

OpenROADM Configuration Guide for Cisco NCS 1004

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Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

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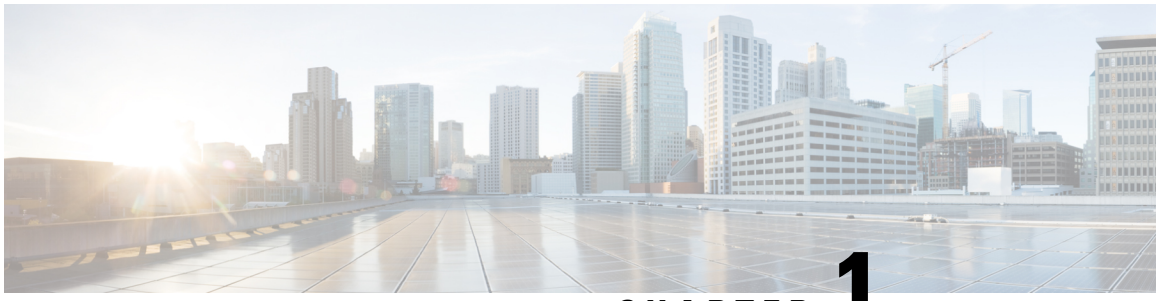
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CHAPTER 1

OpenROADM YANG Models

This chapter explains the required configurations and procedures for using OpenROADM YANG models.

Table 1: Feature History

Feature Name	Release Information	Feature Description
OpenROADM YANG support	Cisco IOS XR Release 7.3.1	The OpenROADM Multi-Source Agreement (MSA) device management model, which defines interoperability specifications for the control and provisioning of ROADM devices, is supported. The specifications consist of optical interoperability and a NETCONF API that uses YANG models. The goal of the OpenROADM MSA is to provide a common management model to simplify the management of multi-vender optical network architectures. With the OpenROADM YANG support, you can control and manage the device using an OpenROADM compliant controller and the OpenROADM YANG models.
OpenROADM 200G and 300G Configuration Support	Cisco IOS XR Release 7.3.2	200G and 300G data rates can be configured for MXP on the OTN-XPL line card.

Feature Name	Release Information	Feature Description
Support for QSFP-100G-FR-S and QSFP-100G-LR-S pluggables for Open ROADM configurations	Cisco IOS XR Release 7.5.2	You can now control and manage the QSFP-100G-FR-S and QSFP-100G-LR-S pluggable modules installed on the OTN-XPL line card using an Open ROADM compliant controller. This functionality extends the programmability benefits of the Open ROADM controller to configure these pluggable modules at scale.
REGEN Configurations for 200G and 400G Interfaces	Cisco IOS XR Release 7.5.2	3R regeneration improves optical signal quality by reamplifying, reshaping, and retiming the data pulses. The 200G and 400G interfaces on the OTN-XPL line card now support REGEN configurations. This functionality overcomes the effects of optical signal degradation during long-haul optical transmission.
100G TXP Configurations	Cisco IOS XR Release 7.5.2	It is now possible to configure 100G data rates for a TXP interface on the OTN-XPL line card. This configuration allows the signal to travel longer distances before a need for regeneration.
16 QAM Modulation Format for 200G MXP Interfaces	Cisco IOS XR Release 7.5.2	200G MXP interfaces on the OTN-XPL line card now support the 16 QAM modulation format. This format uses a lower baud rate. As a result, it permits the use of a smaller channel spacing of 50GHz.
Bookended Configuration for 400G Trunk Rates	Cisco IOS XR Release 7.5.2	Bookended configurations are Cisco proprietary configurations where the same network element is present on the near and far end nodes. Bookended configurations are now supported for 400G trunk rates on the OTN-XPL line card, resulting in better optical reach than the standard configuration.

Feature Name	Release Information	Feature Description
Untimed Granularity Ethernet PMs	Cisco IOS XR Release 7.5.2	Untimed granularity PMs are PMs that are collected continuously till the interface is deprovisioned and are used for performance monitoring. The following untimed ethernet PMs are supported on the OTN-XPL line card: • **100G:** codeViolations, inFramesErrored, outFrames, inFrames, fecCorrectedCodewords, fecUncorrectedCodewords • **400G:** fecCorrectedCodewords, fecUncorrectedCodewords
Attention LED	Cisco IOS XR Release 7.8.1	The attention LED is available on all ports of the NCS 1004 line cards. From this release you can use OpenROADM configuration to selectively turn on the LED for specific QSFP ports. When turned on, the LED flashes yellow. This LED flashing functionality helps field engineers quickly identify a specific port on the line card for troubleshooting, especially in a cluttered environment.

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OTN-XPL Line Card

The Cisco NCS 1004 supports the OTN-XPL line card.

The line card contains:

- Eight QSFP28 ports
- Four QSFP-DD ports (These ports also support QSFP28 pluggables.)
- Two CFP2 ports

The line card supports below client rates:

- 400GE
- 100GE/OTU4

The supported operating modes are:

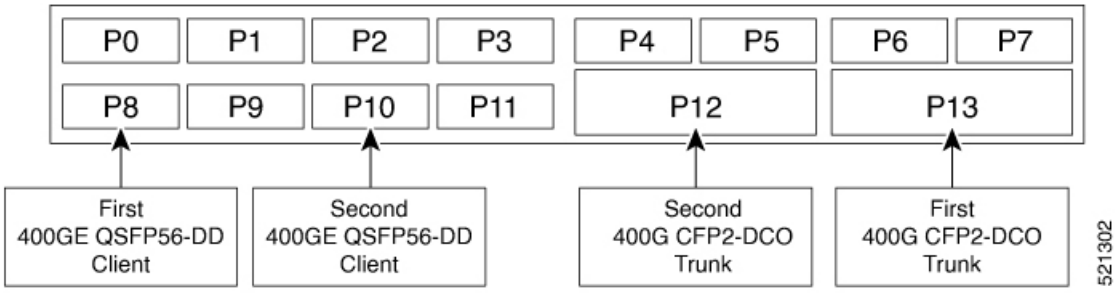
- 2x Transponder
- 2x Muxponder
- 1x Transponder and 1x Muxponder

Supported Pluggable Optical Transceivers for Transponder (400 TXP)

The following table lists the supported pluggable optical transceivers.

Name	PID
Cisco QSFP DD 400G FR4 Pluggable Optics Module	QDD-400G-FR4-S
Cisco CFP2 CFP2D 400G-C Pluggable Optics Module	ONS-CFP2D-400G-C

The OTN-XPL line card uses pluggable optics for both the client and trunk ports. The two client ports use QSFP56-DD (400GE) pluggable transceivers and the trunk ports use CFP2-DCO (400 Gbps) Coherent DWDM pluggable transceivers with OFEC support.



Supported Pluggable Optical Transceivers for Muxponder (400 MXP)

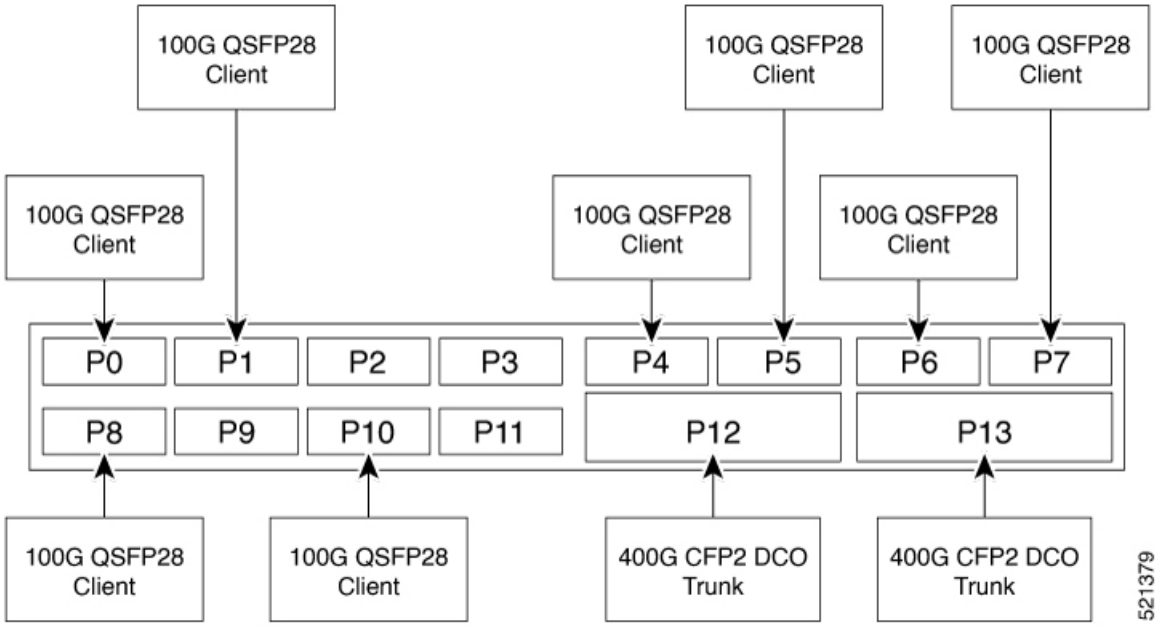
The following table lists the supported pluggable optical transceivers.

Name	PID
Cisco QSFP28 Pluggable Optics Module	ONS-QSFP28-LR4 QSFP-100G-LR4-S QSFP-100G-FR-S QSFP-100G-LR-S
Cisco CFP2 CFP2D 400G-C Pluggable Optics Module	ONS-CFP2D-400G-C

The OTN-XPL line card uses pluggable optics for both the client and trunk ports. The eight client ports use QSFP28 (100G each) pluggable transceivers and the two trunk ports use CFP2-DCO (400 Gbps) Coherent DWDM pluggable transceivers with OFEC support.

Slice	Data Rate	Trunk Port	Client Ports	TPN	Tributary Slot
Slice 0	100G, 200G, 300G, 400G	12	10	1	1.1 - 1.20
	200G, 300G, 400G		7	2	2.1 - 2.20
	300G, 400G		6	3	3.1 - 3.20
	400G		1	4	4.1 - 4.20

Slice	Data Rate	Trunk Port	Client Ports	TPN	Tributary Slot
Slice 1	100G, 200G, 300G, 400G	13	8	1	1.1 - 1.20
	200G, 300G, 400G		5	2	2.1 - 2.20
	300G, 400G		4	3	3.1 - 3.20
	400G		0	4	4.1 - 4.20



PIDs

The following table displays the PIDs of the various components of the Cisco NCS 1004 chassis.

Component	PID
NCS 1004 chassis	NCS1004
Controller or RP	NCS1K4-CNTLR-K9
Fan	NCS1K4-FAN
DC Power module	NCS1K4-DC-PSU
Licensed OTN-XP card	NCS1K4-OTN-XPL

OpenROADM Compliance Overview

The OpenROADM Multi-Source Agreement (MSA) defines interoperability specifications for the control and provisioning of multi-vendor optical devices such as Reconfigurable Optical Add/Drop Multiplexers (ROADM), transponders, and pluggable optics. The specifications consist of optical interoperability and a NETCONF API that uses YANG models. In Release 7.3.1, support for the OpenROADM MSA device management model (version 7.1) is added. The OTN-XPL card is an OpenROADM MSA compliant device. This means that you can control and manage the OTN-XPL card using an OpenROADM compliant controller. The OpenROADM controller provides device inventory, network, and service APIs to northbound OSS systems.

You can control and manage the OTN-XPL card through its NETCONF API using the NETCONF protocol [RFC 6241] on TCP port 830 through your OpenROADM controller and the OpenROADM YANG data models described in this guide. The device only supports running-datastore.

The following SSH algorithms are supported:

- ssh RSA
- ssh DSA
- ssh ED25519

The configuration and management of the OTN-XPL card is controlled through the OpenROADM controller and stored in the controller server infrastructure and not on the device itself.

The OpenROADM capable device is shipped with default username and password as openroadm/openroadm.

For complete details, see the OpenROADM MSA transponder specification at http://www.openroadm.org/.

To access the YANG models (version 7.1), https://github.com/OpenROADM/OpenROADM_MSA_Public/tree/master/model.

OpenROADM YANG Model Support

The OTN-XPL card supports YANG v1.1 that is defined in RFC 7950 [GG].

The following table describes the OpenROADM YANG model.

YANG Components	Examples
YANG nodes defined by configuration and operational data. You can query this data using your controller. Some nodes are read/write (configuration), while others are read-only (operational).	Shelf commissioning data, wavelength connections, and so forth.
Notifications for the purposes of reporting autonomous events to the controller.	Alarms, inventory changes, re-starts and so forth.
Remote Procedure Calls (RPC) that do not effect a change in the device configuration data.	Get operations, file transfers, database backup, and so forth.

The following table lists the OpenROADM YANG model support on OTN-XPL card.

YANG Module	Description
org-openroadm-device See: • Provision Shelf, Line Card, Pluggables, and Interfaces, on page 12 • Loopback On A Interface, on page 146 • IPv6, on page 12 • Set Current Date and Time, on page 11 • Create Tech Information, on page 164 • PRBS, on page 148	• Datapath provisioning • Loopback provisioning • IPv6 provisioning • Current date and time provisioning • Collecting logs for debugging • Conducting PRBS tests on OTN and ODU interfaces.
org-openroadm-alarm See Monitor Alarms, on page 128	Active alarm list and notification
org-openroadm-probable-cause	Probable cause attributes and grouping
org-openroadm-pm See Monitor Performance, on page 115.	Current and historical PM lists, clear PMs and collect historical file actions.
org-openroadm-tca See Threshold Crossing Alerts (TCAs), on page 137.	TCA provisioning for supported PMs
org-openroadm-user-mgmt See User Account Management, on page 10.	User account management
org-openroadm-syslog See Gather System Logs, on page 165.	System logging
org-openroadm-file-transfer See File Management, on page 151.	Device file management
org-openroadm-de-operations See Device Operations, on page 145.	Restart or reloads of device or circuit-packs.
org-openroadm-swdl See Software Upgrades, on page 152.	Download, stage, and activate software package.
org-openroadm-ethernet-interfaces	Ethernet attributes augmented onto interface list
org-openroadm-maintenance-loopback	Maintenance loopback definitions
org-openroadm-maintenance	Maintenance list of terminalLoopback, facilityLoopback operations.

YANG Module	Description
org-openroadm-otn-common-types	OTU and ODU rate and type identities and payload type def
org-openroadm-pluggable-optics-holder-capability	Pluggable optics holder capabilities lists supported circuit packs, port references, port capabilities.
org-openroadm-port-capability	Augments circuit-packs ports with port capabilities, augments device with port-group-restrictions
org-openroadm-port-types	Definitions for port types
org-openroadm-resource-types	Definitions for resource types
org-openroadm-resource	Defines resource-type which is a choice of circuit-pack, port, shelf, physical-link, xponder, and so forth.

OpenROADM Device YANG Model Support

The OpenROADM device YANG model defines the YANG nodes as described in the following table.

YANG Node	Description
Information	The Information container provides general node information including node name, IP address, and so forth.
Shelves	Provide shelf information. A node can consist of one or more shelve.s
Circuit Packs	Represents a physical piece of equipment which contains a group of hardware functional blocks such as common equipment, cards, and pluggable optics.
Ports	The Ports container defines the ports associated with a circuit pack or pluggable optics and the associated port attributes
Connection Map	Wavelength agnostic and reflects any connectivity restrictions or blocking in the device (not wavelength contention).
Switching Pool	Define the connectivity associated within the ODU layer by providing the ODU connectivity between external ports of the muxponder.
Interfaces	Defines supported interface types and are associated with Port YANG nodes.

User Account Management

The controller provisions the *user* accounts on the device that include the username, password, and group. Currently only one group is defined called *sudo*. that has full access to the device. You can use the *org-openroadm-device.yang* model to list, add, or delete users. User accounts are managed in the *users* container. When you create a new user, it is added to the OpenROADM controller operating system. Similarly, when you delete a user, it is removed from the underlying operating system.

When you add or update a user entry, the password and group are validated against the data-model specified in the YANG data model.

The username is a string containing a minimum of three characters to a maximum of 32 characters. The first character must always be lowercase while the remaining characters can be a lowercase character or number. The password is a string containing a minimum of eight characters to a maximum of 128 characters and can include lowercase and uppercase letters, numbers, and special characters such as ! $ % ^ ( ) _ + ~ { } [ ]. The following characters are not allowed \ | ? # @ &.

Per the OpenROADM requirement, the default username and password are:

- Username—openroadm
- Password—openroadm

After the new *user* account is provisioned, the controller is expected to log out of the default openroadm account and log in again with the newly provisioned *user* account. It is also expected to delete the default *'openroadm'* account.

To view the list of users, use the following RPC request:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <users>
          <user/>
        </users>
      </org-openroadm-device>
    </filter>
  </get>
</rpc>
```

```
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:bf8c106d-4b83-4289-aff1-4d6a6225cda6">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <users>
       <user>
          <name>openroadm</name>
        </user>
      </users>
    </org-openroadm-device>
  </data>
</rpc-reply>
```

Note The password is not displayed for the default user 'openroadm' in a get-config or get RPC request.

To create a user **openroadm1** with a password set to **testpassword**, use the following RPC request:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <users>
          <user>
            <name>openroadm1</name>
            <password>testpassword</password>
          </user>
        </users>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

To delete a user **openroadm1**, use the following RPC request:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
   <edit-config>
      <target>
         <running />
      </target>
      <config>
         <org-openroadm-device xmlns=http://org/openroadm/device>
            <users>
             <user xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0" nc:operation="delete">

                  <name>openroadm1</name>
               </user>
            </users>
         </org-openroadm-device>
      </config>
   </edit-config>
</rpc>
```

You can also change the existing password using the *org-openroadm-user-mgmt.yang* model.

To change the existing password, use the **chg-password** RPC function:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <chg-password xmlns="http://org/openroadm/user-mgmt">
    <currentPassword>openroadm</currentPassword>
    <newPassword>openroadm1</newPassword>
    <newPasswordConfirm>openroadm1</newPasswordConfirm>
  </chg-password>
</rpc>
```

Set Current Date and Time

The controller synchronizes the date and time with the device by provisioning the date and time directly on the device using the *set-current-datetime* RPC function.

The following is a sample of the date and time provisioning.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<set-current-datetime xmlns="http://org/openroadm/device">
<current-datetime>2020-10-27T19:36:00.000+05:30</current-datetime>
```

```
</set-current-datetime>
</rpc>
```

IPv6

When the NCS 1004 is powered up, the management interface fetches an IPv6 address from the DHCP server present in the same LAN. The controller can now log in to the device, using the temporary address and provision the permanent IP address using the edit-config operation. The default gateway can also be provisioned. The IP address, prefix length, and default gateway must be specified in the same edit config operation.

The prefix range is from 0 to 128.

The following is a sample of IPv6 provisioning.



Note In the current XR release, the DHCPv6 address assigned is always configured with prefix-length as 64.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <info>
          <ipAddress>2001:410:500:2011::364:40</ipAddress>
          <prefix-length>64</prefix-length>
          <defaultGateway>2001:410:500:2011::364:1</defaultGateway>
        </info>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```



Note The link local address (fe80::) can also be used as the default gateway.

Provision Shelf, Line Card, Pluggables, and Interfaces

The workflow to provision the shelf, line card, pluggable optics, and interfaces is described below:

- Load the OpenROADM device models in the YANG tool and open a NETCONF session to the device.
- Verify the info container of device model.
- Execute the RPC calls to configure the inventory—shelf provisioning, circuit pack provisioning, and port provisioning.
- Fetch operational data.
- Execute the RPC calls for interface provisioning.
- Fetch operational data.

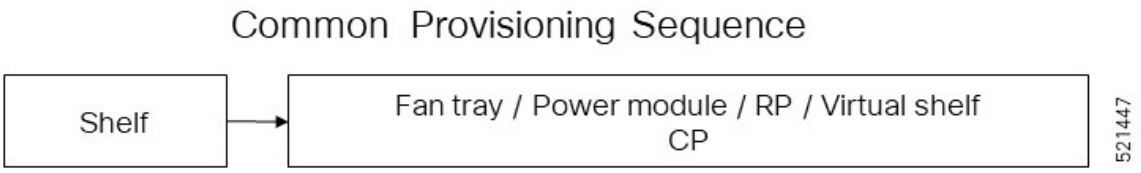
OTN-XPL Card Pre-provisioning Support

When the OpenROADM controller is connected to the network element, it can configure the network element even though the OTN-XPL card is not installed in the NCS 1004 chassis. When the OTN-XPL card is installed in the chassis, the configurations are automatically applied.

Common Circuit Pack Provisioning Workflow

The following diagram displays the common provisioning sequence after a NETCONF session has been established and a node ID has been provisioned.

Figure 1: Common Provisioning Sequence



1. Establish a NETCONF session between the controller and the device.

```
<nc:hello xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <nc:capabilities>
    <nc:capability>urn:ietf:params:netconf:base:1.0</nc:capability>
    <nc:capability>urn:ietf:params:netconf:base:1.1</nc:capability>
   <nc:capability>urn:ietf:params:netconf:capability:writable-running:1.0</nc:capability>

   <nc:capability>urn:ietf:params:netconf:capability:confirmed-commit:1.0</nc:capability>


<nc:capability>urn:ietf:params:netconf:capability:rollback-on-error:1.0</nc:capability>

    <nc:capability>urn:ietf:params:netconf:capability:startup:1.0</nc:capability>

<nc:capability>urn:ietf:params:netconf:capability:url:1.0?scheme=http,ftp,file,https,sftp</nc:capability>

    <nc:capability>urn:ietf:params:netconf:capability:validate:1.0</nc:capability>
    <nc:capability>urn:ietf:params:netconf:capability:xpath:1.0</nc:capability>
    <nc:capability>urn:ietf:params:netconf:capability:notification:1.0</nc:capability>

<nc:capability>urn:liberouter:params:netconf:capability:power-control:1.0</nc:capability>

    <nc:capability>urn:ietf:params:netconf:capability:interleave:1.0</nc:capability>
   <nc:capability>urn:ietf:params:netconf:capability:with-defaults:1.0</nc:capability>

  </nc:capabilities>
</nc:hello>
```

2. Provision the node ID.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="Set_Node_ID-101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <info>
          <node-id>MDTNJCSC-12408CSC1</node-id>
        </info>
      </org-openroadm-device>
```

```
    </config>
  </edit-config>
</rpc>
```

3. Provision the RP management interface.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<edit-config>
<target>
<running/>
</target>
<config>
<org-openroadm-device xmlns="http://org/openroadm/device">
<interface>
<name>MgmtEth0</name>
<type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:ethernetCsmacd</type>
<administrative-state>inService</administrative-state>
<supporting-circuit-pack-name>0/RP0</supporting-circuit-pack-name>
<supporting-port>MgmtEth0/RP0/CPU0/0</supporting-port>
<ethernet xmlns="http://org/openroadm/ethernet-interfaces">
<speed>1000</speed>
<fec
xmlns:org-openroadm-common-types="http://org/openroadm/common-types">org-openroadm-common-types:off</fec>
<duplex>full</duplex>
</ethernet>
</interface>
</org-openroadm-device>
</config>
</edit-config>
</rpc>
```

4. Provision the shelf:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <shelves>
          <shelf-name>0</shelf-name>
          <shelf-type>NCS1004 Chassis</shelf-type>
          <administrative-state>inService</administrative-state>
        </shelves>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

5. Provision the fan tray circuit packs:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>0/FT0</circuit-pack-name>
          <circuit-pack-type>NCS1004 Fan</circuit-pack-type>
          <circuit-pack-product-code>NCS1K4-FAN=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
```

```
          <administrative-state>inService</administrative-state>
          <equipment-state>reserved-for-facility-planned</equipment-state>
          <circuit-pack-mode>NORMAL</circuit-pack-mode>
          <shelf>0</shelf>
          <slot>FT0</slot>
          <user-description>Thisisafan-tray12432^&amp;amp;*</user-description>
          <due-date>2019-03-18T00:00:00+00:00</due-date>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>

<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>0/FT1</circuit-pack-name>
          <circuit-pack-type>NCS1004 Fan</circuit-pack-type>
          <circuit-pack-product-code>NCS1K4-FAN=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <equipment-state>reserved-for-facility-planned</equipment-state>
          <circuit-pack-mode>NORMAL</circuit-pack-mode>
          <shelf>0</shelf>
          <slot>FT1</slot>
          <user-description>Thisisafan-tray12432^&amp;amp;*</user-description>
          <due-date>2019-03-18T00:00:00+00:00</due-date>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>

<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>0/FT2</circuit-pack-name>
          <circuit-pack-type>NCS1004 Fan</circuit-pack-type>
          <circuit-pack-product-code>NCS1K4-FAN=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <equipment-state>reserved-for-facility-planned</equipment-state>
          <circuit-pack-mode>NORMAL</circuit-pack-mode>
          <shelf>0</shelf>
          <slot>FT2</slot>
          <user-description>Thisisafan-tray12432^&amp;amp;*</user-description>
          <due-date>2019-03-18T00:00:00+00:00</due-date>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

6. Provision the power module circuit packs:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>0/PM0</circuit-pack-name>
          <circuit-pack-type>NCS1K4-DC-PSU</circuit-pack-type>
          <circuit-pack-product-code>NCS1K4-DC-PSU=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <equipment-state>reserved-for-facility-planned</equipment-state>
          <circuit-pack-mode>NORMAL</circuit-pack-mode>
          <shelf>0</shelf>
          <slot>PM0</slot>
          <user-description>Thisispowermod-12432^&amp;amp;*</user-description>
          <due-date>2019-03-18T00:00:00+00:00</due-date>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>0/PM1</circuit-pack-name>
          <circuit-pack-type>NCS1K4-DC-PSU</circuit-pack-type>
          <circuit-pack-product-code>NCS1K4-DC-PSU=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <equipment-state>reserved-for-facility-planned</equipment-state>
          <circuit-pack-mode>NORMAL</circuit-pack-mode>
          <shelf>0</shelf>
          <slot>PM1</slot>
          <user-description>Thisispowermod-12432^&amp;amp;*</user-description>
          <due-date>2019-03-18T00:00:00+00:00</due-date>
        </circuit-packs>
       </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

7. Provision the RP circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>0/RP0</circuit-pack-name>
          <circuit-pack-type>NCS1004 Controller</circuit-pack-type>
          <circuit-pack-product-code>NCS1K4-CNTLR-K9=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
```

```
          <equipment-state>reserved-for-facility-planned</equipment-state>
          <circuit-pack-mode>NORMAL</circuit-pack-mode>
          <shelf>0</shelf>
          <slot>RP0</slot>
          <user-description>Thisiscontroller-12432^&amp;amp;*</user-description>
          <due-date>2019-03-18T00:00:00+00:00</due-date>
          <ports>
            <port-name>MgmtEth0/RP0/CPU0/0</port-name>
            <port-type>Manageability</port-type>
          </ports>
          <ports>
            <port-name>MgmtEth0/RP0/CPU0/1</port-name>
            <port-type>Manageability</port-type>
          </ports>
        </circuit-packs>
     </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

8. Provision the virtual shelf circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>0/SC0</circuit-pack-name>
          <circuit-pack-type>NCS1004</circuit-pack-type>
          <circuit-pack-product-code>NCS1K4-SC=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <equipment-state>reserved-for-facility-planned</equipment-state>
          <circuit-pack-mode>NORMAL</circuit-pack-mode>
          <shelf>0</shelf>
          <slot>SC0</slot>
          <user-description>thisisSCcp</user-description>
          <due-date>2019-05-06T00:00:00+00:00</due-date>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

9. Fetch operational data:

   - Verify the shelf and circuit pack inventory details.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <shelves>
          <shelf-name/>
          <shelf-type/>
          <administrative-state/>
          <vendor/>
          <model/>
          <serial-id/>
          <type/>
          <product-code/>
          <manufacture-date/>
```

```
          <clei/>
          <hardware-version/>
          <is-physical/>
          <is-passive/>
          <faceplate-label/>
        </shelves>
        <circuit-packs>
          <circuit-pack-name/>
          <circuit-pack-type/>
          <administrative-state/>
          <vendor/>
          <model/>
          <serial-id/>
          <type/>
          <clei/>
          <hardware-version/>
          <faceplate-label/>
        </circuit-packs>
      </org-openroadm-device>
    </filter>
  </get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:67163e4d-565e-4629-99cf-0ef8489bbd41"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <shelves>
        <shelf-name>0</shelf-name>
        <shelf-type>NCS1004 Chassis</shelf-type>
        <administrative-state>inService</administrative-state>
        <vendor>CISCO SYSTEMS, INC</vendor>
        <model>NCS1004</model>
        <serial-id>CAT2311B0BW</serial-id>
        <type>NCS1004 Chassis</type>
        <product-code>800-47655-01</product-code>
        <manufacture-date>2019-03-18T00:00:00+00:00</manufacture-date>
        <clei>WOMS400GRA</clei>
        <hardware-version>V01</hardware-version>
        <is-physical>true</is-physical>
        <is-passive>false</is-passive>
        <faceplate-label>shelf-faceplate-label</faceplate-label>
      </shelves>
      <circuit-packs>
        <circuit-pack-name>0/1</circuit-pack-name>
        <circuit-pack-type>NCS1004 OTN XPL</circuit-pack-type>
        <administrative-state>inService</administrative-state>
        <vendor>CISCO SYSTEMS, INC</vendor>
        <model>NCS1K4-OTN-XPL</model>
        <serial-id>CAT2318B0SG</serial-id>
        <type>NCS1004 OTN XPL</type>
        <clei>CHANGE0ME0</clei>
        <hardware-version>V00</hardware-version>
         <faceplate-label>OTN-XPL</faceplate-label>
      </circuit-packs>
      <circuit-packs>
        <circuit-pack-name>0/FT0</circuit-pack-name>
        <circuit-pack-type>NCS1004 Fan</circuit-pack-type>
        <administrative-state>inService</administrative-state>
        <vendor>CISCO SYSTEMS, INC</vendor>
        <model>NCS1K4-FAN</model>
        <serial-id>CAT2310B161</serial-id>
```

