management-address-tlv

Use this command to set the sub type of the Management Address TLV.

Use `no` form of this command to unset the sub type of the Management Address TLV.

### Command Syntax

```
set lldp management-address-tlv (mac-address | ip-address)
no set lldp management-address-tlv
```

### Parameters

mac-address	Use the MAC address as the Management Address.
ip-address	Use the management IP address as the Management Address.

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#lldp-agent
(lldp-agent)#set lldp management-address-tlv ip-address
(lldp-agent)#no set lldp management-address-tlv
```

---

## set lldp med-devtype

Use this command to configure the LLDP device type as Network-Connectivity/ End-Point Class1/ End-Point Class2/ End-Point Class3 device.

Use the `no` parameter to un set the configured LLDP device type.

### Command Syntax

```
set lldp med-devtype (net-connect| ep-class1| ep-class2| ep-class3)
no lldp med-devtype (net-connect| ep-class1| ep-class2| ep-class3)
```

### Parameters

<code>net-connect</code>	Set device type as Network-Connectivity
<code>ep-class1</code>	Set device type as End-Point Class1
<code>ep-class2</code>	Set device type as End-Point Class2
<code>ep-class3</code>	Set device type as End-Point Class3

### Default

None

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#set lldp med-devtype ep-class1
(config-if)#exit

#configure terminal
(config)#interface eth0
(config-if)#no set lldp med-devtyp
(config-if)#exit
```

---

## set lldp msg-tx-hold

Use this command to set the `msg-tx-hold` parameter that determines the Time To Live (TTL) value for LLDPDUs to be transmitted by the port. The value set with this command is multiplied by the `lldp timer msg-tx-interval` value, which determines the final TTL value.

Use `no` form of this command to set the default value of message transmit hold.

### Command Syntax

```
set lldp msg-tx-hold VALUE
no set lldp msg-tx-hold
```

### Parameters

VALUE Specify time in seconds in the range of <1-100> to set message transmit hold.

### Default

The default value of message transmit hold is 4 seconds.

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#interface eth0
(config-if)#lldp-agent
(lldp-agent)#set lldp msg-tx-hold 3
(lldp-agent)#no set lldp msg-tx-hold
```

---

## set lldp port-id-tlv

Use this command to set the sub type of the Port ID.

Use `no` form of this command to unset the sub type of the Port ID.

### Command Syntax

```
set lldp port-id-tlv (if-alias | ip-address | mac-address | if-name | agt-circuit-id | locally-assigned)
no set lldp port-id-tlv
```

### Parameters

<code>mac-address</code>	Use the MAC address as the port-id-tlv.
<code>ip-address</code>	Use the management IP address as the port-id-tlv
<code>if-alias</code>	Use the IP alias as the port-id-tlv
<code>if-name</code>	Use the interface name as the port-id-tlv
<code>agt-circuit-id</code>	Use the agt-circuit-id name as the port-id-tlv
<code>locally-assigned</code>	Use the locally assigned value as the port-id-tlv

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#interface eth0
(config-if)#lldp-agent
(lldp-agent)#set lldp port-id-tlv ip-address
(lldp-agent)#no set lldp port-id-tlv
```

---

## set lldp timer

Use this command to set the interval at which LLDP frames are transmitted.

Use `no` form of this command to set the default value for timer.

### Command Syntax

```
set lldp timer msg-fast-tx <1-3600>
set lldp timer msg-tx-interval <5-3600>
set lldp timer reinit-Delay VALUE
no set lldp timer msg-fast-tx
no set lldp timer msg-tx-interval
no set lldp timer reinit-Delay
```

### Parameters

<code>msg-fast-tx</code>	Set the value in range <1-3600>
<code>msg-tx-interval</code>	Set the value in range <5-3600>
<code>reinitDelay</code>	Set the value in range <1-10>

### Default Values

The default value for `msg-fast-tx` is 1 second.

The default value for `msg-tx-interval` is 30 seconds.

The default value for `reinitDelay` is 2 seconds.

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#lldp-agent
(lldp-agent)#set lldp timer msg-fast-tx 40
(lldp-agent)#no set lldp timer msg-fast-tx
(lldp-agent)#exit

#configure terminal
(config)#interface eth0
(config-if)#lldp-agent
(lldp-agent)#set lldp timer msg-tx-interval 40
(lldp-agent)#no set lldp timer msg-tx-interval
(lldp-agent)#exit
```

```
#configure terminal
(config)#interface eth0
(config-if)#lldp-agent
(lldp-agent)#set lldp timer reinitDelay 3
(lldp-agent)#no set lldp timer reinitDelay
(lldp-agent)#exit
```



---

## set lldp too-many-neighbors

Use this command to set the action to take when the remote table is full.

Use no form of this command to unset too many neighbors parameters.

### Command Syntax

```
set lldp too-many-neighbors limit <1-65535> discard received-info timer <1-65535>
set lldp too-many-neighbors limit <1-65535> discard existing-info MAC timer <1-65535>
no set lldp too-many-neighbors limit
```

### Parameters

limit	The limit on the number of LLDP neighbors.
<1-65535>	Upper limit for the number of Remote LLDP Information.
received-info	The information received for this neighbor.
timer	The period after which received information is discarded.
<1-65535>	The period in seconds after which received information is discarded.
existing-info	The information for this neighbor.
MAC	Identifies the remote LLDP Agent for which information is discarded.
timer	The period in seconds after which existing information is discarded.
<1-65535>	The period in seconds after which existing information is discarded.

### Default Value

No upper limit is enforced for the number of remote LLDP agents.

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#lldp-agent
(lldp-agent)#set lldp too-many-neighbors limit 20 disc existing-info
1001.1001.1001 timer 1

(config)#interface eth1
(config-if)#lldp-agent
(lldp-agent)#set lldp too-many-neighbors limit 1 discard received-info timer 1
```

---

## lldp tlv-select

Use this command to select the set of optional TLV's to be included in the LLDP frames.

Use the `no` parameter to disable the selected set of optional TLV's.

### Command Syntax

```
lldp tlv-select {basic-mgmt| ieee-8021-org-specific| ieee-8023-org-specific}  
no lldp tlv-select {basic-mgmt| ieee-8021-org-specific| ieee-8023-org-specific}
```

### Parameters

<code>basic-mgmt</code>	Basic management specific TLV.
<code>ieee-8021-org-specific</code>	IEEE 802.1 organizationally-specific TLV.
<code>ieee-8023-org-specific</code>	IEEE 803.1 organizationally-specific TLV

### Default Value

None

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal  
(config)#interface eth0  
(config-if) lldp-agent  
(lldp-agent)#lldp tlv-select basic-mgmt  
(lldp-agent)#exit
```

---

## lldp tlv-select med

Use this command to select the set of optional TLV's which can enabled for transmission.

Use the `no` parameter to disable the selected set of optional TLV's.

### Command Syntax

```
lldp tlv-select med (media-capabilities | network-policy| location | extended-  
power-via-mdi | inventory|)  
  
no lldp tlv-select med (media-capabilities | network-policy| location | extended-  
power-via-mdi | inventory|)
```

### Parameters

<code>network-policy</code>	Select the Network-policy as optional TLV
<code>media-capabilities</code>	Select the Media-capabilities as optional TLV
<code>location</code>	Select the Location as optional TLV
<code>extended-power-via-mdi</code>	Select the extended-power-via-mdi as optional TLV, when PoE feature is available
<code>inventory</code>	Select the Inventory as optional TLV

### Default Value

None

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal  
(config)#interface eth0  
(config-if)lldp-agent  
(lldp-agent)#lldp tlv-select network-policy  
(lldp-agent)#exit
```

---

## lldp tlv-select basic-mgmt

Use this command to select the set of basic management TLV's to be included in the LLDP frames.

Use the `no` parameter to disable selected set of basic management TLV's.

### Command Syntax

```
lldp tlv-select basic-mgmt {port-description| system-name| system-description/  
system-capabilities| management-address}  
  
no lldp tlv-select basic-mgmt {port-description| system-name| system-description/  
system-capabilities| management-address}
```

### Parameters

port-description	Port description specific TLV
system-name	System name specific TLV
system-description	System Description specific TLV
system-capabilities	System capabilities specific TLV
management-address	Management address specific TLV

### Default Value

None

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal  
(config)#interface eth0  
(config-if)lldp-agent  
(lldp-agent)#lldp tlv-select basic-mgmt system-name  
(lldp-agent)#exit
```

---

## lldp tlv-select ieee-8021-org-specific

Use this command to select the set of ieee-8021-org-specific TLV to be included in the LLDP frames.

Use the `no` parameter to disable the selected set of ieee-8021-org-specific TLV.

### Command Syntax

```
lldp tlv-select ieee-8021-org-specific {port-vlanid| port-ptcl-vlanid| vlan-name|
ptcl-identity| vid-digest| mgmt-vid| link-agg| data-center-bridging|}
no lldp tlv-select ieee-8021-org-specific {port-vlanid| port-ptcl-vlanid| vlan-
name| ptcl-identity| vid-digest| mgmt-vid| link-agg| data-center-bridging|}
```

### Parameters

<code>mgmt-vid</code>	Select management VLAN identifier TLV
<code>port-ptcl-vlanid</code>	Select port protocol VLAN identifier TLV
<code>port-vlanid</code>	Select port VLAN identifier TLV
<code>ptcl-identity</code>	Select protocol-identifier TLV
<code>vid-digest</code>	Select VLAN identifier digest TLV
<code>vlan-name</code>	Select VLAN name TLV
<code>link-agg</code>	Select link-aggregation TLV
<code>data-center-bridging</code>	Select data-center-bridging TLV

### Default Value

None

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)lldp-agent
(lldp-agent)#lldp tlv-select ieee-8021-org-specific port-vlanid
(lldp-agent)#exit
```

---

## lldp tlv-select ieee-8023-org-specific

Use this command to select the set of ieee-8023-org-specific TLV to be included in the LLDP frames.

Use the `no` parameter to disable the selected ieee-8023-org-specific TLV.

### Command Syntax

```
lldp tlv-select ieee-8023-org-specific {mac-phy| power-via-mdi| max-mtu-size|}  
no lldp tlv-select ieee-8023-org-specific {mac-phy| power-via-mdi| max-mtu-size|}
```

### Parameters

<code>mac-phy</code>	VLAN ID Of the provider edge port <2-4094>.
<code>power-via-mdi</code>	Power-via-MDI (only when PoE feature is available)
<code>max-mtu-size</code>	max-mtu-size TLV

### Default Value

None

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal  
(config)#interface eth0  
(config-if)lldp-agent  
(lldp-agent)#lldp tlv-select ieee-8023-org-specific mac-phy  
(lldp-agent)#exit
```

---

## set lldp system-description

Use this command to identify the string that describes the LLDP system.

Use no form of this command to unset the system description.

### Command Syntax

```
set lldp system-description LINE
unset lldp system-description
```

### Parameters

LINE	Set the description of the LLDP system.
------	---

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#set lldp system-description LLDP agent on B1
(config)#unset lldp system-description
```

---

## set lldp system-name

Use this command to identify the system name of the LLDP function.

### Command Syntax

```
set lldp system-name NAME
unset lldp system-name
```

### Parameters

NAME	Name of the LLDP system.
------	--------------------------

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#set lldp system-name LLDP1
(config)#unset lldp system-name
```



---

## set lldp tx-fast-init

Use this command to determine the maximum value of LLDP frames that are transmitted during a fast transmission period.

Use `no` form of this command to set fast transmission period to default value.

### Command Syntax

```
set lldp tx-fast-init <1-8>
no set lldp tx-fast-init
```

### Parameters

`tx-fast-init` Set the message transmit interval value <1-8>.

### Default Value

Default value is 4.

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#lldp-agent
(lldp-agent)#set lldp tx-fast-init 4
(lldp-agent)#no set lldp tx-fast-init
(lldp-agent)#exit
```

---

## set lldp tx-max-credit

Use this command to set the maximum value of transmission credit, which signifies the number of consecutive LLDP frames transmitted.

Use `no` form of this command to set the maximum value of transmission credit to default value.

### Command Syntax

```
set lldp tx-max-credit <1-10>
no set lldp tx-max-credit
```

### Parameters

`tx-max-credit` The maximum value of transmission credit.

