Deploying the Cisco Routed PON Solution

Completing the implementation of the Cisco Routed PON Solution requires setting up the various components that make up the system. At a high level, the steps to configure the Cisco Routed PON Solution are as follows:

1. Install the Cisco PON pluggable OLT.

2. Install and configure the Cisco PON Manager.

3. Install and configure the MongoDB database.

4. Configure and activate the Cisco PON Controller.

Install the Cisco PON pluggable OLT

For steps to install the PON transceiver module refer to *Install and Remove Transceiver Modules* in the Cisco NCS 540 Router Hardware Installation Guide.

Install and Configure the PON Manager

For steps to install the PON Manager, refer to *PON Manager Installation* in the *Cisco Routed PON Installation Guide*.

Install and Configure the MongoDB database

For steps to install the MongoDB database, refer to *MongoDB Installation* in the *Cisco Routed PON Installation Guide*.

Configuring the PON Controller

The PON Controller is installed on a Docker container on the router. The PON Controller installation package is stored either on the hard disk of the router or on a network server to which the router has access.

To configure the PON controller, follow the steps:

Configuring Cisco Routers using the Cisco IOS XR7 framework

For the Cisco Routers using the Cisco IOS XR7 framework, execute the following commands to install the software package:

> **Note** This section is applicable for the following routers:
>
> - N540X-16Z4G8Q2C-A, N540X-16Z4G8Q2C-D
> - N540-28Z4C-SYS-A, N540-28Z4C-SYS-D
> - N540-24Q8L2DD-SYS
> - NCS-55A2-MOD-S
> - NCS-57C1-48Q6D

1. Execute the following command to confirm if the PON Controller package is present in the router:

   ```
   show install active | i pon
   ```

   Sample Output

   ```
   RP/0/RP0/CPU0:PON-Rtr1-CrLk#show install active | i pon
   Tue Feb 27 08:45:29.246 UTC
   xr-pon-ctlr                                    24.1.1.40Iv1.0.1-1
   ```

   If the PON Controller isn't present, the command won't return any value.

2. If the PON Controller isn't present refer to the appropriate guide for steps to download and configure additional packages. The steps to configure an additional package might differ based on the router model.

   - For NCS 5500 or NCS 5700 router, refer to *Install Optional Packages to Provide Additional Functionality* in System Setup and Software Installation Guide for Cisco NCS 5500 Series Routers.

   - For NCS 540 router, refer to *Install Optional Packages to Provide Additional Functionality* in System Setup and Software Installation Guide for Cisco NCS 540 Series Routers.

Configuring Cisco Routers using the IOS XR framework

This section provides the steps to configure Cisco PON Controller software in the routers using the IOS XR framework.

Note This section is applicable for the below routers:

- N540-24Z8Q2C-SYS

- N540-ACC-SYS

- NCS-55A1-24Q6H-SS

1. Execute the following command to confirm if the PON Controller package is present in the router:

    ```
    show install active | i pon
    ```

    Sample Output

    ```
    RP/0/RP0/CPU0:PON-Rtr5-Peyto#show install active | i pon
    Tue Feb 27 08:44:53.345 UTC
    ncs5500-pon-ctlr-1.0.0.0-r241140I
    ncs5500-pon-ctlr-1.0.0.0-r241140I
    ```

    If the PON Controller isn't present, the command doesn't return any values.

2. If the PON Controller isn't present refer to the appropriate guide for steps to download and configure additional packages. The steps to configure an additional package might differ based on the router model.

    - For NCS 5500 or NCS 5700 router, refer to *Install Packages* in System Setup and Software Installation Guide for Cisco NCS 5500 Series Routers.

    - For NCS 540 router, refer to *Install Packages* in System Setup and Software Installation Guide for Cisco NCS 540 Series Routers.

Activating the PON Controller

After setting up the PON Controller in the router, you need to activate it by connecting to MongoDB and applying additional configurations to the controller.

Before you begin:

- Ensure that you have synchronized the XR clock with that of an NTP server.

  The steps to configure an NTP server might differ based on the router model. Refer to the appropriate guide for steps to configure an NTP server.

  - For NCS 5500 or NCS 5700 routers, refer to *Configuring Network Time Protocol* in System Management Configuration Guide for Cisco NCS 5500 Series Routers.

  - For NCS 540 router, refer to *Synchronize Router Clock with NTP Server* in System Setup and Software Installation Guide for Cisco NCS 540 Series Routers.

- Ensure that Linux Networking is configured on the router as given below:

  ```
  linux networking
   vrf default
    address-family ipv4
     default-route software-forwarding
     source-hint default-route interface MgmtEth0/RP0/CPU0/0
     !
  ```

```
 !
 !
```

The steps to configure Linux Networking might differ based on the router model. Refer to the appropriate guide for steps to configure an NTP server.

- For NCS 5500 or NCS 5700 routers, refer to *Packet I/O on IOS XR* in Application Hosting Configuration Guide for Cisco NCS 5500 Series Routers.

- For NCS 540 router, refer to *Setup the Linux Network for Application Hosting* in Application Hosting Configuration Guide for Cisco NCS 540 Series Routers.

- Ensure that the MongoDB server is reachable from your router by executing the following command:

```
bash ping <IP address of the MongoDB server>
```

Sample Output

```
RP/0/RP0/CPU0:PON-Rtr5-Peyto#bash ping 192.0.2.0
Tue Feb 27 09:17:53.046 UTC
RP/0/RP0/CPU0:Feb 27 09:17:53.087 UTC: bash_cmd[66952]: %INFRA-INFRA_MSG-5-RUN_LOGIN :
 User lab logged into shell from con0/RP0/CPU0
PING 192.0.2.0 (192.0.2.0) 56(84) bytes of data.
64 bytes from 192.0.2.0: icmp_seq=1 ttl=64 time=0.820 ms
64 bytes from 192.0.2.0: icmp_seq=2 ttl=64 time=0.769 ms
64 bytes from 192.0.2.0: icmp_seq=3 ttl=64 time=0.703 ms
```

Edit the parameters in the **PonCntlInit.json** that is part of the PON Controller package establish connection with the MongoDB server. A sample **PonCntlInit.json** is included in the PON Controller package.