```
  <type>NCS1004 Fan</type>
  <clei>WOCUBERRAA</clei>
  <hardware-version>V01</hardware-version>
  <faceplate-label>FAN0|FAN1|FAN2</faceplate-label>
</circuit-packs>
<circuit-packs>
  <circuit-pack-name>0/FT1</circuit-pack-name>
  <circuit-pack-type>NCS1004 Fan</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <vendor>CISCO SYSTEMS, INC</vendor>
  <model>NCS1K4-FAN</model>
  <serial-id>CAT2310B130</serial-id>
  <type>NCS1004 Fan</type>
  <clei>WOCUBERRAA</clei>
  <hardware-version>V01</hardware-version>
  <faceplate-label>FAN0|FAN1|FAN2</faceplate-label>
</circuit-packs>
<circuit-packs>
  <circuit-pack-name>0/FT2</circuit-pack-name>
  <circuit-pack-type>NCS1004 Fan</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <vendor>CISCO SYSTEMS, INC</vendor>
  <model>NCS1K4-FAN</model>
  <serial-id>CAT2310B172</serial-id>
  <type>NCS1004 Fan</type>
  <clei>WOCUBERRAA</clei>
  <hardware-version>V01</hardware-version>
  <faceplate-label>FAN0|FAN1|FAN2</faceplate-label>
</circuit-packs>
<circuit-packs>
  <circuit-pack-name>0/PM0</circuit-pack-name>
  <circuit-pack-type>NCS1K4-DC-PSU</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <vendor>CISCO SYSTEMS, INC</vendor>
  <model>NCS1K4-DC-PSU</model>
  <serial-id>POG2310CT00</serial-id>
  <type>NCS1K4-DC-PSU</type>
  <hardware-version>V01</hardware-version>
  <faceplate-label>NCS1K4-AC-PSU</faceplate-label>
</circuit-packs>
<circuit-packs>
  <circuit-pack-name>0/PM1</circuit-pack-name>
  <circuit-pack-type>NCS1K4-DC-PSU</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <vendor>CISCO SYSTEMS, INC</vendor>
  <model>NCS1K4-DC-PSU</model>
  <serial-id>POG2311CLAZ</serial-id>
  <type>NCS1K4-DC-PSU</type>
  <clei>WOPUAG1SAA</clei>
  <hardware-version>V01</hardware-version>
  <faceplate-label>NCS1K4-AC-PSU</faceplate-label>
</circuit-packs>
<circuit-packs>
  <circuit-pack-name>0/RP0</circuit-pack-name>
  <circuit-pack-type>NCS1004 Controller</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <vendor>CISCO SYSTEMS, INC</vendor>
  <model>NCS1K4-CNTLR-K9</model>
  <serial-id>CAT2303B07P</serial-id>
  <type>NCS1004 Controller</type>
  <clei>WOCUBEPRAA</clei>
  <hardware-version>V00 </hardware-version>
 <faceplate-label>CNTLR</faceplate-label>
</circuit-packs>
```

```
<circuit-packs>
  <circuit-pack-name>0/SC0</circuit-pack-name>
  <circuit-pack-type>NCS1004</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <vendor>CISCO SYSTEMS, INC</vendor>
  <model>NCS1004</model>
  <serial-id>CAT2311B0BW</serial-id>
  <type>NCS1004</type>
  <clei>WOMS400GRA</clei>
  <hardware-version>V01</hardware-version>
  <faceplate-label>none</faceplate-label>
</circuit-packs>
<circuit-packs>
<circuit-pack-name>Optics0/1/0/1</circuit-pack-name>
  <circuit-pack-type>QSFP28</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <type>QSFP28</type>
  <faceplate-label>not-installed</faceplate-label>
</circuit-packs>
 <circuit-packs>
  <circuit-pack-name>Optics0/1/0/10</circuit-pack-name>
  <circuit-pack-type>QSFP28</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <vendor>CISCO-FINISAR</vendor>
  <model>ONS-QSFP28-LR4</model>
  <serial-id>FNS24160MB1</serial-id>
  <type>QSFP28</type>
  <clei>WOTRD4WBAA</clei>
  <hardware-version>V01</hardware-version>
  <faceplate-label>pluggable</faceplate-label>
</circuit-packs>
<circuit-packs>
  <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
  <circuit-pack-type>CFP2-DCO</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <vendor>CISCO-ACACIA</vendor>
  <model>ONS-CFP2D-400G-C</model>
  <serial-id>ACA2448003B</serial-id>
  <type>CFP2-DCO</type>
  <clei>WOTREW6BAA</clei>
  <hardware-version>VES1</hardware-version>
  <faceplate-label>pluggable</faceplate-label>
</circuit-packs>
<circuit-packs>
  <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
  <circuit-pack-type>CFP2-DCO</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <vendor>CISCO-ACACIA</vendor>
  <model>ONS-CFP2D-400G-C</model>
  <serial-id>SIM-400-ELB</serial-id>
  <type>CFP2-DCO</type>
  <clei>0000</clei>
  <hardware-version>VES1</hardware-version>
  <faceplate-label>pluggable</faceplate-label>
</circuit-packs>
<circuit-packs>
  <circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
  <circuit-pack-type>QSFP28</circuit-pack-type>
  <administrative-state>inService</administrative-state>
  <vendor>CISCO-INNOLIGHT</vendor>
  <model>QSFP-100G-FR-S</model>
  <serial-id>INL24041238</serial-id>
  <type>QSFP28</type>
  <clei>INUIAC3EAA</clei>
```

```
        <hardware-version>V01</hardware-version>
        <faceplate-label>pluggable</faceplate-label>
      </circuit-packs>
      <circuit-packs>
        <circuit-pack-name>Optics0/1/0/7</circuit-pack-name>
        <circuit-pack-type>QSFP28</circuit-pack-type>
        <administrative-state>inService</administrative-state>
        <type>QSFP28</type>
        <faceplate-label>not-installed</faceplate-label>
      </circuit-packs>
      <circuit-packs>
        <circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
        <circuit-pack-type>QSFP56-DD</circuit-pack-type>
        <administrative-state>inService</administrative-state>
        <vendor>CISCO-INNOLIGHT</vendor>
        <model>QDD-400G-DR4-S</model>
        <serial-id>INL24155383</serial-id>
        <type>QSFP56-DD</type>
        <clei>CMUIAUPCAA</clei>
        <hardware-version>V01</hardware-version>
        <faceplate-label>pluggable</faceplate-label>
      </circuit-packs>
      </org-openroadm-device>
  </data>
</rpc-reply>
```

- Verify the pluggable optics holder capabilities for slot 0/1.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<circuit-packs>
<circuit-pack-name>0/1</circuit-pack-name>
<cp-slots>
<pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability"/>
</cp-slots>
</circuit-packs>
<provisioned-port-grp xmlns="http://org/openroadm/port-capability"/>
</org-openroadm-device>
</filter>
</get>
</rpc>


<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:5be82d87-14a7-47a6-b6cb-5a76375a5c59"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <circuit-packs>
        <circuit-pack-name>0/1</circuit-pack-name>
        <cp-slots>
          <pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability">
            <supported-circuit-pack>
              <supported-circuit-pack-type>QSFP28</supported-circuit-pack-type>
              <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:QSFP28</supported-pluggable-id-type>

              <ports>
                <port-name>0/1/0/0</port-name>
                <port-capabilities>
```

```
                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

                    <otn-capability>
                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-4</muxp-profile-name>
                      </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

                    <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-4</muxp-profile-name>
                      </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
                </port-capabilities>
              </ports>
            </supported-circuit-pack>
          </pluggable-optics-holder-capability>
        </cp-slots>
        <cp-slots>
          <pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability">
            <supported-circuit-pack>
              <supported-circuit-pack-type>QSFP28</supported-circuit-pack-type>
              <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:QSFP28</supported-pluggable-id-type>

              <ports>
                <port-name>0/1/0/1</port-name>
                <port-capabilities>
                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

                    <otn-capability>
                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-4</muxp-profile-name>
```

```
                      </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

                    <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                     <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-4</muxp-profile-name>
                      </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
                </port-capabilities>
              </ports>
            </supported-circuit-pack>
          </pluggable-optics-holder-capability>
        </cp-slots>
        <cp-slots>
          <pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability">
            <supported-circuit-pack>
              <supported-circuit-pack-type>QSFP28</supported-circuit-pack-type>
              <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:QSFP28</supported-pluggable-id-type>

              <ports>
                <port-name>0/1/0/4</port-name>
                <port-capabilities>
                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

                    <otn-capability>
                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                     <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-3</muxp-profile-name>
                      </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

                    <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                      <mpdr-client-restriction>
```

```
<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                    <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-3</muxp-profile-name>
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                   </otn-capability>
                 </supported-interface-capability>
               </port-capabilities>
             </ports>
           </supported-circuit-pack>
         </pluggable-optics-holder-capability>
       </cp-slots>
       <cp-slots>
         <pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability">
           <supported-circuit-pack>
             <supported-circuit-pack-type>QSFP28</supported-circuit-pack-type>
             <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:QSFP28</supported-pluggable-id-type>

             <ports>
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               <port-capabilities>
                 <supported-interface-capability>
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xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

                   <otn-capability>
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<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                     <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-2</muxp-profile-name>
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                   <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                     <mpdr-client-restriction>

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                     <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-2</muxp-profile-name>
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                   </otn-capability>
                 </supported-interface-capability>
               </port-capabilities>
             </ports>
           </supported-circuit-pack>
         </pluggable-optics-holder-capability>
```

```
        </cp-slots>
        <cp-slots>
          <pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability">
            <supported-circuit-pack>
              <supported-circuit-pack-type>QSFP28</supported-circuit-pack-type>
              <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:QSFP28</supported-pluggable-id-type>

              <ports>
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                <port-capabilities>
                  <supported-interface-capability>
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xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

                    <otn-capability>
                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-3</muxp-profile-name>
                      </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
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                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

                    <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-3</muxp-profile-name>
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                  </supported-interface-capability>
                </port-capabilities>
              </ports>
            </supported-circuit-pack>
          </pluggable-optics-holder-capability>
        </cp-slots>
        <cp-slots>
          <pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability">
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              <supported-circuit-pack-type>QSFP28</supported-circuit-pack-type>
              <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:QSFP28</supported-pluggable-id-type>

              <ports>
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                <port-capabilities>
                  <supported-interface-capability>
```

```
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xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

                    <otn-capability>
                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-2</muxp-profile-name>
                       </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

                    <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

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                       <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-2</muxp-profile-name>
                       </mpdr-client-restriction>
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                  </supported-interface-capability>
                </port-capabilities>
              </ports>
            </supported-circuit-pack>
          </pluggable-optics-holder-capability>
        </cp-slots>
        <cp-slots>
          <pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability">
            <supported-circuit-pack>
              <supported-circuit-pack-type>QSFP28</supported-circuit-pack-type>
              <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:QSFP28</supported-pluggable-id-type>

              <ports>
                <port-name>0/1/0/8</port-name>
                <port-capabilities>
                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

                    <otn-capability>
                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-1</muxp-profile-name>
                       </mpdr-client-restriction>
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                    </otn-capability>
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                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

                    <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                      <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-1</muxp-profile-name>
                      </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
                </port-capabilities>
              </ports>
            </supported-circuit-pack>
            <supported-circuit-pack>
              <supported-circuit-pack-type>QSFP56-DD</supported-circuit-pack-type>
              <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:QSFP56-DD</supported-pluggable-id-type>

              <ports>
                <port-name>0/1/0/8</port-name>
                <port-capabilities>
                  <supported-interface-capability>
                    <if-cap-type
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                    <otn-capability>
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<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                      <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>

                      </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
                </port-capabilities>
              </ports>
            </supported-circuit-pack>
          </pluggable-optics-holder-capability>
        </cp-slots>
        <cp-slots>
          <pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability">
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              <supported-circuit-pack-type>QSFP28</supported-circuit-pack-type>
              <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:QSFP28</supported-pluggable-id-type>

              <ports>
                <port-name>0/1/0/10</port-name>
                <port-capabilities>
                  <supported-interface-capability>
                    <if-cap-type
```

```
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

                    <otn-capability>
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<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-1</muxp-profile-name>
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                     </otn-capability>
                   </supported-interface-capability>
                   <supported-interface-capability>
                     <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

                     <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                       <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>


<muxp-profile-name>4-by-100G-muxp-oduc4-TPN-1</muxp-profile-name>
                       </mpdr-client-restriction>
                     </otn-capability>
                   </supported-interface-capability>
                 </port-capabilities>
               </ports>
             </supported-circuit-pack>
             <supported-circuit-pack>
               <supported-circuit-pack-type>QSFP56-DD</supported-circuit-pack-type>
               <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:QSFP56-DD</supported-pluggable-id-type>

               <ports>
                 <port-name>0/1/0/10</port-name>
                 <port-capabilities>
                   <supported-interface-capability>
                     <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-400GE</if-cap-type>

                     <otn-capability>
                       <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>

                       </mpdr-client-restriction>
                     </otn-capability>
                   </supported-interface-capability>
                 </port-capabilities>
               </ports>
             </supported-circuit-pack>
           </pluggable-optics-holder-capability>
         </cp-slots>
         <cp-slots>
```

```
          <pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability">
            <supported-circuit-pack>
              <supported-circuit-pack-type>CFP2-DCO</supported-circuit-pack-type>
              <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:CFP2-DCO</supported-pluggable-id-type>

              <ports>
                <port-name>0/1/0/12</port-name>
                <port-capabilities>
                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-otsi-otsigroup</if-cap-type>


<otsigroup-capability-profile-name>OtsiGroup-Network-400G</otsigroup-capability-profile-name>

                    <otn-capability>
                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>

                      </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
                </port-capabilities>
              </ports>
            </supported-circuit-pack>
          </pluggable-optics-holder-capability>
        </cp-slots>
        <cp-slots>
          <pluggable-optics-holder-capability
xmlns="http://org/openroadm/pluggable-optics-holder-capability">
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              <supported-pluggable-id-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:CFP2-DCO</supported-pluggable-id-type>

              <ports>
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                <port-capabilities>
                  <supported-interface-capability>
                    <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-otsi-otsigroup</if-cap-type>


<otsigroup-capability-profile-name>OtsiGroup-Network-400G</otsigroup-capability-profile-name>

                    <otn-capability>
                      <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                       <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>

                      </mpdr-client-restriction>
                    </otn-capability>
                  </supported-interface-capability>
                </port-capabilities>
              </ports>
            </supported-circuit-pack>
          </pluggable-optics-holder-capability>
```

```
        </cp-slots>
      </circuit-packs>
    </org-openroadm-device>
  </data>
</rpc-reply>
```



Note The *otsigroup-capability-profile-name* for 200G interfaces is **OtsiGroup-Network-200G** and for 300G interfaces, it is **OtsiGroup-Network-300G**.

- Verify muxp-profile.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <muxp-profile/>
      </org-openroadm-device>
    </filter>
  </get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:f5e9c608-c7f9-4a9e-af3d-93379a5fff6f"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <muxp-profile>
        <profile-name>2-by-100G-muxp-oduc2-TPN-1</profile-name>
        <odtu-type
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODTUCn.ts</odtu-type>

        <network-odu-rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODUCn</network-odu-rate>

        <network-oducn-n-rate>2</network-oducn-n-rate>
        <network-ho-odu-trib-port-number>1</network-ho-odu-trib-port-number>
        <network-ho-odu-opucn-trib-slots>1.1</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.10</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.11</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.12</network-ho-odu-opucn-trib-slots>
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        <network-ho-odu-opucn-trib-slots>1.18</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.19</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.2</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.20</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.3</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.4</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.5</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.6</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.7</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.8</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>1.9</network-ho-odu-opucn-trib-slots>
      </muxp-profile>
      <muxp-profile>
```

```
        <profile-name>2-by-100G-muxp-oduc2-TPN-2</profile-name>
        <odtu-type
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODTUCn.ts</odtu-type>

        <network-odu-rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODUCn</network-odu-rate>

        <network-oducn-n-rate>2</network-oducn-n-rate>
        <network-ho-odu-trib-port-number>2</network-ho-odu-trib-port-number>
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        <network-ho-odu-opucn-trib-slots>4.20</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>4.3</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>4.4</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>4.5</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>4.6</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>4.7</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>4.8</network-ho-odu-opucn-trib-slots>
        <network-ho-odu-opucn-trib-slots>4.9</network-ho-odu-opucn-trib-slots>
      </muxp-profile>
    </org-openroadm-device>
  </data>
</rpc-reply>
```

- Verify Otsigroup-capability-profile.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
```

```
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <otsigroup-capability-profile/>
      </org-openroadm-device>
    </filter>
  </get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:f52dbacb-1924-4e1d-8411-89620dd49727"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <otsigroup-capability-profile>
        <profile-name>OtsiGroup-Network-400G</profile-name>
        <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTUCn-ODUCn</if-cap-type>

        <otucn-n-rate>4</otucn-n-rate>
        <foic-type
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">org-openroadm-common-optical-channel-types:foic4.8</foic-type>


<otn-capability-profile-name>Otn-ODUCn-TTP-no-protection</otn-capability-profile-name>


<otn-odu-mux-hierarchy-profile-name>one-stage-ODUCn-mux</otn-odu-mux-hierarchy-profile-name>

      </otsigroup-capability-profile>
    </org-openroadm-device>
  </data>
</rpc-reply>
```



Note The *profile-name* for 200G interfaces is **OtsiGroup-Network-200G** and for 300G interfaces, it is **OtsiGroup-Network-300G**.

- Verify Otn-odu-mux-hierarchy-profile.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <otn-odu-mux-hierarchy-profile/>
      </org-openroadm-device>
    </filter>
  </get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:ebffbd76-7d87-4b4b-92fb-ab1c68e0bf85"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <otn-odu-mux-hierarchy-profile>
        <profile-name>one-stage-ODUCn-mux</profile-name>
        <mux-capability>
          <stage-number>1</stage-number>
          <ho-odu-type
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODUCn</ho-odu-type>

          <ho-odu-payload-type>22</ho-odu-payload-type>
```

```
          <supported-lo-odu-type
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODUflex-dar</supported-lo-odu-type>

          <supported-lo-odu-type
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU4</supported-lo-odu-type>

          <lo-odu-proactive-DMp>false</lo-odu-proactive-DMp>
          <lo-odu-tcm-capable>false</lo-odu-tcm-capable>
        </mux-capability>
      </otn-odu-mux-hierarchy-profile>
    </org-openroadm-device>
  </data>
</rpc-reply>
```

- Verify Otn-capability-profile.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <otn-capability-profile/>
      </org-openroadm-device>
    </filter>
  </get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:bcf6e688-d13e-4c14-91c9-4da571f7ea84"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <otn-capability-profile>
        <profile-name>Otn-ODU4-TTP-no-protection</profile-name>
        <proactive-DMp>false</proactive-DMp>
        <tcm-capable>false</tcm-capable>
      </otn-capability-profile>
      <otn-capability-profile>
        <profile-name>Otn-ODUCn-TTP-no-protection</profile-name>
        <proactive-DMp>false</proactive-DMp>
        <tcm-capable>false</tcm-capable>
        <opu-payload-type-mapping>22</opu-payload-type-mapping>
      </otn-capability-profile>
    </org-openroadm-device>
  </data>
</rpc-reply>
```

- Verify mc-capability-profile.

```
rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<mc-capability-profile/>
</org-openroadm-device>
</filter>
</get>
</rpc>
```

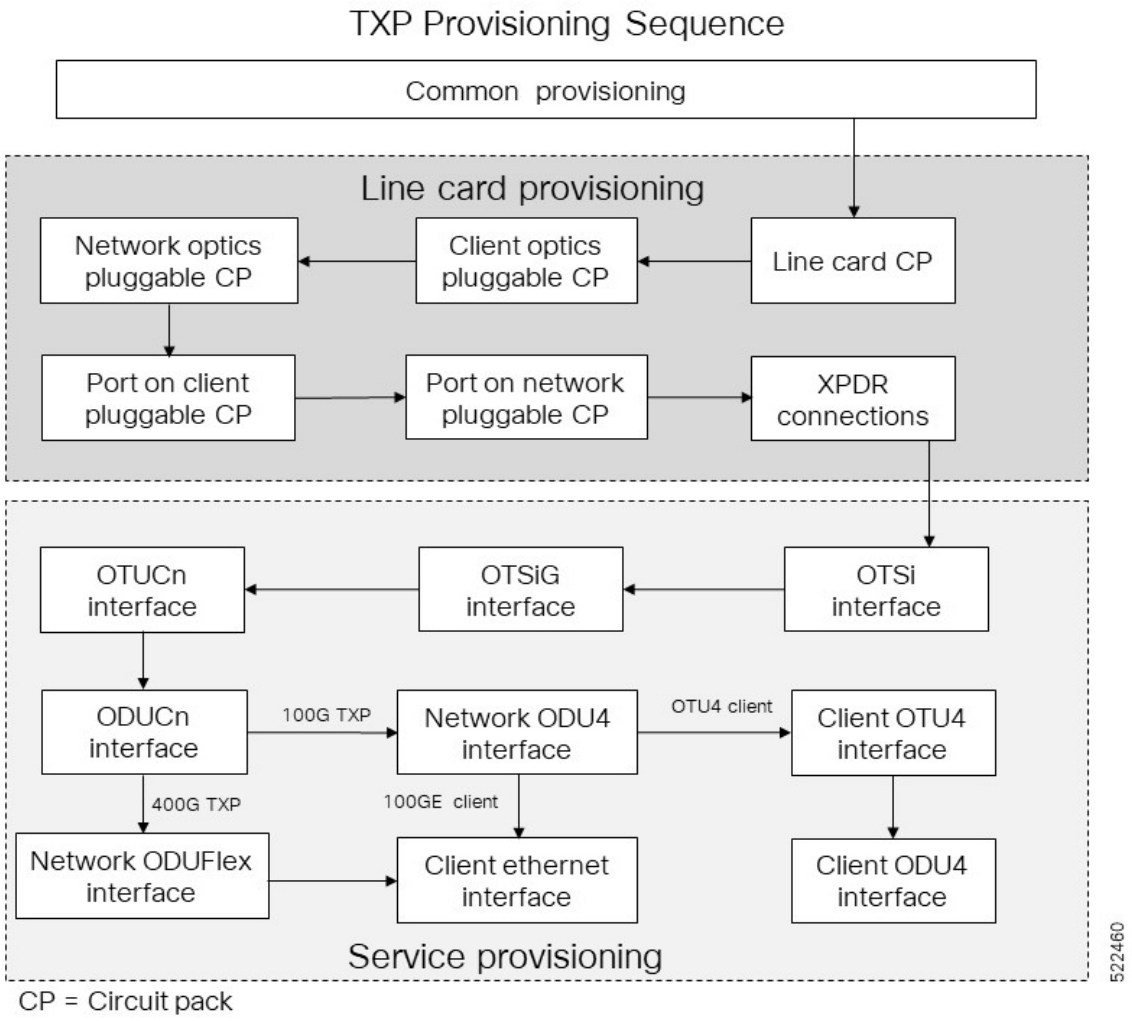
```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:69c23223-242d-4d5b-8c17-82a8ec363b2d"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <mc-capability-profile>
```

```
          <profile-name>mc-cap-profile</profile-name>
          <center-freq-granularity>6.25</center-freq-granularity>
          <min-edge-freq>191.325</min-edge-freq>
          <max-edge-freq>196.125</max-edge-freq>
          <slot-width-granularity>50.0</slot-width-granularity>
          <min-slots>1</min-slots>
          <max-slots>1</max-slots>
        </mc-capability-profile>
      </org-openroadm-device>
    </data>
  </rpc-reply>
```

TXP Configuration Workflow

The following diagram displays the TXP provisioning sequence for 400G.

Figure 2: TXP Provisioning Sequence



Note The example below uses client port 8 and network port 13. See OTN-XPL Line Card, on page 4 for all possible combinations.

1. Provision the line card circuit-pack:

Note Interface provisioning is rejected if the *equipmentMismatch* alarm exists on configured line card circuit pack. Ensure that the configured circuit pack type matches the PID of the line card that is installed in the chassis.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>0/1</circuit-pack-name>
          <circuit-pack-type>NCS1004 OTN XPL</circuit-pack-type>
          <circuit-pack-product-code>NCS1K4-OTN-XPL=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <equipment-state>reserved-for-facility-planned</equipment-state>
          <circuit-pack-mode>TXP-MXP400</circuit-pack-mode>
          <shelf>0</shelf>
          <slot>1</slot>
          <user-description>Thisisalinecardcp</user-description>
          <due-date>2019-03-18T00:00:00+00:00</due-date>
        </circuit-packs>
       </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

2. Provision the client optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
          <circuit-pack-type>QSFP56-DD</circuit-pack-type>
          <circuit-pack-product-code>QDD-400G-FR4-S=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <shelf>0</shelf>
          <slot>1</slot>
          <user-description>thisispluggablecp</user-description>
          <due-date>2019-05-06T00:00:00+00:00</due-date>
          <parent-circuit-pack>
            <circuit-pack-name>0/1</circuit-pack-name>
            <cp-slot-name>8</cp-slot-name>
          </parent-circuit-pack>
        </circuit-packs>
```

```
    </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

3. Provison the network optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <circuit-pack-type>CFP2-DCO</circuit-pack-type>
          <circuit-pack-product-code>ONS-CFP2D-400G-C=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <shelf>0</shelf>
          <slot>1</slot>
          <user-description>thisispluggablecp</user-description>
          <due-date>2019-05-06T00:00:00+00:00</due-date>
          <parent-circuit-pack>
            <circuit-pack-name>0/1</circuit-pack-name>
            <cp-slot-name>13</cp-slot-name>
          </parent-circuit-pack>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

4. Provision the port on the client optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
          <ports>
            <port-name>0/1/0/8</port-name>
            <port-type>QSFP-DD</port-type>
            <port-qual>xpdr-client</port-qual>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/8/1</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/8/2</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/8/3</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/8/4</port-name>
```

```
            <administrative-state>inService</administrative-state>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

5. Provision the port on the network optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <ports>
            <port-name>0/1/0/13</port-name>
            <port-type>CFP2-DCO</port-type>
            <port-qual>xpdr-network</port-qual>
            <administrative-state>inService</administrative-state>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

6. Provision the XPDR connections:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<edit-config>
<target>
<running/>
</target>
<config>
<org-openroadm-device xmlns="http://org/openroadm/device">
<xponder xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0" nc:operation="replace">
<xpdr-number>1</xpdr-number>
<xpdr-type>tpdr</xpdr-type>
<xpdr-port>
<index>1</index>
<circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
<port-name>0/1/0/13</port-name>
</xpdr-port>
<xpdr-port>
<index>2</index>
<circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
<port-name>0/1/0/8</port-name>
</xpdr-port>
</xponder>
</org-openroadm-device>
</config>
</edit-config>
</rpc>
```

7. Fetch operational data
   - Verify the client and trunk pluggable circuit pack details.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<circuit-packs>
<circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
<faceplate-label/>
</circuit-packs>
<circuit-packs>
<circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
<faceplate-label/>
</circuit-packs>
</org-openroadm-device>
</filter>
</get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:a8aa419a-88c7-4c4a-86d7-36746dfa2b94"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">

     <circuit-packs>
      </circuit-packs>
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <circuit-pack-type>CFP2-DCO</circuit-pack-type>
          <administrative-state>inService</administrative-state>
          <vendor>CISCO-ACACIA</vendor>
          <model>ONS-CFP2D-400G-C</model>
          <serial-id>ACA2436000P</serial-id>
          <type>CFP2-DCO</type>
          <product-code>10-3500-01</product-code>
          <hardware-version>VES1</hardware-version>
        <faceplate-label>pluggable</faceplate-label>
       </circuit-packs>
      <circuit-packs>
          <circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
          <circuit-pack-type>QSFP56-DD</circuit-pack-type>
          <administrative-state>inService</administrative-state>
          <vendor>CISCO-INNOLIGHT</vendor>
          <model>QDD-400G-DR4-S</model>
          <serial-id>INL24155383</serial-id>
```

```
        <type>QSFP56-DD</type>
        <product-code>10-3320-01</product-code>
        <manufacture-date>2020-04-09T00:00:00+00:00</manufacture-date>
        <clei>CMUIAUPCAA</clei>
        <hardware-version>V01</hardware-version>
      <faceplate-label>pluggable</faceplate-label>
      </circuit-packs>
    </org-openroadm-device>
  </data>
</rpc-reply>
```

- Verify connection-map capabilities.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<connection-map/>
</org-openroadm-device>
</filter>
</get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:6ab9cfd7-fd02-4419-9ada-c03955dd6117"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <connection-map>
        <connection-map-number>1381</connection-map-number>
        <source>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <port-name>0/1/0/13</port-name>
        </source>
        <destination>
          <circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
          <port-name>0/1/0/8</port-name>
        </destination>
      </connection-map>
      <connection-map>
        <connection-map-number>8131</connection-map-number>
        <source>
          <circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
          <port-name>0/1/0/8</port-name>
        </source>
        <destination>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <port-name>0/1/0/13</port-name>
        </destination>
      </connection-map>
    </org-openroadm-device>
  </data>
</rpc-reply>
```

- Verify the port-capabilities.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<circuit-packs>
<ports>
<port-name>0/1/0/13</port-name>
```

```
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/8</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
</circuit-packs>
</org-openroadm-device>
</filter>
</get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:0e7e872d-cc92-4143-b3aa-cf06f89fcba4"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <circuit-packs>
        <ports>
          <port-name>0/1/0/13</port-name>
          <port-capabilities xmlns="http://org/openroadm/port-capability">
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-otsi-otsigroup</if-cap-type>


<otsigroup-capability-profile-name>OtsiGroup-Network-400G</otsigroup-capability-profile-name>

              <otn-capability>
                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>
                </mpdr-client-restriction>
              </otn-capability>
              <logical-port>
                <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
                <port-name>0/1/0/13</port-name>
              </logical-port>
            </supported-interface-capability>
          </port-capabilities>
        </ports>
      </circuit-packs>
      <circuit-packs>
        <ports>
          <port-name>0/1/0/8</port-name>
          <port-capabilities xmlns="http://org/openroadm/port-capability">
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-400GE</if-cap-type>

              <otn-capability>
                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/13</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/13</network-ho-odu-port-name>
                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
          </port-capabilities>
        </ports>
      </circuit-packs>
```

```
        </org-openroadm-device>
      </data>
    </rpc-reply>
```

In the configuration steps below, the names assigned to the interfaces follow the naming conventions defined in the table below:

Interface	Naming Convention
OTSi	otsi-<pluggable-cp-name>/<pluggable-port-name>
OTSiG	otsig-<pluggable-cp-name>/<pluggable-port-name>
OTUCn	otuc-<pluggable-cp-name>/<pluggable-port-name>
ODUCn	oduc-<pluggable-cp-name>/<pluggable-port-name>
ODUFlex	odu-<pluggable-cp-name>/<pluggable-port-name>.<tpn>
Ethernet	eth-<pluggable-cp-name>/<pluggable-port-name>

8. Provision the OTSi interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>otsi-Optics0/1/0/13/0/1/0/13</name>
          <administrative-state>inService</administrative-state>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi</type>
          <supporting-circuit-pack-name>Optics0/1/0/13</supporting-circuit-pack-name>
          <supporting-port>0/1/0/13</supporting-port>
         <otsi xmlns="http://org/openroadm/optical-channel-tributary-signal-interfaces">

            <provision-mode>explicit</provision-mode>
            <frequency>193.10</frequency>
            <modulation-format>dp-qam16</modulation-format>
             <transmit-power>0</transmit-power>
              <fec
xmlns:org-openroadm-common-types="http://org/openroadm/common-types">org-openroadm-common-types:ofec</fec>

            <otsi-rate
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">

            org-openroadm-common-optical-channel-types:R400G-otsi</otsi-rate>
            <flexo>
              <foic-type
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">

             org-openroadm-common-optical-channel-types:foic4.8</foic-type>
              <iid>1</iid>
              <iid>2</iid>
              <iid>3</iid>
              <iid>4</iid>
            </flexo>
```

```
          </otsi>
        </interface>
    </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```



Note The IID attributes must be added in ascending order. Else the configuration is rejected.

100G Network Interfaces
Modulation format is dp-qpsk
OTSi rate is R100G-otsi
FOIC type is foic1.4 where 1 indicates the number of FlexO frames and 4 indicates the number of electrical lanes being used.
The number of IID attributes provisioned is one.

