



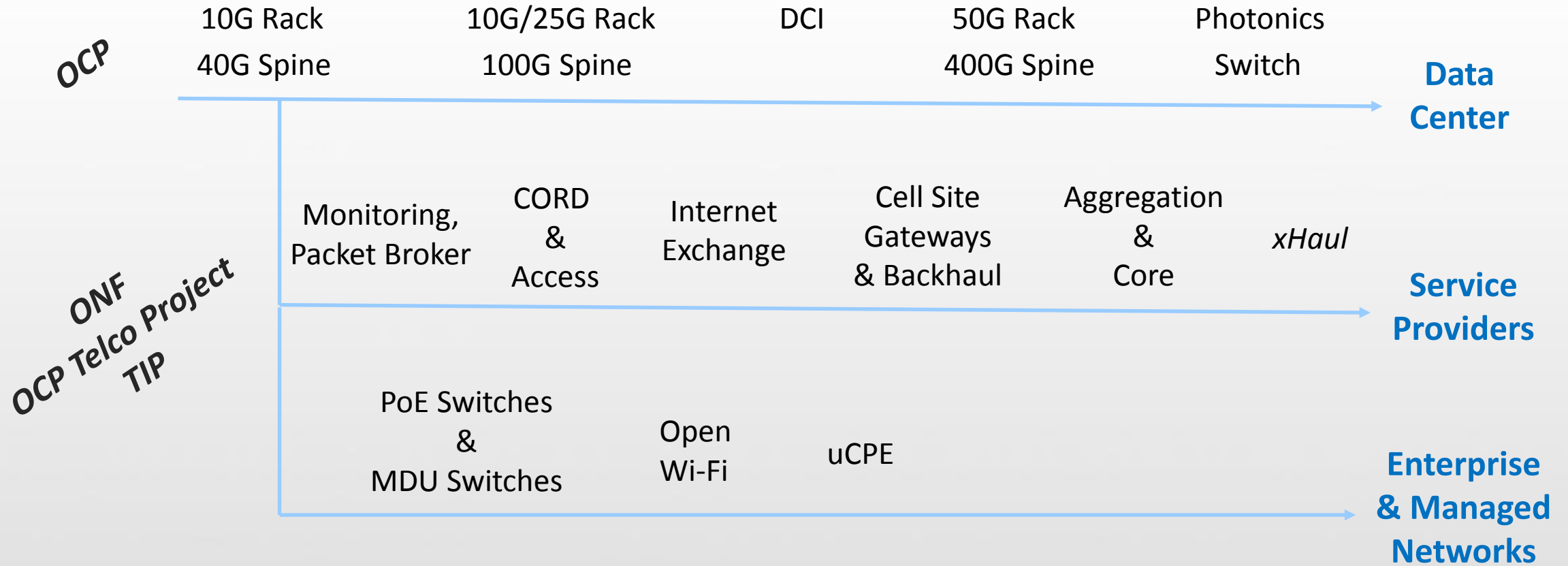
# The Open Revolution From Web Operator To Telco