### Default Value

Default value is 5

### Command Mode

LLDP Agent mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)lldp-agent
(lldp-agent)#set lldp tx-max-credit <1-10>
(lldp-agent)#no set lldp tx-max-credit
(lldp-agent)#exit
```

---

## show debugging lldp

Use this command to display LLDP debugging information.

### Command Syntax

```
show debugging lldp
```

### Parameters

None

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

The following sample output displays information about an LLDP debugging.

```
#show debugging lldp
LLDP debugging status:
  LLDP message debugging is on
```

## show lldp neighbors

Use this command to display LLDP neighbors information.

### Command Syntax

```
show lldp (nearest-bridge| non-tpmr-bridge| customer-bridge|) neighbors
(brief|details)
```

### Parameters

nearest-bridge	Display LLDP nearest bridge information
non-tpmr-bridge	Display LLDP non-TPMR-bridge information
customer-bridge	Display LLDP customer-bridge information
neighbor	Neighbor
brief	Brief
details	Details

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3 and changed in OcNOS version 1.3.1.

### Example

The following sample output displays information about an LLDP neighbors

```
#sh lldp nearest-bridgr neighbors brief
```

```
Loc PortID  Rem Host Name    Rem Chassis Id  Rem Port Id  Agent Mode
```

```
-----
xe3/1      OcNOS             ecf4.bbfe.2864  ecf4.bbb2.4c65 Nearest bridge
```

```
#show lldp neighbors detail
```

```
-----
Nearest bridge Neighbors
```

```
Interface Name      : ge4
```

```
Mandatory TLVs
```

```
Chassis id type      : MAC address [0c48.c6e1.e160]
```

```
Port id type         : MAC address [0c48.c660.8165]
```

```
Time to live         : 121
```

```
Basic Management TLVs
```

```
System Name         : R-7015
```

```
System Description   : Hardware Model:CEL_BELGITE_E1070, Software versio
```

```
n: OcNOS,6.3.2.47
```

```

Port Description           : ge4
Remote System Capabilities : Bridge
                           Router
  Capabilities Enabled     : Router
Management Address        : MAC Address [0c48.c660.8165]
  Interface Number subtype : ifindex
    Interface Number       : 10004
    OID Number             : 0
802.1 Org specific TLVs
  Port vlan id            : 0
  Port & Protocol vlan id : 0
  Remote Configured VLANs : None
  Remote Protocols Advertised: None
  Remote VID Usage Digest : 0
  Remote Management Vlan  : 0
  Link Aggregation Capability: not capable of being aggregated
  Link Aggregation Status  : not currently in aggregation
  Link Aggregation Port ID :
802.3 Org specific TLVs
  AutoNego Support        : Not-Supported
  AutoNego Status         : Disabled
  AutoNego Capability     : 0
  Operational MAU Type    : 0 [unknown]
  Max Frame Size          :
#

```

Table 11-26 Shows the output details.

**Table 11-25: show lldp neighbor output details**

Entry	Description
Loc Port ID	Local interface SNMP index (appears when the interface option is used).
Rem Host Name	Name of the remote host.
Rem Chassis Id	Remote chassis identifier of the chassis type listed.
Rem Port Id	Remote port identifier of the port type listed.
Agent Mode	Agent mode enabled to the nearest bridge.
Time to live	Number of seconds for which this information is valid.
Interface Name	Name of the interface.
Chassis id type	Chassis identifier of the chassis type listed.
Port id type	Type of port identifier supplied, such as Locally assigned.
System Name	Name supplied by the system on the interface.
System Description	Description supplied by the system on the interface.

**Table 11-25: show lldp neighbor output details**

Entry	Description
Port Description	The port description field uses the configured port description, the port name or the SNMP if Index (appears when the interface option is used).
Remote System Capabilities	Remote system capabilities (such as Bridge, Bridge Router, and Bridge Telephone) that are supported.
Capabilities Enabled	Enabled by the system on the interface (appears when the interface option is used).
Management Address	Details of management address (such as 10.204.35.34).
Interface Number subtype	Interfaces subtype for which neighbor information is available.
Interface Number	Interfaces for which neighbor information is available.
OID Number	Number of identifier.
Port VLAN ID	Details of the port VLAN identifier.
Protocol VLAN ID	Details of the protocol VLAN identifier.
Remote Configured VLANs	Details of the remote configured VLAN.
Remote Protocols Advertised	Details of the remote protocols.
Remote VID usage Digest	Details of the VID usage.
Remote Management VLAN	Details of the management VLAN.
Link Aggregation Capability	Capabilities that supported by the link aggregation on the interface.
Link Aggregation Status	Status of the link aggregation.
Link Aggregation Port ID	Details of the link aggregation port identifier.
Auto Nego Support	Support of the auto nego on the interface.
Auto Nego Status	Status of the auto nego.
Auto Nego Capability	Capabilities that supported by the auto nego on the interface.
Operational MAU Type	Type of operational MAU on the interface.
Max Frame Size	Maximum frame size on the transit.

---

## show lldp interface

Use this command to display LLDP interface information.

### Command Syntax

```
show lldp interface IFNAME (nearest-bridge| non-tpmr-bridge| customer-bridge | )
                             (neighbor| )
```

### Parameters

IFNAME	
	Display LLDP interface information for all agent
nearest-bridge	
	Display LLDP nearest bridge information
non-TPMR-bridge	
	Display LLDP non-TPMR-bridge information
customer-bridge	
	Display LLDP customer-bridge information
neighbor	
	Display LLDP neighbor details.

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show lldp interface eth0
Agent Mode : Customer-bridge
Enable (tx/rx): N/N
MED Enabled :N
Device Type: NOT_DEFINED
LLDP Agent traffic statistics:
Total frames transmitted: 0
Total entries aged: 0
Total frames recieved: 0
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): N/N
MED Enabled :N
Device Type: NOT_DEFINED
LLDP Agent traffic statistics:
Total frames transmitted: 0
```

```

Total entries aged: 0
Total frames recieved: 0
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 :N
Device Type: NOT_DEFINED
LLDP Agent traffic statistics:
Total frames transmitted: 2495
Total entries aged: 0
Total frames recieved: 0
Total frames received in error: 0
Total frames discarded: 0
Total discarded TLVs: 0
Total unrecognised TLVs: 0

```

Table 11-26 Shows the output details.

**Table 11-26: show lldp interface output details**

Entry	Description
Agent Mode	Agent mode enabled to the customer-bridge, Non-TPMR-bridge, and nearest bridge.
Enable (tx/rx)	Enables the transmit and receive on the interface.
Device Type	Type of device in the networks.
LLDP Agent traffic statistics	Statistics on exchanged LLDP frames between a device and neighbors.
Total frames transmitted	Number of frames transmitted in network.
Total entries aged	Number of aged entries in a networks.
Total frames received	Number of frames received from the neighbor network.
Total frames received in error	Number of frames not received from the neighbor network.
Total discarded TLVs	Number of TLVs discarded in transit.
Total unrecognised TLVs	Number of unrecognised TLVs in transit.



---

## snmp restart lldp

Use this command to restart SNMP in Link Layer Discovery Protocol (LLDP)

### Command Syntax

```
snmp restart lldp
```

### Parameters

None

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#snmp restart lldp
```

## CHAPTER 12 Port Security Commands

---

This chapter describes the port security commands.

- `port-security`
- `show port-security`
- `switchport port-security`
- `switchport port-security logging`
- `switchport port-security mac-address`
- `switchport port-security maximum`

---

## port-security

Use this command to enable or disable port security globally.

### Command Syntax

```
port-security (enable | disable)
```

### Parameters

enable	Enable port security globally
disable	Disable port security globally

### Default

By default, port security is enabled globally.

### Command Mode

Configure mode

### Applicability

This command was introduced in OcNOS-SP version 4.0.

### Examples

```
(config)#port-security enable  
(config)#
```

---

## show port-security

Use this command to display the port security configuration for all interfaces or for a particular interface.

### Command Syntax

```
show port-security (interface IFNAME |)
```

### Parameters

IFNAME	Interface name
--------	----------------

### Default

None

### Command Mode

Exec mode

### Applicability

This command was introduced in OcNOS-SP version 4.0.

### Examples

```
#show port-security
Port port-security mode MAC limit CVLAN SVLAN static secure MAC
-----
ge1  dynamic          3          2          0000.0000.1112
                                   10          0000.0000.3333
```

```
#show port-security interface ge1
Port Security Mode : Dynamic
Secure MAC limit : 3
Static Secure MAC list :
CVLAN SVLAN MAC Address
-----
2          0000.0000.1112
10         0000.0000.3333
```

---

## switchport port-security

Use this command to enable port security on an interface.

Use the `no` form of this command to disable port security on an interface. This command removes configured secured MAC, if any, on this interface.

**Note:** This command is supported for physical, LAG, and MLAG (active) interfaces only. Enabling port security on an interface removes learned MAC addresses of interfaces (whether learned by static or dynamic means), and then relearns the secure MAC addresses. Multicast MAC addresses are not considered as part of the MAC learning limit.

**Note:** This command is ignored when port security is already enabled on an interface.

### Command Syntax

```
switchport port-security (static |)
no switchport port-security
```

### Parameters

<code>static</code>	Static mode
---------------------	-------------

### Default

By default this feature is disabled; the default mode of port security is to dynamically learn. In dynamic mode, devices learn MAC addresses dynamically. You can program static MACs, however, dynamic MAC learning will not be allowed in static mode for port security.

### Command Mode

Interface mode

### Applicability

This command was introduced in OcNOS-SP version 4.0.

### Examples

```
#configure terminal
(config)#interface ge1
(config-if)#switchport
(config-if)#bridge-group 1
(config-if)#switchport mode hybrid
(config-if)#switchport hybrid allowed vlan all
(config-if)#switchport port-security
```

---

## switchport port-security logging

Use this command to enable violated MAC logging on a port security enabled interface.

Use the `disable` parameter with this command to disable violated mac logging on a port security enabled interface.

### Command Syntax

```
switchport port-security logging (enable | disable)
```

### Parameters

<code>enable</code>	Enable violated MAC logging
<code>disable</code>	Disable violated MAC logging

### Default

By default logging is disabled.

### Command Mode

Interface mode

### Applicability

This command was introduced in OcNOS-SP version 4.0.

### Examples

```
#configure terminal
(config)#interface ge1
(config-if)#switchport port-security logging enable
```

---

## switchport port-security mac-address

Use this command to add static secure MAC addresses.

Use the `no` form of this command to remove static secure MAC addresses.

### Command Syntax

```
switchport port-security mac-address XXXX.XXXX.XXXX
no switchport port-security mac-address XXXX.XXXX.XXXX
switchport port-security mac-address XXXX.XXXX.XXXX vlanId <2-4094>
no switchport port-security mac-address XXXX.XXXX.XXXX vlanId <2-4094>
switchport port-security mac-address XXXX.XXXX.XXXX svlanId <2-4094>
no switchport port-security mac-address XXXX.XXXX.XXXX svlanId <2-4094>
switchport port-security mac-address XXXX.XXXX.XXXX vlanId <2-4094> svlanId <2-4094>
no switchport port-security mac-address XXXX.XXXX.XXXX vlanId <2-4094> svlanId <2-4094>
```

### Parameters

XXXX.XXXX.XXXX	Static secure MAC address
vlanId	VLAN identifier
<2-4094>	VLAN identifier
svlanId	SVLAN identifier
<2-4094>	SVLAN identifier

### Default

N/A

### Command Mode

Interface mode

### Applicability

This command was introduced in OcNOS-SP version 4.0.

### Examples

```
#configure terminal
(config)#interface ge1
(config-if)#switchport port-security mac-address 0000.0000.1112 vlan 2
(config-if)# no switchport port-security mac-address 0000.0000.1112 vlan 2
(config)#interface ge2
(config-if)#switchport port-security mac-address 0000.1111.2222
(config-if)#no switchport port-security mac-address 0000.1111.2222
(config)#interface ge3
(config-if)#switchport port-security mac-address 0000.2222.3333 svlan 9
(config-if)#no switchport port-security mac-address 0000.2222.3333 svlan 9
(config)#interface ge4
```

