

Session on policies and regulatory methods for broadband deployment and broadband access technologies

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Broadband access in the Cloud era

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Summary

- ✓ The Changing Telecom Industry Landscape
- ✓ The Software Centric Network/SDN
- ✓ The Software Centric Network/NFV
- ✓ Data Center Innovations
- ✓ The Cloud Central Office (Cloud CO)
- ✓ Broadband Access Abstraction (BAA)

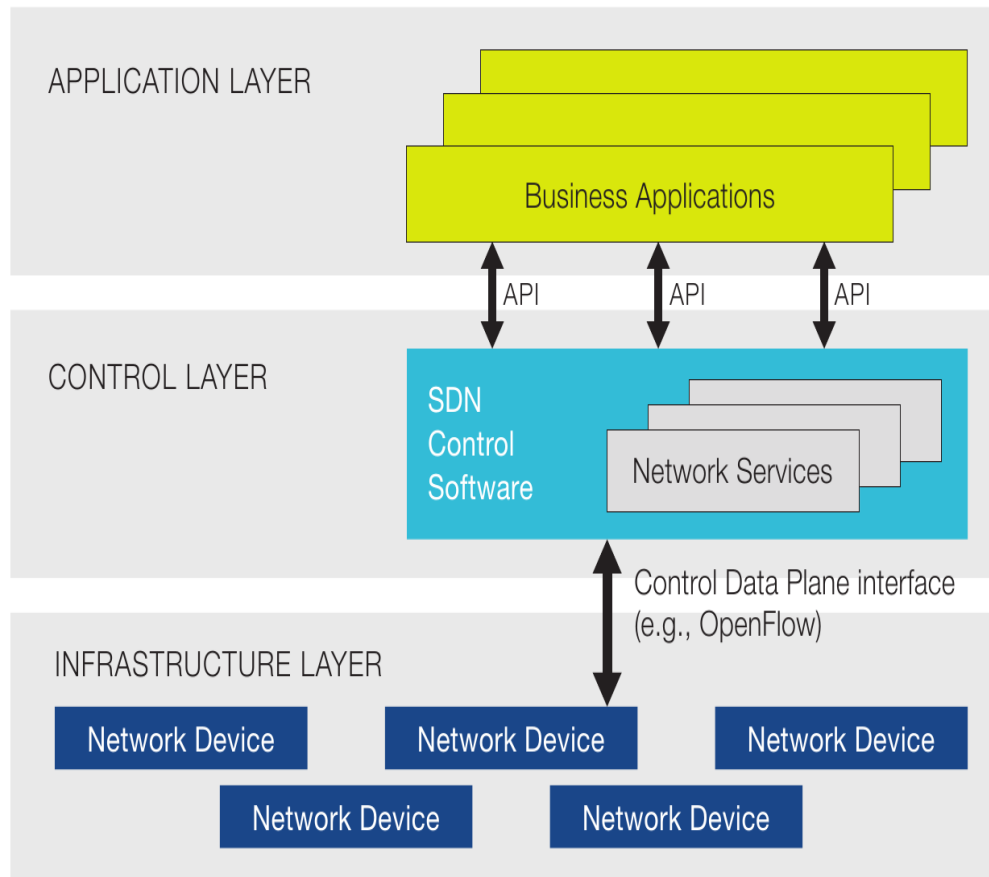


The Changing Telecom Industry Landscap

A movement from Telco to Data Center Practices

The Software Centric Network

Software Defined Networking (SDN)