Note To create the OTSi interface for a bookended configuration (Cisco transponders installed in the near-end and far-end node), use the following RPC :

```
rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<edit-config>
<target>
<running/>
</target>
<config>
<org-openroadm-device xmlns="http://org/openroadm/device">
<interface>
<name>otsi-Optics0/1/0/13/0/1/0/13</name>
<administrative-state>inService</administrative-state>
<type xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi</type>
<supporting-circuit-pack-name>Optics0/1/0/13</supporting-circuit-pack-name>
<supporting-port>0/1/0/13</supporting-port>
<otsi xmlns="http://org/openroadm/optical-channel-tributary-signal-interfaces">
<provision-mode>profile</provision-mode>
<frequency>193.10</frequency>
<transmit-power>0</transmit-power>
<optical-operational-mode>ORBKD-W-400G-10001</optical-operational-mode>
<flexo>
<foic-type
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">org-openroadm-common-optical-channel-types:foic4.8</foic-type>
<iid>1</iid>
<iid>2</iid>
<iid>3</iid>
<iid>4</iid>
</flexo>
</otsi>
</interface>
</org-openroadm-device>
</config>
</edit-config>
</rpc>
```

The trunk rate is 400G.

9. Provision the OTSiG interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface>
      <name>otsig-Optics0/1/0/13/0/1/0/13</name>
      <administrative-state>inService</administrative-state>
      <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi-group</type>
     <supporting-interface-list>otsi-Optics0/1/0/13/0/1/0/13</supporting-interface-list>

      <otsi-group xmlns="http://org/openroadm/otsi-group-interfaces">
      <group-rate xmlns:org-openroadm-common-optical-channel-types=

"http://org/openroadm/common-optical-channel-types">org-openroadm-common-optical-channel-types:R400G-otsi</group-rate>

      <group-id>1</group-id>
```

```
      </otsi-group>
      </interface>
    </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

100G Network Interfaces
OTSi rate is R100G-otsi

10. Provision the OTUCn interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>otuc-Optics0/1/0/13/0/1/0/13</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOtu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>otsig-Optics0/1/0/13/0/1/0/13</supporting-interface-list>
          <otu xmlns="http://org/openroadm/otn-otu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:OTUCn</rate>

            <otucn-n-rate>4</otucn-n-rate>
          </otu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

100G Network Interfaces
OTUCn rate is 1

11. Provision the ODUCn interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>oduc-Optics0/1/0/13/0/1/0/13</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOdu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>otuc-Optics0/1/0/13/0/1/0/13</supporting-interface-list>
          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODUCn</rate>
```

```
            <oducn-n-rate>4</oducn-n-rate>
            <odu-function
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU-TTP</odu-function>

            <monitoring-mode>terminated</monitoring-mode>
            <opu>
              <payload-type>22</payload-type>
              <exp-payload-type>22</exp-payload-type>
            </opu>
          </odu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

100G Network Interfaces
ODUCn rate is 1

12. • **400G:**Provision the ODUFlex interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>odu-Optics0/1/0/13/0/1/0/13.1</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOdu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>oduc-Optics0/1/0/13/0/1/0/13</supporting-interface-list>

          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">
             org-openroadm-otn-common-types:ODUflex-cbr</rate>
            <oduflex-cbr-service
xmlns:org-openroadm-otn-common-types="http://org/openroadm/

otn-common-types">org-openroadm-otn-common-types:ODUflex-cbr-400G</oduflex-cbr-service>

            <odu-function
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">
            org-openroadm-otn-common-types:ODU-TTP-CTP</odu-function>
            <monitoring-mode>terminated</monitoring-mode>
            <parent-odu-allocation>
              <trib-port-number>1</trib-port-number>
              <opucn-trib-slots>1.1</opucn-trib-slots>
              <opucn-trib-slots>1.2</opucn-trib-slots>
              <opucn-trib-slots>1.3</opucn-trib-slots>
              <opucn-trib-slots>1.4</opucn-trib-slots>
              <opucn-trib-slots>1.5</opucn-trib-slots>
              <opucn-trib-slots>1.6</opucn-trib-slots>
              <opucn-trib-slots>1.7</opucn-trib-slots>
              <opucn-trib-slots>1.8</opucn-trib-slots>
              <opucn-trib-slots>1.9</opucn-trib-slots>
              <opucn-trib-slots>1.10</opucn-trib-slots>
```

```
<opucn-trib-slots>1.11</opucn-trib-slots>
<opucn-trib-slots>1.12</opucn-trib-slots>
<opucn-trib-slots>1.13</opucn-trib-slots>
<opucn-trib-slots>1.14</opucn-trib-slots>
<opucn-trib-slots>1.15</opucn-trib-slots>
<opucn-trib-slots>1.16</opucn-trib-slots>
<opucn-trib-slots>1.17</opucn-trib-slots>
<opucn-trib-slots>1.18</opucn-trib-slots>
<opucn-trib-slots>1.19</opucn-trib-slots>
<opucn-trib-slots>1.20</opucn-trib-slots>
<opucn-trib-slots>2.1</opucn-trib-slots>
<opucn-trib-slots>2.2</opucn-trib-slots>
<opucn-trib-slots>2.3</opucn-trib-slots>
<opucn-trib-slots>2.4</opucn-trib-slots>
<opucn-trib-slots>2.5</opucn-trib-slots>
<opucn-trib-slots>2.6</opucn-trib-slots>
<opucn-trib-slots>2.7</opucn-trib-slots>
<opucn-trib-slots>2.8</opucn-trib-slots>
<opucn-trib-slots>2.9</opucn-trib-slots>
<opucn-trib-slots>2.10</opucn-trib-slots>
<opucn-trib-slots>2.11</opucn-trib-slots>
<opucn-trib-slots>2.12</opucn-trib-slots>
<opucn-trib-slots>2.13</opucn-trib-slots>
<opucn-trib-slots>2.14</opucn-trib-slots>
<opucn-trib-slots>2.15</opucn-trib-slots>
<opucn-trib-slots>2.16</opucn-trib-slots>
<opucn-trib-slots>2.17</opucn-trib-slots>
<opucn-trib-slots>2.18</opucn-trib-slots>
<opucn-trib-slots>2.19</opucn-trib-slots>
<opucn-trib-slots>2.20</opucn-trib-slots>
<opucn-trib-slots>3.1</opucn-trib-slots>
<opucn-trib-slots>3.2</opucn-trib-slots>
<opucn-trib-slots>3.3</opucn-trib-slots>
<opucn-trib-slots>3.4</opucn-trib-slots>
<opucn-trib-slots>3.5</opucn-trib-slots>
<opucn-trib-slots>3.6</opucn-trib-slots>
<opucn-trib-slots>3.7</opucn-trib-slots>
<opucn-trib-slots>3.8</opucn-trib-slots>
<opucn-trib-slots>3.9</opucn-trib-slots>
<opucn-trib-slots>3.10</opucn-trib-slots>
<opucn-trib-slots>3.11</opucn-trib-slots>
<opucn-trib-slots>3.12</opucn-trib-slots>
<opucn-trib-slots>3.13</opucn-trib-slots>
<opucn-trib-slots>3.14</opucn-trib-slots>
<opucn-trib-slots>3.15</opucn-trib-slots>
<opucn-trib-slots>3.16</opucn-trib-slots>
<opucn-trib-slots>3.17</opucn-trib-slots>
<opucn-trib-slots>3.18</opucn-trib-slots>
<opucn-trib-slots>3.19</opucn-trib-slots>
<opucn-trib-slots>3.20</opucn-trib-slots>
<opucn-trib-slots>4.1</opucn-trib-slots>
<opucn-trib-slots>4.2</opucn-trib-slots>
<opucn-trib-slots>4.3</opucn-trib-slots>
<opucn-trib-slots>4.4</opucn-trib-slots>
<opucn-trib-slots>4.5</opucn-trib-slots>
<opucn-trib-slots>4.6</opucn-trib-slots>
<opucn-trib-slots>4.7</opucn-trib-slots>
<opucn-trib-slots>4.8</opucn-trib-slots>
<opucn-trib-slots>4.9</opucn-trib-slots>
<opucn-trib-slots>4.10</opucn-trib-slots>
<opucn-trib-slots>4.11</opucn-trib-slots>
<opucn-trib-slots>4.12</opucn-trib-slots>
<opucn-trib-slots>4.13</opucn-trib-slots>
<opucn-trib-slots>4.14</opucn-trib-slots>
```

```
              <opucn-trib-slots>4.15</opucn-trib-slots>
              <opucn-trib-slots>4.16</opucn-trib-slots>
              <opucn-trib-slots>4.17</opucn-trib-slots>
              <opucn-trib-slots>4.18</opucn-trib-slots>
              <opucn-trib-slots>4.19</opucn-trib-slots>
              <opucn-trib-slots>4.20</opucn-trib-slots>
            </parent-odu-allocation>
            <opu>
              <payload-type>32</payload-type>
              <exp-payload-type>32</exp-payload-type>
            </opu>
          </odu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

- **100G:** Provision the network ODU4 interface:

```
rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>odu-Optics0/1/0/13/0/1/0/13.1</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOdu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>oduc-Optics0/1/0/13/0/1/0/13</supporting-interface-list>

          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU4</rate>

            <odu-function
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU-CTP</odu-function>

            <monitoring-mode>not-terminated</monitoring-mode>
            <parent-odu-allocation>
              <trib-port-number>1</trib-port-number>
              <opucn-trib-slots>1.1</opucn-trib-slots>
              <opucn-trib-slots>1.2</opucn-trib-slots>
              <opucn-trib-slots>1.3</opucn-trib-slots>
              <opucn-trib-slots>1.4</opucn-trib-slots>
              <opucn-trib-slots>1.5</opucn-trib-slots>
              <opucn-trib-slots>1.6</opucn-trib-slots>
              <opucn-trib-slots>1.7</opucn-trib-slots>
              <opucn-trib-slots>1.8</opucn-trib-slots>
              <opucn-trib-slots>1.9</opucn-trib-slots>
              <opucn-trib-slots>1.10</opucn-trib-slots>
              <opucn-trib-slots>1.11</opucn-trib-slots>
              <opucn-trib-slots>1.12</opucn-trib-slots>
              <opucn-trib-slots>1.13</opucn-trib-slots>
              <opucn-trib-slots>1.14</opucn-trib-slots>
              <opucn-trib-slots>1.15</opucn-trib-slots>
              <opucn-trib-slots>1.16</opucn-trib-slots>
              <opucn-trib-slots>1.17</opucn-trib-slots>
              <opucn-trib-slots>1.18</opucn-trib-slots>
              <opucn-trib-slots>1.19</opucn-trib-slots>
              <opucn-trib-slots>1.20</opucn-trib-slots>
```

```
              </parent-odu-allocation>
            </odu>
          </interface>
        </org-openroadm-device>
      </config>
    </edit-config>
  </rpc>
```

13. (Applies only to 100G TXP with OTU4 client interface) Provision the OTU4 interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
  <org-openroadm-device xmlns="http://org/openroadm/device">
   <interface>
     <name>otu-Optics0/1/0/8/0/1/0/8</name>
     <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOtu</type>
     <administrative-state>inService</administrative-state>
     <supporting-circuit-pack-name>Optics0/1/0/10</supporting-circuit-pack-name>
     <supporting-port>0/1/0/8</supporting-port>
     <otu xmlns="http://org/openroadm/otn-otu-interfaces">
    <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:OTU4</rate>

     </otu>
   </interface>
  </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

14. (Applies only to 100G TXP with OTU4 client interface) Provision the client ODU4 interface.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
  <org-openroadm-device xmlns="http://org/openroadm/device">
   <interface>
     <name>odu-Optics0/1/0/8/0/1/0/8.1</name>
     <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOdu</type>
     <administrative-state>inService</administrative-state>
     <supporting-interface-list>otu-Optics0/1/0/8/0/1/0/8</supporting-interface-list>
     <odu xmlns="http://org/openroadm/otn-odu-interfaces">
    <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU4</rate>

    <odu-function
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU-CTP</odu-function>

    <monitoring-mode>monitored</monitoring-mode>
                            <opu>
                              <payload-type>21</payload-type>
                              <exp-payload-type>21</exp-payload-type>
                            </opu>
     </odu>
   </interface>
```

```
  </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

15. (Applies to 400G TXP and 100G TXP with 100GE client interface)Provision the ethernet interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>eth-Optics0/1/0/8/0/1/0/8</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:ethernetCsmacd</type>

          <administrative-state>inService</administrative-state>
          <supporting-circuit-pack-name>Optics0/1/0/8</supporting-circuit-pack-name>
          <supporting-port>0/1/0/8</supporting-port>
          <ethernet xmlns="http://org/openroadm/ethernet-interfaces">
            <speed>400000</speed>
            <fec
xmlns:org-openroadm-common-types="http://org/openroadm/common-types">org-openroadm-common-types:rsfec</fec>

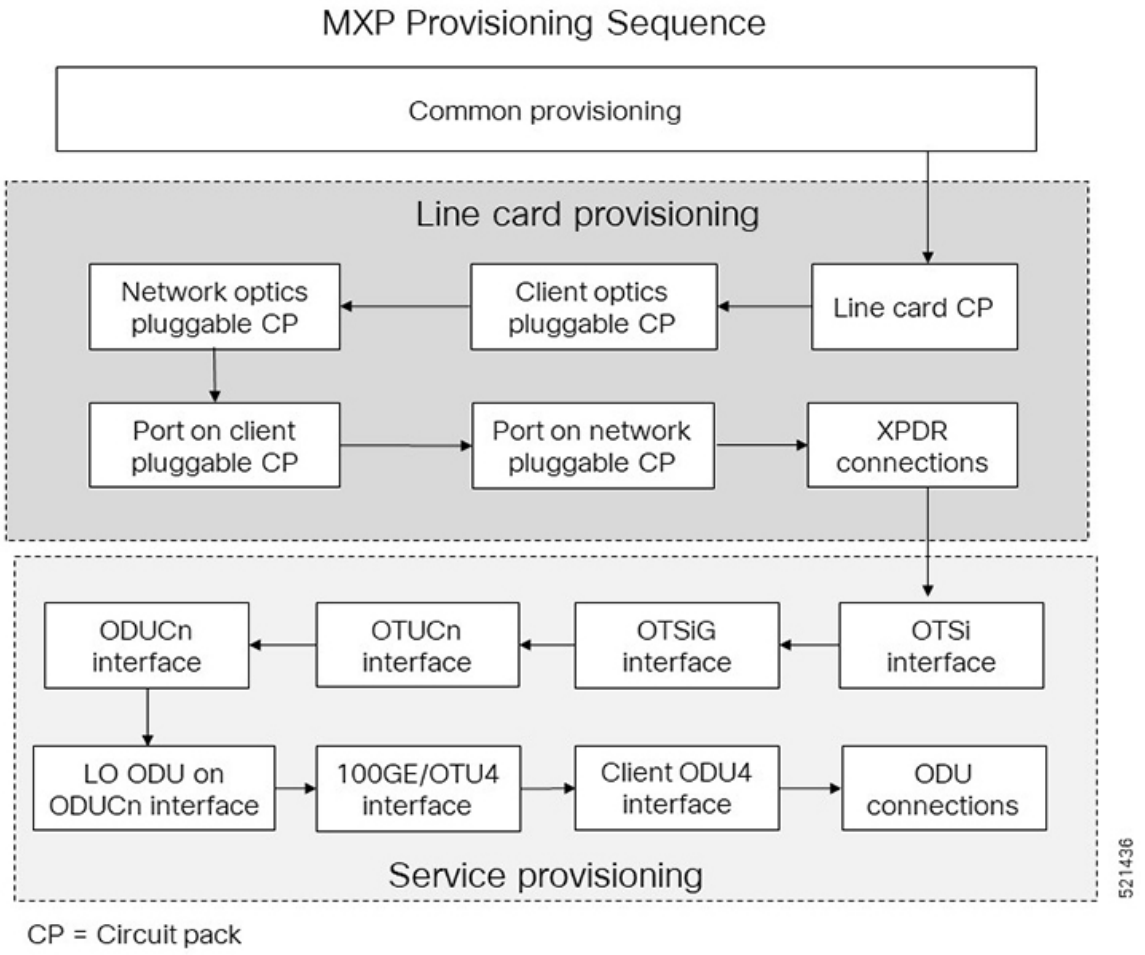
          </ethernet>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

100G Network Interfaces
Speed is 100000

MXP Configuration Workflow

The following diagram displays the MXP provisioning sequence.

Figure 3: MXP Provisioning Sequence



1. Provision the line card circuit pack:

Note Interface provisioning is rejected if the *equipmentMismatch* alarm exists on configured line card circuit pack. Ensure the configured circuit pack type matches the PID of the line card that is installed in the chassis.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>0/1</circuit-pack-name>
          <circuit-pack-type>NCS1004 OTN XPL</circuit-pack-type>
          <circuit-pack-product-code>NCS1K4-OTN-XPL=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <equipment-state>reserved-for-facility-planned</equipment-state>
          <circuit-pack-mode>TXP-MXP400</circuit-pack-mode>
```

```
          <shelf>0</shelf>
          <slot>1</slot>
          <user-description>Thisisalinecardcp</user-description>
          <due-date>2019-03-18T00:00:00+00:00</due-date>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

2. Provision the client optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/1</circuit-pack-name>
          <circuit-pack-type>QSFP28</circuit-pack-type>
          <circuit-pack-product-code>QSFP-100G-LR4-S=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <shelf>0</shelf>
          <slot>1</slot>
          <user-description>thisispluggablecp</user-description>
          <due-date>2019-05-06T00:00:00+00:00</due-date>
          <parent-circuit-pack>
            <circuit-pack-name>0/1</circuit-pack-name>
            <cp-slot-name>1</cp-slot-name>
          </parent-circuit-pack>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
          <circuit-pack-type>QSFP28</circuit-pack-type>
          <circuit-pack-product-code>QSFP-100G-LR4-S=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <shelf>0</shelf>
          <slot>1</slot>
          <user-description>thisispluggablecp</user-description>
          <due-date>2019-05-06T00:00:00+00:00</due-date>
          <parent-circuit-pack>
            <circuit-pack-name>0/1</circuit-pack-name>
            <cp-slot-name>6</cp-slot-name>
          </parent-circuit-pack>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/7</circuit-pack-name>
          <circuit-pack-type>QSFP28</circuit-pack-type>
          <circuit-pack-product-code>QSFP-100G-LR4-S=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <shelf>0</shelf>
          <slot>1</slot>
          <user-description>thisispluggablecp</user-description>
          <due-date>2019-05-06T00:00:00+00:00</due-date>
          <parent-circuit-pack>
            <circuit-pack-name>0/1</circuit-pack-name>
            <cp-slot-name>7</cp-slot-name>
          </parent-circuit-pack>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <circuit-packs>
          <circuit-pack-name>Optics0/1/0/10</circuit-pack-name>
          <circuit-pack-type>QSFP28</circuit-pack-type>
          <circuit-pack-product-code>QSFP-100G-LR4-S=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <shelf>0</shelf>
          <slot>1</slot>
          <user-description>thisispluggablecp</user-description>
          <due-date>2019-05-06T00:00:00+00:00</due-date>
          <parent-circuit-pack>
            <circuit-pack-name>0/1</circuit-pack-name>
            <cp-slot-name>10</cp-slot-name>
          </parent-circuit-pack>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

3. Provison the network optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
```

```
            <circuit-pack-type>CFP2-DCO</circuit-pack-type>
            <circuit-pack-product-code>ONS-CFP2D-400G-C=</circuit-pack-product-code>
            <lifecycle-state>deployed</lifecycle-state>
            <administrative-state>inService</administrative-state>
            <shelf>0</shelf>
            <slot>1</slot>
            <user-description>thisispluggablecp</user-description>
            <due-date>2019-05-06T00:00:00+00:00</due-date>
            <parent-circuit-pack>
              <circuit-pack-name>0/1</circuit-pack-name>
              <cp-slot-name>12</cp-slot-name>
            </parent-circuit-pack>
          </circuit-packs>
        </org-openroadm-device>
      </config>
    </edit-config>
</rpc>
```

4. Provision the port on the client optics pluggable circuit pack:

Note

- You can create up to four client port circuit-packs for every network port circuit-pack. Network port 12 is mapped to client ports 1, 6, 7, and 10 for a 400G configuration. Network port 13 is mapped to client ports 0, 4, 5, and 8 for a 400G configuration.
- For QSFP-100G-FR-S and QSFP-100G-LR-S, do not create configurations for subports, where *i* in *R/S/I/P/i* stands for subport.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <circuit-packs>
          <circuit-pack-name>Optics0/1/0/1</circuit-pack-name>
          <ports>
            <port-name>0/1/0/1</port-name>
            <port-type>QSFP28</port-type>
            <port-qual>switch-client</port-qual>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/1/1</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/1/2</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/1/3</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/1/4</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
```

```
    </config>
  </edit-config>
</rpc>

<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <circuit-packs>
          <circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
          <ports>
            <port-name>0/1/0/6</port-name>
            <port-type>QSFP28</port-type>
            <port-qual>switch-client</port-qual>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/6/1</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/6/2</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/6/3</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/6/4</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>

<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <circuit-packs>
          <circuit-pack-name>Optics0/1/0/7</circuit-pack-name>
          <ports>
            <port-name>0/1/0/7</port-name>
            <port-type>QSFP28</port-type>
            <port-qual>switch-client</port-qual>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/7/1</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/7/2</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
```

```
            <port-name>0/1/0/7/3</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/7/4</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <circuit-packs>
          <circuit-pack-name>Optics0/1/0/10</circuit-pack-name>
          <ports>
            <port-name>0/1/0/10</port-name>
            <port-type>QSFP28</port-type>
            <port-qual>switch-client</port-qual>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/10</port-name>
            <port-qual>switch-client</port-qual>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/10/1</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/10/2</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/10/3</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
          <ports>
            <port-name>0/1/0/10/4</port-name>
            <administrative-state>inService</administrative-state>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

5. Provision the port on the network optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
```

```
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
          <ports>
            <port-name>0/1/0/12</port-name>
            <port-type>CFP2-DCO</port-type>
            <port-qual>switch-network</port-qual>
            <administrative-state>inService</administrative-state>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

6. Provision the XPDR connections:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
          <xponder xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="merge">
          <xpdr-number>2</xpdr-number>
          <xpdr-type>mpdr</xpdr-type>
          <xpdr-port>
          <index>1</index>
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
          <port-name>0/1/0/12</port-name>
          </xpdr-port>
          <xpdr-port>
          <index>2</index>
          <circuit-pack-name>Optics0/1/0/10</circuit-pack-name>
          <port-name>0/1/0/10</port-name>
          </xpdr-port>
          <xpdr-port>
          <index>3</index>
          <circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
          <port-name>0/1/0/6</port-name>
          </xpdr-port>
          <xpdr-port>
          <index>4</index>
          <circuit-pack-name>Optics0/1/0/1</circuit-pack-name>
          <port-name>0/1/0/1</port-name>
          </xpdr-port>
          <xpdr-port>
          <index>5</index>
          <circuit-pack-name>Optics0/1/0/7</circuit-pack-name>
          <port-name>0/1/0/7</port-name>
          </xpdr-port>
          </xponder>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

7. Fetch operational data

   - Verify the client and trunk pluggable circuit pack details.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
```

```
<circuit-packs>
<circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
<faceplate-label/>
</circuit-packs>
<circuit-packs>
<circuit-pack-name>Optics0/1/0/10</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
<faceplate-label/>
</circuit-packs>
<circuit-packs>
<circuit-pack-name>Optics0/1/0/7</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
</circuit-packs>
<circuit-packs>
<circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
<faceplate-label/>
</circuit-packs>
<circuit-packs>
<circuit-pack-name>Optics0/1/0/1</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
```

```
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
<faceplate-label/>
</circuit-packs>
</org-openroadm-device>
</filter>
</get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:77c17e06-b7d2-4633-ae2a-3683e573554f"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <shelves>
        <shelf-name>0</shelf-name>
        <shelf-type>NCS1004 Chassis</shelf-type>
        <administrative-state>inService</administrative-state>
        <vendor>CISCO SYSTEMS, INC</vendor>
        <model>NCS1004</model>
        <serial-id>CAT2311B0BW</serial-id>
        <type>NCS1004 Chassis</type>
        <product-code>800-47655-01</product-code>
        <manufacture-date>2019-03-18T00:00:00+00:00</manufacture-date>
        <clei>WOMS400GRA</clei>
        <hardware-version>V01</hardware-version>
        <is-physical>true</is-physical>
        <is-passive>false</is-passive>
        <faceplate-label>shelf-faceplate-label</faceplate-label>
      </shelves>
      <circuit-packs>
        <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
        <circuit-pack-type>CFP2-DCO</circuit-pack-type>
        <administrative-state>inService</administrative-state>
        <vendor>CISCO-ACACIA</vendor>
        <model>ONS-CFP2D-400G-C</model>
        <serial-id>ACA2436000P</serial-id>
        <type>CFP2-DCO</type>
        <product-code>10-3500-01</product-code>
        <hardware-version>VES1</hardware-version>
       <faceplate-label>pluggable</faceplate-label>
      </circuit-packs>
             <circuit-packs>
        <circuit-pack-name>Optics0/1/0/10</circuit-pack-name>
        <circuit-pack-type>QSFP28</circuit-pack-type>
        <administrative-state>inService</administrative-state>
        <vendor>CISCO-INNOLIGHT</vendor>
        <model>QSFP-100G-LR4-S</model>
        <serial-id>INL24164478</serial-id>
        <type>QSFP28</type>
        <product-code>10-3146-02</product-code>
        <hardware-version>V02</hardware-version>
      <faceplate-label>pluggable</faceplate-label>
      </circuit-packs>
      <circuit-packs>
        <circuit-pack-name>Optics0/1/0/7</circuit-pack-name>
        <circuit-pack-type>QSFP28</circuit-pack-type>
        <administrative-state>inService</administrative-state>
        <vendor>CISCO-INNOLIGHT</vendor>
        <model>QSFP-100G-LR4-S</model>
        <serial-id>INL24164478</serial-id>
        <type>QSFP28</type>
```

```
        <product-code>10-3146-02</product-code>
        <hardware-version>V02</hardware-version>
      <faceplate-label>pluggable</faceplate-label>
       </circuit-packs>
              <circuit-packs>
        <circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
        <circuit-pack-type>QSFP28</circuit-pack-type>
        <administrative-state>inService</administrative-state>
        <vendor>CISCO-INNOLIGHT</vendor>
        <model>QSFP-100G-LR4-S</model>
        <serial-id>INL24164478</serial-id>
        <type>QSFP28</type>
        <product-code>10-3146-02</product-code>
        <hardware-version>V02</hardware-version>
       <faceplate-label>pluggable</faceplate-label>
       </circuit-packs>
            <circuit-packs>
        <circuit-pack-name>Optics0/1/0/1</circuit-pack-name>
        <circuit-pack-type>QSFP28</circuit-pack-type>
        <administrative-state>inService</administrative-state>
        <vendor>CISCO-INNOLIGHT</vendor>
        <model>QSFP-100G-LR4-S</model>
        <serial-id>INL24164478</serial-id>
        <type>QSFP28</type>
        <product-code>10-3146-02</product-code>
        <hardware-version>V02</hardware-version>
       <faceplate-label>pluggable</faceplate-label>
       </circuit-packs>
     </org-openroadm-device>
   </data>
</rpc-reply>
```

- Verify the port-capabilities.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<circuit-packs>
<ports>
<port-name>0/1/0/12</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/10</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/1</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/6</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/7</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/10</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
</circuit-packs>
</org-openroadm-device>
```

```
</filter>
</get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:34304b7e-68d2-43e2-9baa-513469edfb9b"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <circuit-packs>
        <ports>
          <port-name>0/1/0/1</port-name>
          <port-capabilities xmlns="http://org/openroadm/port-capability">
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

              <otn-capability>
                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                <muxp-profile-name>4-by-100G-muxp-oduc4-TPN-4</muxp-profile-name>

                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

              <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                <muxp-profile-name>4-by-100G-muxp-oduc4-TPN-4</muxp-profile-name>

                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
          </port-capabilities>
        </ports>
      </circuit-packs>
      <circuit-packs>
        <ports>
          <port-name>0/1/0/10</port-name>
          <port-capabilities xmlns="http://org/openroadm/port-capability">
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

              <otn-capability>
                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                <muxp-profile-name>4-by-100G-muxp-oduc4-TPN-1</muxp-profile-name>
```

```
                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

              <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                <muxp-profile-name>4-by-100G-muxp-oduc4-TPN-1</muxp-profile-name>

                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
          </port-capabilities>
        </ports>
        <ports>
          <port-name>0/1/0/10</port-name>
          <port-capabilities xmlns="http://org/openroadm/port-capability">
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

              <otn-capability>
                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                <muxp-profile-name>4-by-100G-muxp-oduc4-TPN-1</muxp-profile-name>

                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

              <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                <muxp-profile-name>4-by-100G-muxp-oduc4-TPN-1</muxp-profile-name>

                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
          </port-capabilities>
        </ports>
      </circuit-packs>
      <circuit-packs>
```

```
        <ports>
          <port-name>0/1/0/12</port-name>
          <port-capabilities xmlns="http://org/openroadm/port-capability">
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-otsi-otsigroup</if-cap-type>

<otsigroup-capability-profile-name>OtsiGroup-Network-400G</otsigroup-capability-profile-name>

              <otn-capability>
                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                </mpdr-client-restriction>
              </otn-capability>
              <logical-port>
                <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
                <port-name>0/1/0/12</port-name>
              </logical-port>
            </supported-interface-capability>
          </port-capabilities>
        </ports>
      </circuit-packs>
      <circuit-packs>
        <ports>
          <port-name>0/1/0/6</port-name>
          <port-capabilities xmlns="http://org/openroadm/port-capability">
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

              <otn-capability>
                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                <muxp-profile-name>4-by-100G-muxp-oduc4-TPN-3</muxp-profile-name>

                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

              <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                <muxp-profile-name>4-by-100G-muxp-oduc4-TPN-3</muxp-profile-name>

                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
          </port-capabilities>
```

```
        </ports>
      </circuit-packs>
      <circuit-packs>
        <ports>
          <port-name>0/1/0/7</port-name>
          <port-capabilities xmlns="http://org/openroadm/port-capability">
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-100GE-ODU4</if-cap-type>

              <otn-capability>
                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                <muxp-profile-name>4-by-100G-muxp-oduc4-TPN-2</muxp-profile-name>

                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
            <supported-interface-capability>
              <if-cap-type
xmlns:org-openroadm-port-types="http://org/openroadm/port/types">org-openroadm-port-types:if-OTU4-ODU4</if-cap-type>

              <otn-capability>

<otn-capability-profile-name>Otn-ODU4-TTP-no-protection</otn-capability-profile-name>

                <mpdr-client-restriction>

<network-ho-odu-circuit-pack-name>Optics0/1/0/12</network-ho-odu-circuit-pack-name>

                  <network-ho-odu-port-name>0/1/0/12</network-ho-odu-port-name>
                <muxp-profile-name>4-by-100G-muxp-oduc4-TPN-2</muxp-profile-name>