Youngcor Shueh

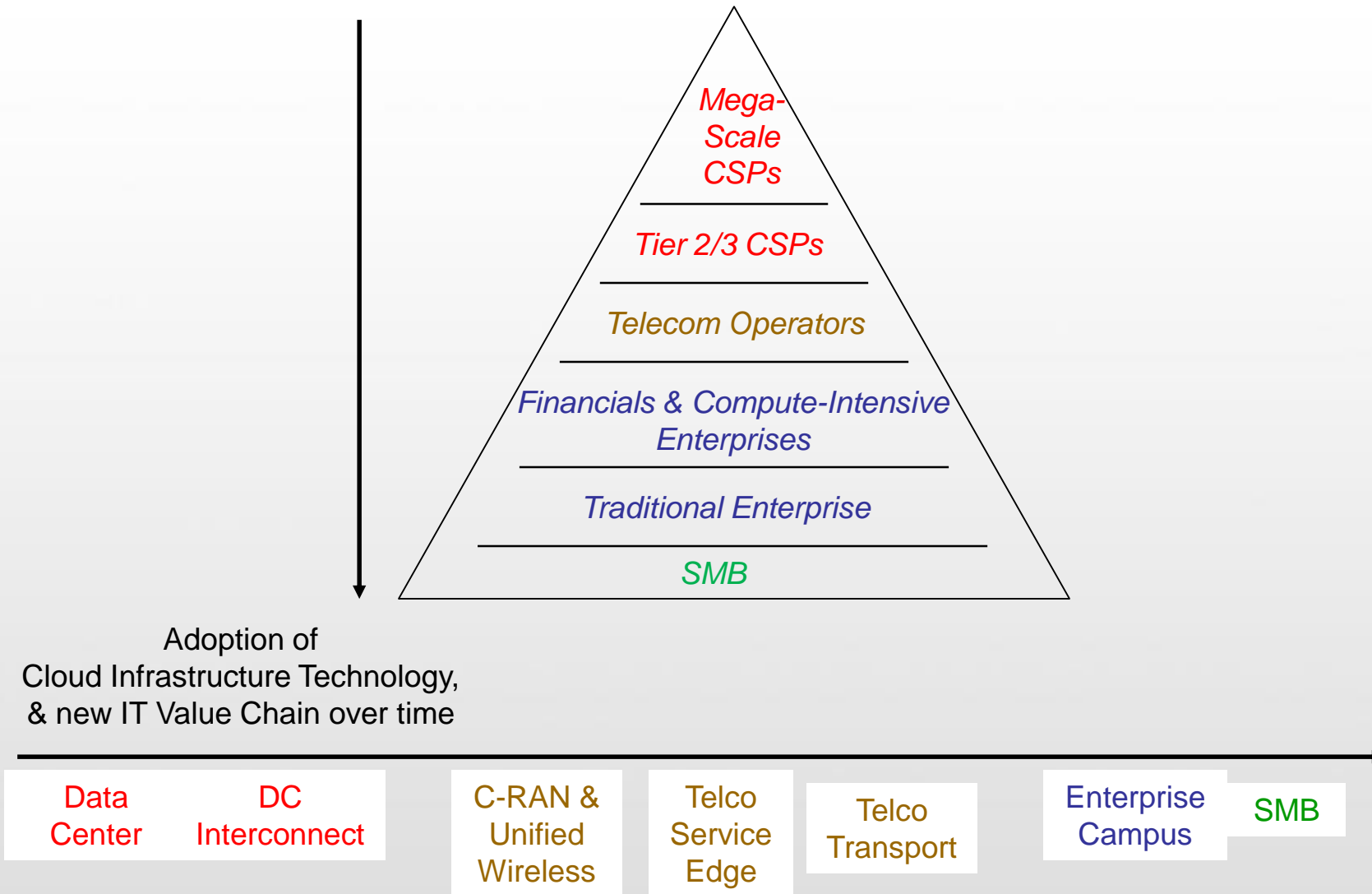
*January 15, 2019*

# Open Networking Evolution

## *Edgecore Investment in each Market*



# Transition to Cloud Network Architecture & Delivery



# Software Paths in Open Networking

**Open Network Hardware: whitebox, disaggregated**

**Commercial Software**

**Open Source Software**

**Packaged NOS**

- OEMs: Cisco, Arista, etc

Data Center

- Big Switch

- Cumulus

- BRCM ICOS

CSP

- Arrcus

- DriveNets

- IP Infusion

**Software Components**

- Rtbrick
- MetaSwith
- Aricent
- Etc

**Platforms**

- SoNIC
- ONF Stratum
- DANOS-- TBD

**Software Components**

- ONL
- OFDPA
- Open BMC
- P4
- etc

# Enabling Software Options for Range of Use Cases

**Enablers**

**Diagnostics**



**Open BMC  
Vendor BMC**



**1. Tier 1 Operator's software on Accton whiteboxes**



**Hyperscaler**

**2. Commercial Whitebox Software Partners**

Enterprise

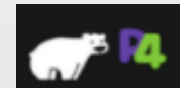
Packet Broker

Data Center Fabric

Service Provider



**3. Open Source Software**

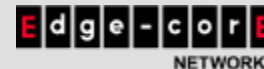


**Edgecore Open Source Package**

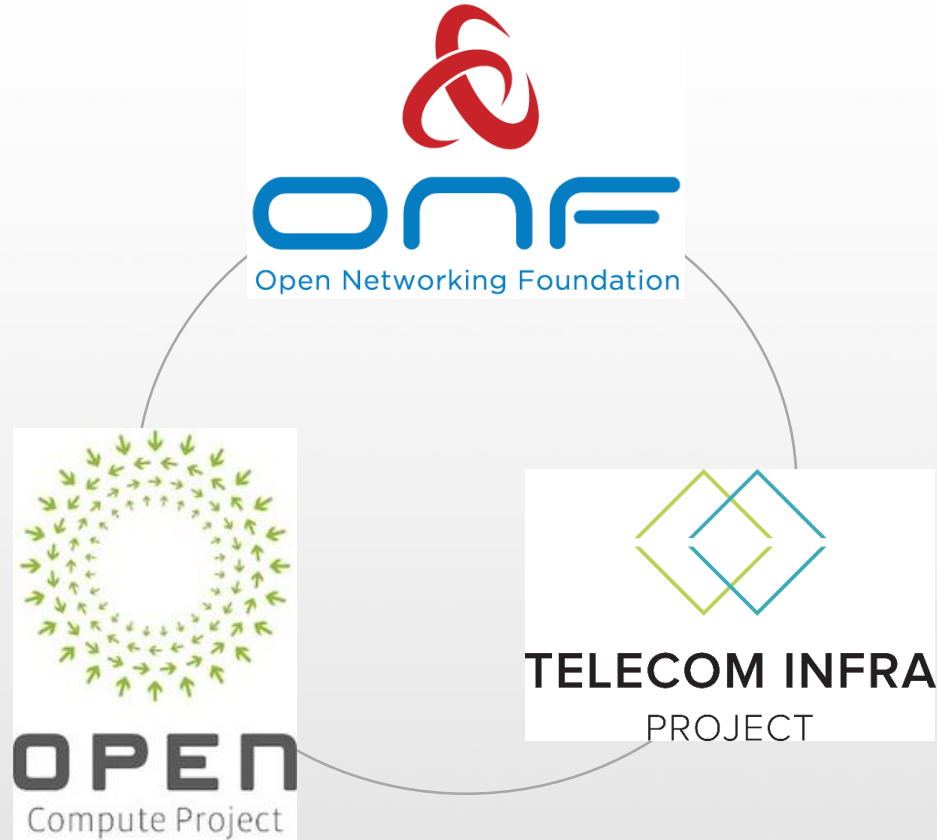
**4. OEM SW on Edgecore whiteboxes for lead customers**



**5. Edgecore EdgeCOS for MDU switches**



# Open Networking Community



## ONF Operator Partners



# Leadership in Open Networking Community

- VP Tech Jeff Catlin on Incubation Comm
- CEO George Tchapanian chair of OCP Taiwan
- 1<sup>st</sup> & leading contributor to Network Group
- Designs for new use cases in Telco Project
- Support all OCP Software/Firmware



- CEO George Tchapanian on ONF Board
- Member since 2014, Partner since 2018
- Edgecore hardware basis for CORD
- Contributing to all four Ref Designs



- Contribute Cassini packet transponder
- Integrating optical tech from leading partners
- 1<sup>st</sup> contributor to DCSG cell site project

# Most Network Design Contributions to Open Source

*Industry Firsts: 10G to 400G DC switches, New Telco Use Cases*

## OCP-ACCEPTED™ Designs & Products

- *1G Rack Mgmt Switch*      *Helix4*
- *10G TOR Switch*      *Trident II*
- *40G Spine Switch*      *Trident II*
- *100G TOR & Spine Switch*      *Tomahawk*
- *100G TOR & Spine Switches*      *Trident3*
- *64 x 100G Spine Switch*      *Tomahawk II*
- *32 x 400G*      *Tomahawk III*
- *10G/100G Edge Switch*      *Qumran*
- *Open Rack Switch Adapter*

## Design Contributions in OCP Review

- *100G OMP800 Chassis*      *Tomahawk*
- *100G OMP1600 Chassis*      *Tomahawk*
- *25G TOR Switch*      *Tomahawk*

## Partner Designs, Edgecore OCP-INSPIRED™ Product

- *Wedge40-16X*      *Facebook*
- *Wedge100-32X*      *Facebook*
- *Wedge100BF-32X*      *Barefoot*
- *Wedge100BF-65X*      *Barefoot*

## OCP Telco Working Group

- *ASXvOLT16 10G OLT*      *BCM Qumran & Maple*
- *AS7316-26XB Cell Site Gateway*      *QumranAX*
- *AS7926-40XK and -80XK Aggregation Routers*      *Jericho2 in OCP Review*

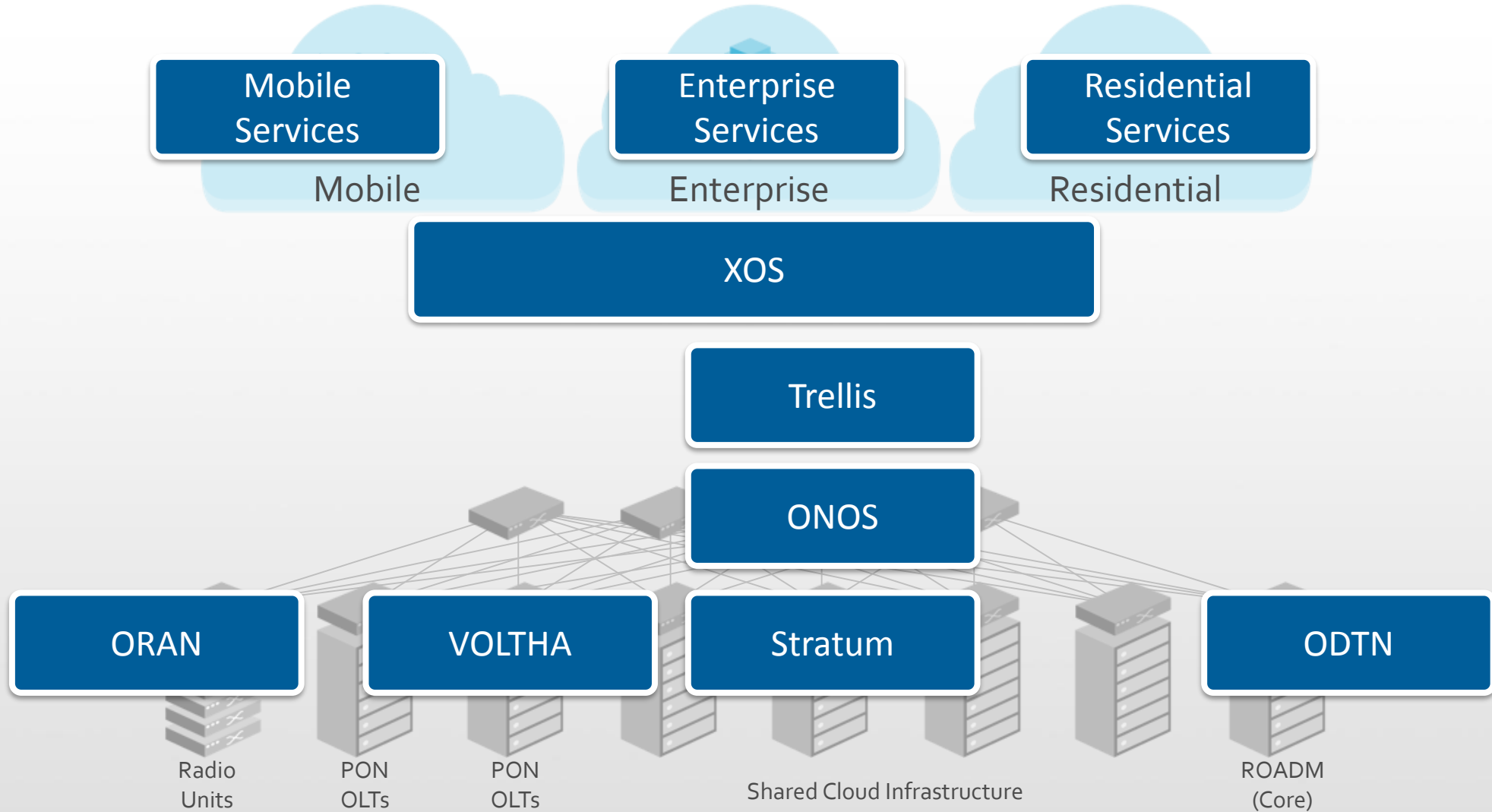
## OCP-ACCEPTED™ Access Products

- *1G PoE Switch*      *Helix4*
- *802.11ac Wave1 Wi-Fi APs*      *BCM*
- *802.11ac Wave2 Wi-Fi APs*      *QCA*

