

# Unified PON

MCMS PON Controller

Installation Example  
for  
NFX250-S2 Network Services Platform

October 2021

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## Overview

This installation example can be used to install an Ubuntu KVM qcow2 image for the MCMS PON Controller software to run as a VNF on the NFX250-S2 and provision the NFX250-S2 for the Virtual Network Function [VNF].

The steps to create the Ubuntu KVM qcow2 image for the MCMS PON Controller software is beyond the scope of this document.

## Deployment Model

The field deployment model for this example installation is depicted in Figure 1 below.

The PON Controller software runs as a Virtual Network Function [VNF] (as an Ubuntu VM) on the target NFX250-S2 and utilizes the NFX250's external faceplate GbE switch ports. The NFX250-S2 switch ports provide the Layer 2 and Layer 3 connection points to the ACX router(s) and MCMS PON Manager Datastore respectively.

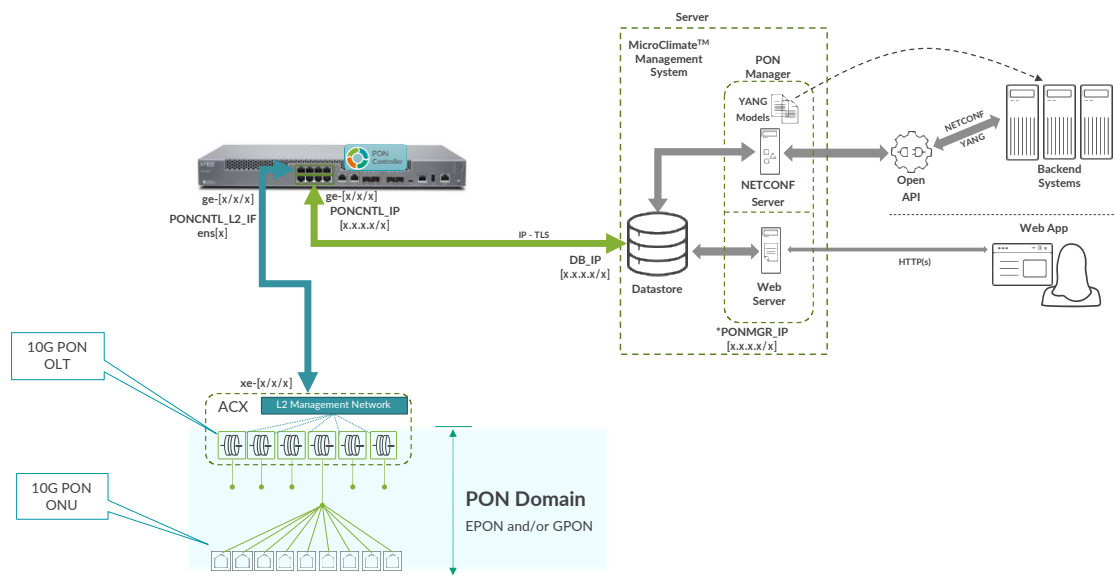


Figure 1 PON Controller Deployment Model

The Layer 2 Control Plane connection(s) to the ACX router(s) can use any of the NFX250's top four ethernet switch ports. E.g., ge-0/0/0, ge-0/0/2, ge-0/0/4 or ge-0/0/6.

The Layer 3 Control Plane connection to the MCMS Datastore can use any **one** of the NFX250's bottom four ethernet switch ports. E.g., ge-0/0/1, ge-0/0/3, ge-0/0/5 or ge-0/0/7.

**NOTE:** Other NFX250 ports and port configurations may be valid but are beyond the scope of this document.

The internal service connection mapping on the NFX250 for this example PON Controller VNF is depicted in Figure 2 below.

The PON Controller VNF's two Ethernet control plane connections are mapped from the PON Controller VNF through the NFX's OVS Bridge structure to the external GbE faceplate switch ports using internal VLANs. Appropriate example VLAN configuration information is provided in the example Junos configuration in [Appendix A](#).

