R-CORD GPON Aggregation Switch

Case-study

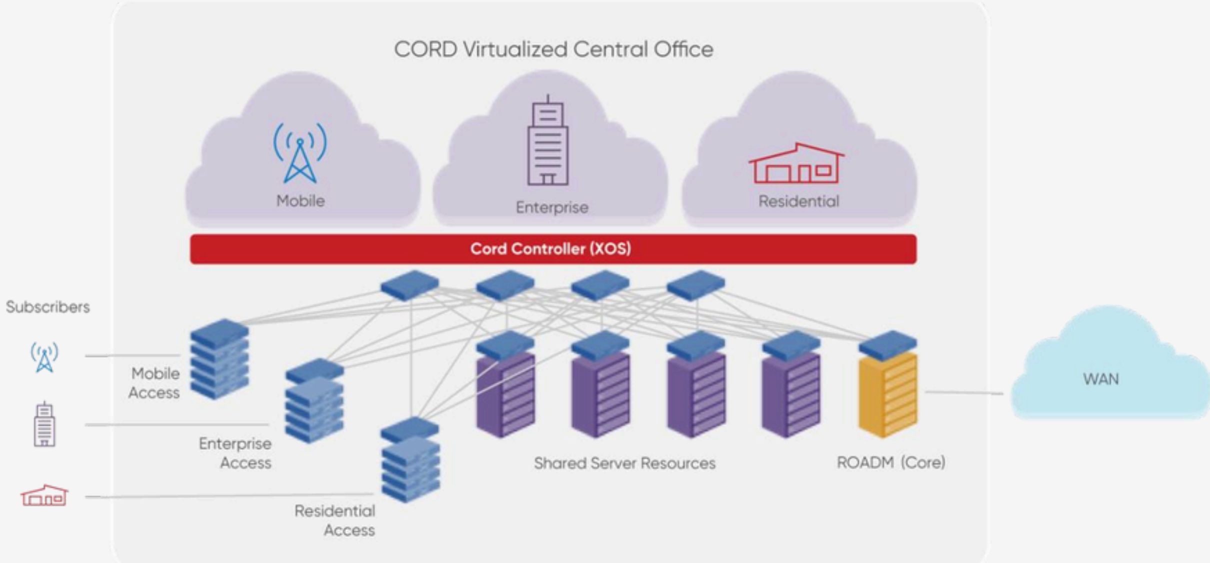
1. Introduction

This document describes the project undertaken by PalC Networks for building **GPON Aggregation switch in a CORD** deployment.

1.1. CORD Introduction

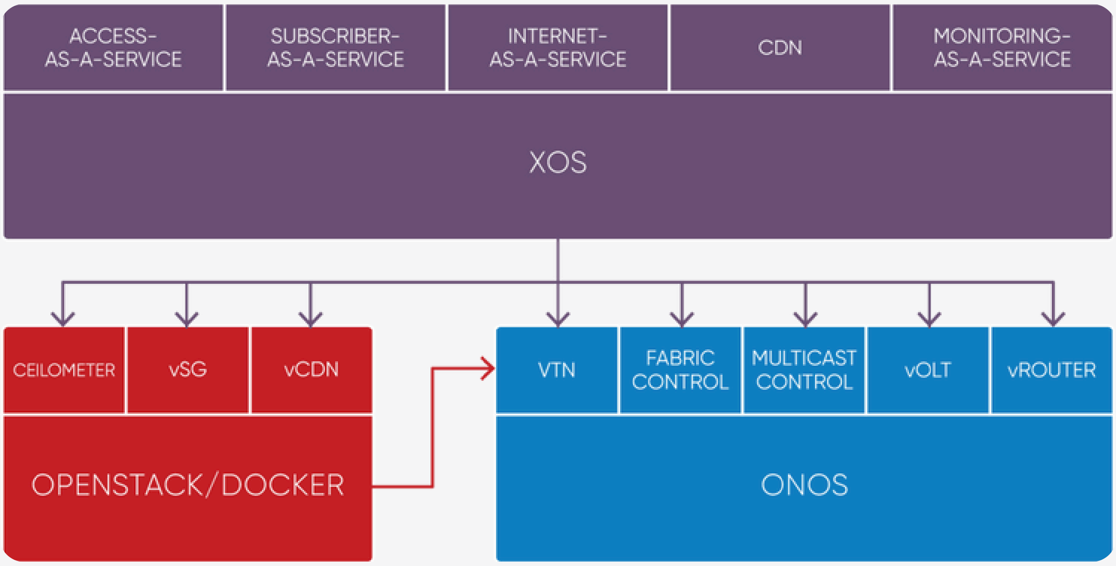
The CORD (Central Office Re-architected as a Datacenter) platform leverages SDN, NFV and Cloud technologies to build agile datacenters for the network edge. Integrating multiple open source projects, CORD delivers a cloud-native, open, programmable, agile platform for network operators to create innovative services.