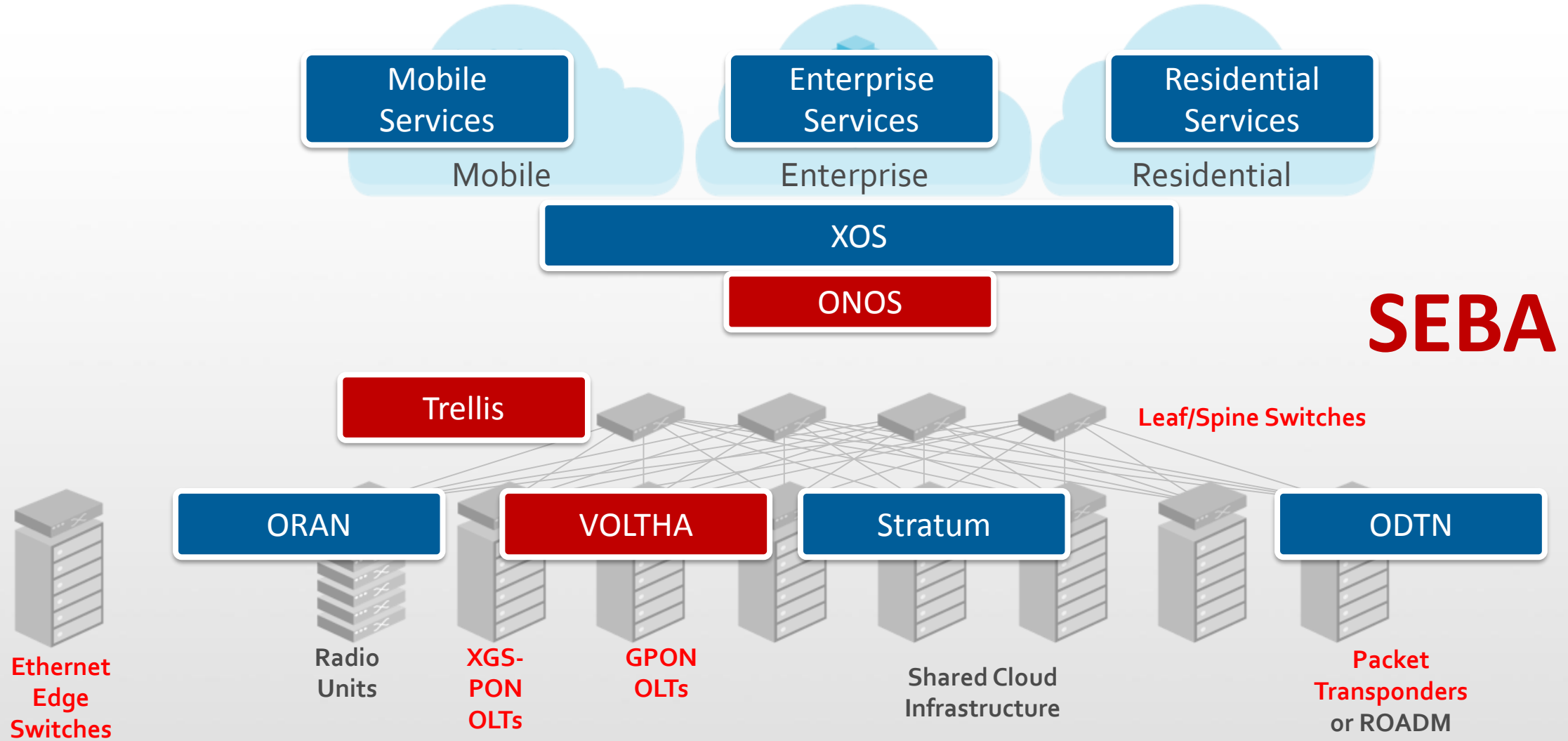




# ONF Projects & Platforms



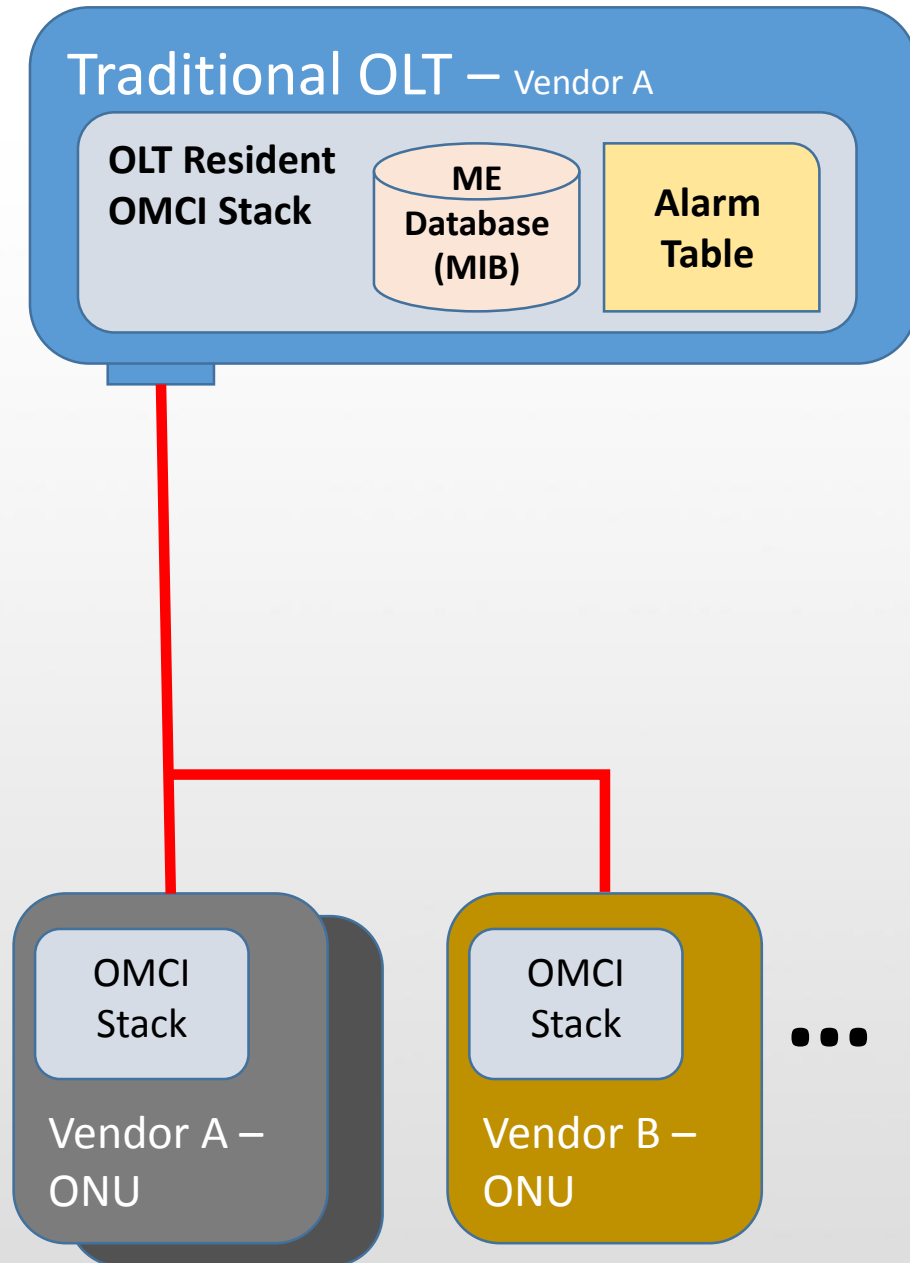
# ONF Projects & Platforms with Edgeworks Products



