Configuring the Card Mode

This chapter lists the supported configurations and the procedures to configure the card mode on the line cards.

Note Unless otherwise specified, “line cards” refers to 1.2T and 1.2TL line cards.

1.2T and 1.2TL Line Cards

The following section describes the supported configurations and procedures to configure the card modes on the line cards.

Card Modes

The line cards support module and slice configurations.

The line cards have two trunk ports (0 and 1) and 12 client ports (2 through 13) each. You can configure the line card in two modes:

- Muxponder—In this mode, both trunk ports are configured with the same trunk rate. The client-to-trunk mapping is in a sequence.
- Muxponder slice—In this mode, each trunk port is configured independent of the other with different trunk rates. The client-to-trunk mapping is fixed. For Trunk 0, the client ports are 2 through 7. For Trunk 1, the client ports are 8 through 13.

Sub 50G Configuration

You can configure the sub 50G or coupled mode on the line card only in the muxponder mode. The following table displays the port configuration for the supported data rates.

Trunk Data Rate (per trunk)	Total Configured Data rate	Card Support	Trunk Ports	Client Ports for Trunk 0 (100G)	Shared Client Port (50G per trunk)	Client Ports for Trunk 1 (100G)
50G	100G	1.2T, 1.2TL	0, 1	-	2	-
150G	300G	1.2T, 1.2TL	0, 1	2	3	4
250G	500G	1.2T, 1.2TL	0, 1	2, 3	4	5, 6
350G	700G	1.2T, 1.2TL	0, 1	2, 3, 4	5	6, 7, 8
450G	900G	1.2T	0, 1	2, 3, 4, 5	6	7, 8, 9, 10
550G	1.1T	1.2T	0, 1	2, 3, 4, 5, 6	7	8, 9, 10, 11, 12

From Release 7.5.2, 1.2T and 1.2TL line cards support an alternate port configuration for Sub 50G (split client port mapping) that you configure using CLI. The following table displays the port configuration for the supported data rates.

Trunk Data Rate (per trunk)	Total Configured Data rate	Card Support	Trunk Ports	Client Ports for Trunk 0 (100G)	Shared Client Port (50G per trunk)	Client Ports for Trunk 1 (100G)
50G	100G	1.2T, 1.2TL	0, 1	-	7	-
150G	300G	1.2T, 1.2TL	0, 1	2	7	8
250G	500G	1.2T, 1.2TL	0, 1	2, 3	7	8, 9
350G	700G	1.2T, 1.2TL	0, 1	2, 3, 4	7	8, 9, 10
450G	900G	1.2T	0, 1	2, 3, 4, 5	7	8, 9, 10, 11
550G	1.1T	1.2T	0, 1	2, 3, 4, 5, 6	7	8, 9, 10, 11, 12

Note In all x50G configurations, client traffic on the middle port is affected with ODUK-BDI and LF alarms after the **power cycle or link flap** on the trunk side. This issue is raised when the two network lanes work in coupled mode and move from low to high power. To solve this issue, create a new frame either at the near-end or far-end by performing **shut** or **no shut** of the trunk ports.

Coupled Mode Restrictions

The following restrictions apply to the coupled mode configuration:

- Both trunk ports must be configured with the same bits-per-symbol or baud rate and must be sent over same fiber and direction.
- The chromatic dispersion must be configured to the same value for both trunk ports.

- When trunk internal loopback is configured, it must be done for both trunk ports. Configuring internal loopback on only one trunk results in traffic loss.
- Fault on a trunk port of a coupled pair may cause errors on all clients including those running only on the unaffected trunk port.

Configure Split Client Port Mapping

Table 1: Feature History

Feature Name	Release Information	Description
Split Client Port Mapping	Cisco IOS XR Release 7.5.2	A new trunk port to client port mapping for sub 50G configurations is now available on the 1.2T C band, 1.2T L band, and 800G QSFP-DD Transponder line cards. In this mapping, the same shared client port is used for all Sub 50G trunk data rates, eliminating recabling while changing the data rates.

You can configure the trunk port to client port mapping for sub 50G data ratesin the default mode or in the split client port mapping mode.

In the default mode, consecutive client ports carry the information. For example, on a 2-QDD-C card, if the trunk data rate per trunk is 150G, client ports 2, 3, and 4 carry the data and client port 3 is the shared client port. For a trunk data rate of 250G, client ports 2, 3, 4, 5, and 6 carry the data and client port 4 is the shared client port. However, if you configure split client port mapping, trunk port to client port mapping is fixed. The shared client port is client port 5 for 2-QDD-C card and client port 7 for 1.2T and 1.2TL cards.

To configure the split client port mapping, use the following commands.

configure

hw-module location *location* **mxponder**

split-client-port-mapping

commit

The following is a sample in which split-client-port-mapping is configured with a 450G trunk payload.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#split-client-port-mapping
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#end
```

To remove the split client port-mapping configuration and configure default client port mapping, use the following commands.

configure

hw-module location *location* **mxponder**

no split-client-port-mapping

commit

The following is a sample in which split client port-mapping configuration is removed.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#no split-client-port-mapping
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#end
```

Verifying the Port Mapping Configuration

The following is a sample ouput of the split client port-mapping.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder

Location:             0/1
Client Bitrate:       100GE
Trunk  Bitrate:       450G
Status:               Provisioning In Progress
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/1/0/0
CoherentDSP0/1/0/1
                                Traffic Split Percentage

HundredGigECtrlr0/1/0/2         ODU40/1/0/0/1                         100
       0
HundredGigECtrlr0/1/0/3         ODU40/1/0/0/2                         100
       0
HundredGigECtrlr0/1/0/4         ODU40/1/0/0/3                         100
       0
HundredGigECtrlr0/1/0/5         ODU40/1/0/0/4                         100
       0
HundredGigECtrlr0/1/0/7         ODU40/1/0/0/5                          50
      50
HundredGigECtrlr0/1/0/8         ODU40/1/0/1/1                           0
     100
HundredGigECtrlr0/1/0/9         ODU40/1/0/1/2                           0
     100
HundredGigECtrlr0/1/0/10        ODU40/1/0/1/3                           0
     100
HundredGigECtrlr0/1/0/11        ODU40/1/0/1/4                           0
     100
```

The following is a sample ouput of the default client port mapping.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder

Location:             0/1
Client Bitrate:       100GE
Trunk  Bitrate:       450G
Status:               Provisioning In Progress
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/1/0/0
CoherentDSP0/1/0/1
                                Traffic Split Percentage

HundredGigECtrlr0/1/0/2         ODU40/1/0/0/1                         100
       0
HundredGigECtrlr0/1/0/3         ODU40/1/0/0/2                         100
       0
HundredGigECtrlr0/1/0/4         ODU40/1/0/0/3                         100
       0
```

```
HundredGigECtrlr0/1/0/5         ODU40/1/0/0/4                        100
       0
HundredGigECtrlr0/1/0/6         ODU40/1/0/0/5                         50
      50
HundredGigECtrlr0/1/0/7         ODU40/1/0/1/1                          0
     100
HundredGigECtrlr0/1/0/8         ODU40/1/0/1/2                          0
     100
HundredGigECtrlr0/1/0/9         ODU40/1/0/1/3                          0
     100
HundredGigECtrlr0/1/0/10        ODU40/1/0/1/4                          0
     100
```

Supported Data Rates

The following data rates are supported on the line card.

In R7.0.1, you can configure the client port to OTU4 only in the muxponder mode. In R7.1.1 and later releases, you can configure the client port to OTU4 in both the muxponder and muxponder slice modes. In muxponder slice mode, both the slices must be configured with either OTU4 or 100GE Ethernet client rates in R7.1.1. In R7.2.0, a mixed configuration of OTU4 and 100GE is supported in the muxponder slice mode. LLDP drop, L1 encryption, and AINS are not supported on the OTU4 configuration.

The following table displays the client and trunk ports that are enabled for the muxponder configuration.

Trunk Data Rate	Card Support	Client Data Rate (100GE, OTU4)	Trunk Ports	Client Ports
100	1.2T, 1.2TL	100GE, OTU4	0, 1	2, 3
200	1.2T, 1.2TL	100GE, OTU4	0, 1	2, 3, 4, 5
300	1.2T, 1.2TL	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7
400	1.2T, 1.2TL	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7, 8, 9
500	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7, 8, 9, 10, 11
600	1.2T	100GE, OTU4	0, 1	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

The following table displays the client and trunk ports that are enabled for the muxponder slice 0 configuration.

Trunk Data Rate	Card Support	Client Data Rate	Trunk Ports	Client Ports
100	1.2T, 1.2TL	100, OTU4	0	2
200	1.2T, 1.2TL	100, OTU4	0	2, 3
300	1.2T, 1.2TL	100, OTU4	0	2, 3, 4
400	1.2T, 1.2TL	100, OTU4	0	2, 3, 4, 5
500	1.2T	100, OTU4	0	2, 3, 4, 5, 6
600	1.2T	100, OTU4	0	2, 3, 4, 5, 6, 7

The following table displays the client and trunk ports that are enabled for the muxponder slice 1 configuration.

Trunk Data Rate	Card Support	Client Data Rate	Trunk Ports	Client Ports
100	1.2T, 1.2TL	100, OTU4	1	8
200	1.2T, 1.2TL	100, OTU4	1	8, 9
300	1.2T, 1.2TL	100, OTU4	1	8, 9, 10
400	1.2T, 1.2TL	100, OTU4	1	8, 9, 10, 11
500	1.2T	100, OTU4	1	8, 9, 10, 11, 12
600	1.2T	100, OTU4	1	8, 9, 10, 11, 12, 13

All configurations can be accomplished by using appropriate values for client bitrate and trunk bitrate parameters of the **hw-module** command.

The following table displays the trunk parameter ranges for the 1.2T card.

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
50G	15%	1	1.3125	24.0207911	31.5272884
50G	27%	1	1.4453125	24.0207911	34.7175497
100G	15%	1	2.625	24.0207911	63.0545768
100G	27%	1	2.890625	24.0207911	69.4350994
150G	15%	1.3203125	3.9375	24.0207911	71.6359689
150G	27%	1.453125	4.3359375	24.0207911	71.6749413
200G	15%	1.7578125	5.25	24.0207911	71.7420962
200G	27%	2	4.40625	31.51	69.43
250G	15%	2.1953125	6	26.2727403	71.8059237
250G	27%	2.4140625	6	28.9312914	71.9068991
300G	15%	2.6328125	6	31.5272884	71.8485385
300G	27%	2.8984375	6	34.7175497	71.8681352
350G	15%	3.0703125	6	36.7818364	71.8790086
350G	27%	3.3828125	6	40.503808	71.8404724
400G	15%	3.5078125	6	42.0363845	71.9018782
400G	27%	3.8671875	6	46.2900663	71.8197392
450G	15%	3.9453125	6	47.2909326	71.9196757

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
450G	27%	4.34375	6	52.0763245	71.9327648
500G	15%	4.3828125	6	52.5454806	71.93392
500G	27%	4.8281250	6	57.8625828	71.9068991
550G	15%	4.8203125	6	57.8000287	71.9455787
550G	27%	5.3125	6	63.6488411	71.88575
600G	15%	5.2578125	-	-	71.9552971

The following table displays the trunk parameter ranges for the 1.2TL card.

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
100G	15%	1	2.625	24.0207911	63.0545768
100G	27%	1	2.890625	24.0207911	69.4350994
150G	15%	1.3203125	3.9375	24.0207911	71.6359689
150G	27%	1.453125	4.3359375	24.0207911	71.6749413
200G	15%	2	4	31.5272884	63.0545768
200G	27%	2	4.40625	31.51664088	69.43509943
250G	15%	2.1953125	4.5	35.0303204	71.8059237
250G	27%	2.4140625	4.5	38.5750552	71.9068991
300G	15%	2.6328125	4.5	42.0363845	71.8485385
300G	27%	2.8984375□	4.5	46.2900662857142	71.86813526
350G	15%	3.0703125	4.5	49.0424486	71.8790086
350G	27%	3.3828125	4.5	54.0050773	71.8404724
400G	15%	3.5078125	4.5	56.0485127	71.9018782
400G	27%	3.8671875	4.5	61.72008838	71.81973921

To configure the BPS, see Configuring the BPS, on page 13.

Configuring the Card Mode

You can configure the line card in the module (muxponder) or slice configuration (muxponder slice).

To configure the card in the muxponder mode, use the following commands.

configure

hw-module location *location* **mxponder client-rate {100GE | OTU4}**

hw-module location *location* **mxponder trunk-rate** {**50G | 100G150G | 200G | 250G | 300G | 350G | 400G | 450G | 500G | 550G | 600G** }

commit

To configure the card in the muxponder slice mode, use the following commands.

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number* **client-rate { 100GE|OTU4}**

hw-module location *location* **mxponder-slice trunk-rate** { **100G | 200G | 300G | 400G | 500G | 600G** }

commit

Examples

The following is a sample in which the card is configured in the muxponder mode with a 550G trunk payload.

```
RP/0/RP0/CPU0:ios#config
Tue Oct 15 01:24:56.355 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder trunk-rate 550G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder mode with a 500G trunk payload.

```
RP/0/RP0/CPU0:ios#config
Sun Feb 24 14:09:33.989 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder client-rate OTU4
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder trunk-rate 500G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder slice 0 mode with a 500G trunk payload.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0 client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0 trunk-rate 500G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder slice 1 mode with a 400G trunk payload.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1 client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1 trunk-rate 400G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured with mixed client rates in the muxponder slice mode.

```
RP/0/RP0/CPU0:ios#configure
Mon Mar 23 06:10:22.227 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0 client-rate OTU4 trunk-rate
 500G
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1 client-rate 100GE trunk-rate
 500G
RP/0/RP0/CPU0:ios(config)#commit
```

Verifying the Card Configuration

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2 mxponder
Fri Mar 15 11:48:48.344 IST

Location:             0/2
Client Bitrate:       100GE
Trunk  Bitrate:       500G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
Client Port            Mapper/Trunk Port   CoherentDSP0/2/0/0  CoherentDSP0/2/0/1
                     Traffic Split Percentage

HundredGigECtrlr0/2/0/2  ODU40/2/0/0/1               100                  0
HundredGigECtrlr0/2/0/3  ODU40/2/0/0/2               100                  0
HundredGigECtrlr0/2/0/4  ODU40/2/0/0/3               100                  0
HundredGigECtrlr0/2/0/5  ODU40/2/0/0/4               100                  0
HundredGigECtrlr0/2/0/6  ODU40/2/0/0/5               100                  0
HundredGigECtrlr0/2/0/7  ODU40/2/0/1/1                 0                100
HundredGigECtrlr0/2/0/8  ODU40/2/0/1/2                 0                100
HundredGigECtrlr0/2/0/9  ODU40/2/0/1/3                 0                100
HundredGigECtrlr0/2/0/10 ODU40/2/0/1/4                 0                100
HundredGigECtrlr0/2/0/11 ODU40/2/0/1/5                 0                100
```

The following is a sample ouput of the coupled mode configuration where the shared client port is highlighted.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder
Tue Oct 15 01:25:57.358 UTC

Location:             0/1
Client Bitrate:       100GE
Trunk  Bitrate:       550G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
Client Port           Mapper/Trunk Port    CoherentDSP0/1/0/0 CoherentDSP0/1/0/1
                   Traffic Split Percentage

HundredGigECtrlr0/1/0/2    ODU40/1/0/0/1             100                  0
HundredGigECtrlr0/1/0/3    ODU40/1/0/0/2             100                  0
HundredGigECtrlr0/1/0/4    ODU40/1/0/0/3             100                  0
HundredGigECtrlr0/1/0/5    ODU40/1/0/0/4             100                  0
HundredGigECtrlr0/1/0/6    ODU40/1/0/0/5             100                  0
HundredGigECtrlr0/1/0/7    ODU40/1/0/0/6              50                 50
HundredGigECtrlr0/1/0/8    ODU40/1/0/1/1               0                100
HundredGigECtrlr0/1/0/9    ODU40/1/0/1/2               0                100
HundredGigECtrlr0/1/0/10   ODU40/1/0/1/3               0                100
HundredGigECtrlr0/1/0/11   ODU40/1/0/1/4               0                100
HundredGigECtrlr0/1/0/12   ODU40/1/0/1/5               0                100
```

The following is a sample ouput of all the muxponder slice 0 configurations.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder-slice  0
Fri Mar 15 06:04:18.348 UTC

Location:             0/1
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       500G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/1/0/0
                                Traffic Split Percentage
```

```
HundredGigECtrlr0/1/0/2         ODU40/1/0/0/1                      100
HundredGigECtrlr0/1/0/3         ODU40/1/0/0/2                      100
HundredGigECtrlr0/1/0/4         ODU40/1/0/0/3                      100
HundredGigECtrlr0/1/0/5         ODU40/1/0/0/4                      100
HundredGigECtrlr0/1/0/6         ODU40/1/0/0/5                      100
```

The following is a sample ouput of all the muxponder slice 1 configurations.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder-slice 1
Fri Mar 15 06:11:50.020 UTC

Location:             0/1
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    TRUE
Client Port                     Mapper/Trunk Port          CoherentDSP0/1/0/1
                                Traffic Split Percentage

HundredGigECtrlr0/1/0/8         ODU40/1/0/1/1                      100
HundredGigECtrlr0/1/0/9         ODU40/1/0/1/2                      100
HundredGigECtrlr0/1/0/10        ODU40/1/0/1/3                      100
HundredGigECtrlr0/1/0/11        ODU40/1/0/1/4                      100
```

The following is a sample ouput of the muxponder slice 1 configuration with client configured as OTU4.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/0 mxponder-slice 1

Wed Mar 11 13:59:11.073 UTC

Location:             0/0
Slice ID:             1
Client Bitrate:       OTU4
Trunk  Bitrate:       200G
Status:               Provisioned
Client Port                     Peer/Trunk Port            CoherentDSP0/0/0/1
                              Traffic Split Percentage
OTU40/0/0/8                     ODU40/0/0/1/1                      100
OTU40/0/0/9                     ODU40/0/0/1/2                      100
```

The following is a sample to verify the mixed client rate configuration in the muxponder slice mode.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder
Mon Mar 23 06:20:22.227 UTC

Location:             0/1
Slice ID:             0
Client Bitrate:       OTU4
Trunk  Bitrate:       500G
Status:               Provisioned
Client Port                     Peer/Trunk Port            CoherentDSP0/1/0/0
                                Traffic Split Percentage

OTU40/1/0/2                     ODU40/1/0/0/1                      100
OTU40/1/0/3                     ODU40/1/0/0/2                      100
OTU40/1/0/4                     ODU40/1/0/0/3                      100
OTU40/1/0/5                     ODU40/1/0/0/4                      100
OTU40/1/0/6                     ODU40/1/0/0/5                      100


Location:             0/1
Slice ID:             1
Client Bitrate:       100GE
```

```
Trunk  Bitrate:       500G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/1/0/1
                                Traffic Split Percentage

HundredGigECtrlr0/1/0/8         ODU40/1/0/1/1                         100
HundredGigECtrlr0/1/0/9         ODU40/1/0/1/2                         100
HundredGigECtrlr0/1/0/10        ODU40/1/0/1/3                         100
HundredGigECtrlr0/1/0/11        ODU40/1/0/1/4                         100
HundredGigECtrlr0/1/0/12        ODU40/1/0/1/5                         100
```

Use the following command to clear alarm statistics on the optics or coherent DSP controller.

clear counters controller *controllertype R/S/I/P*

The following is a sample in which the alarm statistics are cleared on the coherent DSP controller.

```
RP/0/RP0/CPU0:ios#show controller coherentDSP 0/1/0/0
Tue Jun 11 05:15:12.540 UTC

Port                                            : CoherentDSP 0/1/0/0
Controller State                                : Up
Inherited Secondary State                       : Normal
Configured Secondary State                      : Normal
Derived State                                   : In Service
Loopback mode                                   : None
BER Thresholds                                  : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                          : Enable

Alarm Information:
LOS = 1 LOF = 1 LOM = 0
OOF = 1 OOM = 1 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 2      BDI = 2 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                                 : None

Bit Error Rate Information
PREFEC  BER                                     : 8.8E-03
POSTFEC BER                                     : 0.0E+00

TTI :
        Remote hostname                         : P2B8
        Remote interface                        : CoherentDSP 0/1/0/0
        Remote IP addr                          : 0.0.0.0

FEC mode                                        : Soft-Decision 15

AINS Soak                                       : None
AINS Timer                                      : 0h, 0m
AINS remaining time                             : 0 seconds
RP/0/RP0/CPU0:ios#clear counters controller coherentDSP 0/1/0/0
Tue Jun 11 05:17:07.271 UTC
All counters are cleared
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/1/0/1
Tue Jun 11 05:20:55.199 UTC

Port                                            : CoherentDSP 0/1/0/1
Controller State                                : Up
Inherited Secondary State                       : Normal
Configured Secondary State                      : Normal
Derived State                                   : In Service
```

```
Loopback mode                                   : None
BER Thresholds                                  : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                          : Enable

Alarm Information:
LOS = 0 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 0      BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0
Detected Alarms                                 : None

Bit Error Rate Information
PREFEC  BER                                     : 1.2E-02
POSTFEC BER                                     : 0.0E+00

TTI :
        Remote hostname                         : P2B8
        Remote interface                        : CoherentDSP 0/1/0/1
        Remote IP addr                          : 0.0.0.0

FEC mode                                        : Soft-Decision 15

AINS Soak                                       : None
AINS Timer                                      : 0h, 0m
AINS remaining time                             : 0 seconds
```

Regeneration Mode

In an optical transmission system, 3R regeneration helps extend the reach of the optical communication links by reamplifying, reshaping, and retiming the data pulses. Regeneration helps to correct any distortion of optical signals by converting it to an electrical signal, processing that electrical signal, and then retransmitting it again as an optical signal.

In Regeneration (Regen) mode, the OTN signal is received on a trunk port and the regenerated OTN signal is sent on the other trunk port of the line card and the other way round. In this mode, only the trunk optics controller and coherentDSP controllers are created.

Configuring the Card in Regen Mode

The supported trunk rates for the different cards are:

- 1.2T card—100G to 600G in multiples of 100G
- 1.2TL card—200G to 400G in multiples of 100G
- 2-QDD-C card—200G to 400G in multiples of 100G

To configure regen mode on 1.2T, 1.2TL, and 2-QDD-C cards, use the following commands:

configure

hw-module location *location*

regen

trunk-rate *trunk-rate*

commit

exit

Example

The following is a sample to configure the regen mode on 1.2T, 1.2TL, and 2-QDD-C line cards with the trunk-rate 300.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0
RP/0/RP0/CPU0:ios(config-hwmod)#regen
RP/0/RP0/CPU0:ios(config-regen)#trunk-rate 300
RP/0/RP0/CPU0:ios(config-regen)#commit
RP/0/RP0/CPU0:ios(config-regen)#exit
```

Verifying the Regen Mode

The following is a sample to verify the regen mode.

show hw-module location *location* **regen**

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 regen
Mon Mar 25 09:50:42.936 UTC

Location:              0/0
Trunk  Bitrate:        400G
Status:                Provisioned
East Port               West Port
CoherentDSP0/0/0/0       CoherentDSP0/0/0/1
```

The terms, East Port and West Port are used to represent OTN signal regeneration at the same layer.

