CORD Deployment Experiences

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system integration services in taking the concept system onto a field trial ready system.

CORD is a reference design supporting rapid innovation and customization

- **CONCEPTUALIZATION**
  - quick enabler with basic ingredients

- **CUSTOMIZATION**
  - Customize to specific needs

- **INTEGRATION**
  - Integrate to existing legacy systems

- **DEPLOYMENT**
  - Field trials, deployments

**base Software Distribution**

- Enhanced scale/capacity/performance
- I&C on CSP selected platform, and CSP selected PON hardware
- User plane dis-aggregation for enhanced performance - CUPS
- OSS/BSS integration
- Lab trials with customized/enhanced system

**Additional Features**

- Network planning
- Deployment considerations
- From lab to field readiness
Reference Design: Integrated CORD POD

CORD POD: Loaded with CSP needed software – customer just connects power & optics on site

- Enables & simplifies CSP transition towards devops software model
- Dramatically reduces CSP Time-to-market (TTM) for new services
- De-risks CSP move towards IaaS cloud for NFV

Inputs
- CORD
- Open source initiative
- Open Software (ONOS, XOS, Openstack)
- Hardware Blueprints

Design
- Arch/Design & Customization Services

Integrate
- Integration & Validation

Support
- Maintenance, Sparing & Support
- Deployment & Remote Management

Outputs
- CORD Domain Services

Radisys and 3rd party HW/SW Products & Technologies

+ Tool, Processes & test plans required for adoption of the develops model
Control Plane

Data Plane

- Home router
  - IP
  - ONT
  - Splitter
  - C-tagged
  - 8/16 – Port DPU
  - G.Fast

- Home router
  - IP
  - ONT

- ONT
  - No VLAN

- Splitter
  - 802.1Q Assignment

- OLT
  - 8/16 – Port DPU
  - C-tagged

- Switch
  - Fabric

- Compute
  - Storage

- vBNG
  - (Core)
  - ONOS

- XOS / ONAP Controller
  - OSS
  - BSS
  - Authentication
  - Authorization

- vOLTHA
  - Vendor Proprietary Interface

- SFC
  - Containers
  - VNF

- OpenStack
  - Nova
  - Neutron
  - Keystone

- vCPE
  - DPI
  - Firewalls
  - Parental Control

- VN F (Fabric)

- ONOS

- Virtual Subscriber Gateway

- VMs

- Containers
  - VIM
**Control Plane**

**Data Plane**

- **CPE Router**
- **ONT**
- **Splitter**
- **8/16 – Port DPU**
- **G.Fast**
- **Network Uplink**
- **Q-in-Q tagged**
- **Vendor Proprietary Interface**
- **Central Office**
- **OLT**
- **vOLTHA**
- **ONOS**
- **Platform (NFVI + Orchestrator)**
- **BNG**
- **RADIUS**
- **DHCP**
- **BSS**
- **OSS**

*This can be done with vBNG with select vendors inside POD.*
Proof of Concept:
Successful POCs - Typically << 50-100 Subscribers/POD

Lab Trial & Early Field Trials:
Successful Lab/Field Trial Typically << 500-1000 Subscribers/POD

Deployment:
Typically >= 10000 Subscribers/POD

• 16 PON Ports/OLT x 32 ONU/PON x 16 OLTs = 8,192 Subscribers
• 16 PON Ports/OLT x 64 ONU/PON x 16 OLTs = 16,384 Subscribers
• 16 PON Ports/OLT x 128 ONU/PON x 16 OLTs = 32,768 Subscribers
Why disaggregation & disruption – The White box business model

• #1 More OPEX oriented business case than CAPEX

• #2 CAPEX comparisons just move from a blended to a separated cost/margin representation.

• OPEX is Cost Effective
  • More flexible supply chain & operational model
  • More adept to change management
  • Whitebox hw powered with disaggregated model – more granular and agile choices of building network

Evolution towards disaggregation and white box model is a natural causality of networking maturity.
Initial POC and Field Trial Testing was with CORD:

- Radisys helps with validating the Whitebox/Disaggregated Proof of Concept
- Initial training
- Whitebox selection
- Lab Trials
- Customization
- Hardening
- Scalability
We found that in order to move from initial POC to Lab Trials and to consider Deployment:

- Need to be able to support additional Capabilities
- Full management Layer on top of VOLTHA supporting an FCAPS model
- Interfacing with Management Systems both Legacy OSS/BSS and newer systems like ONAP.
- Streamline Installation Complexity

Support additional capabilities like:

- Traffic Management; QoS, Scheduling/Queuing Policies
- Support Multiple Access Technologies without burdening VOLTHA Core with needing to understand the details/complexities of each Access Technology.
- Scalability Testing/Hardening
- Life Cycle Management
- Performance Monitoring
- Customize Services (HSIA, Voice, Video, Multicast)
- ONU and Subscriber Authentication Customization
Management Plane
Control Plane
Data Plane

Central Office

Management FCAPS

OLT

Switch Fabric

vCPE server

CPE Router
IP
ONT
No VLAN

Splitter

C-tagged

Q-in-Q tagged
Network Uplink
Vendor Proprietary Interface

vOLTHA

OF

vOLT Fabric
ONOS

Platform
(NFVI + Orchestrator)

vBNG

BNG

OSS

BSS

RADIUS
DHCP

*This can be done with vBNG with select vendors inside POD

Authentication Authorization 802.1Q Assignment
SEBA Introduced Mid 2018 – High Level Alignment with Radisys Experiences

Fault mgmt
Config
Accounting
Performance
Security
Inventory

Subscriber traffic ‘fast-path’ to Internet.

Network Edge Mediator (NEM)

VOLTHA

UNI
OLT

ONU

BNG as a workload option
- External physical BNG
- vBNG in compute
- BNG as PNF in Agg switches
- BNG as PNF in OLT boxes

ONAP
Legacy OSS

ONAP
OSAM-Local
EMS/NMS-adaptor

ONAP
OSAM-Local
EMS/NMS-adaptor

VOLTHA

All control software deployed as Docker containers on compute nodes using Kubernetes

REST Kafka

Redfish

OF

OF/P4

Redfish

OpenStack Nova

K8

SR
FPM
T3

dhcp
mcast

FOV

Compute

Subscriber traffic ‘fast-path’ to Internet.
ONF Roadmap

- BNG Disaggregation
- Using P4 in Aggregation switch
- Implementing more operator workflows
- Performance & scale improvements for Trials
- Redundancy
- Integrating VOLTHA 2.0 & Technology profiles
- ISSU
- Integrating M-CORD profile to use SEBA as mobile backhaul
ECO-SYSTEM & THE BIG PICTURE !!!

- **HARDWARE LAYER**
  - CELL SITE
  - METRO EDGE
  - CORE
  - CO
  - KONTRON /DELL / QUANTA (OCP/RMS)

- **NFVI LAYER**
  - WINDRIVER (TITANIUM )
  - REDHAT
  - VMWARE (ESXI)

- **EDGE COMPUTE PLATFORM LAYER**
  - COMMON/SCALABLE EDGE COMPUTE SOFTWARE PLATFORM

- **VNF LAYER**
  - vOLT (RCORD/VOLTHA/SEBA)
  - vRAN/vEPC (MCORD)
  - Edge App (vMRF/AR/VR/…)

- **MANO LAYER**
  - ONAP
  - OSM
  - VNFM
  - EMS

- **CONTAINERS (K8S) / VNF**

- **OSS/BSS**
  - ONAP
  - OSM
  - VNFM
  - EMS