**SEBA**

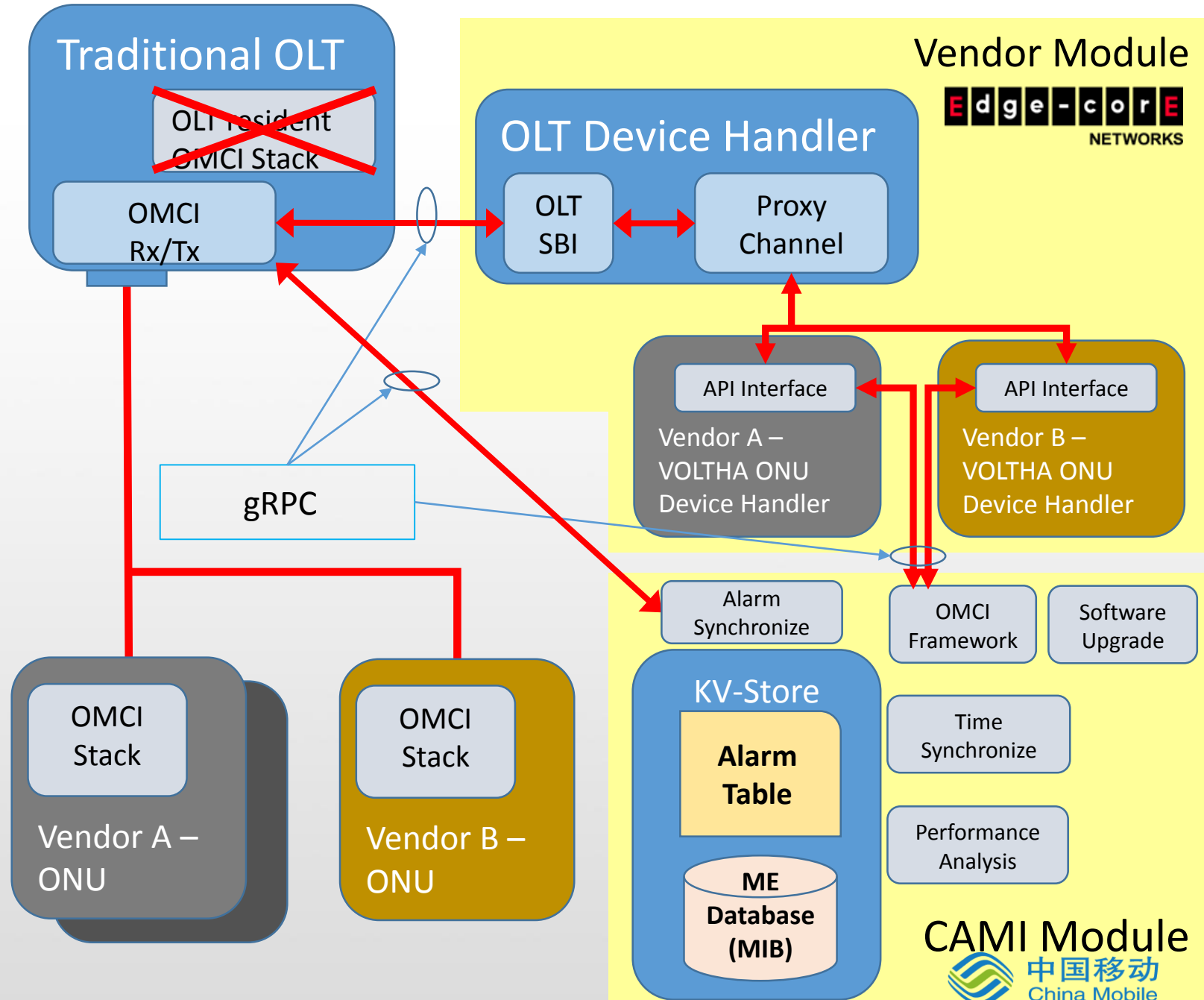
# Traditional OLT & ONU

- OLT PNF responsible for:
  - running all applicable OMCI State Machines
  - Maintaining ME and Alarm Databases.
  - Supporting any variations or work-arounds needed for different vendors ONU's OMCI stack implementations.



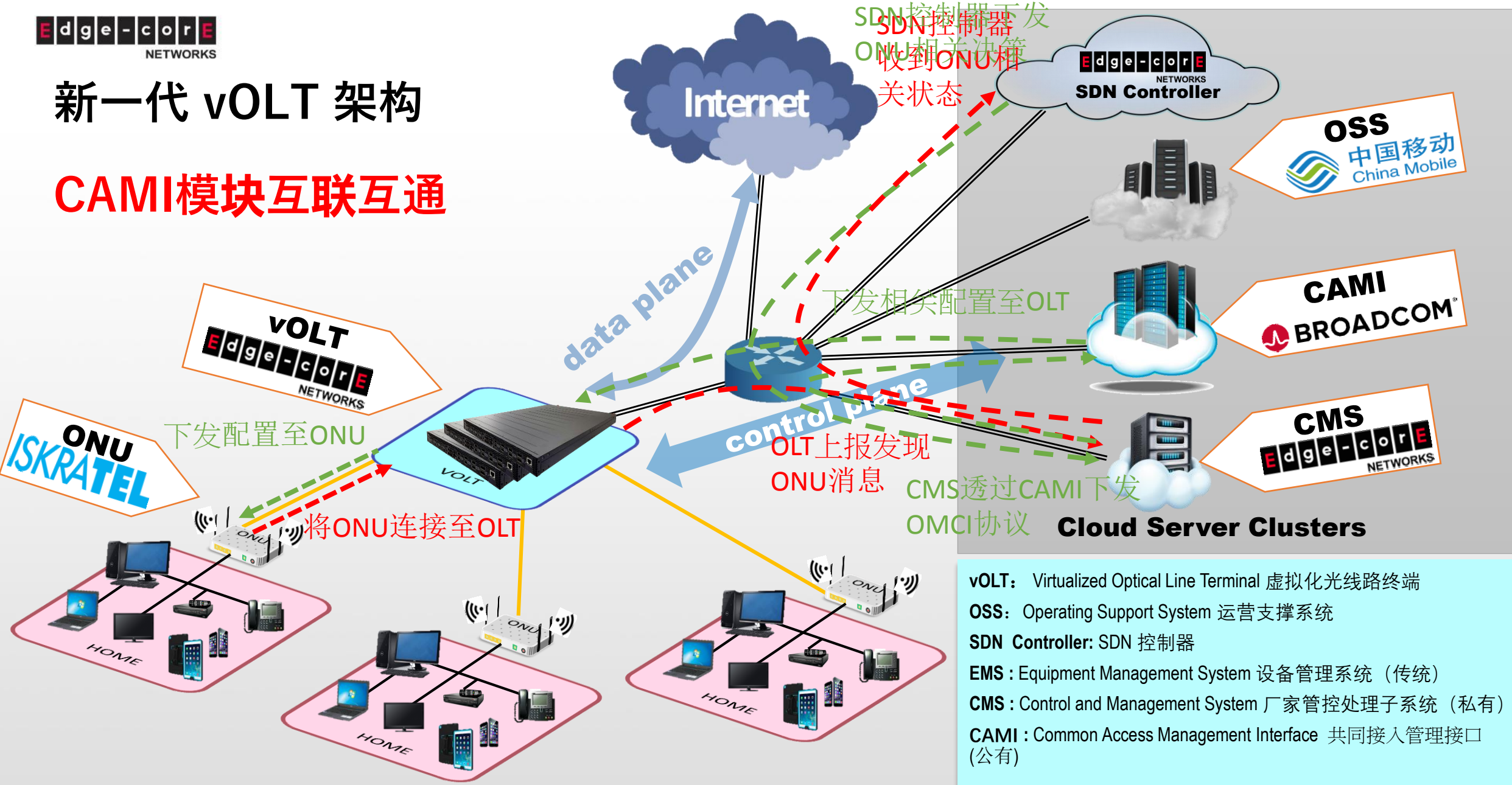
# vOLT System

- CAMI Module responsible for:
  - OMCI Message
  - Alarm Management
  - Software Upgrade
  - Time Synchronzie
  - ...
- Vendors Module responsible for:
  - OMCI Message Proxy (no modifications/monitoring of OMCI frame)
  - Provide per state-machine/OMCI Task modifications specific to Vendor's ONU