```
(config-if)#switchport port-security mac-address 0000.2222.3333 vlan 23 svlan  
31  
(config-if)#no switchport port-security mac-address 0000.2222.3333 vlan 23  
svlan 31
```



---

## switchport port-security maximum

Use this command to set the MAC address learning limit for an interface.

**Note:** This command is supported for physical, LAG, and MLAG (active) interfaces only. When a newly configured maximum learn limit is less than the previous value, you must remove/flush-out the unwanted MACs to stop traffic forwarding from the unwanted source MAC addresses. MAC addresses can be removed using the [clear mac address-table](#) command.

Use `no` form cli to set the maximum limit back to default value 1.

### Command Syntax

```
switchport port-security maximum <1-1000>
no switchport port-security maximum
```

### Parameters

<1-1000>	Maximum MAC address learning limit
----------	------------------------------------

### Default

The default MAC address learning limit is 1.

### Command Mode

Interface mode

### Applicability

This command was introduced in OcNOS-SP version 4.0.

### Examples

```
#configure terminal
(config)#interface ge1
(config-if)#switchport port-security maximum 3
```

```
#configure terminal
(config)#interface po1
(config-if)#switchport port-security maximum 3
```

```
#configure terminal
(config)#interface mlag1
(config-if)#switchport port-security maximum 3
```

---

## CHAPTER 13 VLAN Cross-Connect Commands

---

This chapter contains VLAN cross-connect commands.

- `cross-connect`
- `disable`
- `outer-vlan VLAN_RANGE2 (inner-vlan VLAN_RANGE2 |)`
- `show cross-connect`

---

## cross-connect

Use this command to enter VLAN cross-connect mode to configure cross-connect parameters.

Use the `no` form of this command to delete a cross-connect.

### Command Syntax

```
cross-connect WORD
no cross-connect WORD
```

### Parameters

WORD	Cross-connect name, length <1-255>
------	------------------------------------

### Command Mode

Configure mode

### Applicability

This command was introduced in OcNOS version 1.3.6.

### Examples

```
#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
(config)#cross-connect VC1
(config-XC)#
```

```
#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
(config)#no cross-connect VC1
(config)#
```

## disable

Use this command to make a cross-connect administratively disabled or enabled.

### Command Syntax

```
disable
no disable
```

### Parameters

None

### Command Mode

Cross-connect mode

### Applicability

This command was introduced in OcNOS version 1.3.6.

### Examples

```
OcNOS#sh cross-connect
Cross-connect name : VC1
EP1:ce24/1      EP2:ce31/1      Admin Status:UP      Oper Status:UP
+=====+
| EP      | OVID    | IVID    | Rx packets | Rx bytes  | Tx packets | Tx bytes |
|Interface Status|
+=====+
| EP1      | 100     | -       | 0          | 0         | 0         | 0        |
|UP        |         |         |            |           |           |          |
| EP2      | 100     | -       | 0          | 0         | 0         | 0        |
|UP        |         |         |            |           |           |          |
+=====+

cross-connect summary
Total XC      : 1
Admin Up      : 1
Admin Down    : 0
Total Rules   : 1
OcNOS#conf t
Enter configuration commands, one per line. End with CNTL/Z.
OcNOS(config)#cross-connect VC1
OcNOS(config-XC)#disable
2021 Mar 22 07:35:30.083 : OcNOS : NSM : CRITI : [VXC_DOWN_2]: Cross_Connect VC1 changed
state to down
OcNOS(config-XC)#end
OcNOS#sh cross-connect
ross-connect name : VC1
EP1:ce24/1      EP2:ce31/1      Admin Status:DOWN      Oper Status:DOWN
```

```

=====
=====+
| EP      | OVID    | IVID    | Rx packets | Rx bytes  | Tx packets | Tx bytes
|Interface Status|
=====+
| EP1     | -       | -       | 0          | 0         | 0         | 0
|UP       |         |         |
| EP2     | -       | -       | 0          | 0         | 0         | 0
|UP       |         |         |
=====
=====+

```

cross-connect summary

```

Total XC      : 1
Admin Up      : 0
Admin Down    : 1
Total Rules   : 0

```

OcNOS#conf t

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

OcNOS(config)#cross-connect VC1

OcNOS(config-XC)#no disable

OcNOS(config-XC)#2021 Mar 22 07:35:46.814 : OcNOS : NSM : CRITI : [VXC\_UP\_2]:

Cross\_Connect VC1 changed state to up

OcNOS#sh cross-connect

Cross-connect name : VC1

EP1:ce24/1 EP2:ce31/1 Admin Status:UP Oper Status:UP

```

=====
=====+
| EP      | OVID    | IVID    | Rx packets | Rx bytes  | Tx packets | Tx bytes
|Interface Status|
=====+
| EP1*    | -       | -       | 47836      | 47836000  | 0          | 0
|UP       |         |         |
| EP2*    | -       | -       | 0          | 0         | 48149      | 48149000
|UP       |         |         |
=====
=====+

```

cross-connect summary

```

Total XC      : 1
Admin Up      : 1
Admin Down    : 0
Total Rules   : 1

```

---

## outer-vlan VLAN\_RANGE2 (inner-vlan VLAN\_RANGE2 |)

Use this command to configure parameters for VLAN cross-connect.

### Command Syntax

```
outer-vlan VLAN_ID inner-vlan VLAN_ID ep1 IFNAME ep2 IFNAME
```

### Parameters

outer-vlan	Outer-VLAN associated with the cross-connect
VLAN ID	VLAN ID <2 - 4094>
inner-vlan	Inner-VLAN associated with the cross-connect
VLAN ID	VLAN ID <2 - 4094>
ep1	Interface for cross-connect endpoint 1
IFNAME	Interface name for endpoint 1
ep2	Interface for cross-connect endpoint 2
IFNAME	Interface name for endpoint 2

### Command Mode

Cross-connect mode

### Applicability

This command was introduced in OcNOS version 1.3.6.

### Examples

```
#conf t
```

Enter configuration commands, one per line. End with CNTL/Z. (config)#cross-connect VC1

```
(config-XC)#vlan ep1 ce25/1 ep2 ce16/1
```

```
(config-VXC)#outer-vlan 10 inner-vlan 20
```

```
(config-VXC)#
```

## show cross-connect

Use this command to display the VLAN cross-connect configuration.

### Command Syntax

```
show cross-connect
```

### Parameters

None

### Command Mode

Configure mode

### Applicability

This command was introduced in OcNOS version 1.3.6.

### Examples

```
OcNOS#sh cross-connect
```

```
Cross-connect name : VC1
```

```
EP1:ce25/1      EP2:ce16/1      Admin Status:UP      Oper Status:UP
```

=====+						
=====+						
EP	OVID	IVID	Rx packets	Rx bytes	Tx packets	Tx bytes
Interface Status						
+=====+						
EP1	100	-	0	0	0	0
UP						
EP2	100	-	0	0	0	0
UP						
+=====+						
=====+						

```
cross-connect summary
```

```
Total XC      : 1
```

```
Admin Up      : 1
```

```
Admin Down    : 0
```

```
Total Rules   : 1
```

## CHAPTER 14 Unidirectional Link Detection Commands

---

This section describes the Unidirectional Link Detection (UDLD) commands.

- [udld](#)
- [udld message-time](#)
- [udld mode](#)
- [udld state](#)
- [show udld](#)
- [show udld interface](#)



---

## udld

Use this command to enable or disable the UDLD feature globally.

### Command Syntax

```
udld (enable | disable)
```

### Parameters

None

### Default

Disabled

### Command Mode

Configure mode

### Applicability

This command was introduced in OcNOS Version 5.0

### Examples

```
(config)#udld enable
```

---

## udld message-time

Use this command to set the UDLD message interval.

### Command Syntax

```
udld message-time <7-90>
```

### Parameters

<7-90>	Interval time in seconds
--------	--------------------------

### Default

15 seconds

### Command Mode

Configure mode

### Applicability

This command was introduced in OcNOS Version 5.0.

### Examples

```
config)#udld message-time 50
```

---

## udld mode

Use this command to configure UDLD mode as aggressive or normal.

### Command Syntax

```
udld mode (aggressive | normal)
```

### Parameters

aggressive	Aggressive mode
normal	Normal mode

### Default

N/A

### Command Mode

Interface mode

### Applicability

This command was introduced in OcNOS Version 5.0.

### Examples

```
(config-if)#udld mode aggressive
```

---

## udld state

Use this command to enable or disable the UDLD feature for an interface.

### Command Syntax

```
udld state (enable | disable)
```

### Parameters

None

### Default

Disabled

### Command Mode

Interface mode

### Applicability

This command was introduced in OcNOS Version 5.0.

### Examples

```
(config)#int xe7  
(config-if)#udld state enable
```

---

## show udld

Use this command to display UDLD statistic for all interface.

### Command Syntax

```
show udld
```

### Parameters

None

### Command Mode

Exec mode

### Applicability

This command was introduced in OcNOS-SP version 5.0.

### Examples

```
#show udld
UDLD                : Enable
Message Interval(sec) : 15
Port    UDLD Status  Mode                Link-Status
-----
xe7      Enable       Normal                Bi-Directional
```

[Table 14-27](#) explains the output fields.

**Table 14-27: show udld output fields**

Field	Description
UDLD	Whether UDLD is enabled or disabled
Message Interval	Message interval in seconds
Port	Interface name
UDLD Status	Whether UDLD is enabled or disabled on the interface
Mode	Whether the mode is aggressive or normal
Link-Status	State of the link: Unknown Loop-Back Neighbor Mismatch Unidirectional Undetermined Bi-Directional

---

## show udld interface

Use this command to display UDLD settings for particular interface.

### Command Syntax

```
show udld interface IFNAME
```

### Parameters

None

### Command Mode

Exec mode

### Applicability

This command was introduced in OcNOS-SP version 5.0.

### Examples

```
#show udld interface xe14
UDLD Status           : Enable
UDLD Mode              : Aggressive
Link-State             : Bi-Directional
#
```

[Table 14-28](#) explains the output fields.

**Table 14-28: show udld interface output fields**

Field	Description
UDLD Status	Whether UDLD is enabled or disabled
UDLD Mode	Whether the mode is aggressive or normal
Link-State	State of the link: Unknown Loop-Back Neighbor Mismatch Unidirectional Undetermined Bi-Directional

## CHAPTER 15 Layer 2 Control Protocols Tunneling Commands

---

This chapter is a reference for the Layer 2 Control Protocols (L2CP) tunneling commands:

- [clear l2protocol interface counters](#)
- [l2protocol](#)
- [l2protocol encapsulation dest-mac](#)
- [show l2protocol interface counters](#)
- [show l2protocol processing interface](#)

---

## clear l2protocol interface counters

This command allows you to clear the counters for numbers of packets peered, discarded and tunneled.

### Command Syntax

```
clear l2protocol interface (IFNAME|) counters (peer|discard|tunnel|tunnel-discard|)
```

### Parameters

peer	Clear stats for Peer protocol packets.
discard	Clear stats for Tunnel protocol packets.
tunnel	Clear stats for Tunnel protocol packets.
tunnel-discard	Clear stats for Tunnel discard protocol packets.

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS-SP version 1.0.

### Examples

```
# clear l2protocol interface xel counters peer
```



---

## l2protocol

This command allows you to change the process of protocol to peer/discard/tunnel.

### Command Syntax

```
l2protocol (stp|lacp|efm|elmi|lldp|synce) (peer|discard|tunnel)
```

### Parameters

stp	Spanning Tree Protocols.
lacp	Link Aggregation (LACP).
efm	Ethernet first mile (Link OAM).
elmi	Ethernet local management interface.
lldp	Link layer discovery protocol.
synce	Link layer discovery protocol.
peer	Act as peer to the customer Device instance of the protocol.
discard	Discard the protocol data unit.
tunnel	Tunnel the Protocol data unit into the SVLAN.

### Default

Default process value is peer.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS-SP version 1.0.

### Examples

```
#configure terminal
(config)#interface xe1
(config-if)#switchport
(config-if)#bridge-group 1
(config-if)#switchport mode customer-edge access
(config-if)#l2protocol stp tunnel
(config-if)#l2protocol stp peer
(config-if)#l2protocol stp discard
```

## I2protocol encapsulation dest-mac

Use this command to change destination mac of tunneled I2 protocol packet. Allowed mac are 0100.C2CD.CDD0 or 0104.DFCD.CDD0.

Use the `no` parameter with this command to set default mac 0100.C2CD.CDD0.

Note: This command only applies to provider bridging. For more information, see [Chapter 26, Provider Bridging Configuration](#).

### Command Syntax