Configuring the BPS

You can configure the Bits per Symbol (BPS) to 3.4375 to support 300G trunk configurations on 75 GHz networks using the following commands:

configure

controller optics *R/S/I/P* **bits-per-symbol 3.4375**

commit

The following is a sample in which the BPS is configured to 3.4375.

```
RP/0/RP0/CPU0:ios#configure
Wed Mar 27 14:12:49.932 UTC
RP/0/RP0/CPU0:ios(config)#controller optics 0/3/0/0 bits-per-symbol 3.4375
RP/0/RP0/CPU0:ios(config)#commit
```

Viewing BPS and Baud Rate Ranges

To view the the BPS for a specific range use the following command:

show controller optics *R/S/I/P* **bps-range** *bps-range* **| include** *data-rate* **| include** *fec-type*

```
RP/0/RP0/CPU0:ios#show controllers optics 0/3/0/0 bps-range 3 3.05 | include 300G | include
 SD27
Thu Mar 28 03:01:39.751 UTC
300G            SD27            3.0000000       69.4350994
300G            SD27            3.0078125       69.2547485
300G            SD27            3.0156250       69.0753320
300G            SD27            3.0234375       68.8968428
300G            SD27            3.0312500       68.7192736
```

```
300G            SD27            3.0390625       68.5426174
300G            SD27            3.0468750       68.3668671
```

To view the baud for a specific range use the following command:

show controller optics *R/S/I/P* **baud-rate-range** *baud-range* **| include** *data-rate* **| include** *fec-type*

```
RP/0/RP0/CPU0:ios#show controllers optics 0/3/0/0 baud-rate-range 43 43.4 | include 300G |
 include SD27
Thu Mar 28 03:12:36.521 UTC
300G            SD27            4.8046875       43.3545986
300G            SD27            4.8125000       43.2842178
300G            SD27            4.8203125       43.2140651
300G            SD27            4.8281250       43.1441394
300G            SD27            4.8359375       43.0744397
300G            SD27            4.8437500       43.0049648
```

Configuring the Trunk Rate for BPSK

From R7.2.1 onwards, you can configure trunk rates of 50G, 100G, and 150G to support Binary Phase-Shift Keying (BPSK) modulation. The BPSK modulation enables information to be carried over radio signals more efficiently.

You can configure trunk rates for BPSK using CLI, NetConf YANG, and OC models.

The following table list the 50G, 100G, and 150G trunk rates with the supported BPSK modulation:

Trunk Rate	BPSK Modulation
50G	1 to 1.4453125
100G	1 to 2.890625
150G	1.453125 to 4.3359375

To configure the trunk rate for BPSK modulation, enter the following commands:

configure

hw-module location *location* **mxponder**

trunk-rate {50G | 100G | 150G}

commit

The following example shows how to configure trunk rate to 50G:

```
RP/0/RP0/CPU0:(config)#hw-module location 0/0 mxponder
RP/0/RP0/CPU0:(config-hwmod-mxp)#trunk-rate 50G
RP/0/RP0/CPU0:(config-hwmod-mxp)#commit
```

Viewing the BPSK Trunk Rate Ranges

To view the trunk rate configured for the BPSK modulation, use the following **show** commands:

```
RP/0/RP0/CPU0:ios(hwmod-mxp)#show hw-module location 0/0 mxponder

Tue Feb 25 11:13:41.934 UTC
```

```
Location:             0/0
Client Bitrate:       100GE
Trunk  Bitrate:       50G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/0
CoherentDSP0/0/0/1
                                Traffic Split Percentage


HundredGigECtrlr0/0/0/2         ODU40/0/0/0                            50
      50


RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/0
Thu Mar  5 07:12:55.681 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: On

LED State: Green

 Optics Status

         Optics Type:  DWDM optics
         DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,
         Wavelength=1552.524nm

         Alarm Status:
         -------------
         Detected Alarms: None


         LOS/LOL/Fault Status:

         Alarm Statistics:

         -------------
         HIGH-RX-PWR = 0            LOW-RX-PWR = 2
         HIGH-TX-PWR = 0            LOW-TX-PWR = 0
         HIGH-LBC = 0               HIGH-DGD = 0
         OOR-CD = 0                 OSNR = 0
         WVL-OOL = 0                MEA  = 0
         IMPROPER-REM = 0
         TX-POWER-PROV-MISMATCH = 0
         Laser Bias Current = 0.0 %
         Actual TX Power = 1.97 dBm
         RX Power = 1.58 dBm
         RX Signal Power = 0.60 dBm
         Frequency Offset = 386 MHz

         Performance Monitoring: Enable

         THRESHOLD VALUES
         ----------------

         Parameter                 High Alarm  Low Alarm  High Warning  Low Warning
         ------------------------  ----------  ---------  ------------  -----------
         Rx Power Threshold(dBm)          4.9      -12.0           0.0          0.0
         Tx Power Threshold(dBm)          3.5      -10.1           0.0          0.0
         LBC Threshold(mA)                N/A        N/A          0.00         0.00

         Configured Tx Power = 2.00 dBm
         Configured CD High Threshold = 180000 ps/nm
         Configured CD lower Threshold = -180000 ps/nm
         Configured OSNR lower Threshold = 0.00 dB
         Configured DGD Higher Threshold = 180.00 ps
         Baud Rate =  34.7175521851 GBd
         Bits per Symbol = 1.0000000000  bits/symbol
         Modulation Type: BPSK
         Chromatic Dispersion -9 ps/nm
         Configured CD-MIN -180000 ps/nm  CD-MAX 180000 ps/nm
         Polarization Mode Dispersion = 0.0 ps
         Second Order Polarization Mode Dispersion = 125.00 ps^2
         Optical Signal to Noise Ratio = 34.60 dB
         SNR = 20.30 dB
         Polarization Dependent Loss = 0.20 dB
         Polarization Change Rate = 0.00 rad/s
         Differential Group Delay = 2.00 ps
         Filter Roll Off Factor : 0.100
         Rx VOA Fixed Ratio : 15.00 dB
         Enhanced Colorless Mode : 0
         Enhanced SOP Tolerance Mode : 0
         NLEQ Compensation Mode : 0
         Cross Polarization Gain Mode : 0
         Cross Polarization Weight Mode : 0
         Carrier Phase Recovery Window : 0
         Carrier Phase Recovery Extended Window : 0


AINS Soak                : None
AINS Timer               : 0h, 0m
AINS remaining time      : 0 seconds
```

OTN-XP Card

The following section describes the supported configurations and procedures to configure the card modes on the line card.

LC Mode on OTN-XP Card

When you install the OTN-XP card in the Cisco NCS 1004 chassis, it is in the POWERED_ON state. The **LCMODE is not configured for line card** alarm is present on the card and the LED status is AMBER.

```
sysadmin-vm:0_RP0# show platform
Thu Mar  26 21:38:07.305 UTC+00:00
Location  Card Type               HW State      SW State      Config State
----------------------------------------------------------------------------
0/0       NCS1K4-LC-FILLER        PRESENT       N/A           NSHUT
0/1       NCS1K4-OTN-XP           POWERED_ON    N/A           NSHUT
0/RP0     NCS1K4-CNTLR-K9         OPERATIONAL   OPERATIONAL   NSHUT
0/FT0     NCS1K4-FAN              OPERATIONAL   N/A           NSHUT
0/FT1     NCS1K4-FAN              OPERATIONAL   N/A           NSHUT
0/FT2     NCS1K4-FAN              OPERATIONAL   N/A           NSHUT
0/PM0     NCS1K4-AC-PSU           OPERATIONAL   N/A           NSHUT
0/SC0     NCS1004                 OPERATIONAL   N/A           NSHUT
```

```
sysadmin-vm:0_RP0# show alarms brief system active
Thu Mar  26 21:38:34.394 UTC+00:00
```

```
-------------------------------------------------------------------------------
Active Alarms
-------------------------------------------------------------------------------
Location          Severity      Group          Set time            Description
-------------------------------------------------------------------------------
0                major         environ        03/26/20 20:23:11   Power Module redundancy
 lost.
0                 critical      environ        03/26/20 20:23:29   Fan: One or more LCs
missing, running fans at max speed.
0/1              not_alarmed   shelf          03/26/20 21:38:26   LCMODE is not configured
 for line card
sysadmin-vm:0_RP0#

sysadmin-vm:0_RP0# show led location 0/1
Thu Mar  26 21:39:05.101 UTC+00:00
=============================================================
Location  LED Name                      Mode         Color
=============================================================
0/1
          0/1-Status LED                WORKING     AMBER
sysadmin-vm:0_RP0#
```

You must select a datapath mode by configuring the LC mode. OTN-XP does not have a default LC mode. After the LC mode is configured using the CLI,the card transitions to the OPERATIONAL state, the alarm clears, and the LED status turns to GREEN.

The LC modes supported on the OTN-XP card are:

- 10G-GREY-MXP
- 4x100G-MXP-400G-TXP
- 40x10G-4x100G-MXP
- 4x100GE-MXP-DD
- 400GE-TXP-DD
- FC-MXP
- OTUCn-REGEN
- 2x100GE-TXP-MXP

Note 100G-TXP LC mode is not supported.

Only one LC mode can be configured on the OTN-XP card at a time. When the LC mode is changed using the CLI, the **LCMODE changed, delete the datapath config and reload line card** alarm is present on the card and the DP FPD is in disabled state. To clear the alarm and enable the DP FPD, delete the the existing datapath configuration and reload the line card to apply the new LC mode to make the card operational.

If a LC mode requires a different FPGA configuration, and the package is not available, the **OTN_XP_DP_FPD_PKG is missing, please install the package to proceed** alarm is present on the card. To clear the alarm, install the OTN_XP_DP_FPD_PKG file. After the package installation is complete, the required FPGA image is copied from the OTN_XP_DP_FPD_PKG file to the card, the card is automatically reloaded, and the card becomes operational.

Note The LC mode configuration is a shared plane configuration. The configuration does not enter the preconfigured state when the line card is not available.

Configuring the LC Mode

Note

- Ensure the OTN_XP_DP_FPD_PKG file is installed before configuring the LC mode.
- When you insert an OTN-XP line card having a lower FPD version, you must configure a LC mode which is supported on the software release that the line card is loaded with. You cannot upgrade the FPD of a line card if you configure a LC mode supported only in a higher software release.
- The LC_CPU_MOD_FW version on a new OTN-XP line card is 7.3.1. Support for new LC modes or features from version 7.5.1 or higher, such as OTUCn-REGEN mode in 7.5.2, is not available in this line card software. When you install an OTN-XP card for the first time in an NCS 1004 chassis with the controller card software version of 7.5.1 or higher, you must upgrade LC_CPU_MOD_FW, to ensure the availability and support for the LC modes or features that are supported supported in the XR software version. You must configure an LC mode which is supported in the 7.3.1 XR software, such as 4x100G-MXP-400G-TXP, and bring the card to OPERATIONAL state to upgrade the line card software.

To configure the LC mode on the OTN-XP card, use the following commands:

configure

lc-module location *location* **lcmode** *mode*

commit

Example

To view the LC modes available on the OTN-XP card, use the following command:

```
RP/0/RP0/CPU0:ios#sh lc-module location 0/0 lcmode all
Wed Sep 29 14:41:51.487 UTC
States: A-Available     R-Running       C-Configured

Node    Lcmode_Supported    Owner    Options(State)                HW_Ver
--------------------------------------------------------------------------------
0/0     Yes                 None     10G-GREY-MXP (A)               3.0
                                     4x100G-MXP-400G-TXP (A)        2.0
```

From Release 7.3.2 onwards, you can view the hybrid mode options that are supported on the OTN-XP card. To view the LC modes supported on the OTN-XP card, use the following command:

```
RP/0/RP0/CPU0:ios#show lc-module location 0/3 lcmode all
Wed Aug 11 17:06:29.538 UTC
States: A-Available     R-Running       C-Configured

Node    Lcmode_Supported    Owner    Options(State)                HW_Ver
--------------------------------------------------------------------------------
0/3     Yes                 CLI      10G-GREY-MXP (A)               3.0
                                     4x100G-MXP-400G-TXP (A)        2.0
                                     40x10G-4x100G-MXP (A)          3.0
                                     4x100GE-MXP-DD (R/C)           7.0
```

Note The 100G-TXP mode is listed when using the **show lc-module location lcmode all** command, but the configuration on 100G-TXP mode is not supported.

The following is a sample in which the OTN-XP card is configured in the 10G-GREY-MXP mode.

```
RP/0/RP0/CPU0:ios#configure
Thu Mar 26 21:40:51.495 UTC
RP/0/RP0/CPU0:ios(config)#lc-module location 0/1 lcmode 10G-GREY-MXP
RP/0/RP0/CPU0:ios(config)#commit
```

Verifying the LC Mode Configuration

The following is a sample output of a successful 10G-GREY-MXP LC mode configuration after which the card transitions to the OPERATIONAL state, the alarm clears, and the LED status turns to GREEN.

```
RP/0/RP0/CPU0:ios(config)#do show platform
Thu Mar 26 21:41:17.206 UTC
Node              Type                       State            Config state
--------------------------------------------------------------------------------
0/0               NCS1K4-LC-FILLER           PRESENT          NSHUT
0/1               NCS1K4-OTN-XP              OPERATIONAL      NSHUT
0/RP0/CPU0        NCS1K4-CNTLR-K9(Active)    IOS XR RUN       NSHUT
0/FT0             NCS1K4-FAN                 OPERATIONAL      NSHUT
0/FT1             NCS1K4-FAN                 OPERATIONAL      NSHUT
0/FT2             NCS1K4-FAN                 OPERATIONAL      NSHUT
0/PM0             NCS1K4-AC-PSU              OPERATIONAL      NSHUT
0/SC0             NCS1004                    OPERATIONAL      NSHUT
RP/0/RP0/CPU0:ios(config)#do show alarms brief system active
Thu Mar 26 21:41:29.641 UTC

------------------------------------------------------------------------------------
Active Alarms
------------------------------------------------------------------------------------
Location        Severity     Group            Set Time                   Description



------------------------------------------------------------------------------------
0               Major        Environ          03/26/2020 20:23:11 UTC    Power Module
redundancy lost.


0               Critical     Environ          03/26/2020 20:23:29 UTC    Fan: One or more
LCs missing, running fans at max speed.

RP/0/RP0/CPU0:ios(config)#end
RP/0/RP0/CPU0:ios#show lc-module location 0/1 lcmode all
Thu Mar 26 21:41:58.780 UTC
States: A-Available     R-Running       C-Configured

Node    Lcmode_Supported    Owner    Options(State)                HW_Ver
--------------------------------------------------------------------------------
0/1     Yes                 CLI      10G-GREY-MXP (R/C)             3.0
                                     4x100G-MXP-400G-TXP (A)        2.0
RP/0/RP0/CPU0:ios#show lc-module location 0/1 lcmode
Thu Mar 26 21:42:18.997 UTC

Node    Lcmode_Supported    Owner    Running                Configured
```

```
--------------------------------------------------------------------------------
0/1     Yes                 CLI      10G-GREY-MXP          10G-GREY-MXP
RP/0/RP0/CPU0:ios#admin
Thu Mar 26 21:42:38.525 UTC

root connected from 192.0.2.3 using ssh on sysadmin-vm:0_RP0
sysadmin-vm:0_RP0# show led location 0/1
Thu Mar  26 21:42:45.337 UTC+00:00
=============================================================
Location  LED Name                      Mode         Color
=============================================================
0/1
          0/1-Status LED                WORKING     GREEN
```

Example

The following is a sample in which the LC mode is changed from 10G-GREY-MXP to the 4x100G-MXP-400G-TXP mode. In this sample, the datapath configuration is deleted and the card is reloaded to apply the new LC mode.

```
RP/0/RP0/CPU0:ios#show lc-module location all lcmode
Thu Sep 30 10:19:29.853 UTC

Node    Lcmode_Supported    Owner    Running                Configured
--------------------------------------------------------------------------------
0/0     Yes                 CLI      10G-GREY-MXP           10G-GREY-MXP
0/1     No                  N/A      N/A                    N/A
0/2     No                  N/A      N/A                    N/A
0/3     No                  N/A      N/A                    N/A


RP/0/RP0/CPU0:ios#configure
Thu Sep 30 10:19:32.818 UTC
Current Configuration Session  Line       User     Date                     Lock
00001000-000051f7-00000000     vty1       root     Wed Sep 29 15:26:00 2021
RP/0/RP0/CPU0:ios(config)#no lc-module location 0/0 lcmode 10g-GREY-MXP
RP/0/RP0/CPU0:ios(config)#commit
Thu Sep 30 10:20:34.086 UTC
RP/0/RP0/CPU0:ios(config)#do show alarms brief system active
Thu Sep 30 10:20:52.950 UTC

------------------------------------------------------------------------------------
Active Alarms
------------------------------------------------------------------------------------
Location        Severity     Group            Set Time                 Description



------------------------------------------------------------------------------------
0/PM0          Major        Environ         09/29/2021 14:41:59 UTC    Power Module Output
 Disabled


0               Major        Environ          09/29/2021 14:42:15 UTC    Power Module
redundancy lost.


0               Critical     Environ          09/29/2021 14:42:25 UTC    Fan: One or more
LCs missing, running fans at max speed.
```

```
0/0             NotAlarmed   Shelf            09/30/2021 10:20:34 UTC    LCMODE changed,
delete the datapath config and reload line card




RP/0/RP0/CPU0:ios#configure
Thu Sep 30 10:21:41.281 UTC
Current Configuration Session  Line       User     Date                         Lock
00001000-000051f7-00000000     vty1       root     Wed Sep 29 15:26:00 2021
RP/0/RP0/CPU0:ios(config)#no hw-module location 0/0
RP/0/RP0/CPU0:ios(config)#commit
Thu Sep 30 10:21:49.982 UTC
RP/0/RP0/CPU0:ios(config)#

RP/0/RP0/CPU0:ios#show platform
Thu Sep 30 10:22:08.482 UTC
Node              Type                       State             Config state
--------------------------------------------------------------------------------
0/0               NCS1K4-OTN-XP              OPERATIONAL       NSHUT
0/2               NCS1K4-LC-FILLER           PRESENT           NSHUT
0/3               NCS1K4-LC-FILLER           PRESENT           NSHUT
0/RP0/CPU0        NCS1K4-CNTLR-K9(Active)    IOS XR RUN        NSHUT
0/FT0             NCS1K4-FAN                 OPERATIONAL       NSHUT
0/FT1             NCS1K4-FAN                 OPERATIONAL       NSHUT
0/FT2             NCS1K4-FAN                 OPERATIONAL       NSHUT
0/PM0             NCS1K4-AC-PSU              OPERATIONAL       NSHUT
0/SC0             NCS1004                    OPERATIONAL       NSHUT
RP/0/RP0/CPU0:ios#
RP/0/RP0/CPU0:ios#admin
Thu Sep 30 10:23:55.937 UTC
Last login: Thu Sep 30 04:32:57 2021 from 192.0.2.3
root connected from 192.0.2.3 using ssh on sysadmin-vm:0_RP0
sysadmin-vm:0_RP0# hw-module location 0/0 reload
Thu Sep  30 10:24:17.938 UTC+00:00
Reloading the module will be traffic impacting if not properly drained. Continue to Reload
 hardware module ? [no,yes] yes
result Card graceful reload request on 0/0 succeeded.
sysadmin-vm:0_RP0#show platform
Thu Sep  30 10:25:16.876 UTC+00:00
Location  Card Type               HW State      SW State      Config State
----------------------------------------------------------------------------
0/0       NCS1K4-OTN-XP           POWERED_ON    N/A           NSHUT
0/2       NCS1K4-LC-FILLER        PRESENT       N/A           NSHUT
0/3       NCS1K4-LC-FILLER        PRESENT       N/A           NSHUT
0/RP0     NCS1K4-CNTLR-K9         OPERATIONAL   OPERATIONAL   NSHUT
0/FT0     NCS1K4-FAN              OPERATIONAL   N/A           NSHUT
0/FT1     NCS1K4-FAN              OPERATIONAL   N/A           NSHUT
0/FT2     NCS1K4-FAN              OPERATIONAL   N/A           NSHUT
0/PM0     NCS1K4-2KW-AC           OPERATIONAL   N/A           NSHUT
0/SC0     NCS1004-K9              OPERATIONAL   N/A           NSHUT

sysadmin-vm:0_RP0#exit
RP/0/RP0/CPU0:ios#show lc-module location all lcmode
Thu Sep 30 10:29:08.183 UTC

Node    Lcmode_Supported    Owner    Running               Configured
--------------------------------------------------------------------------------
0/0     Yes                 None     Not running           Not configured
0/1     No                  N/A      N/A                   N/A
0/2     No                  N/A      N/A                   N/A
0/3     No                  N/A      N/A                   N/A
```

```
RP/0/RP0/CPU0:ios#show platform
Thu Sep 30 10:29:36.075 UTC
Node              Type                       State            Config state
--------------------------------------------------------------------------------
0/0               NCS1K4-OTN-XP              POWERED_ON       NSHUT
0/2               NCS1K4-LC-FILLER           PRESENT          NSHUT
0/3               NCS1K4-LC-FILLER           PRESENT          NSHUT
0/RP0/CPU0        NCS1K4-CNTLR-K9(Active)    IOS XR RUN       NSHUT
0/FT0             NCS1K4-FAN                 OPERATIONAL      NSHUT
0/FT1             NCS1K4-FAN                 OPERATIONAL      NSHUT
0/FT2             NCS1K4-FAN                 OPERATIONAL      NSHUT
0/PM0             NCS1K4-AC-PSU              OPERATIONAL      NSHUT
0/SC0             NCS1004                    OPERATIONAL      NSHUT
RP/0/RP0/CPU0:ios#
RP/0/RP0/CPU0:ios#configure
Thu Sep 30 10:29:57.997 UTC
Current Configuration Session  Line       User     Date                     Lock
00001000-000051f7-00000000     vty1       root     Wed Sep 29 15:26:00 2021
RP/0/RP0/CPU0:ios(config)#lc-module location 0/0 lcmode 4x100G-MXP-400G-TXP
RP/0/RP0/CPU0:ios(config)#commit
Thu Sep 30 10:30:11.312 UTC
RP/0/RP0/CPU0:ios(config)#end
RP/0/RP0/CPU0:ios#show lc-module location all lcmode
Thu Sep 30 10:40:56.480 UTC

Node    Lcmode_Supported    Owner    Running                Configured
--------------------------------------------------------------------------------
0/0     Yes                 CLI      4x100G-MXP-400G-TXP    4x100G-MXP-400G-TXP
0/1     No                  N/A      N/A                    N/A
0/2     No                  N/A      N/A                    N/A
0/3     No                  N/A      N/A                    N/A

RP/0/RP0/CPU0:ios# RP/0/RP0/CPU0:ios#show  platform
Thu Sep 30 10:41:25.093 UTC
Node              Type                       State            Config state
--------------------------------------------------------------------------------
0/0               NCS1K4-OTN-XP              OPERATIONAL      NSHUT
0/2               NCS1K4-LC-FILLER           PRESENT          NSHUT
0/3               NCS1K4-LC-FILLER           PRESENT          NSHUT
0/RP0/CPU0        NCS1K4-CNTLR-K9(Active)    IOS XR RUN       NSHUT
0/FT0             NCS1K4-FAN                 OPERATIONAL      NSHUT
0/FT1             NCS1K4-FAN                 OPERATIONAL      NSHUT
0/FT2             NCS1K4-FAN                 OPERATIONAL      NSHUT
0/PM0             NCS1K4-AC-PSU              OPERATIONAL      NSHUT
0/SC0             NCS1004                    OPERATIONAL      NSHUT
RP/0/RP0/CPU0:ios#
```

Example: 4x100GE-MXP-DD LC Mode

To view the LC modes available on the OTN-XP card, use the following command: The following is a sample in which the OTN-XP card is configured in the 4x100GE-MXP-DD mode.

```
RP/0/RP0/CPU0:ios#show lc-module location all lcmode all
Thu Sep 30 10:43:47.536 UTC
States: A-Available     R-Running       C-Configured

Node    Lcmode_Supported    Owner    Options(State)               HW_Ver
--------------------------------------------------------------------------------
0/0     Yes                 CLI      100G-TXP (A)                  3.0
                                     10G-GREY-MXP (A)              3.0
                                     4x100G-MXP-400G-TXP (A)       2.0
                                     40x10G-4x100G-MXP (A)         3.0
                                     4x100GE-MXP-DD (R/C)           7.0
                                     400GE-TXP-DD (A)               1.0
                                     FC-MXP (A)                     4.0
                                     OTUCn-REGEN (A)                8.0
                                     2x100GE-TXP-MXP (R/C)          9.0
0/1     No                  N/A      N/A                            N/A
0/2     No                  N/A      N/A                            N/A
0/3     No                  N/A      N/A                            N/A
```

Example: OTUCn-REGEN Mode

The following is a sample to configure the OTUCn-REGEN mode:

```
RP/0/RP0/CPU0:ios#configure
Fri Feb  4 16:52:18.021 UTC
RP/0/RP0/CPU0:ios(config)#lc-module location 0/2 lcmode OTUCn-REGEN
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample to verify the OTUCn-REGEN LC mode.