# 新一代 vOLT 架构

## CAMI模块互联互通



vOLT: Virtualized Optical Line Terminal 虚拟化光线路终端  
OSS: Operating Support System 运营支撑系统  
SDN Controller: SDN 控制器  
EMS: Equipment Management System 设备管理系统 (传统)  
CMS: Control and Management System 厂家管控处理子系统 (私有)  
CAMI: Common Access Management Interface 共同接入管理接口 (公有)

- Disaggregated 10G PON OLT for SEBA or R-CORD infrastructure
- XGS-PON or NG-PON2
- Conforms with AT&T XGS-PON Spec in OCP Telco Project
- 16 x XFP 10G PON
- 4 x QSFP28 100GbE Uplinks
- Broadcom DNX QumranAX switch silicon, Broadcom Maple PON silicon
- Includes ONIE, ONL, vOLTHA driver (OpenOLT driver) for compatibility with SEBA/CORD infrastructures
- NEBS
- Available today

Aricent®

DZS™

ONF  
SEBA

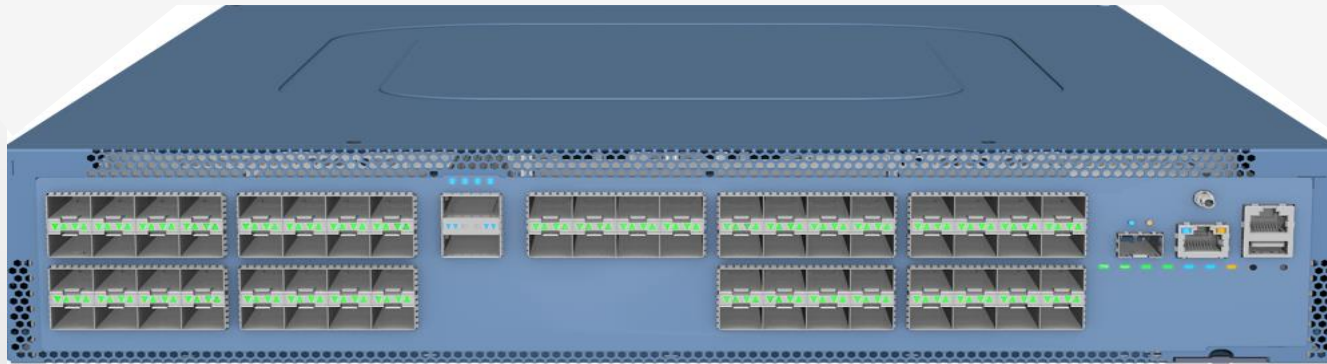


# Open GPON OLTs

- Conform to Deutsche Telekom Open GPON-OLT Specification
- Edgecore contributing hardware designs to OCP
- Open Source software for R-CORD, SEBA infrastructures: ONL, VOLTHA
- Commercial Software from partners

Aricent

ONF  
SEBA

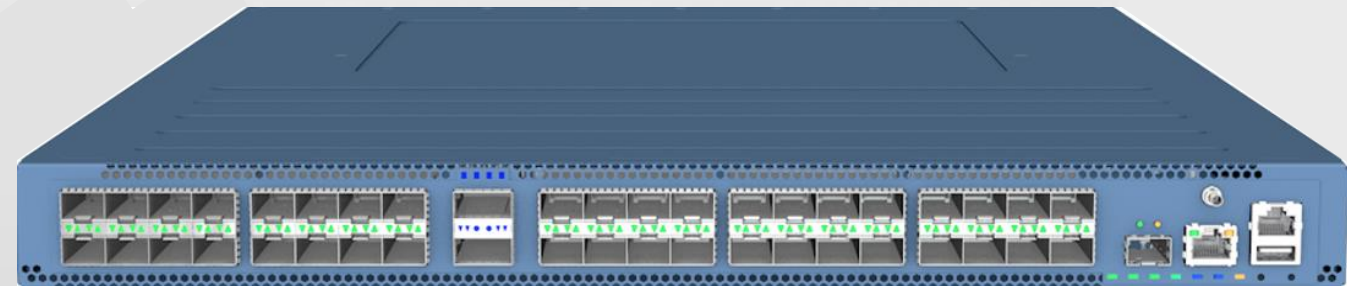


64 x GPON

2 x 100GbE, 8 x25GbE Uplinks

32 x GPON

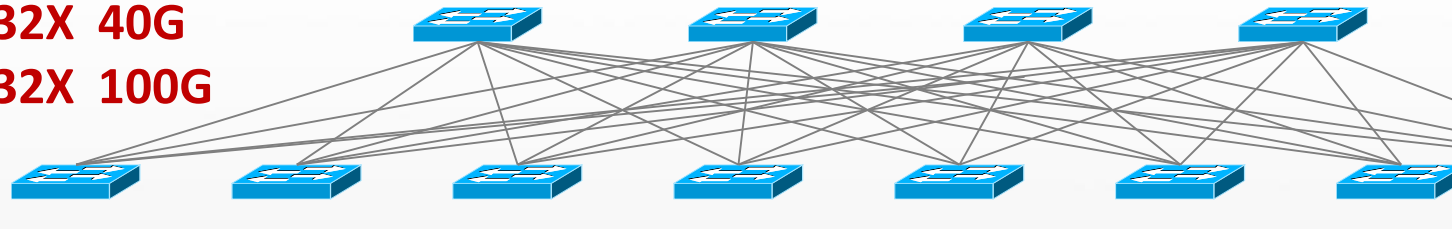
2 x 100GbE, 8 x25GbE Uplinks



# Edgecore CORD products for Tier 1 SPs

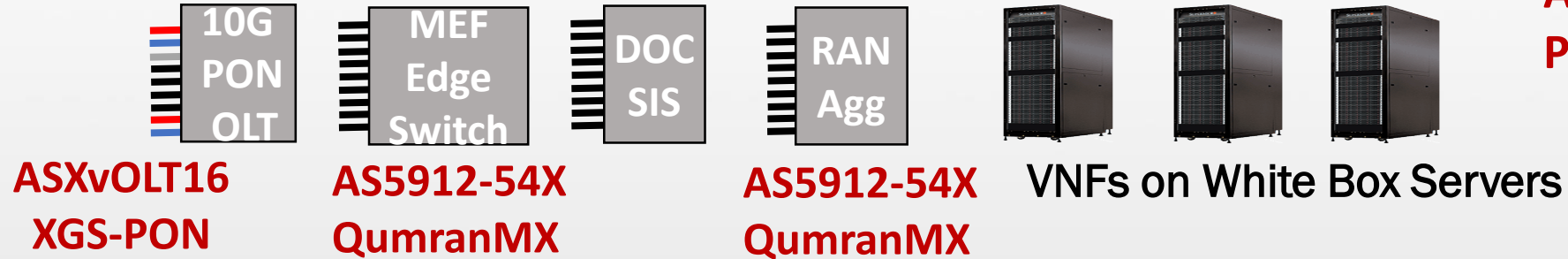
## Leaf-Spine Fabric: 40G, 100G Open Network Switches