CORD provides a complete integrated platform, integrating everything needed to create a complete operational edge datacenter with built-in service capabilities, all built on commodity hardware using the latest in cloud-native design principles. The below diagram represent the hardware architecture of the CORD.



Commodity Servers Interconnected by a Fabric of White-box Switches. Switching Fabric in a Spine-Leaf Topology for Optimized East-to-West Traffic, Specialized access hardware for connecting subscribers (residential, mobile and/or enterprise)

The below diagram represents the software architecture of the CORD deployment

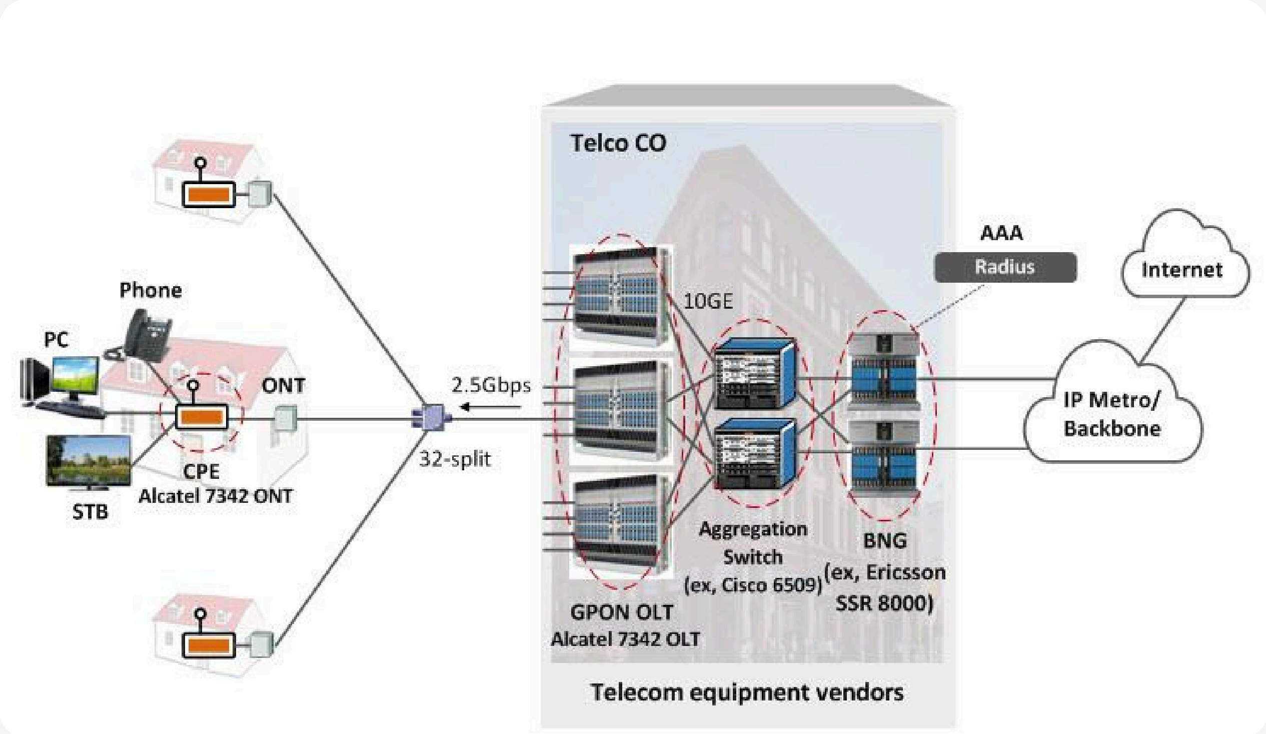


Built with commodity hardware, the CORD platform leverages dozens of upstream open source projects including

- OpenStack - Provides IaaS capability for creating and provisioning virtual machines (VMs) and virtual networks
- Docker - Provides a container-based means to instantiate service elements
- ONOS - Network operating system that controls the underlying whitebox switching fabric and overlay networks, enabling delivery of end-user service from the fabric where possible (minimizing the need for all services to be hosted as VNFs on more expensive servers)
- XOS - Framework for assembling and composing services