```
RP/0/RP0/CPU0:ios#sh lc-module location 0/2 lcmode
Fri Feb  4 17:00:09.842 UTC

Node    Lcmode_Supported    Owner      Running          Configured
------------------------------------------------------------------------------------------
0/2       Yes                CLI       OTUCn-REGEN       OTUCn-REGEN
```

Example: FC-MXP Mode

The following is a sample to configure the OTN-XP card in FC-MXP mode:

```
RP/0/RP0/CPU0:ios#configure
Fri Feb  5 15:53:17.023 UTC
RP/0/RP0/CPU0:ios(config)#lc-module location 0/2 lcmode FC-MXP
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample to verify the FC-MXP mode configured on the OTN-XP card:

```
RP/0/RP0/CPU0:ios#show lc-module location 0/2 lcmode
Fri Feb  4 16:13:32.745 UTC

Node    Lcmode_Supported    Owner    Running     Configured
------------------------------------------------------------------------------------------
0/2          Yes             CLI     FC-MXP       FC-MXP

RP/0/RP0/CPU0:ios#
```

Example: 2x100GE-TXP-MXP

The following is a sample to configure the OTN-XP card in 2x100GE-TXP-MXP mode:

```
RP/0/RP0/CPU0:ios#configure
Fri Feb  5 15:53:17.023 UTC
RP/0/RP0/CPU0:ios(config)#lc-module location 0/0 lcmode 2x100GE-TXP-MXP
RP/0/RP0/CPU0:ios(config)#commit
```

Following is a sample output that verifies the 2x100GE-TXP-MXP mode configured on the OTN-XP card:

```
RP/0/RP0/CPU0:ios#sh lc-module location 0/0 lcmode
Mon Nov  7 10:41:48.398 UTC

Node    Lcmode_Supported    Owner    Running                Configured
--------------------------------------------------------------------------------
0/0     Yes                 CLI      2x100GE-TXP-MXP    2x100GE-TXP-MXP
```

Regeneration Mode on OTN-XP Card

Table 2: Feature History Table

Feature	Release Information	Description
Regeneration Mode Support on the OTN-XP Card	Cisco IOS XR Release 7.5.2	The OTN-XP card now supports the OTUCn-REGEN LC mode for regeneration. This mode allows regeneration of the DWDM channels across trunk ports of the OTN-XP card and significantly extends the reach of the service. You can configure 200G and 400G trunk rates on the card.

The OTN-XP card supports the OTUCn-REGEN mode as a part of the LC mode for regeneration.

The OTUCn-REGEN mode supports the following features:

- Trunk rate—400G and 200G
- Modulation type:
  - 16-QAM for 400G
  - 8-QAM, 16-QAM, and QPSK for 200G
- Trunk optics—ONS-CFP2D-400G-C
- Supported features—Loopbacks, TTI, AINS

Limitations

GCC0 is not supported on the REGEN trunks.

Configuring Regen Mode on OTN-XP Card

Note You must configure the OTUCn-REGEN LC mode on the OTN-XP card before performing this configuration. See Example: OTUCn-REGEN Mode, on page 23.

The following is a sample for configuring regen mode with 400G trunk rate:

```
RP/0/RP0/CPU0:ios#configure
Fri Feb  4 16:53:48.018 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 regen
RP/0/RP0/CPU0:ios(config-regen)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-regen)#commit
Fri Feb  4 16:54:05.920 UTC
```

The following is a sample to verify the 400G trunk rate configured in the regen mode.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2 regen
Fri Feb  4 16:58:51.716 UTC
```

```
Location:             0/2
Trunk  Bitrate:       400G
Status:               Provisioned
East Port                   West Port
---------                   ---------
CoherentDSP0/2/0/12         CoherentDSP0/2/0/13
```

The following is a sample for configuring regen mode with 200G trunk rate:

```
RP/0/RP0/CPU0:ios#configure
Fri Feb  4 16:53:48.018 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 regen
RP/0/RP0/CPU0:ios(config-regen)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-regen)#commit
Fri Feb  4 16:54:05.920 UTC
```

If you want to change the modulation format for the 200G trunk rate, see Configuring 8QAM Modulation for 200G Muxponder Mode, on page 64.

The following is a sample to verify the 200G trunk rate configured in the regen mode.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2 regen
Fri Feb  4 16:58:51.716 UTC

Location:             0/2
Trunk  Bitrate:       200G
Status:               Provisioned
East Port                   West Port
---------                   ---------
CoherentDSP0/2/0/12         CoherentDSP0/2/0/13
```

FC-MXP Mode on OTN-XP Card

Table 3: Feature History Table

Feature	Release Information	Description
FC-MXP Mode Support on the OTN-XP Card	Cisco IOS XR Release 7.5.2	The OTN-XP card now supports FC-MXP LC mode for Fiber Channel (FC) support. You can configure 16G FC with 400G trunk rate.

Table 4: Feature History Table

Feature	Release Information	Description
32G FC-MXP Mode Support on the OTN-XP Card	Cisco IOS XR Release 7.7.1	The OTN-XP card now supports 32G FC-MXP LC mode for Fiber Channel (FC) support, in addition to the 16G FC-MXP mode that was supported already. You can configure 32G FC with 400G trunk rate on slice 0.

From Release 7.5.2 onwards, the OTN-XP card supports FC-MXP LC mode for Fiber Channel (FC) support. You can configure 16G FC with 400G trunk rate on both the slices.

From Release 7.7.1, 32GFC can be configured on slice 0.

FC Mode	Supported Slices	Slice 0 Ports	Slice 1 Ports	Client Payloads	Trunk Rate	Client Optics	Trunk Optics	Modulation Type
16G FC-MXP	Slice 0 and Slice 1	Clients: 1, 6, 7, 9, 10, 11 and Trunk: 12	Clients: 0, 2, 3, 4, 5, 8 and Trunk: 13	16G FC	400G (OTUC4) on both the slices	ONS-QC-16GFC-SW	ONS-CFP2D-400G-C DP04CFP2-M25-K9	16-QAM
32G FC-MXP	Slice 0	Clients: 9, 10, 11 and Trunk: 12	NA	32G FC	400G (OTUC4) on slice 0	DS-SFP-4X32G-SW	ONS-CFP2D-400G-C DP04CFP2-M25-K9	16-QAM

The FC-MXP mode supports the following features:

- Loopback
- PRBS
- AINS
- Laser squelch

The FC-MXP mode supports the following alarms:

- SIGLOSS—Signal Loss
- SYNCLOSS—Loss of Synchronization
- NOS—Not-Operational Primitive Sequence

Limitations:

- The combination of 16G FC and 32G FC configurations is not supported on the same slice.
- GCC0 and GCC1 are not supported.
- Local Fault and Remote Fault Ethernet alarms are not supported.
- FC32 only supports SIGLOSS alarm.
- FC32 does not support statistics counters.

Configuring the OTN-XP Card in 16G FC Muxponder Mode

Note You must configure the FC-MXP LC mode on the OTN-XP card before performing this configuration. See Example: FC-MXP Mode, on page 23.

To configure the OTN-XP card in 16G FC-MXP mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 400G

client-port-rate *client-port-number* **lane** *lane-number* **client-type fc16**

commit

Example:

The following is a sample to configure 16G FC muxponder mode on slice 0 of the OTN-XP card:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
Fri Feb  4 16:06:59.967 UTC
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#
```

The following is a sample to verify the 16G FC muxponder mode configured on slice 0 of the OTN-XP card:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2 mxponder-slice 0
Fri Feb  4 16:15:10.984 UTC

Location:             0/2
Slice ID:             0
Client Bitrate:       FC16G
Trunk  Bitrate:       400G
Status:               Provisioned
Client Port                     Mapper/Trunk Port          CoherentDSP0/2/0/12
                                Traffic Split Percentage

SixteenGigFibreChanCtrlr0/2/0/1/1       ODU-FLEX0/2/0/12/1/1                          100
SixteenGigFibreChanCtrlr0/2/0/1/2       ODU-FLEX0/2/0/12/1/2                          100
SixteenGigFibreChanCtrlr0/2/0/1/3       ODU-FLEX0/2/0/12/1/3                          100
SixteenGigFibreChanCtrlr0/2/0/1/4       ODU-FLEX0/2/0/12/1/4                          100
SixteenGigFibreChanCtrlr0/2/0/6/1       ODU-FLEX0/2/0/12/6/1                          100
SixteenGigFibreChanCtrlr0/2/0/6/2       ODU-FLEX0/2/0/12/6/2                          100
```

```
SixteenGigFibreChanCtrlr0/2/0/6/3      ODU-FLEX0/2/0/12/6/3                        100
SixteenGigFibreChanCtrlr0/2/0/6/4      ODU-FLEX0/2/0/12/6/4                        100
SixteenGigFibreChanCtrlr0/2/0/7/1      ODU-FLEX0/2/0/12/7/1                        100
SixteenGigFibreChanCtrlr0/2/0/7/2      ODU-FLEX0/2/0/12/7/2                        100
SixteenGigFibreChanCtrlr0/2/0/7/3      ODU-FLEX0/2/0/12/7/3                        100
SixteenGigFibreChanCtrlr0/2/0/7/4      ODU-FLEX0/2/0/12/7/4                        100
SixteenGigFibreChanCtrlr0/2/0/9/1      ODU-FLEX0/2/0/12/9/1                        100
SixteenGigFibreChanCtrlr0/2/0/9/2      ODU-FLEX0/2/0/12/9/2                        100
SixteenGigFibreChanCtrlr0/2/0/9/3      ODU-FLEX0/2/0/12/9/3                        100
SixteenGigFibreChanCtrlr0/2/0/9/4      ODU-FLEX0/2/0/12/9/4                        100
SixteenGigFibreChanCtrlr0/2/0/10/1     ODU-FLEX0/2/0/12/10/1                       100
SixteenGigFibreChanCtrlr0/2/0/10/2     ODU-FLEX0/2/0/12/10/2                       100
SixteenGigFibreChanCtrlr0/2/0/10/3     ODU-FLEX0/2/0/12/10/3                       100
SixteenGigFibreChanCtrlr0/2/0/10/4     ODU-FLEX0/2/0/12/10/4                       100
SixteenGigFibreChanCtrlr0/2/0/11/1     ODU-FLEX0/2/0/12/11/1                       100
SixteenGigFibreChanCtrlr0/2/0/11/2     ODU-FLEX0/2/0/12/11/2                       100
SixteenGigFibreChanCtrlr0/2/0/11/3     ODU-FLEX0/2/0/12/11/3                       100
SixteenGigFibreChanCtrlr0/2/0/11/4     ODU-FLEX0/2/0/12/11/4                       100

RP/0/RP0/CPU0:ios#
```

The following is a sample to configure 16G FC muxponder mode on slice 1 of the OTN-XP card:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 lane 1 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 lane 2 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 lane 3 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 lane 4 client-type fc16
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
Fri Feb  4 16:06:59.967 UTC
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#
```

The following is a sample to verify the 16G FC muxponder mode configured on slice 1 of the OTN-XP card:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2 mxponder-slice 1
Fri Feb  4 16:15:10.984 UTC

Location:             0/2
Slice ID:             1
Client Bitrate:       FC16G
Trunk  Bitrate:       400G
Status:               Provisioned
Client Port                     Mapper/Trunk Port          CoherentDSP0/2/0/13
```

```
                                Traffic Split Percentage

SixteenGigFibreChanCtrlr0/2/0/0/1       ODU-FLEX0/2/0/13/0/1                          100
SixteenGigFibreChanCtrlr0/2/0/0/2       ODU-FLEX0/2/0/13/0/2                          100
SixteenGigFibreChanCtrlr0/2/0/0/3       ODU-FLEX0/2/0/13/0/3                          100
SixteenGigFibreChanCtrlr0/2/0/0/4       ODU-FLEX0/2/0/13/0/4                          100
SixteenGigFibreChanCtrlr0/2/0/2/1       ODU-FLEX0/2/0/13/2/1                          100
SixteenGigFibreChanCtrlr0/2/0/2/2       ODU-FLEX0/2/0/13/2/2                          100
SixteenGigFibreChanCtrlr0/2/0/2/3       ODU-FLEX0/2/0/13/2/3                          100
SixteenGigFibreChanCtrlr0/2/0/2/4       ODU-FLEX0/2/0/13/2/4                          100
SixteenGigFibreChanCtrlr0/2/0/3/1       ODU-FLEX0/2/0/13/3/1                          100
SixteenGigFibreChanCtrlr0/2/0/3/2       ODU-FLEX0/2/0/13/3/2                          100
SixteenGigFibreChanCtrlr0/2/0/3/3       ODU-FLEX0/2/0/13/3/3                          100
SixteenGigFibreChanCtrlr0/2/0/3/4       ODU-FLEX0/2/0/13/3/4                          100
SixteenGigFibreChanCtrlr0/2/0/4/1       ODU-FLEX0/2/0/13/4/1                          100
SixteenGigFibreChanCtrlr0/2/0/4/2       ODU-FLEX0/2/0/13/4/2                          100
SixteenGigFibreChanCtrlr0/2/0/4/3       ODU-FLEX0/2/0/13/4/3                          100
SixteenGigFibreChanCtrlr0/2/0/4/4       ODU-FLEX0/2/0/13/4/4                          100
SixteenGigFibreChanCtrlr0/2/0/5/1       ODU-FLEX0/2/0/13/5/1                         100
SixteenGigFibreChanCtrlr0/2/0/5/2       ODU-FLEX0/2/0/13/5/2                         100
SixteenGigFibreChanCtrlr0/2/0/5/3       ODU-FLEX0/2/0/13/5/3                         100
SixteenGigFibreChanCtrlr0/2/0/5/4       ODU-FLEX0/2/0/13/5/4                         100
SixteenGigFibreChanCtrlr0/2/0/8/1       ODU-FLEX0/2/0/13/8/1                         100
SixteenGigFibreChanCtrlr0/2/0/8/2       ODU-FLEX0/2/0/13/8/2                         100
SixteenGigFibreChanCtrlr0/2/0/8/3       ODU-FLEX0/2/0/13/8/3                         100
SixteenGigFibreChanCtrlr0/2/0/8/4       ODU-FLEX0/2/0/13/8/4                         100

RP/0/RP0/CPU0:ios#
```

Configuring the OTN-XP Card in 32G FC Muxponder Mode

Note You must configure the FC-MXP LC mode on the OTN-XP card before performing this configuration. See Example: FC-MXP Mode, on page 23.

Note The Production Software Maintenance Updates (SMU) for the Cisco IOS-XR Release 7.7.1 (ncs1004-sysadmin-7.7.1.CSCwb01852.tar) is mandatory to configure the latest port configurations for the 32G FC muxponder mode.

To configure the OTN-XP card in 32G FC-MXP mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 400G

client-port-rate *client-port-number* **lane** *lane-number* **client-type fc32**

commit

Example:

The following is a sample to configure 32G FC muxponder mode on slice 0 of the OTN-XP card:

```
RP/0/RP0/CPU0:ios#configure
Fri Feb  4 16:24:53.964 UTC
RP/0/RP0/CPU0:ios(config)#
```

```
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 1 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 2 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 3 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 4 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 lane 1 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 lane 2 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 lane 3 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 lane 4 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 1 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 2 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 3 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 4 client-type fc32
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
Fri Feb  4 16:26:46.550 UTC
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#
```

The following is a sample to verify the 32G FC muxponder mode configured on slice 0 of the OTN-XP card:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2 mxponder-slice 0
Fri Feb  4 16:31:37.494 UTC

Location:             0/2
Slice ID:             0
Client Bitrate:       FC32G
Trunk  Bitrate:       400G
Status:               Provisioned
Client Port                     Mapper/Trunk Port          CoherentDSP0/2/0/12
                                Traffic Split Percentage

ThirtyTwoGigFibreChanCtrlr0/2/0/9/1     ODU-FLEX0/2/0/12/9/1                          100
ThirtyTwoGigFibreChanCtrlr0/2/0/9/2     ODU-FLEX0/2/0/12/9/2                          100
ThirtyTwoGigFibreChanCtrlr0/2/0/9/3     ODU-FLEX0/2/0/12/9/3                          100
ThirtyTwoGigFibreChanCtrlr0/2/0/9/4     ODU-FLEX0/2/0/12/9/4                          100
ThirtyTwoGigFibreChanCtrlr0/2/0/10/1     ODU-FLEX0/2/0/12/10/1                         100
ThirtyTwoGigFibreChanCtrlr0/2/0/10/2     ODU-FLEX0/2/0/12/10/2                         100
ThirtyTwoGigFibreChanCtrlr0/2/0/10/3     ODU-FLEX0/2/0/12/10/3                         100
ThirtyTwoGigFibreChanCtrlr0/2/0/10/4     ODU-FLEX0/2/0/12/10/4                         100
ThirtyTwoGigFibreChanCtrlr0/2/0/11/1     ODU-FLEX0/2/0/12/11/1                         100
ThirtyTwoGigFibreChanCtrlr0/2/0/11/2     ODU-FLEX0/2/0/12/11/2                         100
ThirtyTwoGigFibreChanCtrlr0/2/0/11/3     ODU-FLEX0/2/0/12/11/3                         100
ThirtyTwoGigFibreChanCtrlr0/2/0/11/4     ODU-FLEX0/2/0/12/11/4                         100