✓ **SDN in the WAN (SD-WAN)**; QoS, VPNs, service chaining,

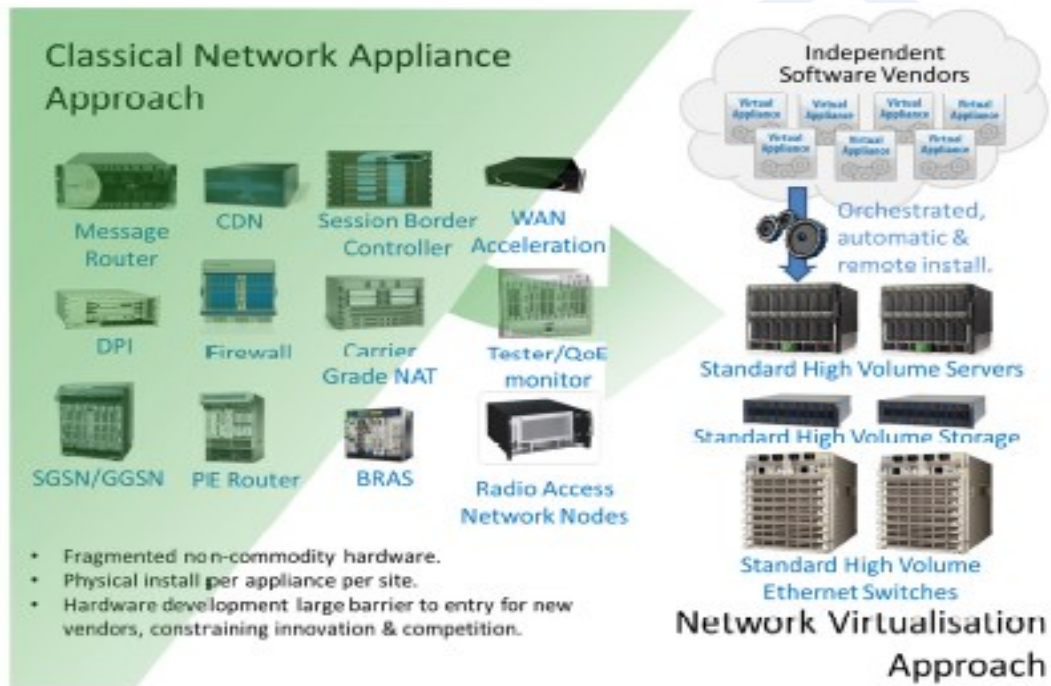
✓ **SDN in the Optical Transport Network (T-SDN)**; Multilayer SDN Control, carrier SDN

✓ **SDN Wireless Transport Network**

✓ **SDN in the Datacenter** ; Overlay Networks, Application policy

The Software Centric Network

Network Functions Virtualization(NFV)



- ✓ **Network Functions Virtualisation** aims to transform the way that network operators architect networks
- ✓ This could be achieved by **evolving standard IT virtualisation** technology to consolidate many network equipment types onto industry standard high volume servers, switches and storage, which could be located in Datacenters, Network Nodes or/and in the end user premises

Source: ETSI Vision for Network Functions Virtualisation

Data Center Innovations

1

2-stage
Leaf-Spine
Clos Fabrics

2

Virtualization
, Overlays
&
Openstack

3

SDN, Policy
&
Intent

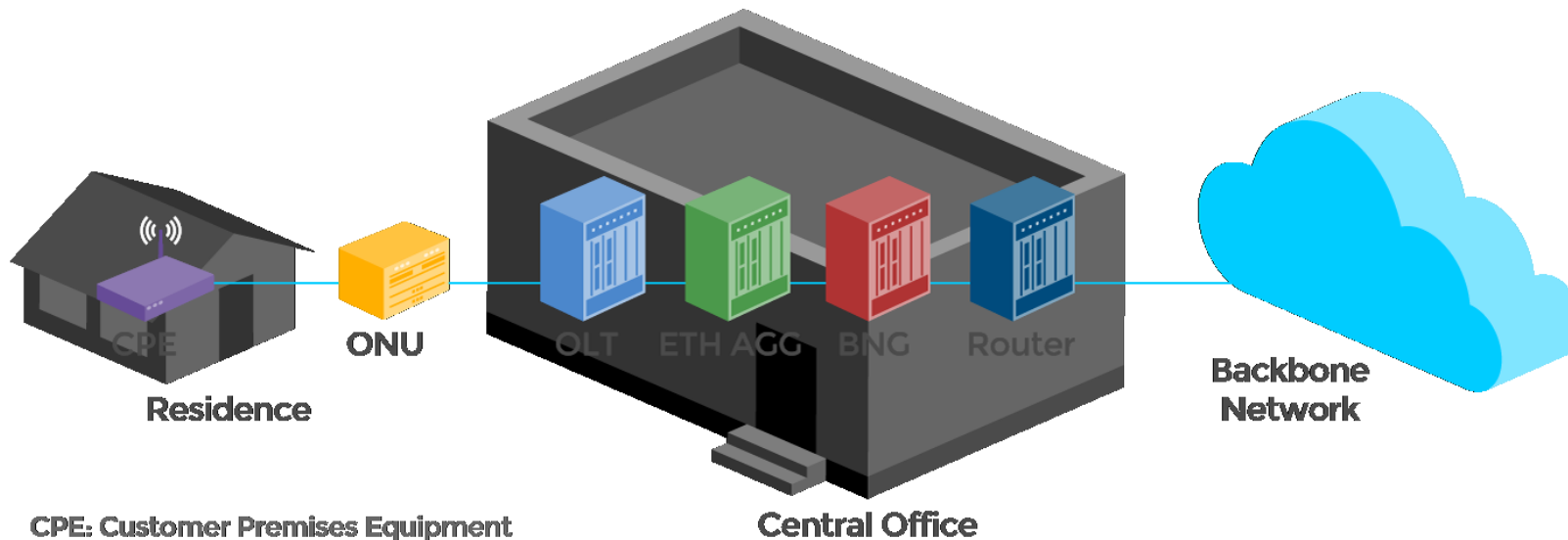
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Big Data
&
Analytics

