

Cisco Routed PON Solution Overview

With the advancements in broadband technology, the customer demands have expanded to high-resolution audio and video playback, seamless audio and video streaming, immersive Virtual Reality (VR) experiences, and responsive gaming. These applications need substantial bandwidth and minimal latency to operate effectively. Currently, these requirements are met by employing an Optical Line Terminal (OLT) chassis, which connects at the access layer of the network.

Cisco's Routed PON Solution is a transformational approach that condenses the OLT chassis into a pluggable form factor. The solution becomes a part of the access router by plugging the Cisco PON SFP+ into 10G ports of NCS540, NCS5500, and NCS5700 series routers. You have the option to utilize a scalable model based on your bandwidth requirements, choosing between PON pluggable optics or Ethernet optics for your requirements.

This solution provides a network infrastructure that supports future upgrades, enabling a transition from a 10G pluggable OLT to a 25G variant when it becomes available. This solution not only uses the advanced features and capabilities of the Cisco routers but also capitalizes on the cost efficiency of PON networks. Since it uses passive devices, it doesn't require an extra power supply, leading to lower overall power consumption in the network.

The transceiver module acts as a substitute for the OLT chassis, managing the entire optical span within the access network. The Cisco PON OLT is compatible with various Optical Network Terminals (ONTs) on the market, provided they adhere to the ONU Management and Control Interface (OMCI) standard. This port-by-port network expansion approach eliminates the need for adding fixed line cards to a chassis-based OLT, allowing for a more capital-efficient network growth strategy.

Some of the advantages of the solution are:

- The transceiver module removes the need of any 3rd-party hardware for OLTs, thereby reducing the dependency on 3rd-party vendors and streamlining the network infrastructure.
- The transceiver module is a pluggable OLT that is inserted into the router. The cost of the OLT is lower than the OLT Chassis, hence reducing the cost of deployment.
- Since the device is a pluggable transceiver module, this significantly reduces the physical footprint of the network.
- Use of the PON Manager to deploy and upgrade the Routed PON solution saves time due to the use of a single point of management.

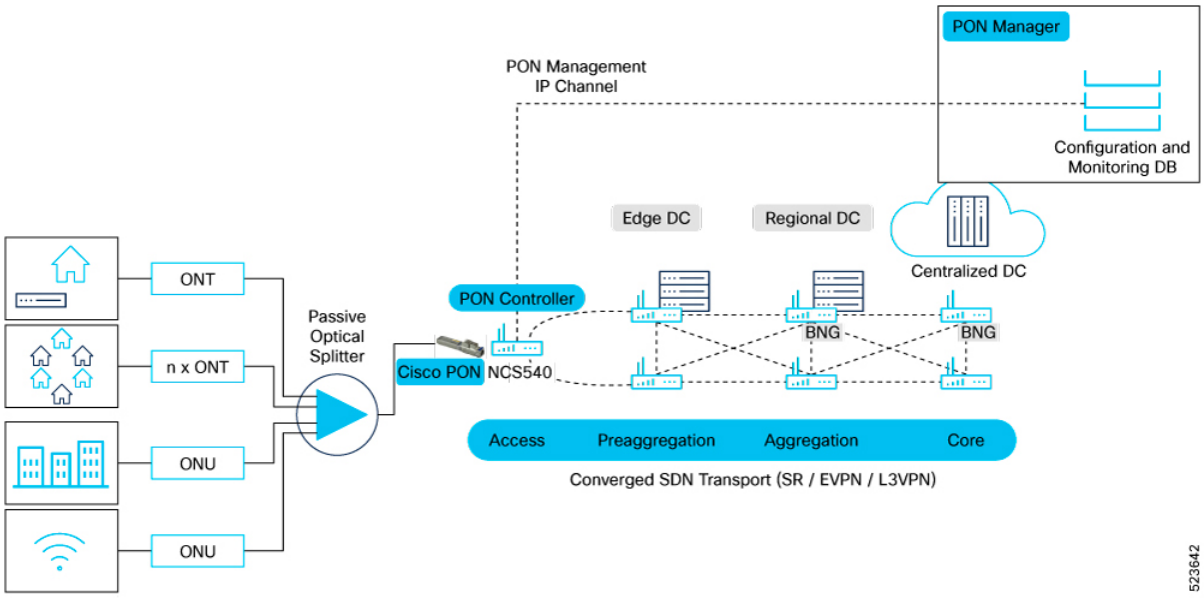
This release supports the PON Controller on the following Cisco router variants:

- N540-24Z8Q2C-SYS

- N540-ACC-SYS
- N540X-16Z4G8Q2C-A, N540X-16Z4G8Q2C-D
- N540-28Z4C-SYS-A, N540-28Z4C-SYS-D
- N540-24Q8L2DD-SYS
- NCS-55A1-24Q6H-SS
- NCS-55A2-MOD-S
- NCS-57C1-48Q6D
- NCS-57C3-MODS-SYS

Cisco Routed PON Architecture

Figure 1: Cisco Routed PON solution



The solution involves integrating the Cisco PON pluggable OLT into the 10G Ethernet ports found on the Cisco NCS 540, NCS 5500, and NCS 5700 routers. The PON manager and its corresponding database are hosted on either an external system or specialized hardware, which can be located within the core network infrastructure or hosted on a cloud platform. The PON controller establishes a protected link facilitating the exchange of data between the PON manager and the network's OLTs and ONUs. A more in-depth examination of these individual elements of the solution follows.