RP/0/RP0/CPU0:ios#
```

Supported Pluggables for OTN-XP Card

Table 5: Feature History

Feature Name	Release Information	Description
FC Mode Support on DP04CFP2-M25-K9 Pluggable	Cisco IOS XR Release 7.7.1	The 16G FC and 32G FC muxponder modes support is added to the trunk pluggable DP04CFP2-M25-K9 on the OTN-XP card. This is in addition to the 4x100 muxponder and 400G-TXP modes that were supported previously.

The OTN-XP card supports the following trunk and client pluggables:

Trunk Pluggables

- ONS-CFP2D-400G-C
- QDD-400G-ZRP-S
- CFP2-WDM-DETS-1HL
- DP04CFP2-M25-K9

Note

- Starting from the Release 7.5.2, DP04CFP2-M25-K9 supports 4x100 muxponder and 400G-TXP modes.
- Starting from the Release 7.7.1, DP04CFP2-M25-K9 supports 16G FC and 32G FC muxponder modes.

Client Pluggables

- QSFP-100G-LR4
- QSFP-100G-FR-S
- QSFP-100G-SR4-S
- QSFP-100G-CWDM4-S
- QSFP-100G-LR4-S
- QSFP-100G-AOC
- QSFP-100G-PSM4
- QSFP-100G-DR-S
- QSFP-4x10-MLR

- QSFP-40G-SR4=
- QDD-400G-FR4-S
- QDD-400G-DR4-S
- QDD-400G-LR8-S
- ONS-QC-16GFC-SW
- DS-SFP-4X32G-SW
- QSFP-100G-LR-S
- ONS-QSFP28-LR4

See Supported Pluggables, for the complete list of pluggables supported by NCS 1004.

Muxponder Configuration on OTN-XP Card

The OTN-XP card has two trunk ports and 12 client ports. The muxponder configuration supports two slices, 0 and 1. You can configure mxponder-slice 0, mxponder-slice 1, or both. Each mxponder-slice supports 10 client interfaces.

From Release 7.3.1 onwards, the OTN-XP card supports two trunk ports for CFP2 DCO on port 12 and port 13, and 8 client ports. For configuration, see Configuring the Muxponder Mode for 4x100G MXP, on page 42.

From Release 7.3.2 onwards, the OTN-XP card supports two trunk ports for QDD ZRP on port 9 and port 11, and 8 client ports. For configuration, see Configuring the Muxponder Mode for 4x100GE-MXP-DD, on page 71.

From Release 7.5.1 onwards, the OTN-XP card supports two trunk ports for QDD ZRP on port 9 and port 11, and the supported operating modes are 400G-TXP-DD, 3X100GE MXP, and 2X100GE MXP. For configuration, see Configuring the Transponder Mode for 400GE-TXP-DD, on page 79. The client rates 2x100GE and 3x100G are supported as part of the 4x100GE-MXP-DD mode. For configurations, see Configuring the Muxponder Mode for 2x100GE-MXP-DD, on page 73 and Configuring the Muxponder Mode for 3x100GE-MXP-DD, on page 76.

Table 6: Feature History

Feature Name	Release Information	Description
400 TXP or MXP modes with CFP2 DCO for OTN-XP Card	Cisco IOS XR Release 7.3.1	On the OTN-XP card, you can configure a single 400GE or 4x100G payload that is received over the client port as a 400G signal over DWDM on the line side. The card improves efficiency, performance, and flexibility for customer networks allowing 400GE or 4x100G client transport over 400G WDM wavelength. Commands modified: • **controller coherentDSP** • **show controller coherentDSP**
OC192 and STM64 clients on OTN-XP card	Cisco IOS XR Release 7.10.1	40x10G-4x100G-MXP card mode on the OTN-XP card now supports OC192/STM64 clients in the 40x10G mode. This allows you to use the OTN-XP card to handle OC192 SONET and STM64 SDH payloads.

Table 7: Hardware Module Configuration with Client to Trunk Mapping

Hardware Module Configuration	Line Card Mode	Client Port Rate	Client to Trunk Mapping	Trunk Rate
10G Grey Muxponder	10G-GREY-MXP	OTU2, OTU2e, or 10 GE	Mxponder-slice 0—Client ports 4, 5, and 2 are mapped to the trunk port 0. Mxponder-slice 1—Client ports 7, 6, and 11 are mapped to the trunk port 1. Each client port consists of four lanes, 1, 2, 3, and 4. The lanes 3 and 4 can only be configured for ports 2 and 11. It is not mandatory to configure all 10 client lanes for a slice.	100G
400G-MXP	4x100G-MXP -400G-TXP	100GE, OTU4	Mxponder-slice 0—Client ports 1, 6, 7, and 10 are mapped to the trunk port 12. Mxponder-slice 1—Client ports 0, 4, 5, and 8 are mapped to the trunk port 13.	400G
400G-TXP	4x100G-MXP -400G-TXP	400GE	Mxponder-slice 0—Client port 10 is mapped to the trunk port 12. Mxponder-slice 1—Client port 8 is mapped to the trunk port 13.	400G
40x10G	40x10G-4x100G-MXP	STM64, OC192, OTU2, OTU2e, or 10 GE	Mxponder-slice 0—10G Client ports 0, 1, 2, 3, 4, 5, 6, 7, 9, and 11 mapped to the trunk port 12. Each client port consists of four lanes, 1, 2, 3, and 4.	400G CFP2

Hardware Module Configuration	Line Card Mode	Client Port Rate	Client to Trunk Mapping	Trunk Rate
30x10G	40x10G-4x100G-MXP	OTU2, OTU2e, or 10 GE	Mxponder-slice 0—10G Client ports 0, 1, 2, 3, 4, 5, 9, and 11 are mapped to the trunk port 12. The client ports 0, 1, 2, 3, 4, 5, and 9 are configured for all four lanes, 1, 2, 3, and 4. The client port 11 is configured for lanes 1 and 2.	300G CFP2
20x10G + 2x100G	40x10G-4x100G-MXP	10 GE, 100 GE, OTU2, OTU2e, or OTU4	Mxponder-slice 0—The following 100G and 10G client ports are mapped to trunk port 12. • 100G client port—0 and 1 • 10G client port—4, 5, 6, and 7 are configured for all four lanes, 1, 2, 3, and 4. • 10G client port—11 and 2 are configured for lanes 3 and 4.	300G CFP2

Hardware Module Configuration	Line Card Mode	Client Port Rate	Client to Trunk Mapping	Trunk Rate
10x10G + 3 x 100G	40x10G-4x100G-MXP	10GE, 100GE, OTU4, OTU2, or OTU2e	Mxponder-slice 0—The following 100G and 10G client ports are mapped to a trunk port 12. • 100G client port—0, 1, and 6 • 10G client port—4 and 5 are configured for all four lanes, 1, 2, 3, and 4. • 10G client port—2 are configured for lanes 3 and 4.	400G CFP2
20x10G + 1 x 100G	40x10G-4x100G-MXP	10 GE, 100 GE, OTU2, OTU2e, or OTU4	Mxponder-slice 0—The following 100G and 10G client ports are mapped to trunk port 12. • 100G client port—0 • 10G client port—1, 4,5 and 9 are configured for all four lanes, 1, 2, 3, and 4. • 10G client port—2 is configured for lanes 3 and 4 and 11 is configured for lanes 1 and 2.	300G CFP2

Hardware Module Configuration	Line Card Mode	Client Port Rate	Client to Trunk Mapping	Trunk Rate
30x10G + 1 x 100G	40x10G-4x100G-MXP	10 GE, 100 GE, OTU2, OTU2e, or OTU4	Mxponder-slice 0—The following 100G and 10G client ports are mapped to trunk port 12. • 100G client port—6 • 10G client port—0, 1, 2, 3, 4, 5, and 9 are configured for all four lanes, 1, 2, 3, and 4. • 10G client port—11 is configured for lanes 1 and 2.	400G CFP2
10x10G + 2 x 100G	40x10G-4x100G-MXP	10 GE, 100 GE, OTU2, OTU2e, or OTU4	Mxponder-slice 0—The following 100G and 10G client ports are mapped to trunk port 12. • 100G client port—0 and 1 • 10G client port—4, and 5 are configured for all four lanes, 1, 2, 3, and 4. • 10G client port—2 is configured for lanes 3 and 4.	300G CFP2

Hardware Module Configuration	Line Card Mode	Client Port Rate	Client to Trunk Mapping	Trunk Rate
10x10G + 1 x 100G	40x10G-4x100G-MXP	10 GE and 100 GE	Mxponder-slice 0—The following 100G and 10G client ports are mapped to trunk port 12. • 100G client port—0 • 10G client port—4, and 5 are configured for all four lanes, 1, 2, 3, and 4. • 10G client port—2 is configured for lanes 3 and 4. • Mxponder-slice 1—The following 100G and 10G client ports are mapped to trunk port 13. • 100G client port—1 • 10G client port—6, and 7 are configured for all four lanes, 1, 2, 3, and 4. • 10G client port—11 is configured for lanes 3 and 4.	200G CFP2
200G Muxponder	200G-FOIC2-oFEC-QPSK-1-S 200G-FOIC2-oFEC-8QAM-1-E	OTU4, 100GE	Mxponder-slice 0—Client ports 7 and 10 mapped to the trunk port 12. Mxponder-slice1—Client ports 5 and 8 mapped to the trunk port 13.	200G CFP2

Hardware Module Configuration	Line Card Mode	Client Port Rate	Client to Trunk Mapping	Trunk Rate
QDD ZRP	4x100GE-MXP-DD	100GE	Mxponder-slice 0—Client ports 1, 6, 7, and 10 are mapped to the trunk port 11. Mxponder-slice 1—Client ports 0, 4, 5, and 8 are mapped to the trunk port 9.	400G
QDD ZRP	400GE-TXP-DD	400GE	Mxponder-slice 0—Client port 10 is mapped to the trunk port 11. Mxponder-slice 1—Client port 8 is mapped to the trunk port 9.	400G
	4x100GE-MXP-DD	100GE	Mxponder-slice 0—Client ports 1, 7, and 10 are mapped to the trunk port 11. Mxponder-slice 1—Client ports 4, 5, and 8 are mapped to the trunk port 9.	300G
	4x100GE-MXP-DD	100GE	Mxponder-slice 0—Client ports 7, and 10 are mapped to the trunk port 11. Mxponder-slice 1—Client ports 4 and 5 are mapped to the trunk port 9.	200G

Note OC192 and STM64 are supported only on Cisco 4x10G QSFP+ MLR Pluggable Optics Module as the client pluggable.

QDD ZRP Limitations

- Hold of timer and Idle insertion are not supported on 400GE Client for 400G-TXP mode.
- Local Fault and Remote Fault ethernet alarms are not supported on 400GE Client for 400G-TXP mode.

- Far-end PM counters on Coherent DSP controllers are not supported for 400G-TXP and 4x100G MXP modes.
- QDD ZRP alarms appear with *Flexo* label due to absence of a separate ZRP layer.

Limitations for STM64 and OC192 in 40x10G-4x100G-MXP Mode

- OC192 and STM64 are available only in 400G trunk mode and only slice 0 is supported.
- Data communication channel for STM64 and OC192 is available only in path monitoring mode.
- PRBS, AINS, and SNMP are not supported for OC192 and STM64.
- The OC192 and STM64 controllers do not support the **controller description** command.
- Current and History PM counters do not support flex and 30 second bucket types.
- OOF alarm (out-of-frame) is not supported.

Configuring the Muxponder Mode for 10G Grey Muxponder

Note The LC mode must be configured to 10G-GREY-MXP on the OTN-XP card before you perform this configuration.

To configure the OTN-XP card in the muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 100G

client-port-rate *client-port-number* **lane** *lane-number* **client-type { 10GE | OTU2 | OTU2e}**

commit

Example

The following is a sample in which the OTN-XP card is configured with mixed client rates in the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 21 09:21:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 100G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

Verifying the Muxponder Configuration

The following is a sample to verify the muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder
Tue Apr 21 09:26:12.308 UTC
```

```
Location:             0/1
Slice ID:             0
Client Bitrate:       MIXED
Trunk  Bitrate:       100G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port   Mapper/Trunk Port    Peer/Trunk Port    OTU40/0/0/0
              Traffic Split Percentage
OTU20/0/0/2/3            NONE          ODU20/0/0/0/2/3      100
OTU20/0/0/2/4            NONE          ODU20/0/0/0/2/4      100
TenGigECtrlr0/0/0/4/1 ODU2E0/0/0/0/4/1       NONE           100
```

Configuring DAC Rate for 400G Muxponder Modes

Table 8: Feature History

Feature Name	Release	Description
DAC Configuration Support for 400GE, 4x100G, or 400G Regen modes	Cisco IOS XR Release 7.5.2	On the OTN-XP card, you can configure the Digital-to-Analog (DAC) rate for the 400GE, 4x100G, or 400G Regen modes with CFP2 DCO pluggable. Based on the DAC rate configured, pulse shaping and modem setting is set on the CFP2 DCO trunk pluggable.

From Release 7.5.2 onwards, you can configure DAC rate to set the bookended mode for the 400GE, 4x100G, or 400G Regen modes on the OTN-XP card.

DAC Supported Modes

The following operating modes are supported on the CFP2 coherent pluggable module for the OTN-XP card:

Table 9: DAC Supported Modes

Network Configuration Mode	Trunk Rate	Data Path	Line Framing	FEC Type	Modulation Format	BPS	Baud Rate (GBd)	Pulse Shaping	Mode Type
400G	400G	400G TXP, 4x100G MXP, 400G Regen	FlexO-4	oFEC	16 QAM	4	63.1	1	Enhanced

The following table provides the pulse shaping and modem setting values for the respective DAC rates.

Note The default pulse shaping is *1.5* and mode type is *Standard* for the supported modes.

Table 10: DAC Rate

DAC Rate	Pulse Shape	Modem Setting
1	0	Standard
1.25	1	Enhanced
1.5	1	Standard
2	0	Enhanced

To configure the DAC rate for OTN-XP card in the 400G TXP, 4x100G MXP, and 400G Regen modes, use the following commands:

configure

controller optics *Rack/Slot/Instance/Port* **dac-rate** 1x1.25

commit

The following is a sample in which DAC rate is configured.

```
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/12 dac-Rate 1x1.25
RP/0/RP0/CPU0:ios(config-Optics)#commit
```

Verifying the DAC Rate Configuration

The following is a sample to verify the DAC rate configuration for the 400G TXP, 4x100G MXP, and 400G Regen modes in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show controllers optics 0/2/0/12
Wed Apr 13 15:00:10.044 UTC

Controller State: Up

Transport Admin State: In Service

Laser State: On

LED State: Red

DAC RATE: 1x1.25

Configured DAC RATE: 1x1.25
```

Configuring the Muxponder Mode for 4x100G MXP

Note The LC mode must be configured to 4x100G-MXP-400G-TXP on the OTN-XP card before you perform this configuration. See Configuring the LC Mode, on page 18.

To configure the OTN-XP card in the 4x100 muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 400G

client-port-rate *client-port-number* **client-type {100GE | OTU4}**

commit

Example

The following is a sample in which the OTN-XP card is configured with 400G trunk rate on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 21 09:21:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample in which the OTN-XP card is configured with 400G trunk rate on the mxponder-slice 1 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 21 09:21:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 client-type OTU4
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

Verifying the Muxponder Configuration

The following is a sample to verify the muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder
Mon Nov 30 01:32:57.338 UTC

Location: 0/1
Slice ID: 0
Client Bitrate: 100GE
Trunk Bitrate: 400G
Status: Provisioned
LLDP Drop Enabled: FALSE
ARP Snoop Enabled: FALSE
Client Port Mapper/Trunk Port CoherentDSP0/1/0/12
Traffic Split Percentage

HundredGigECtrlr0/1/0/1 ODU40/1/0/12/1 100


Location: 0/1
Slice ID: 1
Client Bitrate: OTU4
Trunk Bitrate: 400G
Status: Provisioned
Client Port Peer/Trunk Port CoherentDSP0/1/0/13
Traffic Split Percentage

OTU40/1/0/8 ODUC40/1/0/13 100
```

Configuring the Muxponder Mode for 400G TXP

Note The LC mode must be configured to 4x100G-MXP-400G-TXP on the OTN-XP card before you perform this configuration.

To configure the OTN-XP card in the 400G TXP mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 400G

client-port-rate *client-port-number* **client-type 400GE**

commit

Example

The following is a sample in which the OTN-XP card is configured with 400G trunk rate on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 21 09:21:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 client-type 400GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample in which the OTN-XP card is configured with 400G trunk rate on the mxponder-slice 1 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 21 09:21:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 client-type 400GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

Verifying the Muxponder Configuration

The following is a sample to verify the muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder
Mon Nov 30 01:36:14.514 UTC

Location: 0/1
Slice ID: 0
Client Bitrate: 400GE
Trunk Bitrate: 400G
Status: Provisioned
LLDP Drop Enabled: FALSE
ARP Snoop Enabled: FALSE
Client Port Mapper/Trunk Port CoherentDSP0/1/0/12
Traffic Split Percentage

FourHundredGigECtrlr0/1/0/10 ODU-FLEX0/1/0/12/10 100
```

```
Location: 0/1
Slice ID: 1
Client Bitrate: 400GE
Trunk Bitrate: 400G
Status: Provisioned
LLDP Drop Enabled: FALSE
ARP Snoop Enabled: FALSE
Client Port Mapper/Trunk Port CoherentDSP0/1/0/13
Traffic Split Percentage

FourHundredGigECtrlr0/1/0/8 ODU-FLEX0/1/0/13/8 100
```

Static TPN and TS Allocation for TXP-MXP-Grey Muxponder Modes

The OTN-XP card uses the following mapping of tributary port numbers, tributary slots, and clients for the various TXP and MXP configurations.

Table 11: TPN-TS Mapping in 400GE TXP Configuration

Slice	Client Port	Client Rate	Trunk Port	Trunk Rate	TPN	TS
0	10	400GE	12	400G	1	1.1 to 4.20
1	8	400GE	13	400G	1	1.1 to 4.20

Table 12: TPN-TS Mapping in 4 X 100G MXP Configuration

Slice	Client Port	Client Rate	Trunk Port	Trunk Rate	TPN	TS
0	10	100GE/OTU4	12	400G	1	1.1 to 1.20
	7	100GE/OTU4			2	2.1 to 2.20
	6	100GE/OTU4			3	3.1 to 3.20
	1	100GE/OTU4			4	4.1 to 4.20
1	8	100GE/OTU4	13	400G	1	1.1 to 1.20
	5	100GE/OTU4			2	2.1 to 2.20
	4	100GE/OTU4			3	3.1 to 3.20
	0	100GE/OTU4			4	4.1 to 4.20

Table 13: TPN-TS Mapping in 10 X 10G Grey Muxponder Configuration

Slice	Client Port	Client Lane	Client Rate	Trunk Port	Trunk Rate	TPN	TS
0	4	1	10GE/OTU2/OTU2e	0	100G	1	1–8
		2	10GE/OTU2/OTU2e			2	9–16
		3	10GE/OTU2/OTU2e			3	17–24
		4	10GE/OTU2/OTU2e			4	25–32
	5	1	10GE/OTU2/OTU2e			5	33–40
		2	10GE/OTU2/OTU2e			6	41–48
		3	10GE/OTU2/OTU2e			7	49–56
		4	10GE/OTU2/OTU2e			8	57–64
	2	3	10GE/OTU2/OTU2e			9	65–72
		4	10GE/OTU2/OTU2e			10	73–80
1	7	1	10GE/OTU2/OTU2e	1	100G	1	1–8
		2	10GE/OTU2/OTU2e			2	9–16
		3	10GE/OTU2/OTU2e			3	17–24
		4	10GE/OTU2/OTU2e			4	25–32
	6	1	10GE/OTU2/OTU2e			5	33–40
		2	10GE/OTU2/OTU2e			6	41–48
		3	10GE/OTU2/OTU2e			7	49–56
		4	10GE/OTU2/OTU2e			8	57–64
	11	3	10GE/OTU2/OTU2e			9	65–72
		4	10GE/OTU2/OTU2e			10	73–80

Configuring the Muxponder Mode for 40x10G Muxponder

To configure the OTN-XP card in the 40x10G muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 400G

client-port-rate *client-port-number* **lane** *lane-number* **client-type {10GE | OTU2 | OTU2E | STM64 | OC192}**

commit

Example

The following is a sample in which the OTN-XP card is configured with 400G trunk rate on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 21 09:21:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/3 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample in which the port 0 lane 1 has OC192 payload and lane 2 has STM64 payload. Only slice 0 configuration is supported for OC192/STM64.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 21 09:21:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 1 client-type oc192
```

```
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 2 client-type stm64
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

Verifying the Muxponder Configuration

The following is a sample to verify the 40x10G muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/3 mxponder
Wed Jun  2 17:57:36.647 UTC

Location:             0/3
Slice ID:             0
Client Bitrate:       10GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port           CoherentDSP0/3/0/12
                                Traffic Split Percentage

TenGigECtrlr0/3/0/0/1           ODU2E0/3/0/12/0/1                             100
TenGigECtrlr0/3/0/0/2           ODU2E0/3/0/12/0/2                             100
TenGigECtrlr0/3/0/0/3           ODU2E0/3/0/12/0/3                             100
TenGigECtrlr0/3/0/0/4           ODU2E0/3/0/12/0/4                             100
TenGigECtrlr0/3/0/1/1           ODU2E0/3/0/12/1/1                             100
TenGigECtrlr0/3/0/1/2           ODU2E0/3/0/12/1/2                             100
TenGigECtrlr0/3/0/1/3           ODU2E0/3/0/12/1/3                             100
TenGigECtrlr0/3/0/1/4           ODU2E0/3/0/12/1/4                             100
TenGigECtrlr0/3/0/2/1           ODU2E0/3/0/12/2/1                             100
TenGigECtrlr0/3/0/2/2           ODU2E0/3/0/12/2/2                             100
TenGigECtrlr0/3/0/2/3           ODU2E0/3/0/12/2/3                             100
TenGigECtrlr0/3/0/2/4           ODU2E0/3/0/12/2/4                             100
TenGigECtrlr0/3/0/3/1           ODU2E0/3/0/12/3/1                             100
TenGigECtrlr0/3/0/3/2           ODU2E0/3/0/12/3/2                             100
TenGigECtrlr0/3/0/3/3           ODU2E0/3/0/12/3/3                             100
TenGigECtrlr0/3/0/3/4           ODU2E0/3/0/12/3/4                             100
TenGigECtrlr0/3/0/4/1           ODU2E0/3/0/12/4/1                             100
TenGigECtrlr0/3/0/4/2           ODU2E0/3/0/12/4/2                             100
TenGigECtrlr0/3/0/4/3           ODU2E0/3/0/12/4/3                             100
TenGigECtrlr0/3/0/4/4           ODU2E0/3/0/12/4/4                             100
TenGigECtrlr0/3/0/5/1           ODU2E0/3/0/12/5/1                             100
TenGigECtrlr0/3/0/5/2           ODU2E0/3/0/12/5/2                             100
TenGigECtrlr0/3/0/5/3           ODU2E0/3/0/12/5/3                             100
TenGigECtrlr0/3/0/5/4           ODU2E0/3/0/12/5/4                             100
TenGigECtrlr0/3/0/6/1           ODU2E0/3/0/12/6/1                             100
TenGigECtrlr0/3/0/6/2           ODU2E0/3/0/12/6/2                             100
TenGigECtrlr0/3/0/6/3           ODU2E0/3/0/12/6/3                             100
TenGigECtrlr0/3/0/6/4           ODU2E0/3/0/12/6/4                             100
TenGigECtrlr0/3/0/7/1           ODU2E0/3/0/12/7/1                             100
TenGigECtrlr0/3/0/7/2           ODU2E0/3/0/12/7/2                             100
TenGigECtrlr0/3/0/7/3           ODU2E0/3/0/12/7/3                             100
TenGigECtrlr0/3/0/7/4           ODU2E0/3/0/12/7/4                             100
TenGigECtrlr0/3/0/9/1           ODU2E0/3/0/12/9/1                             100
TenGigECtrlr0/3/0/9/2           ODU2E0/3/0/12/9/2                             100
TenGigECtrlr0/3/0/9/3           ODU2E0/3/0/12/9/3                             100
TenGigECtrlr0/3/0/9/4           ODU2E0/3/0/12/9/4                             100
TenGigECtrlr0/3/0/11/1          ODU2E0/3/0/12/11/1                            100
TenGigECtrlr0/3/0/11/2          ODU2E0/3/0/12/11/2                            100
TenGigECtrlr0/3/0/11/3          ODU2E0/3/0/12/11/3                            100
TenGigECtrlr0/3/0/11/4          ODU2E0/3/0/12/11/4                            100
```

Configuring the Muxponder Mode for 30x10G

To configure the OTN-XP card in the 30x10G muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 300G

client-port-rate *client-port-number* **lane** *lane-number* **client-type {10GE | OTU2E | OTU2}**

commit

Example

The following is a sample in which the OTN-XP card is configured with 300G trunk rate on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 21 09:21:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 300G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

Verifying the Muxponder Configuration

The following is a sample to verify the 30x10G muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder
Wed Jun  2 17:56:40.574 UTC
```

```
Location:             0/1
Slice ID:             0
Client Bitrate:       MIXED
Trunk  Bitrate:       300G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                   Mapper/Trunk Port   Peer/Trunk Port       CoherentDSP0/1/0/12

                                Traffic Split Percentage

OTU20/1/0/0/3                         NONE      ODU20/1/0/12/0/3
    100
OTU20/1/0/1/3                         NONE      ODU20/1/0/12/1/3
    100
OTU20/1/0/2/3                         NONE      ODU20/1/0/12/2/3
    100
OTU20/1/0/3/3                         NONE      ODU20/1/0/12/3/3
    100
OTU20/1/0/4/3                         NONE      ODU20/1/0/12/4/3
    100
OTU20/1/0/5/3                         NONE      ODU20/1/0/12/5/3
    100
OTU20/1/0/9/3                         NONE      ODU20/1/0/12/9/3
    100
OTU2E0/1/0/0/2                        NONE      ODU2E0/1/0/12/0/2
    100
OTU2E0/1/0/1/2                        NONE      ODU2E0/1/0/12/1/2
    100
OTU2E0/1/0/2/2                        NONE      ODU2E0/1/0/12/2/2
    100
OTU2E0/1/0/3/2                        NONE      ODU2E0/1/0/12/3/2
    100
OTU2E0/1/0/4/2                        NONE      ODU2E0/1/0/12/4/2
    100
OTU2E0/1/0/5/2                        NONE      ODU2E0/1/0/12/5/2
    100
OTU2E0/1/0/9/2                        NONE      ODU2E0/1/0/12/9/2
    100
TenGigECtrlr0/1/0/0/1           ODU2E0/1/0/12/0/1             NONE
    100
TenGigECtrlr0/1/0/0/4           ODU2E0/1/0/12/0/4             NONE
    100
TenGigECtrlr0/1/0/1/1           ODU2E0/1/0/12/1/1             NONE
    100
TenGigECtrlr0/1/0/1/4           ODU2E0/1/0/12/1/4             NONE
    100
TenGigECtrlr0/1/0/2/1           ODU2E0/1/0/12/2/1             NONE
    100
TenGigECtrlr0/1/0/2/4           ODU2E0/1/0/12/2/4             NONE
    100
TenGigECtrlr0/1/0/3/1           ODU2E0/1/0/12/3/1             NONE
    100
TenGigECtrlr0/1/0/3/4           ODU2E0/1/0/12/3/4             NONE
    100
TenGigECtrlr0/1/0/4/1           ODU2E0/1/0/12/4/1             NONE
    100
TenGigECtrlr0/1/0/4/4           ODU2E0/1/0/12/4/4             NONE
    100
TenGigECtrlr0/1/0/5/1           ODU2E0/1/0/12/5/1             NONE
    100
TenGigECtrlr0/1/0/5/4           ODU2E0/1/0/12/5/4             NONE
    100
```