                </mpdr-client-restriction>
              </otn-capability>
            </supported-interface-capability>
          </port-capabilities>
        </ports>
      </circuit-packs>
    </org-openroadm-device>
  </data>
</rpc-reply>
```

Note The *otsigroup-capability-profile-name* for 200G interfaces is **OtsiGroup-Network-200G** and for 300G interfaces, it is **OtsiGroup-Network-300G**.

In the configuration steps below, the names assigned to the interfaces follow the naming conventions defined in the table below:

Interface	Naming Convention
OTSi	otsi-<pluggable-cp-name>/<pluggable-port-name>
OTSiG	otsig-<pluggable-cp-name>/<pluggable-port-name>

Interface	Naming Convention
OTUCn	otuc-<pluggable-cp-name>/<pluggable-port-name>
ODUCn	oduc-<pluggable-cp-name>/<pluggable-port-name>
LO ODU	odu-<pluggable-cp-name>/<pluggable-port-name>.<tpn>
Ethernet/ OTU4	eth-<pluggable-cp-name>/<pluggable-port-name> otu-<pluggable-cp-name>/<pluggable-port-name>
Client ODU	odu-<pluggable-cp-name>/<pluggable-port-name>.<tpn>
ODU connections	A unique name is assigned.

8. Provision the OTSi interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>otsi-Optics0/1/0/12/0/1/0/12</name>
          <administrative-state>inService</administrative-state>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi</type>
          <supporting-circuit-pack-name>Optics0/1/0/12</supporting-circuit-pack-name>
          <supporting-port>0/1/0/12</supporting-port>
         <otsi xmlns="http://org/openroadm/optical-channel-tributary-signal-interfaces">

            <provision-mode>explicit</provision-mode>
            <frequency>193.10</frequency>
            <modulation-format>dp-qam16</modulation-format>
             <transmit-power>0</transmit-power>
               <fec
xmlns:org-openroadm-common-types="http://org/openroadm/common-types">org-openroadm-common-types:ofec</fec>

            <otsi-rate
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">

          org-openroadm-common-optical-channel-types:R400G-otsi</otsi-rate>
            <flexo>
              <foic-type
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">

               org-openroadm-common-optical-channel-types:foic4.8</foic-type>
              <iid>1</iid>
              <iid>2</iid>
              <iid>3</iid>
              <iid>4</iid>
            </flexo>
          </otsi>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

Note The IID attributes must be added in ascending order. Else the configuration is rejected.

Note To create the OTSi interface for a bookended configuration (Cisco transponders installed in the near-end and far-end node), use the following RPC :

```
rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<edit-config>
<target>
<running/>
</target>
<config>
<org-openroadm-device xmlns="http://org/openroadm/device">
<interface>
<name>otsi-Optics0/1/0/13/0/1/0/13</name>
<administrative-state>inService</administrative-state>
<type xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi</type>
<supporting-circuit-pack-name>Optics0/1/0/13</supporting-circuit-pack-name>
<supporting-port>0/1/0/13</supporting-port>
<otsi xmlns="http://org/openroadm/optical-channel-tributary-signal-interfaces">
<provision-mode>profile</provision-mode>
<frequency>193.10</frequency>
<transmit-power>0</transmit-power>
<optical-operational-mode>ORBKD-W-400G-10001</optical-operational-mode>
<flexo>
<foic-type
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">org-openroadm-common-optical-channel-types:foic4.8</foic-type>
<iid>1</iid>
<iid>2</iid>
<iid>3</iid>
<iid>4</iid>
</flexo>
</otsi>
</interface>
</org-openroadm-device>
</config>
</edit-config>
</rpc>
```

The trunk rate is 400G.

200G Network Interfaces	300G Network Interfaces
Modulation format is dp-qpsk In Release 7.5.2, dp-qam16 is also supported.	Modulation format is dp-qam8
OTSi rate is R200G-otsi	OTSi rate is R300G-otsi
For dp-qpsk, the FOIC type is foic2.4 where 2 indicates the number of FlexO frames and 4 indicates the number of electrical lanes being used. For dp-qam16, the FOIC type is foic2.8.	FOIC type is foic3.6 where 3 indicates the number of FlexO frames and 6 indicates the number of electrical lanes being used.
The number of IID attributes provisioned is two.	The number of IID attributes provisioned is three.

9. Provision the OTSiG interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>otsig-Optics0/1/0/12/0/1/0/12</name>
          <administrative-state>inService</administrative-state>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi-group</type>

<supporting-interface-list>otsi-Optics0/1/0/12/0/1/0/12</supporting-interface-list>
          <otsi-group xmlns="http://org/openroadm/otsi-group-interfaces">
          <group-rate
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/

common-optical-channel-types">org-openroadm-common-optical-channel-types:R400G-otsi</group-rate>

          <group-id>1</group-id>
          </otsi-group>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

200G Network Interfaces	300G Network Interfaces
OTSi rate is R200G-otsi	OTSi rate is R300G-otsi

10. Provision the OTUCn interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>otuc-Optics0/1/0/12/0/1/0/12</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOtu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>otsig-Optics0/1/0/12/0/1/0/12</supporting-interface-list>
          <otu xmlns="http://org/openroadm/otn-otu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:OTUCn</rate>

            <otucn-n-rate>4</otucn-n-rate>
          </otu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

200G Network Interfaces	300G Network Interfaces
OTUCn rate is 2	OTUCn rate is 3

11. Provision the ODUCn interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>oduc-Optics0/1/0/12/0/1/0/12</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOdu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>otuc-Optics0/1/0/12/0/1/0/12</supporting-interface-list>
          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODUCn</rate>

            <oducn-n-rate>4</oducn-n-rate>
            <odu-function
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU-TTP</odu-function>

            <monitoring-mode>terminated</monitoring-mode>
            <opu>
              <payload-type>22</payload-type>
              <exp-payload-type>22</exp-payload-type>
            </opu>
          </odu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

200G Network Interfaces	300G Network Interfaces
ODUCn rate is 2	ODUCn rate is 3

12. Provision the LO-ODU interfaces. A total of four ODU4 interfaces are created in an ODUCn interface, each with 20 tributary slots. The example below, describes the creation of one ODU4 interface. Create the remaining three ODU4 interfaces as needed by referring to the TPN values in OTN-XPL Line Card, on page 4.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>odu-Optics0/1/0/12/0/1/0/12.1</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOdu</type>
          <administrative-state>inService</administrative-state>
```

```
<supporting-interface-list>oduc-Optics0/1/0/12/0/1/0/12</supporting-interface-list>
          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU4</rate>

            <odu-function
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU-CTP</odu-function>

            <monitoring-mode>monitored</monitoring-mode>
            <parent-odu-allocation>
              <trib-port-number>1</trib-port-number>
              <opucn-trib-slots>1.1</opucn-trib-slots>
              <opucn-trib-slots>1.2</opucn-trib-slots>
              <opucn-trib-slots>1.3</opucn-trib-slots>
              <opucn-trib-slots>1.4</opucn-trib-slots>
              <opucn-trib-slots>1.5</opucn-trib-slots>
              <opucn-trib-slots>1.6</opucn-trib-slots>
              <opucn-trib-slots>1.7</opucn-trib-slots>
              <opucn-trib-slots>1.8</opucn-trib-slots>
              <opucn-trib-slots>1.9</opucn-trib-slots>
              <opucn-trib-slots>1.10</opucn-trib-slots>
              <opucn-trib-slots>1.11</opucn-trib-slots>
              <opucn-trib-slots>1.12</opucn-trib-slots>
              <opucn-trib-slots>1.13</opucn-trib-slots>
              <opucn-trib-slots>1.14</opucn-trib-slots>
              <opucn-trib-slots>1.15</opucn-trib-slots>
              <opucn-trib-slots>1.16</opucn-trib-slots>
              <opucn-trib-slots>1.17</opucn-trib-slots>
              <opucn-trib-slots>1.18</opucn-trib-slots>
              <opucn-trib-slots>1.19</opucn-trib-slots>
              <opucn-trib-slots>1.20</opucn-trib-slots>
            </parent-odu-allocation>
          </odu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

13. Provision the 100GE or OTU4 interface:

- **100GE:**

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface>
          <name>eth-Optics0/1/0/10/0/1/0/10</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:ethernetCsmacd</type>

          <administrative-state>inService</administrative-state>

<supporting-circuit-pack-name>Optics0/1/0/10</supporting-circuit-pack-name>
          <supporting-port>0/1/0/10</supporting-port>
          <ethernet xmlns="http://org/openroadm/ethernet-interfaces">
            <speed>100000</speed>
            <fec
xmlns:org-openroadm-common-types="http://org/openroadm/common-types">org-openroadm-common-types:off</fec>
```

```
          </ethernet>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

- **OTU4:**

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
  <org-openroadm-device xmlns="http://org/openroadm/device">
   <interface>
     <name>otu-Optics0/1/0/10/0/1/0/10</name>
     <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOtu</type>
     <administrative-state>inService</administrative-state>
     <supporting-circuit-pack-name>Optics0/1/0/10</supporting-circuit-pack-name>
     <supporting-port>0/1/0/10</supporting-port>
     <otu xmlns="http://org/openroadm/otn-otu-interfaces">
    <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:OTU4</rate>

     </otu>
   </interface>
  </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

Note Repeat this step for other client ports (7, 6, and 1) as required for a 400G configuration.

14. Provision the client ODU4 interface.

- **100GE client:**

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>odu-Optics0/1/0/10/0/1/0/10.1</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOdu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>eth-Optics0/1/0/10/0/1/0/10</supporting-interface-list>

          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU4</rate>

            <odu-function
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU-TTP-CTP</odu-function>
```

```
            <monitoring-mode>terminated</monitoring-mode>
            <opu>
              <payload-type>07</payload-type>
              <exp-payload-type>07</exp-payload-type>
            </opu>
          </odu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

- **OTU4 client:**

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
  <org-openroadm-device xmlns="http://org/openroadm/device">
   <interface>
     <name>odu-Optics0/1/0/10/0/1/0/10.1</name>
     <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOdu</type>
     <administrative-state>inService</administrative-state>

<supporting-interface-list>otu-Optics0/1/0/10/0/1/0/10</supporting-interface-list>

     <odu xmlns="http://org/openroadm/otn-odu-interfaces">
    <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU4</rate>

    <odu-function
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU-CTP</odu-function>

    <monitoring-mode>monitored</monitoring-mode>
     </odu>
   </interface>
  </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

Note Repeat this step for other client ports (7, 6, and 1) as required for a 400G configuration.

15. Create ODU connections between the client side ODU4 ports and the network side LO ODU ports. The ODU connections must be configured for the traffic to run on the node. The tributary port numbers must match on both the client and network side while configuring the ODU connnections.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <odu-connection>
          <connection-name>4</connection-name>
```

```
            <direction>bidirectional</direction>
            <source>
            <src-if>odu-Optics0/1/0/10/0/1/0/10.1</src-if>
            </source>
            <destination>
            <dst-if>odu-Optics0/1/0/12/0/1/0/12.1</dst-if>
            </destination>
          </odu-connection>
        </org-openroadm-device>
      </config>
    </edit-config>
  </rpc>
```

Note Repeat this step for other client ports (7, 6, and 1) as required for a 400G configuration.

16. Fetch operational data:

- Verify the ODU switching pool. Switching pools describe the connectivity associated within the ODU layer by providing the ODU connectivity between external ports of the muxponder. Network port 12 is mapped to a pool of client ports, that is ports 1, 6, 7, and 10 for a 400G configuration. Network port 13 is mapped to a pool of client ports, that is ports 0, 4, 5, and 8 for a 400G configuration.

Note The ODU switching pool is published only after the OTSiGroup is created.

```
rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <odu-switching-pools/>
      </org-openroadm-device>
    </filter>
  </get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:56e03858-664b-4ce3-b9d6-ca6cb22efc16"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <odu-switching-pools>
        <switching-pool-number>112</switching-pool-number>
        <switching-pool-type>blocking</switching-pool-type>

<odu-connection-direction-capabilities>connection-direction_bi</odu-connection-direction-capabilities>

        <non-blocking-list>
          <nbl-number>1</nbl-number>
          <interconnect-bandwidth-unit>1000000000</interconnect-bandwidth-unit>
          <interconnect-bandwidth>0</interconnect-bandwidth>
          <port-list>
            <circuit-pack-name>Optics0/1/0/1</circuit-pack-name>
            <port-name>0/1/0/1</port-name>
          </port-list>
          <port-list>
            <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
```

```
        <port-name>0/1/0/12</port-name>
      </port-list>
      <pluggable-optics-holder-list>
        <circuit-pack-name>0/1</circuit-pack-name>
        <slot-name>1</slot-name>
      </pluggable-optics-holder-list>
    </non-blocking-list>
    <non-blocking-list>
      <nbl-number>6</nbl-number>
      <interconnect-bandwidth-unit>1000000000</interconnect-bandwidth-unit>

      <interconnect-bandwidth>0</interconnect-bandwidth>
      <port-list>
        <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
        <port-name>0/1/0/12</port-name>
      </port-list>
      <port-list>
        <circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
        <port-name>0/1/0/6</port-name>
      </port-list>
      <pluggable-optics-holder-list>
        <circuit-pack-name>0/1</circuit-pack-name>
        <slot-name>6</slot-name>
      </pluggable-optics-holder-list>
    </non-blocking-list>
    <non-blocking-list>
      <nbl-number>7</nbl-number>
      <interconnect-bandwidth-unit>1000000000</interconnect-bandwidth-unit>

      <interconnect-bandwidth>0</interconnect-bandwidth>
      <port-list>
        <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
        <port-name>0/1/0/12</port-name>
      </port-list>
      <port-list>
        <circuit-pack-name>Optics0/1/0/7</circuit-pack-name>
        <port-name>0/1/0/7</port-name>
      </port-list>
      <pluggable-optics-holder-list>
        <circuit-pack-name>0/1</circuit-pack-name>
        <slot-name>7</slot-name>
      </pluggable-optics-holder-list>
    </non-blocking-list>
    <non-blocking-list>
      <nbl-number>10</nbl-number>
     <interconnect-bandwidth-unit>1000000000</interconnect-bandwidth-unit>

      <interconnect-bandwidth>0</interconnect-bandwidth>
      <port-list>
        <circuit-pack-name>Optics0/1/0/10</circuit-pack-name>
        <port-name>0/1/0/10</port-name>
      </port-list>
      <port-list>
        <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
        <port-name>0/1/0/12</port-name>
      </port-list>
      <pluggable-optics-holder-list>
        <circuit-pack-name>0/1</circuit-pack-name>
        <slot-name>10</slot-name>
      </pluggable-optics-holder-list>
    </non-blocking-list>
  </odu-switching-pools>
</org-openroadm-device>
```

```
  </data>
</rpc-reply>
```

- Verify the ODU Multi Structure Identifier (MSI). You can fetch MSI values on ODUCn interfaces. There are three types of MSI:



Note The RPC responses displayed below have all the client ports configured.

  - TX-MSI: These are TPN and time slot values that are transmitted to the far-end node.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<interface>
<name>oduc-Optics0/1/0/12/0/1/0/12</name>
<odu xmlns="http://org/openroadm/otn-odu-interfaces">
<opu>
<opucn-msi>
<tx-msi/>
</opucn-msi>
</opu>
</odu>
</interface>
</org-openroadm-device>
</filter>
</get>
</rpc>


<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:5728981d-4982-4e73-83f0-cb38e22f99dc"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface>
        <name>oduc-Optics0/1/0/12/0/1/0/12</name>
        <odu xmlns="http://org/openroadm/otn-odu-interfaces">
          <opu>
            <opucn-msi>
              <tx-msi>
                <opucn-trib-slot>1.1</opucn-trib-slot>
                <availability>true</availability>
                <occupation>true</occupation>
                <trib-port>1</trib-port>
              </tx-msi>
              <tx-msi>
                <opucn-trib-slot>1.2</opucn-trib-slot>
                <availability>true</availability>
                <occupation>true</occupation>
                <trib-port>1</trib-port>
              </tx-msi>
              .
              .
              snipped
              .
              .
              <tx-msi>
                <opucn-trib-slot>4.19</opucn-trib-slot>
                <availability>true</availability>
```

```
                <occupation>true</occupation>
                <trib-port>4</trib-port>
              </tx-msi>
              <tx-msi>
                <opucn-trib-slot>4.20</opucn-trib-slot>
                <availability>true</availability>
                <occupation>true</occupation>
                <trib-port>4</trib-port>
              </tx-msi>
            </opucn-msi>
          </opu>
        </odu>
      </interface>
    </org-openroadm-device>
  </data>
</rpc-reply>
```

- RX MSI: These are TPN and time slot values that are received from the far-end node.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<interface>
<name>oduc-Optics0/1/0/12/0/1/0/12</name>
<odu xmlns="http://org/openroadm/otn-odu-interfaces">
<opu>
<opucn-msi>
<rx-msi/>
</opucn-msi>
</opu>
</odu>
</interface>
</org-openroadm-device>
</filter>
</get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:0df876fb-3c65-472c-a7af-bec21b762a8f"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface>
        <name>oduc-Optics0/1/0/12/0/1/0/12</name>
        <odu xmlns="http://org/openroadm/otn-odu-interfaces">
          <opu>
            <opucn-msi>
              <rx-msi>
                <opucn-trib-slot>1.1</opucn-trib-slot>
                <availability>true</availability>
                <occupation>true</occupation>
                <trib-port>1</trib-port>
              </rx-msi>
              <rx-msi>
                <opucn-trib-slot>1.2</opucn-trib-slot>
                <availability>true</availability>
                <occupation>true</occupation>
                <trib-port>1</trib-port>
              </rx-msi>
              .
              .
              snipped
```

```
                .
                .
                <rx-msi>
                  <opucn-trib-slot>4.19</opucn-trib-slot>
                  <availability>true</availability>
                  <occupation>false</occupation>
                </rx-msi>
                <rx-msi>
                  <opucn-trib-slot>4.20</opucn-trib-slot>
                  <availability>true</availability>
                  <occupation>false</occupation>
                </rx-msi>
              </opucn-msi>
            </opu>
          </odu>
        </interface>
      </org-openroadm-device>
    </data>
</rpc-reply>
```

- Expected MSI: These are TPN and time slot values that are expected from the far-end node.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<interface>
<name>oduc-Optics0/1/0/12/0/1/0/12</name>
<odu xmlns="http://org/openroadm/otn-odu-interfaces">
<opu>
<opucn-msi>
<exp-msi/>
</opucn-msi>
</opu>
</odu>
</interface>
</org-openroadm-device>
</filter>
</get>
</rpc>
```

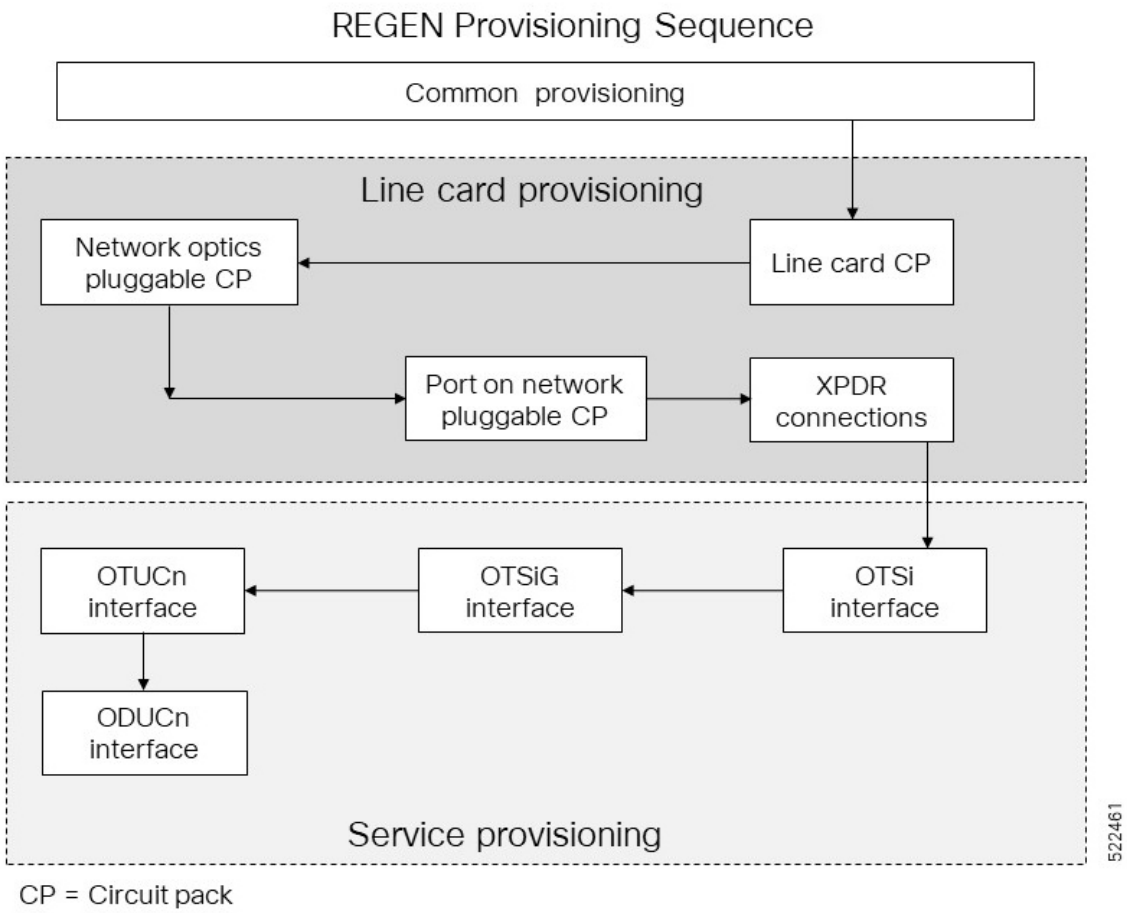
```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:58a5e516-2fad-4d3d-aa88-27ce1f616383"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface>
        <name>oduc-Optics0/1/0/12/0/1/0/12</name>
        <odu xmlns="http://org/openroadm/otn-odu-interfaces">
          <opu>
            <opucn-msi>
              <exp-msi>
                <opucn-trib-slot>1.1</opucn-trib-slot>
                <availability>true</availability>
                <occupation>true</occupation>
                <trib-port>1</trib-port>
              </exp-msi>
              <exp-msi>
                <opucn-trib-slot>1.2</opucn-trib-slot>
                <availability>true</availability>
                <occupation>true</occupation>
                <trib-port>1</trib-port>
              </exp-msi>
              .
```

```
                .
                snipped
                .
                .
                <exp-msi>
                  <opucn-trib-slot>4.19</opucn-trib-slot>
                  <availability>true</availability>
                  <occupation>true</occupation>
                  <trib-port>4</trib-port>
                </exp-msi>
                <exp-msi>
                  <opucn-trib-slot>4.20</opucn-trib-slot>
                  <availability>true</availability>
                  <occupation>true</occupation>
                  <trib-port>4</trib-port>
                </exp-msi>
              </opucn-msi>
            </opu>
          </odu>
        </interface>
      </org-openroadm-device>
    </data>
</rpc-reply>
```

REGEN Configuration Workflow

The following diagram displays the REGEN provisioning sequence.

Figure 4: REGEN Provisioning Sequence



1. Provision the line card circuit pack:

Note Interface provisioning is rejected if the *equipmentMismatch* alarm exists on configured line card circuit pack. Ensure the configured circuit pack type matches the PID of the line card that is installed in the chassis.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
     <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>0/1</circuit-pack-name>
          <circuit-pack-type>NCS1004 OTN XPL</circuit-pack-type>
          <circuit-pack-product-code>NCS1K4-OTN-XPL=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <equipment-state>reserved-for-facility-planned</equipment-state>
          <circuit-pack-mode>REGEN</circuit-pack-mode>
          <shelf>0</shelf>
```

```
          <slot>1</slot>
          <user-description>Thisisalinecardcp</user-description>
          <due-date>2019-03-18T00:00:00+00:00</due-date>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

2. Provison the network optics pluggable circuit pack for port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
          <circuit-pack-type>CFP2-DCO</circuit-pack-type>
          <circuit-pack-product-code>ONS-CFP2D-400G-C=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <shelf>0</shelf>
          <slot>1</slot>
          <user-description>thisispluggablecp</user-description>
          <due-date>2019-05-06T00:00:00+00:00</due-date>
          <parent-circuit-pack>
            <circuit-pack-name>0/1</circuit-pack-name>
            <cp-slot-name>12</cp-slot-name>
          </parent-circuit-pack>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

3. Provision the port on the network optics pluggable circuit pack for port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
          <ports>
            <port-name>0/1/0/12</port-name>
            <port-type>CFP2-DCO</port-type>
            <port-qual>xpdr-network</port-qual>
            <administrative-state>inService</administrative-state>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

4. Provison the network optics pluggable circuit pack for port 13:

```
rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <circuit-pack-type>CFP2-DCO</circuit-pack-type>
          <circuit-pack-product-code>ONS-CFP2D-400G-C=</circuit-pack-product-code>
          <lifecycle-state>deployed</lifecycle-state>
          <administrative-state>inService</administrative-state>
          <shelf>0</shelf>
          <slot>1</slot>
          <user-description>thisispluggablecp</user-description>
          <due-date>2019-05-06T00:00:00+00:00</due-date>
          <parent-circuit-pack>
            <circuit-pack-name>0/1</circuit-pack-name>
            <cp-slot-name>13</cp-slot-name>
          </parent-circuit-pack>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

5. Provision the port on the network optics pluggable circuit pack for port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <ports>
            <port-name>0/1/0/13</port-name>
            <port-type>CFP2-DCO</port-type>
            <port-qual>xpdr-network</port-qual>
            <administrative-state>inService</administrative-state>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

6. Provision the XPDR connections:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
          <xponder xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="merge">
          <xpdr-number>1</xpdr-number>
          <xpdr-type>regen</xpdr-type>
```

```
          <xpdr-port>
          <index>1</index>
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
          <port-name>0/1/0/12</port-name>
          </xpdr-port>
          <xpdr-port>
          <index>1</index>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <port-name>0/1/0/13</port-name>
          </xpdr-port>
          </xponder>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

7. Fetch operational data

   - Verify connection-map capabilities.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<connection-map/>
</org-openroadm-device>
</filter>
</get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:6ab9cfd7-fd02-4419-9ada-c03955dd6117"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <connection-map>
        <connection-map-number>12130</connection-map-number>
        <source>
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
          <port-name>0/1/0/12</port-name>
        </source>
        <destination>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <port-name>0/1/0/13</port-name>
        </destination>
      </connection-map>
      <connection-map>
        <connection-map-number>13120</connection-map-number>
        <source>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <port-name>0/1/0/13</port-name>
        </source>
        <destination>
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
          <port-name>0/1/0/12</port-name>
        </destination>
      </connection-map>
    </org-openroadm-device>
  </data>
</rpc-reply>
```

   - Verify trunk pluggable circuit pack details.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">

<circuit-packs>
<circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
<faceplate-label/>
</circuit-packs>
<circuit-packs>
<circuit-pack-name>Optics0/1/0/10</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
<faceplate-label/>
</circuit-packs>
<circuit-packs>
<circuit-pack-name>Optics0/1/0/7</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
</circuit-packs>
<circuit-packs>
<circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
<faceplate-label/>
</circuit-packs>
<circuit-packs>
<circuit-pack-name>Optics0/1/0/1</circuit-pack-name>
<circuit-pack-type/>
<administrative-state/>
```

```
<vendor/>
<model/>
<serial-id/>
<type/>
<product-code/>
<manufacture-date/>
<clei/>
<hardware-version/>
<faceplate-label/>
</circuit-packs>
</org-openroadm-device>
</filter>
</get>
</rpc>
```

- Verify the port-capabilities.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<get>
<filter>
<org-openroadm-device xmlns="http://org/openroadm/device">
<circuit-packs>
<ports>
<port-name>0/1/0/12</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/10</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/1</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/6</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/7</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
<ports>
<port-name>0/1/0/10</port-name>
<port-capabilities xmlns="http://org/openroadm/port-capability"/>
</ports>
</circuit-packs>
</org-openroadm-device>
</filter>
</get>
</rpc>
```

In the configuration steps below, the names assigned to the interfaces follow the naming conventions defined in the table below:

Interface	Naming Convention
OTSi	otsi-<pluggable-cp-name>/<pluggable-port-name>
OTSiG	otsig-<pluggable-cp-name>/<pluggable-port-name>
OTUCn	otuc-<pluggable-cp-name>/<pluggable-port-name>

Interface	Naming Convention
ODUCn	oduc-<pluggable-cp-name>/<pluggable-port-name>

8. Provision the OTSi interface for port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>otsi-Optics0/1/0/12/0/1/0/12</name>
          <administrative-state>inService</administrative-state>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi</type>
          <supporting-circuit-pack-name>Optics0/1/0/12</supporting-circuit-pack-name>
          <supporting-port>0/1/0/12</supporting-port>
         <otsi xmlns="http://org/openroadm/optical-channel-tributary-signal-interfaces">

            <provision-mode>explicit</provision-mode>
            <frequency>193.10</frequency>
            <modulation-format>dp-qam16</modulation-format>
             <transmit-power>0</transmit-power>
             <fec
xmlns:org-openroadm-common-types="http://org/openroadm/common-types">org-openroadm-common-types:ofec</fec>

            <otsi-rate
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm

/common-optical-channel-types">org-openroadm-common-optical-channel-types:R400G-otsi</otsi-rate>

            <flexo>
              <foic-type
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">

               org-openroadm-common-optical-channel-types:foic4.8</foic-type>
              <iid>1</iid>
              <iid>2</iid>
              <iid>3</iid>
              <iid>4</iid>
            </flexo>
          </otsi>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

Note The IID attributes must be added in ascending order. Else the configuration is rejected.

200G Network Interfaces	400G Network Interfaces
Modulation format is dp-qpsk In Release 7.5.2, dp-qam16 is also supported.	Modulation format is dp-qam16

200G Network Interfaces	400G Network Interfaces
OTSi rate is R200G-otsi	OTSi rate is R400G-otsi
For dp-qpsk, the FOIC type is foic2.4 where 2 indicates the number of FlexO frames and 4 indicates the number of electrical lanes being used. For dp-qam16, the FOIC type is foic2.8.	FOIC type is foic4.8 where 4 indicates the number of FlexO frames and 8 indicates the number of electrical lanes being used.
The number of IID attributes provisioned is two.	The number of IID attributes provisioned is four.



Note To create the OTSi interface for a bookended configuration (Cisco transponders installed in the near-end and far-end node), use the following RPC :