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The Cloud Central Office (CloudCO)

The Central Office entities



CPE: Customer Premises Equipment
ONU: Optical Network Unit
OLT: Optical Line Termination
ETH AGG: Ethernet Aggregation Switch
BNG: Broadband Network Gateway

Source: R-CORD/ ONF

- ✓ Legacy networks were built using a number of discrete **purpose-built hardware devices** to connect residential subscribers to the carrier's backbone network.
- ✓ Each of these devices is a source of **complexity and considerable expense, as both capex and opex**. Additionally, new hardware is needed when scaling capacity or creating new services

Bringing Cloud Economies and Agility to the Telco Central Office

ITU-T Y.3500 Cloud computing is a paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand.

“ Cloud Central Office (CloudCO) is a recasting of the Central Office hosting infrastructure that utilizes SDN, NFV and Cloud technologies to support network functions.

In doing so, it radically redefines the architectures of the access and aggregation networks that have developed incrementally in previous Broadband Forum specifications “ *Broadband Forum*

Cloud Characteristics ITU-T Y.3500



✓ Measured service

✓ Multi-tenancy



✓ Resource pooling



✓ On-demand self-service



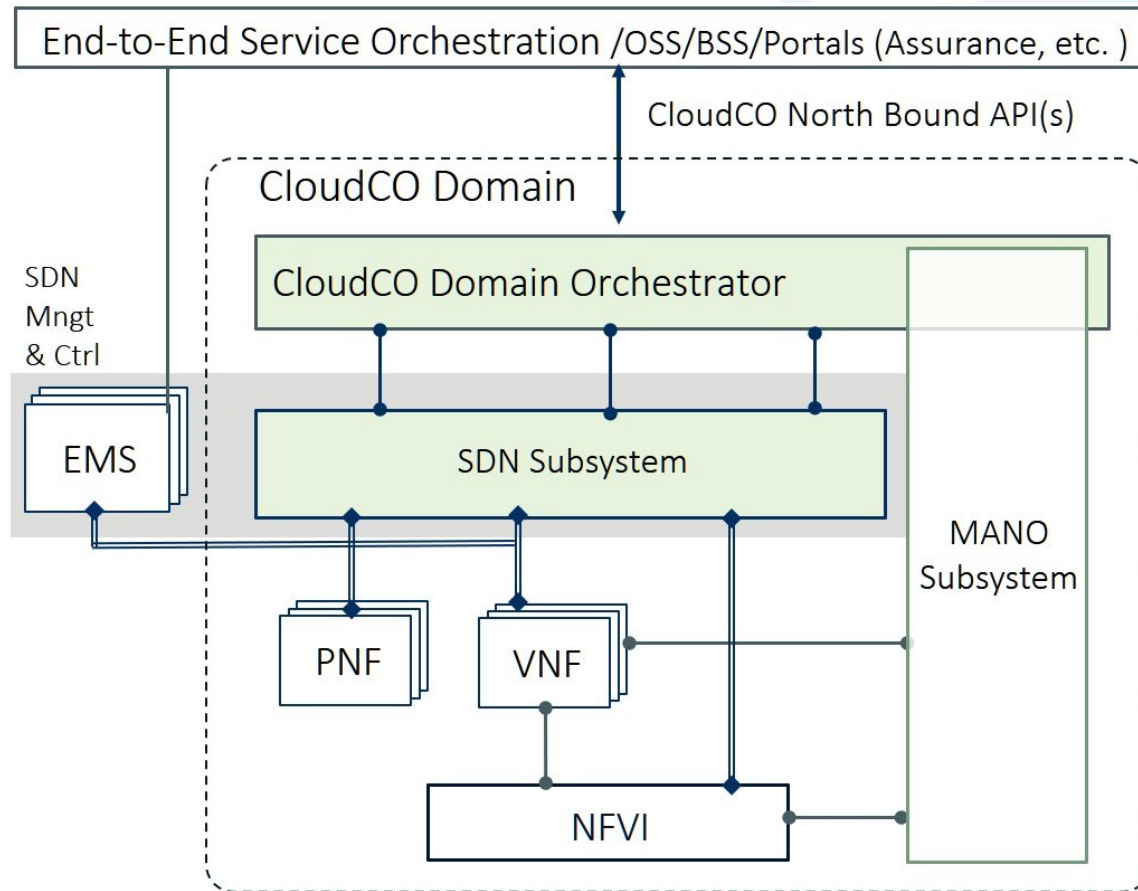
✓ Rapid elasticity and scalability



✓ Broad network access



BBF's CloudCO Architecture



Source: Broadband forum TR-384

✓ Is a **combination of an SDN and NFV architecture** applied over a hybrid physical and NFV infrastructure