Other possible VLAN configurations are beyond the scope of this document.

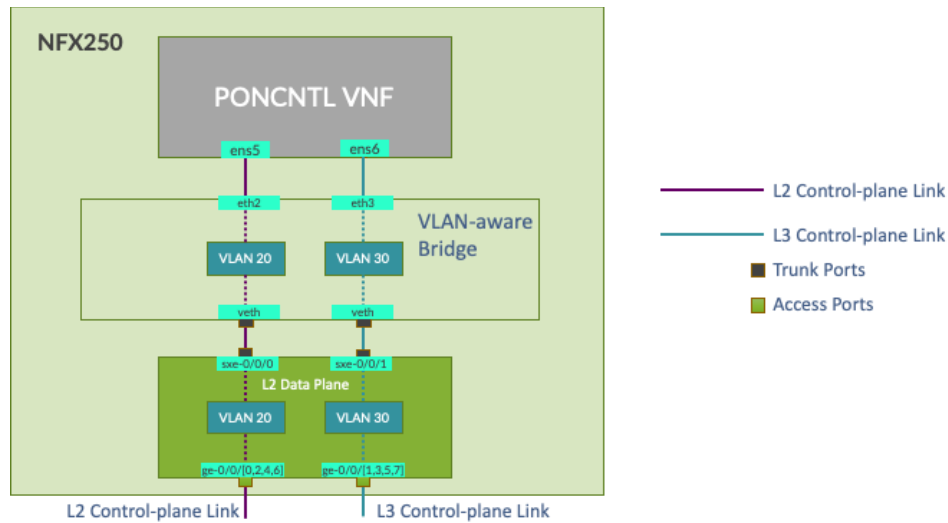


Figure 2 NFX250 Internal Service Connection Mapping

## Requirements

- Juniper NFX250-S2 Network Services Platform
  - Junos Minimum Release: 20.2R2 Next Gen Software
  - Root user access
  - Dedicated for PON Controller use
- Ubuntu KVM qcow2 image for the MCMS PON Controller software
  - Please see the [Unified PON MicroClimate™ Installation Guide](#) for the MCMS PON Controller Ubuntu OS requirements

**NOTE:** The creation of an Ubuntu KVM qcow2 image is beyond the scope of this document.

---

## Installation

### Overview

The following are the high-level steps that will be executed during the installation example process.

- Verify/upgrade NFX250-S2 software to recommended release
- Factory default (Zeroize) the configuration for the NFX250
- Transfer Ubuntu KVM qcow2 VM image file for the PON Controller software to the NFX250
- Provision the NFX250
- Check the status of the PON Controller VNF
- Log into the PON Controller VNF locally
- Install the PON Controller software on the VNF
- Verify/change the PON Controller configuration
- Configure control plane connections on supported ACX router for NFX250 PON Controller VNF connectivity
- Verify PON Controller software operation

### Install

The following steps are provided to install the Ubuntu KVM qcow2 image for the MCMS PON Controller software onto the NFX250.

**NOTE:** Before proceeding with the install, it is recommended to zeroize the NFX250's configuration. Please refer to the [Junos® OS Software Installation and Upgrade Guide](#) for system zeroize procedure.

1. Configure the NFX250-S2 to operate in compute mode.

From operational mode, run the `request vmhost mode compute` CLI command.

This configuration change will require a system reboot.

- 
2. Transfer the previously prepared Ubuntu KVM qcow2 VM image for the PON Controller software to the NFX250.

Using scp, transfer the Ubuntu KVM qcow2 image file to the NFX250's /var/lshare/public directory.

```
scp nfx250-poncntl.qcow2 root@x.x.x.x:/var/lshare/public/
```

3. Provision the NFX250-S2 including the virtual-network-functions settings for the PON Controller VNF. Make sure the following appropriate configuration options are set using the example in [Appendix A](#) as a guide.
  - system memory hugepages
  - vlans
  - interfaces
  - vmhost vlans
  - virtual-network-functions

The NFX250-S2 virtual-network-function configuration will create four (4) Ethernet ports for the VNF.