```
TenGigECtrlr0/1/0/9/1           ODU2E0/1/0/12/9/1             NONE
    100
TenGigECtrlr0/1/0/9/4           ODU2E0/1/0/12/9/4             NONE
    100
```

Configuring Hybrid Modes Using 40x10G-4x100G-MXP

Table 14: Feature History

Feature Name	Release Information	Description
Hybrid Modes Using 40x10G-4x100G-MXP	Cisco IOS XR Release 7.3.2	With the 40x10G-4x100G-MXP muxponder mode support, you can configure the following hybrid modes: • 20x10G + 2x100G • 10x10G + 3 x 100G With the 40x10G-4x100G-MXP muxponder mode support, you have flexibility to choose a combination of 10G and 100G client rates across different OTN and Ethernet client rates.

Table 15: Feature History

Feature Name	Release Information	Description
Support for 10x10G + 2 x 100G, 20x10G + 1 x 100G, and 30x10G + 1 x 100G Hybrid Modes	Cisco IOS XR Release 7.5.1	You can configure different client rates across the ports depending on the bandwidth requirement, using the following hybrid modes: • 30x10G + 1 x 100G • 10x10G + 2 x 100G • 20x10G + 1 x 100G

With the 40x10G-4x100G-MXP muxponder mode support, you can configure the following hybrid modes:

- 20x10G + 2x100G
- 10x10G + 3 x 100G
- 30x10G + 1 x 100G
- 10x10G + 2 x 100G
- 20x10G + 1 x 100G

For more information on the client to trunk mapping for each of the mode, see #unique_5 unique_5_Connect_42_table_yft_mn1_srb.

Configuring the Muxponder Mode for 20x10G-2x100G

To configure the OTN-XP card in the 20x10G-2x100G muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 400G

client-port-rate *client-port-number* **client-type {100GE | OTU4}**

client-port-rate *client-port-number* **lane** *lane-number* **client-type {10GE | OTU2 | OTU2E}**

commit

Example

The following is a sample in which the OTN-XP card is configured with 400G trunk rate on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 21 09:21:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type OTU4
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 1 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 3 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 4 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 1 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 3 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 4 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

Verifying the Muxponder Configuration

The following is a sample to verify the 20x10G-2x100G muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder
Wed Jun  2 18:00:58.201 UTC

Location:              0/1
Slice ID:              0
Client Bitrate:        MIXED
```

```
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                  Mapper/Trunk Port   Peer/Trunk Port       CoherentDSP0/1/0/12

                                Traffic Split Percentage

OTU40/1/0/1                           NONE      ODU40/1/0/12/1                        100
OTU2E0/1/0/2/3                        NONE      ODU2E0/1/0/12/2/3
    100
OTU2E0/1/0/2/4                        NONE      ODU2E0/1/0/12/2/4
    100
OTU2E0/1/0/4/1                        NONE      ODU2E0/1/0/12/4/1
    100
OTU2E0/1/0/4/2                        NONE      ODU2E0/1/0/12/4/2
    100
OTU2E0/1/0/4/3                        NONE      ODU2E0/1/0/12/4/3
    100
OTU2E0/1/0/4/4                        NONE      ODU2E0/1/0/12/4/4
    100
OTU2E0/1/0/5/1                        NONE      ODU2E0/1/0/12/5/1
    100
OTU2E0/1/0/5/2                        NONE      ODU2E0/1/0/12/5/2
    100
OTU2E0/1/0/5/3                        NONE      ODU2E0/1/0/12/5/3
    100
OTU2E0/1/0/5/4                        NONE      ODU2E0/1/0/12/5/4
    100
TenGigECtrlr0/1/0/6/1           ODU2E0/1/0/12/6/1                             100
TenGigECtrlr0/1/0/6/2           ODU2E0/1/0/12/6/2                             100
TenGigECtrlr0/1/0/6/3           ODU2E0/1/0/12/6/3                             100
TenGigECtrlr0/1/0/6/4           ODU2E0/1/0/12/6/4                             100
TenGigECtrlr0/1/0/7/1           ODU2E0/1/0/12/7/1                             100
TenGigECtrlr0/1/0/7/2           ODU2E0/1/0/12/7/2                             100
TenGigECtrlr0/1/0/7/3           ODU2E0/1/0/12/7/3                             100
TenGigECtrlr0/1/0/7/4           ODU2E0/1/0/12/7/4                             100
TenGigECtrlr0/1/0/11/3           ODU2E0/1/0/12/11/3                             100
TenGigECtrlr0/1/0/11/4           ODU2E0/1/0/12/11/4                             100
HundredGigECtrlr0/1/0/0         ODU40/1/0/12/0        NONE                            100
```

Configuring the Muxponder Mode for 10 x 10G-3 x 100G

To configure the OTN-XP card in the 10 x 10G and 3 x 100G muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 400G

client-port-rate *client-port-number* **client-type {100GE | OTU4}**

client-port-rate *client-port-number* **lane** *lane-number* **client-type {10GE | OTU2 | OTU2E}**

commit

Example

The following is a sample in which the OTN-XP card is configured with 400G trunk rate on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 21 09:21:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type OTU4
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 1 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 3 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 4 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 1 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 2 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 3 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 4 client-type OTU2E
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

Verifying the Muxponder Configuration

The following is a sample to verify the 10 x 10G and 3 x 100G muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder
Wed Jun  2 18:00:58.201 UTC

Location:             0/1
Slice ID:             0
Client Bitrate:       MIXED
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                  Mapper/Trunk Port   Peer/Trunk Port       CoherentDSP0/1/0/12

                                Traffic Split Percentage

OTU40/1/0/1                           NONE      ODU40/1/0/12/1                        100
OTU2E0/1/0/2/3                        NONE      ODU2E0/1/0/12/2/3
    100
OTU2E0/1/0/2/4                        NONE      ODU2E0/1/0/12/2/4
    100
OTU2E0/1/0/4/1                        NONE      ODU2E0/1/0/12/4/1
    100
OTU2E0/1/0/4/2                        NONE      ODU2E0/1/0/12/4/2
    100
OTU2E0/1/0/4/3                        NONE      ODU2E0/1/0/12/4/3
    100
OTU2E0/1/0/4/4                        NONE      ODU2E0/1/0/12/4/4
    100
OTU2E0/1/0/5/1                        NONE      ODU2E0/1/0/12/5/1
    100
OTU2E0/1/0/5/2                        NONE      ODU2E0/1/0/12/5/2
    100
OTU2E0/1/0/5/3                        NONE      ODU2E0/1/0/12/5/3
    100
OTU2E0/1/0/5/4                        NONE      ODU2E0/1/0/12/5/4
    100
HundredGigECtrlr0/1/0/0         ODU40/1/0/12/0        NONE                            100
HundredGigECtrlr0/1/0/6         ODU40/1/0/12/6        NONE                            100
```

Configuring Hybrid Modes for 20x10G + 1 x 100G Over 300G

To configure the OTN-XP card in the 20x10G + 1x100G muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 300G

client-port-rate *client-port-number* **client-type {100GE | OTU4}**

client-port-rate *client-port-number* **lane** *lane-number* **client-type {10GE | OTU2 | OTU2E}**

commit

The following is a sample in which the OTN-XP card is configured with the 20x10G + 1x100G mode on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#configure
Sun Jul 25 12:43:00.399 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 300G
RP/0/RP0/CPU0:ios#configure
Sun Jul 25 12:43:00.399 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 300G
/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 3 client-type otu2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 4 client-type otu2e
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type otu2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 4 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample to verify the 20x10G + 1x100G muxponder configuration in the OTN-XP card:

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/2 mxponder-slice 0
Sun Jul 25 13:11:01.829 UTC

Location:             0/2
Slice ID:             0
Client Bitrate:       MIXED
Trunk  Bitrate:       300G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                  Mapper/Trunk Port   Peer/Trunk Port       CoherentDSP0/2/0/12
```

```
                                Traffic Split Percentage

OTU20/2/0/1/3                         NONE      ODU20/2/0/12/1/3
    100
OTU20/2/0/2/3                         NONE      ODU20/2/0/12/2/3
    100
OTU20/2/0/4/3                         NONE      ODU20/2/0/12/4/3
    100
OTU20/2/0/4/4                         NONE      ODU20/2/0/12/4/4
    100
OTU2E0/2/0/1/4                        NONE      ODU2E0/2/0/12/1/4
    100
OTU2E0/2/0/2/1                        NONE      ODU2E0/2/0/12/2/1
    100
OTU2E0/2/0/2/2                        NONE      ODU2E0/2/0/12/2/2
    100
TenGigECtrlr0/2/0/1/1           ODU2E0/2/0/12/1/1             NONE
    100
TenGigECtrlr0/2/0/1/2           ODU2E0/2/0/12/1/2             NONE
    100
TenGigECtrlr0/2/0/2/4           ODU2E0/2/0/12/2/4             NONE
    100
TenGigECtrlr0/2/0/4/1           ODU2E0/2/0/12/4/1             NONE
    100
TenGigECtrlr0/2/0/4/2           ODU2E0/2/0/12/4/2             NONE
    100
TenGigECtrlr0/2/0/5/1           ODU2E0/2/0/12/5/1             NONE
    100
TenGigECtrlr0/2/0/5/2           ODU2E0/2/0/12/5/2             NONE
    100
TenGigECtrlr0/2/0/5/3           ODU2E0/2/0/12/5/3             NONE
    100
TenGigECtrlr0/2/0/5/4           ODU2E0/2/0/12/5/4             NONE
    100
TenGigECtrlr0/2/0/9/1           ODU2E0/2/0/12/9/1             NONE
    100
TenGigECtrlr0/2/0/9/2           ODU2E0/2/0/12/9/2             NONE
    100
TenGigECtrlr0/2/0/9/3           ODU2E0/2/0/12/9/3             NONE
    100
TenGigECtrlr0/2/0/9/4           ODU2E0/2/0/12/9/4             NONE
    100
TenGigECtrlr0/2/0/11/1          ODU2E0/2/0/12/11/1            NONE
    100
TenGigECtrlr0/2/0/11/2          ODU2E0/2/0/12/11/2            NONE
    100
HundredGigECtrlr0/2/0/0        ODU40/2/0/12/0        NONE                            100
                          100

RP/0/RP0/CPU0:ios#show lc-module location 0/2 lcmode
Sun Jul 25 15:28:16.324 UTC

Node    Lcmode_Supported    Owner    Running                         Configured
--------------------------------------------------------------------------------
0/2                    Yes                CLI      40x10G-4x100G-MXP      40x10G-4x100G-MXP
```

Configuring Hybrid Modes for 30x10G + 1 x 100G Over 400G

To configure the OTN-XP card in the 30x10G + 1x100G muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 400G

client-port-rate *client-port-number* **client-type {100GE | OTU4}**

client-port-rate *client-port-number* **lane** *lane-number* **client-type {10GE | OTU2 | OTU2E}**

commit

The following is a sample in which the OTN-XP card is configured with 300G trunk rate on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#configure
Sun Jul 25 12:43:00.399 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios#configure
Sun Jul 25 12:43:00.399 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 2 client-type otu2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 3 client-type otu2e
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 3 client-type otu2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 4 client-type otu2e
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 1 client-type otu2e
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 2 client-type otu2e
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type otu2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 3 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 4 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 9 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample to verify the 30x10G + 1x100G muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/2 mxponder-slice 0
Sun Jul 25 13:11:01.829 UTC

Location:             0/2
Slice ID:             0
Client Bitrate:       MIXED
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
```

```
ARP Snoop Enabled:    FALSE
Client Port                   Mapper/Trunk Port  Peer/Trunk Port       CoherentDSP0/2/0/12

                                Traffic Split Percentage

OTU20/2/0/0/2                         NONE      ODU20/2/0/12/0/2
    100
OTU20/2/0/1/3                         NONE      ODU20/2/0/12/1/3
    100
OTU20/2/0/2/3                         NONE      ODU20/2/0/12/2/3
    100
OTU20/2/0/4/3                         NONE      ODU20/2/0/12/4/3
    100
OTU20/2/0/4/4                         NONE      ODU20/2/0/12/4/4
    100
OTU2E0/2/0/0/3                        NONE      ODU2E0/2/0/12/0/3
    100
OTU2E0/2/0/1/4                        NONE      ODU2E0/2/0/12/1/4
    100
OTU2E0/2/0/2/1                        NONE      ODU2E0/2/0/12/2/1
    100
OTU2E0/2/0/2/2                        NONE      ODU2E0/2/0/12/2/2
    100
TenGigECtrlr0/2/0/0/1           ODU2E0/2/0/12/0/1            NONE
    100
TenGigECtrlr0/2/0/0/4           ODU2E0/2/0/12/0/4            NONE
    100
TenGigECtrlr0/2/0/1/1           ODU2E0/2/0/12/1/1            NONE
    100
TenGigECtrlr0/2/0/1/2           ODU2E0/2/0/12/1/2            NONE
    100
TenGigECtrlr0/2/0/2/4           ODU2E0/2/0/12/2/4            NONE
    100
TenGigECtrlr0/2/0/3/1           ODU2E0/2/0/12/3/1            NONE
    100
TenGigECtrlr0/2/0/3/2           ODU2E0/2/0/12/3/2            NONE
    100
TenGigECtrlr0/2/0/3/3           ODU2E0/2/0/12/3/3            NONE
    100
TenGigECtrlr0/2/0/3/4           ODU2E0/2/0/12/3/4            NONE
    100
TenGigECtrlr0/2/0/4/1           ODU2E0/2/0/12/4/1            NONE
    100
TenGigECtrlr0/2/0/4/2           ODU2E0/2/0/12/4/2            NONE
    100
TenGigECtrlr0/2/0/5/1           ODU2E0/2/0/12/5/1            NONE
    100
TenGigECtrlr0/2/0/5/2           ODU2E0/2/0/12/5/2            NONE
    100
TenGigECtrlr0/2/0/5/3           ODU2E0/2/0/12/5/3            NONE
    100
TenGigECtrlr0/2/0/5/4           ODU2E0/2/0/12/5/4            NONE
    100
TenGigECtrlr0/2/0/9/1           ODU2E0/2/0/12/9/1            NONE
    100
TenGigECtrlr0/2/0/9/2           ODU2E0/2/0/12/9/2            NONE
    100
TenGigECtrlr0/2/0/9/3           ODU2E0/2/0/12/9/3            NONE
    100
TenGigECtrlr0/2/0/9/4           ODU2E0/2/0/12/9/4            NONE
    100
TenGigECtrlr0/2/0/11/1          ODU2E0/2/0/12/11/1           NONE
    100
TenGigECtrlr0/2/0/11/2          ODU2E0/2/0/12/11/2           NONE
```

```
    100
HundredGigECtrlr0/2/0/6         ODU40/2/0/12/0        NONE                            100
                       100

RP/0/RP0/CPU0:ios#show lc-module location 0/2 lcmode
Sun Jul 25 15:28:16.324 UTC

Node    Lcmode_Supported    Owner    Running                         Configured
--------------------------------------------------------------------------------
0/2                    Yes               CLI     40x10G-4x100G-MXP      40x10G-4x100G-MXP
```

Configuring Hybrid Modes for 10x10G + 2 x 100G Over 300G

To configure the OTN-XP card in the 10x10G + 2x100G muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 300G

client-port-rate *client-port-number* **client-type {100GE | OTU4}**

client-port-rate *client-port-number* **lane** *lane-number* **client-type {10GE | OTU2 | OTU2E}**

commit

The following is a sample in which the OTN-XP card is configured with 300G trunk rate on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#configure
Sun Jul 25 12:43:00.399 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 300G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type otu4
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type OTU2e
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 3 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 4 client-type OTU2
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample to verify the 10x10G + 2x100G muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/2 mxponder-slice 0
Sun Jul 25 14:57:40.806 UTC

Location:             0/2
Slice ID:             0
Client Bitrate:       MIXED
Trunk  Bitrate:       300G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                  Mapper/Trunk Port   Peer/Trunk Port       CoherentDSP0/2/0/12

                                Traffic Split Percentage
```

```
OTU40/2/0/1                           NONE      ODU40/2/0/12/1                        100
OTU2e0/2/0/2/4                         NONE      ODU2e0/2/0/12/2/4
      100
OTU20/2/0/4/3                         NONE      ODU20/2/0/12/4/3
    100
OTU20/2/0/4/4                         NONE      ODU20/2/0/12/4/4
    100
TenGigECtrlr0/2/0/2/3           ODU2E0/2/0/12/2/3             NONE
    100
TenGigECtrlr0/2/0/4/1           ODU2E0/2/0/12/4/1             NONE
    100
TenGigECtrlr0/2/0/4/2           ODU2E0/2/0/12/4/2             NONE
    100
TenGigECtrlr0/2/0/5/1           ODU2E0/2/0/12/5/1             NONE
    100
TenGigECtrlr0/2/0/5/2           ODU2E0/2/0/12/5/2             NONE
    100
TenGigECtrlr0/2/0/5/3           ODU2E0/2/0/12/5/3             NONE
    100
TenGigECtrlr0/2/0/5/4           ODU2E0/2/0/12/5/4             NONE
    100
HundredGigECtrlr0/2/0/0         ODU40/2/0/12/0        NONE                            100

RP/0/RP0/CPU0:ios#show lc-module location 0/2 lcmode
Sun Jul 25 15:28:16.324 UTC

Node    Lcmode_Supported    Owner    Running                         Configured
--------------------------------------------------------------------------------
0/2                    Yes                CLI      40x10G-4x100G-MXP     40x10G-4x100G-MXP
```

Configuring Hybrid Mode for 10x10G + 1x100G Over 200G

Table 16: Feature History

Feature Name	Release Information	Description
10x10G + 1x100G Hybrid Mode for OTN-XP Card	Cisco IOS XR Release 7.7.1	A new hybrid mode 10x10G + 1x100G over 200G trunk rate is introduced for OTN-XP card. This mode is configurable on both slice 1 and slice 0. This feature provides you the flexibility to choose a combination of 10G and 100G client rates simultaneously on both slices of the OTN-XP card.

To configure the OTN-XP card in the 10 x 10G and 1 x 100G muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 200G

client-port-rate *client-port-number* **client-type {100GE | OTU4}**

client-port-rate *client-port-number* **lane** *lane-number* **client-type {10GE | 100GE}**

commit

Example

The following is a sample in which the OTN-XP card is configured with 200G trunk rate on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 22 10:51:44.460 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 2 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

Example

The following is a sample in which the OTN-XP card is configured with 200G trunk rate on the mxponder-slice 1 mode.

```
RP/0/RP0/CPU0:ios#config
Tue Apr 22 11:01:44:55.250 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 1 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 2 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 3 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 11 lane 4 client-type 10GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

Verifying the Muxponder Configuration

The following is a sample to verify the 10 x 10G and 1 x 100G muxponder configuration in the OTN-XP card.

```
RRP/0/RP0/CPU0:ios#sh hw-module location 0/2 mxponder-slice 0
Fri Jun 17 15:55:43.520 UTC

Location:             0/2
Slice ID:             0
Client Bitrate:       MIXED
Trunk  Bitrate:       200G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/2/0/12
```

```
                                Traffic Split Percentage

TenGigECtrlr0/2/0/2/3           ODU2E0/2/0/12/2/3                             100
TenGigECtrlr0/2/0/2/4           ODU2E0/2/0/12/2/4                             100
TenGigECtrlr0/2/0/4/1           ODU2E0/2/0/12/4/1                             100
TenGigECtrlr0/2/0/4/2           ODU2E0/2/0/12/4/2                             100
TenGigECtrlr0/2/0/4/3           ODU2E0/2/0/12/4/3                             100
TenGigECtrlr0/2/0/4/4           ODU2E0/2/0/12/4/4                             100
TenGigECtrlr0/2/0/5/1           ODU2E0/2/0/12/5/1                             100
TenGigECtrlr0/2/0/5/2           ODU2E0/2/0/12/5/2                             100
TenGigECtrlr0/2/0/5/3           ODU2E0/2/0/12/5/3                             100
TenGigECtrlr0/2/0/5/4           ODU2E0/2/0/12/5/4                             100
HundredGigECtrlr0/2/0/0         ODU40/2/0/12/0                        100

RP/0/RP0/CPU0:ios#
```

Configuring the Muxponder Mode for 200G on OTN-XP Card

Table 17: Feature History

Feature Name	Release Information	Description
Muxponder Configuration for 200G Trunk with QPSK and 8QAM Modulation	Cisco IOS XR Release 7.3.2	The OTN-XP card supports up to 200G trunk rate with QPSK and 8QAM modulation using CFP2. This feature enhances the signal reachability with reduced noise and can support the 50GHz network. Commands modified: • hw-module (OTN-XP Card)

To configure the OTN-XP card in the 200G muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 200G

commit

The following is a sample configuration of 200G trunk rate on the mxponder-slice 0 mode for OTN-XP card:

```
RP/0/RP0/CPU0:ios#config
Wed Jun  2 17:17:59.409 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample configuration of 200G trunk rate on the mxponder-slice 1 mode for OTN-XP card:

```
RP/0/RP0/CPU0:ios#config
Wed Jun  2 17:17:59.409 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
```

```
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 0:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 xponder-capabilities mxponder-slice 0
Wed Jun  2 17:02:33.088 UTC

Location: 0/1

Trunk-Port(s): 12

Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     400G                          1, 6, 7, 10

Trunk-bandwidth: 400G
Client-port                       Supported client rates
     1                             OTU4, 100GE
     6                             OTU4, 100GE
     7                             OTU4, 100GE
     10                            OTU4, 100GE, 400GE

Trunk-bandwidth: 300G
Client-port                       Supported client rates
     6                             OTU4, 100GE
     7                             OTU4, 100GE
     10                            OTU4, 100GE

Trunk-bandwidth: 200G
Client-port                       Supported client rates
     7                             OTU4, 100GE
     10                            OTU4, 100GE
```

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 1:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 xponder-capabilities mxponder-slice 1
Wed Jun  2 17:02:50.133 UTC

Location: 0/1

Trunk-Port(s): 13

Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     400G                          0, 4, 5, 8

Trunk-bandwidth: 400G
Client-port                       Supported client rates
     0                             OTU4, 100GE
     4                             OTU4, 100GE
     5                             OTU4, 100GE
     8                             OTU4, 100GE, 400GE

Trunk-bandwidth: 300G
Client-port                       Supported client rates
     4                             OTU4, 100GE
     5                             OTU4, 100GE
     8                             OTU4, 100GE

Trunk-bandwidth: 200G
Client-port                       Supported client rates
```

```
        5                              OTU4, 100GE
        8                              OTU4, 100GE
```

Configuring 8QAM Modulation for 200G Muxponder Mode

By default, QPSK is the modulation format, when you configure 200G trunk rate.

The following operating modes are supported on the DP04CFP2 coherent pluggable module:

Table 18: DP04CFP2 Supported Modes

Network Configuration Mode	Client Type	Trunk Rate	Data Path	Line Framing	FEC Type	Modulation Format	BPS	Baud Rate (GBd)	Pulse Shaping	Mode Type
200G-FOIC2-oFEC-QPSK-1-S (Default mode)	2xFOIC1.2	200G	FlexO Str	FlexO-2	oFEC	QPSK	2	63.1	1	Standard
200G-FOIC2-oFEC-8QAM-1-E	2xFOIC1.2	200G	FlexO Str	FlexO-2	oFEC	8QAM	3	42.1	1	Enhanced

Use the following commands to change the modulation format to 8QAM:

configure

controller optics *Rack/Slot/Instance/Port* **bits-per-symbol** 3

commit

The following is a sample in which 8QAM modulation is configured.