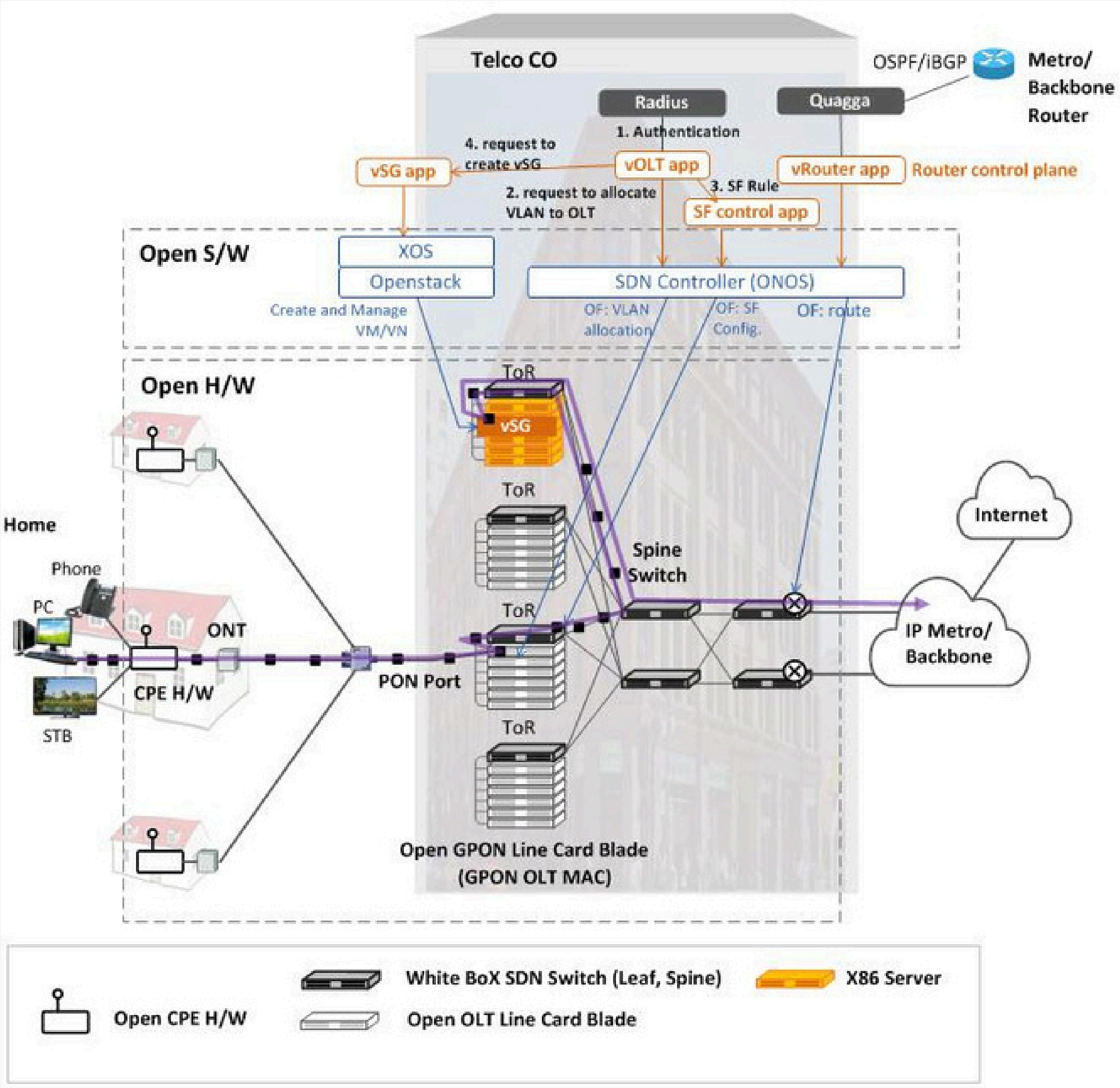
1.2. Container Orchestration

The below diagram represents non CORD deployment of Telco’s central office.



The prime focus of R-CORD is to dis-aggregate the various services running in the specialised hardware to a virtualised appliances running in the server. Residential CORD (R-CORD) includes services that leverage wireline access technologies like GPON, G.Fast, 10GPON, and DOCSIS. R-CORD includes a virtual OLT (vOLT), virtual Subscriber Gateway (vSG) and leverages a core networking service - virtual Router (vRouter); the former is implemented by a container that is bound to each subscriber and the latter is an ONOS control application.

The below diagram shows the R-CORD deployment with various services deployed in X86 server which are being orchestrated by ONOS controller. The OLT blades are connected to a WhiteBox Aggregation switch (mentioned in the green circle) which terminates the subscriber and provides the services mentioned in the TR.101 Broadband Spec.



