OcNOS®

Open Compute Network Operating System for Routed Optical Networking Version 6.4.2

Layer 1 Guide

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Contents

Preface

This guide describes how to configure OcNOS.

Audience

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

Conventions

Table 1 shows the conventions used in this guide.

Table 1: Conventions

Convention	Description
Italics	Emphasized terms; titles of books
Note:	Special instructions, suggestions, or warnings
`monospaced type`	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.

Migration Guide

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

Feature Availability

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

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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 1 describes the conventions used to represent command syntax in this reference.

Table 1: Syntax conventions

Convention	Description	Example
`monospaced font`	Command strings entered on a command line	`show ip ospf`
`lowercase`	Keywords that you enter exactly as shown in the command syntax.	`show ip ospf`
`UPPERCASE`	See Variable Placeholders	`IFNAME`
`()`	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.	`(A.B.C.D|<0-4294967295>)`
`()`	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.	`(A.B.C.D|<0-4294967295>|)`
`()`	Optional parameter which you can specify or omit. Do not enter the parentheses or vertical bar as part of the command.	`(IFNAME|)`
`{}`	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.	`{intra-area <1-255>|inter-area <1-255>|external <1-255>}`

Table 1: 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 2 shows the tokens used in command syntax use to represent variables for which you supply a value.

Table 2: 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 3 explains the sections used to describe each command in this reference.

Table 3: Command descriptions

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

Keyboard Operations

Table 4 lists the operations you can perform from the keyboard.

Table 4: 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 4: Keyboard operations (Continued)

Key combination	Operation
Ctrl+t	Transposes the current character with the previous character
Ctrl+c	Ignores the current line and redisplays 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 5 apply for all string parameters used in OcNOS commands, unless some other restrictions are noted for a particular command.

Table 5: String parameter restrictions

Restriction	Description
Input length	1965 characters or less
Restricted special characters	“?”, “,”, “>”, “|”, and “=” The “|” is allowed only for `description` CLI in interface mode.

Command Modes

Commands are grouped into modes arranged in a hierarchy. Each mode has its own set of commands. Table 6 lists the command modes common to all protocols.

Table 6: Common command modes

Name	Description
Executive mode	Also called *view* 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 `show`, `exit`, `quit`, `help`, and `enable`.
Privileged executive mode	Also called *enable* mode, in this mode you can run additional basic commands such as `debug`, `write`, and `show`.
Configure mode	Also called *configure terminal* 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.

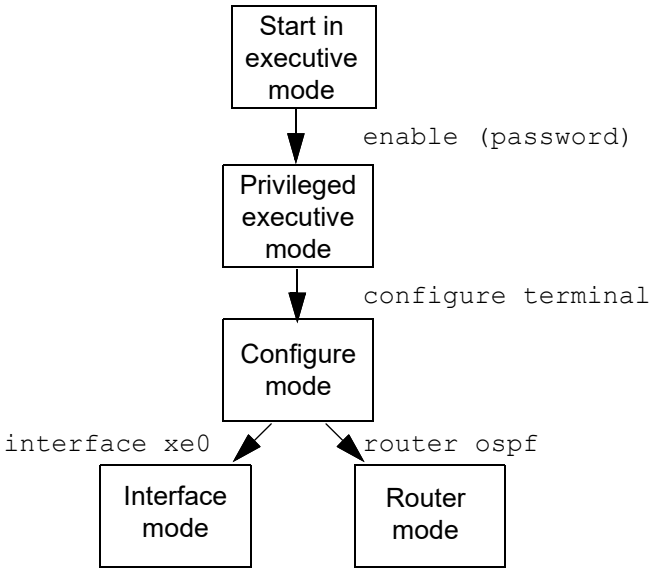

Figure 4-1: Common command modes

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 1 Configuration Guide

CHAPTER 1 Cross-Connect (XC)

This Chapter contains the cross-connect configuration example.

Overview

This feature is to configure the cross connection between two 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 cannot be used for another cross connect

This following are the types of endpoints supported by this port based cross connect.

1. Native Ethernet interface
2. LAG interface

OSPF, BGP and BFD Session Establishments via Cross-connect

The following configuration example will illustrate OSPF, BFD and BGP session establishments via Cross-connect.