```
bridge <1-32> l2protocol encapsulation dest-mac XXXX.XXXX.XXXX
no bridge <1-32> l2protocol encapsulation dest-mac
```

### Parameters

bridge	Bridge group for bridging.
<1-32>	<1-32>
l2protocol	Configure Layer2 Protocol Tunneling.
encapsulation	Encapsulation of L2PT packet.
dest-mac	Encapsulation with destination mac.
XXXX.XXXX.XXXX	Destination Mac-address of L2PT tunneling (0100.C2CD.CDD0 or 0104.DFCD.CDD0).

### Command Mode

Configuration mode

### Applicability

This command is introduced in OcNOS-SP version 1.0.

### Examples

```
(config)#bridge 1 l2protocol encapsulation dest-mac ?
XXXX.XXXX.XXXX Destination Mac-address of L2PT tunneling (0100.C2CD.CDD0 or
0104.DFCD.CDD0)
(config)#bridge 1 l2protocol encapsulation dest-mac 0104.DFCD.CDD1
L2PT destination mac should be 0100.C2CD.CDD0 or 0104.DFCD.CDD0
(config)#bridge 1 l2protocol encapsulation dest-mac 0104.DFCD.CDD0
(config)#bridge 1 l2protocol encapsulation dest-mac 0100.C2CD.CDD0
(config)#bridge 1 l2protocol encapsulation dest-mac 0100.C2CD.CDD1
L2PT destination mac should be 0100.C2CD.CDD0 or 0104.DFCD.CDD0
(config)#

(config)#no bridge 1 l2protocol encapsulation dest-mac
(config)#show running-config | in bridge
bridge 1 protocol provider-rstp edge
vlan 2-10 type customer bridge 1 state enable
vlan 11-12 type service point-point bridge 1 state enable
cvlan registration table map1 bridge 1
bridge-group 1
bridge-group 1
(config)#
```

---

## show l2protocol interface counters

This command allows you to display the counters for numbers of packets peered, discarded and tunneled.

Note: In case of Provider-Bridging, tunneling will be done via slow path forwarding (via CPU).

And for other tunneling feature such as EVPN cases, L2protocol will follow hardware forwarding path to be tunneled.

Except Provider-Bridging feature, for other tunneling feature such as EVPN cases, tunnel counters will not be captured. Peering and discarding decision will be taken at CPU, hence, these counters will be captured with this show command.

### Command Syntax

```
show l2protocol interface (IFNAME|) counters (peer|discard|tunnel|tunnel-discard|)
```

### Parameters

peer	Display stats for Peer protocol packets.
discard	Display stats for Tunnel protocol packets.
tunnel	Display stats for Tunnel protocol packets.
tunnel-discard	Display stats for Tunnel discard protocol packets.

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS-SP version 1.0.

### Examples

```
# show l2protocol interface xel counters peer
Interface xel
Peer:      stp:      1

# show l2protocol interface xel counters
Interface xel
Peer:      stp:      1
Discard:   stp:      10
Tunnel:    stp:      5
```

---

## show l2protocol processing interface

This command allows you to display the processing information on Layer 2 protocol interface.

### Command Syntax

```
show l2protocol processing interface IFNAME
```

### Parameters

IFNAME	Interface name
--------	----------------

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command is introduced was before OcNOS-SP version 1.0.

### Examples

```
#show l2protocol processing interface xe1/1
```

Bridge	Interface Name	Protocol	Processing Status
=====	=====	=====	=====
1	xe1/1	stp	Tunnel
1	xe1/1	gmrp	Peer
1	xe1/1	gvrp	Peer
1	xe1/1	mmrp	Peer
1	xe1/1	mvrp	Peer
1	xe1/1	lacp	Peer
1	xe1/1	lldp	Peer
1	xe1/1	efm	Peer
1	xe1/1	elmi	Peer
1	xe1/1	ptp	Peer
1	xe1/1	synce	Peer

---

## CHAPTER 16 Provider Bridging Commands

---

This chapter describes the Provider Bridging (PB) commands.

IEEE 802.1ad standardizes the architecture and bridged protocols to allow Ethernet frames with multiple VLAN tags. Packets through a provider network are doubly tagged with both an:

- Inner (C-VLAN) tag which is the customer network VLAN identifier
- Outer (S-VLAN) tag which is the service provider network VLAN identifier
  - `bridge protocol provider-mstp`
  - `bridge protocol provider-rstp`
  - `cvlan registration table`
  - `cvlan svlan`
  - `dotad`
  - `show cvlan registration table`
  - `switchport customer-edge`
  - `switchport customer-edge hybrid`
  - `switchport customer-edge trunk`
  - `switchport customer-edge vlan registration`
  - `switchport customer-network allowed vlan`
  - `switchport customer-network vlan`
  - `switchport mode`
  - `switchport mode customer-edge`
  - `switchport mode customer-edge hybrid acceptable-frame-type`
  - `switchport provider-network`
  - `switchport provider-network isolated-vlan`
  - `vlan type`
  - `vlan type customer`

---

## bridge protocol provider-mstp

Use this command to create a provider multiple spanning-tree protocol (MSTP) bridge. MSTP bridges can have different spanning-tree topologies for different VLANs inside a region of similar MSTP bridges.

Using this command creates an instance of the spanning tree, and associates the VLANs specified with that instance. A bridge created by this command forms its own separate region.

The multiple spanning tree protocol, like the rapid spanning tree protocol, provides rapid reconfiguration features, while providing load-balancing capability.

### Command Syntax

```
bridge <1-32> protocol provider-mstp (edge|)
```

### Parameters

<1-32>	Bridge identifier.
edge	Configure as an edge bridge.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#bridge 2 protocol provider-mstp edge
```

---

## bridge protocol provider-rstp

Use this command to add an IEEE 802.1D-2004 Rapid Spanning Tree Protocol (RSTP) bridge.

After creating a bridge instance, add interfaces to the bridge using the `bridge-group` command. Bring the bridge instance into operation with the `no shutdown` command in interface mode.

### Command Syntax

```
bridge <1-32> protocol provider-rstp (edge|)
```

### Parameters

<code>&lt;1-32&gt;</code>	Bridge identifier.
<code>edge</code>	Configure as an edge bridge.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#bridge 2 protocol provider-rstp edge
```

---

## cvlan registration table

Use this command to create a customer VLAN (CVLAN) registration table that maps between CVLANs and service provider VLANs (SVLANs).

Use the `no` parameter with this command to delete the CVLAN registration table.

### Command Syntax

```
cvlan registration table WORD bridge <1-32>
no cvlan registration table WORD bridge <1-32>
```

### Parameters

WORD	Name of the CVLAN registration table.
<1-32>	Specify a bridge ID.

### Command Mode

Configure mode

### Applicability

This command was introduced before OcnOS version 1.3.

### Example

```
#configure terminal
(config)#cvlan registration table customer1
(config-cvlan-registration)#
```



## cvlan svlan

Use this command to map one or more customer VLANs (CVLANs) to a service provider VLAN (SVLAN).

To update the optional QoS parameters `cos-to-queue` and `remark-cos`, execute the complete command along with the optional parameters. To remove these options, execute the same command by removing the optional parameters.

Refer `qos profile` commands from configuration guide for more details about qos profiles.

Use the `no` forms of this command to delete a mapping.

### Command Syntax

```
cvlan VLAN_RANGE2 (cvlan VLAN_ID|) svlan VLAN_ID ({untagged-pep|untagged-
  cep}|) ({cos-to-queue NAME | remark-cos}|)
no cvlan VLAN_RANGE2 svlan VLAN_ID
```

### Parameters

<code>cvlan</code>	CVLAN
<code>VLAN_RANGE2</code>	VLAN identifier <1-4094> or range such as 2-5,10 or 2-5,7-19
<code>cvlan</code>	Translation of CVID
<code>VLAN_ID</code>	Translated CVID <1-4095>
<code>svlan</code>	SVLAN corresponding to the C-VLAN
<code>VLAN_ID</code>	VLAN identifier 1-4094>
<code>untagged-pep</code>	Provider edge port is untagged for this CVLAN
<code>untagged-cep</code>	Customer edge port is untagged for this CVLAN
<code>cos-to-queue</code>	
	Configure cos-to-queue map for cvlan
<code>NAME</code>	Ingress profile to modify queue/color on basis of c-cos
<code>remark-cos</code>	Remark Egress COS

### Command Mode

CVLAN Registration mode

### Applicability

This command was introduced before OcNOS version 1.3 and updated in OcNOS-SP version 1.0.

### Example

```
#configure terminal
(config)#cvlan registration table customer1 bridge 1
(config-cvlan-registration)#cvlan 2 svlan 3
(config-cvlan-registration)#cvlan 3 svlan 3 cos-to-queue c1 remark-cos
(config-cvlan-registration)#cvlan 100 cvlan 101 svlan 200 cos-to-queue p1
remark-cos
(config-cvlan-registration)#cvlan 3 svlan 3 remark-cos
(config-cvlan-registration)#cvlan 4 svlan 5 untagged-pep
(config-cvlan-registration)#cvlan 5 svlan 6 untagged-cep
(config-cvlan-registration)#no cvlan 3 svlan 3
```

```
(config-cvlan-registration)#cvlan 23 svlan 31 untagged-pep untagged-cep cos-  
to-queue p1 remark-cos  
(config-cvlan-registration)#cvlan 15-16 svlan 18 untagged-cep remark-cos
```

---

## dotad

This command allows you to change the TPID for a port.

Use the no form of this command to unset the TPID to default value.

### Command Syntax

```
dotad ethertype ETHERTYPE
no dotad ethertype
```

### Parameters

dotad	Set the switching characteristics of the Layer2 dot1q header.
ETHERTYPE	Ethertype value for outer tag (Allowed ethertype values are 0x8100 (default) or 0x88a8 or 0x9100 or 0x9200)

### Default

The default TPID value is 8100.

### Command Mode

Interface Mode

### Applicability

This command was introduced before OcNOS-SP version 1.0.

### Examples

```
#configure terminal
(config)#interface xe1
(config-if)# dotad ethertype 0x88a8
(config-if)# no dotad ethertype
```

## show cvlan registration table

Use this command to display the CVLAN registration table.

### Command Syntax

```
show cvlan registration table (WORD|bridge <1-32>|WORD bridge <1-32>|)
```

### Parameters

WORD	CVLAN registration table name.
<1-32>	Bridge identifier

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#sh cvlan registration table bridge 1
Bridge          Table Name      Port List
=====
1              map              xe17

CVLAN ID      T-CVLAN ID  SVLAN ID  Profile Name  Egress remark-Cos
=====
100           101         200       p1            Yes
```

Table 16-29 explains the output fields.

Table 16-29: show cvlan registration table output

Entry	Description
Bridge	ID number of the bridge associated with the Customer VLAN (CVLAN).
Table Name	ID of the CVLAN registration table.
Port List	List of ports used by this CVLAN (including Link aggregators).
CVLAN ID	ID number of the CVLAN.
T-CVLAN ID	Translation CVLAN ID.
SVLAN ID	ID number of the Service VLAN (SVLAN) associated with the CVLAN.
Profile Name	cos-to-queue profile name.
Egress remark-Cos	Remark Egress Cos

---

## switchport customer-edge

Use this command to set the switching characteristics of the layer 2 interface and the default customer VLAN.

Use the `no` form of this command to remove a customer VLAN.

### Command Syntax

```
switchport customer-edge (access|hybrid) vlan <2-4094>
no switchport customer-edge (access|hybrid) vlan
```

### Parameters

<code>access</code>	Set the layer 2 interface as access.
<code>hybrid</code>	Set the layer 2 interface as hybrid.
<code>&lt;2-4094&gt;</code>	Set the default VID for the interface.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth0
(config-if)#switchport customer-edge access vlan 3

(config)#interface eth0
(config-if)#no switchport customer-edge access vlan
```

---

## switchport customer-edge hybrid

Use this command to set the switching characteristics of the Layer 2 customer-facing interface to hybrid. Both tagged and untagged frames will be classified over hybrid interfaces.

### Command Syntax

```
switchport customer-edge hybrid allowed vlan add VLAN_ID
switchport customer-edge hybrid allowed vlan remove VLAN_ID
switchport customer-edge hybrid allowed vlan all
switchport customer-edge hybrid allowed vlan none
```

### Parameters

add	Add a VLAN to transmit and receive through the Layer 2 interface.
VLAN_ID	ID of the VLAN <2-4094>.
remove	Remove a VLAN from the member set.
VLAN_ID	ID of the VLAN <2-4094>.
all	Allow all VLANs to transmit and receive through the Layer 2 interface.
none	Allow no VLANs to transmit and receive through the Layer 2 interface.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#interface eth0
(config-if)#switchport customer-edge hybrid allowed vlan add 2
```

---

## switchport customer-edge trunk

Use this command to set the Layer2 interface as trunk.