**AS6812-32X 40G**  
**AS7712-32X 100G**



**Coherent  
Optical to  
Core**

**AS7716-24XC  
Packet Transponder**



**ONOS Open Source Controller**



**BGP App**

**Network App**

**Control App**

**ONAP Cloud Management and Service Orchestration**

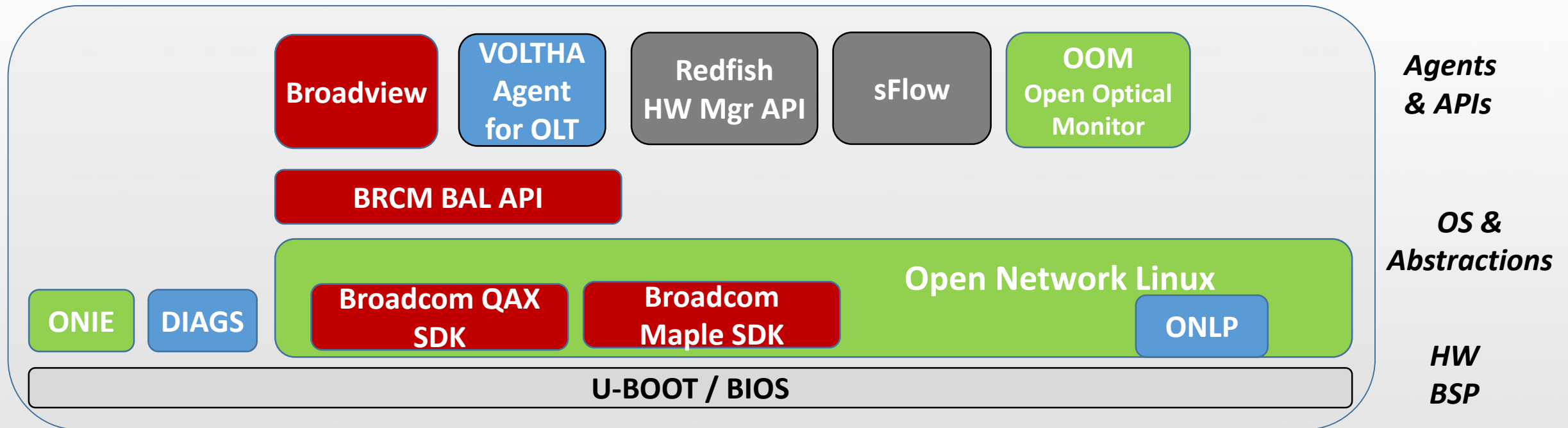
Attribution: ON.Lab



# vOLT SW for ONF CORD Architecture

## CORD Controllers

### Switch Software



## Switch Hardware

Key: OCP Open Source Edgecore Broadcom

# Cassini AS7716-24SC: Packet Transponder

- Integrates 100GbE switching with L1 optical transport functions
- DC Interconnect, CORD uplinks, POP interconnect
- 3.2 Tbps switch based on Broadcom Tomahawk+
  - 16 x 100G QSFP28 100G Ethernet fixed ports
  - 8 Module Slots for additional QSFP28, or up to 8 x 100/200G ACO/DCO
- Optical Partners: Acacia, Finisar, FOC, NTT Electronics, Lumentum/Oclaro . . .
- CPU Module: x86 Broadwell-DE with 16-64 GB DRAM, 32-128 GB M.2, Optional BMC
- GA



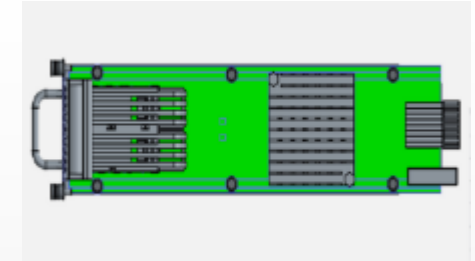
TELECOM INFRA PROJECT

*Open Design thru  
Telecom Infra Project*



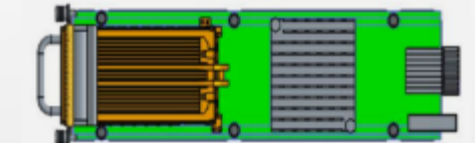
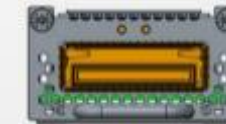
## LCQSFP-1

- 2 x QSFP28 100GbE
- PHY for retiming and MACsec encryption
- Four LEDs per QSFP28 to indicate status



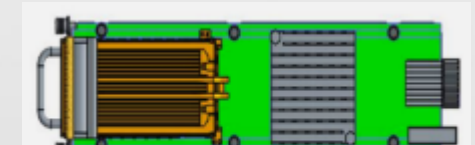
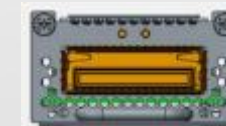
## LCDCO-1

- 1 x CFP2 100/200G
- Accepts standard CFP2 DCO module, e.g. Acacia AC200 CFP2-DCO Module
- PHY for retiming and MACsec encryption
- Two LEDs to indicate CFP2 status