```
RP/0/RP0/CPU0:ios#config
Wed Jun  2 17:21:59.409 UTC
RP/0/RP0/CPU0:ios(config)#controller optics0/1/0/12 bits-per-symbol 3
RP/0/RP0/CPU0:ios(config-optics)#commit
```

Verifying the 8QAM Modulation Configuration

```
RP/0/RP0/CPU0:ios#show controllers optics 0/1/0/12
Wed Jun  2 17:17:29.652 UTC

 Controller State: Up

 Transport Admin State: In Service

 Laser State: On

 LED State: Green

 Optics Status

         Optics Type:  <Unknown> DWDM
         DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,
         Wavelength=1552.524nm

         Alarm Status:
         -------------
         Detected Alarms: None
```

```
        LOS/LOL/Fault Status:

        Alarm Statistics:

        -------------
        HIGH-RX-PWR = 0            LOW-RX-PWR = 1
        HIGH-TX-PWR = 0            LOW-TX-PWR = 1
        HIGH-LBC = 0               HIGH-DGD = 0
        OOR-CD = 0                 OSNR = 1
        WVL-OOL = 0                MEA  = 0
        IMPROPER-REM = 0
        TX-POWER-PROV-MISMATCH = 0
        Laser Bias Current = 0.0 %
        Actual TX Power = 0.97 dBm
        RX Power = 1.47 dBm
        RX Signal Power = 17.67 dBm
        Frequency Offset = 82 MHz

        Performance Monitoring: Enable

        THRESHOLD VALUES
        ----------------

        Parameter                 High Alarm  Low Alarm  High Warning  Low Warning
        ------------------------  ----------  ---------  ------------  -----------
        Rx Power Threshold(dBm)          3.0      -31.5           0.0          0.0
        Tx Power Threshold(dBm)          3.0      -12.0           0.0          0.0
        LBC Threshold(mA)                N/A        N/A          0.00         0.00

        LBC High Threshold = 90 %
        Configured Tx Power = 1.00 dBm
        Configured CD High Threshold = 96000 ps/nm
        Configured CD lower Threshold = -96000 ps/nm
        Configured OSNR lower Threshold = 13.70 dB
        Configured DGD Higher Threshold = 67.00 ps
        Baud Rate =  42.2082633972 GBd
        Bits per Symbol = 3.0000000000  bits/symbol
        Modulation Type: 8QAM
        Chromatic Dispersion 2 ps/nm
        Configured CD-MIN -48000 ps/nm  CD-MAX 48000 ps/nm
        Polarization Mode Dispersion = 0.0 ps
        Second Order Polarization Mode Dispersion = 72.00 ps^2
        Optical Signal to Noise Ratio = 34.10 dB
        SNR = 18.40 dB
        Polarization Dependent Loss = 1.20 dB
        Polarization Change Rate = 0.00 rad/s
        Differential Group Delay = 2.00 ps

Transceiver Vendor Details

        Form Factor            : Not set
        Fiber Connector Type: Not Set
        Otn Application Code: Not Set
        Sonet Application Code: Not Set
        Ethernet Compliance Code: Not set

Transceiver Temperature : 46 Celsius



AINS Soak                : None
AINS Timer               : 0h, 0m
```

```
 AINS remaining time      : 0 seconds
```

Configuring the Muxponder Mode for 300G on OTN-XP Card

Table 19: Feature History

Feature Name	Release Information	Description
Muxponder Configuration for 300G Trunk with 8QAM Modulation	Cisco IOS XR Release 7.3.2	The OTN-XP card supports up to 300G trunk rate with 8QAM modulation using CFP2. This feature improves the signal reachability with decreased noise. Commands modified: • hw-module (OTN-XP Card)

To configure the OTN-XP card in the 300G muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 300G

commit

The following is a sample configuration of 300G trunk rate on the mxponder-slice 0 mode for OTN-XP card:

```
RP/0/RP0/CPU0:ios#config
Wed Jun  2 17:17:59.409 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 300G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample configuration of 300G trunk rate on the mxponder-slice 1 mode for OTN-XP card:

```
RP/0/RP0/CPU0:ios#config
Wed Jun  2 17:17:59.409 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 300G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 0:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 xponder-capabilities mxponder-slice 0
Wed Jun  2 17:02:33.088 UTC

Location: 0/1

Trunk-Port(s): 12
```

```
Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     400G                          1, 6, 7, 10

Trunk-bandwidth: 400G
Client-port                       Supported client rates
     1                             OTU4, 100GE
     6                             OTU4, 100GE
     7                             OTU4, 100GE
     10                            OTU4, 100GE, 400GE

Trunk-bandwidth: 300G
Client-port                       Supported client rates
     6                             OTU4, 100GE
     7                             OTU4, 100GE
     10                            OTU4, 100GE

Trunk-bandwidth: 200G
Client-port                       Supported client rates
     7                             OTU4, 100GE
     10                            OTU4, 100GE
```

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 1:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 xponder-capabilities mxponder-slice 1
Wed Jun  2 17:02:50.133 UTC

Location: 0/1

Trunk-Port(s): 13

Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     400G                          0, 4, 5, 8

Trunk-bandwidth: 400G
Client-port                       Supported client rates
     0                             OTU4, 100GE
     4                             OTU4, 100GE
     5                             OTU4, 100GE
     8                             OTU4, 100GE, 400GE

Trunk-bandwidth: 300G
Client-port                       Supported client rates
     4                             OTU4, 100GE
     5                             OTU4, 100GE
     8                             OTU4, 100GE

Trunk-bandwidth: 200G
Client-port                       Supported client rates
     5                             OTU4, 100GE
     8                             OTU4, 100GE
```

By default, 8QAM is the modulation format, when you configure 300G trunk rate.

The following operating mode is supported on the DP04CFP2 coherent pluggable module:

Table 20: DP04CFP2 Supported Modes

Network Configuration Mode	Client Type	Trunk Rate	Data Path	Line Framing	FEC Type	Modulation Format	BPS	Baud Rate (GBd)	Pulse Shaping	Mode Type
300G-FOIC3-oFEC-8QAM-1-S (Default mode)	3xFOIC1.2	300G	FlexO Str	FlexO-3	oFEC	8QAM	3	63.1	1	Standard

The following sample shows the supported client rates for 300G trunk rate and the provisioning status of slice 1:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/1 mxponder-slice 1
Fri Jul 23 16:04:42.279 UTC

Location:             0/1
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       300G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/1/0/13
                                Traffic Split Percentage
HundredGigECtrlr0/1/0/4         ODU40/1/0/13/8                 100
HundredGigECtrlr0/1/0/5         ODU40/1/0/13/5                 100
HundredGigECtrlr0/1/0/8         ODU40/1/0/13/8                 100
```

The following sample shows the default 8QAM modulation format for the 300G trunk rate:

```
RP/0/RP0/CPU0:ios#show controllers optics 0/1/0/12
Wed Jun  2 17:17:29.652 UTC

 Controller State: Up

 Transport Admin State: In Service

 Laser State: On

 LED State: Green

 Optics Status

         Optics Type:  <Unknown> DWDM
         DWDM carrier Info: C BAND, MSA ITU Channel=61, Frequency=193.10THz,
         Wavelength=1552.524nm

         Alarm Status:
         -------------
         Detected Alarms: None


         LOS/LOL/Fault Status:

         Alarm Statistics:

         -------------
         HIGH-RX-PWR = 0            LOW-RX-PWR = 1
         HIGH-TX-PWR = 0            LOW-TX-PWR = 1
         HIGH-LBC = 0               HIGH-DGD = 0
         OOR-CD = 0                 OSNR = 1
         WVL-OOL = 0                MEA  = 0
```

```
        IMPROPER-REM = 0
        TX-POWER-PROV-MISMATCH = 0
        Laser Bias Current = 0.0 %
        Actual TX Power = 0.97 dBm
        RX Power = 1.47 dBm
        RX Signal Power = 17.67 dBm
        Frequency Offset = 82 MHz

        Performance Monitoring: Enable

        THRESHOLD VALUES
        ----------------

        Parameter                 High Alarm  Low Alarm  High Warning  Low Warning
        ------------------------  ----------  ---------  ------------  -----------
        Rx Power Threshold(dBm)          3.0      -31.5           0.0          0.0
        Tx Power Threshold(dBm)          3.0      -12.0           0.0          0.0
        LBC Threshold(mA)                N/A        N/A          0.00         0.00

        LBC High Threshold = 90 %
        Configured Tx Power = 1.00 dBm
        Configured CD High Threshold = 96000 ps/nm
        Configured CD lower Threshold = -96000 ps/nm
        Configured OSNR lower Threshold = 13.70 dB
        Configured DGD Higher Threshold = 67.00 ps
        Baud Rate =  42.2082633972 GBd
        Bits per Symbol = 3.0000000000  bits/symbol
        Modulation Type: 8QAM
        Chromatic Dispersion 2 ps/nm
        Configured CD-MIN -48000 ps/nm  CD-MAX 48000 ps/nm
        Polarization Mode Dispersion = 0.0 ps
        Second Order Polarization Mode Dispersion = 72.00 ps^2
        Optical Signal to Noise Ratio = 34.10 dB
        SNR = 18.40 dB
        Polarization Dependent Loss = 1.20 dB
        Polarization Change Rate = 0.00 rad/s
        Differential Group Delay = 2.00 ps

Transceiver Vendor Details

        Form Factor            : Not set
        Fiber Connector Type: Not Set
        Otn Application Code: Not Set
        Sonet Application Code: Not Set
        Ethernet Compliance Code: Not set

Transceiver Temperature : 46 Celsius



AINS Soak                : None
AINS Timer               : 0h, 0m
AINS remaining time      : 0 seconds
```

Configuring the Muxponder Mode for 4x100GE-MXP-DD

Table 21: Feature History

Feature Name	Release Information	Description
4X100GE MXP modes with QDD ZRP for OTN-XP Card	Cisco IOS XR Release 7.3.2	On the OTN-XP card, you can configure a single 4x100GE payload that isreceived over the client port as a 400GE signal over DWDM on the line side. The card improves efficiency, performance, and flexibility for customer networksallowing 4x100GE client transport over 400GE WDM wavelength.

From Release 7.3.2 onwards, you can configure the 4x100GE-MXP-DD muxponder mode on the OTN-XP card.

Restrictions for Port Group Mapping

The following table explains about the port mapping when the mxponder-slice 0 is at the near end and is connected to the mxponder-slice 1 at the far end:

Table 22: Port Group Mapping for Shared-Client-Group-Bandwidth

Slice Configuration - Client Port	Shared-Client-Group-Bandwidth	Shared-Group-Client-Ports
Slice 0	400G	1, 6, 7, 10
Slice 1	400G	8, 0, 4, 5

Table 23: Port Group Mapping for Trunk-Bandwidth

Trunk-Bandwidth	Slice Configuration - Client Port	Supported Client Rates	Client-Ports
400G	Slice 0	100G	1, 6, 7, 10
	Slice 1	100G	8, 0, 4, 5
300G	Slice 0	100G	6, 7, 10
	Slice 1	100G	8, 4, 5
200G	Slice 0	100G	7, 10
	Slice 1	100G	4, 5

The traffic flows from the near-end slice-0 to the far-end slice-1 client ports:

- The port 1 traffic reaches port 8

- The port 6 traffic reaches port 0
- The port 7 traffic reaches port 4
- The port 10 traffic reaches port 5

The following table describes the QSFP DD trunk port to the slice-0 client port and slice-1 client port mapping:

Table 24: QSFP DD Trunk Port to the Slice-0 and Slice-1 Client Port Mapping

QSFP-DD Trunk Port	Slice 0 - Client Port	Slice 1 - Client Port
0	Port 10	Port 5
1	Port 7	Port 4
2	Port 6	Port 0
3	Port 1	Port 8

Configuring the Muxponder Mode for 4x100GE-MXP-DD

To configure the OTN-XP card in the 4x100GE-MXP-DD muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 400G

client-port-rate *client-port-number* **client-type 100GE**

commit

Example

The following is a sample in which the OTN-XP card is configured with 400G trunk rate on the mxponder-slice 0 mode.

```
RP/0/RP0/CPU0:ios#configure
Tue Jun 15 20:20:17.227 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 6 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 7 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
Tue Jun 15 20:20:57.532 UTC
```

Verifying the Muxponder Configuration

The following is a sample to verify the 4x100GE-MXP-DD muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder
Tue Jun 15 20:21:46.587 UTC

Location:             0/0
```

```
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/11
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/1                  -                           100
HundredGigECtrlr0/0/0/6                  -                           100
HundredGigECtrlr0/0/0/7                  -                           100
HundredGigECtrlr0/0/0/10                 -                           100
```

The following is a sample in which the OTN-XP card is configured with 400G trunk rate on the mxponder-slice 1 mode.

```
RP/0/RP0/CPU0:ios#configure
Tue Jun 15 20:22:13.981 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

Verifying the Muxponder Configuration

The following is a sample to verify the 4x100GE-MXP-DD muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder-slice 1
Tue Jun 15 20:23:06.217 UTC

Location:             0/0
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/9
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/0                  -                           100
HundredGigECtrlr0/0/0/4                  -                           100
HundredGigECtrlr0/0/0/5                  -                           100
HundredGigECtrlr0/0/0/8                  -                           100


RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder
Tue Jun 15 20:23:46.650 UTC

Location:             0/0
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/11
```

```
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/1                  -                            100
HundredGigECtrlr0/0/0/6                  -                            100
HundredGigECtrlr0/0/0/7                  -                            100
HundredGigECtrlr0/0/0/10                 -                            100


Location:             0/0
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/9
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/0                  -                            100
HundredGigECtrlr0/0/0/4                  -                            100
HundredGigECtrlr0/0/0/5                  -                            100
HundredGigECtrlr0/0/0/8                  -                            100
```

Configuring the Muxponder Mode for 2x100GE-MXP-DD

Table 25: Feature History

Feature Name	Release Information	Description
2X100GE MXP modes with QDD ZRP for OTN-XP Card	Cisco IOS XR Release 7.5.1	On the OTN-XP card, you can configure two 2x100GE payloads that are received over the client port as a 200GE signal over DWDM on the line side. The 2x100GE-MXP-DD muxponder mode improves efficiency, performance, and flexibility for customer networks allowing 2x100GE client transport over 200GE WDM wavelength.

From Release 7.5.1 onwards, you can configure the 2x100GE-MXP-DD muxponder mode on the OTN-XP card.

Note

The LC mode must be configured to 4x100GE-MXP-DD on the OTN-XP card before you perform this configuration.

Two slices of 2x100GE-MXP-DD can be configured with the same LC mode on the OTN-XP card.

Restrictions on the port group mapping exist when the mxponder-slice 0 is at the near end and is connected to the mxponder-slice 1 at the far end. For more details, see Restrictions for Port Group Mapping , on page 70.

To configure the OTN-XP card in the 2x100GE-MXP-DD muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 200G

client-port-rate *client-port-number* **client-type 100GE**

commit

Example

The following is a sample in which the OTN-XP card is configured with 200G trunk rate on the mxponder-slice 1 mode.

```
RP/0/RP0/CPU0:ios#configure
Tue Jun 15 20:20:17.227 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
Tue Jun 15 20:20:57.532 UTC
```

Verifying the Supported Client Rates for each Trunk Rate

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 0.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 xponder-capabilities mxponder-slice 0
Fri Jul 23 15:35:43.059 UTC

Location: 0/0

Trunk-Port(s): 11

Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     400G                          1, 6, 7, 10

Trunk-bandwidth: 400G
Client-port                       Supported client rates
     1                             100GE
     6                             100GE
     7                             100GE
     10                            100GE

Trunk-bandwidth: 300G
Client-port                       Supported client rates
     6                             100GE
     7                             100GE
     10                            100GE

Trunk-bandwidth: 200G
Client-port                       Supported client rates
     7                             100GE
     10                            100GE
```

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 1.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 xponder-capabilities mxponder-slice 1
Wed Sep 15 00:30:47.433 UTC

Location: 0/0

Trunk-Port(s): 9
```

```
Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     400G                          8, 0, 4, 5

Trunk-bandwidth: 400G
Client-port                       Supported client rates
     8                             100GE
     0                             100GE
     4                             100GE
     5                             100GE

Trunk-bandwidth: 300G
Client-port                       Supported client rates
     8                             100GE
     4                             100GE
     5                             100GE

Trunk-bandwidth: 200G
Client-port                       Supported client rates
     4                             100GE
     5                             100GE
```

Verifying the Running Configuration

The following is a sample to verify the provisioned slice and client port information for 2x100GE-MXP-DD muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show running config
hw-module location 0/2
 mxponder-slice 0
  trunk-rate 200G
  client-port-rate 1 client-type 100GE
  client-port-rate 7 client-type 100GE
 !
hw-module location  0/1
 mxponder-slice 1
  trunk-rate 200G
  client-port-rate 4 client-type 100GE
  client-port-rate 5 client-type 100GE
 !
!
```

Verifying the Muxponder Configuration

The following is a sample to verify the 2x100GE-MXP-DD muxponder configuration in the OTN-XP card for mxponder-slice 0.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder-slice 0
Fri Jul 23 16:04:42.279 UTC

Location:             0/0
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       200G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/11
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/7                 -                           100
HundredGigECtrlr0/0/0/10                -                           100
```

The following is a sample to verify the 2x100GE-MXP-DD muxponder configuration in the OTN-XP card for mxponder-slice 1.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder-slice 1
Tue Jun 15 20:21:46.587 UTC

Location:             0/0
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       200G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/11
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/4                  -                             100
HundredGigECtrlr0/0/0/5                  -                             100
```

Configuring the Muxponder Mode for 3x100GE-MXP-DD

Table 26: Feature History

Feature Name	Release Information	Description
3x100GE MXP modes with QDD ZRP for OTN-XP Card	Cisco IOS XR Release 7.5.1	On the OTN-XP card, you can configure two 3x100GE payloads that are received over the client port as a 300GE signal over DWDM on the line side. The 3x100GE-MXP-DD muxponder mode improves efficiency, performance, and flexibility for customer networks allowing 3x100GE client transport over 300GE WDM wavelength.

From Release 7.5.1 onwards, you can configure the 3x100GE-MXP-DD muxponder mode on the OTN-XP card.

Note The LC mode must be configured to 4x100GE-MXP-DD on the OTN-XP card before you perform this configuration.

Two slices of 3x100GE-MXP-DD can be configured with the same LC mode on the OTN-XP card.

Restrictions on the port group mapping exist when the mxponder-slice 0 is at the near end and is connected to the mxponder-slice 1 at the far end. For more details, see Restrictions for Port Group Mapping , on page 70.

To configure the OTN-XP card in the 3x100GE-MXP-DD muxponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 300G

client-port-rate *client-port-number* **client-type 100GE**

commit

Example

The following is a sample in which the OTN-XP card is configured with 300G trunk rate on the mxponder-slice 1 mode.

```
RP/0/RP0/CPU0:ios#configure
Tue Jun 15 20:20:17.227 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 300G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
Tue Jun 15 20:20:57.532 UTC
```

Verifying the Supported Client Rates for each Trunk Rate

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 0.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 xponder-capabilities mxponder-slice 0
Fri Jul 23 15:35:43.059 UTC

Location: 0/0

Trunk-Port(s): 11

Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     400G                          1, 6, 7, 10

Trunk-bandwidth: 400G
Client-port                       Supported client rates
     1                             100GE
     6                             100GE
     7                             100GE
     10                            100GE

Trunk-bandwidth: 300G
Client-port                       Supported client rates
     6                             100GE
     7                             100GE
     10                            100GE

Trunk-bandwidth: 200G
Client-port                       Supported client rates
     7                             100GE
     10                            100GE
```

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 1.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 xponder-capabilities mxponder-slice 1
Wed Sep 15 00:30:47.433 UTC

Location: 0/0

Trunk-Port(s): 9

Port Group Restrictions:
```

```
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     400G                          8, 0, 4, 5

Trunk-bandwidth: 400G
Client-port                       Supported client rates
     8                             100GE
     0                             100GE
     4                             100GE
     5                             100GE

Trunk-bandwidth: 300G
Client-port                       Supported client rates
     8                             100GE
     4                             100GE
     5                             100GE

Trunk-bandwidth: 200G
Client-port                       Supported client rates
     4                             100GE
     5                             100GE
```

Verifying the Running Configuration

The following is a sample to verify the provisioned slice and client port information for 3x100GE-MXP-DD muxponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show running config
hw-module location 0/2
 mxponder-slice 0
  trunk-rate 300G
  client-port-rate 1 client-type 100GE
  client-port-rate 7 client-type 100GE
  client-port-rate 10 client-type 100GE
 !
hw-module location  0/1
 mxponder-slice 1
  trunk-rate 300G
  client-port-rate 4 client-type 100GE
  client-port-rate 5 client-type 100GE
  client-port-rate 8 client-type 100GE
 !
!
```

Verifying the Muxponder Configuration

The following is a sample to verify the 3x100GE-MXP-DD muxponder configuration in the OTN-XP card for mxponder-slice 0.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder-slice 0
Tue Jun 15 20:21:46.587 UTC

Location:             0/0
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       300G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/11
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/1                 -                            100
HundredGigECtrlr0/0/0/7                 -                            100
```

```
HundredGigECtrlr0/0/0/10                -                            100
```

The following is a sample to verify the 3x100GE-MXP-DD muxponder configuration in the OTN-XP card for mxponder-slice 1.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder-slice 1
Tue Jun 15 20:21:46.587 UTC

Location:             0/0
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       300G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/11
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/8                 -                            100
HundredGigECtrlr0/0/0/4                 -                            100
HundredGigECtrlr0/0/0/5                 -                            100
```

Configuring the Transponder Mode for 400GE-TXP-DD

Table 27: Feature History

Feature Name	Release Information	Description
400GE TXP mode with QDD ZRP for OTN-XP Card	Cisco IOS XR Release 7.5.1	On the OTN-XP card, you can configure two 400GE payloads that are received over the client port as a 400GE signal over DWDM on the line side. The 400GE-TXP-DD muxponder mode improves efficiency, performance, and flexibility for customer networks allowing 400GE client transport over 400GE WDM wavelength.

From Release 7.5.1 onwards, you can configure the 400GE-TXP-DD transponder mode on the OTN-XP card.

Note The LC mode must be configured to 400GE-TXP-DD on the OTN-XP card before you perform this configuration.

Two slices of 400GE-TXP-DD can be configured with the same LC mode on the OTN-XP card.

Restrictions on the port group mapping exist when the mxponder-slice 0 is at the near end and is connected to the mxponder-slice 1 at the far end. For more details, see Restrictions for Port Group Mapping , on page 70.

To configure the OTN-XP card in the 400GE-TXP-DD transponder mode, use the following commands:

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number*

trunk-rate 400G

client-port-rate *client-port-number* **client-type 100GE**

commit

Example

The following is a sample in which the OTN-XP card is configured with 400G trunk rate on the mxponder-slice 1 mode.