Topology

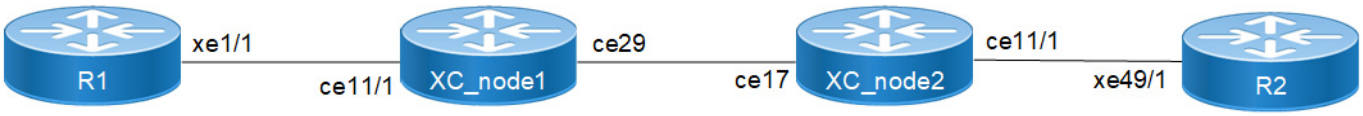

Figure 1-1: Session establishments via Cross-connect

R1

`#configure terminal`	Enter configure mode
`(config)#hostname R1`	Configure the host name
`(config)#interface xe1/1`	Enter into interface level
`(config-if)#ip address 10.10.10.1/24`	Configure IP address to the interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface xe32/1`	Enter into interface mode
`(config-if)#ip address 20.20.20.1/24`	Configure ip address to the interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface lo`	Enter into loop-back interface
`(config-if)#ip address 1.1.1.1/24 secondary`	Configuring secondary IP address
`(config-if)#exit`	Exiting the loop-back interface level
`(config)#bfd interval 3 minrx 3 multiplier 3`	Configuring BFD options
`(config)#router ospf 10`	Configuring OSPF process
`(config-router)#router-id 1.1.1.1`	Configuring router-id

(config-router)#network 10.10.10.0 0.0.0.255 area 0	Configuring Network id and Area ID
(config-router)#redistribute connected	Configuring redistribute connected
(config-router)#bfd all-interfaces	Configuring bfd on all-interfaces
(config-router)#exit	Exiting the OSPF process
(config)#router bgp 100	Configuring BGP process
(config-router)#neighbor 10.10.10.2 remote-as 200	Configuring neighbor details
(config-router)#commit	Commit the configuration

XC_node1

#configure terminal	Enter configure mode
(config)#hostname Xc Node-1	Configuring the hostname
(config)#coherent-module 7	Entering into coherent-module
(config-module)#enable	Enabling the coherent module
(config-module)#exit	Exiting the coherent module
(config)#interface ce29	Entering into interface level
(config-if)#switchport	Configuring switchport
(config-if)#exit	Exiting the interface level
(config)#interface ce11/1	Entering the interface level
(config-if)#switchport	Configuring the switchport
(config-if)#exit	Exiting the interface level
(config)#cross-connect OSPF_BFD_BGP	Configuring the Cross-connect
(config-XC)#ep1 ce11/1 ep2 ce29	Creating endpoints
(config-XC)#commit	Commit the configuration

XC_node2

#configure terminal	Enter configure mode
(config)#hostname Xc Node-2	Configuring the hostname
(config)#coherent-module 1	Entering into coherent-module
(config-module)#enable	Enabling the coherent module
(config-module)#exit	Exiting the coherent module
(config)#interface ce17	Entering into interface level
(config-if)#switchport	Configuring switchport
(config-if)#exit	Exiting the interface level
(config)#interface ce11/1	Entering the interface level
(config-if)#switchport	Configuring the switchport
(config-if)#exit	Exiting the interface level
(config)#cross-connect OSPF_BFD_BGP-1	Configuring the Cross-connect

(config-XC)#ep1 ce17 ep2 ce11/1	Creating endpoints
(config-XC)#commit	Commit the configuration

R2

#configure terminal	Enter configure mode
(config)#hostname R2	Configure the host name
(config)#interface xe49/1	Enter into interface level
(config-if)#ip address 10.10.10.2/24	Configure IP address to the interface
(config-if)#exit	Exiting from interface level
(config)#interface xe45	Enter into interface mode
(config-if)#ip address 30.30.30.1/24	Configure ip address to the interface
(config-if)#exit	Exiting from interface level
(config)#interface lo	Enter into loop-back interface
(config-if)#ip address 2.2.2.2/24 secondary	Configuring secondary IP address
(config-if)#exit	Exiting the loop-back interface level
(config)#bfd interval 3 minrx 3 multiplier 3	Configuring BFD options
(config)#router ospf 10	Configuring OSPF process
(config-router)#router-id 2.2.2.2	Configuring router-id
(config-router)#network 10.10.10.0 0.0.0.255 area 0	Configuring Network id and Area ID
(config-router)#redistribute connected	Configuring redistribute connected
(config-router)#bfd all-interfaces	Configuring bfd on all-interfaces
(config-router)#exit	Exiting the OSPF process
(config)#router bgp 200	Configuring BGP process
(config-router)#neighbor 10.10.10.1 remote-as 100	Configuring neighbor details
(config-router)#commit	Commit the configuration