The first two ports are the default VNF ports and include the NFX250-S2 to VNF communication network port and a OOB port (which will be disabled later within the Ubuntu VNF).

The second two ports are the Ethernet ports designed for use with the PON Controller software.

One port for Layer 2 Control Plane communications with the 10G PON OLT devices and one Layer 3 port for IP communications with the PON Manager database.

**NOTE:** Please see [Appendix A](#) for an example NFX250-S2 configuration for details

---

4. Verify the status of the PON Controller VNF.

After provisioning the VNF in the Junos configuration in step 3 above, Check the status of the PON Controller VNF.

From the NFX250-S2 Junos cli, enter the following command. You should see the PON Controller VNF State as "Running" and the Liveliness as "alive".

From operational mode with root login, enter the `show virtual-network-functions <vnfName>` CLI command.

```
user> show virtual-network-functions poncntl
      ID      Name                State      Liveliness
-----
      2      poncntl                Running    alive
```

5. Log into the PON Controller VNF through the NFX250 CLI.

From the NFX250-S2 Junos CLI, enter the following command to create a ssh connection to the PON Controller VNF.

From operational mode with root login access, enter the `request virtual-network-functions <vnfName> ssh user-name <user>` CLI command.

**NOTE:** The PON Controller VM username and password are created during the Ubuntu KVM qcow2 image creation, which is beyond the scope of this document.

5. Provision the Ethernet interfaces for PON Controller to use.

Determine the Ethernet interface names in the Ubuntu VNF.

From the Ubuntu VNF CLI prompt, enter the `ip address` CLI command.

```

user@host:~$ ip address

1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group
default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: ens3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state
UP group default qlen 1000
    link/ether f0:7c:c7:48:f4:31 brd ff:ff:ff:ff:ff:ff
    inet 192.0.2.100/24 brd 192.0.2.255 scope global dynamic ens3
        valid_lft 2364sec preferred_lft 2364sec
3: ens4: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state
UP group default qlen 1000
    link/ether f0:7c:c7:48:f4:32 brd ff:ff:ff:ff:ff:ff
4: ens5: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state
UP group default qlen 1000
    link/ether f0:7c:c7:48:f4:2d brd ff:ff:ff:ff:ff:ff
5: ens6: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state
UP group default qlen 1000
    link/ether f0:7c:c7:48:f4:2e brd ff:ff:ff:ff:ff:ff
    inet 10.0.0.164/24 brd 10.0.0.255 scope global ens6
        valid_lft forever preferred_lft forever

```

Interfaces 2 and 3 above (ens3 and ens4 in this example but may use different names based upon your installation) are the default NFX250-S2 VNF Ethernet ports described earlier.

Interfaces 4 and 5 (ens5 and ens6) are the two Ethernet ports used for the PON Controller VNF. Interface 'ens5' is the Layer 2 control-plane interface between PON Controller and the ACX5448 with the 10G OLT transceivers installed.

Interface 'ens6' is the Layer 3 IP interface for connection between the PON Controller and the PON Manager/Database server.

---

6. Provision the Ethernet ports using Ubuntu netplan and the network manager yaml configuration file.

- a. Create a backup copy of the existing yaml configuration file in the `/etc/netplan/` directory.

From the Ubuntu VNF CLI prompt, enter the following CLI command.

```
sudo cp /etc/netplan/<nameOfYamlFile>.yaml <nameOfYamlFile>.yaml.bak
```

- b. Using a text edit such a vi or nano, edit the existing netplan configuration yaml file in the `/etc/netplan/` directory using the information below.