1.3. Requirement

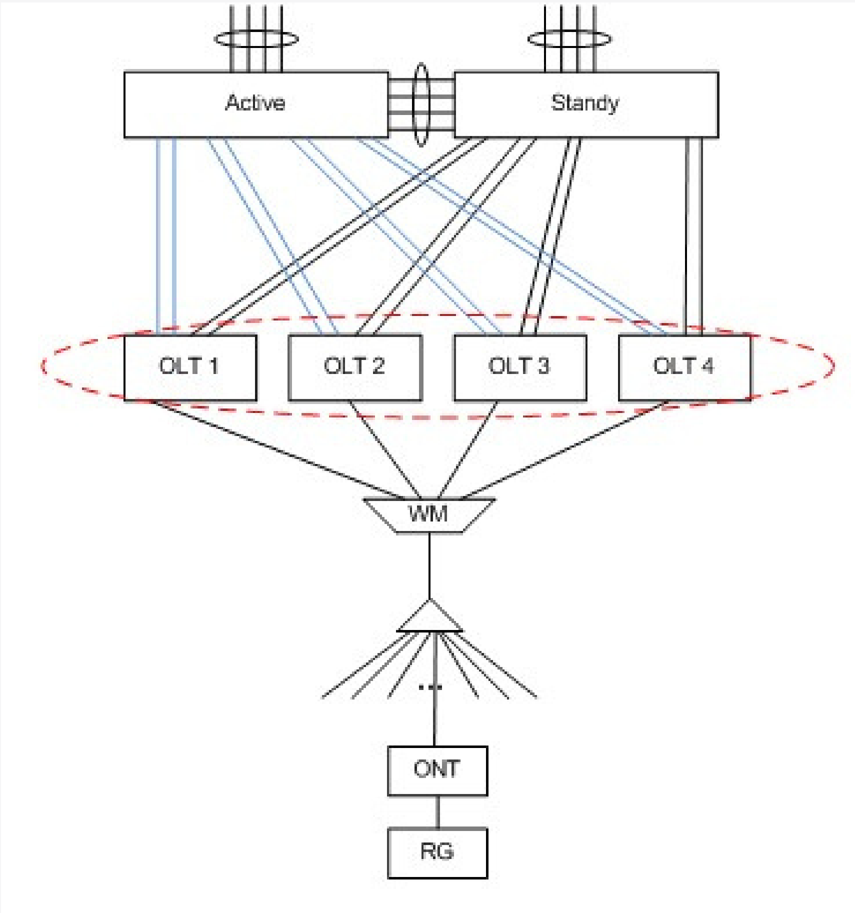
The requirement is to develop most of the features mentioned in TR.101 Spec from the aggregation switch side on top of one of the commercial whitebox NOS vendor. Refer to the above section for more information about the list of features developed as part of this project.

2. NOS Platform Architecture

The below diagram represents the high-level overview of the NOS architecture.

3. Network Architecture

This section talks about the deployment models and network architectures.



The above diagram describes the network architecture of the GPON network to provide data, voice and video services for subscribers. The aggregation switches which is shown as Active and Standby in the below diagram provides Layer2 termination based on subscriber and service VLAN. After terminating the Layer2, it provides routing service. These devices run MC-LAG in between them to provide active- standby redundancy paths for group of OLT devices. The OLT devices are connected to ToR device via LAG interface which is operating in active-standby mode. This is to provide redundancy in layer2 level to avoid any packet loss when the active node goes away. In L3 side, VRRP will be running across these two aggregation nodes (towards the south-bound interface) which brings redundancy in L3 level.

4. Supported Features

Below is the list of features, which we had supported for the Leaf-spine deployment.

5. Approach

We understood the customer requirement and discuss with the customer about the list of features to be ported for the use case. Once the use case was understood we

1. The NOS was running on a Debian7 based OS. Since the board CPU doesn't have support for linux kernel version 3.x. We upgraded the NOS to run on Debian 9 with linux kernel 4.x kernel.
2. Brought the board up with the new NOS which is packaged as a ONIE installer.
3. Bring all the system features which is running on the management interface.
4. Write the hardware hook code to interact with the chipset from control plane.

- Initialize the board, different tables, interfaces etc.
- Wrote the code to manage all the peripheral devices in the board like fan, led, power supply, temperature sensor etc.
- Bring the Interface up with different speed, mtu and breakout
- Port L2 features
  Port L3 features Port
  ACL & QoS g. Port
  VxLAN feature
- Perform test
  Test the features individually
  Test the use case

6. GLOSSARY

BFD: Bidirectional Forwarding Detection
CE: Customer Edge
H&S: Hub & Spoke
IDU: Indoor Unit
MNGT: Management
ODU: Outdoor Unit
PE: Provider Edge
PoC1: Point of Concentration 1st level (aggregation level next to the core network)
PoC2: Point of Concentration 2nd level (intermediate aggregation level)
PoC3: Point of Concentration 3rd level (first aggregation point after last mile/access)
SDN: Software Defined Networks
DCSG: Disaggregated Cell Site Gateways