Validation

Coherent-module Summary Validation

```
XC_node1#show coherent-module 7
---------------------------------------------------------------
SLOT-ID : 7
---------------------------------------------------------------
Module Type                          :   DCO
Admin-Status                         :   UP
Oper-Status                          :   Ready
Vendor-name                          :   Acacia Comm Inc.
Vendor-SN                            :   203066225
Vendor-FW-Version                    :   38.5
Network-Interfaces                   :   1
Host-Interfaces                      :   2
CFP2 Vendor-name                     :   Acacia Comm Inc.
```

```
CFP2 Vendor-OUI                     :   0x0
CFP2 Vendor-Part                    :   AC200-D23-005
CFP2 Vendor-SN                      :   203066225
CFP2 Vendor-FW-Version              :   38.5
CFP2 Temperature                    :   48.60 °C
CFP2 Power Supply                   :   3.322 V

---------------------------------------------------------------
SLOT-ID : 7   NETIF : 0
---------------------------------------------------------------
OperStatus                          :   ready
DSP-OperStatus                      :   ready
Modulation-format                   :   dp-16-qam
FEC Mode                            :   15per-denali
Differential Encoding               :   FALSE
Pulseshaping-Rx                     :
Pulseshaping-Tx                     :   TRUE
Loopback-type                       :   none
PRBS-type                           :   none
Losi-Enabled                        :
PRBS-IN-SYNC                        :   FALSE
Current PRBS BER                    :   nan
Current BER Period                  :   1000 ms
Current PRE FEC BER                 :   1.115706e-03
Current POST FEC BER                :
Current Chromatic Dispersion        :   -1 ps/nm
Current Differential Group Delay    :   3 ps
Tx-Disable                          :   FALSE
TX-Output-Power                     :   0.00 dBm
TX-Laser-freq                       :   193500000.000000 MHz
Min-LaserFreq                       :   191250000.000000 MHz
Max-LaserFreq                       :   196100000.000000 MHz
Current TX Laser Freq               :   193500000.000000 MHz
Grid-Spacing                        :   6.25-ghz
Laser-Grid                          :   50-ghz 12.5-ghz 6.25-ghz
Current Output Power                :   0.04 dBm
Current Input Power                 :   -4.36 dBm
Current Post VOA Power              :
Current Prov~ Chnl Power            :   -3.78 dBm
Current Post VOA Prov~ Chnl Power   :   -3.78 dBm
Current OSNR Estimate               :   34.30 dB
Current Q-Margin                    :   2.80 dB
Current Uncorrected Block-count     :   0
Laser Age                           :   0 %

---------------------------------------------------------------
SLOT-ID : 7   HOSTIF : 0
---------------------------------------------------------------
Fec-type                            :   none
Loopback-type                       :   none
```

```
Current PRE FEC BER                 :   nan
-------------------------------------------------------------
SLOT-ID : 7   HOSTIF : 1
-------------------------------------------------------------
Fec-type                            :   none
Loopback-type                       :   none
Current PRE FEC BER                 :   nan

XC_node2#sh coherent-module 1
-------------------------------------------------------------
SLOT-ID : 1
-------------------------------------------------------------
Module Type                         :   DCO
Admin-Status                        :   UP
Oper-Status                         :   Ready
Vendor-name                         :   LUMENTUM
Vendor-SN                           :   VCD19310002
Vendor-FW-Version                   :   0.52
Network-Interfaces                  :   1
Host-Interfaces                     :   2
CFP2 Vendor-name                    :   LUMENTUM
CFP2 Vendor-OUI                     :   0xF00200
CFP2 Vendor-Part                    :   TRB200DAA-01
CFP2 Vendor-SN                      :   VCD19310002
CFP2 Vendor-FW-Version              :   0.52
CFP2 Temperature                    :   69.02 °C
CFP2 Power Supply                   :   3.340 V

-------------------------------------------------------------
SLOT-ID : 1   NETIF : 0
-------------------------------------------------------------
OperStatus                          :   ready
DSP-OperStatus                      :   ready
Modulation-format                   :   dp-16-qam
FEC Mode                            :   15per-denali
Differential Encoding               :   FALSE
Pulseshaping-Rx                     :
Pulseshaping-Tx                     :   TRUE
Loopback-type                       :   none
PRBS-type                           :   none
Losi-Enabled                        :
PRBS-IN-SYNC                        :   FALSE
Current PRBS BER                    :   nan
Current BER Period                  :   1000 ms
Current PRE FEC BER                 :   4.560457e-04
Current POST FEC BER                :
Current Chromatic Dispersion        :   5 ps/nm
Current Differential Group Delay    :   6 ps
Tx-Disable                          :   FALSE
TX-Output-Power                     :   0.00 dBm
```

```
TX-Laser-freq                        :   193500000.000000 MHz
Min-LaserFreq                        :   191150000.000000 MHz
Max-LaserFreq                        :   196100000.000000 MHz
Current TX Laser Freq                :   193500000.000000 MHz
Grid-Spacing                         :   6.25-ghz
Laser-Grid                           :   100-ghz 50-ghz 25-ghz 12.5-ghz 6.25-ghz
Current Output Power                 :   -0.18 dBm
Current Input Power                  :   -1.79 dBm
Current Post VOA Power               :
Current Prov~ Chnl Power             :   -2.44 dBm
Current Post VOA Prov~ Chnl Power    :   -2.44 dBm
Current OSNR Estimate                :   25.00 dB
Current Q-Margin                     :   3.50 dB
Current Uncorrected Block-count      :   0
Laser Age                            :   0 %

-------------------------------------------------------------
SLOT-ID : 1   HOSTIF : 0
-------------------------------------------------------------
Fec-type                             :   none
Loopback-type                        :   none
Current PRE FEC BER                  :   nan
-------------------------------------------------------------
SLOT-ID : 1   HOSTIF : 1
-------------------------------------------------------------
Fec-type                             :   none
Loopback-type                        :   none
Current PRE FEC BER                  :   nan

XC_node2#sh run interface ce17
!
interface ce17
!
```