```
RP/0/RP0/CPU0:ios#configure
Tue Jun 15 20:20:17.227 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 8 client-type 400GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
Tue Jun 15 20:20:57.532 UTC
```

Verifying the Supported Client Rates for each Trunk Rate

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 0.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 xponder-capabilities mxponder-slice 0
Wed Oct 27 16:14:35.693 UTC

Location: 0/0

Trunk-Port(s): 11

Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     400G                          10

Trunk-bandwidth: 400G
Client-port                       Supported client rates
     10                            100GE
```

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 1.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 xponder-capabilities mxponder-slice 1
Wed Oct 27 16:16:37.524 UTC

Location: 0/0

Trunk-Port(s): 9

Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     400G                          8

Trunk-bandwidth: 400G
Client-port                       Supported client rates
     8                             400GE
```

Verifying the Running Configuration

The following is a sample to verify the provisioned slice and client port information for 400GE-TXP-DD transponder configuration in the OTN-XP card.

```
RP/0/RP0/CPU0:ios#show running config
hw-module location 0/0
```

```
 mxponder-slice 0
  trunk-rate 400G
  client-port-rate 10 client-type 100GE
 !
hw-module location  0/0
 mxponder-slice 1
  trunk-rate 400G
  client-port-rate 8 client-type 100GE
 !
!
```

Verifying the Muxponder Configuration

The following is a sample to verify the 400GE-TXP-DD transponder configuration in the OTN-XP card for mxponder-slice 0.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder-slice 0
Fri Jul 23 16:04:42.279 UTC

Location:             0/0
Slice ID:             0
Client Bitrate:       400GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/11
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/1                  -                            100
HundredGigECtrlr0/0/0/6                  -                            100
HundredGigECtrlr0/0/0/7                  -                            100
HundredGigECtrlr0/0/0/10                 -                            100
```

The following is a sample to verify the 400GE-TXP-DD transponder configuration in the OTN-XP card for mxponder-slice 1.

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder-slice 1
Tue Jun 15 20:21:46.587 UTC

Location:             0/0
Slice ID:             1
Client Bitrate:       400GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/9
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/8                  -                            100
HundredGigECtrlr0/0/0/0                  -                            100
HundredGigECtrlr0/0/0/4                  -                            100
HundredGigECtrlr0/0/0/5                  -                            100
```

Verifying the Client Ethernet Controller Status

The following is a sample to verify the Client Ethernet Controller Status of the 400GE-TXP-DD transponder configuration in the OTN-XP card.

```
P/0/RP0/CPU0:ios#show controller hundredGigECtrlr 0/0/0/1
Fri Jul 23 16:07:11.541 UTC
Operational data for interface HundredGigECtrlr0/0/0/1:


State:
    Administrative state: enabled
    Operational state: Up
    LED state: Green On
    Maintenance: Disabled
    AINS Soak: None
      Total Duration: 0 hour(s) 0 minute(s)
      Remaining Duration: 0 hour(s) 0 minute(s) 0 second(s)
    Laser Squelch: Disabled


Phy:
    Media type: Not known


Autonegotiation disabled.


Operational values:
    Speed: 100Gbps
    Duplex: Full Duplex
    Flowcontrol: None
    Loopback: None (or external)
    BER monitoring:
        Not supported
    Holdoff Time: 0ms
```

Configuring Inverse Muxponder on OTN-XP Card for 400GE Client

Table 28: Feature History

Feature Name	Release Information	Feature Description
Inverse Muxponder Configuration on OTN-XP Card	Cisco IOS XR Release 7.3.2	The OTN-XP card supports inverse multiplexing for 400GE client over 2x200G CFP2 trunk ports. This feature allows you to split the 400GE client signal and carry it over 2x200G trunks thereby increasing the ease of signal reachability. Commands modified: • hw-module (OTN-XP Card) • controller coherentDSP

You can configure the OTN-XP card to support inverse multiplexing for 400GE client over 2x200G CFP2 trunk ports. To configure the inverse muxponder datapath, use the following commands:

configure

hw-module location *location*

mxponder

trunk-rate 200G

client-port-rate *client-port-number* **client-type 400GE**

commit

end

The following sample configures inverse muxponder for 400G:

```
RP/0/RP0/CPU0:ios #Configure
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 10 client-type 400GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following sample verifies the inverse muxponder configuration:

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder
Wed Jun  9 23:16:59.478 UTC

Location:             0/0
Client Bitrate:       400GE
Trunk  Bitrate:       200G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                   Mapper/Trunk Port          CoherentDSP0/0/0/12
CoherentDSP0/0/0/13
                              Traffic Split Percentage

FourHundredGigECtrlr0/0/0/10  ODU-FLEX0/0/0/12/10          50                  50
```

Alarm Correlation in Inverse Muxponder

When any service-affecting alarm is raised on the trunk port 12 or 13, the alarms are reported on the ports as follows:

- Port 12—Flexo alarms (FLEXO_LOS, FLEXO_LOL, FLEXO_GIDM, FLEXO_FMM, FLEXO_LOF, and FLEXO_LOM) and OTU alarms (LOD, AIS, LOS, LOM, LOD, and TIM)
- Port 13—Flexo alarms except Flexo MM and GIDM.

Both ports 12 and 13 go down when any service-affecting alarm is raised.

Example:

Shut down the trunk port 12:

```
RP/0/RP0/CPU0:ios(config)#controller coherentDSP 0/3/0/12
RP/0/RP0/CPU0:ios(config-CoDSP)#shutdown
RP/0/RP0/CPU0:ios(config-CoDSP)#commit
Thu Sep 30 14:12:48.416 UTC
```

The following sample verifies that when trunk port 12 is shut down, LOS alarm is raised and the trunk port 13 also goes down.

```
RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/2/0/12
Thu Sep 30 14:12:54.604 UTC

Port                                            : CoherentDSP 0/2/0/12
```

```
Controller State                                : Down
Inherited Secondary State                       : Normal
Configured Secondary State                      : Normal
Derived State                                   : In Service
Loopback mode                                   : None
BER Thresholds                                  : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                          : Enable
Bandwidth                                       : 200.0Gb/s

Alarm Information:
LOS = 2 LOF = 0 LOM = 0
OOF = 1 OOM = 0 AIS = 1
IAE = 0 BIAE = 0        SF_BER = 0
SD_BER = 0      BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0     FLEXO_GIDM = 0
FLEXO-MM = 0    FLEXO-LOM = 0   FLEXO-RDI = 1
FLEXO-LOF = 0
Detected Alarms                                 : LOS

Bit Error Rate Information
PREFEC  BER                                     : 0.00E+00
POSTFEC BER                                     : 0.00E+00
Q-Factor                                        : 0.00 dB

Q-Margin                                        : 0.00dB

TTI :
        Remote IP addr                          : 0.0.0.0

FEC mode                                        : O_FEC

Flexo-Mode                                      : Enable
Flexo Details:
        Tx GID                                  : 1
        TX IID                                  : 1, 2,
        Rx GID                                  : 0
        RX IID                                  : 0, 0,

Flexo Peers Information:
        Controller                              : CoherentDSP0_2_0_13
        OTUCn rate                              : OTUC2


AINS Soak                                       : None
AINS Timer                                      : 0h, 0m
AINS remaining time                             : 0 seconds


RP/0/RP0/CPU0:ios#show controllers coherentDSP 0/2/0/13
Thu Sep 30 14:12:59.330 UTC

Port                                            : CoherentDSP 0/2/0/13
Controller State                                : Down
Inherited Secondary State                       : Normal
Configured Secondary State                      : Normal
Derived State                                   : In Service
Loopback mode                                   : None
BER Thresholds                                  : SF = 1.0E-5  SD = 1.0E-7
Performance Monitoring                          : Enable
Bandwidth                                       : 200.0Gb/s

Alarm Information:
LOS = 1 LOF = 0 LOM = 0
OOF = 0 OOM = 0 AIS = 0
```

```
IAE = 0 BIAE = 0         SF_BER = 0
SD_BER = 0       BDI = 0 TIM = 0
FECMISMATCH = 0 FEC-UNC = 0      FLEXO_GIDM = 0
FLEXO-MM = 0     FLEXO-LOM = 0   FLEXO-RDI = 1
FLEXO-LOF = 0
Detected Alarms                                  : None

Bit Error Rate Information
PREFEC  BER                                      : 0.00E+00
POSTFEC BER                                      : 0.00E+00
Q-Factor                                         : 15.80 dB

Q-Margin                                         : 9.50dB

TTI :
        Remote IP addr                           : 0.0.0.0

FEC mode                                         : O_FEC

Flexo-Mode                                       : Enable
Flexo Details:
        Tx GID                                   : 1
        TX IID                                   : 3, 4,
        Rx GID                                   : 1
        RX IID                                   : 3, 4,

Flexo Peers Information:
        Controller                               : CoherentDSP0_2_0_12
        OTUCn rate                               : OTUC2


AINS Soak                                        : None
AINS Timer                                       : 0h, 0m
AINS remaining time                              : 0 seconds
```

You can perform the following configurations on the DSPcontroller ports:

- Flexo Parameter Update on Inverse Muxponder Configuration on the OTN-XP Card
- Configure TTI on Inverse Muxponder Configuration on the OTN-XP Card
- Configure Loopback on Inverse Muxponder Configured on the OTN-XP Card

2x100GE-TXP-MXP on OTN-XP Card

Table 29: Feature History Table

Feature Name	Release Information	Description
NCS1K4-OTN-XP Line Card Interoperability	Cisco IOS XR Release 7.8.1	This feature allows the NCS1K4-OTN-XP card with CFP2-DCO 200G pluggable to interoperate with the NCS2K-400G-XP and NCS4K-4H-OPW-QC2 cards. Using the new 2x100GE-TXP-MXP mode for the OTN-XP card, you can configure 1x100GE or 2x100GE payloads over 100G or 200G DWDM on the line side, respectively. The interoperation improves customer networks' efficiency, performance, and flexibility, allowing 100GE-TXP traffic over 100G DWDM or 2x100GE-MXP traffic over 200G DWDM wavelengths on each slice.

2x100GE-TXP-MXP mode supports the following features:

- PRBS
- GCCO
- Loopbacks
- Laser Squelch
- TTI
- LLDP
- AINS
- Modulation type:
  - QPSK for 100G
  - 16-QAM for 200G

Table 30: 100GE-TXP Mapping in 2XTXP-MXP Configuration

Slice	Client	Trunk Port
0	0	12

Slice	Client	Trunk Port
1	4	13

Table 31: 2x100GE-MXP Mapping in 2XTXP-MXP Configuration

Slice	Client	Trunk Port
0	0 & 1	12
1	4 & 5	13

- Trunk rate—100G and 200G
- Trunk optics—CFP2-WDM-DETS-1HL

The following is a sample to configure OTN-XP card in the LC mode 2x100GE-TXP-MXP transponder mode:

```
RP/0/RP0/CPU0:ios#configure
Fri Feb  4 16:52:18.021 UTC
RP/0/RP0/CPU0:ios(config)#lc-module location 0/2 lcmode 2x100GE-TXP-MXP
RP/0/RP0/CPU0:ios(config)#commit
```

To verify the OTN-XP card in the 2x100GE-TXP-MXP transponder mode, use the following commands:

```
RP/0/RP0/CPU0:ios#sh lc-module location 0/0 lcmode
Sat Nov 12 22:58:47.917 UTC

Node    Lcmode_Supported    Owner    Running                 Configured
--------------------------------------------------------------------------------
0/0     Yes                 CLI      2x100GE-TXP-MXP           2x100GE-TXP-MXP
```

The following is a sample in which the OTN-XP card is configured with 100G trunk rate on the mxponder-slice 0.

```
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 100G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample in which the OTN-XP card can be verified with 100G trunk rate on the mxponder-slice 0.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/2 mxponder-slice 0
Mon Oct 10 14:06:41.807 UTC

Location:             0/2
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       100G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/2/0/12
                                Traffic Split Percentage

HundredGigECtrlr0/2/0/0         ODU40/2/0/12/0                        100
```

The following is a sample in which the OTN-XP card is configured with 200G trunk rate on the mxponder-slice 0.

```
LC slot# 2, client port 0 & 1, and client type 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 0 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample in which the OTN-XP card can be verified with 200G trunk rate on the mxponder-slice 0.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/2 mxponder-slice 0
Mon Oct 10 14:06:41.807 UTC

Location:             0/2
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       200G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/2/0/12
                                Traffic Split Percentage

HundredGigECtrlr0/2/0/0         ODU40/2/0/12/0                        100
HundredGigECtrlr0/2/0/1         ODU40/2/0/12/1                        100
```

The following is a sample in which the OTN-XP card is configured with 200G trunk rate on the mxponder-slice 1.

```
LC slot# 2, client port 0 & 1, and client type 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/2 mxponder-slice 1
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 4 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 5 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#commit
```

The following is a sample in which the OTN-XP card can be verified with 200G trunk rate on the mxponder-slice 1.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/2 mxponder-slice 1
Mon Oct 10 14:06:41.807 UTC

Location:             0/2
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       200G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/2/0/13
                                Traffic Split Percentage

HundredGigECtrlr0/2/0/4         ODU40/2/0/13/4                        100
HundredGigECtrlr0/2/0/5         ODU40/2/0/13/5                        100
```

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 0

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/2 xponder-capabilities mxponder-slice 0
Mon Oct 10 14:32:15.881 UTC

Location: 0/2

Trunk-Port(s): 12
```

```
Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     200G                          0
     200G                          1

Trunk-bandwidth: 100G
Client-port                        Supported client rates
     0                              100GE

Trunk-bandwidth: 200G
Client-port                        Supported client rates
     0                              100GE
     1                              100GE
```

The following is the sample output for verifying the supported client rates for each trunk rate configured in muxponder slice 1

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/2 xponder-capabilities mxponder-slice 1
Mon Oct 10 14:32:15.881 UTC

Location: 0/2

Trunk-Port(s): 12

Port Group Restrictions:
Shared-Client-Group-Bandwidth    Shared-Group-Client-Ports
     200G                          4
     200G                          5

Trunk-bandwidth: 100G
Client-port                        Supported client rates
     4                              100GE

Trunk-bandwidth: 200G
Client-port                        Supported client rates
     4                              100GE
     5                              100GE
```

Interoperation between OTN-XP and NCS2K and NCS4K:

Interoperation between GCC0 on the line side and PRBS supports the following features:

- PRBS (between OTN-XP Card & NCS4K-4H-OPW-QC2 mapper ODU4s)
- GCC0 between trunk interfaces (200G/100G)
- TTI
- Laser Squelch
- LLDP
- PRBS
- Loopbacks
- AINS
- GCC0

Note GCC0 interoperability between the OTN-XP card and 400G-XP-LC/NCS4K-4H-OPW-QC2 line card is not supported on 100G trunk rate in Slice 0.

Table 32: Hardware Module Configuration with Client to Trunk Mapping

OTN-XP Card-NCS4K-4H-OPW-QC2 Card						
	OTN-XP Card Side			NCS4K-4H-OPW-QC2 Card Side		
Data path	Slice	Trunk Port	Client Port	Slice	Trunk Port	Client Port
100G	0	12	0	N/A	11	0
200G	0	12	0	N/A	11	0
	0		1	N/A		6

OTN-XP Card - 400G-XP-LC Card						
	OTN-XP Card Side			400G-XP-LC Side		
Data path	Slice	Trunk Port	Client Port	Slice	Trunk Port	Client Port
100G	0	12	0	4	12	10
200G	0	12	0	3	12	9
	0		1	4		10

Note Interoperation between OTN-XP and NCS2K works only with 11.30 version.

Note Flex-coherent is not supported, so no GID/IID configuration and flex-o alarms are supported.

Note High switching time is observed with 100G trunks with CD minimum(-10000 ps/nm) or maximum(10000 ps/nm) configured as default.

2-QDD-C Line Card

Table 33: Feature History

Feature Name	Release Information	Description
NCS1K4-2-QDD-C-K9 C-Band Line Card	Cisco IOS XR Release 7.3.1	NCS 1004 supports the NCS1K4-2-QDD-C-K9 C-Band line card. The card has eight client ports (QSFP28 and QSFP-DD) and two DWDM dual sub-channel module trunk ports. Each trunk port is capable of 200, 300, and 400 Gbps line rate with fine control of modulation format, baud-rate, and forward error correction. The trunk ports are software configurable. The line card supports module and slice configurations. Command added: • **controller fourHundredGigECtrlr**

The following section describes the supported configurations and procedures to configure the card modes on the 2-QDD-C line card.

Limitations for 2-QDD-C

- Flex Ethernet is not supported.
- A single 400GE cannot be split and use as 4x 100GE due to hardware limitations.

Unsupported Features for 2-QDD-C in R731

The following features are not supported in R7.3.1 for 2-QDD-C card:

- OTU4 client
- Layer 1 encryption
- GCC remote node management
- Line rates of 50G, 100G, 150G, 250G, and 350G

2-QDD-C Card Modes

The 2-QDD-C line cards support module and slice configurations.

The line cards have two trunk ports (0 and 1) and 8 client ports (2 through 9) each. You can configure the line card in two modes:

- Muxponder—In this mode, both trunk ports are configured with the same trunk rate. The client-to-trunk mapping is in a sequence in vertical order.
- Muxponder slice—In this mode, each trunk port is configured independent of the other with different trunk rates. The client-to-trunk mapping is fixed in vertical order. For Trunk 0, the client ports are 2 through 5. For Trunk 1, the client ports are 6 through 9.

Sub 50G Configuration

Table 34: Feature History

Feature Name	Release Information	Description
Support for n x 50G Rate	Cisco IOS XR Release 7.5.1	You can now configure sub 50G muxponder mode in a combination of trunk and client rates for 2-QDD-C cards.

You can configure sub 50G muxponder mode in the following combination of trunk and client rates:

- 100GE Muxponder mode:
  - 1x100GE and 2x50G
  - 3x100GE and 2x150G
  - 5x100GE and 2x250G
  - 7x100GE and 2x350G
- OTU4 Muxponder mode:
  - 1xOTU4 and 2x50G
  - 3xOTU4 and 2x150G
  - 5xOTU4 and 2x250G
  - 7xOTU4 and 2x350G

The following table displays the port configuration for the supported data rates.

Trunk Data Rate (per trunk)	Total Configured Data rate	Trunk Ports	Client Ports for Trunk 0 (100G)	Shared Client Port (50G per trunk)	Client Ports for Trunk 1 (100G)
50G	100G	0, 1	-	2	-
150G	300G	0, 1	2	3	4
250G	500G	0, 1	2, 3	4	5, 6

Trunk Data Rate (per trunk)	Total Configured Data rate	Trunk Ports	Client Ports for Trunk 0 (100G)	Shared Client Port (50G per trunk)	Client Ports for Trunk 1 (100G)
350G	700G	0, 1	2, 3, 4	5	6, 7, 8

From Release 7.5.2, 2-QDD-C cards support an alternate port configuration for Sub 50G (split client port mapping) that you configure using CLI. The following table displays the port configuration for the supported data rates.

Trunk Data Rate (per trunk)	Total Configured Data rate	Trunk Ports	Client Ports for Trunk 0 (100G)	Shared Client Port (50G per trunk)	Client Ports for Trunk 1 (100G)
50G	100G	0, 1	-	5	-
150G	300G	0, 1	2	5	6
250G	500G	0, 1	2, 3	5	6, 7
350G	700G	0, 1	2, 3, 4	5	6, 7, 8

For information on how to configure split client port mapping, see Configure Split Client Port Mapping, on page 3

Coupled Mode Restrictions

The following restrictions apply to the coupled mode configuration:

- Both trunk ports must be configured with the same bits-per-symbol or baud rate and must be sent over same fiber and direction.
- The chromatic dispersion must be configured to the same value for both trunk ports.
- When trunk internal loopback is configured, it must be done for both trunk ports. Configuring internal loopback on only one trunk results in traffic loss.
- Fault on a trunk port of a coupled pair may cause errors on all clients including those running only on the unaffected trunk port.

Supported Data Rates for 2-QDD-C Card

The following table displays the client and trunk ports that are enabled for the muxponder configuration.

Trunk Data Rate	Card Support	Client Data Rate	Client Optics	Trunk Ports	Client Ports
200	2-QDD-C	100GE, OTU4	QSFP-28	0, 1	2, 3, 4, 5
300	2-QDD-C	100GE, OTU4	QSFP-28	0, 1	2, 3, 4, 5, 6, 7
400	2-QDD-C	100GE, OTU4	QSFP-28	0, 1	2, 3, 4, 5, 6, 7, 8, 9
200	2-QDD-C	400GE	QSFP-DD	0, 1	4

Trunk Data Rate	Card Support	Client Data Rate	Client Optics	Trunk Ports	Client Ports
400	2-QDD-C	400GE	QSFP-DD	0, 1	4,8

The following table displays the client and trunk ports that are enabled for the muxponder slice 0 configuration.

Trunk Data Rate	Card Support	Client Data Rate	Trunk Ports	Client Ports
100	2-QDD-C	100GE, OTU4	0	2
200	2-QDD-C	100GE, OTU4	0	2, 3
300	2-QDD-C	100GE, OTU4	0	2, 3, 4
400	2-QDD-C	100GE, OTU4	0	2, 3, 4, 5
400	2-QDD-C	400GE	0	4

The following table displays the client and trunk ports that are enabled for the muxponder slice 1 configuration.

Trunk Data Rate	Card Support	Client Data Rate	Trunk Ports	Client Ports
100	2-QDD-C	100GE, OTU4	1	6
200	2-QDD-C	100GE, OTU4	1	6, 7
300	2-QDD-C	100GE, OTU4	1	6, 7, 8
400	2-QDD-C	100GE, OTU4	1	6, 7, 8, 9
400	2-QDD-C	400GE	1	8

The following table displays the trunk parameter ranges for the 2-QDD-C card.

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
150G	27%	1.453125	4.335938	24.02079	71.67494
200G	27%	2	4.40625	31.51	69.43
250G	27%	2.414063	6	28.93129	71.9069
300G	27%	2.8984375	6	34.7175497	71.8681352
350G	27%	3.382813	6	40.5038	71.84047
400G	27%	3.8671875	6	46.2900663	71.8197392
150G	15%	1.320313	3.9375	24.02079	71.67494
200G	15%	1.7578125	5.25	24.02079115	71.74209625
250G	15%	2.195313	6	26.27274	71.80592
300G	15%	3.8203125	6	31.52728839	49.51525048

Trunk Payload	FEC	Min BPS	Max BPS	Min GBd	Max GBd
350G	15%	3.070313	6	36.78184	71.87901
400G	15%	3.8671875	6	42.03638452	71.9018782

Note The recommended value for 6 BPS for corresponding line rates are listed below:

Trunk Payload	FEC	BPS	GBd
300G	27%	6	34.7175
350G	27%	6	40.5038
400G	15%	6	42.0364

For more information on the QDD-C card, see the data sheet.