✓ The **NFVI** is sized according to need, and includes **compute and storage** nodes, as well as a **leaf-spine fabric**

✓ **The VNF Manager** is responsible for the lifecycle management of VNF instances

✓ **The VIM** is responsible for controlling and managing the NFVI compute, storage and network resources

Decomposition of Central Office legacy Entities

Disaggregation



✓ It is the process of separating existing nodal functionality into more **modular and granular network function**

Considerations:

- ✓ Ability to Virtualize
- ✓ Ability to efficiently split the user plane and the control plane

Virtualization



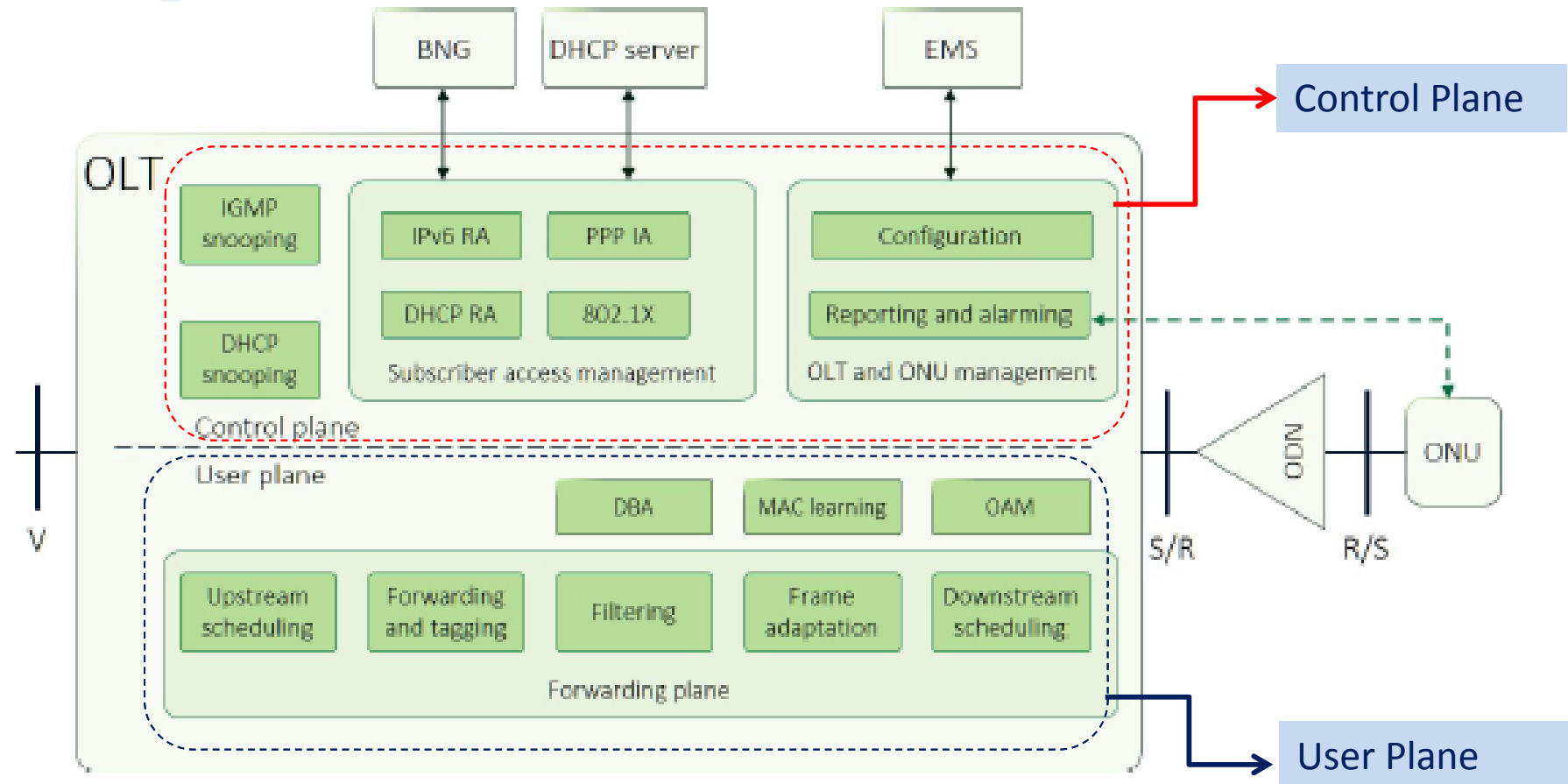
✓ It is the **softwarization of one or several of the nodal network functions** that may be hosted on **generic Commercial Off-The-Shelf (COTS) hardware**

✓ **Each function** in the CloudCO architecture is implemented **either as software or as dedicated hardware** and embedded software via an abstraction layer towards an SDN control framework.