Cross-Connect Validation

```
XC_node1# sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
* - Active Endpoint, none - not configured Cross-connect name : OSPF_BFD_BGP
EP1:ce11/1EP2:ce29Revertive:NoBkp_EP1:NoneBkp_EP2:None Admin Status:UPOper Status:UP
+=============================================================================================
============================+
| EP| OVID| IVID| Rx packets| Rx bytes| Tx packets|Tx bytes
|Interface Status|
+=============================================================================================
============================+
| EP1*
|UP|   -
|   |   -   |0  |0  |0  |0
| EP2*
|UP|   -
|   |   -   |0  |0  |0  |0
```

```
+=============================================================================================
============================+
cross-connect summary Total XC   : 1
Admin Up : 1
Admin Down : 0
Total Rules  : 1

XC_node1#show running-config cross-connect
cross-connect OSPF_BFD_BGP
 ep1 ce11/1 ep2 ce29

XC_node2# sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
* - Active Endpoint, none - not configured Cross-connect name : OSPF_BFD_BGP-1
EP1:ce17EP2:ce11/1Revertive:NoBkp_EP1:NoneBkp_EP2:None Admin Status:UPOper Status:UP
+=============================================================================================
============================+
| EP| OVID| IVID| Rx packets| Rx bytes| Tx packets|Tx bytes
|Interface Status|
+=============================================================================================
============================+
| EP1*
|UP|   -
|   |   -   |0  |0  |0  |0
| EP2*
|UP|   -
|   |   -   |0  |0  |0  |0
+=============================================================================================
============================+
cross-connect summary Total XC   : 1
Admin Up : 1
Admin Down : 0
Total Rules  : 1

XC_node2#show running-config cross-connect
cross-connect OSPF_BFD_BGP-1
 ep1 ce17 ep2 ce11/1
```

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
       Instance ID
2.2.2.2           1   Full/Backup     00:00:37    10.10.10.2      xe1/1
           0

R2#show ip ospf neighbor
Total number of full neighbors: 1
OSPF process 10 VRF(default):
```

```
Neighbor ID     Pri   State           Dead Time   Address         Interface
       Instance ID
1.1.1.1           1   Full/Backup     00:00:38    10.10.10.1      xe49/1
          0
```

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#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 : 00000000000000117138              Pkt Out : 00000000000000117172
Pkts Drop : 0000000000000000000            Auth Pkts Drop : 00000000000000000000
Echo Out : 0000000000000000000             IPv6 Echo Out : 0000000000000000000
IPv6 Pkt In : 00000000000000000000         IPv6 Pkt Out : 00000000000000000000
UP Count : 1                               UPTIME : 00:05:42

Protocol Client Info:
OSPF-> Client ID: 4      Flags: 4
------------------------------------------------------
Number of Sessions:    1

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 : 00000000000000044905              Pkt Out : 00000000000000044905
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 Vaildation

```
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
```

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

XC_node1#sh interface counters rate gbps
+------------------+-------------+------------+-------------+------------+
|     Interface    |    Rx gbps  |    Rx pps  |    Tx gbps  |    Tx pps  |
+------------------+-------------+------------+-------------+------------+
 ce11/1              6.91          13082437     6.91          13082437
 ce29                6.91          13082457     6.91          13082458

XC_node1# sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
* - Active Endpoint, none - not configured Cross-connect name : OSPF_BFD_BGP
EP1:ce11/1EP2:ce29Revertive:NoBkp_EP1:NoneBkp_EP2:None Admin Status:UPOper Status:UP
+=============================================================================================
============================+
```

```
| EP| OVID| IVID| Rx packets| Rx bytes| Tx packets|Tx bytes
|Interface Status|
+=========================================================================================
============================+
| EP1*
|UP|   -
|   |   -   |13082437|1674551936|13082437|1674551936
| EP2*
|UP|   -
|   |   -   |13082457|1674554496|13082457|1674554496
+=========================================================================================
============================+
cross-connect summary Total XC   : 1
Admin Up : 1
Admin Down : 0
Total Rules  : 1

XC_node2#sh interface counters rate gbps
+------------------+-------------+-------------+-------------+-------------+
|     Interface    |    Rx gbps  |    Rx pps   |    Tx gbps  |    Tx pps   |
+------------------+-------------+-------------+-------------+-------------+
 ce11/1              6.91          13082428      6.91          13082429
 ce17                6.91          13082381      6.91          13082378

XC_node2# sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
* - Active Endpoint, none - not configured Cross-connect name : OSPF_BFD_BGP-1
EP1:ce17EP2:ce11/1Revertive:NoBkp_EP1:NoneBkp_EP2:None Admin Status:UPOper Status:UP
+=========================================================================================
============================+
| EP| OVID| IVID| Rx packets| Rx bytes| Tx packets|Tx bytes
|Interface Status|
+=========================================================================================
============================+
| EP1*
|UP|   -
|   |   -   |13082428|1674550784|13082429|1674550784
| EP2*
|UP|   -
|   |   -   |13082381|1674544768|13082381|1674544768
+=========================================================================================
============================+
cross-connect summary Total XC   : 1
Admin Up : 1
Admin Down : 0
Total Rules  : 1
```

```
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
```