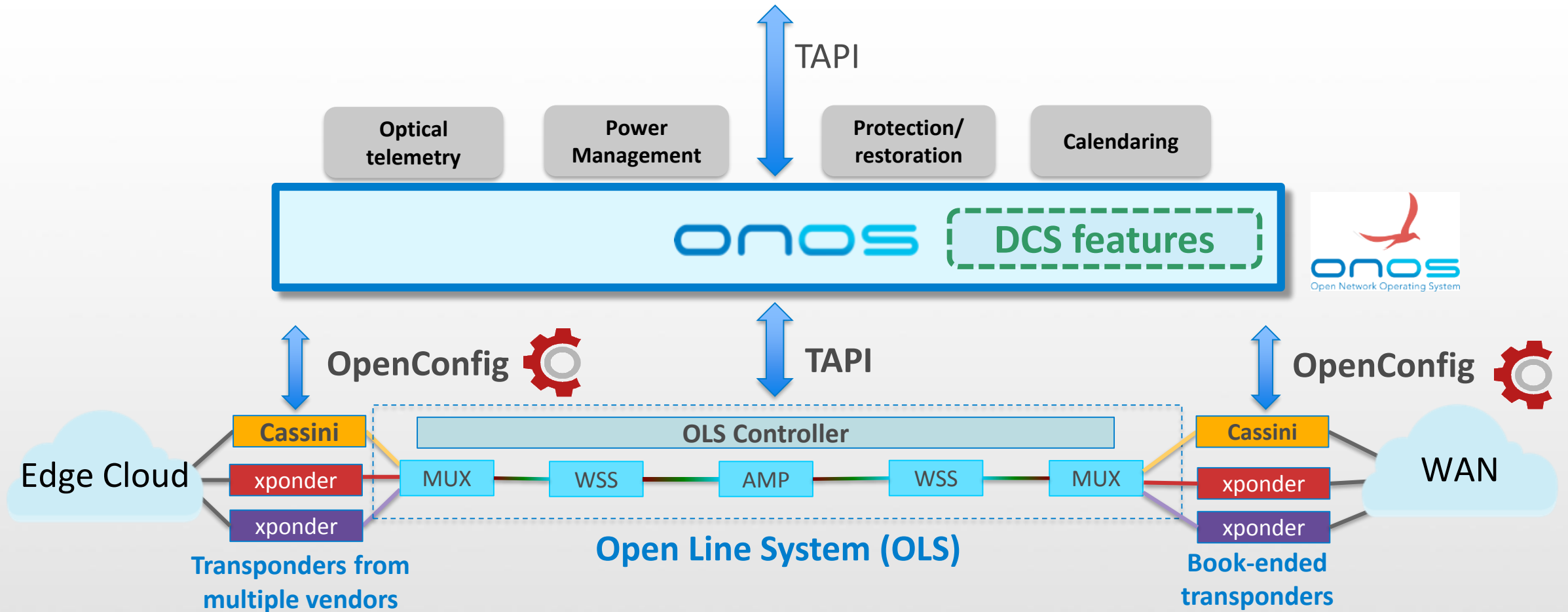


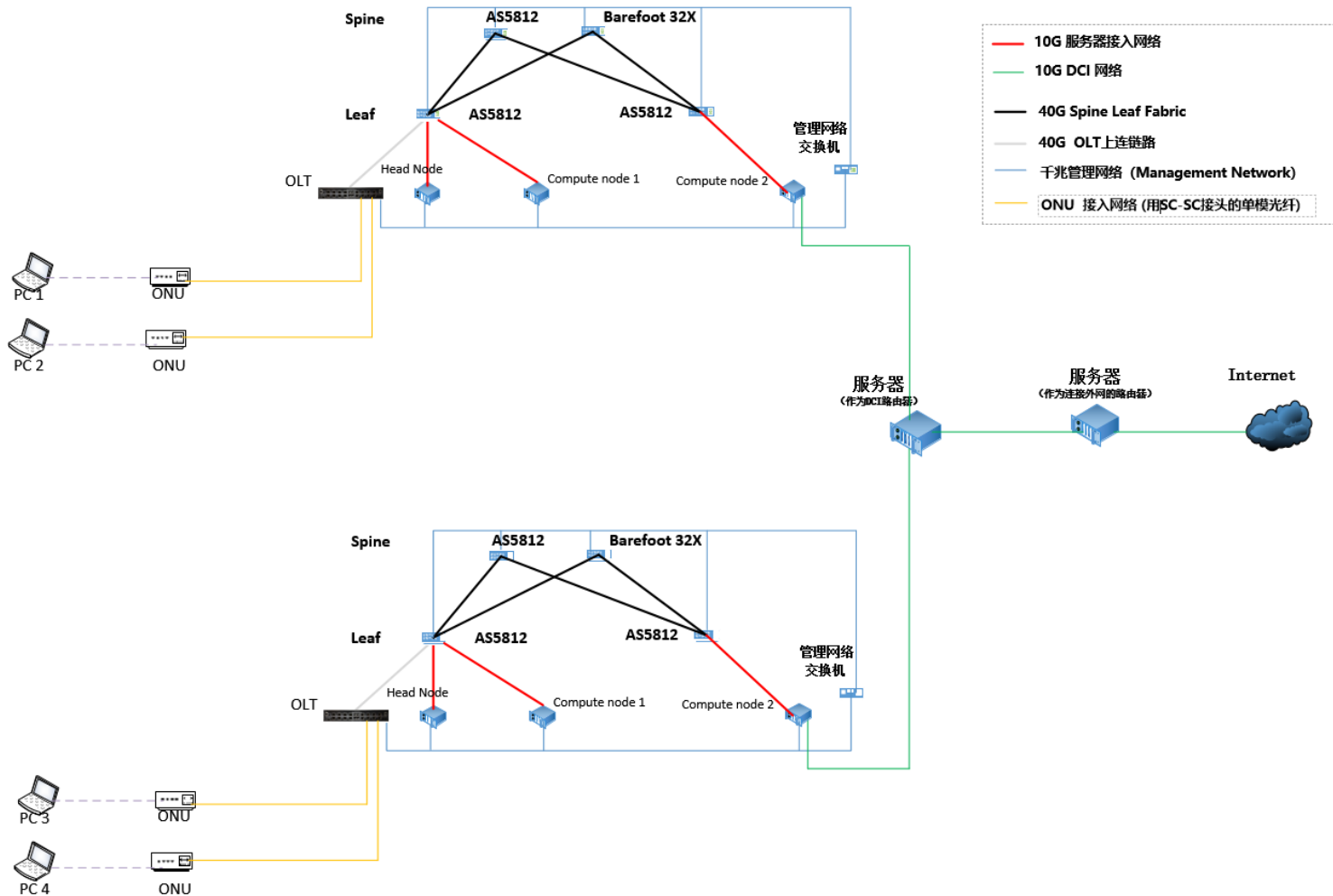
## LCACO-1

- 1 x CFP2 100/200G
- Line Card with NTT ExaSPEED 200 DSP
- Accepts standard CFP2 ACO module, e.g. Finisar CPF2-ACO Coherent Xcvr
- Two LEDs to indicate CFP2 status