```
rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<edit-config>
<target>
<running/>
</target>
<config>
<org-openroadm-device xmlns="http://org/openroadm/device">
<interface>
<name>otsi-Optics0/1/0/12/0/1/0/12</name>
<administrative-state>inService</administrative-state>
<type xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi</type>
<supporting-circuit-pack-name>Optics0/1/0/12</supporting-circuit-pack-name>
<supporting-port>0/1/0/13</supporting-port>
<otsi xmlns="http://org/openroadm/optical-channel-tributary-signal-interfaces">
<provision-mode>profile</provision-mode>
<frequency>193.10</frequency>
<transmit-power>0</transmit-power>
<optical-operational-mode>ORBKD-W-400G-10001</optical-operational-mode>
<flexo>
<foic-type
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">org-openroadm-common-optical-channel-types:foic4.8</foic-type>
<iid>1</iid>
<iid>2</iid>
<iid>3</iid>
<iid>4</iid>
</flexo>
</otsi>
</interface>
</org-openroadm-device>
</config>
</edit-config>
</rpc>
```

The trunk rate is 400G.

9. Provision the OTSiG interface for port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
```

```
          <name>otsig-Optics0/1/0/12/0/1/0/12</name>
          <administrative-state>inService</administrative-state>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi-group</type>

<supporting-interface-list>otsi-Optics0/1/0/12/0/1/0/12</supporting-interface-list>
          <otsi-group xmlns="http://org/openroadm/otsi-group-interfaces">
          <group-rate
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm

/common-optical-channel-types">org-openroadm-common-optical-channel-types:R400G-otsi</group-rate>

          <group-id>10</group-id>
          </otsi-group>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

200G Network Interfaces	400G Network Interfaces
OTSi rate is R200G-otsi	OTSi rate is R400G-otsi

10. Provision the OTUCn interface for port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>otuc-Optics0/1/0/12/0/1/0/12</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOtu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>otsig-Optics0/1/0/12/0/1/0/12</supporting-interface-list>
          <otu xmlns="http://org/openroadm/otn-otu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:OTUCn</rate>

            <otucn-n-rate>4</otucn-n-rate>
          </otu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

200G Network Interfaces	400G Network Interfaces
OTUCn rate is 2	OTUCn rate is 4

11. Provision the ODUCn interface for port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
```

```
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>oduc-Optics0/1/0/12/0/1/0/12</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOdu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>otuc-Optics0/1/0/12/0/1/0/12</supporting-interface-list>
          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODUCn</rate>

            <oducn-n-rate>4</oducn-n-rate>
            <odu-function
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU-TTP</odu-function>

            <monitoring-mode>terminated</monitoring-mode>
            <opu>
              <payload-type>22</payload-type>
              <exp-payload-type>22</exp-payload-type>
            </opu>
          </odu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

200G Network Interfaces	400G Network Interfaces
ODUCn rate is 2	ODUCn rate is 4

12. Provision the OTSi interface for port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>otsi-Optics0/1/0/13/0/1/0/13</name>
          <administrative-state>inService</administrative-state>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi</type>
          <supporting-circuit-pack-name>Optics0/1/0/13</supporting-circuit-pack-name>
          <supporting-port>0/1/0/13</supporting-port>
         <otsi xmlns="http://org/openroadm/optical-channel-tributary-signal-interfaces">

            <provision-mode>explicit</provision-mode>
            <frequency>193.10</frequency>
            <modulation-format>dp-qam16</modulation-format>
             <transmit-power>0</transmit-power>
             <fec
xmlns:org-openroadm-common-types="http://org/openroadm/common-types">org-openroadm-common-types:ofec</fec>

            <otsi-rate
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/
```

```
common-optical-channel-types">org-openroadm-common-optical-channel-types:R400G-otsi</otsi-rate>

            <flexo>
              <foic-type
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">org-openroadm-common-optical-channel-types:foic4.8</foic-type>

              <iid>1</iid>
              <iid>2</iid>
              <iid>3</iid>
              <iid>4</iid>
            </flexo>
          </otsi>
        </interface>
    </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

Note The IID attributes must be added in ascending order. Else the configuration is rejected.

200G Network Interfaces	400G Network Interfaces
Modulation format is dp-qpsk In Release 7.5.2, dp-qam16 is also supported.	Modulation format is dp-qam16
OTSi rate is R200G-otsi	OTSi rate is R400G-otsi
For dp-qpsk, the FOIC type is foic2.4 where 2 indicates the number of FlexO frames and 4 indicates the number of electrical lanes being used. For dp-qam16, the FOIC type is foic2.8.	FOIC type is foic4.8 where 4 indicates the number of FlexO frames and 8 indicates the number of electrical lanes being used.
The number of IID attributes provisioned is two.	The number of IID attributes provisioned is four.

Note To create the OTSi interface for a bookended configuration (Cisco transponders installed in the near-end and far-end node), use the following RPC :

```
rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<edit-config>
<target>
<running/>
</target>
<config>
<org-openroadm-device xmlns="http://org/openroadm/device">
<interface>
<name>otsi-Optics0/1/0/13/0/1/0/13</name>
<administrative-state>inService</administrative-state>
<type xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi</type>
<supporting-circuit-pack-name>Optics0/1/0/13</supporting-circuit-pack-name>
<supporting-port>0/1/0/13</supporting-port>
<otsi xmlns="http://org/openroadm/optical-channel-tributary-signal-interfaces">
<provision-mode>profile</provision-mode>
<frequency>193.10</frequency>
<transmit-power>0</transmit-power>
<optical-operational-mode>ORBKD-W-400G-10001</optical-operational-mode>
<flexo>
<foic-type
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">org-openroadm-common-optical-channel-types:foic4.8</foic-type>
<iid>1</iid>
<iid>2</iid>
<iid>3</iid>
<iid>4</iid>
</flexo>
</otsi>
</interface>
</org-openroadm-device>
</config>
</edit-config>
</rpc>
```

The trunk rate is 400G.

13. Provision the OTSiG interface for port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface>
      <name>otsig-Optics0/1/0/13/0/1/0/13</name>
      <administrative-state>inService</administrative-state>
      <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otsi-group</type>
     <supporting-interface-list>otsi-Optics0/1/0/13/0/1/0/13</supporting-interface-list>

      <otsi-group xmlns="http://org/openroadm/otsi-group-interfaces">
      <group-rate
xmlns:org-openroadm-common-optical-channel-types="http://org/openroadm/common-optical-channel-types">

       org-openroadm-common-optical-channel-types:R400G-otsi</group-rate>
      <group-id>1</group-id>
      </otsi-group>
```

```
      </interface>
    </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

200G Network Interfaces	400G Network Interfaces
OTSi rate is R200G-otsi	OTSi rate is R400G-otsi

14. Provision the OTUCn interface for port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>otuc-Optics0/1/0/13/0/1/0/13</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOtu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>otsig-Optics0/1/0/13/0/1/0/13</supporting-interface-list>
          <otu xmlns="http://org/openroadm/otn-otu-interfaces">
            <rate
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:OTUCn</rate>

            <otucn-n-rate>4</otucn-n-rate>
          </otu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

200G Network Interfaces	400G Network Interfaces
OTUCn rate is 2	OTUCn rate is 4

15. Provision the ODUCn interface for port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>oduc-Optics0/1/0/13/0/1/0/13</name>
          <type
xmlns:openROADM-if="http://org/openroadm/interfaces">openROADM-if:otnOdu</type>
          <administrative-state>inService</administrative-state>

<supporting-interface-list>otuc-Optics0/1/0/13/0/1/0/13</supporting-interface-list>
          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <rate
```

```
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODUCn</rate>

            <oducn-n-rate>4</oducn-n-rate>
            <odu-function
xmlns:org-openroadm-otn-common-types="http://org/openroadm/otn-common-types">org-openroadm-otn-common-types:ODU-TTP</odu-function>

            <monitoring-mode>terminated</monitoring-mode>
            <opu>
              <payload-type>22</payload-type>
              <exp-payload-type>22</exp-payload-type>
            </opu>
          </odu>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

200G Network Interfaces	400G Network Interfaces
ODUCn rate is 2	ODUCn rate is 4

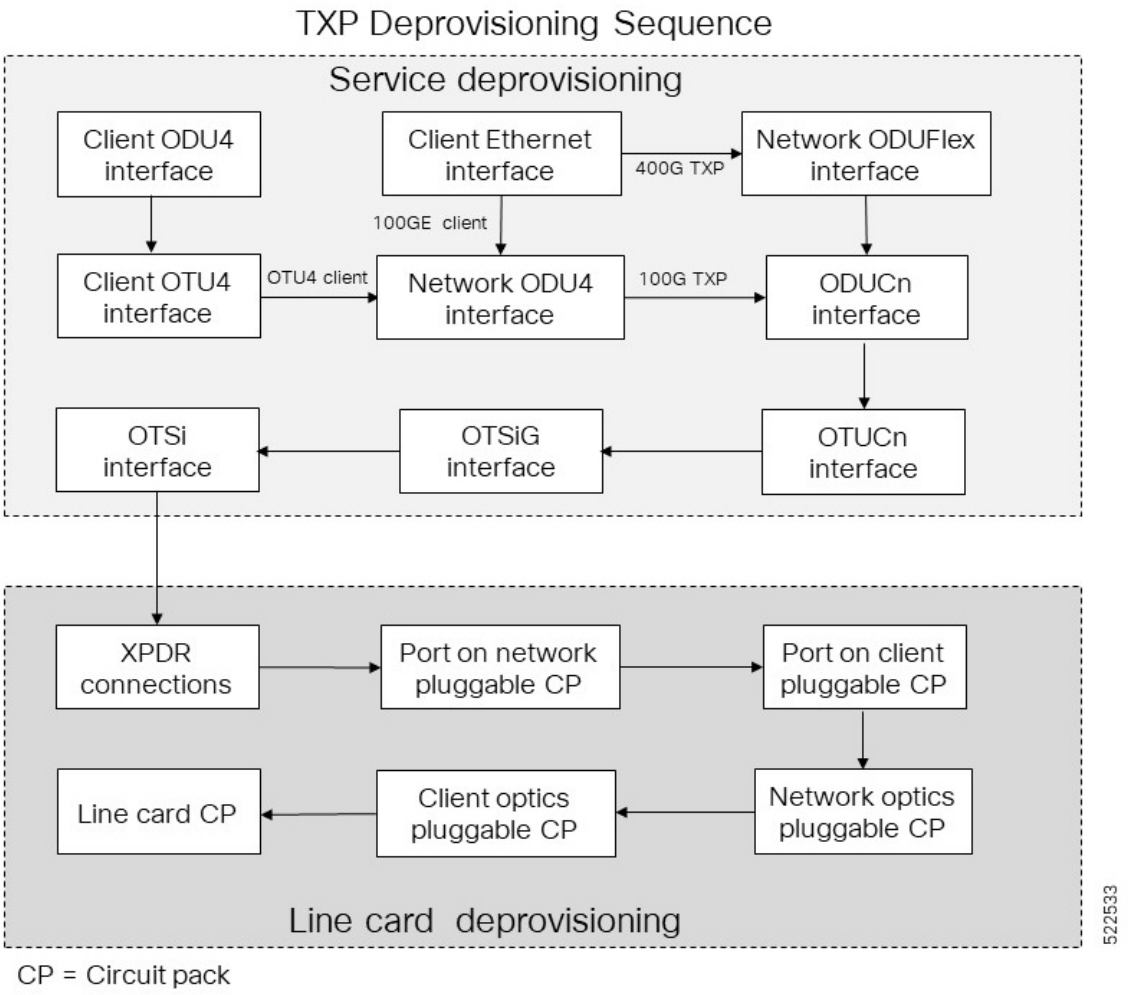
Deprovision Shelf, Line Card, Pluggables, and Interfaces

This section describes the workflow to deprovision the shelf, line card, pluggable optics, and interfaces.

Deprovisioning TXP Workflow

The following diagram displays the TXP deprovisioning sequence.

Figure 5: TXP Deprovisioning Sequence



Use the following steps to deprovision the TXP configuration:

1. (Applies to 400G TXP and 100G TXP with 100GE client interface) Delete the ethernet interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
            <name>eth-Optics0/1/0/8/0/1/0/8</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

2. (Applies only to 100G TXP with OTU4 client interface) Delete the client ODU4 interface.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
            <name>odu-Optics0/1/0/8/0/1/0/8.1</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

3. (Applies only to 100G TXP with OTU4 client interface) Delete OTU4 interface.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
            <name>otu-Optics0/1/0/8/0/1/0/8</</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

4.
   - **400G:** Delete the ODUFlex interface:

     ```
     <rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
       <edit-config>
         <target>
           <running/>
         </target>
         <config>
           <org-openroadm-device xmlns="http://org/openroadm/device">
             <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
     nc:operation="delete">
               <name>odu-Optics0/1/0/13/0/1/0/13.1</name>
             </interface>
           </org-openroadm-device>
         </config>
       </edit-config>
     </rpc>
     ```

   - **100G:** Delete the network ODU4 interface:

     ```
     <rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
       <edit-config>
         <target>
           <running/>
         </target>
         <config>
           <org-openroadm-device xmlns="http://org/openroadm/device">
             <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
     nc:operation="delete">
               <name>odu-Optics0/1/0/13/0/1/0/13.1</name>
             </interface>
     ```

```
          </org-openroadm-device>
        </config>
      </edit-config>
    </rpc>
```

5. Delete the ODUCn interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>oduc-Optics0/1/0/13/0/1/0/13</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

6. Delete the OTUCn interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>otuc-Optics0/1/0/13/0/1/0/13</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

7. Delete the OTSiG interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
        <name>otsig-Optics0/1/0/13/0/1/0/13</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

8. Delete the OTSi interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
```

```
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>otsi-Optics0/1/0/13/0/1/0/13</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

9. Delete the XPDR connections:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <xponder xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <xpdr-number>1</xpdr-number>
        </xponder>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

10. Delete the port on the network optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <ports xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
            <port-name>0/1/0/13</port-name>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

11. Delete the port on the client optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
```

```
          <ports xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
            <port-name>0/1/0/8</port-name>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

12. Delete the network optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

13. Delete the client optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
        </circuit-packs>
     </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

14. Delete the line card circuit pack:



Note All the client and network pluggable circuit packs must be deleted before the line card circuit pack can be deleted.

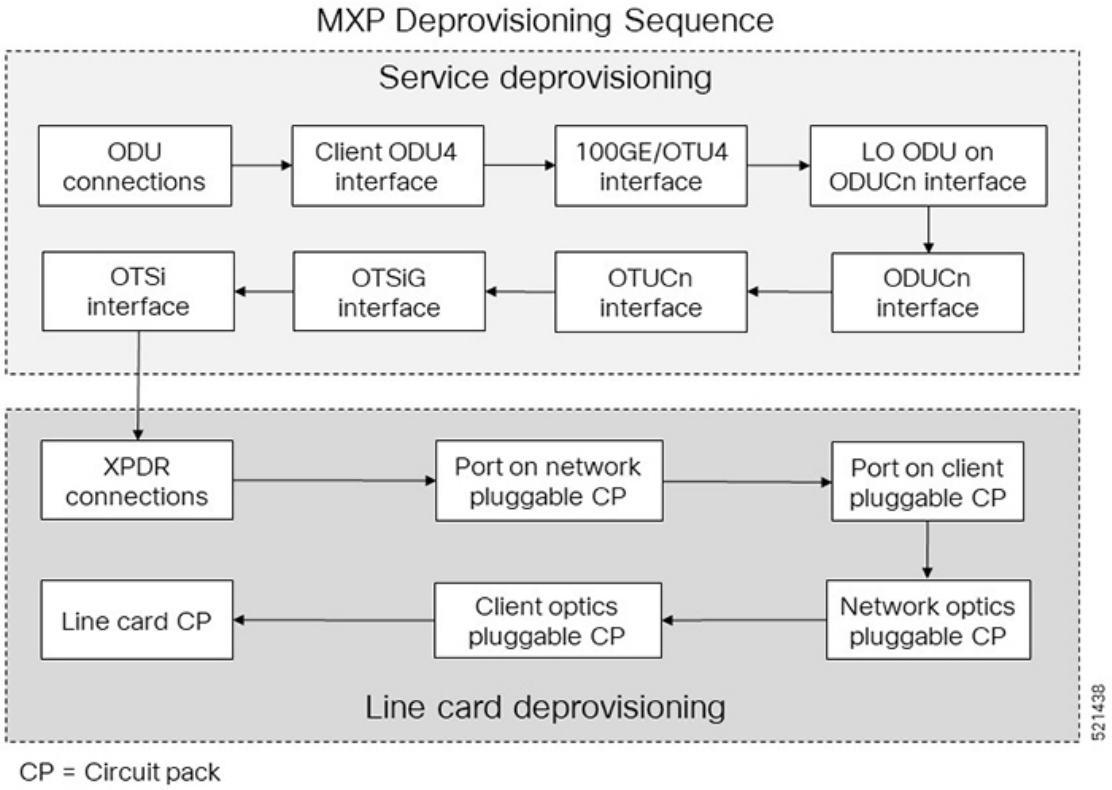
```
rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>0/1</circuit-pack-name>
```

```
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

Deprovisioning MXP Workflow

The following diagram displays the MXP deprovisioning sequence.

Figure 6: MXP Deprovisioning Sequence



Use the following sequence to deprovision the MXP configuration:

1. Delete the ODU connections. Repeat this step for the remaining ODU connections.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <odu-connection xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <connection-name>4</connection-name>
        </odu-connection>
    </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

2. Delete the client ODU4 interface. Repeat this step for the remaining ports.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>odu-Optics0/1/0/10/0/1/0/10.1</name>
         </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

3. Delete the 100GE or OTU4 interface. Repeat this step for the remaining ports.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>eth-Optics0/1/0/10/0/1/0/10</name>
         </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>otu-Optics0/1/0/10/0/1/0/10</name>
         </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

4. Delete the LO ODU interface. Repeat this step for the other three interfaces.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>odu-Optics0/1/0/12/0/1/0/12.1</name>
```

```
        </interface>
       </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

5. Delete ODUCn interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>oduc-Optics0/1/0/12/0/1/0/12</name>
         </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

6. Delete the OTUCn interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>otuc-Optics0/1/0/12/0/1/0/12</name>
         </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

7. Delete the OTSiG interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>otsig-Optics0/1/0/12/0/1/0/12</name>
         </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

8. Delete the OTSi interface:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
```

```
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>otsi-Optics0/1/0/12/0/1/0/12</name>
         </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

9. Delete the XPDR connections:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <xponder xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <xpdr-number>2</xpdr-number>
        </xponder>
    </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

10. Delete the port on the network optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
          <ports xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
            <port-name>0/1/0/12</port-name>
          </ports>
        </circuit-packs>
    </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

11. Delete the port on the client optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/10</circuit-pack-name>
          <ports xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
```

```
            <port-name>0/1/0/10</port-name>
          </ports>
        </circuit-packs>
    </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

12. Delete the network optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
         <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
        </circuit-packs>
    </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

13. Delete the client optics pluggable circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>Optics0/1/0/10</circuit-pack-name>
        </circuit-packs>
  </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

14. Delete the line card circuit pack:

Note All the client and network pluggable circuit packs must be deleted before the line card circuit pack can be deleted.

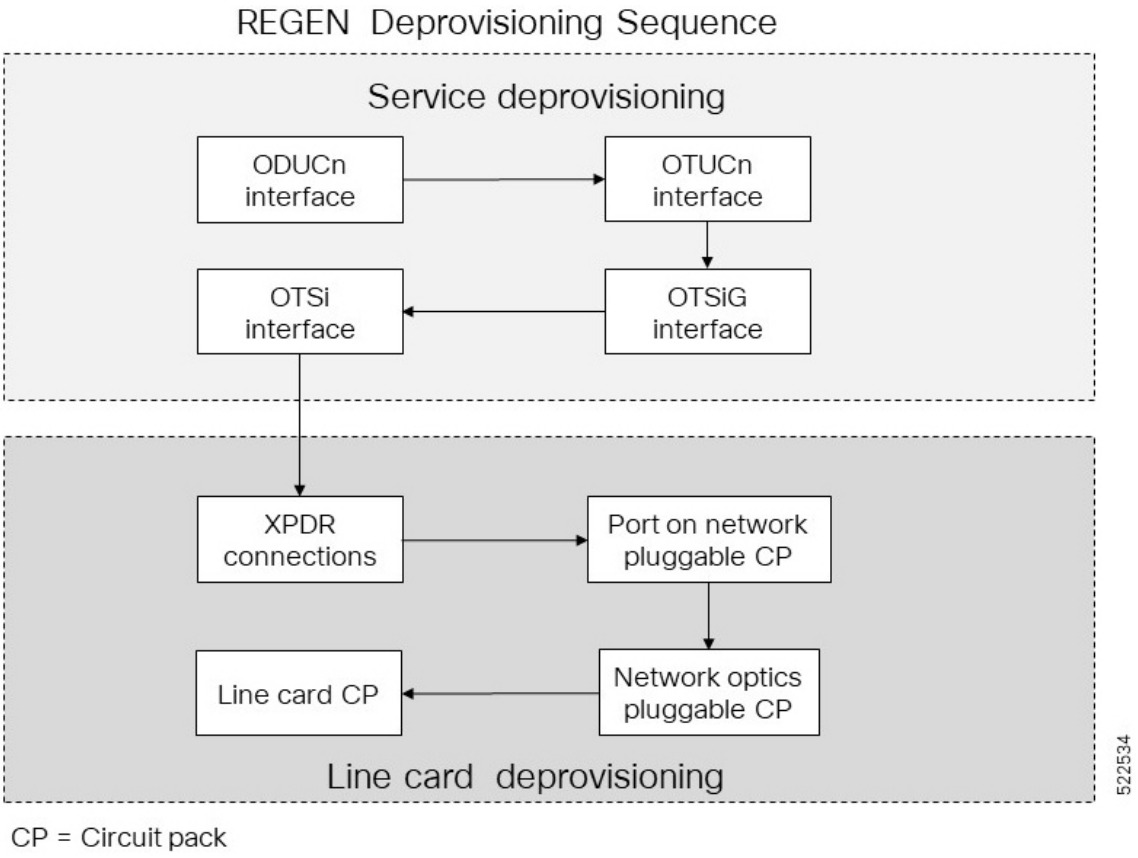
```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>0/1</circuit-pack-name>
        </circuit-packs>
      </org-openroadm-device>
    </config>
```

```
  </edit-config>
</rpc>
```

Deprovisioning REGEN Workflow

The following diagram displays the REGEN deprovisioning sequence.

Figure 7: REGEN Deprovisioning Sequence



Use the following steps to deprovision the REGEN configuration:

1. Delete the ODUCn interface on Port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>oduc-Optics0/1/0/13/0/1/0/13</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

2. Delete the OTUCn interface on Port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>otuc-Optics0/1/0/13/0/1/0/13</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

3. Delete the OTSiG interface on Port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
        <name>otsig-Optics0/1/0/13/0/1/0/13</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

4. Delete the OTSi interface on Port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>otsi-Optics0/1/0/13/0/1/0/13</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

5. Delete the ODUCn interface on Port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
```

```
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>oduc-Optics0/1/0/12/0/1/0/12</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

6. Delete the OTUCn interface on Port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>otuc-Optics0/1/0/12/0/1/0/12</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

7. Delete the OTSiG interface on Port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
        <name>otsig-Optics0/1/0/12/0/1/0/12</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

8. Delete the OTSi interface on Port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <name>otsi-Optics0/1/0/12/0/1/0/12</name>
        </interface>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

9. Delete the XPDR connections:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <xponder xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <xpdr-number>1</xpdr-number>
        </xponder>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

10. Delete the port on the network optics pluggable circuit pack on Port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
          <ports xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
            <port-name>0/1/0/13</port-name>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

11. Delete the network optics pluggable circuit pack on Port 13:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>Optics0/1/0/13</circuit-pack-name>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

12. Delete the port on the network optics pluggable circuit pack on Port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
```

```
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs>
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
          <ports xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
            <port-name>0/1/0/12</port-name>
          </ports>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

13. Delete the network optics pluggable circuit pack on Port 12:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

14. Delete the line card circuit pack:

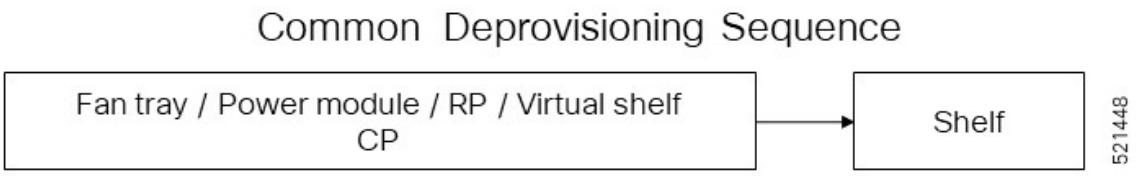
Note All the network pluggable circuit packs must be deleted before the line card circuit pack can be deleted.

```
rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
      <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>0/1</circuit-pack-name>
        </circuit-packs>
     </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

Common Circuit Pack Deprovisioning Workflow

This section describes the steps to deprovision the RP, power module, fan tray, virtual shelf, and shelf. The following diagram displays the common circuit pack deprovisioning sequence.

Figure 8: Common Deprovisioning Sequence



1. Delete the RP circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>0/RP0</circuit-pack-name>
        </circuit-packs>
     </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

2. Delete the power module circuit packs:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>0/PM0</circuit-pack-name>
        </circuit-packs>
   </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>0/PM1</circuit-pack-name>
        </circuit-packs>
     </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

3. Delete the fan tray circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>0/FT0</circuit-pack-name>
        </circuit-packs>
     </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>0/FT1</circuit-pack-name>
        </circuit-packs>
     </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>0/FT2</circuit-pack-name>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

4. Delete the virtual shelf circuit pack:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <circuit-packs xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
nc:operation="delete">
          <circuit-pack-name>0/SC0</circuit-pack-name>
        </circuit-packs>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

5. Delete the shelf :

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
       <shelves xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0" nc:operation="delete">

          <shelf-name>0</shelf-name>
        </shelves>
      </org-openroadm-device>
    </config>
  </edit-config>
</rpc>
```

Attention LED

The *org-openroadm-device* YANG model includes RPC functions that control the attention LED on NCS 1004 ports.

Restriction OpenROADM configuration does not support Card level LED control.

Enable Attention LED Control

The following sample is an RPC request enabling LED control on a line card or route processor card.

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:be720cbd-4361-4c0f-b10a-87a54373b6c5">
  <led-control xmlns="http://org/openroadm/device">
    <circuit-pack-name>0/1</circuit-pack-name>
    <enabled>true</enabled>
  </led-control>
</nc:rpc>
```

The following sample is an RPC response for the previous RPC request.

```
<rpc-reply message-id="urn:uuid:be720cbd-4361-4c0f-b10a-87a54373b6c5"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/device">Failed</status>
  <status-message xmlns="http://org/openroadm/device">led-control is only supported for
pluggable circuit-pack!!! </status-message>
</rpc-reply>
```

Enable Attention LED on a Client Port

The following sample is an RPC request enabling attention LED control on a client port.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <led-control xmlns="http://org/openroadm/device">
    <circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
    <enabled>true</enabled>
  </led-control>
</rpc>
```

The following sample is an RPC response for the previous RPC request.

```
<rpc-reply message-id="urn:uuid:b99c0e55-68f7-4bcf-bbed-909b80cb1f56"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/device">Successful</status>
  <status-message xmlns="http://org/openroadm/device">led-control operation completed
successfully!!</status-message>
</rpc-reply>
```

The following sample is a notification RPC for the previous RPC request.

```
<notification
xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0"><eventTime>2022-11-09T09:59:19.637197+00:00</eventTime>
<alarm-notification xmlns="http://org/openroadm/alarm">
  <id>XR/LED_CONTROL/1#CHASSIS/LCC/1:CONTAINER/LC/1:MODULE/TRC/2:PORT/OPTICS/8</id>
  <resource>
    <device>
      <node-id>openroadm</node-id>
    </device>
    <resource>
      <circuit-pack-name>Optics0/1/0/8</circuit-pack-name>
    </resource>
    <resourceType>
      <type>circuit-pack</type>
    </resourceType>
  </resource>
  <probableCause>
    <cause>equipmentLedOn</cause>
    <direction>notApplicable</direction>
    <location>notApplicable</location>
  </probableCause>
  <raiseTime>2022-11-09T09:59:19-00:00</raiseTime>
  <severity>warning</severity>
  <additional-detail>LED control enabled</additional-detail>
</alarm-notification>
</notification>
```

Disable Attention LED on a Client Port

The following sample is an RPC request disabling attention LED control on a client port.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <led-control xmlns="http://org/openroadm/device">
    <circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
    <enabled>false</enabled>
  </led-control>
</rpc>
```

The following sample is an RPC response for the previous RPC request.

```
<rpc-reply message-id="urn:uuid:ec03c1b3-a999-4c3d-9cfb-fe056da90f8a"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/device">Successful</status>
  <status-message xmlns="http://org/openroadm/device">led-control operation completed
successfully!!</status-message>
 </rpc-reply>
```

The following sample is a notification RPC for the previous RPC request.

```
<notification
xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0"><eventTime>2022-11-09T10:06:38.930263+00:00</eventTime>
<alarm-notification xmlns="http://org/openroadm/alarm">
  <id>XR/LED_CONTROL/1#CHASSIS/LCC/1:CONTAINER/LC/1:MODULE/TRC/2:PORT/OPTICS/6</id>
  <resource>
    <device>
      <node-id>openroadm</node-id>
```

```
    </device>
    <resource>
      <circuit-pack-name>Optics0/1/0/6</circuit-pack-name>
    </resource>
    <resourceType>
      <type>circuit-pack</type>
    </resourceType>
  </resource>
  <probableCause>
    <cause>equipmentLedOn</cause>
    <direction>notApplicable</direction>
    <location>notApplicable</location>
  </probableCause>
  <raiseTime>2022-11-09T09:59:19-00:00</raiseTime>
  <severity>clear</severity>
  <additional-detail>LED control enabled</additional-detail>
</alarm-notification>
</notification>
```

Enable Attention LED on a Trunk Port

The following sample is an RPC request disabling attention LED control on a client port.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <led-control xmlns="http://org/openroadm/device">
    <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
    <enabled>true</enabled>
  </led-control>
</rpc>
```

The following sample is an RPC response for the previous RPC request.

```
<rpc-reply message-id="urn:uuid:1190a1d7-48c0-456b-b614-01b9e049dbd2"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/device">Successful</status>
  <status-message xmlns="http://org/openroadm/device">led-control operation completed
successfully!!</status-message>
</rpc-reply>
```

The following sample is a notification RPC for the previous RPC request.

```
<notification
xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0"><eventTime>2022-11-09T10:12:31.42468+00:00</eventTime>
<alarm-notification xmlns="http://org/openroadm/alarm">
  <id>XR/LED_CONTROL/1#CHASSIS/LCC/1:CONTAINER/LC/1:MODULE/TRC/2:PORT/OPTICS/12</id>
  <resource>
    <device>
      <node-id>openroadm</node-id>
    </device>
    <resource>
      <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
    </resource>
    <resourceType>
      <type>circuit-pack</type>
    </resourceType>
  </resource>
  <probableCause>
    <cause>equipmentLedOn</cause>
    <direction>notApplicable</direction>
    <location>notApplicable</location>
  </probableCause>
  <raiseTime>2022-11-09T10:12:31-00:00</raiseTime>
  <severity>warning</severity>
  <additional-detail>LED control enabled</additional-detail>
```

```
</alarm-notification>
</notification>
```

Disable Attention LED on a Trunk Port

The following sample is an RPC request disabling attention LED control on a client port.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <led-control xmlns="http://org/openroadm/device">
    <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
    <enabled>false</enabled>
  </led-control>
</rpc>
```

The following sample is an RPC response for the previous RPC request.

```
<rpc-reply message-id="urn:uuid:3e721e0b-2cf8-4e43-85fc-960aaf7a462f"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/device">Successful</status>
  <status-message xmlns="http://org/openroadm/device">led-control operation completed
successfully!!</status-message>
</rpc-reply>
```

The following sample is a notification RPC for the previous RPC request.