---

NOTE: Indention matters in a yaml file. Follow the indentation listed below

**Replace the IP addresses below with appropriate addresses for your installation.**

```
# This file describes the network interfaces available on your system
# For more information, see netplan(5).
network:
  version: 2
  renderer: networkd
  ethernets:
    # ens3 is the default NFX250-S2 internal management port.
    ens3:
      link-local: []
      dhcp4: true
      dhcp4-overrides:
        use-routes: false
    # ens4 is the default OOB port on VNF. Unused for PON Controller
    ens4:
      dhcp4: no
      dhcp6: no
    # ens5 is L2 control-plane port for PON Controller to OLT communications
    ens5:
      dhcp4: no
      dhcp6: no
    # ens6 is L3 control-plane port for PON Controller to PON Manager/Database server
    # communications
    ens6:
      link-local: []
      dhcp4: no
      addresses: [10.0.0.164/24]
      gateway4: 10.0.0.1
      nameservers:
        addresses: [192.168.1.254,192.168.1.253]
```

Save the configuration changes

---

7. Test the netplan configuration.

To do so use the following command.

From the Ubuntu VNF CLI prompt, enter the `sudo netplan try` CLI command.

You will see the changes are temporarily applied and then a countdown timer will start.

If you see the countdown timer start counting down towards zero, you can then press enter to save the changes.

```
Press ENTER before the timeout to accept the new configuration
Changes will revert in 119 seconds
Configuration accepted.
```

8. Verify the changes to the IP address of the Ethernet interfaces to ensure they match the requirements.

9. Reboot the VNF

From the Ubuntu VNF CLI prompt, enter the `sudo reboot -h now` CLI command.

10. After the VNF has restarted, verify the State and Liveliness are correct for the VNF.

From the NFX CLI operational mode, run the `show virtual-network functions <vnfName>` CLI command.

```
user@host> show virtual-network-functions poncnt1
ID      Name                               State    Liveliness
-----
6       poncnt1                            Running  alive
```

- 
11. Ping the PON Controller Ubuntu VNF interface from a device on the same network to verify connectivity.

Connect a network cable into ge-0/0/1 of the NFX250-S2 and your network.

From a network computer, verify you can ping the IP address of the Layer 3 control-plane of the PON Controller VNF (ens6) using the IP address configured in the previous steps.

12. To complete the installation, you will need to open a ssh session from a network PC to the PON Controller Ubuntu VNF Layer 3 control-plane port (ens6).

13. Install the PON Controller software

After connecting to the PON Controller Ubuntu VNF via a ssh session, follow the PON Controller installation steps in the [Unified PON MicroClimate™ Installation Guide](#) to install the MCMS PON Controller software and complete its provisioning.

14. Configure control plane connections for the NFX250 PON Controller VNF.

Configure the Layer 2 control plane connection for the NFX250 PON Controller VNF and the VLAN bridge domain in the supported Juniper ACX router.

- a. On the supported ACX router, configure the Layer 2 interface and enable VLAN tagging for the connection to the NFX250.

```
user@host#set interfaces xe-0/0/1 description "PON Controller L2 Control Plane"
user@host#set interfaces xe-0/0/1 native-vlan-id 4090
user@host#set interfaces xe-0/0/1 flexible-vlan-tagging
user@host#set interfaces xe-0/0/1 encapsulation flexible-ethernet-services
user@host#set interfaces xe-0/0/1 unit 4090 encapsulation vlan-bridge
user@host#set interfaces xe-0/0/1 unit 4090 vlan-id 4090
```

- b. On the supported ACX router, configure VLAN bridge domain.

```
user@host#set vlans poncntl description BD_PONCNTL
user@host#set vlans poncntl interface xe-0/0/1.4090
user@host#set vlans poncntl interface xe-0/0/2.4090
```

---

NOTE: The Layer 2 control plane connection for the PON Controller VNF communicates to the 10G PON SFP+ OLT transceivers hosted in the supported ACX router.

The ACX port configuration for the OLT transceivers would also need the VLAN configuration for VLAN 4090 and they would need to be added to the VLAN bridge domain to complete the communications path between the PON Controller VNF and the OLT transceivers.