### Command Syntax

```
switchport customer-edge trunk allowed vlan add VLAN_ID
switchport customer-edge trunk allowed vlan remove VLAN_ID
switchport customer-edge trunk allowed vlan all
switchport customer-edge trunk allowed vlan none
```

### Parameters

add	Add a VLAN to the member set.
VLAN_ID	Specify a VLAN ID <2-4094>
remove	Remove a VLAN from the member set.
all	Allow all VLANs to transmit and receive through the Layer 2 interface.
none	Allow no VLANs to transmit and receive through the Layer 2 interface.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#switchport customer-edge trunk allowed vlan add 12
```

---

## switchport customer-edge vlan registration

Use this command to configure the VLAN registration parameters.

Use the `no` parameter with this command to delete the mapping from the interface.

### Command Syntax

```
switchport customer-edge vlan registration WORD
no switchport customer-edge vlan registration
```

### Parameters

WORD	Name of the CVLAN registration table.
------	---------------------------------------

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth1
(config-if)#switchport customer-edge vlan registration customer1
```



---

## switchport customer-network allowed vlan

Use this command to add SVLAN IDs to the Customer Network Port.

### Command Syntax

```
switchport customer-network allowed vlan add VLAN_RANGE
```

### Parameters

VLAN\_RANGE      VLAN identifier <1-4094> or range such as 2-5,10 or 2-5,7-19.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 6.2.0.

### Examples

In this example, the xe1 interface allows S-TAG 100-200 and 400 traffic from customer.

```
(config)#interface xe1
(config-if)#switchport
(config-if)#dot1ad ethertype 0x88a8
(config-if)#bridge-group 1
(config-if)#switchport mode customer-network
      (config-if)#switchport customer-network allowed vlan add 100-200,400
```

---

## switchport customer-network vlan

Use this command to set the default SVLAN ID for the Customer Network Port.

### Command Syntax

```
switchport customer-network vlan <2-4094>
no switchport customer-network vlan
```

### Parameters

<2-4094>                Set the default VLAN ID for the interface.

### Default

Default Customer Network VLAN is 1.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 6.2.0

### Examples

In this example, the xe1 interface allows C-TAG/untagged traffic from customers, adding SVLAN ID 100 before forwarding to the provider network. While egressing out, the SVLAN ID 100 will be stripped out.

```
(config)#interface xe1
(config-if)#switchport
(config-if)#dot1ad ethertype 0x88a8
(config-if)#bridge-group 1
(config-if)#switchport mode customer-network
(config-if)#switchport customer-network allowed vlan add 100
(config-if)#switchport customer-network vlan 100
```

---

## switchport mode

Use this command to set the switching characteristics of the Layer 2 interface.

### Command Syntax

```
switchport mode (provider-network|customer-edge|customer-network)
```

### Parameters

provider-network Provider network.  
customer-edge Customer edge.  
customer-network Customer network.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal  
(config)#interface eth0  
(config-if)#switchport mode provider-network
```

---

## switchport mode customer-edge

Use this command to set the switching characteristics of the Layer 2 customer facing interface and classify only untagged frames. Received frames are classified based on the VLAN characteristics, then accepted or discarded based on the specified filtering criteria.

### Command Syntax

```
switchport mode customer-edge (access|hybrid|trunk)
switchport mode customer-edge (access|hybrid|trunk)
```

### Parameters

access	Set the layer 2 interface as access.
hybrid	Set the layer 2 interface as hybrid.
trunk	Set the layer 2 interface as trunk.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#switchport mode customer-edge access
```

---

## switchport mode customer-edge hybrid acceptable-frame-type

Use this command to set the layer 2 interface acceptable frames types. This processing occurs after VLAN classification.

### Command Syntax

```
switchport mode customer-edge hybrid acceptable-frame-type (all|vlan-tagged)
```

### Parameters

all	Set all frames can be received.
vlan-tagged	Set only VLAN-tagged frames can be received.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth0
(config-if)#switchport mode customer-edge hybrid acceptable-frame-type vlan-tagged
```

---

## switchport provider-network

Use this command to set the switching characteristics of the provider-network interface.

### Command Syntax

```
switchport provider-network allowed vlan add VLAN_RANGE2
switchport provider-network allowed vlan remove VLAN_RANGE2
switchport provider-network allowed vlan except VLAN_RANGE2
switchport provider-network allowed vlan all
switchport provider-network allowed vlan none
```

### Parameters

add	Add a VLAN to transmit and receive through the Layer 2 interface.
VLAN_RANGE2	VLAN ID 1-4094 or range(s): 2-5 10 or 2-5 7-20.
remove	Remove a VLAN from the member set.
VLAN_RANGE2	VLAN ID 1-4094 or range(s): 2-5 10 or 2-5 7-20.
Except	All VLANs except these VLANs are part of the member set.
VLAN_RANGE2	VLAN ID 1-4094 or range(s): 2-5 10 or 2-5 7-20.
all	Allow all VLANs to transmit and receive through the Layer 2 interface.
none	Allow no VLANs to transmit and receive through the Layer 2 interface.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)#interface eth0
(config-if)#switchport provider-network allowed vlan add 2
```

---

## switchport provider-network isolated-vlan

Use this command to attach a VLAN as an isolated VLAN for a provider network port.

Using an isolated VLAN for PNP ports on a switch can forward all frames received from the PNP port to all other PNP ports. However, if VLANs are configured to be isolated, they can traverse PNP port without sharing any of their frames.

Use the `no` form of this command to remove an isolated VLAN for a provider network port.

### Command Syntax

```
switchport provider-network isolated-vlan VLAN_RANGE
no switchport provider-network isolated-vlan VLAN_RANGE
```

### Parameters

VLAN_RANGE	VLAN identifier <2-4094> or range such as 2-5,10 or 2-5,7-19
------------	--

### Command Mode

Interface mode

### Applicability

This command was introduced in OcNOS-SP version 1.0.

### Example

```
#configure terminal
(config)#bridge 1 protocol provider-rstp
(config)#vlan database
(config-vlan)#vlan 2-10 type service point-point bridge 1 state enable
(config-vlan)#exit
(config)#interface xe0
(config-if)#switchport
(config-if)#bridge-group 1
(config-if)#switchport provider-network allowed vlan all
(config-if)#switchport provider-network isolated-vlan 2-10
```

## switchport provider-network vlan translation

Use this command to add a translation table entry for CVLAN and SVLAN on a provider network port.

Use the `no` form of this command to delete a translation table entry for CVLAN and SVLAN on a provider network port.

### Command Syntax

```
switchport provider-network vlan translation (cvlan <2-4094>| ) svlan <2-4094>
      (cvlan <2-4094> | ) svlan <2-4094>

no switchport (provider-network) vlan translation svlan VLAN_ID svlan VLAN_ID

no switchport (provider-network) vlan translation cvlan <1-4095> svlan <1-4095>
```

### Parameters

cvlan	CVLAN to translate
<2-4094>	CVLAN identifier to translate
svlan	SVLAN to translate
<2-4094>	SVLAN identifier to translate
cvlan	Translated CVLAN
<2-4094>	Translated CVLAN identifier
svlan	Translated SVLAN
<2-4094>	Translated SVLAN identifier
scos	Class of Service in the Priority Code Point (PCP) field of the service provider tag (STAG)
<0-7>	Class-of-service value
scfi	Canonical Format Indicator in the Drop Eligible Indicator (DEI) field of the STAG
<0-1>	Canonical Format Indicator value
ccos	Class of Service in the PCP field of the customer tag (CTAG)
<0-7>	Class-of-service value
ccfi	Canonical Format Indicator in the DEI field of the CTAG
<0-1>	Canonical Format Indicator value

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth1
(config-if)#switchport
(config-if)#bridge-group 1
(config-if)#switchport mode provider-network
(config-if)#switchport provider-network allowed vlan all
```



```
(config-if)#switchport provider-network vlan translation cvlan 2 svlan 3 cvlan  
4 svlan 5
```

---

## vlan type

This command allows you to create a single/range of VLAN's on provide/edge bridge.

Use the no form of this command to delete the VLAN.

### Command Syntax

```
vlan VLAN_RANGE type customer bridge <1-32>
vlan VLAN_RANGE type customer bridge <1-32> name WORD
vlan VLAN_RANGE type customer bridge <1-32> state (enable | disable)
vlan VLAN_RANGE type service point-point bridge <1-32>
vlan VLAN_RANGE type service point-point bridge <1-32> name WORD
vlan VLAN_RANGE type service point-point bridge <1-32> state (enable | disable)

no vlan VLAN_RANGE type customer bridge <1-32>
no vlan VLAN_RANGE type service bridge <1-32>
```

### Parameters

VLAN_RANGE	VLAN identifier <2-4094> or range such as 2-5,10 or 2-5,7-19
customer	Identifies the Customer VLAN
bridge	Specify the bridge group ID in the range <1-32>.
name	The ASCII name of the VLAN. Maximum length allowed is 16 characters.
point-point	Sets the VLAN connectivity mode to point-to-point
WORD	ASCII name of the VLAN.
state	Indicates the operational state of the VLAN.
enable	Sets VLAN into an enable state.
disable	Sets VLAN into a disable state.

### Command Mode

Configuration Mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
(config)vlan 2,4,5-6 customer bridge 2
(config)vlan 10-12 service type point-point bridge 3
```

---

## vlan type customer

Use this command to configure VLANs of type customer, to enable or disable the state of the VLANs, and to configure the name for VLANs.

Use the `no` form of this command to remove the VLAN type.

### Command Syntax

```
vlan <2-4094> type customer bridge <1-32>
vlan <2-4094> type customer bridge <1-32> state (enable|disable)
vlan <2-4094> type customer bridge <1-32> name WORD
no vlan <2-4094> type customer bridge <1-32>
```

### Parameters

<2-4094>	The VID of the VLAN that will be enabled or disabled on the bridge <2-4094>.
type	Identifies the VLAN as a customer, service, or VLAN.
customer	Identifies the Customer VLAN
bridge	Indicates a Service VLAN <1-32>.
name	The ASCII name of the VLAN. Maximum length allowed is 16 characters.
state	Indicates the operational state of the VLAN.
enable	Sets VLAN into an enable state.
disable	Sets VLAN into a disable state.
WORD	ASCII name of the VLAN.

### Command Mode

VLAN Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#vlan database
(config-vlan)#vlan 12 type customer bridge 1 name new state enable
```

## CHAPTER 17 Traffic Mirroring Commands

This chapter provides a description of syntax, and examples for Traffic Mirroring. It includes the following commands:

- `monitor session`
- `monitor session shut`
- `source interface`
- `source vlan`
- `destination interface`
- `no shut`
- `shut`
- `filter`
- `description`
- `remote destination`
- `show monitor`
- `show monitor session`
- `show filter`
- `show monitor running configuration`

---

## monitor session

Use this command to create a local or remote monitor session. By default, a local monitor session is created.

A monitor session consists of:

- A single destination interface, referred to as a mirror-to port or a single remote destination
- One or more source interfaces (egress, ingress, or both)
- One or more VLAN sources in the ingress direction
- One or more filters that can be applied to filter the mirrored packets

Use the `no` parameter to delete a monitor session.

### Command Syntax

```
monitor session <1-18> ( | type ( local | remote ) )
no monitor session ( <1-18> | all )
```

### Parameters

<code>&lt;1-18&gt;</code>	Session number
<code>local</code>	Create a local session
<code>remote</code>	Create a remote source node session
<code>all</code>	All sessions

### Default

By default, monitor session type is local and will not be active by default

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#monitor session 1
(config-monitor)#exit
(config)#monitor session 3 type remote
(config-monitor)#exit
(config)#no monitor session 1
```

---

## monitor session shut

Use this command to deactivate one monitor session.