Cross-connect using Dynamic/Static LAG

The following configuration example illustrates configuration of cross-connect using LAG interfaces on XC Nodes.

Topology

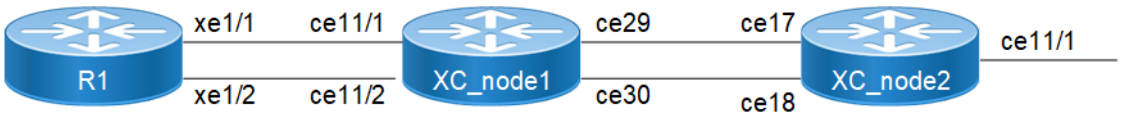

Figure 1-2: Cross-connect using LAG Interfaces

R1

`#configure terminal`	Enter configure mode
`(config)#interface po100`	Create Port channel interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface xe1/1`	Enter into interface mode
`(config-if)#channel-group 100 mode active`	Adding member port to the port channel interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface xe1/2`	Enter into interface level
`(config-if)#channel-group 100 mode active`	Adding member port to the port channel interface
`(config-if)#commit`	Commit the configuration

XC_node1

`#configure terminal`	Enter configure mode
`(config)#interface po100`	Create Port channel interface
`(config-if)#switchport`	Configuring Switchport to the interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface po200`	Create Port channel interface
`(config-if)#switchport`	Configuring Switchport to the interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface ce11/1`	Enter into interface level
`(config-if)#channel-group 100 mode active`	Adding member port to the port channel interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface ce11/2`	Enter into interface level

(config-if)#channel-group 100 mode active	Adding member port to the port channel interface
(config-if)#exit	Exiting from interface level
(config)#interface ce29	Enter into interface level
(config-if)#channel-group 200 mode active	Adding member port to the port channel interface
(config-if)#exit	Exiting from interface level
(config)#interface ce30	Enter into interface level
(config-if)#channel-group 200 mode active	Adding member port to the port channel interface
(config-if)#exit	Exiting from interface level
(config)#cross-connect lag	Create cross-connect by providing the name
(config-XC)#ep1 po100 ep2 po200	Adding end-points ep1 and ep2 as lag interfaces
(config-XC)#exit	Exit Cross-connect mode
(config)#commit	Commit the configuration

XC_node2

#configure terminal	Enter configure mode
(config)#interface po200	Create Port channel interface
(config-if)#switchport	Configuring Switchport to the interface
(config-if)#exit	Exiting from interface level
(config)#interface ce29	Enter into interface level
(config-if)#channel-group 200 mode active	Adding member port to the port channel interface
(config-if)#exit	Exiting from interface level
(config)#interface ce30	Enter into interface level
(config-if)#channel-group 200 mode active	Adding member port to the port channel interface
(config-if)#exit	Exiting from interface level
(config)#interface ce11/1	Enter into interface level
(config-if)#switchport	Configuring Switchport to the interface
(config-if)#exit	Exiting from interface level
(config)#cross-connect lag	Create cross-connect by providing the name
(config-XC)#ep1 po100 ep2 ce11/1	Adding end-points ep1 and ep2 as lag interfaces
(config-XC)#exit	Exit Cross-connect mode
(config)#commit	Commit the configuration

Validation

Cross-connect using Dynamic LAG on XC_node1

```
# sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
* - Active Endpoint, none - not configured Cross-connect name : lag
EP1:po100EP2:po200Revertive:NoBkp_EP1:NoneBkp_EP2:None Admin Status:UPOper Status:UP
+=============================================================================
============================+
| EP| OVID| IVID| Rx packets| Rx bytes| Tx packets|Tx bytes
|Interface Status|
```

```
+=============================================================================================
============================+
| EP1*
|UP|   -
|   |   -   |0  |0  |0  |0
| EP2*
|UP|   -
|   |   -   |0  |0  |0  |0
+=============================================================================================
============================+
cross-connect summary Total XC   : 1
Admin Up : 1
Admin Down : 0
Total Rules  : 1

#sh running-config cross-connect
!
cross-connect lag
 ep1 po100 ep2 po200
!

#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