#### 15. Verify PON Controller software operation

To validate the PON Controller software operation, please refer to the Validation Steps in the PON Controller Installation section of the [Unified PON MicroClimate™ Installation Guide](#).

---

## Appendix A

### NFX250-S2 Example Junos Configuration

The following example configuration provisions the NFX250-S2 as a compute server to support Virtual Network Functions, VNFs, as its main functionality.

The configuration below provisions the basic NFX250-S2 requirements and provisions a single Virtualized Network Function [VNF] for the MCMS PON Controller KVM image to be installed.

Modification of the IP addressing should be made that is appropriate for the individual deployment.

The example configuration provisions four of the GigE copper interface ports to support the Layer 2 PON Management Control Plane connections to external ACX routers with installed 10G PON OLT transceivers. It also provisions the four other GigE copper interface ports to support the Layer 3 PON Management Control Plane connection to the MicroClimate™ Management System [MCMS] database.

**NOTE:** The configuration excerpt below does not show the necessary user credential configuration information for a working system. The deployed system will need to have these configuration parameters set correctly.

**NOTE:** This deployment configuration sets the NFX250-S2 in compute mode and disables most NFX250-S2 Junos functionality so that the system can be used as a VM host server.

### Configuration Example: Stanza Syntax

```
system {
  services {
    ssh {
      root-login allow;
    }
  }
  memory {
    hugepages {
      page-size 1024 {
        page-count 21;
      }
    }
  }
}
```

---

```

    }
  }
}
interfaces {
  ge-0/0/0 {
    description "L2 Only Control Plan PON Controller Port";
    ether-options {
      auto-negotiation;
    }
    unit 0 {
      family ethernet-switching {
        vlan {
          members VLAN-PONCNTL-L2;
        }
        storm-control default;
      }
    }
  }
  sxe-0/0/0 {
    description "Internal Trunk Port to OVS Bridge - #1";
    mtu 9192;
    ether-options {
      flow-control;
    }
    unit 0 {
      family ethernet-switching {
        interface-mode trunk;
        vlan {
          members VLAN-PONCNTL-L2;
        }
      }
    }
  }
  ge-0/0/1 {
    description "L3 Only Control Plan PON Controller Port";
    ether-options {

```

---

```

        auto-negotiation;
    }
    unit 0 {
        family ethernet-switching {
            vlan {
                members VLAN-PONCNTL-L3;
            }
            storm-control default;
        }
    }
}
sxe-0/0/1 {
    description "Internal Trunk Port to OVS Bridge - #2";
    mtu 9192;
    ether-options {
        flow-control;
    }
    unit 0 {
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members VLAN-PONCNTL-L3;
            }
        }
    }
}
ge-0/0/2 {
    description "L2 Only Control Plan PON Controller Port";
    ether-options {
        auto-negotiation;
    }
    unit 0 {
        family ethernet-switching {
            vlan {
                members VLAN-PONCNTL-L2;
            }
            storm-control default;
        }
    }
}

```

---

```
    }
  }
}
ge-0/0/3 {
  description "L3 Only Control Plan PON Controller Port";
  ether-options {
    auto-negotiation;
  }
  unit 0 {
    family ethernet-switching {
      vlan {
        members VLAN-PONCNTL-L3;
      }
      storm-control default;
    }
  }
}
ge-0/0/4 {
  description "L2 Only Control Plan PON Controller Port";
  ether-options {
    auto-negotiation;
  }
  unit 0 {
    family ethernet-switching {
      vlan {
        members VLAN-PONCNTL-L2;
      }
      storm-control default;
    }
  }
}
ge-0/0/5 {
  description "L3 Only Control Plan PON Controller Port";
  ether-options {
    auto-negotiation;
  }
  unit 0 {
```