Configuring the Card Mode for 2-QDD-C Card

From R7.3.1, you can configure the 2-QDD-C line card in the module (muxponder) or slice configuration (muxponder slice).

To configure the card in the muxponder mode, use the following commands:

- **configure**

  hw-module location *location* **mxponder client-rate {100GE | OTU4 }**

  hw-module location *location* **mxponder trunk-rate** {**100G | 150G | 200G | 250G | 300G | 350G | 400G** }

  commit

- **configure**

  hw-module location *location* **mxponder client-rate { 400GE}**

  hw-module location *location* **mxponder trunk-rate { 200G | 400G** }

  commit

To configure the card in the muxponder slice mode, use the following commands.

configure

hw-module location *location* **mxponder-slice** *mxponder-slice-number* **client-rate { 100GE | 400GE}**

hw-module location *location* **mxponder-slice** *mxponder-slice-number* **trunk-rate** { **100G | 200G | 300G | 400G**}

commit

Examples

The following is a sample in which the card is configured in the muxponder mode with a 400G trunk rate.

```
RP/0/RP0/CPU0:ios#config
Tue Oct 15 01:24:56.355 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder trunk-rate 400G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder slice 0 mode with a 400G trunk rate.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0 client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0 trunk-rate 400G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder slice 1 mode with a 400G trunk rate.

```
RP/0/RP0/CPU0:ios#config
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1 client-rate 100GE
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1 trunk-rate 400G
RP/0/RP0/CPU0:ios(config)#commit
```

The following is a sample in which the card is configured in the muxponder mode with a 400GE trunk rate.

```
RP/0/RP0/CPU0:west#configure
Thu Oct  7 11:43:01.914 IST
RP/0/RP0/CPU0:west(config)#hw-module location 0/2 mxponder trunk-rate 4
400G  450G
RP/0/RP0/CPU0:west(config)#hw-module location 0/2 mxponder trunk-rate 400G
RP/0/RP0/CPU0:west(config)#hw-module location 0/2 mxponder client-rate 400GE
RP/0/RP0/CPU0:west(config)#commit
```

Configuring Mixed Client Traffic Mode

Table 35: Feature History

Feature Name	Release Information	Description
Mixed Client Traffic Mode Configuration	Cisco IOS XR Release 7.5.1	You can now configure the client traffic mode on each trunk port of the 2-QDD-C card independently. This feature provides flexibility to carry both OTN and Ethernet client traffic on the 2-QDD-C card at the same time across two slices.

Feature Name	Release Information	Description
Enhanced Mixed Mode Client Traffic Configuration on 2-QDD-C Card	Cisco IOS XR Release 7.10.1	This feature is an upgrade of earlier mixed-mode configuration on 2-QDD-C card that required reprovision of all client ports to switch between provisioning Ethernet or OTU interfaces. This enhancement makes the 2-QDD-C card smarter to delegate OTU and Ethernet traffic in the same slice simultaneously, avoiding the need to reprovision the client ports. This enhancement provides you with greater flexibility to configure both Ethernet and OTU interfaces for different client ports on the same slice in the 2-QDD-C card without disrupting the client traffic. Enable this enhancement with the following keywords on the **hw-module** command: • **client-port-rate <2-5> | <6-9>** • **client-type <100GE | OTU4>**

You can configure the client traffic mode on each trunk in a line card independently. This provides flexibility for the same card to carry both OTN and Ethernet client traffic at the same time across 2 slices.

100G, 200G, and 300G trunk rates are supported on both the slices (slice 0 and slice 1) with different client modes (100GE/OTU4).

From R7.10.1, you can configure both Ethernet and OTU interfaces on different client ports on each trunk in the 2-QDD-C line card independently. This enhancement gives you flexibility on the same 2-QDD-C line card to carry both OTN and Ethernet client traffic at the same time in the same slice for each trunk rates.

An additional 400G trunk rate is supported on both the slices (slice 0 and slice 1) with different client modes (100GE/OTU4).

Different-Slice Mixed Client Traffic Mode

To configure the card in mixed client traffic mode, use the following commands:

```
hw-module location R/S
mxponder-slice 0
  trunk-rate [100G|200G|300G|400G]
  client-rate [100GE|OTU4]
!
 mxponder-slice 1
  trunk-rate [100G|200G|300G|400G]
  client-rate [OTU4|100GE]
!
!
```

The following is a sample in which the card is configured with mixed client rates in the muxponder slice 0 and 1 mode.

```
RP/0/RP0/CPU0:ios#configure
Mon Mar 23 06:10:22.227 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0 client-rate OTU4 trunk-rate
 400G
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 1 client-rate 100GE trunk-rate
 400G
RP/0/RP0/CPU0:ios(config)#commit
```

The following configuration is a sample of the mixed client traffic mode in different slices.

Example 1:

```
hw-module location 0/0
 mxponder-slice 0
  trunk-rate 400G
  client-rate OTU4
 !
 mxponder-slice 1
  trunk-rate 400G
  client-rate 100GE
 !
!
```

Verifying Card Configuration

```
RP/0/RP0/CPU0:ios#show hw-module location 0/0 mxponder

Location:             0/0
Slice ID:             0
Client Bitrate:       OTU4
Trunk  Bitrate:       400G
Status:               Provisioned
Client Port                     Peer/Trunk Port            CoherentDSP0/0/0/0
                                Traffic Split Percentage

OTU40/0/0/2                     ODU40/0/0/0/1                      100
OTU40/0/0/3                     ODU40/0/0/0/2                      100
OTU40/0/0/4                     ODU40/0/0/0/3                      100
OTU40/0/0/5                     ODU40/0/0/0/4                      100


Location:             0/0
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       400G
Status:               Provisioned
Client Port                     Peer/Trunk Port            CoherentDSP0/0/0/1
                                Traffic Split Percentage
HundredGigECtrlr0/0/0/6         ODU40/0/0/1/1                         100
HundredGigECtrlr0/0/0/7         ODU40/0/0/1/2                         100
HundredGigECtrlr0/0/0/8         ODU40/0/0/1/3                         100
HundredGigECtrlr0/0/0/9         ODU40/0/0/1/4                         100
```

The following configuration is a sample in which both the slices use the same client mode.

Example 2:

```
hw-module location 0/3
 mxponder
  trunk-rate 350G
  client-rate 100GE
 !
!
```

Verifying Card Configuration

```
RP/0/RP0/CPU0:ios#show hw-module location 0/3 mxponder
Fri Nov 26 12:21:16.174 UTC

Location:             0/3
Client Bitrate:       100GE
Trunk  Bitrate:       350G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/3/0/0
CoherentDSP0/3/0/1
                                Traffic Split Percentage

HundredGigECtrlr0/3/0/2         ODU40/3/0/0/1                         100
       0
HundredGigECtrlr0/3/0/3         ODU40/3/0/0/2                         100
       0
HundredGigECtrlr0/3/0/4         ODU40/3/0/0/3                         100
       0
HundredGigECtrlr0/3/0/5         ODU40/3/0/0/4                          50
      50
HundredGigECtrlr0/3/0/6         ODU40/3/0/1/1                           0
     100
HundredGigECtrlr0/3/0/7         ODU40/3/0/1/2                           0
     100
HundredGigECtrlr0/3/0/8         ODU40/3/0/1/3                           0
     100
```

Same-Slice Mixed Client Traffic Mode

To configure the card in mixed client traffic mode in same slice, use the following commands:

```
hw-module location R/S
mxponder-slice 0
  trunk-rate [100G|200G|300G|400G]
  client-port-rate 2 client-type <100GE|OTU4>
!
!
 mxponder-slice 1
  trunk-rate [100G|200G|300G|400G]
client-port-rate 2 client-type <100GE|OTU4>
!
!
```

The following is a sample in which the card is configured with mixed client rates in the muxponder slice 0 mode.

```
RP/0/RP0/CPU0:ios#configure
Mon Mar 23 06:10:22.227 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0 client-port-rate 2
client-type OTU4 trunk-rate 400G
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0 client-port-rate 3
client-type 100GE trunk-rate 400G
RP/0/RP0/CPU0:ios(config)#commit
```

The following configuration is a sample of the mixed client port rate in same slice.

```
hw-module location 0/0
 mxponder-slice 0
  trunk-rate 200G
  client-port-rate 2 client-type 100G
  client-port-rate 3 client-type otu4
 !
 mxponder-slice 1
```

```
  trunk-rate 400G
  client-port-rate 4 client-type 100G
  client-port-rate 8 client-type otu4
 !
!
```

QXP Card

Table 36: Feature History

Feature Name	Release Information	Description
Digital-to-Analog (DAC) support for NCS1K4-QXP-K9 card	Cisco IOS XR Release 7.8.1	DAC support is now enabled on NCS1K4-QXP-K9 card for 2x100G, 3x100G, 4x100G, and 400G operating modes. DAC helps in the optimization of digital-to-analog signal conversion.
Forward Error Correction (FEC) support on QXP card for Ethernet controllers	Cisco IOS XR Release 7.8.1	FEC is now supported by the 100GE Ethernet controller on the NCS1K4-QXP-K9 card. FEC is supported for all pluggables except QSFP-100G-LR4-S and ONS-QSFP28-LR4.
Idle insertion on NCS1K4-QXP-K9 card	Cisco IOS XR Release 7.8.1	Idle insertion refers to the idles that are inserted in the traffic stream from the trunk port to the client port for the duration of the configured holdoff-time. Whenever a fault occurs on the trunk port, you can hold the propagation of local faults using idle insertion. Idle insertion is now enabled on 100GE or 400GE controllers for the NCS1K4-QXP-K9 card.
NCS1K4-QXP-K9 card support for 2x100GE and 3x100GE operating mode configurations	Cisco IOS XR Release 7.8.1	Support is enabled for 2x100GE and 3x100GE operating mode configurations through Open Config and CLI on NCS1K4-QXP-K9 card.

Feature Name	Release Information	Description
Cisco 400G QSFP-DD High-Power (Bright) Optical module support on QXP card	Cisco IOS XR Release 7.10.1	The QXP card now supports Cisco 400G QSFP-DD High-Power (Bright) Optical module. This pluggable provides higher output power compared to other ZR Pluggables (QDD-400G-ZR-S and QDD-400G-ZRP-S). This allows users to interconnect directly to add/drop ports without additional amplifiers which improves performance and saves cost for end to end services.
OTN Datapath on QXP card trunk ports	Cisco IOS XR Release 7.10.1	The QXP line card now supports OTN standard based trunk transmission with Cisco 400G QSFP-DD High-Power (Bright) Optical Module. This allows trunk connections from the QXP card to be connected to other OpenROADMcompliant trunk devices.

The NCS1K4-QXP-K9 3.2T QSFP-DD DCO Transponder Line Card has eight client ports (QSFP-DD) and eight trunk ports (QSFP-DD ZR+). Each line card supports up to 3.2 Tbps traffic. The client rates that are supported are 400GE, 4x100GE, and 100GE Ethernet only. The modulation formats supported are 16 QAM for 400GE Txp/4x100GE Mxp and QPSK for 100GE Txp.

The QXP line card provides up to 16 QSFP-DD ports (eight QSFP-DD client ports and eight QSFP-DD trunk ports). The supported operating modes are:

- 400GE-TXP
- 4X100GE MXP
- 100GE TXP

From R7.8.1 onwards the operating modes listed below are supported.

- 3x100GE MXP
- 2x100GE MXP

The QXP card has 8 slices. Each slice consists of one client and one trunk port with a slice capacity of 400G. The total capacity is 3.2T.

Table 37: Slice and Port Mapping on the QXP Card

Slice	Trunk Port	Client Port
0	0	1
1	2	3

Slice	Trunk Port	Client Port
2	4	5
3	6	7
4	8	9
5	10	11
6	12	13
7	14	15

Restriction The QXP card uses only the first 6 client and trunk ports (first 6 slices) when installed in an NCS1004 chassis.

Note

- When you use OPENROADM trunk mode by configuring the **trunk-mode OR** command, use only alternate slices on the QXP card. Either use slices 0, 2, 4, 6 or 1, 3, 5, 7.

Supported Data Rates for QXP Card

The following table displays the client and trunk ports that are enabled for transponder and muxponder modes.

Operating mode	Card Support	Client Data Rate	Client Optics	Trunk Ports	Client Ports
400GE-TXP	QXP Card	400G	QDD-400G-DR4-S, QDD-400G-FR4-S, QDD-AOCxM, QDD-4X100G-FR-S	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15
4X100GE MXP	QXP Card	4X100G Break out	QDD-400G-DR4-S, QDD-4X100G-LR-S, QDD-4X100G-FR-S	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15
3X100GE MXP	QXP Card	3X100G Break out	QDD-400G-DR4-S, QDD-4X100G-LR-S, QDD-4X100G-FR-S	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15
2X100GE MXP	QXP Card	2X100G Break out	QDD-400G-DR4-S, QDD-4X100G-LR-S, QDD-4X100G-FR-S	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15
100GE TXP	QXP Card	100G	QSFP28-100G-LR4, QSFP28-100G-LR-S, QSFP28-100G-DR-S, QSFP28-100G-FR-S	0,2,4,6,8,10,12,14	1,3,5,7,9,11,13,15

Configure 400G Transponder Mode

Use the following commands to configure and provision 400G TXP.

hw-module location *location*

mxponder-slice *slice-number*

trunk-rate 400G

trunk-mode [ZR | OR]

client-port-rate *port-number***client-type 400GE**

The following is a sample configuration of configuring a 400G TXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type 400GE
```

The following is a sample output of **show hw-module location** *location* **mxponder-slice** *slice-number* when configured in 400G Transponder Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/0 mxponder-slice 0
Sat Jun 25 21:32:58.799 UTC

Location:             0/0
Slice ID:             0
Client Bitrate:       400GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/0
                                Traffic Split Percentage

FourHundredGigECtrlr0/0/0/1                  -                            100
```

Note The **trunk-mode** command allows you to choose between OTN and ethernet traffic on the trunk port.

Configure 100G Transponder Mode

Use the following commands to configure and provision 100G TXP.

hw-module location *location*

mxponder-slice *slice-number*

trunk-rate 100G

client-port-rate *port-number***client-type 100GE**

The following is a sample configuration of configuring a 100G TXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/1 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 100G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 client-type 100GE
```

The following is a sample output of **show hw-module location** *location* **mxponder-slice** *slice-number* when configured in 100G Transponder Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/0 mxponder-slice 0
Sat Jun 25 21:58:15.417 UTC

Location:             0/0
Slice ID:             0
Client Bitrate:       100GE
Trunk  Bitrate:       100G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/0/0/0
                                Traffic Split Percentage

HundredGigECtrlr0/0/0/1                  -                           100
```

Configure 400G Muxponder Mode

Use the following commands to configure and provision 400G MXP.

hw-module location *location*

mxponder-slice *slice-number*

trunk-rate 400G

client-port-rate *port-number* **lane** *lane-number***client-type 100GE**

The following is a sample configuration of configuring a 400G MXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 3 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 4 client-type 100GE
```

The following is a sample output of **show hw-module location** *location* **mxponder-slice** *slice-number* when configured in 400G MXP Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/3 mxponder-slice 1
Sat Jun 25 23:03:20.823 UTC

Location:             0/3
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       400G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/3/0/2
                                Traffic Split Percentage

HundredGigECtrlr0/3/0/3/1                -                           100
HundredGigECtrlr0/3/0/3/2                -                           100
HundredGigECtrlr0/3/0/3/3                -                           100
HundredGigECtrlr0/3/0/3/4                -                           100
```

Configure 2x100G Muxponder Mode

Use the following commands to configure and provision 2x100G MXP.

hw-module location *location*

mxponder-slice *slice-number*

trunk-rate 200G

client-port-rate *port-number* **lane** *lane-number***client-type 100GE**

The following is a sample configuration of configuring a 2x100G MXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 200G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 100GE
```

The following is a sample output of **show hw-module location** *location* **mxponder-slice** *slice-number* when configured in 2x100G MXP Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/3 mxponder-slice 1
Sat Jun 25 23:03:20.823 UTC

Location:             0/3
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       200G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/3/0/2
                                Traffic Split Percentage

HundredGigECtrlr0/3/0/3/1                -                            100
HundredGigECtrlr0/3/0/3/2                -                            100
```

Configure 3x100G Muxponder Mode

Use the following commands to configure and provision 3x100G MXP.

hw-module location *location*

mxponder-slice *slice-number*

trunk-rate 300G

client-port-rate *port-number* **lane** *lane-number***client-type 100GE**

The following is a sample configuration of configuring a 3x100G MXP.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0 mxponder-slice 0
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 300G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 2 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#client-port-rate 1 lane 3 client-type 100GE
```

The following is a sample output of **show hw-module location** *location* **mxponder-slice** *slice-number* when configured in 3x100G MXP Mode.

```
RP/0/RP0/CPU0:ios#sh hw-module location 0/3 mxponder-slice 1
Sat Jun 25 23:03:20.823 UTC

Location:             0/3
Slice ID:             1
Client Bitrate:       100GE
Trunk  Bitrate:       300G
Status:               Provisioned
LLDP Drop Enabled:    FALSE
ARP Snoop Enabled:    FALSE
Client Port                     Mapper/Trunk Port          CoherentDSP0/3/0/2
                                Traffic Split Percentage

HundredGigECtrlr0/3/0/3/1                -                           100
HundredGigECtrlr0/3/0/3/2                -                           100
HundredGigECtrlr0/3/0/3/3                -                           100
```

DAC Supported Modes for NCS1K4-QXP-K9 Card

From R7.8.1 DAC support is enabled on the NCS1K4-QXP-K9 card for 2x100G, 3x100G, 4x100G, and 400G operating modes. The following table provides the details of the respective DAC rates for the different trunk rates for NCS1K4-QXP-K9 card.

Table 38: DAC Supported Data Rates for NCS1K4-QXP-K9 Card

Trunk Rate	Modulation Format	Default Value	Modified DAC Supported
100G	QPSK	1x1.50	N/A
200G	QPSK	1x1	1x1.50
200G	8QAM	1x1.25	N/A
200G	16-QAM	1x1.25	N/A
300G	8-QAM	1x1	1x1.25,1x1.50,1x2
400G	16-QAM	1x1	1x1.50

The following example changes the DAC rate to 1x1.5 on an optics controller.

```
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/0
RP/0/RP0/CPU0:ios(config-Optics)#dac-Rate 1x1.50
RP/0/RP0/CPU0:ios(config-Optics)#commit
```

Note

- Changing the DAC turns the laser Off and then back on for the optics. This is a traffic impacting operation.
- The DAC rate configuration must match on both ends of a connection.

FEC Support on QXP Card

From R7.8.1 onwards, FEC support is enabled on 100GE Ethernet controller for all pluggables except the LR4 pluggables such as QSFP-100G-LR4-S and ONS-QSFP28-LR4 for the NCS1K4-QXP-K9 card. For more information on FEC refer to the FEC section.

Cisco 400G QSFP-DD High-Power (Bright ZR+) Optical Module Support on QXP Card

From R7.10.1, QXP card supports Cisco 400G QSFP-DD High-Power (Bright) Optical Modules. The Bright QSFP-DD operates as Ethernet or OTN transponder.

Use the following commands to configure OTN data path on the Bright ZR+ pluggable optical modules. The **trunk-mode OR** refers to OpenROADM.

hw-module location *location*

mxponder-slice 1 *slice-number*

trunk-mode OR

trunk-rate *rate*

Use the following commands to configure Ethernet data path on the Bright ZR+ pluggable optical modules.

hw-module location *location*

mxponder-slice 1 *slice-number*

trunk-mode ZR

trunk-rate *rate*

The following is a sample configuration of configuring a 4x100G OTN trunk on a Bright ZR+ pluggable.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0
RP/0/RP0/CPU0:ios(config-hwmod)#mxponder-slice 4
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-mode OR
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#  client-port-rate 9 lane 1 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#  client-port-rate 9 lane 2 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#  client-port-rate 9 lane 3 client-type 100GE
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#  client-port-rate 9 lane 4 client-type 100GE
```

The following is a sample configuration of configuring Ethernet trunk on a Bright ZR+ pluggable.

```
RP/0/RP0/CPU0:ios#configure
Tue Apr 11 19:29:20.132 UTC
RP/0/RP0/CPU0:ios(config)#hw-module location 0/0
RP/0/RP0/CPU0:ios(config-hwmod)#mxponder-slice 4
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-mode ZR
RP/0/RP0/CPU0:ios(config-hwmod-mxp)#trunk-rate 400G
```

The following is a sample configuration of setting 0dBm transmit power on a Bright ZR+ pluggable.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller optics 0/0/0/2
RP/0/RP0/CPU0:ios(config-Optics)#transmit-power 0
Thu Mar  9 13:02:30.662 UTC
WARNING! Changing TX power can impact traffic
RP/0/RP0/CPU0:ios(config-Optics)#commit
Thu Mar  9 13:02:31.566 UTC
```

The following is a sample output of the **show controllers optics** command, with the transmit power set to 0 dBm.

```
RP/0/RP0/CPU0:ios#show controllers optics 0/0/0/8
Thu Apr 13 13:54:33.163 UTC
 Controller State: Up
 Transport Admin State: In Service
 Laser State: On
 LED State: Green
```

```
Optics Status
        Optics Type:  QSFP-DD DWDM
        DWDM carrier Info: C BAND, MSA ITU Channel=49, Frequency=193.70THz,
        Wavelength=1547.715nm
        Alarm Status:
        -------------
        Detected Alarms: None
        LOS/LOL/Fault Status:
        Alarm Statistics:
        -------------
        HIGH-RX-PWR = 0            LOW-RX-PWR = 4
        HIGH-TX-PWR = 0            LOW-TX-PWR = 1
        HIGH-LBC = 0               HIGH-DGD = 0
        OOR-CD = 0                 OSNR = 4
        WVL-OOL = 0                MEA  = 0
        IMPROPER-REM = 0
        TX-POWER-PROV-MISMATCH = 0
        Laser Bias Current = 0.0 %
        Actual TX Power = 0.00 dBm
        RX Power = -10.50 dBm
        RX Signal Power = -10.35 dBm
        Frequency Offset = 199 MHz

        Performance Monitoring: Enable

        THRESHOLD VALUES
        ----------------

        Parameter                 High Alarm  Low Alarm  High Warning  Low Warning
        ------------------------  ----------  ---------  ------------  -----------
        Rx Power Threshold(dBm)          3.0      -24.5           0.0          0.0
        Tx Power Threshold(dBm)          0.0      -16.0           0.0          0.0
        LBC Threshold(mA)                N/A        N/A          0.00         0.00

        LBC High Threshold = 90 %
        Configured Tx Power = 0.00 dBm
        Configured CD High Threshold = 52000 ps/nm
        Configured CD lower Threshold = -52000 ps/nm
        Configured OSNR lower Threshold = 21.10 dB
        Configured DGD Higher Threshold = 67.00 ps
```

Table 39: Operating Modes Supported for Bright ZR+ Pluggable Modules on QXP Card

Operating mode	Modulation	FEC
4x100GE MXP	16-QAM	CFEC
4x100GE MXP	16-QAM	OFEC
3x100GE MXP	8QAM	OFEC
2x100GE MXP	QPSK	OFEC
400GE TXP	16-QAM	CFEC
400GE TXP	16-QAM	OFEC
100GE TXP	QPSK	OFEC