```
# sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
* - Active Endpoint, none - not configured Cross-connect name : lag
EP1:po200EP2:ce11/1Revertive:NoBkp_EP1:NoneBkp_EP2:None Admin Status:UPOper Status:UP
+=============================================================================================
============================+
| EP| OVID| IVID| Rx packets| Rx bytes| Tx packets|Tx bytes
|Interface Status|
+=============================================================================================
============================+
| EP1*
|UP|   -
|   |   -   |0  |0  |0  |0
| EP2*
|UP|   -
|   |   -   |0  |0  |0  |0
```

```
+=============================================================================================
============================+
cross-connect summary Total XC   : 1
Admin Up : 1
Admin Down : 0
Total Rules  : 1

#show running-config cross-connect
!
cross-connect lag
 ep1 po200 ep2 ce11/1

#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

R1

`#configure terminal`	Enter configure mode
`(config)#interface sa100`	Create static LAG interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface xe1/1`	Enter into interface mode
`(config-if)#static-channel-group 100`	Adding member port to the static LAG interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface xe1/2`	Enter into interface level
`(config-if)#static-channel-group 100`	Adding member port to the static LAG interface
`(config-if)#commit`	Commit the configuration

XC_node1

`#configure terminal`	Enter configure mode
`(config)#interface sa100`	Create static LAG interface
`(config-if)#switchport`	Configuring Switchport to the interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface sa200`	Create static LAG interface
`(config-if)#switchport`	Configuring Switchport to the interface
`(config-if)#exit`	Exiting from interface level
`(config)#interface ce11/1`	Enter into interface level
`(config-if)#static-channel-group 100`	Adding member port to the static LAG interface
`(config-if)#exit`	Exiting from interface level

(config)#interface ce11/2	Enter into interface level
(config-if)#static-channel-group 100	Adding member port to the static LAG interface
(config-if)#exit	Exiting from interface level
(config)#interface ce29	Enter into interface level
(config-if)#static-channel-group 200	Adding member port to the static LAG interface
(config-if)#exit	Exiting from interface level
(config)#interface ce30	Enter into interface level
(config-if)#static-channel-group 200	Adding member port to the static LAG interface
(config-if)#exit	Exiting from interface level
(config)#cross-connect static-lag	Create cross-connect by providing the name
(config-XC)#ep1 sa100 ep2 sa200	Adding end-points ep1 and ep2 as lag interfaces
(config-XC)#exit	Exit Cross-connect mode
(config)#commit	Commit the configuration

XC_node2

#configure terminal	Enter configure mode
(config)#interface sa200	Create static LAG interface
(config-if)#switchport	Configuring Switchport to the interface
(config-if)#exit	Exiting from interface level
(config)#interface ce29	Enter into interface level
(config-if)#static-channel-group 200	Adding member port to the static LAG interface
(config-if)#exit	Exiting from interface level
(config)#interface ce30	Enter into interface level
(config-if)#static-channel-group 200	Adding member port to the static LAG interface
(config-if)#exit	Exiting from interface level
(config)#interface ce11/1	Enter into interface level
(config-if)#switchport	Configure switchport to the interface
(config-if)#exit	Exiting from interface level
(config)#cross-connect static-lag	Create cross-connect by providing the name
(config-XC)#ep1 po200 ep2 ce11/1	Adding end-points ep1 and ep2 as lag interfaces
(config-XC)#exit	Exit Cross-connect mode
(config)#commit	Commit the configuration

Validation

Cross-connect using Static LAG on XC_node1

```
#sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
* - Active Endpoint, none - not configured Cross-connect name : static-lag
EP1:sa100EP2:sa200Revertive:NoBkp_EP1:NoneBkp_EP2:None Admin Status:UPOper Status:UP
+=============================================================================
===========================+
```

```
| EP| OVID| IVID| Rx packets| Rx bytes| Tx packets|Tx bytes
|Interface Status|
+=============================================================================================
============================+
| EP1*
|UP|   -
|   |   -   |0  |0  |0  |0
| EP2*
|UP|   -
|   |   -   |0  |0  |0  |0
+=============================================================================================
============================+
cross-connect summary Total XC   : 1
Admin Up : 1
Admin Down : 0
Total Rules  : 1
```