Use the `no` parameter to activate one monitor session.

### Command Syntax

```
monitor session <1-18> shut
no monitor session <1-18> shut
```

### Parameters

<1-18>	Session number
--------	----------------

### Default

Monitor session will not be active by default

### Command Mode

Configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#monitor session 3 shut
(config)#no monitor session 3 shut
```

---

## source interface

Use this command to configure a source port per monitor session in either ingress or egress or both directions. Source port can be physical interface or a trunk port.

Use the `no` parameter to remove the source port.

`no` parameter to remove the source port.

**Note:** The behavior is changed when the configuration is edited in the current release: For example, if you have configured as follows

```
source interface xe10 rx → running-config: source interface xe10 rx
source interface xe10 tx → running-config: source interface xe10 both
```

its direction is changed to as follows

```
source interface xe10 rx → running-config: source interface xe10 rx
source interface xe10 tx → running-config: source interface xe10 tx
```

### Command Syntax

```
source interface IFNAME ( rx | tx | both | )
no source interface IFNAME
```

### Parameters

IFNAME	Interface name
rx	Ingress direction
tx	Egress direction
both	Both directions

### Default

Source port will be mirrored for both directions if the direction is not specified

### Command Mode

Monitor configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#monitor session 1
(config-monitor)#source interface xe1 both
(config-monitor)#no source interface xe1
```

---

## source vlan

Use this command to configure one or more VLANs as source per monitor session. A VLAN as source will be mirrored only in the ingress direction. Up to 32 VLANs can be configured as source per monitor session.

Use the `no` parameter to remove vlan source from monitor session.

### Command Syntax

```
source vlan VLAN_RANGE
no source vlan VLAN_RANGE
```

### Parameters

VLAN_RANGE	VLAN identifier or VLAN identifier range
------------	--

### Default

A trunk port is a member of all VLANs by default.

### Command Mode

Monitor configure mode

### Applicability

This command was introduced before OcnOS version 1.3.

### Example

```
#configure terminal
(config)#monitor session 1
(config-monitor)#source vlan 2
(config-monitor)#source vlan 4-10
(config-monitor)#no source vlan 2-5,10
```



---

## destination interface

Use this command to configure a mirror-to port per local monitor session. A destination port can be a physical port or a trunk port.

Use the `no` parameter to remove the destination port from a local monitor session.

**Note:** For the monitor sessions, the destination interface should be an switchport with no service attached. This port will not participate in L2/L3 packet forwarding.

### Command Syntax

```
destination interface IFNAME
no destination interface IFNAME
```

### Parameters

IFNAME	Interface name
--------	----------------

### Default

No default value is specified

### Command Mode

Monitor configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface xe3
(config-if)#switchport
(config-if)#exit
(config)#monitor session 1
(config-monitor)#destination interface xe3
(config-monitor)#no destination interface xe3
```

---

## no shut

Use this command to activate a monitor session

### Command Syntax

```
no shut
```

### Parameters

None

### Default

Monitor session will not be active by default.

### Command Mode

Monitor configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#monitor session 3
(config-monitor)#no shut
```

---

## shut

Use this command to de-activate a monitor session.

### Command Syntax

```
shut
```

### Parameters

None

### Default

Monitored session is not active by default.

### Command Mode

Monitor configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#monitor session 3
(config-monitor)#shut
```

## filter

Use this command to add filters to the monitor session. Filters can be applied only in case of ingress mirroring. The configuration of sequence identifier for each rule is optional, but even if it is not configured explicitly, it will always be generated and in steps of 10.

Use the `no` parameter to remove the filter from monitor session.

### Command Syntax

```
(<1-268435453>/<1-4294967294> |) filter {vlan VLAN_RANGE|inner-vlan VLAN_RANGE| cos
<0-7> | dest-mac (host XXXX.XXXX.XXXX | XXXX.XXXX.XXXX XXXX.XXXX.XXXX) | src-mac
(host XXXX.XXXX.XXXX | XXXX.XXXX.XXXX XXXX.XXXX.XXXX) | frame-type (ETHTYPE | arp
(req | resp|) (sender-ip A.B.C.D|) (target-ip A.B.C.D|) | ipv4 (src-ip (A.B.C.D |
A.B.C.D/M)|) (dest-ip (A.B.C.D | A.B.C.D/M)|) | ipv6 (src-ip X:X::X:X/M |) (dest-
ip X:X::X:X/M |))}
no (<1-268435453>/<1-4294967294>) filter
```

### Parameters

(<1-268435453>/<1-4294967294>  )	Sequence identifier for each rule.
Inner-VLAN	Specify Inner VLAN ID or range(s)
VLAN_RANGE	VLAN ID 2-4094 or range(s): 2-5,10 or 2-5,7-19
<0-7>	COS number
XXXX.XXXX.XXXX	MAC address
ETHTYPE	Ethertype
arp	ARP frames
req	Request frames
resp	Response frames
A.B.C.D	Single IP address
A.B.C.D/M	IP addresses with mask
X:X::X:X/M	IPv6 addresses with mask

### Default

No default value is specified.

### Command Mode

Monitor configure mode

### Applicability

This command was introduced before OcnOS version 1.3. The VLAN\_RANGE option is available from OcnOS Version 6.4.0.

### Example

```
#configure terminal
(config)#monitor session 3
```

```
(config-monitor)#35 filter vlan 200
(config-monitor)#filter dest-mac host 0000.0001.2421 frame-type ipv4
(config-monitor)#filter cos 3 frame-type arp req sender-ip 2.2.2.1
(config-monitor)#no 10 filter
(config-monitor)#no 20 filter
(config-monitor)#no 35 filter

#configure terminal
(config)#monitor session 3
(config-monitor)#35 filter vlan 10-20,50
```

---

## description

Use this command to add a description to the monitor session.

Use the `no` parameter to delete a description of the monitor session.

### Command Syntax

```
description LINE
no description
```

### Parameters

LINE	Enter the description string
------	------------------------------

### Default

No default value is specified.

### Command Mode

Monitor configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#monitor session 3
(config-monitor)#description "port mirror rx"
(config-monitor)#no description
```

---

## remote destination

Use this command to configure a destination VLAN and the reflector port for the remote monitor session.

Use the `no` parameter to remove a destination from a remote monitor session.

### Command Syntax

```
destination remote vlan <2-4094> reflector-port IFNAME
no destination remote
```

### Parameters

<2-4094>	VLAN identifier
IFNAME	Interface name

### Default

No default value is specified

### Command Mode

Monitor configure mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#no vlan 900 bridge 1
(config)#interface xe3
(config-if)#switchport
(config)#monitor session 1
(config-monitor)#destination remote vlan 900 reflector-port xe3
(config-monitor)#no destination remote
```

# show monitor

Use this command to display states of all monitor sessions. If a session is down, the reason is displayed.

## Command Syntax

```
show monitor
```

## Parameters

None

## Command Mode

Exec mode and Privileged Exec mode

## Applicability

This command was introduced before OcNOS version 1.3.

## Example

```
#show monitor
Session      State      Reason      Description
-----
1            down      No sources configured
2            down      Dst in wrong mode
```

Table P-17-30 explains the output fields.

Table 17-30: show monitor fields

Entry	Description
Session admin shut	If the monitoring session is administratively shutdown, session will be in this state. This is the default state for any newly created monitoring session. Monitoring sessions can be activated using the command 'no shut' on monitoring session mode.
Dst in wrong mode	If both source and destination is configured on monitoring session and session is activated, then:  1. In case of local monitoring, if the destination port is not configured with 'switchport' or the destination is associated with bridge, then session will be in this state. Destination port shouldn't participate in regular switching. Hence this configuration state is mandatory.  2. In case of remote monitoring, if the reflector port is not configured with 'switchport' or the destination is associated with bridge and/or if remote VLAN is part of bridge then session will be in this state. Remote VLAN ID used for encapsulation should be unused VLAN ID by bridge on the mirroring node.
No sources configured	If no source configured on the monitoring session (either source VLAN or source ports) and monitoring session is activated, then the session will be in this state. In order to recover, source needs to be configured on the monitoring session. Multiple sources can be configured on a monitoring session.
No dest configured	If a session is not configured with destination (either destination port in case of local monitoring or with remote vlan and reflector port in case of remote monitoring) and if the monitoring session is activated, then session will be in this state. In order to recover, destination needs to be configured on the monitoring session. Only one destination can be configured per monitoring session.



**Table 17-30: show monitor fields**

Entry	Description
No operational src/dst	<p>If both source and destination configured on monitoring session, destination is configured in right mode and session is activated, but</p> <ol style="list-style-type: none"><li>1. In case of local monitoring, if the destination port link state is down, then session will be in this state.</li><li>2. In case of remote monitoring, if the reflector port link state is down, then session will be in this state.</li><li>3. In case the sources configured are ports and none of them are in link up state, then session will be in this state.</li><li>4. In case the sources configured are VLAN and none of the VLANs are part of bridge forwarding, then session will be in this state.</li></ol>
No hardware resource	<p>If all the configurations are correct and multiple sessions are configured and activated, then one of the hardware limitation may be reached:</p> <ol style="list-style-type: none"><li>1. Destination port exceeding maximum limit.</li><li>2. Filters exceeding maximum limit.</li><li>3. VLAN source ports exceeding maximum limit.</li></ol> <p>In these cases, effected sessions will be in this state.</p>
Hardware failure	<p>If all the configurations are correct and sessions are activated but due to some expected or unexpected cases if the configuration cannot be applied in hardware, then the session will be in this state. This is not accepted state for a session and the issue needs to be analyzed and fixed.</p>

---

# show monitor session

Use this command to display the configuration details of one or more monitor sessions.

## Command Syntax

```
show monitor session (<1-18>|all|(range RANGE)) (brief|)
```

## Parameters

<1-18>	Session number
all	All sessions
RANGE	Session number range (n1-n2)
brief	Brief information

## Command Mode

Exec mode or Privileged Exec mode

## Applicability

This command was introduced before OcNOS version 1.3.

## Example

```
#show monitor session 1
session 1
-----
type           : local
state          : down (Session admin shut)
source intf    :
tx             : xe1 xe3 xe4
rx             : xe2 xe3 xe4
both           : xe3 xe4
source VLANs   :
rx             : 2,5-10,15,18-20
destination ports : xe5
filter count    :

Legend: f = forwarding enabled, l = learning enabled
#
```

[Table P-17-31](#) explains the output fields.

**Table 17-31: show monitor session output fields**

Entry	Description
Type	Type of monitor session.
State	State of the security flow filter. There are different error messages when you do RSPAN configuration: <ol style="list-style-type: none"> <li>1. Session admin shut</li> <li>2. Dst in wrong mode</li> <li>3. No sources configured</li> <li>4. No dest configured</li> <li>5. No operational src/dst</li> <li>6. No hardware resource</li> <li>7. Hardware failure.</li> </ol>
Session admin shut	If the monitoring session is administratively shutdown, session will be in this state. This is the default state for any newly created monitoring session. Monitoring sessions can be activated using the command 'no shut' on monitoring session mode.
Dst in wrong mode	If both source and destination is configured on monitoring session and session is activated, then: <ol style="list-style-type: none"> <li>1. In case of local monitoring, if the destination port is not configured with 'switchport' or the destination is associated with bridge, then session will be in this state. Destination port shouldn't participate in regular switching. Hence this configuration state is mandatory.</li> <li>2. In case of remote monitoring, if the reflector port is not configured with 'switchport' or the destination is associated with bridge and/or if remote VLAN is part of bridge then session will be in this state. Remote VLAN ID used for encapsulation should be unused VLAN ID by bridge on the mirroring node.</li> </ol>
No sources configured	If no source configured on the monitoring session (either source VLAN or source ports) and monitoring session is activated, then the session will be in this state. In order to recover, source needs to be configured on the monitoring session. Multiple sources can be configured on a monitoring session.
No dest configured	If a session is not configured with destination (either destination port in case of local monitoring or with remote vlan and reflector port in case of remote monitoring) and if the monitoring session is activated, then session will be in this state. In order to recover, destination needs to be configured on the monitoring session. Only one destination can be configured per monitoring session.
No operational src/dst	If both source and destination configured on monitoring session, destination is configured in right mode and session is activated, but: <ol style="list-style-type: none"> <li>1. In case of local monitoring, if the destination port link state is down, then session will be in this state.</li> <li>2. In case of remote monitoring, if the reflector port link state is down, then session will be in this state.</li> <li>3. In case the sources configured are ports and none of them are in link up state, then session will be in this state.</li> <li>4. In case the sources configured are VLAN and none of the VLANs are part of bridge forwarding, then session will be in this state.</li> </ol>
No hardware resource	If all the configurations are correct and multiple sessions are configured and activated, then one of the hardware limitation may be reached: <ol style="list-style-type: none"> <li>1. Destination port exceeding maximum limit.</li> <li>2. Filters exceeding maximum limit.</li> <li>3. VLAN source ports exceeding maximum limit.</li> </ol> In these cases, effected sessions will be in this state.
Hardware failure	If all the configurations are correct and sessions are activated but due to some expected or unexpected cases if the configuration cannot be applied in hardware, then the session will be in this state. This is not accepted state for a session and the issue needs to be analyzed and fixed.

**Table 17-31: show monitor session output fields**

Entry	Description
Rx	Incoming flow (source and destination IP addresses).
Tx	Reverse flow (source and destination IP addresses).
Both	Incoming and reverse flow (source and destination IP address)
Destination Port	Name of the destination port to be matched.
Source intf	Number of maximum intf central source session.
Source VLANs	Number of maximum VLANs central source session.
Filter count	Used to count number of lines in a file or table.

---

## show filter

Use this command to display filters for one or more monitor sessions.

### Command Syntax