```
<notification
xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0"><eventTime>2022-11-09T10:15:23.751501+00:00</eventTime>
<alarm-notification xmlns="http://org/openroadm/alarm">
  <id>XR/LED_CONTROL/1#CHASSIS/LCC/1:CONTAINER/LC/1:MODULE/TRC/2:PORT/OPTICS/12</id>
  <resource>
    <device>
      <node-id>openroadm</node-id>
    </device>
    <resource>
      <circuit-pack-name>Optics0/1/0/12</circuit-pack-name>
    </resource>
    <resourceType>
      <type>circuit-pack</type>
    </resourceType>
  </resource>
  <probableCause>
    <cause>equipmentLedOn</cause>
    <direction>notApplicable</direction>
    <location>notApplicable</location>
  </probableCause>
  <raiseTime>2022-11-09T10:12:31-00:00</raiseTime>
  <severity>clear</severity>
  <additional-detail>LED control enabled</additional-detail>
</alarm-notification>
</notification>
```

Enable Attention LED on a Port without Optics Configuration



Restriction If you try to enable LEDs without optics configuration on the port, you receive failure responses.

The following sample is an RPC enabling attention LED control on a port without optics configuration.

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:cdec5714-c9d5-4156-827d-b83bf4502774">
  <led-control xmlns="http://org/openroadm/device">
    <circuit-pack-name>0/1/0/1</circuit-pack-name>
```

```
    <enabled>true</enabled>
  </led-control>
</nc:rpc>
```

The following sample is an RPC error response for the previous RPC request.

```
<rpc-reply message-id="urn:uuid:cdec5714-c9d5-4156-827d-b83bf4502774"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <rpc-error>
    <error-type>protocol</error-type>
    <error-tag>operation-failed</error-tag>
    <error-severity>error</error-severity>
    <error-app-tag>instance-required</error-app-tag>
    <error-path xmlns:org-openroadm-device="http://org/openroadm/device">
    /rpc/org-openroadm-device:led-control/org-openroadm-device:circuit-pack-name
    <error-message xml:lang="en">illegal reference
/org-openroadm-device:led-control/circuit-pack-name</error-message>
    <error-info xmlns:org-openroadm-device="http://org/openroadm/device"
xmlns:tailf="http://tail-f.com/ns/netconf/params/1.1">
      <tailf:bad-keyref>

<tailf:bad-element>/org-openroadm-device:led-control/org-openroadm-device:circuit-pack-name</tailf:bad-element>


<tailf:missing-element>/org-openroadm-device:org-openroadm-device/org-openroadm-device:circuit-packs[org-openroadm-device:circuit-pack-name='0/0/1']/org-openroadm-device:circuit-pack-name</tailf:missing-element>

      </tailf:bad-keyref>
    </error-info>
  </rpc-error>
</rpc-reply>
```

Monitor Performance

The OTN-XPL card supports the *org-openroadm-pm.yang* data model for reporting current performance monitoring (PM) data. It also provides support for retrieving historical PM data, and support for clearing PM data.

Note

- PM parameters cannot be fetched on no-OAM ODUs in an MXP configuration. If 100GE is configured on the client side, then the client side ODU4 is the no-OAM ODU. If OTU4 is configured on the client side, then the trunk side ODU4 to which it is connected is the no-OAM ODU.
- For QSFP-100G-FR-S and QSFP-100G-LR-S, the optical PM parameters are available on the *R/S/I/P* port.
- PM history parameters for Optics, Ethernet, and OTUC4 interfaces are not deleted after
  - power cycle of the shelf
  - warm/cold reboot of RP circuit pack
  - software upgrade
  - warm/cold reload of LC circuit pack

The model supports three types of granularity : 15-minute , 24-hour, and untimed.

There are two primary lists associated with PM :

- *currentPmlist*-Contains PM data that is currently being collected and updated on the device. The PM is collected in 15-minute and 24-hour bins.
- The *historicalPmlist*- Contains all the binned PM values that are collected by the device during some time window in 15-min intervals and 1-day intervals.

Digital or counter type PMs are collected for current 15-minute and 24-hour granularities. You can also retrieve historical counter bins by way of file transfer. You can retrieve up to the last thirty two 15-minute bins, as well as one 24-hour bin.

Analog or gauge type PMs report the current instantaneous value, as well as the minimum, maximum, and average value over the duration of the reported interval (15-minute or 24-hour). For gauge type PMs, only the minimum, maximum and average values are reported for historical bins.

Untimed granularity PMs are supported only for ethernet interfaces. In Release 7.3.1, MAC counters are supported.

The following tables list the PMs supported on the OTN-XPL interfaces.

OTUCn PMs

OpenROADM PM Name
erroredSeconds (near-end)
severelyErroredSeconds (near-end)
unavailableSeconds (near-end)
erroredBlockCount (near-end)
erroredSeconds (far-end)
severelyErroredSeconds (far-end)
unavailableSeconds (far-end)
erroredBlockCount (far-end)

OTU4 PMs

OpenROADM PM Name
erroredSeconds (near-end)
severelyErroredSeconds (near-end)
unavailableSeconds (near-end)
erroredBlockCount (near-end)
erroredSeconds (far-end)
severelyErroredSeconds (far-end)
unavailableSeconds (far-end)
erroredBlockCount (far-end)

preFECCorrectedErrors
FECUncorrectableBlocks

OTSi PMs

OpenROADM PM Name
preFECCorrectedErrors
FECUncorrectableBlocks

ODUCn/ODUFlex PMs

OpenROADM PM Name
erroredSeconds (near-end)
severelyErroredSeconds (near-end)
unavailableSeconds (near-end)
erroredBlockCount (near-end)
erroredSeconds (far-end)
severelyErroredSeconds (far-end)
unavailableSeconds (far-end)
erroredBlockCount (far-end)

400G Ethernet PMs

OpenROADM PM Name
fecUncorrectedCodewords
fecCorrectedCodewords
erroredSeconds (near-end)
severelyErroredSeconds (near-end)
unavailableSeconds (near-end)
erroredSeconds (far-end)
severelyErroredSeconds (far-end)
unavailableSeconds (far-end)

100G Ethernet PMs

OpenROADM PM Name
fecUncorrectedCodewords
fecCorrectedCodewords

inFrames
outFrames
inFramesErrored
codeViolations
erroredSeconds (near-end)
severelyErroredSeconds (near-end)
unavailableSeconds (near-end)
erroredSeconds (far-end)
severelyErroredSeconds (far-end)
erroredSeconds (far-end)

Port PMs



Note The totalOpticalPower PMs are applicable only to network ports.

OpenROADM PM Name
opticalPowerOutput
opticalPowerOutputMax
opticalPowerOutputAverage
opticalPowerOutputMin
opticalPowerInputMax
opticalPowerInputAverage
opticalPowerInput
opticalPowerInputMin
totalOpticalPowerInputMax
totalOpticalPowerInputAvg
totalOpticalPowerMin
totalOpticalPower



Note The TCA configuration for the inFramesErrored parameter is not supported.

The following is a sample to fetch the current PMs.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
      <current-pm-list xmlns="http://org/openroadm/pm">
        <current-pm-entry>
          <pm-resource-instance xmlns:org-openroadm-device="http://org/openroadm/device">
          /org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
          [org-openroadm-device:name='eth-Optics0/1/0/10/0/1/0/10']</pm-resource-instance>
          <current-pm/>
            <retrieval-time/>
        </current-pm-entry>
      </current-pm-list>
    </filter>
  </get>
</rpc>
```

```
<rpc-reply message-id="urn:uuid:e88a1656-f35c-467b-b99e-ee8da60c8c94"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <current-pm-list xmlns="http://org/openroadm/pm">
      <current-pm-entry>
        <pm-resource-type>interface</pm-resource-type>
        <pm-resource-type-extension/>
        <pm-resource-instance xmlns:org-openroadm-device=
        "http://org/openroadm/device">/org-openroadm-device:
         org-openroadm-device/org-openroadm-device:interface
         [org-openroadm-device:name='eth-Optics0/1/0/10/0/1/0/10']</pm-resource-instance>
         <retrieval-time>2021-01-22T12:13:24+00:00</retrieval-time>
        <current-pm>
          <type>codeViolations</type>
          <extension/>
          <location>nearEnd</location>
          <direction>rx</direction>
          <measurement>
            <granularity>notApplicable</granularity>
            <pmParameterValue>0</pmParameterValue>
            <pmParameterUnit>errors</pmParameterUnit>
            <validity>suspect</validity>
          </measurement>
          <measurement>
            <granularity>15min</granularity>
            <pmParameterValue>0</pmParameterValue>
            <pmParameterUnit>errors</pmParameterUnit>
            <validity>suspect</validity>
          </measurement>
          <measurement>
            <granularity>24Hour</granularity>
            <pmParameterValue>0</pmParameterValue>
            <pmParameterUnit>errors</pmParameterUnit>
            <validity>suspect</validity>
          </measurement>
        </current-pm>
        <current-pm>
          <type>unavailableSeconds</type>
          <extension/>
          <location>farEnd</location>
          <direction>rx</direction>
          <measurement>
            <granularity>notApplicable</granularity>
            <pmParameterValue>0</pmParameterValue>
            <pmParameterUnit>sec</pmParameterUnit>
            <validity>suspect</validity>
```

```
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>24Hour</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
  </current-pm>
  <current-pm>
    <type>unavailableSeconds</type>
    <extension/>
    <location>nearEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>notApplicable</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>24Hour</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
  </current-pm>
  <current-pm>
    <type>severelyErroredSeconds</type>
    <extension/>
    <location>farEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>notApplicable</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>24Hour</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
  </current-pm>
  <current-pm>
    <type>severelyErroredSeconds</type>
```

```
    <extension/>
    <location>nearEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>notApplicable</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>24Hour</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
  </current-pm>
  <current-pm>
    <type>erroredSeconds</type>
    <extension/>
    <location>farEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>notApplicable</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>24Hour</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
  </current-pm>
  <current-pm>
    <type>erroredSeconds</type>
    <extension/>
    <location>nearEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>notApplicable</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
```

```
      <granularity>24Hour</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>sec</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
  </current-pm>
  <current-pm>
    <type>inFramesErrored</type>
    <extension/>
    <location>nearEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>notApplicable</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>packets</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>packets</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>24Hour</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>packets</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
  </current-pm>
  <current-pm>
    <type>outFrames</type>
    <extension/>
    <location>nearEnd</location>
    <direction>tx</direction>
    <measurement>
      <granularity>notApplicable</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>packets</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>packets</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
    <measurement>
      <granularity>24Hour</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>packets</pmParameterUnit>
      <validity>suspect</validity>
    </measurement>
  </current-pm>
  <current-pm>
    <type>inFrames</type>
    <extension/>
    <location>nearEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>notApplicable</granularity>
      <pmParameterValue>0</pmParameterValue>
      <pmParameterUnit>packets</pmParameterUnit>
      <validity>suspect</validity>
```

```
      </measurement>
      <measurement>
        <granularity>15min</granularity>
        <pmParameterValue>0</pmParameterValue>
        <pmParameterUnit>packets</pmParameterUnit>
        <validity>suspect</validity>
      </measurement>
      <measurement>
        <granularity>24Hour</granularity>
        <pmParameterValue>0</pmParameterValue>
        <pmParameterUnit>packets</pmParameterUnit>
        <validity>suspect</validity>
      </measurement>
    </current-pm>
    <current-pm>
      <type>fecCorrectedCodewords</type>
      <extension/>
      <location>nearEnd</location>
      <direction>rx</direction>
      <measurement>
        <granularity>notApplicable</granularity>
        <pmParameterValue>0</pmParameterValue>
        <pmParameterUnit>codewords</pmParameterUnit>
        <validity>suspect</validity>
      </measurement>
      <measurement>
        <granularity>15min</granularity>
        <pmParameterValue>0</pmParameterValue>
        <pmParameterUnit>codewords</pmParameterUnit>
        <validity>suspect</validity>
      </measurement>
      <measurement>
        <granularity>24Hour</granularity>
        <pmParameterValue>0</pmParameterValue>
        <pmParameterUnit>codewords</pmParameterUnit>
        <validity>suspect</validity>
      </measurement>
    </current-pm>
    <current-pm>
      <type>fecUncorrectedCodewords</type>
      <extension/>
      <location>nearEnd</location>
      <direction>rx</direction>
      <measurement>
        <granularity>notApplicable</granularity>
        <pmParameterValue>0</pmParameterValue>
        <pmParameterUnit>codewords</pmParameterUnit>
        <validity>suspect</validity>
      </measurement>
      <measurement>
        <granularity>15min</granularity>
        <pmParameterValue>0</pmParameterValue>
        <pmParameterUnit>codewords</pmParameterUnit>
        <validity>suspect</validity>
      </measurement>
      <measurement>
        <granularity>24Hour</granularity>
        <pmParameterValue>0</pmParameterValue>
        <pmParameterUnit>codewords</pmParameterUnit>
        <validity>suspect</validity>
      </measurement>
    </current-pm>
  </current-pm-entry>
</current-pm-list>
```

```
  </data>
</rpc-reply>
```

The following is a sample to fetch the historical PMs on an OTSi interface.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
      <historical-pm-list xmlns="http://org/openroadm/pm">
        <historical-pm-entry>
          <pm-resource-instance xmlns:org-openroadm-device=
         "http://org/openroadm/device">/org-openroadm-device:
         org-openroadm-device/org-openroadm-device:interface
        [org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12']
        </pm-resource-instance>
          <historical-pm/>
        </historical-pm-entry>
      </historical-pm-list>
    </filter>
  </get>
</rpc>
```

```
<rpc-reply message-id="urn:uuid:fc16ab15-0ffa-4380-abd2-69a573cd058b"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <historical-pm-list xmlns="http://org/openroadm/pm">
      <historical-pm-entry>
        <pm-resource-instance xmlns:org-openroadm-device=
        "http://org/openroadm/device">/org-openroadm-device:
        org-openroadm-device/org-openroadm-device:interface
        [org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12']</pm-resource-instance>
        <historical-pm>
          <type>opticalPowerOutputMin</type>
          <extension/>
          <location>nearEnd</location>
          <direction>tx</direction>
          <measurement>
            <granularity>15min</granularity>
            <bin-number>1</bin-number>
            <pmParameterValue>0.77</pmParameterValue>
            <pmParameterUnit>dBm</pmParameterUnit>
            <validity>complete</validity>
            <completion-time>2021-01-22T12:14:59+00:00</completion-time>
          </measurement>
          <measurement>
            <granularity>15min</granularity>
            <bin-number>2</bin-number>
            <pmParameterValue>0.68</pmParameterValue>
            <pmParameterUnit>dBm</pmParameterUnit>
            <validity>suspect</validity>
            <completion-time>2021-01-22T11:59:59+00:00</completion-time>
          </measurement>
        </historical-pm>
        <historical-pm>
          <type>opticalPowerOutputMax</type>
          <extension/>
          <location>nearEnd</location>
          <direction>tx</direction>
          <measurement>
            <granularity>15min</granularity>
            <bin-number>1</bin-number>
            <pmParameterValue>1.22</pmParameterValue>
            <pmParameterUnit>dBm</pmParameterUnit>
            <validity>complete</validity>
```

```
      <completion-time>2021-01-22T12:14:59+00:00</completion-time>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>2</bin-number>
      <pmParameterValue>1.22</pmParameterValue>
      <pmParameterUnit>dBm</pmParameterUnit>
      <validity>suspect</validity>
      <completion-time>2021-01-22T11:59:59+00:00</completion-time>
    </measurement>
  </historical-pm>
  <historical-pm>
    <type>opticalPowerOutputAvg</type>
    <extension/>
    <location>nearEnd</location>
    <direction>tx</direction>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>1</bin-number>
      <pmParameterValue>0.98</pmParameterValue>
      <pmParameterUnit>dBm</pmParameterUnit>
      <validity>complete</validity>
      <completion-time>2021-01-22T12:14:59+00:00</completion-time>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>2</bin-number>
      <pmParameterValue>0.98</pmParameterValue>
      <pmParameterUnit>dBm</pmParameterUnit>
      <validity>suspect</validity>
      <completion-time>2021-01-22T11:59:59+00:00</completion-time>
    </measurement>
  </historical-pm>
  <historical-pm>
    <type>opticalPowerInputMin</type>
    <extension/>
    <location>nearEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>1</bin-number>
      <pmParameterValue>-0.4</pmParameterValue>
      <pmParameterUnit>dBm</pmParameterUnit>
      <validity>complete</validity>
      <completion-time>2021-01-22T12:14:59+00:00</completion-time>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>2</bin-number>
      <pmParameterValue>-0.56</pmParameterValue>
      <pmParameterUnit>dBm</pmParameterUnit>
      <validity>suspect</validity>
      <completion-time>2021-01-22T11:59:59+00:00</completion-time>
    </measurement>
  </historical-pm>
  <historical-pm>
    <type>opticalPowerInputMax</type>
    <extension/>
    <location>nearEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>1</bin-number>
      <pmParameterValue>0.73</pmParameterValue>
```

```
      <pmParameterUnit>dBm</pmParameterUnit>
      <validity>complete</validity>
      <completion-time>2021-01-22T12:14:59+00:00</completion-time>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>2</bin-number>
      <pmParameterValue>0.67</pmParameterValue>
      <pmParameterUnit>dBm</pmParameterUnit>
      <validity>suspect</validity>
      <completion-time>2021-01-22T11:59:59+00:00</completion-time>
    </measurement>
  </historical-pm>
  <historical-pm>
    <type>opticalPowerInputAvg</type>
    <extension/>
    <location>nearEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>1</bin-number>
      <pmParameterValue>0.06</pmParameterValue>
      <pmParameterUnit>dBm</pmParameterUnit>
      <validity>complete</validity>
      <completion-time>2021-01-22T12:14:59+00:00</completion-time>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>2</bin-number>
      <pmParameterValue>0.1</pmParameterValue>
      <pmParameterUnit>dBm</pmParameterUnit>
      <validity>suspect</validity>
      <completion-time>2021-01-22T11:59:59+00:00</completion-time>
    </measurement>
  </historical-pm>
  <historical-pm>
    <type>preFECCorrectedErrors</type>
    <extension/>
    <location>nearEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>1</bin-number>
      <pmParameterValue>516912720627</pmParameterValue>
      <pmParameterUnit>bits</pmParameterUnit>
      <validity>complete</validity>
      <completion-time>2021-01-22T12:14:59+00:00</completion-time>
    </measurement>
    <measurement>
      <granularity>15min</granularity>
      <bin-number>2</bin-number>
      <pmParameterValue>226718444721</pmParameterValue>
      <pmParameterUnit>bits</pmParameterUnit>
      <validity>suspect</validity>
      <completion-time>2021-01-22T11:59:59+00:00</completion-time>
    </measurement>
  </historical-pm>
  <historical-pm>
    <type>FECUncorrectableBlocks</type>
    <extension/>
    <location>nearEnd</location>
    <direction>rx</direction>
    <measurement>
      <granularity>15min</granularity>
```

```
            <bin-number>1</bin-number>
            <pmParameterValue>0</pmParameterValue>
            <pmParameterUnit>words</pmParameterUnit>
            <validity>complete</validity>
            <completion-time>2021-01-22T12:14:59+00:00</completion-time>
          </measurement>
          <measurement>
            <granularity>15min</granularity>
            <bin-number>2</bin-number>
            <pmParameterValue>0</pmParameterValue>
            <pmParameterUnit>words</pmParameterUnit>
            <validity>suspect</validity>
            <completion-time>2021-01-22T11:59:59+00:00</completion-time>
          </measurement>
        </historical-pm>
      </historical-pm-entry>
    </historical-pm-list>
  </data>
</rpc-reply>
```

You can use the asynchronous *clear-pm* RPC functionto clear all PMs or current PMs. The input to the RPC must be *pm-type* (*all* or *current*) along with the *granularity* (default is *15min*). Use separate RPC calls to obtain the 15-min and 24-hour granularities.

The following is a sample for clearing PMs.

```
clear-pm xmlns="http://org/openroadm/pm">
<resource>
<interface-name>eth-Optics0/1/0/10/0/1/0/10</interface-name>
</resource>
<resourceType>
<type>interface</type>
</resourceType>
<pm-type>current</pm-type>
<granularity>15min</granularity>
</clear-pm>
```

You can also collect the historical PM file. The following is a sample to the collect historical PM file for bin 1 to bin 10 for a granularity of 15 minutes.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <collect-historical-pm-file xmlns="http://org/openroadm/pm">
    <from-bin-number>1</from-bin-number>
    <to-bin-number>10</to-bin-number>
    <granularity>15min</granularity>
  </collect-historical-pm-file>
</rpc>


<rpc-reply message-id="urn:uuid:5f160d51-3577-4550-a050-3798eba47b56"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
<pm-filename
xmlns="http://org/openroadm/pm">/misc/disk2/history_pm_2021_08_26T11_44_19_346506.xml.gz</pm-filename>
<status xmlns="http://org/openroadm/pm">Successful</status>
<status-message xmlns="http://org/openroadm/pm">File collection started</status-message>
</rpc-reply>
NETCONF rpc COMPLETE
Received message from host
<notification
xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0"><eventTime>2021-08-26T11:44:20.759163+00:00</eventTime>
<historical-pm-collect-result xmlns="http://org/openroadm/pm">
<pm-filename>/misc/disk2/history_pm_2021_08_26T11_44_19_346506.xml.gz</pm-filename>
<status>Successful</status>
<status-message>Collected PM file.</status-message>
```

```
</historical-pm-collect-result>
</notification>
```

Monitor Alarms

Alarms can be monitored on the provisioned circuit-packs, ports, and interfaces of the OTN-XPL card. The OTN-XPL card supports:

- OpenROADM active alarm list-A list of currently active alarms.
- OpenROADM notifications-Alarm raise and clear events.

Active alarms or conditions are listed only if the OTN-XPL card on which they are raised is in-service. An active alarm or condition may also be suppressed if an alarm with greater severity is active.

Notifications are generated when an alarm or condition is raised or cleared.

The following alarms are raised on the OTN-XPL card.

Alarm	Severity	Probable Cause
OTUk Interface Alarms		
lossOfSignal	Critical	Applicable only for OTU client interface. Is raised on the client port when there is a loss of signal.
alarmIndicationSignal	Indeterminate	An Alarm Indication Signal (AIS) signal communicates with the receiving node when the transmit node does not send a valid signal. This alarm is applicable for the OTU4 client interface.
lossOfFrame	Critical	The card has lost frame delineation on the input data for more than three milliseconds. This alarm is applicable for the OTU4 client interface.
lossOfMultiframe	Critical	The multiframe alignment process is in the out-of-multiframe (OOM) state for three milliseconds. This alarm is applicable for the OTU4 client interface.
incomingAlignmentError	Minor	The IAE bit in the SM overhead field is "1" for 5 consecutive frames.

Alarm	Severity	Probable Cause
backwardIncomingAlignmentError	Warning	The BEI/BIAE bits in the SM/TCM overhead field (byte 3, bits 1 to 4) are "1011" for X consecutive frames.
backwardsDefectIndication	Indeterminate	Path termination error in the upstream data.
degradedDefect	Warning	The quality of signal is poor causing the bit error rate on the incoming optical line to exceed the signal degrade threshold.
serverSignalFail	Warning	The quality of signal is poor causing the bit error rate on the incoming optical line to exceed the signal failure threshold.
trailTraceIdentifierMismatch	Critical	The received trace identifier is different from the expected trace identifier.
terminalLoopbackActive	Warning	Terminal loopback is enabled on the network port.
facilityLoopbackActive	Warning	Facility loopback is enabled on MXP client port.
ODUk Interface Alarms		
alarmIndicationSignal	Indeterminate	The accepted STAT information is 111
lockedDefect	Indeterminate	The upstream connection is locked, and no signal is passed through.
backwardsDefectIndication	Indeterminate	The BDI bit in the SM/TCMi/PM overhead field is "1" for 5 consecutive frames.
trailTraceIdentifierMismatch	Major	The expected TTI string does not match the received section trace string.
degradedDefect	Warning	The quality of signal is so poor that the Bit Error Rate (BER) on the incoming optical line passed the signal degrade threshold.

Alarm	Severity	Probable Cause
serverSignalFail	Warning	The quality of signal is poor causing the bit error rate on the incoming optical line to exceed the signal failure threshold.
OPUk Alarms		
payloadMismatch	Critical	The accepted payload type (AcPT) is not equal to the expected payload type(s) as defined by the specific adaptation function.
clientSignalFailDefect	Warning	The CSF bit in the OPUk PSI overhead is "1" for 3 consecutive 256-frame multiframes.
Ethernet Interface Alarms		
localFault (Applies to 100GE and 400GE)	Major	A local fault character sequence is received in the incoming MAC stream.
remoteFault (Applies to 100GE and 400GE)	Major	A remote fault character sequence is received in the incoming MAC stream.
lossOfSignal (Applies to 100GE and 400GE)	Major	Is raised on the client-side QSFP when there is a loss of ethernet signal.
lossOfSynchronization (Applies to 100GE and 400GE)	Major	Raised on the client and trunk ports when there is a loss of signal synchronization on the port.
highBER (Applies to 100GE)	Major	The client and trunk ports receive 16 or more invalid sync-headers in 125 microseconds.
localdegradedser (Applies to 400GE)	Major	Excessive FEC corrected errors in the Ethernet controller receive path
remotedegradedser (Applies to 400GE)	Major	Excessive FEC corrected errors in the Ethernet controller transmit path or the far end Ethernet controller detects localdegradedser alarm.
facilityLoopback2Active (Applies to 400GE)	Warning	FAC2 loopback is enabled on 400GE client on TXP.
terminalLoopbackActive	Warning	Terminal loopback is enabled on the network port.

Alarm	Severity	Probable Cause
facilityLoopbackActive	Warning	Facility loopback is enabled on MXP client port.
OTSi Alarms		
lossOfSignal	Critical	Is raised on the OTSi interface when there is a loss of signal.
powerOutOfSpecificationHigh	Minor	The measured individual lane optical signal power of the received or transmitted signal exceeds the default or user-defined threshold.
powerOutOfSpecificationLow	Minor	The measured individual lane optical signal power of the received or transmitted signal falls below the default or user-defined threshold.
backwardsDefectIndication	Warning	FlexO Remote Defect Indicator is raised as BDI on the OTSi interface.
lossOfMultiframe	Critical	The multiframe alignment process is in the out-of-multiframe (OOM) state for three milliseconds.
OTSiG Alarms		
groupIdMismatch	Critical	Group ID mismatch for the FlexO frames
flexoMapMismatch	Critical	FlexO map mismatch
lossOfFrameAndLossOfMultiframe	Critical	Applicable only for the OTUC4 interface. The lossOfFrameAndLossOfMultiframe alarm is raised when the lossOfFrame or lossOfMultiframe condition is detected on the interface.
Circuit Pack Alarms		
equipmentRemoved	Warning	Equipment removed from the chassis although provisioning exists
firmwareVersionMismatch	Major	When one or more FPDs are not in current state and require upgrade.

Alarm	Severity	Probable Cause
equipmentMismatch	Critical	• Mismatch in the configured client data rate and the supported QSFP physical data rate. • Installed line card does not match the configured line card type. **Note** Third-party optics do not report the equipmentMismatch alarm.
equipmentFault	Major	Power to the fan tray has failed or an optical module, PLL device, CDR device, line card RAM device, line card, FPGA, or line card disk has failed.
diskFull	Critical	No disk space available for location Sysadmin.
equipmentLedOn	Warning	Flashing LED control is enabled.
equipmentInterConnectFailure	Major	Pex switch access failure, motherboard SSD failure, or Advanced Technology Attachment (ATA) errors
circuitPackActivateFailed	Major	The datapath FPGA fails to configure on the line card inserted, which will impact ports 0—13.
	Major	The line card EEPROM is corrupted or when the line card fails to connect within the timeout period of a maximum of two minutes.
	Major	There is a delay in getting the PWR_ON request from the shelf_mgr.
	Indeterminate	The LC app is disconnected due to lcapp crash, restart, or warm reload of lcapp.
	Critical	The line card fails to boot in the expected amount of time or when the line card modules do not boot correctly.

Alarm	Severity	Probable Cause
Shelf Alarms		
fanCoolingFail	Major	Fan trays are removed from the chassis
Port Alarms (Client Side)		
powerOutOfSpecificationHigh	Minor	The measured individual lane optical Rx signal power of the received or transmitted signal exceeds the default or user-defined threshold.
powerOutOfSpecificationLow	Minor	The measured individual lane optical signal power of the received or transmitted signal falls below the default or user-defined threshold.
Failure Mode and Effects Analysis (FMEA) Alarms		
firmwareDownloadOrActivationFailure	Major	BIOS image is corrupted and system is booted with the Golden image.
	Major	System detects the BP corruption and boots with the Golden image.
	Major	Line card is booted with the Golden image.
	Major	Datapath FPGA bootup with back up or golden image due to corruption of primary image.
	Major	BP detects the corruption of the FPGA.
	Major	The system detects the CPU corruption and boots with the Golden image.
	Critical	DP detects error in Unit.
certificateNotInstalled	Major	SUDI certificates are not programmed.
	Major	Failure to communicate with chassis ACT2LITE
softwareVersionMismatch	Major	The backup ISO image is not properly backed up and is corrupted.

Alarm	Severity	Probable Cause
vendorExtension	Major	Over current is observed on USB0.
	Major	Over current is observed on USB1.
	Major	CPU SSD temperature is high.
	Major	There is an OBFL read or write failure for the NODE scope.
	Major	There is an OBFL read or write failure for the RACK scope.
	Major	The Chassis SSD Temperature has exceeded threshold.

OpenROADM Alarm YANG Model Support

The following table displays the content of the active-alarm-list within the org-openroadm-alarm YANG module for every actively reported alarm on the OTN-XPL card.

YANG Node	Description
id	Unique ID for the alarm.
resource	Resource under alarm, specifies the instance of the resource. The format depends on the resource type.
probableCause	This is the alarm name.
raiseTime	Time stamp when the alarm was raised.
severity	Values such as critical, major, minor, warning, clear, indeterminate.
additional-detail	Provides additional descriptive text about the probable cause.

The following is a sample for retrieving the currently active alarms.

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:a29020cd-d7ee-4446-8079-eec0d804b491">
  <nc:get>
    <nc:filter>
      <active-alarm-list xmlns="http://org/openroadm/alarm">
        <activeAlarms/>
      </active-alarm-list>
    </nc:filter>
  </nc:get>
</nc:rpc>


<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:a29020cd-d7ee-4446-8079-eec0d804b491"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <active-alarm-list xmlns="http://org/openroadm/alarm">
```

```
      <activeAlarms>

<id>XR/HW_ETHERNET/121#CHASSIS/LCC/1:CONTAINER/LC/2:MODULE/TRC/1:MODULE/SLICE/0:PORT/OPTICS/6:PORT/ETHERNET/6</id>

        <resource>
          <device>
            <node-id>openroadm</node-id>
          </device>
          <resource>
            <interface-name>eth-Optics0/1/0/6/0/1/0/6</interface-name>
          </resource>
          <resourceType>
            <type>interface</type>
          </resourceType>
        </resource>
        <probableCause>
          <cause>localFault</cause>
          <direction>rx</direction>
          <location>nearEnd</location>
        </probableCause>
        <raiseTime>2020-10-13T05:04:44-00:00</raiseTime>
        <severity>major</severity>
        <additional-detail>Local Fault</additional-detail>
      </activeAlarms>
      <activeAlarms>

<id>XR/HW_G709/11#CHASSIS/LCC/1:CONTAINER/LC/2:MODULE/TRC/1:MODULE/SLICE/0:PORT/OPTICS/12:PORT/G709/12</id>

        <resource>
          <device>
            <node-id>openroadm</node-id>
          </device>
          <resource>
            <interface-name>otuc-Optics0/1/0/12/0/1/0/12</interface-name>
          </resource>
          <resourceType>
            <type>interface</type>
          </resourceType>
        </resource>
        <probableCause>
          <cause>lossOfSignalPayload</cause>
          <direction>rx</direction>
          <location>nearEnd</location>
        </probableCause>
        <raiseTime>2020-10-13T05:04:44-00:00</raiseTime>
        <severity>critical</severity>
        <additional-detail>Incoming Payload Signal Absent</additional-detail>
      </activeAlarms>
      <activeAlarms>

<id>XR/HW_G709/18#CHASSIS/LCC/1:CONTAINER/LC/2:MODULE/TRC/1:MODULE/SLICE/0:PORT/OPTICS/10:PORT/G709/10:PORT/G709/10</id>

        <resource>
          <device>
            <node-id>openroadm</node-id>
          </device>
          <resource>
            <interface-name>odu-Optics0/1/0/10/0/1/0/10.1</interface-name>
          </resource>
          <resourceType>
            <type>interface</type>
          </resourceType>
        </resource>
        <probableCause>
```

```
          <cause>alarmIndicationSignal</cause>
          <direction>rx</direction>
          <location>nearEnd</location>
        </probableCause>
        <raiseTime>2020-10-13T05:04:44-00:00</raiseTime>
        <severity>indeterminate</severity>
        <additional-detail>Path Monitoring Alarm Indication Signal</additional-detail>
      </activeAlarms>
    </active-alarm-list>
  </data>
</rpc-reply>
```

The following is a sample of a raise and clear event for the local fault alarm.