Cross-connect using Static Lag on XC_node2

```
# sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
* - Active Endpoint, none - not configured Cross-connect name : static-lag
EP1:sa200EP2:ce11/1Revertive:NoBkp_EP1:NoneBkp_EP2:None Admin Status:UPOper Status:UP
+=============================================================================================
============================+
| EP| OVID| IVID| Rx packets| Rx bytes| Tx packets|Tx bytes
|Interface Status|
+=============================================================================================
============================+
| EP1*
|UP|   -
|   |   -   |0  |0  |0  |0
| EP2*
|UP|   -
|   |   -   |0  |0  |0  |0
+=============================================================================================
============================+
cross-connect summary Total XC   : 1
Admin Up : 1
Admin Down : 0
Total Rules  : 1
```

Disable Cross-connect on XC_node1

`#configure terminal`	Enter configure mode
`(config)#cross-connect lag`	Create cross-connect by providing the name
`(config-XC)#disable`	Disabling the Cross-connect
`(config-XC)#exit`	Exit Cross-connect mode
`(config)#commit`	Commit the configuration

Validation

Disable the cross-connect on XC node1

```
# sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
* - Active Endpoint, none - not configured Cross-connect name : lag
EP1:po100EP2:po200Revertive:NoBkp_EP1:NoneBkp_EP2:None Admin Status:DOWNOper
Status:DOWN
+=============================================================================================
============================+
| EP| OVID| IVID| Rx packets| Rx bytes| Tx packets|Tx bytes
|Interface Status|
+=============================================================================================
============================+
| EP1*
|UP|   -
|   |   -   |13082428|1674550784|13082429|1674550784
| EP2*
|UP|   -
|   |   -   |13082381|1674544768|13082381|1674544768
+=============================================================================================
============================+
cross-connect summary Total XC: 1
Admin Up : 0 Admin Down : 1 Total Rules : 0
```

Enable Cross-connect on XC_node1

`#configure terminal`	Enter configure mode
`(config)#cross-connect lag`	Create cross-connect by providing the name
`(config-XC)#no disable`	Enable the Cross-connect
`(config-XC)#exit`	Exit Cross-connect mode
`(config)#commit`	Commit the configuration

Validation

Cross-connect after enable on XC_node1

```
# sh cross-connect
Codes: EP - Endpoint, Bkp_EP - Backup endpoint
* - Active Endpoint, none - not configured Cross-connect name : lag
EP1:po100EP2:po200Revertive:NoBkp_EP1:NoneBkp_EP2:None Admin Status:UPOper Status:UP
+=============================================================================================
============================+
| EP| OVID| IVID| Rx packets| Rx bytes| Tx packets|Tx bytes
|Interface Status|
+=============================================================================================
============================+
| EP1*
|UP|   -
```

```
|   |   -   |13082428|1674550784|13082429|1674550784
| EP2*
|UP |   -
|   |   -   |13082381|1674544768|13082381|1674544768
+=============================================================================================
============================+
cross-connect summary  Total XC: 1
Admin Up : 1 Admin Down : 0 Total Rules : 1
```

CHAPTER 2 Cross-Connect (XC) Resiliency

This Chapter contains the cross-connect resiliency configuration example.

Overview

This feature is to support resiliency to port level cross connect link by providing backup link if primary link goes down. Whenever, any of the endpoint of cross-connect goes down, pre-configured backup endpoint will be chosen and cross-connect will be up with backup endpoint. Same backup endpoints cannot be used in another cross-connect.

This following are the types of end points supported as backup endpoints.

1. Native Ethernet interface
2. LAG interface

Topology

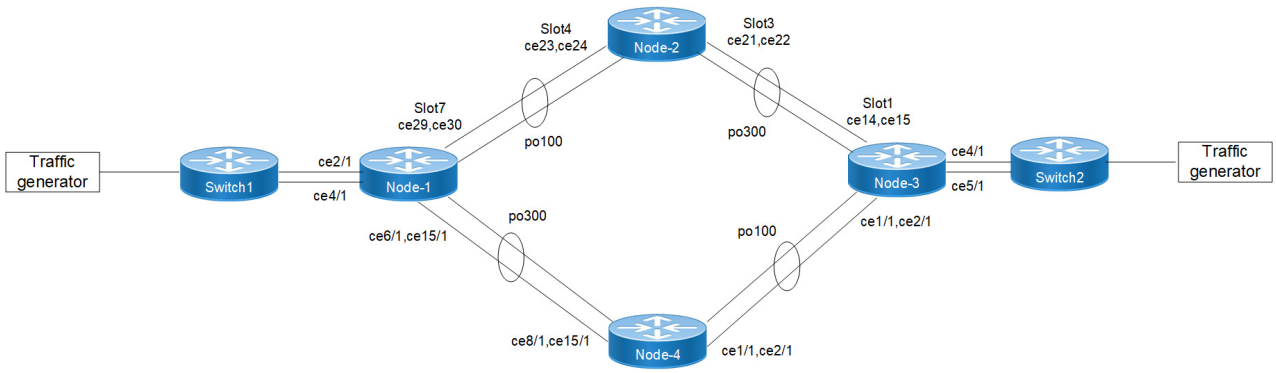

Figure 2-1: Cross-connect Resiliency Topology

LFPT (Link-Fault-Pass-Through)