---

```
        family ethernet-switching {
            vlan {
                members VLAN-PONCNTL-L3;
            }
            storm-control default;
        }
    }
}
ge-0/0/6 {
    description "L2 Only Control Plan PON Controller Port";
    ether-options {
        auto-negotiation;
    }
    unit 0 {
        family ethernet-switching {
            vlan {
                members VLAN-PONCNTL-L2;
            }
            storm-control default;
        }
    }
}
ge-0/0/7 {
    description "L3 Only Control Plan PON Controller Port";
    ether-options {
        auto-negotiation;
    }
    unit 0 {
        family ethernet-switching {
            vlan {
                members VLAN-PONCNTL-L3;
            }
            storm-control default;
        }
    }
}
vlans {
```

---

```
VLAN-PONCNTL-L2 {
    description "Internal Layer 2 VLAN for PON Controller Control Plane
to OLTs";
    vlan-id 20;
}
VLAN-PONCNTL-L3 {
    description "Internal Layer 3 VLAN for PON Controller Control-plane
to PON Manager";
    vlan-id 30;
}
default {
    vlan-id 1;
}
}
vmhost {
    vlans {
        vlan-poncntl-l2 {
            description "VNF VLAN for PON Controller L2 Control Plane";
            vlan-id 20;
        }
        vlan-poncntl-l3 {
            description "VNF VLAN for PON Controller L3 Control Plane";
            vlan-id 30;
        }
    }
}
virtual-network-functions poncntl-1 {
    type {
        virtual-machine;
    }
    image {
        /var/public/poncntl.qcow2;
        image-type qcow2;
    }
    virtual-cpu {
        0 {
            physical-cpu 10;
        }
    }
}
```

---

```
count 1;
features {
    hardware-virtualization;
}
}
interfaces eth2 {
    description "L2 ONLY Control-plane PON Controller PORT (ens5)";
    mapping {
        vlan {
            members vlan-poncntl-12;
        }
    }
}
interfaces eth3 {
    description "L3 ONLY Control-plane PON Controller PORT (ens6)";
    mapping {
        vlan {
            members vlan-poncntl-13;
        }
    }
}
memory {
    size 4000000;
    features {
        hugepages {
            page-size 1024;
        }
    }
}
}
```

---

## Configuration Example: Set Commands

```
set system services ssh root-login allow
set system memory hugepages page-size 1024 page-count 21
set interfaces ge-0/0/0 description "L2 Only Control Plan PON Controller
Port"
set interfaces ge-0/0/0 ether-options auto-negotiation
set interfaces ge-0/0/0 unit 0 family ethernet-switching vlan members VLAN-
PONCNTL-L2
set interfaces ge-0/0/0 unit 0 family ethernet-switching storm-control
default
set interfaces sxe-0/0/0 description "Internal Trunk Port to OVS Bridge - #1"
set interfaces sxe-0/0/0 mtu 9192
set interfaces sxe-0/0/0 ether-options flow-control
set interfaces sxe-0/0/0 unit 0 family ethernet-switching interface-mode
trunk
set interfaces sxe-0/0/0 unit 0 family ethernet-switching vlan members VLAN-
PONCNTL-L2
set interfaces ge-0/0/1 description "L3 Only Control Plan PON Controller
Port"
set interfaces ge-0/0/1 ether-options auto-negotiation
set interfaces ge-0/0/1 unit 0 family ethernet-switching vlan members VLAN-
PONCNTL-L3
set interfaces ge-0/0/1 unit 0 family ethernet-switching storm-control
default
set interfaces sxe-0/0/1 description "Internal Trunk Port to OVS Bridge - #2"
set interfaces sxe-0/0/1 mtu 9192
set interfaces sxe-0/0/1 ether-options flow-control
set interfaces sxe-0/0/1 unit 0 family ethernet-switching interface-mode
trunk
set interfaces sxe-0/0/1 unit 0 family ethernet-switching vlan members VLAN-
PONCNTL-L3
set interfaces ge-0/0/2 description "L2 Only Control Plan PON Controller
Port"
set interfaces ge-0/0/2 ether-options auto-negotiation
set interfaces ge-0/0/2 unit 0 family ethernet-switching vlan members VLAN-
PONCNTL-L2
set interfaces ge-0/0/2 unit 0 family ethernet-switching storm-control
default
set interfaces ge-0/0/3 description "L3 Only Control Plan PON Controller
Port"
set interfaces ge-0/0/3 ether-options auto-negotiation
```