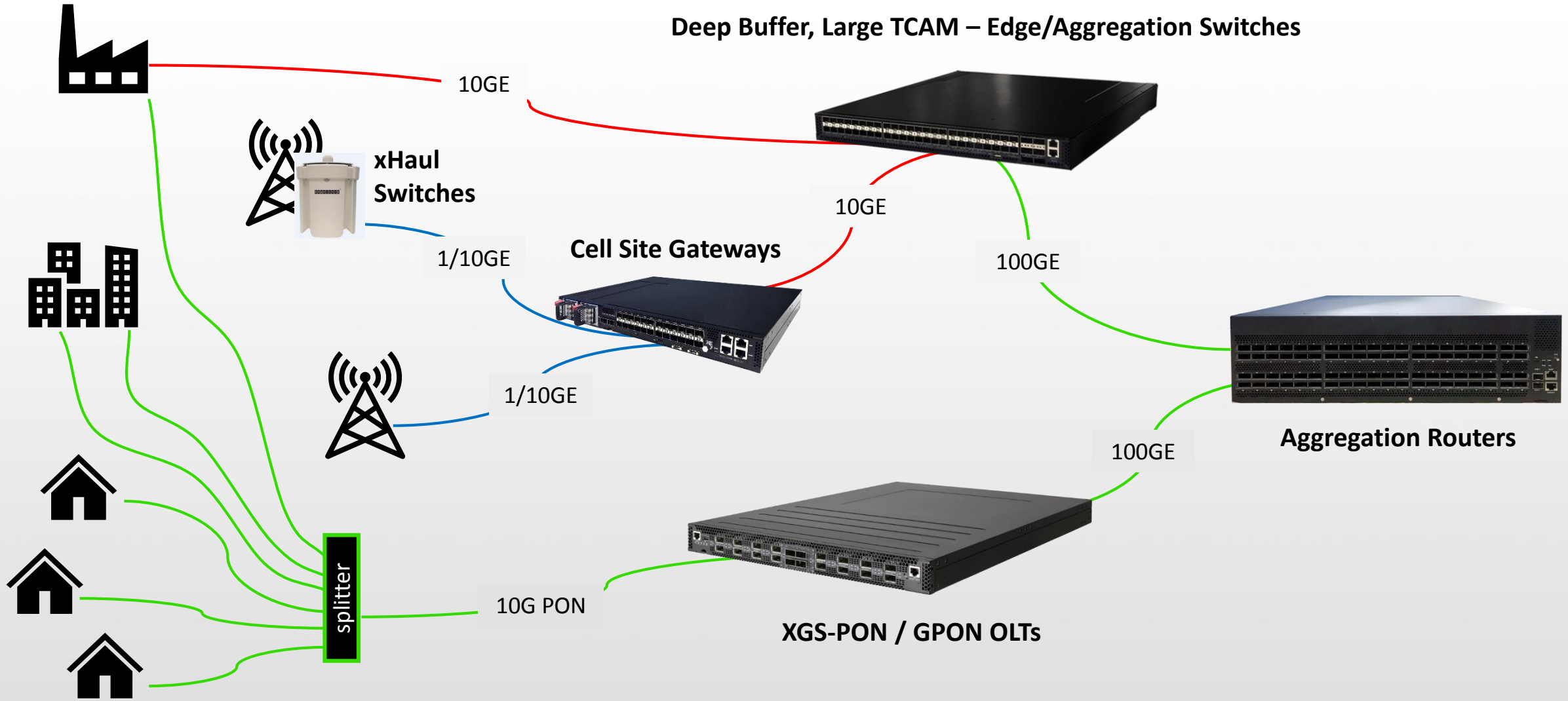
# ONF ODTN Reference Design



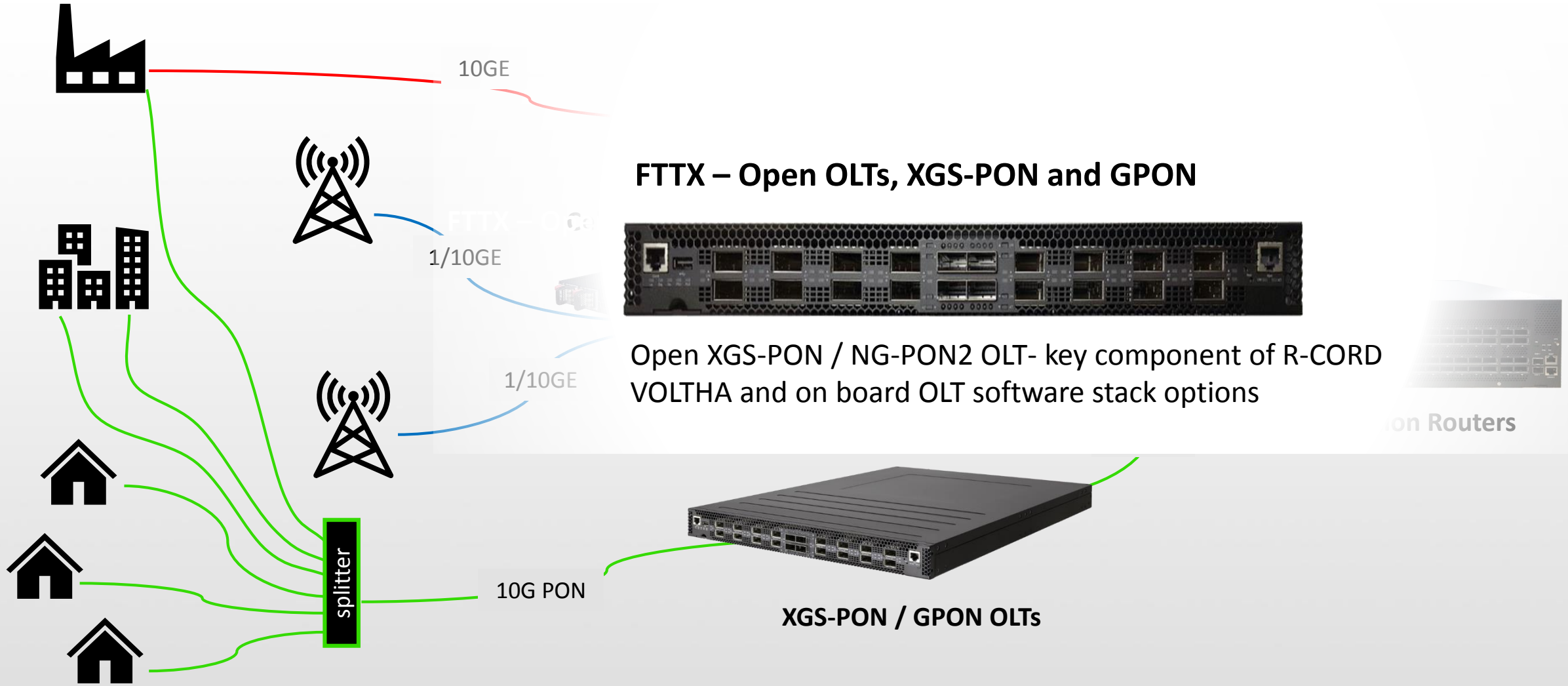


- 接入端:
- CPE和ONU只保留簡單的資料處理
- 局端:
- 業務邏輯處理，通過vOLT、vSG、vRouter、vCDN等虛擬化技術，
- 一方面實現控制與轉發分離，另一方面實現控制面集中管理
- 實現設備資源虛擬化，采用雲技術進行業務承載，並根據業務的具體需求，動態擴容或縮減資源
- 在未來，通過相關API，實現新的協力廠商專有業務功能，個人用戶/企業用戶可在協力廠商Portal上直接啟動新的業務。

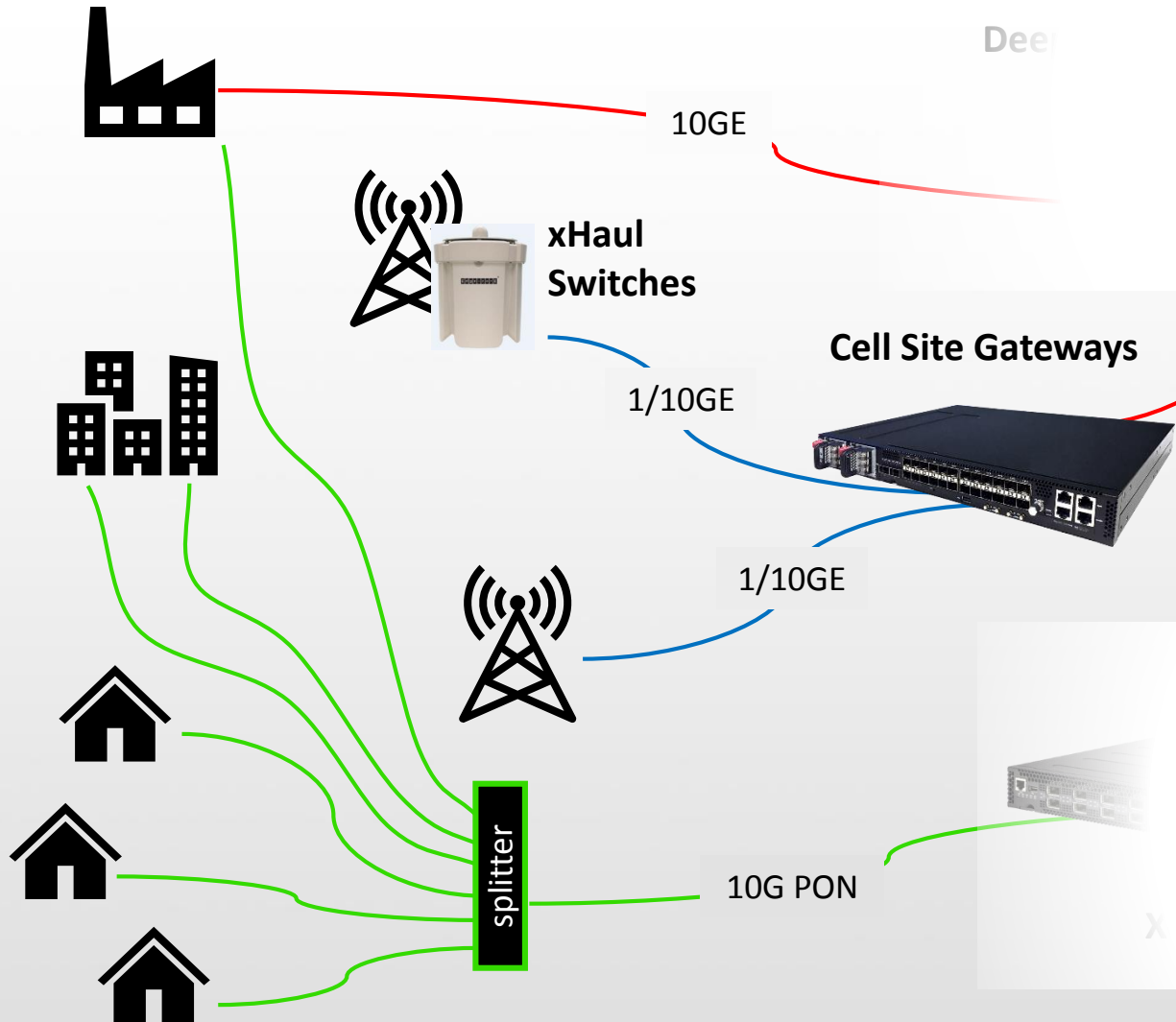
# Open Networking for Telecom



# Open Networking for Telecom



# Open Networking for Telecom: 5G



- Cell Site Gateway family
  - Environmentally hardened
  - Extensive synchronisation
  - Designed with leading CSPs, OCP Telco, TIP
- Aggregation Switches
- xHaul Switches: next whitebox opportunity



# Cell Site Router Gateway

## *Industry's First Whitebox for 5G Cell Sites*

- 16 x 10G SFP+, 8 x 25G QSFP28, 2 x 100G QSFP28
- Deep Buffer Switch
- Outdoor Plant Deployment
  - NEBS3, -40 to 65C operating temp
  - 1U, 300mm depth
  - 350W max power
- Full 1588 and Synchronous Ethernet
- AC and 48VDC Power Options
- Broadcom StrataDNX QumranAX silicon

ipinfusion™ BROADCOM®

DANOS



謝謝