If one endpoint goes down, other endpoint of the link should get notified and port status should be made 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, so the traffic flows via backup EP1 i.e., po300.But when po100 comes up on Node-1 then the traffic need to switch from backup EP to primary EP i.e., from po300 to po100

Node-1

`#configure terminal`	Enter configure mode
`(config)#hostname Node-1`	Configure the hostname

(config)#coherent-module 7	Enter into coherent-module
(config-module)#enable	Enabling the coherent module
(config-module)#exit	Exiting the coherent module
(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
(config-XC)#commit	Commit the configuration

Node-2

`#configure terminal`	Enter configure mode
`(config)#hostname Node-2`	Configure the hostname
`(config)#coherent-module 4`	Enter into coherent-module
`(config-module)#enable`	Enabling the coherent module
`(config-module)#exit`	Exit from coherent module mode
`(config)#coherent-module 3`	Enter into coherent-module
`(config-module)#enable`	Enabling the coherent module
`(config-module)#exit`	Exiting the coherent module
`(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
`(config-XC)#commit`	Commit the configuration

Node-3

`#configure terminal`	Enter configure mode
`(config)#hostname Node-3`	Configure the hostname

(config)#coherent-module 1	Enter into coherent-module
(config-module)#enable	Enabling the coherent module
(config-module)#exit	Exiting the coherent module
(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
(config-XC)#commit	Commit the configuration

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
`(config-XC)#commit`	Commit the configuration

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)#commit`	Commit the configuration
`(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)#commit	Commit the configuration
(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|
+=============================================================================================
============================+
| 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
```

CHAPTER 3 CFM over xConnect Configuration

This chapter contains a complete example of CFM over xConnect configuration.

The main objective of this feature 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 OTN platforms.

Topology

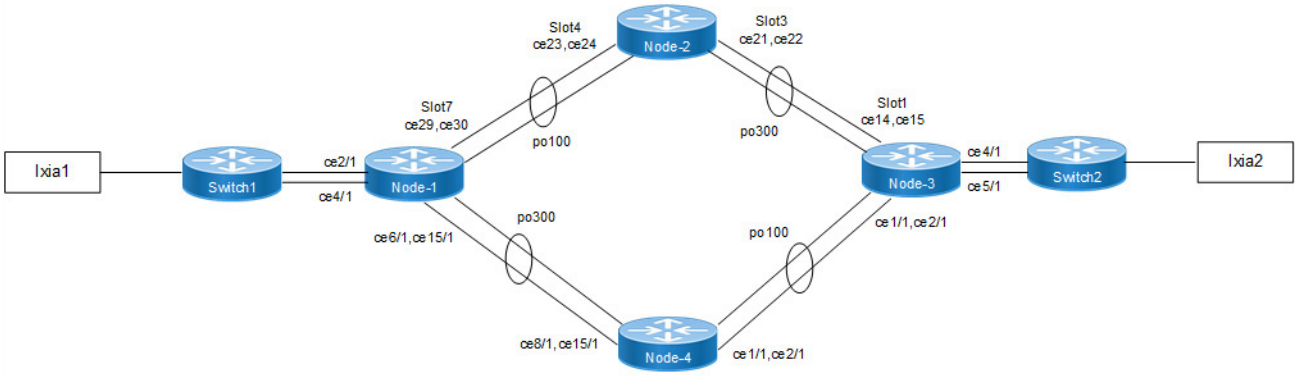

Figure 3-1: CFM over xConnect Topology

Node-1

`#configure terminal`	Enter configure mode
`(config)# hostname Node-1`	Configure the hostname.
`(config)#coherent-module 7`	Enter into coherent-module
`(config-module)#enable`	Enabling the coherent module
`(config-module)#exit`	Exiting the coherent module
`(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)#coherent-module 4`	Enter into coherent-module
`(config-module)#enable`	Enabling the coherent module
`(config-module)#exit`	Exit from coherent module mode
`(config)#coherent-module 3`	Enter into coherent-module
`(config-module)#enable`	Enabling the coherent module
`(config-module)#exit`	Exit from coherent module mode
`(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)#coherent-module 1	Enter into coherent-module
(config-module)#enable	Enabling the coherent module
(config-module)#exit	Exit from coherent module mode
(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
```

Layer 1 Command Reference

CHAPTER 1 Port Based xConnect Commands

This chapter contains the port based xConnect commands.

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-OTN version 4.2.

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

xc-name	Cross-connect name

Default

None

Command Mode

Configure mode

Applicability

This command was introduced in OcNOS-OTN version 1.1.0.

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-OTN version 4.2.

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-OTN version 1.1.0.

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-OTN version 1.1.0.

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-OTN version 4.2.

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-OTN version 1.1.0.

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
```

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