A sample **PonCntlInit.json** is given below:

```
{
    "CNTL": {
        "Auth": false,
        "CFG Version": "R4.0.0",
        "DHCPv4": false,
        "DHCPv6": false,
        "PPPoE": false,
        "UMT interface": "tibitvirt",
        "Maximum CPEs Allowed": 0,
        "Maximum CPE Time": 0
    },
    "DEBUG": {},
    "JSON": {
        "databaseDir": "/opt/cisco/poncntl/database/",
        "defaultDir": "/opt/cisco/poncntl/database/"
    },
    "Local Copy": {
        "CNTL-STATE": false,
        "OLT-STATE": false,
        "ONU-STATE": false
    },
    "Logging": {
        "Directory": "/var/log/tibit",
        "FileCount": 2,
        "FileSize": 5120000,
        "Tracebacks": false,
        "Timestamp": false,
        "Facility" : "user"
    },
    "MongoDB": {
        "auth_db": "cisco_users",
        "auth_enable": false,
```

```
      "ca_cert_path": "/etc/cisco/ca.pem",
      "compression": false,
      "write_concern": "default",
      "host": "192.0.2.0",                        <-- mongoDB server IP Address
      "name": "cisco_pon_controller",
      "password": "",
      "port": "27017",                            <-- mongoDB port
      "tls_enable": false,                        <-- field to enable TLS based
connection
      "username": "",
      "dns_srv": false,
      "db_uri": "",
      "replica_set_enable": false,
      "replica_set_name": "rs0",
      "replica_set_hosts":
        [
        "192.0.2.3:27017",                        <-- mongoDB replica set 1
        "192.0.2.4:27999",                        <-- mongoDB replica set 2
        "mongo02.example.com:17999"
        ],
      "validate_cfg": true
    },
    "databaseType": "MongoDB",
    "interface": "veth_pon_glb",
    "interface_namespace": ""
}
```

1. Change the **host** IP address parameter to the IP address of your MongoDB server.

2. (Optional) To enable secure connection between the PON Controller and the MongoDB server, change the value for **tls_enable** to **true**.

   If a secure connection is enabled, you'll need to configure the **username** and **password** parameters as well.

3. If you have configured a replica set for MongoDB, change the IP address for the MongoDB replica set.

4. Copy and paste the **PonCntlinit.json** file to either the hard disk of the router or to your network folder.

   When copying the file to the hard disk of the router, it is stored in `/misc/disk1` by default.

5. Execute the `cfg-file` command to initiate the PON controller, the command is used to load the PON controller application on the router.

   Syntax

   ```
   cfg-file <tftp transfer protocol>/package_path/ or harddisk/package_path/ vrf <vrf-name>
    tls-pem <tftp transfer protocol>/pem_file_path/
   ```

   Syntax Description

tftp transfer protocol	TFTP server IP address
package_path	Location of the .json file
Harddisk	Harddisk of the router. If the .json file is located on the harddisk, provide the path to on the harddisk
vrf	Specifies VPN routing and forwarding (VRF)
vrf-name	Name of a VRF
tls-pem	Specifies that TLS is used

pem_file_path	Path of the .pem file. This can either be stored on the router harddisk or a TFTP server

Example:

```
RP/0/RP0/CPU0:ios(config)#pon-ctlr cfg-file
tftp://192.0.2.0/auto/tftp-users2/user2/PonCntlInit.json vrf default tls-pem
tftp://192.0.2.0/auto/tftp-blr-users2/user/rootCA.pem
```

6. Ensure that the main interface for the SFP is in active.

For example, if the Cisco PON pluggable OLT is inserted in the port 0/0/0/5:

```
RP/0/RP0/CPU0:ios(config)#interface TenGigE0/0/0/5
RP/0/RP0/CPU0:ios(config-if)#no shutdown
```

7. Create a subinterface with ID 4090 on the port where the small form-factor pluggable is inserted. The subinterface is required to receive the control packets between the PON Controller and the Cisco PON pluggable OLT.

```
interface TenGigE0/0/0/5.4090
encapsulation dot1q 4090
```

When the subinterface is created, the PON controller discovers the OLTs and ONUs in the network.

```
RP/0/RP0/CPU0:ios#run
Thu Oct 19 08:04:53.799 UTC
[xr-vm_node0_RP0_CPU0:~]$docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
7909570b4803 cisco-poncntl.xr:R4.0.0 "/usr/bin/supervisor…" 26 hours ago Up 26 hours
pon_ctlr
[xr-vm_node0_RP0_CPU0:~]$docker logs pon_ctlr --tail 50
2023-10-19 08:07:33.482 INFO PonCntl Total Controllers: 1 OLTs: 1 ONUs: 1
```

8. Run the *lldp* command to enable Link Layer Discovery Protocol (LLDP) for the OLT port. This helps in the discovery of the OLTs and ONUs.

```
RP/0/RP0/CPU0:ios(config)# lldp
```

9. Confirm if the PON Controller, OLT, and ONU details are displayed in the PON Manager.

Note If the Controller summary displays **Status:** as **offline,** then match the UTC clock on your router to that of the Cisco UCS server.

For more information on PON Controller, refer to *PON Controller* in the *Cisco Routed PON Installation Guide*.