---

```
set interfaces ge-0/0/3 unit 0 family ethernet-switching vlan members VLAN-
PONCNTL-L3
set interfaces ge-0/0/3 unit 0 family ethernet-switching storm-control
default
set interfaces ge-0/0/4 description "L2 Only Control Plan PON Controller
Port"
set interfaces ge-0/0/4 ether-options auto-negotiation
set interfaces ge-0/0/4 unit 0 family ethernet-switching vlan members VLAN-
PONCNTL-L2
set interfaces ge-0/0/4 unit 0 family ethernet-switching storm-control
default
set interfaces ge-0/0/5 description "L3 Only Control Plan PON Controller
Port"
set interfaces ge-0/0/5 ether-options auto-negotiation
set interfaces ge-0/0/5 unit 0 family ethernet-switching vlan members VLAN-
PONCNTL-L3
set interfaces ge-0/0/5 unit 0 family ethernet-switching storm-control
default
set interfaces ge-0/0/6 description "L2 Only Control Plan PON Controller
Port"
set interfaces ge-0/0/6 ether-options auto-negotiation
set interfaces ge-0/0/6 unit 0 family ethernet-switching vlan members VLAN-
PONCNTL-L2
set interfaces ge-0/0/6 unit 0 family ethernet-switching storm-control
default
set interfaces ge-0/0/7 description "L3 Only Control Plan PON Controller
Port"
set interfaces ge-0/0/7 ether-options auto-negotiation
set interfaces ge-0/0/7 unit 0 family ethernet-switching vlan members VLAN-
PONCNTL-L3
set interfaces ge-0/0/7 unit 0 family ethernet-switching storm-control
default
set vlans VLAN-PONCNTL-L2 description "Internal Layer 2 VLAN for PON
Controller Control Plane to OLTs"
set vlans VLAN-PONCNTL-L2 vlan-id 20
set vlans VLAN-PONCNTL-L3 description "Internal Layer 3 VLAN for PON
Controller Control-plane to PON Manager"
set vlans VLAN-PONCNTL-L3 vlan-id 30
set vmhost vlans vlan-poncntl-12 description "VNF VLAN for PON Controller L2
Control Plane"
set vmhost vlans vlan-poncntl-12 vlan-id 20
set vmhost vlans vlan-poncntl-13 description "VNF VLAN for PON Controller L3
Control Plane"
```

---

```
set vmhost vlans vlan-poncctl-13 vlan-id 30
set virtual-network-functions poncctl-1 type virtual-machine
set virtual-network-functions poncctl-1 image /var/public/poncctl.qcow2
set virtual-network-functions poncctl-1 image image-type qcow2
set virtual-network-functions poncctl-1 virtual-cpu 0 physical-cpu 10
set virtual-network-functions poncctl-1 virtual-cpu count 1
set virtual-network-functions poncctl-1 virtual-cpu features hardware-
virtualization
set virtual-network-functions poncctl-1 interfaces eth2 description "L2 ONLY
Control-plane PON Controller PORT (ens5)"
set virtual-network-functions poncctl-1 interfaces eth2 mapping vlan members
vlan-poncctl-12
set virtual-network-functions poncctl-1 interfaces eth3 description "L3 ONLY
Control-plane PON Controller PORT (ens6)"
set virtual-network-functions poncctl-1 interfaces eth3 mapping vlan members
vlan-poncctl-13
set virtual-network-functions poncctl-1 memory size 4000000
set virtual-network-functions poncctl-1 memory features hugepages page-size
1024
```