Raise Event

```
<?xml version="1.0" encoding="UTF-8"?>
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2020-10-16T01:54:29.66056+00:00</eventTime>
  <alarm-notification xmlns="http://org/openroadm/alarm">

<id>XR/HW_ETHERNET/121#CHASSIS/LCC/1:CONTAINER/LC/2:MODULE/TRC/1:MODULE/SLICE/0:PORT/OPTICS/6:PORT/ETHERNET/6</id>

    <resource>
      <device>
        <node-id>openroadm</node-id>
      </device>
      <resource>
        <interface-name>eth-Optics0/1/0/6/0/1/0/6</interface-name>
      </resource>
      <resourceType>
        <type>interface</type>
      </resourceType>
    </resource>
    <probableCause>
      <cause>localFault</cause>
      <direction>rx</direction>
      <location>nearEnd</location>
    </probableCause>
    <raiseTime>2020-10-16T01:54:27-00:00</raiseTime>
    <severity>major</severity>
    <additional-detail>Local Fault</additional-detail>
  </alarm-notification>
```

Clear Event

```
<?xml version="1.0" encoding="UTF-8"?>
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2020-10-16T01:56:01.229847+00:00</eventTime>
  <alarm-notification xmlns="http://org/openroadm/alarm">

<id>XR/HW_ETHERNET/121#CHASSIS/LCC/1:CONTAINER/LC/2:MODULE/TRC/1:MODULE/SLICE/0:PORT/OPTICS/6:PORT/ETHERNET/6</id>

    <resource>
      <device>
        <node-id>openroadm</node-id>
      </device>
      <resource>
        <interface-name>eth-Optics0/1/0/6/0/1/0/6</interface-name>
      </resource>
      <resourceType>
        <type>interface</type>
      </resourceType>
```

```
    </resource>
    <probableCause>
      <cause>localFault</cause>
      <direction>rx</direction>
      <location>nearEnd</location>
    </probableCause>
    <raiseTime>2020-10-16T01:54:27-00:00</raiseTime>
    <severity>clear</severity>
    <additional-detail>Local Fault</additional-detail>
  </alarm-notification>
</notification>
```

Threshold Crossing Alerts (TCAs)

Threshold crossing alerts (TCAs) can be provisioned for analog and digital PM parameters using absolute values. Low and high thresholds are supported. TCA notifications are displayed whenever a high or low threshold is crossed. The TCA notifications are transient in nature.

Using the *org-openroadm-tca.yang* model, you can set the TCAs for the PMs that are supported on the controller with granularities of 15 minutes or 24 hours.

Note TCAs cannot be configured on no-OAM ODUs in an MXP configuration. If 100GE is configured on the client side, then the client side ODU4 is the no-OAM ODU. If OTU4 is configured on the client side, then the trunk side ODU4 to which it is connected is the no-OAM ODU.

The following tables list the PMs for which the TCA can be set.

OTUCn

PM	Granularity	Threshold Low	Threshold High
erroredSeconds	15min	0	900
severelyErroredSeconds	15min	0	900
unavailableSeconds	15min	0	900
erroredBlockCount	15min	0	8850600
erroredSeconds	24Hour	0	86400
severelyErroredSeconds	24Hour	0	86400
unavailableSeconds	24Hour	0	86400
erroredBlockCount	24Hour	0	849657600

OTU4

PM	Granularity	Threshold Low	Threshold High
erroredSeconds	15min	0	900
severelyErroredSeconds	15min	0	900
unavailableSeconds	15min	0	900

erroredBlockCount	15min	0	8850600
preFECCorrectedErrors	15min	0	3156162969600
FECUncorrectableBlocks	15min	0	4724697600
erroredSeconds	24Hour	0	86400
severelyErroredSeconds	24Hour	0	86400
unavailableSeconds	24Hour	0	86400
erroredBlockCount	24Hour	0	849657600
preFECCorrectedErrors	24Hour	0	3156162969600
FECUncorrectableBlocks	24Hour	0	4724697600

OTSi

Note Analog PM thresholds (OPR/OPT) need to be configured in dbm units only

PM	Granularity	Threshold Low	Threshold High
opticalPowerOutputMax	15min	-30.0	63.3
opticalPowerOutputMin	15min	-30.0	63.3
opticalPowerInputMax	15min	-30.0	63.3
opticalPowerInputMin	15min	-30.0	63.3
preFECCorrectedErrors	15min	0	18446744073709551615
FECUncorrectableBlocks	15min	0	4724697600
opticalPowerOutputMax	24Hour	-30.0	63.3
opticalPowerOutputMin	24Hour	-30.0	63.3
opticalPowerInputMax	24Hour	-30.0	63.3
opticalPowerInputMin	24Hour	-30.0	63.3
preFECCorrectedErrors	24Hour	0	18446744073709551615
FECUncorrectableBlocks	24Hour	0	4724697600

ODUCn/ODUFLEX/ODUn

PM	Granularity	Threshold Low	Threshold High
erroredSeconds	15min	0	900
severelyErroredSeconds	15min	0	900
unavailableSeconds	15min	0	900
erroredBlockCount	15min	0	8850600
erroredSeconds	24Hour	0	86400

severelyErroredSeconds	24Hour	0	86400
unavailableSeconds	24Hour	0	86400
erroredBlockCount	24Hour	0	849657600

400G Ethernet

PM	Granularity	Threshold Low	Threshold High
fecUncorrectedCodewords	15min	1	18446744073709551615
fecCorrectedCodewords	15min	1	18446744073709551615
fecUncorrectedCodewords	24Hour	1	18446744073709551615
fecCorrectedCodewords	124Hour	1	18446744073709551615

100G Ethernet

PM	Granularity	Threshold Low	Threshold High
fecUncorrectedCodewords	15min	1	18446744073709551615
fecCorrectedCodewords	15min	1	18446744073709551615
inFrames	15min	1	4294967295
outFrames	15min	1	4294967295
codeViolations	15min	1	18446744073709551615
erroredSeconds	15min	0	900
severelyErroredSeconds	15min	0	900
unavailableSeconds	15min	0	900
fecUncorrectedCodewords	24Hour	1	18446744073709551615
fecCorrectedCodewords	24Hour	1	18446744073709551615
inFrames	24Hour	1	4294967295
outFrames	24Hour	1	4294967295
codeViolations	24Hour	1	18446744073709551615
erroredSeconds	24Hour	0	86400
severelyErroredSeconds	24Hour	0	86400
unavailableSeconds	24hour	0	86400

The following is a sample to provision a TCA entry.

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:d3282564-31e2-4e37-87d1-016926f12ebf"><nc:edit-config>
<nc:target>
<nc:running/>
</nc:target>
<nc:config>
<potential-tca-list xmlns="http://org/openroadm/tca">
<tca-entry>
<tca-resource-type>interface</tca-resource-type>
```

```
<tca-resource-type-extension>""</tca-resource-type-extension>
<tca-resource-instance>/org-openroadm-device/interface[name='otsi-Optics0/1/0/12/0/1/0/12']</tca-resource-instance>
<enabled>true</enabled>
<pm-entry>
<type>opticalPowerOutputMax</type>
<extension>""</extension>
<location>nearEnd</location>
<direction>tx</direction>
<measurement>
<granularity>15min</granularity>
<threshold-type>high</threshold-type>
<enabled>true</enabled>
<threshold-value>2</threshold-value>
</measurement>
</pm-entry>
</tca-entry>
</potential-tca-list>
</nc:config>
</nc:edit-config>
</nc:rpc>
```

Subscribe to OPENROADM notification to get all the notifications. The following is a sample of a OpenROADM notification subscription.

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:41dcdafa-e440-4eac-bb79-c45deec28791"><create-subscription
xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
    <stream>OPENROADM</stream>
  </create-subscription>
</nc:rpc>
```

When a TCA entry is configured, the corresponding change notification is triggered as shown below:

```
<?xml version="1.0" encoding="UTF-8"?>
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2021-01-22T09:11:43.036026+00:00</eventTime>
  <change-notification xmlns="http://org/openroadm/device">
    <change-time>2021-01-22T09:11:43.022374+00:00</change-time>
    <changed-by>
      <username>openroadm</username>
      <session-id>2596</session-id>
      <source-host>10.105.57.29</source-host>
    </changed-by>
    <datastore>running</datastore>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
      org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']

[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance=

      "/org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
      [org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12’]"]</target>
      <operation>create</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
      org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']

[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance=

      "/org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
```

```
[org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12']"]/org-openroadm-tca:tca-resource-type</target>

      <operation>replace</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
      org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']

[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance=

      "/org-openroadm-device:org-openroadm-device/org-openroadm-device:interface

[org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12']"]/org-openroadm-tca:tca-resource-type-extension</target>

      <operation>replace</operation>
    </edit>
   <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
      org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']

[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="

      /org-openroadm-device:org-openroadm-device/org-openroadm-device:interface

[org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12']"]/org-openroadm-tca:tca-resource-instance</target>

      <operation>replace</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
      org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']

[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="

      /org-openroadm-device:org-openroadm-device/org-openroadm-device:interface

[org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12']"]/org-openroadm-tca:enabled</target>

      <operation>replace</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
    org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']

[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="

   /org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
   [org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12']"]/org-openroadm-tca:pm-entry
   [org-openroadm-tca:type='opticalPowerOutputMax'][org-openroadm-tca:extension='""']
  [org-openroadm-tca:location='nearEnd'][org-openroadm-tca:direction='tx']</target>
      <operation>create</operation>
    </edit>
    <edit>
      <target xmlns:org-openroadm-tca="http://org/openroadm/tca">
   /org-openroadm-tca:potential-tca-list/org-openroadm-tca:tca-entry
 [org-openroadm-tca:tca-resource-type='interface']  [org-openroadm-tca:
 tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="
 /org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
  [org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12']"]/org-openroadm-tca:
```

```
 pm-entry[org-openroadm-tca:type='opticalPowerOutputMax'][org-openroadm-tca:extension='""']

[org-openroadm-tca:location='nearEnd'][org-openroadm-tca:direction='tx']/org-openroadm-tca:type

 </target>
      <operation>replace</operation>
    </edit>
    <edit>
      <target xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca

:potential-tca-list/org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']

[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="

/org-openroadm-device:org-openroadm-device/org-openroadm-device:interface[org-openroadm-device:name=

'otsi-Optics0/1/0/12/0/1/0/12’]"]/org-openroadm-tca:pm-entry[org-openroadm-tca:type='opticalPowerOutputMax']

[org-openroadm-tca:extension='""'][org-openroadm-tca:location='nearEnd'][org-openroadm-tca:direction='tx']

   /org-openroadm-tca:extension</target>
      <operation>replace</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
  org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']

[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance=

  "/org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
  [org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12’]"]/org-openroadm-tca:pm-entry
  [org-openroadm-tca:type='opticalPowerOutputMax'][org-openroadm-tca:extension='""']

[org-openroadm-tca:location='nearEnd'][org-openroadm-tca:direction='tx']/org-openroadm-tca:location

  </target>
      <operation>replace</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
   org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']

[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="

  /org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
  [org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12’]"]/org-openroadm-tca:
  pm-entry[org-openroadm-tca:type='opticalPowerOutputMax'][org-openroadm-tca:extension='""']

 [org-openroadm-tca:location='nearEnd'][org-openroadm-tca:direction='tx']/org-openroadm-tca:

  direction</target>
      <operation>replace</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
  org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']
```

```
[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="

  /org-openroadm-device:org-openroadm-device/org-openroadm-device:interface

[org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12’]"]/org-openroadm-tca:pm-entry[org-openroadm-tca:

  type='opticalPowerOutputMax'][org-openroadm-tca:extension='""']
 [org-openroadm-tca:location='nearEnd'][org-openroadm-tca:direction='tx']
/org-openroadm-tca:measurement[org-openroadm-tca:granularity='15min']
[org-openroadm-tca:threshold-type='high']</target>
      <operation>create</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
 org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']

[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="
/org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
[org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12’]"]/org-openroadm-tca:
pm-entry[org-openroadm-tca:type='opticalPowerOutputMax'][org-openroadm-tca:extension='""']
[org-openroadm-tca:location='nearEnd'][org-openroadm-tca:direction='tx']/org-openroadm-tca:
measurement[org-openroadm-tca:granularity='15min'][org-openroadm-tca:threshold-type='high']
/org-openroadm-tca:granularity</target>
      <operation>replace</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']
[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="
/org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
[org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12’]"]/org-openroadm-tca:pm-entry
[org-openroadm-tca:type='opticalPowerOutputMax'][org-openroadm-tca:extension='""']
[org-openroadm-tca:location='nearEnd'][org-openroadm-tca:direction='tx']
/org-openroadm-tca:measurement[org-openroadm-tca:granularity='15min'][org-openroadm-tca:threshold-type='high']
/org-openroadm-tca:threshold-type</target>
      <operation>replace</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']
[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="
/org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
[org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12’]"]/org-openroadm-tca:pm-entry
[org-openroadm-tca:type='opticalPowerOutputMax'][org-openroadm-tca:extension='""']
[org-openroadm-tca:location='nearEnd'][org-openroadm-tca:direction='tx']/org-openroadm-tca:
measurement[org-openroadm-tca:granularity='15min'][org-openroadm-tca:threshold-type='high']
/org-openroadm-tca:enabled</target>
      <operation>replace</operation>
    </edit>
    <edit>
      <target
xmlns:org-openroadm-tca="http://org/openroadm/tca">/org-openroadm-tca:potential-tca-list/
org-openroadm-tca:tca-entry[org-openroadm-tca:tca-resource-type='interface']
[org-openroadm-tca:tca-resource-type-extension='""'][org-openroadm-tca:tca-resource-instance="
/org-openroadm-device:org-openroadm-device/org-openroadm-device:interface
[org-openroadm-device:name='otsi-Optics0/1/0/12/0/1/0/12’]"]/org-openroadm-tca:pm-entry
[org-openroadm-tca:type='opticalPowerOutputMax'][org-openroadm-tca:extension='""']
[org-openroadm-tca:location='nearEnd'][org-openroadm-tca:direction='tx']
/org-openroadm-tca:measurement[org-openroadm-tca:granularity='15min'][org-openroadm-tca:threshold-type='high']
/org-openroadm-tca:threshold-value</target>
```

```
      <operation>replace</operation>
    </edit>
  </change-notification>
</notification>
```

TCA is also supported on client port optics. When you configure the TCA on a client port, it must be configured on the parent port. After configuring TCA on the parent port, the TCA is applied to all the four lanes on the device.

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:2466db67-1e28-4124-8e18-81b6bf66d2a7">
  <nc:edit-config>
    <nc:target>
      <nc:running/>
    </nc:target>
    <nc:config>
      <potential-tca-list xmlns="http://org/openroadm/tca">
        <tca-entry>
          <tca-resource-type>port</tca-resource-type>
          <tca-resource-type-extension>""</tca-resource-type-extension>

<tca-resource-instance>/org-openroadm-device/circuit-packs[circuit-pack-name='Optics0/1/0/10']/ports[port-name='0/1/0/10']
 </tca-resource-instance>
          <enabled>true</enabled>
          <pm-entry>
            <type>opticalPowerOutputMin</type>
            <extension>""</extension>
            <location>nearEnd</location>
            <direction>tx</direction>
            <measurement>
              <granularity>15min</granularity>
              <threshold-type>low</threshold-type>
              <enabled>true</enabled>
              <threshold-value>1.5</threshold-value>
            </measurement>
          </pm-entry>
        </tca-entry>
      </potential-tca-list>
    </nc:config>
  </nc:edit-config>
</nc:rpc>
```

However, the monitoring of TCA notifications is supported per lane.

```
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2020-10-30T14:38:00.312643+05:30</eventTime>
  <tca-notification xmlns="http://org/openroadm/tca">
    <tca-resource-instance xmlns:org-openroadm-device="http://org/openroadm/device">
/org-openroadm-device:org-openroadm-device/org-openroadm-device:circuit-packs[org-openroadm-device:circuit-pack-name='Optics0/1/0/10']
/org-openroadm-device:ports[org-openroadm-device:port-name='0/1/0/10/1']</tca-resource-instance>

    <tca-resource-type>port</tca-resource-type>
    <pm-type>opticalPowerOutputMin</pm-type>
    <pm-location>nearEnd</pm-location>
    <pm-direction>rx</pm-direction>
    <pm-granularity>15min</pm-granularity>
    <threshold-value>-30.0</threshold-value>
    <threshold-type>low</threshold-type>
    <pm-value>-40.0</pm-value>
    <raise-time>2020-10-28T14:35:11-00:00</raise-time>
  </tca-notification>
</notification>
```

Device Operations

The *org-openroadm-de-operations* YANG model includes RPC functions that control circuit-pack and device restart functions.

The following is a sample of a reload operation of the line card circuit pack.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <restart xmlns="http://org/openroadm/de/operations">
    <device>
      <node-id>openroadm</node-id>
    </device>
    <resource>
      <circuit-pack-name>0/0</circuit-pack-name>
    </resource>
    <resourceType>
      <type>circuit-pack</type>
    </resourceType>
    <option>warm</option>
  </restart>
</rpc>
```

```
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:d442718a-48e4-40cf-a35c-d56b261e8df4"><status
xmlns="http://org/openroadm/de/operations">Ok</status>
<status-message xmlns="http://org/openroadm/de/operations">Card graceful reload request on
 0/0 succeeded.</status-message>
</rpc-reply>
```

The following restart notification is displayed:

```
{
   "notification": {
      "@xmlns": "urn:ietf:params:xml:ns:netconf:notification:1.0",
      "eventTime": "2020-09-29T12:04:36.541178+00:00",
      "restart-notification": {
         "@xmlns": "http://org/openroadm/de/operations",
         "device": {
            "node-id": "openroadm"
         },
         "resource": {
            "circuit-pack-name": "0/0"
         },
         "resourceType": {
            "type": "circuit-pack"
         }
      }
   }
}
```

To perform a reload of the RP circuit pack, use the following RPC function.

```
<restart xmlns="http://org/openroadm/de/operations">
<resource>
<circuit-pack-name>0/RP0</circuit-pack-name>
</resource>
<resourceType>
<type>circuit-pack</type>
</resourceType>
```

```
<option>warm</option>
</restart>
```

```
<?xml version='1.0' encoding='UTF-8'?>
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:2182c640-6387-474c-80e9-a226efd1ce1d"><status
xmlns="http://org/openroadm/de/operations">Ok</status>
<status-message xmlns="http://org/openroadm/de/operations">Card graceful reload request on
 0/RP0 succeeded.</status-message>
</rpc-reply>
```

To perform a power cycle of the device set the resource type value as device and the restart option option as cold.

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:03b05261-65ff-468c-b094-efa22fb7ac3d">
  <restart xmlns="http://org/openroadm/de/operations">
    <resource>
      <node-id>openroadm</node-id>
    </resource>
    <resourceType>
      <type>device</type>
    </resourceType>
    <option>cold</option>
  </restart>
</nc:rpc>
```

```
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:03b05261-65ff-468c-b094-efa22fb7ac3d"><status
xmlns="http://org/openroadm/de/operations">Ok</status>
<status-message xmlns="http://org/openroadm/de/operations">Device reloaded successfully
!!</status-message>
</rpc-reply>
```

To perform a RP reload of the device set the resource type value as device and the restart option option as warm. This operation is not traffic impacting.

Loopback On A Interface

The OpenROADM MSA device model supports facility and terminal loopbacks on both Ethernet and OTU client-side and network-side interfaces. These loopbacks can be used to diagnose problems in the network before live traffic can be run.

Note An alarm is raised when loopback is enabled on the client on the network interface. This alarm is cleared when loopback is disabled.

A loopback is initiated on an interface by setting the *maint-loopback/enabled=true*. The resource must be in *maintenance* administrative state for the device to accept maintenance operations such as loopback.

A facility loopback or local loopback is used to test external connections to the interface. The OTN-XPL card supports facility loopback of *type=fac2* where FEC is supported and enabled.

A terminal loopback or remote loopback is used to test end-to-end circuits or test internal connections To establish this loopback on the OTN-XPL card, set the *type=term*.

The following table displays the type of loopback supported on the interfaces.

Interface	Loopback Type
400GE	fac2, term
100GE	fac, term
OTU4	fac, term
OTUCn	fac, term

The following is a sample to set the interface in maintenance and configure loopback:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
   <edit-config>
     <target>
     <running/>
    </target>
  <config>
 <org-openroadm-device xmlns="http://org/openroadm/device">
              <interface>
                 <name>eth-Optics0/1/0/8/0/1/0/8</name>
                 <administrative-state>maintenance</administrative-state>
                 <ethernet xmlns="http://org/openroadm/ethernet-interfaces">
                       <maint-loopback>
                         <enabled>true</enabled>
                         <type>term</type>
                        </maint-loopback>
                  </ethernet>
                </interface>
          </org-openroadm-device>
     </config>
   </edit-config>
</rpc>
```

The following is a sample to clear the loopback and set the interface in service:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
   <edit-config>
     <target>
     <running/>
    </target>
  <config>
 <org-openroadm-device xmlns="http://org/openroadm/device">
              <interface>
                 <name>eth-Optics0/1/0/8/0/1/0/8</name>
                 <administrative-state>inService</administrative-state>
                 <ethernet xmlns="http://org/openroadm/ethernet-interfaces">
                       <maint-loopback>
                         <enabled>false</enabled>
                       </maint-loopback>
                  </ethernet>
                </interface>
          </org-openroadm-device>
     </config>
   </edit-config>
</rpc>
```

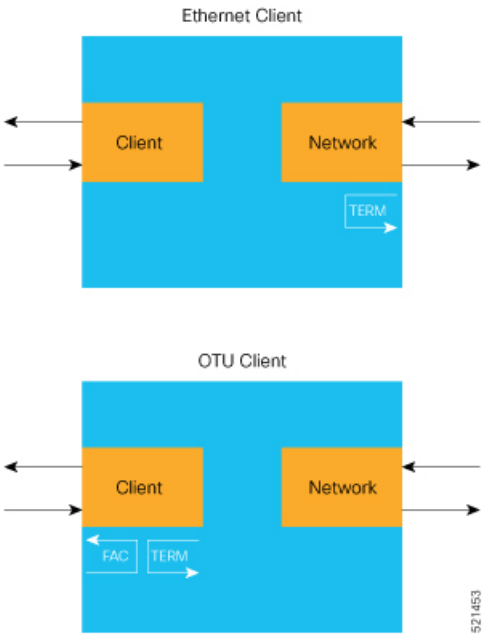
PRBS

The device supports the conducting of PRBS tests on ODU interfaces.

Note The interface admin state must be set to maintenance before PRBS is configured.

In the PRBS RPC request, setting *enabled=true* on the desired interface enables the test signal. The *testPattern* attribute must be set to *PRBS31*. The *type* attribute can take either facility (fac) or terminal (term) as values. The value that is assigned to the *type* attribute depends on:

- When PRBS is configured on the network side ODU4 and 100G ethernet is configured on the far end client side where the ODU4 is no-OAM, the type is configured as **term**.
- When PRBS is configured on the client side OTU4 or ODU4 and the network side ODU4 is no-OAM, the type configured is either **fac** or **term**.



The following is a sample to configure PRBS.

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:43d2acc3-8230-4a81-9414-e53a73389580"><nc:edit-config>
    <nc:target>
      <nc:running/>
    </nc:target>
    <nc:config>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>odu-Optics0/1/0/12/0/1/0/12.3</name>
          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <maint-testsignal>
              <enabled>true</enabled>
              <testPattern>PRBS31</testPattern>
```

```
            <type>term</type>
          </maint-testsignal>
        </odu>
      </interface>
    </org-openroadm-device>
  </nc:config>
</nc:edit-config>
</nc:rpc>
```

To verify the PRBS status, use the following RPC:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
          <name>odu-Optics0/1/0/12/0/1/0/12.3</name>
          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <maint-testsignal/>
          </odu>
        </interface>
      </org-openroadm-device>
    </filter>
  </get>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:5ef72505-60a8-43d3-b7c7-bdfa9cbf1395"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface>
        <name>odu-Optics0/1/0/12/0/1/0/12.3</name>
        <odu xmlns="http://org/openroadm/otn-odu-interfaces">
          <maint-testsignal>
            <enabled>true</enabled>
            <testPattern>PRBS31</testPattern>
            <type>term</type>
            <inSync>true</inSync>
            <seconds>54</seconds>
            <bitErrors>0</bitErrors>
          </maint-testsignal>
        </odu>
      </interface>
    </org-openroadm-device>
  </data>
</rpc-reply>
```

To clear all the maintenance and diagnostic counters, use the following *clear-diagnostics* action:

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:3dc8cccf-7d6c-4d13-b30b-ef29349f43ef">
  <action xmlns="urn:ietf:params:xml:ns:yang:1">
    <org-openroadm-device xmlns="http://org/openroadm/device">
      <interface>
        <name>odu-Optics0/1/0/12/0/1/0/12.3</name>
        <odu xmlns="http://org/openroadm/otn-odu-interfaces">
          <maint-testsignal>
            <clear-diagnostics>
              <type>term</type>
            </clear-diagnostics>
          </maint-testsignal>
```

```
        </odu>
      </interface>
    </org-openroadm-device>
  </action>
</nc:rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:3dc8cccf-7d6c-4d13-b30b-ef29349f43ef"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/otn-odu-interfaces">Ok</status>

  <status-message xmlns="http://org/openroadm/otn-odu-interfaces">Diagnostics cleared
successfully!!</status-message>


</rpc-reply>
```

When PRBS is enabled, the following alarm notification is displayed:

```
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2020-11-29T15:45:20.142827+05:30</eventTime>
  <alarm-notification xmlns="http://org/openroadm/alarm">

<id>ORM_ALM/HW/MAINT_TESTSIGNAL/1#CHASSIS/LCC/1:CONTAINER/LC/1:MODULE/TRC/1:PORT/OPTICS/8</id>

    <resource>
      <device>
        <node-id>openroadm</node-id>
      </device>
      <resource>
        <interface-name>odu-Optics0/1/0/12/0/1/0/12.3</interface-name>
      </resource>
      <resourceType>
        <type>interface</type>
      </resourceType>
    </resource>
    <probableCause>
      <cause>terminalTestsignalActive</cause>
      <direction>notApplicable</direction>
      <location>notApplicable</location>
    </probableCause>
    <raiseTime>2020-11-29T15:45:20-00:00</raiseTime>
    <severity>warning</severity>
    <additional-detail>PRBS terminal maintainence testsignal active</additional-detail>
  </alarm-notification>
</notification>
```

When PRBS is disabled or the interface on which PRBS was configured is deleted, the clear alarm notification is displayed.

```
notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2020-11-29T15:46:08.435416+05:30</eventTime>
  <alarm-notification xmlns="http://org/openroadm/alarm">

<id>ORM_ALM/HW/MAINT_TESTSIGNAL/1#CHASSIS/LCC/1:CONTAINER/LC/1:MODULE/TRC/1:PORT/OPTICS/8</id>

    <resource>
      <device>
        <node-id>openroadm</node-id>
      </device>
      <resource>
        <interface-name>odu-Optics0/1/0/12/0/1/0/12.3</interface-name>
      </resource>
      <resourceType>
```

```
        <type>interface</type>
      </resourceType>
    </resource>
    <probableCause>
      <cause>terminalTestsignalActive</cause>
      <direction>notApplicable</direction>
      <location>notApplicable</location>
    </probableCause>
    <raiseTime>2020-11-29T15:45:20-00:00</raiseTime>
    <severity>clear</severity>
    <additional-detail>PRBS terminal maintainence testsignal active</additional-detail>
  </alarm-notification>
</notification>
```

File Management

The file structure of the OpenROADM device model is flat and does not contain subdirectories. The device supports simple file operations with the OpenROADM controller. When an operation generates multiple files, they are placed in a tarball and zipped in a single file which is stored locally in the flat file structure on the device. Files used for software upgrade operations, database backup and restore operations, and syslog messages are stored in this file system.

The OpenROADM controller accesses the device directory structure through RPC calls. The device supports the following RPC calls:

- *transfer* — Supports file upload and download operations from the SFTP server to the device and the other way round.
- *show-file* — Retrieves list of files and its details from the device file system.
- *delete-file* — Deletes the specified file from the device file system.

The following is a sample of a file download:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<transfer xmlns="http://org/openroadm/file-transfer">
<action>download</action>
<local-file-path>/misc/disk2/ncs-python-vm.log</local-file-path>
<remote-file-path>sftp://user:password@server-ip/path/ncs-python-vm.log /remote-file-path
</transfer>
</rpc>
```

Note In the case of IPv6, the *server-ip* is enclosed in [ ].