```
show monitor session (<1-18>|all|(range RANGE)) filter
```

### Parameters

<1-18>	Session number
all	All sessions
RANGE	Session number range (n1-n2)

### Command Mode

Exec mode or Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show monitor session 1 filter
session 1
-----
filter count : 3
-----

match set 1
-----
destination mac address : 0000.0002.4451 (host)
source mac address : 0000.0012.2288 (host)
-----

match set 2
-----
frame type : arp
sender ip address : 2.2.2.5
target ip address : 2.2.2.8
-----

match set 3
-----
destination mac address : 0000.0001.1453 (host)
frame type : ipv4
source ip address : 3.3.3.5
#
```

---

## show monitor running configuration

Use this command to display the mirror-related running configuration.

### Command Syntax

```
show running-config monitor (all|)
```

### Parameters

all	Show running configuration with defaults
-----	--

### Command Mode

Exec mode or Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show running-config monitor
!
monitor session 1
 source interface xe10 rx
 destination interface po1
 no shut

#
```

# Data Center Bridging Command Reference

## CHAPTER 1 Data Center Bridge Commands

---

This section lists and describes the commands that can be used in a Data Center Bridging (DCB) environment.

The DCB includes the following commands:

- [data-center-bridging](#)
- [show data-center-bridging](#)



---

## data-center-bridging

Use this command to enable the Data Center Bridging

Use the `no` form of this command to disable the Data Center Bridging

### Command Syntax

```
data-center-bridging enable
data-center-bridging disable
```

### Parameters

None

### Default

Disabled

### Command Mode

Configuration mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
OcNOS(config)#data-center-bridging enable bridge 1
OcNOS(config)#commit
OcNOS(config)#
OcNOS(config)#data-center-bridging disable bridge 1
OcNOS(config)#commit
OcNOS(config)#
```

## show data-center-bridging

Use this command to display information about show data-center-bridging.

### Command Syntax

```
show data-center-bridging admin-details
show data-center-bridging operational-details
show data-center-bridging remote-details
```

### Parameters

```
admin-details
    administrative details
operational-details
    operational details
remote-details
    remote details
```

### Command Mode

Exec mode and Privileged Exec mode

### Applicability

This command was introduced before OcNOS version 6.5.1.

### Examples

```
#show data-center-bridging admin-details interface xe4/3
PFC administrative details
interface : xe4/3
State advertise willing    cap    syncd    priorities
```

```
=====
==
On      On          On          4      On          3 4
```

```
ETS administrative details
interface : xe4/3
State advertise willing    MAX_TCGs TCG-ID    BW%    priorities    Syncd
=====
==
Off    Off      Off      0      0      0      0 1 2 3 4 5 6 7on
Off    Off      Off      0      1      0              on
Off    Off      Off      0      2      0              on
Off    Off      Off      0      3      0              on
Off    Off      Off      0      4      0              on
Off    Off      Off      0      5      0              on
Off    Off      Off      0      6      0              on
Off    Off      Off      0      7      0              on
```

Application priority administrative details

interface : xe4/3

State advertise willing Protocol ProtoID priorities Syncd

#show data-center-bridging operational-details interface xe4/3

PFC Operational details

interface : xe4/3

state cap syncd priorities

```
=====
==
On      4      On      0 1 2
```

ETS Operational details

interface : xe4/3

State MAX\_TCGs TCG-ID BW% priorities

```
=====
==
Off  0      0      0      0 1 2 3 4 5 6 7
Off  0      1      0
Off  0      2      0
Off  0      3      0
Off  0      4      0
Off  0      5      0
Off  0      6      0
Off  0      7      0
```

Application priority operational details

interface : xe4/3

State Adv Will Proto ProtoID priorities app

```
=====
==
```

#show data-center-bridging remote-details interface xe4/3

PFC Remote details

interface : xe4/3

State Willing Cap Priorities

```
=====
==
On      On      4      0 1 2
```

ETS Remote details

interface : xe4/3

State willing Error Max-Tcgs TCG-ID BW% priorities

```
=====
==
Off  Off      Off      0      0      0      0 1 2 3 4 5 6 7
Off  Off      Off      0      1      0
Off  Off      Off      0      2      0
Off  Off      Off      0      3      0
Off  Off      Off      0      4      0
Off  Off      Off      0      5      0
Off  Off      Off      0      6      0
Off  Off      Off      0      7      0
```

---

Application priority Remote details

interface : xe4/3

State	willing	Error	Protocol	ProtoID	priorities
-------	---------	-------	----------	---------	------------

=====

==

Off	Off	Off			
-----	-----	-----	--	--	--

---

## CHAPTER 2 Priority-based Flow Control Commands

---

This section lists and describes the commands that can be used to configure Priority-based Flow Control (PFC) in a Data Center Bridging (DCB) environment. It includes the following commands:

- [priority-flow-control accept-peer-config](#)
- [priority-flow-control advertise-local-config](#)
- [priority-flow-control enable](#)
- [priority-flow-control cap](#)
- [priority-flow-control enable priority](#)
- [priority-flow-control link-delay-allowance](#)
- [priority-flow-control mode](#)
- [show priority-flow-control details](#)
- [show priority-flow-control statistics](#)

---

## priority-flow-control accept-peer-config

Use this command to enable willing mode for PFC on the interface.

If willing is enabled, then by default advertise mode is also enabled.

Use the `no` form of this command to disable willing mode.

### Command Syntax

```
priority-flow-control accept-peer-config  
no priority-flow-control accept-peer-config
```

### Parameters

None

### Default

By default, willing mode for PFC on the interface is disabled. If willing is enabled, then by default advertise mode is also enabled.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal  
(config)#interface eth1  
(config-if)#priority-flow-control accept-peer-config
```

---

## priority-flow-control advertise-local-config

Use this command to enable advertising mode for PFC on the interface.

Use the `no` form of this command to disable advertising mode.

### Command Syntax

```
priority-flow-control advertise-local-config
no priority-flow-control advertise-local-config
```

### Parameters

None

### Default

By default, advertising mode for PFC on the interface is disabled. If willing is enabled, then by default advertise mode is also enabled.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth1
(config-if)#priority-flow-control advertise-local-config
```

---

## priority-flow-control enable

Use this command to enable Priority-based Flow Control (PFC) on a switch (bridge).

Use the `no` form of this command to disable PFC.

### Command Syntax

```
priority-flow-control enable bridge <1-32>
no priority-flow-control bridge <1-32>
```

### Parameters

<1-32>	Bridge ID.
--------	------------

### Default

By default, PFC is disabled.

### Command Mode

Configure mode

### Default

PFC is disabled by default.

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#priority-flow-control enable bridge 32

#configure terminal
(config)#no priority-flow-control bridge 32
```



---

## priority-flow-control cap

Use this command to configure a priority-flow-control cap for the number of priorities allowed on an interface.

Use the `no` parameter along with this command to return the value to its default level.

### Command Syntax

```
priority-flow-control cap <0-8>
no priority-flow-control cap
```

### Parameters

`<0-8>`                      Select a cap value. Zero indicates that there is no limitations.

### Default

By default, priority-flow-control cap value is 8.

### Command Mode

Interface mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Examples

```
#configure terminal
(config)#interface eth2
(config-if)#priority-flow-control cap 7
```



---

## priority-flow-control link-delay-allowance

Use this command to set PFC link delay allowance on an interface. This command provides allowance for round-trip propagation delay of the link in bits; moreover, it is one of the factors that determines when to trigger PAUSE.

Use the `no` parameter along with this command to unset PFC link delay allowance on an interface.

### Command Syntax

```
priority-flow-control link-delay-allowance <0-4294967296>
no priority-flow-control link-delay-allowance
```

### Parameter

<0-4294967296> Link characteristics that affect the link delay (for example, link length).

### Command Mode

Interface mode

### Default

Default value is zero.

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth1
(config-if)#priority-flow-control link-delay-allowance 5

(config)#interface eth1
(config-if)#no priority-flow-control link-delay-allowance
```

---

## priority-flow-control mode

Use this command to enable Priority-based Flow Control (PFC) on an interface.

Use the `no` form of this command to disable PFC on an interface.

### Command Syntax

```
priority-flow-control mode (on | auto)
no priority-flow-control
```

### Parameters

<code>auto</code>	Negotiate PFC capabilities.
<code>on</code>	Force-enable PFC, overriding negotiation.

### Default

By default, PFC is disabled.

### Command Mode

Interface mode

### Default

PFC is disabled by default.

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#configure terminal
(config)#interface eth1
(config-if)#priority-flow-control mode auto
```

## show priority-flow-control details

Use this command to display the PFC details for a specified interface or bridge.

### Command Syntax

```
show priority-flow-control details ((interface IFNAME) | (bridge <1-32>))
```

### Parameters

IFNAME	Name of the input or output interface.
<1-32>	Specify a bridge ID.

### Default

None

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show priority-flow-control details interface eth1
bridge : 2
priority flow control : on
interface : eth1
```

Admin Configuration

mode	advertise	willing	cap	link	priorities
				delay	
				allowance	

```
=====
on      on          off      5      128      2 3 4 5
```

Operational Configuration

state	cap	link	priorities
		delay	
		allowance	

```
=====
on      5      128      2 3 4 5
```

**Table 2-32: Show priority-flow control details output**

Entry	Description
bridge	The bridge number to which this interface is associated (1-32).
priority flow control	Show whether priority flow control is either <code>on</code> or <code>off</code> .
interface	The interface name.
Admin Configuration	The configuration as entered on this device.
mode	The priority flow control operating mode – <code>on</code> , <code>off</code> , or <code>auto</code> .
advertise	Status of advertisement of the configuration to the peer device.
willing	The willingness of the local interface to learn the PFC configuration from the peer. Values are either <code>on</code> or <code>off</code> .
cap	Cap is a limit set that specifies the maximum number of PFC priorities.
link delay allowance	The allowance made for round-trip propagation delay of the link in bits.
Priorities	Shows the PFCs that have been to be used on the priorities.
Operational Configuration	The actual configuration that exists between this device and its PFC peer.
state	Shows whether PFC is functioning. Values are <code>on</code> , <code>off</code> , or <code>auto</code> .
cap	Cap is the limit that specifies the maximum number of PFC priorities.
link delay allowance	The allowance being used for round-trip propagation delay of the link in bits.
priorities	The PFCs actually being used by this device and its peer.

---

## show priority-flow-control statistics

Use this command to display statistics about the number of PFC Pause frames sent and received for a specified interface or bridge. If you do not specify a bridge or interface, this commands shows statistics for the bridge.

### Command Syntax

```
show priority-flow-control statistics ((interface IFNAME) | (bridge <1-32>))
```

### Parameters

<1-32>	Specify bridge ID.
IFNAME	Name of the input or output interface.

### Default

None

### Command Mode

Exec mode

### Applicability

This command was introduced before OcNOS version 1.3.