- Components of the Cisco Routed PON Solution, on page 2

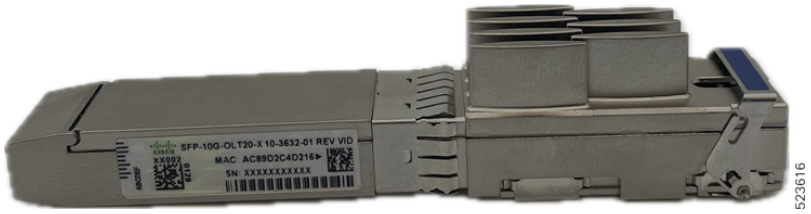
Components of the Cisco Routed PON Solution

The Various components of the solution are:

Cisco PON pluggable OLT

The Cisco PON pluggable OLT features a hot-swappable SFP+ design that enables the deployment of a software-defined broadband network. It incorporates a 10G Ethernet to XGS PON MAC Bridge IC along with a Layer 1 optical transceiver. This integration facilitates the module's connection from a PON network to a dedicated Ethernet SFP+ port on routers. The system is capable of supporting 10G data transmission speeds both upstream and downstream.

Figure 2: PON Transceiver Module



Technical specifications of the Cisco PON pluggable OLT are:

Table 1: Cisco PON pluggable OLT Technical Specifications

Dimension (H x W x D)	8.55mm x 13.4mm x 80.65mm
PID	SFP-10G-OLT20-X
Data rate	Symmetric rates: 8G upstream/8G downstream
Connector Type	SC/UPC
Maximum Distance	20 km
Operating Temperature	-20°C to 75°C
Typical Power Consumption	3.2W
Average Launch Power	4 dbm min 7 dbm max
ODN Class	N2
Cable Type	Single Mode Fiber

Cisco Routed PON ONT

Cisco 10G routed PON ONTs are fully compliant with the XGS-PON ITU-T G.9807.1 standard, supporting symmetrical 10-Gbps downstream and upstream optical connectivity via an SC/APC optical connector to meet current and future networking needs. With integrated XGS-PON optics, MAC, and Ethernet switching capabilities, these ONTs help network operators optimize Total Cost of Ownership by reducing edge transport, switching, and routing costs, as well as minimizing footprint and power consumption. Used with Cisco routed PON modules, Cisco PON ONTs provide an ideal end-to-end solution for cost-effective, agile, and diverse networking requirements.

Supported Cisco 10G Routed XGS-PON ONTs

- ENC-10G-ONT-10 for high-speed single-port RJ-45 deployments

- ENC-10G-ONT-14A for multiple business broadband and voice port option
- ENC-10G-ONT-01PR for outdoor deployments

Cisco PON Manager

The Cisco PON manager is a web application and an accompanying REST API that provides a graphical user interface for managing the PON network. The PON manager is used to set up the OLTs and ONUs, as well as downloading firmware updates for both the OLTs and ONUs. The REST API accompanies the web application for the purposes of providing access to MongoDB for managing PON users and the PON network. The PON manager facilitates:

- Alarm management
- Dashboard view
- Device monitoring and statistic
- Device provisioning and management
- Service configuration
- User management
- Database management

MongoDB database

The MongoDB datastore contains all of the configuration, state, statistics, alarms, and logging data for the devices in the PON network. Northbound interfaces, such as the Routed PON Manager and the customer applications interface with MongoDB to provision and retrieve monitoring information for devices in the PON network. MongoDB serves as the interface between the PON Manager and the PON Controller.

Cisco Routed PON Netconf Server

The Cisco Routed PON Netconf Server features a Netconf-compliant interface and an API that allows clients to manage PON networks effectively. Built on Netopeer2 and ConfD, the server provides robust configuration management and connects to a MongoDB database for operational data handling. It complies with the Broadband Forum's TR-383 and TR-385 YANG models, ensuring the server can configure subscriber services reliably within the PON network infrastructure.

Cisco PON Controller

Cisco PON Controller is a light-weight application which runs as a docker container on each NCS540, NCS 5500, and NCS 5700 devices. Various configurations applied to the OLTs and ONTs in the network are fetched from the MongoDB database and provisioned on the OLT ONUs by the PON Controller. At each polling cycle, the PON controller collects state information, statistics, alarms, and logs from devices and reports the information to higher layer applications through MongoDB.