```
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:c659a89c-878d-488d-9299-339d93f1c614"><status
xmlns="http://org/openroadm/file-transfer">Successful</status>
<status-message xmlns="http://org/openroadm/file-transfer">Started SFTP download operation
 asynchronously</status-message>
</rpc-reply>
```

The following file transfer notification is displayed:

```
notification
 eventTime 2020-10-23T00:09:36.550259+00:00
transfer-notification
  local-file-path /misc/disk2/ncs1004-golden-x-7.3.1.33I-V1.iso
  status Successful
  status-message File download operation is successful
!
!
```

The following is a sample for retrieving the list of files. It lists the filename, file size, and the last modified date for every file. You can leave the filename blank to fetch all files or use an asterisk (*) for a wildcard search.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<show-file xmlns="http://org/openroadm/file-transfer"/>
</rpc>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="1">
  <status xmlns="http://org/openroadm/file-transfer">Successful</status>
  <status-message xmlns="http://org/openroadm/file-transfer">Show RPC
successful</status-message>
  <file xmlns="http://org/openroadm/file-transfer">
    <filename>/misc/disk2/history_pm_2020-11-20T05-52-25.txt.gz</filename>
    <file-size>103</file-size>
    <modified-date>2020-11-20T05:52:25.379308711+00:00</modified-date>
  </file>
  <file xmlns="http://org/openroadm/file-transfer">
    <filename>/misc/disk2/ncs1004-golden-x-7.3.1.30I-V1.iso</filename>
    <file-size>2379608064</file-size>
    <modified-date>2020-11-18T13:18:24.010121249+00:00</modified-date>
  </file>
  <file xmlns="http://org/openroadm/file-transfer">
    <filename>/misc/disk2/syslog_messages</filename>
    <file-size>1933824</file-size>
    <modified-date>2020-11-20T05:53:41.868311328+00:00</modified-date>
  </file>
</rpc-reply>
```

The following is a sample for deleting a file:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<delete-file xmlns="http://org/openroadm/file-transfer">
<filename>/misc/disk2/history_pm_2020-11-20T05-52-25.txt.gz</filename>
</delete-file>
</rpc>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="1">
  <status xmlns="http://org/openroadm/file-transfer">Successful</status>
  <status-message xmlns="http://org/openroadm/file-transfer">Successfully deleted file:
/misc/disk2/history_pm_2020-11-20T05-52-25.txt.gz</status-message>
</rpc-reply>
```

Software Upgrades

The device uses the following RPCs for software upgrades:

- **File Transfer RPC**— Downloads the software package from an external storage to the device using SFTP.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<transfer xmlns="http://org/openroadm/file-transfer">
<action>download</action>
<local-file-path>/misc/disk2/ncs1004-golden-x-7.3.1.30I-V1.iso</local-file-path>
<remote-file-path>sftp://user[:password]@[host:port]/path/ncs1004-golden-x-7.3.1.30I-V1.iso</remote-file-path>
</transfer>
</rpc>
```

The following sample is an RPC request that downloads the software package from an external storage to the device using SFTP.

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:3a295def-8b55-47b9-a6f9-2b03f131eb89"><transfer
xmlns="http://org/openroadm/file-transfer">
<action>download</action>
<local-file-path>/misc/disk2/ncs1004-golden-x-7.8.1.30I-V1.iso</local-file-path>
<remote-file-path>sftp://root:password@[2001:420:5446:2014::364:26]/bh/GISO/GISO/ncs1004-golden-x-7.8.1.30I-V1.iso</remote-file-path>
</transfer>
</nc:rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:7180f03e-b8e4-4477-a06a-c43568e6cc48"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/file-transfer">Successful</status>


  <status-message xmlns="http://org/openroadm/file-transfer">Started SFTP download
operation asynchronously</status-message>


</rpc-reply>
```

The following file transfer notification is displayed:

```
<notification
xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0"><eventTime>2020-10-23T07:32:23.50912+00:00</eventTime>
<transfer-notification xmlns="http://org/openroadm/file-transfer">
  <local-file-path>/misc/disk2/ncs1004-golden-x-7.3.1.30I-V1.iso</local-file-path>
  <status>Successful</status>
  <status-message>File download operation is successful</status-message>
</transfer-notification>
</notification>
```

Note The file transfer status notification is displayed only after the completion of the file transfer because it is an asynchronous operation.

Note If the OpenROADM alarms in the following table are active on the system and the additional details in the table are in the RPC, it stops:

- Software staging
- DB init
- DB restore
- RP circuit pack firmware upgrade
- RP circuit pack warm/cold reload

OpenROADM Alarm	Additional Details
firmwareDownloadOrActivationFailure	BIOS is corrupt, system booted with golden copy
	BP_FPGA is corrupt, system booted with golden copy
	SEU Errors DP Device, Reload Required
	CPU_FPGA is corrupt, system booted with golden copy
	SEU Un-corrected errors BP_FPGA, reload required
equipmentInterConnectFailure	PEX Switch access failed
	BP_FPGA Device offline
	CPU_FPGA Device offline
	BP FPGA XR end point device offline
	Chassis SSD Has ATA Errors
	Chassis SSD is faulty
	CPU SSD Has ATA Errors
equipmentFault	XGE FLASH access failure
	CPU Flash 0 access failure
	CPU Flash 1 access failure
	BP FPGA Flash access failure
	Eth-Switch: EEPROM corrupted

- **Software stage RPC** — Prepares and stages the new software load to be installed on the device. The following notification is displayed:

  Software stage notification — returns a success or fail notification.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<sw-stage xmlns="http://org/openroadm/de/swdl">
<filename>/misc/disk2/ncs1004-golden-x-7.3.1.30I-V1.iso</filename>
</sw-stage>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:0de7901b-76d1-4ecb-a588-67637f308ba9"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/de/swdl">Successful</status>


  <status-message xmlns="http://org/openroadm/de/swdl">SW Stage Started
asynchronously</status-message>


</rpc-reply>
```

The following notification is displayed:

```
<notification
xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0"><eventTime>2020-10-23T07:37:54.276501+00:00</eventTime>
<sw-stage-notification xmlns="http://org/openroadm/de/swdl">
  <status>Successful</status>
  <status-message>sw-stage successful for
ncs1004-golden-x-7.3.1.30I-V1.iso</status-message>
</sw-stage-notification>
</notification>
```

A *pending-sw* container is a read-only container that is populated and used during the staging phase of a software upgrade operation. It contains the following:

- *sw-version* — Displays the sw-version of the staged software. This is populated after the software staging is complete.
- *sw-validation-timer* — This attribute is applicable only if the software activate RPC was run with a non-zero value for the validation timer. This value is displayed after the device comes up after a reboot with the new sw-version. It displays the time remaining to perform the validation of the new software load. When this timer is running, you can send the `cancel-validation-timer` RPC with the `accept` parameter set to true to accept the new software load. Alternatively you can rollback to a previous sw-version by sending the `cancel-validation-timer` RPC with the `accept` parameter set to false. If you do not provide an input for the `accept` parameter, the timer elapses and the node rolls back to the previous sw-version.
- *activation-date-time* — Displays the timestamp when new sw-version was activated.

- **Software activate RPC** — Activates the software after a software stage operation. The device reboots after completion of the software activation.

  The following notifications are displayed:

  - *Activate* — The software image has been activated. This is displayed upon successful completion of the `sw-activate` request.
  - *Commit* —The software has been committed. This is displayed for a `sw-activate` request without a validation timer. In the case of a `sw-activate` request with a validation timer, it is displayed after a `cancel-validation-timer` request has been sent with the `accept` parameter set to true.



Note Configuration commits are rejected until the software commit is complete.

- *Cancel* —The software load has been cancelled. This is displayed after a `cancel-validation-timer` request has been sent with the accept parameter set to false or the expiry of the `cancel-validation-timer`.

sw-activate with validation timer:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <sw-activate xmlns="http://org/openroadm/de/swdl">
    <version>7.3.1.30I-V1</version>
    <validationTimer>00-00-00</validationTimer>
  </sw-activate>
</rpc>
```

sw-activate without validation timer:

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:b280376f-f499-4583-9143-5e6b319e7e76"><sw-activate
xmlns="http://org/openroadm/de/swdl">
<version>7.3.1.30I-V1</version>
</sw-activate>
</nc:rpc>
```

```
<rpc-reply message-id="urn:uuid:b280376f-f499-4583-9143-5e6b319e7e76"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/de/swdl">Successful</status>


  <status-message xmlns="http://org/openroadm/de/swdl">SW Activate Started asynchronously
 for pkg ncs1004-golden-x-7.3.1.30I-V1</status-message>


</rpc-reply>
```

```
<notification
xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0"><eventTime>2020-11-04T00:06:36.342319+00:00</eventTime>
<sw-activate-notification xmlns='http://org/openroadm/de/swdl'>
  <sw-active-notification-type>activate</sw-active-notification-type>
  <status>Successful</status>
  <status-message>sw-activate successful for
ncs1004-golden-x-7.3.1.30I-V1</status-message>
</sw-activate-notification>
```

```
<sw-activate-notification xmlns='http://org/openroadm/de/swdl'>
  <sw-active-notification-type>commit</sw-active-notification-type>
  <status>Successful</status>
  <status-message>Commit Successful</status-message>
</sw-activate-notification>
```



Note The validation timer can be used for validating the software before it is committed by setting it to a non-zero value. When this timer is running, you can send the `cancel-validation-timer` RPC with the `accept` parameter set to true to accept the new software load. Alternatively, you can rollback to a previous sw-version by sending the `cancel-validation-timer` RPC with the `accept` parameter set to false.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="101">
  <cancel-validation-timer xmlns="http://org/openroadm/de/swdl">
    <accept>true</accept>
  </cancel-validation-timer>
</rpc>
```

```
<?xml version='1.0' encoding='UTF-8'?>
<ok xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"/>
```

```
<sw-activate-notification xmlns='http://org/openroadm/de/swdl'>
  <sw-active-notification-type>commit</sw-active-notification-type>

  <status>Successful</status>
  <status-message>Commit Successful</status-message>
</sw-activate-notification>
```

Manifest File

The manifest file provides a basic set of attributes and then an instruction set that describes the sequence of RPC requests required to perform the operation. The OpenROADM controller uses the manifest file to detail how the device performs a software download operation. The following is a sample of a manifest file.

```
{
  "vendor": "Cisco Systems, Inc.",
    "model": "NCS1004",
    "sw-version": "7.3.1.30I-V1",
    "global-async-timeout": 5400,
    "global-sync-timeout": 300,
    "instruction-set": [{
      "index": 1,
      "from-sw-version": ["7.3.1.28I-V1"],
      "is-commit-sw-activate-async": "true",
      "sw-manifest-commands": {
        "sw-manifest-command": [
        {
          "command-order": 1,
          "command": "org-openroadm-manifest-file:download-file",
          "download-file": {
            "remote-filename":
"sftp://username:password@host_ip:[port]/path/ncs1004-golden-x-7.3.1.30I-V1.iso",
            "local-file-path": "/misc/disk2/ncs1004-golden-x-7.3.1.30I-V1.iso",
            "timeout": 1800,
            "is-async": "true"
          }
        },
        {
          "command-order": 2,
          "command": "org-openroadm-manifest-file:sw-stage",
```

```
          "sw-stage": {
            "filename": "/misc/disk2/ncs1004-golden-x-7.3.1.30I-V1.iso",
            "timeout": 1200,
            "is-async": "true"
          }
        },
        {
          "command-order": 3,
          "command": "org-openroadm-manifest-file:delete-file",
          "delete-file": {
            "filename": "/misc/disk2/ncs1004-golden-x-7.3.1.30I-V1.iso",
            "is-async": "false"
          }
        },
        {
          "command-order": 4,
          "command": "org-openroadm-manifest-file:sw-activate",
          "sw-activate": {
            "validation-timer": "00-00-00",
            "auto-reboot": 1800,
            "version": "7.3.1.30I-V1",
            "timeout": 5400,
            "is-async": "true"
          }
        }
        ]
      }
    }]
}
```

The following is a sample of a manifest file with validation timer.

```
{
  "vendor": "Cisco Systems, Inc.",
    "model": "NCS1004",
    "sw-version": "7.3.1.30I-V1",
    "global-async-timeout": 5400,
    "global-sync-timeout": 300,
    "instruction-set": [{
      "index": 1,
      "from-sw-version": ["7.3.1.28I-V1"],
      "is-commit-sw-activate-async": "true",
      "cancel-validation-timer-async-timeout": 2700,
      "sw-manifest-commands": {
        "sw-manifest-command": [
        {
          "command-order": 1,
          "command": "org-openroadm-manifest-file:download-file",
          "download-file": {
            "remote-filename":
"sftp://username:password@host_ip:[port]/path/ncs1004-golden-x-7.3.1.30I-V1.iso",
            "local-file-path": "/misc/disk2/ncs1004-golden-x-7.3.1.30I-V1.iso",
            "timeout": 1800,
            "is-async": "true"
          }
        },
        {
          "command-order": 2,
          "command": "org-openroadm-manifest-file:sw-stage",
          "sw-stage": {
            "filename": "/misc/disk2/ncs1004-golden-x-7.3.1.30I-V1.iso",
            "timeout": 1200,
            "is-async": "true"
          }
        },
```

```
        {
          "command-order": 3,
          "command": "org-openroadm-manifest-file:delete-file",
          "delete-file": {
            "filename": "/misc/disk2/ncs1004-golden-x-7.3.1.30I-V1.iso",
            "is-async": "false"
          }
        },
        {
          "command-order": 4,
          "command": "org-openroadm-manifest-file:sw-activate",
          "sw-activate": {
            "validation-timer": "01-30-00",
            "auto-reboot": 1800,
            "version": "7.3.1.30I-V1",
            "timeout": 5400,
            "is-async": "true"
          }
        }
        ]
      }
    }]
}
```

Firmware Upgrades

A firmware upgrade upgrades the firmware on the specified circuit pack. There are three scenarios in which firmware upgrades happen. They are:

- During a software download operation—After the software activation process, all firmware that are non service-affecting are upgraded.
- During a DE-Operation—During a circuit pack cold restart, all the firmware related to the circuit pack that are in the NEED UPGD state are upgraded.



Note The BIOS of the RP controller needs a cold restart operation for it to be upgraded.

- Specific firmware upgrades of a circuit pack using the *org-openroadm-fwdl.yang* model.

The following is a sample of a circuit pack firmware upgrade using the *org-openroadm-fwdl.yang* model .

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<fw-update xmlns="http://org/openroadm/fwdl">
<circuit-pack-name>0/1</circuit-pack-name>
</fw-update>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:c519abdc-1118-4098-80c2-21e3d1925bfc"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
<status xmlns="http://org/openroadm/fwdl">Successful</status>


<status-message xmlns="http://org/openroadm/fwdl">FPD upgrade started
asynchronously</status-message>
```

```
</rpc-reply>
```

During a firmware upgrade, DE operations performed on the same circuit pack are rejected.

When a line card with software version prior to Release 7.5.2, is inserted in the chassis, the supported LC mode is automatically configured and the line card becomes operational. Perform a cold restart of the line card to upgrade the firmware. After the firmware upgrade is complete, the Release 7.5.2 configuration which was already configured on the node is applied automatically.



Restriction You must not perform multiple line card FPD upgrade operations simultaneously. Wait for an FPD upgrade operation to return a successful response before proceeding with the next FPD upgrade. NCS 1004 supports FPD upgrades of only one line card at a time.

Trail Trace Identifiers (TTI)

Trail Trace Identifiers (TTI) are used to identify a signal from source to destination in an OTN network . The TTI is a 64-byte multi-frame signal that occupies one byte of the frame aligned with the OTUk multi-frame and transmitted four times per multi-frame. The TTI includes the Source Access Point Identifier (SAPI) and Destination Access Point Identifier (DAPI). The TTI byte is carried in the OTUk Section Monitoring (SM) overhead, ODUk Path Monitoring (PM) overhead, and ODUk Tandem Connection Monitoring (TCM) overhead.

For adjacency discovery, the TTI that is sent out of the interface can be configured by the controller and the TTI received from the interface can be retrieved by the controller. The TTI can then be used to discover or confirm network topology.

The operator or controller provisions the 15-character transmitted API strings (*tx-sapi*, *tx-dapi*) and the 32-character transmitted operator specific string (*tx-operator*). The operator or controller may provision the 15-character expected API strings (*expected-sapi*, *expected-dapi*) if TTI mismatch detection is desired. Note: implementations shall automatically add the SAPI[0] and DAPI[0] fields (fixed to all-0s) per ITU-T G.709 [D].

The received API strings (*accepted-sapi*, *accepted-dapi*, *accepted-operator*) are retrieved from the received multi-frame TTI field. An *otn-tti-info-change* notification (*resource-type*, *otn-interface-type*, *otn-interface-tcm-layer*, *otn-interface-tcm-direction*, *accepted-sapi*, *accepted-dapi*, *accepted-operator*) is generated when any changes to the received TTI attributes (*accepted-sapi*, *accepted-dapi*, *accepted-operator*) occur.

A TTI Mismatch (TIM) alarm is raised when the received string (*accepted-sapi* or *accepted-dapi*) is different than the expected provisioned string (*expected-sapi* or *expected-dapi*). The followingTIM detection modes (*tim-detect-mode*) are modeled against a device:

- *Disabled*: TTI is ignored
- *SAPI*: the *expected-sapi* is compared to the *accepted-sapi* (other TTI fields are ignored)
- *DAPI*: the *expected-dapi* is compared to the *accepted-dapi* (other TTI fields are ignored)
- *SAPI-and-DAPI:* the *expected-sapi* and *expected-dapi* are compared to the *accepted-sapi* and *accepted-dapi* (*accepted-operator* is ignored)

The following is a sample to configure TTI on OTUc interfaces.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<edit-config>
<target>
<running/>
</target>
<config>
<org-openroadm-device xmlns="http://org/openroadm/device">
<interface>
<name>otuc-Optics0/1/0/12/0/1/0/12</name>
<otu xmlns="http://org/openroadm/otn-otu-interfaces">
<tx-sapi>@#@$%%!!kjkdfdK</tx-sapi>
<tx-dapi>@#@$%%!!kjkdfdL</tx-dapi>
<tx-operator>@#@$%%!!kjkdfdON</tx-operator>
<expected-sapi>@#@$%%!!kjkdfdL</expected-sapi>
<expected-dapi>@#@$%%!!kjkdfdK</expected-dapi>
</otu>
</interface>
</org-openroadm-device>
</config>
</edit-config>
</rpc>
```

The following is a sample to configure TTI on ODUc interfaces.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<edit-config>
<target>
<running/>
</target>
<config>
<org-openroadm-device xmlns="http://org/openroadm/device">
<interface>
<name>oduc-Optics0/2/0/12/0/2/0/12</name>
<odu xmlns="http://org/openroadm/otn-odu-interfaces">
<tx-sapi>@#@$%%!!kjkdfdL</tx-sapi>
<tx-dapi>@#@$%%!!kjkdfdK</tx-dapi>
<tx-operator>@#@$%%!!kjkdfdKszf534343423#!@#$</tx-operator>
<expected-sapi>@#@$%%!!kjkdfdK</expected-sapi>
<expected-dapi>@#@$%%!!kjkdfdL</expected-dapi>
<tim-act-enabled>true</tim-act-enabled>
</odu>
</interface>
</org-openroadm-device>
</config>
</edit-config>
</rpc>
```

If the *tim-act-enabled* attribute is set to true, traffic is impacted when the TIM alarm is raised.

The following is a sample to retrieve TTI values for OTUc interfaces:

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <get>
    <filter>
      <org-openroadm-device xmlns="http://org/openroadm/device">
        <interface>
           <name>otuc-Optics0/1/0/12/0/1/0/12</name>
          <odu xmlns="http://org/openroadm/otn-odu-interfaces">
            <accepted-sapi/>
            <accepted-dapi/>
            <accepted-operator/>
          </odu>
        </interface>
      </org-openroadm-device>
    </filter>
```

```
  </get>
</rpc>
```

Database Backup and Restore Operations

The device supports the *org-openroadm-database.yang* model. The following functions are supported:

- The database backup operation allows you to back up the local device configuration data to a file.
- The database restore operation allows you restore a previously backed database. This is required if there was a device database corruption or configuration issue, and you want to revert to a previously known state. This operation is followed by a RP reload.
- The database-init operation allows you to restore a device to its factory default configuration. This operation is followed by a RP reload.

The following RPCs calls are supported:

- ***db-backup*** [*filename*] **RPC**—Copies the current running configuration to the specified *.dbs* file. A ***db-backup-notification*** is generated as a result of a batabase backup operation.
- ***db-restore*** [*filename*] [*nodeIDCheck*] **RPC**—Stages the *.dbs* file for the restore operation. If the *nodIDCheck* attribute is enabled, it compares the *nodeId* in the specified database file to the *nodeId* of the device and the operation is rejected if they do not match.
- ***db-activate*** **RPC**—Activates the new configuration that was read from the *.dbs* file and the device is reloaded.

  The following notifications are sent after the db-activate is complete:

  Activate — The restore operation is started and the NSO is reloaded.

  Commit —The restore operation has been committed.



Note The db-activate and db-commit notifications are sent after the device is reloaded following a *db-activate* operation. These notifications are sent before port 830 is up for connections when the device comes up with the restored configuration. Use the replay notifications support with an appropriate value for the *startTime* attribute to receive these notifications.

- ***database-init*** **RPC** —Applies the default configuration (the factory default) to the device.

Replay Notification

The device supports the notification replay feature. The replay feature enables you to request the device to send or resend previously logged event notifications asynchronously.

The replay is defined by the following attributes in the *create-subscription* RPC:

- *startTime* — Indicates that the subscription request is for a replay of the event notifications starting at the specified time. The time specified must not be later than the current time.
- *stopTime* — Indicates the end time of the replay request. The time must not be earlier than the *startTime* .

If both the *startTime* and *stopTime* parameters are present, the subscription request is for a replay of the event notifications starting at the specified *startTime* and ending at the specified *stopTime*. After the replay is complete, the subscription terminates and it becomes a normal NETCONF session.

If the *startTime* parameter is present but the *stopTime* parameter is not present, event notifications will continue until the subscription is terminated. If the subscription includes a *stopTime*, the session becomes a normal NETCONF session again after the *stopTime* has been reached. A *replayComplete* notification is sent after all the replay event notifications have been sent.

The following is a RPC sample for the database backup operation.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <db-backup xmlns="http://org/openroadm/database"/>
</db-backup>
</rpc>
```

Note A system defined filename with a timestamp is created for the backup file if the *filename* attribute is not provided.

Note The *rollbackTimer* attribute is not applicable while performing the db-activate operation because database rollback is not supported. The cancel-rollback-timer RPC is also not supported.

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:b9558ff2-18ef-4e18-a658-686a84e29035"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/database">Successful</status>
  <status-message xmlns="http://org/openroadm/database">DB backup operation started
asynchronously</status-message>
</rpc-reply>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2020-09-23T23:34:51.842975+00:00</eventTime>
  <db-backup-notification xmlns="http://org/openroadm/database">
    <status>Successful</status>
    <status-message>DB backup file /misc/disk2/openroadm_backup_2020923_233448.DBS created
 successfully</status-message>
  </db-backup-notification>
</notification>
```

The following is a RPC sample for the database restore operation.

```
<nc:rpc xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
message-id="urn:uuid:c92e27ce-c063-423e-8d3f-802b2f63798d">
  <db-restore xmlns="http://org/openroadm/database">
    <filename>/misc/disk2/openroadm_backup_2020923_233448.DBS</filename>
    <nodeIDCheck>true</nodeIDCheck>
  </db-restore>
</nc:rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:c92e27ce-c063-423e-8d3f-802b2f63798d"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/database">Successful</status>
  <status-message xmlns="http://org/openroadm/database">Successfully staged the file
```

```
/misc/disk2/openroadm_backup_2020923_233448.DBS for db-restore</status-message>
</rpc-reply>
```

The following is a RPC sample for the database activate operation.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
<db-activate xmlns="http://org/openroadm/database"/>
</rpc>
```

```
<?xml version="1.0" ?>
<rpc-reply message-id="urn:uuid:14addd6e-e9d4-4a7b-9e7f-349cd67ac04e"
xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
  <status xmlns="http://org/openroadm/database">Successful</status>
  <status-message xmlns="http://org/openroadm/database">db-activate started
asynchronously</status-message>
</rpc-reply>
```

The following notifications are displayed after a db-activate operation is successful.

```
<?xml version="1.0" encoding="UTF-8"?>
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2020-09-23T23:40:15.435716+00:00</eventTime>
  <db-activate-notification xmlns="http://org/openroadm/database">
    <db-active-notification-type>activate</db-active-notification-type>
    <status>Successful</status>
    <status-message>DB activate successful</status-message>
  </db-activate-notification>
</notification>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2020-09-23T23:40:15.936852+00:00</eventTime>
  <db-activate-notification xmlns="http://org/openroadm/database">
    <db-active-notification-type>commit</db-active-notification-type>
    <status>Successful</status>
    <status-message>DB commit successful</status-message>
  </db-activate-notification>
</notification>
```

Create Tech Information

The create-tech-info RPC function is used to generate log files for debugging issues. The output file is saved in a location that is accessible through SFTP.

The following is a sample of the create-tech info RPC call.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <create-tech-info xmlns="http://org/openroadm/device">
    <shelf-id>0</shelf-id>
    <log-option>ncs1004</log-option>
  </create-tech-info>
</rpc>
```

```
{
   "{urn:ietf:params:xml:ns:netconf:base:1.0}rpc-reply": {
   "@message-id": "urn:uuid:88965338-6d8e-40bc-8dec-46e06b791ed6",
  "shelf-id": 0,
"status": "Successful",
  "status-message": "techInfo Log collection started..."
   }
}
```

A create-tech-info-notification is sent out later for the result of the operation as displayed below:

```
{
   "notification": {
      "@xmlns": "urn:ietf:params:xml:ns:netconf:notification:1.0",
      "eventTime": "2020-10-22T23:53:34.372007+00:00",
      "create-tech-info-notification": {
         "@xmlns": "http://org/openroadm/device",
         "shelf-id": "0",
         "log-file-name": "/misc/disk2/techInfo_2020-10-22T23-53-32_ncs1004_complete.tgz",
         "status": "Successful",
         "status-message": "collected the data"
      }
   }
}
```


Gather System Logs

The Syslog protocol (RFC 5424 [AA]) is used to log device event notifications. An OpenROADM MSA device supports logging of all device event notifications to a syslog file on its local filesystem.

The following is a sample of the *syslog* RPC function.

```
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="101">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <syslog xmlns="http://org/openroadm/syslog">
        <log-actions>
          <remote>
            <destination>
              <name>bodest</name>
              <udp>
                <address>10.105.57.119</address>
                <port>22</port>
              </udp>
              <log-selector>
                <log-facility>
                  <facility>all</facility>
                  <severity>alert</severity>
                  <severity-operator>equals-or-higher</severity-operator>
                </log-facility>
              </log-selector>
            </destination>
          </remote>
        </log-actions>
      </syslog>
    </config>
  </edit-config>
</rpc>
```

OpenROADM Debuggability

Use any one of the following methods to obtain logs for debugging an OpenROADM configuration.

- Using telnet:

  1. Telnet to the device and enter the device password.

```
bash-4.2$ telnet 10.105.57.41
Trying 10.105.57.41...
Connected to 10.105.57.41.
Escape character is '^]'.

User Access Verification

Username: openroadm
Password:
RP/0/RP0/CPU0:ios#
```

2. To gather logs and traces, run the CLI command, **show tech-support ncs1004**.

```
RP/0/RP0/CPU0:ios#show tech-support ncs1004
Wed Dec 9 22:23:47.966 UTC
++ Show tech start time: 2020-Dec-09.222348.UTC ++
Wed Dec 9 22:23:49 UTC 2020 Waiting for gathering to complete
.....................................................................................
Wed Dec 9 22:28:54 UTC 2020 Compressing show tech output
Show tech output available at 0/RP0/CPU0 :
/harddisk:/showtech/showtech-ncs1004-2020-Dec-09.222348.UTC.tgz
++ Show tech end time: 2020-Dec-09.222913.UTC ++
```

3. To collect logs outside the device, run the XR VM. Change the directory to showtech and copy the *.tgz* log file from the device to the remote host system.

```
RP/0/RP0/CPU0:ios#run
Wed Dec 9 22:30:17.451 UTC
[xr-vm_node0_RP0_CPU0:~]$cd /harddisk\:
[xr-vm_node0_RP0_CPU0:/harddisk:]$cd showtech/
[xr-vm_node0_RP0_CPU0:/harddisk:/showtech]$
[xr-vm_node0_RP0_CPU0:/harddisk:/showtech]$
[xr-vm_node0_RP0_CPU0:/harddisk:/showtech]$ls
showtech-alarm_mgr-2020-Dec-08.063650.UTC.tgz
showtech-alarm_mgr-2020-Dec-08.064511.UTC.tgz
showtech-alarm_mgr-2020-Dec-09.222622.UTC.tgz
showtech-ncs1004-2020-Dec-09.222348.UTC.tgz
showtech-ptah-2020-Dec-08.063602.UTC.tgz
showtech-ptah-2020-Dec-08.064422.UTC.tgz
showtech-ptah-2020-Dec-09.222531.UTC.tgz
[xr-vm_node0_RP0_CPU0:/harddisk:/showtech]$ip netns exec tpnns bash
[xr-vm_node0_RP0_CPU0:/harddisk:/showtech]$scp
showtech-ncs1004-2020-Dec-09.222348.UTC.tgz remote-host-system
```

- Using SSH:

1. Before you use SSH, you must disable the public key authentication on the host system. Open the SSHd configuration file in a text editor. Search for `PubkeyAuthentication` and set the option to `no`.

```
PubkeyAuthentication no
```

2. SSH to the device and enter the device password.

```
bash-4.2$ ssh openroadm@10.105.57.41
Password:
RP/0/RP0/CPU0:ios#
```

3. To gather logs and traces, run the CLI command, **show tech-support ncs1004**.

```
RP/0/RP0/CPU0:ios#show tech-support ncs1004
Wed Dec 9 22:23:47.966 UTC
++ Show tech start time: 2020-Dec-09.222348.UTC ++
Wed Dec 9 22:23:49 UTC 2020 Waiting for gathering to complete
.....................................................................................
Wed Dec 9 22:28:54 UTC 2020 Compressing show tech output
```

```
Show tech output available at 0/RP0/CPU0 :
/harddisk:/showtech/showtech-ncs1004-2020-Dec-09.222348.UTC.tgz
++ Show tech end time: 2020-Dec-09.222913.UTC ++
```

4. To collect logs outside the device, run the XR VM. Change the directory to showtech and copy the *.tgz* log file from the device to the remote host system.

```
RP/0/RP0/CPU0:ios#run
Wed Dec 9 22:30:17.451 UTC
[xr-vm_node0_RP0_CPU0:~]$cd /harddisk\:
[xr-vm_node0_RP0_CPU0:/harddisk:]$cd showtech/
[xr-vm_node0_RP0_CPU0:/harddisk:/showtech]$
[xr-vm_node0_RP0_CPU0:/harddisk:/showtech]$
[xr-vm_node0_RP0_CPU0:/harddisk:/showtech]$ls
showtech-alarm_mgr-2020-Dec-08.063650.UTC.tgz
showtech-alarm_mgr-2020-Dec-08.064511.UTC.tgz
showtech-alarm_mgr-2020-Dec-09.222622.UTC.tgz
showtech-ncs1004-2020-Dec-09.222348.UTC.tgz
showtech-ptah-2020-Dec-08.063602.UTC.tgz
showtech-ptah-2020-Dec-08.064422.UTC.tgz
showtech-ptah-2020-Dec-09.222531.UTC.tgz
[xr-vm_node0_RP0_CPU0:/harddisk:/showtech]$ip netns exec tpnns bash
[xr-vm_node0_RP0_CPU0:/harddisk:/showtech]$scp
showtech-ncs1004-2020-Dec-09.222348.UTC.tgz remote-host-system
```

- Generate the log files using the create-tech-info RPC function. See Create Tech Information, on page 164. Copy the log file using the transfer RPC call. See File Management, on page 151.

Terminology

This section provides an expansion of the acronyms used in this guide:

- API: Application Programming Interface
- BIOS: Basic Input Output System
- DHCP: Dynamic Host Control Protocol
- LAN: Local Area Network
- LO: Low Order
- MSI: Multiplex Structure Identifier
- MXP: Muxponder
- OSS: Operations Support Systems
- PM: Performance Monitoring
- PRBS: Pseudo Ramdom Bit Sequence
- RPC: Remote Procedure Calls
- RP: Route Processer
- SFTP: Secure File Transfer Protocol
- SSH: Secure SHell

- TCA: Threshold Crossing Alert
- TPN: Tributary Port Number
- TXP: Transponder
- XPDR: Crossponder