### Example

```
#show priority-flow-control statistics interface eth1
bridge : 2
interface : eth1
pause sent      pause received
=====
59680614996248372055834574861
```

# Index

## Numerics

### 802.1x Commands

- auth-mac dynamic-vlan-creation disable 645
- auth-mac system-auth-ctrl 648
- debug dot1x 648
- dot1x port-control 650
- dot1x protocol-version 651
- dot1x quiet-period 652
- dot1x reauthentication 654
- dot1x reauthMax 653
- dot1x system-auth-ctrl 655
- dot1x timeout re-authperiod 656
- dot1x timeout server-timeout 657
- dot1x timeout supp-timeout 658
- dot1x timeout tx-period 659
- ip radius source-interface 660
- radius-server host 661
- show debugging dot1x 664
- show dot1x 666

## A

- authentication 29
- auth-mac dynamic-vlan-creation disable 645
- auth-mac system-auth-ctrl 648

## B

- begin modifier 22
- BGP community value
  - command syntax 20
- braces
  - command syntax 19
- bridge acquire 432
- bridge address 433
- bridge ageing-time 434
- bridge cisco-interoperability 464
- Bridge commands
  - bridge acquire 432
  - bridge address 433
  - bridge ageing-time 434
  - bridge protocol mstp 470
  - bridge protocol rstp 471
  - clear mac address-table 447
  - show interface switchport bridge 454
  - switchport 460
- bridge forward-time 435
- bridge instance priority 466
- bridge max-age 438
- bridge max-hops 439
- bridge multiple-spanning-tree enable 468
- bridge priority 440
- bridge protocol mstp 470
- bridge protocol provider-rstp 751

- bridge protocol rpvst+ 534
- bridge protocol rstp 471
- bridge rapid-spanning-tree enable 473
- bridge region 474
- bridge revision 475
- bridge shutdown 441
- bridge spanning-tree enable 476
- bridge spanning-tree errdisable-timeout enable 477
- bridge spanning-tree portfast bpdu-filter 480
- bridge te-msti 482
- bridge transmit-holdcount 442
- bridge-group instance 483
- bridge-group instance path-cost 484
- bridge-group path-cost 444
- bridge-group priority 445
- bridge-group vlan 533

## C

- clear mac address-table 447
- clear spanning-tree detected protocols 489
- command abbreviations 18
- command completion 18
- command line
  - errors 18
  - help 17
  - keyboard operations 21
- command modes 25
  - configure 25
  - exec 25
  - interface 25
  - privileged exec 25
  - router 25
- command negation 19
- command syntax
  - ? 20
  - . 20
  - () 19
  - { } 19
  - | 19
  - A.B.C.D/M 20
  - AA:NN 20
  - BGP community value 20
  - braces 19
  - conventions 19
  - curly brackets 19
  - HH:MM:SS 20
  - IFNAME 20
  - interface name 20
  - IPv4 address 20
  - IPv6 address 20
  - LINE 20
  - lowercase 19
  - MAC address 20
  - monospaced font 19
  - numeric range 20
  - parentheses 19
  - parentheses 19
  - period 20



- question mark 20
- square brackets 20
- time 20
- uppercase 19
- variable placeholders 20
- vertical bars 19
- WORD 20
- X:X::X:X 20
- X:X::X:X/M 20
- XX:XX:XX:XX:XX:XX 20
- common commands
  - errdisable 420
  - errdisable timeout 423
- Common NSM Layer 2 commands
  - storm-control level 526
- configuration
  - disable spanning tree 40
- configure
  - 802.1x authentication 29
  - GMRP 314, 318
  - LACP 56
  - LLDP 109
  - MSTP 166
  - Provider Bridging 246
  - RSTP 208
  - STP 217
- configure mode 25
- curly brackets
  - command syntax 19
- customer-spanning-tree customer-edge path-cost 491
- customer-spanning-tree customer-edge priority 492
- customer-spanning-tree forward-time 493
- customer-spanning-tree hello-time 494
- customer-spanning-tree max-age 495
- customer-spanning-tree priority 496
- customer-spanning-tree provider-edge path-cost 497
- customer-spanning-tree provider-edge priority 498
- customer-spanning-tree transmit-holdcount 499
- cvlan registration table 752
- cvlan svlan 753

## D

- debug dot1x 648
- debug lacp command 547
- debug mcec 575
- debug mstp 500
- disable spanning tree
  - configuration 40
  - spanning-tree te-msti configuration 525
- domain hello timeout 577
- domain priority 578
- domain system number 579
- domain-address 576
- dot1x port-control 650
- dot1x protocol-version 651
- dot1x quiet-period 652
- dot1x reauthentication 654
- dot1x reauthMax 653

- dot1x system-auth-control 655
- dot1x timeout re-authperiod 656
- dot1x timeout server-timeout 657
- dot1x timeout supp-timeout 658
- dot1x timeout tx-period 659
- DRNI 126

## E

- errdisable 420
- errdisable timeout 423
- exec command mode 25

## G

- GARP Multicast Registration Protocol 314, 318
- GMRP
  - configuring 314, 318

## H

- hardware-profile portmode 353

## I

- IEEE 802.1x 29
- IFNAME 20
- interface mode 25
- interface po 548
- interface sa 549
- ip radius source-interface 660
- IPv4 address
  - command syntax 20
- IPv6 address
  - command syntax 20

## L

- LACP
  - configuring 56
- LACP Commands
  - debug lacp 547
  - lacp port-priority 552
  - lacp system-priority 553
  - lacp timeout 554
  - show debugging lacp 560
  - show lacp-counter 565
  - show port etherchannel 566
  - static-channel-group 571
- LACP commands
  - port-channel load-balance 555
- lacp destination-mac 550
- lacp port-priority command 552
- lacp system-priority command 553
- lacp timeout command 554
- LINE 20
- Link aggregation 126
- LLDP commands

lldp system-name 684, 712  
set lldp disable 679, 694  
set lldp enable 680, 694  
set lldp locally-assigned 681, 700  
set lldp msg-tx-hold 683, 701  
set lldp msg-tx-interval 703, 713  
set lldp too-many-neighbors 685, 714  
show lldp port 686, 715  
lldp system-name 684, 712

## M

MAC address  
command syntax 20  
mcec domain configuration 582  
MC-LAG 126  
MC-LAG Configuration 126  
mlag 583  
MSTP  
configuring 166

## N

NSM Commands  
show router-id 424

## P

parentheses  
command syntax 19  
parentheses  
command syntax 19  
period  
command syntax 20  
PFC commands  
priority-flow-control accept-peer-config 793, 798  
priority-flow-control link-delay-allowance 803  
priority-flow-control mode 804  
show priority-flow-control details 805  
PFC priority-flow-control advertise-local-config 799  
port 557, 559  
portal-system-number 587  
portal-topology 587  
port-channel load-balance 555  
port-channel min-links 557, 559  
port-conv-id 587  
Private-VLAN commands  
switchport private-vlan host-association 627  
switchport private-vlan mapping 628  
privileged exec mode 25  
Provider Bridging commands  
bridge protocol provider-rstp 751  
cvlan registration table 752  
cvlan svlan 753  
switchport customer-edge 757  
switchport customer-edge hybrid allowed vlan 758  
switchport customer-edge vlan registration 760  
switchport mode customer-edge access 764  
vlan type 770

## Q

question mark  
command syntax 20

## R

radius-server host 661  
router mode 25  
RPVST+ commands  
bridge protocol rpvst+ 534  
bridge-group vlan 533  
spanning-tree rpvst+ configuration 540  
spanning-tree vlan path-cost 541  
spanning-tree vlan restricted-role 541  
spanning-tree vlan restricted-tcn 542

## S

set lldp disable 694  
set lldp enable 680, 694  
set lldp locally-assigned 681, 700  
set lldp msg-tx-hold 683, 701  
set lldp msg-tx-interval 703, 713  
set lldp too-many-neighbors 685, 714  
show commands 22  
exclude modifier 23  
include modifier 23  
redirect modifier 24  
show debugging dot1x 664  
show debugging lacp command 560  
show debugging mstp 502  
show dot1x 666  
show errdisable details 424  
show interface errdisable status 425  
show interface switchport bridge 454  
show lacp-counter command 565  
show lldp interface 719  
show lldp port 686, 715  
show mac address-table count bridge 456  
show mcec statistics 585  
show mlag conversation-id 587  
show mlag detail 587  
show mlag summary 589  
show port etherchannel command 566  
show router-id 424  
show running-config switch 426  
show spanning-tree 503  
show spanning-tree mst 507  
show spanning-tree statistics 509  
show vlan 605  
show vlan access-map 604  
show vlan all 605  
show vlan auto 607  
show vlan brief 607  
show vlan classifier 608  
snmp restart mstp 512  
spanning-tree autoedge 513  
spanning-tree edgeport 514

- spanning-tree guard root 515
- spanning-tree hello-time 516
- spanning-tree instance restricted-role 516
- spanning-tree instance restricted-tcn 517
- spanning-tree link-type 518
- spanning-tree mst configuration 519
- spanning-tree restricted-role 523
- spanning-tree restricted-tcn 524
- spanning-tree spvts+ configuration 540
- spanning-tree te-msti configuration 525
- spanning-tree vlan path-cost 541
- spanning-tree vlan restricted-role 541
- spanning-tree vlan restricted-tcn 542
- square brackets
  - command syntax 20
- static-channel-group 571
- storm-control level 526
- STP
  - configuring 217
- STP commands
  - bridge cisco-interoperability 464
  - bridge forward-time 435
  - bridge instance priority 466
  - bridge max-age 438
  - bridge max-hops 439
  - bridge multiple-spanning-tree enable 468
  - bridge priority 440
  - bridge rapid-spanning-tree enable 473
  - bridge region 474
  - bridge revision 475
  - bridge shutdown 441
  - bridge spanning-tree enable 476
  - bridge spanning-tree errdisable-timeout enable 477
  - bridge spanning-tree portfast bpdu-filter 480
  - bridge transmit-holdcount 442
  - bridge-group path-cost 444
  - bridge-group priority 445
  - clear spanning-tree detected protocols 489
  - customer-spanning-tree customer-edge path-cost 491
  - customer-spanning-tree customer-edge priority 492
  - customer-spanning-tree forward-time 493
  - customer-spanning-tree hello-time 494
  - customer-spanning-tree max-age 495
  - customer-spanning-tree priority 496
  - customer-spanning-tree provider-edge path-cost 497
  - customer-spanning-tree provider-edge priority 498
  - customer-spanning-tree transmit-holdcount 499
  - debug mstp 500
  - show debugging mstp 502
  - show spanning-tree 503
  - show spanning-tree mst 507
  - show spanning-tree statistics 509
  - spanning-tree autoedge 513
  - spanning-tree edgeport 514
  - spanning-tree guard root 515
  - spanning-tree hello-time 516
  - spanning-tree instance restricted-role 516

- spanning-tree instance restricted-tcn 517
- spanning-tree link-type 518
- spanning-tree mst configuration 519
- spanning-tree restricted-role 523
- spanning-tree restricted-tcn 524
- switchport 460
  - switchport access vlan 612
  - switchport customer-edge 757
  - switchport customer-edge hybrid allowed vlan 758
  - switchport customer-edge vlan registration 760
  - switchport hybrid allowed vlan 613
  - switchport mode customer-edge access 764
  - switchport mode hybrid 616, 620, 621
  - switchport mode trunk 617, 621
  - switchport private-vlan host-association 627
  - switchport private-vlan mapping 628
  - switchport trunk allowed vlan 621
  - switchport trunk native vlan 624

## T

- time
  - command syntax 20
- Topology 126

## U

- UDLD configuration 243

## V

- vertical bars
  - command syntax 19
- vlan classifier ipv4 634
- VLAN commands
  - show vlan 605
  - show vlan access-map 604
  - show vlan all 605
  - show vlan auto 607
  - show vlan brief 607
  - show vlan classifier 608
  - switchport access vlan 612
  - switchport hybrid allowed vlan 613
  - switchport mode hybrid 616, 620, 621
  - switchport mode trunk 617, 621
  - switchport trunk allowed vlan 621
  - switchport trunk native vlan 624
  - vlan classifier ipv4 634
  - vlan database 636
- vlan database command 636
- vlan type 770

## W

- WORD 20