Decomposition of Central Office legacy Entities (Cont)

PON based Access Node

✓ OLT devices terminate the optical distribution network (ODN) link in the Central Office, with each physical termination point aggregating a set of subscriber connections.

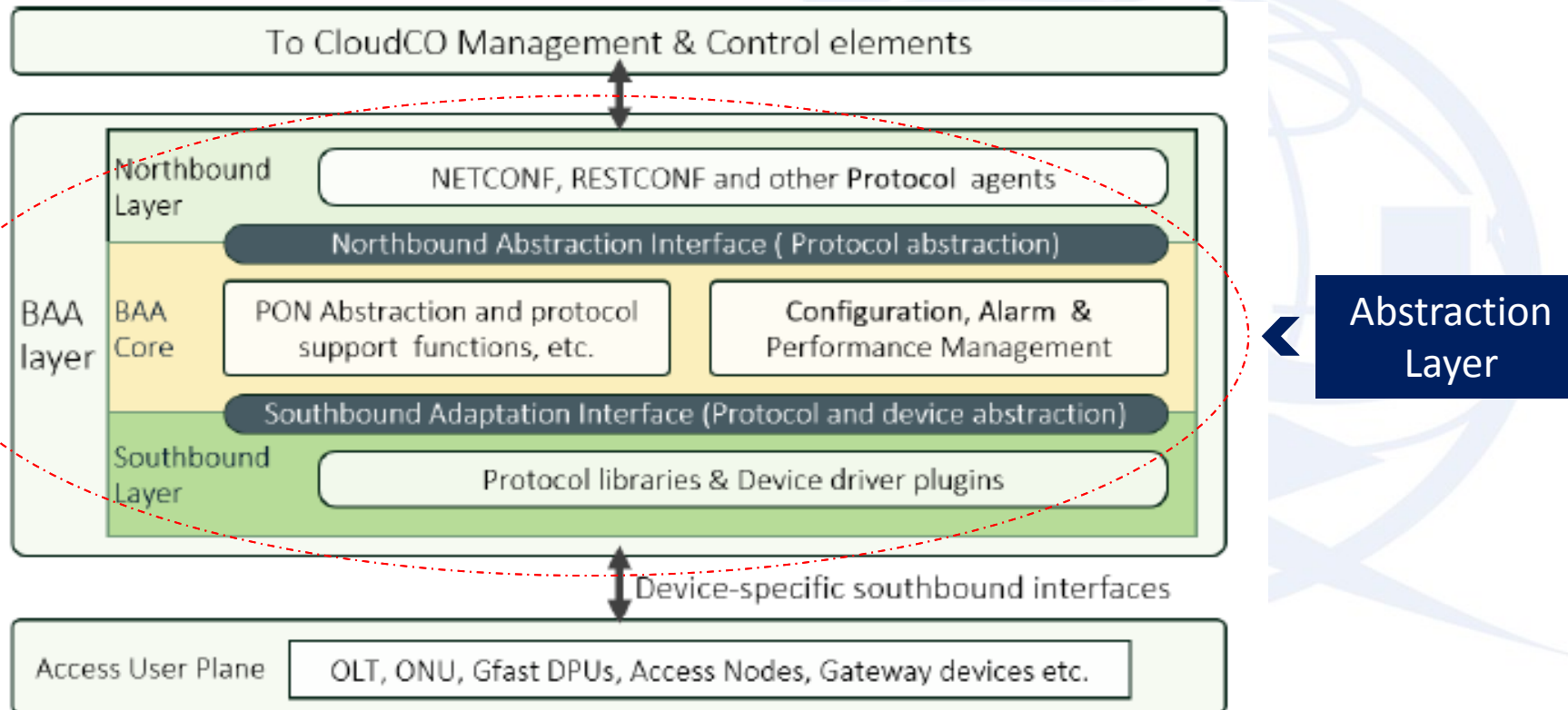


Functional components in OLT
source: broadband forum TR-384



Broadband Access Abstraction (BAA)

BBF's Broadband Access Abstraction Architecture



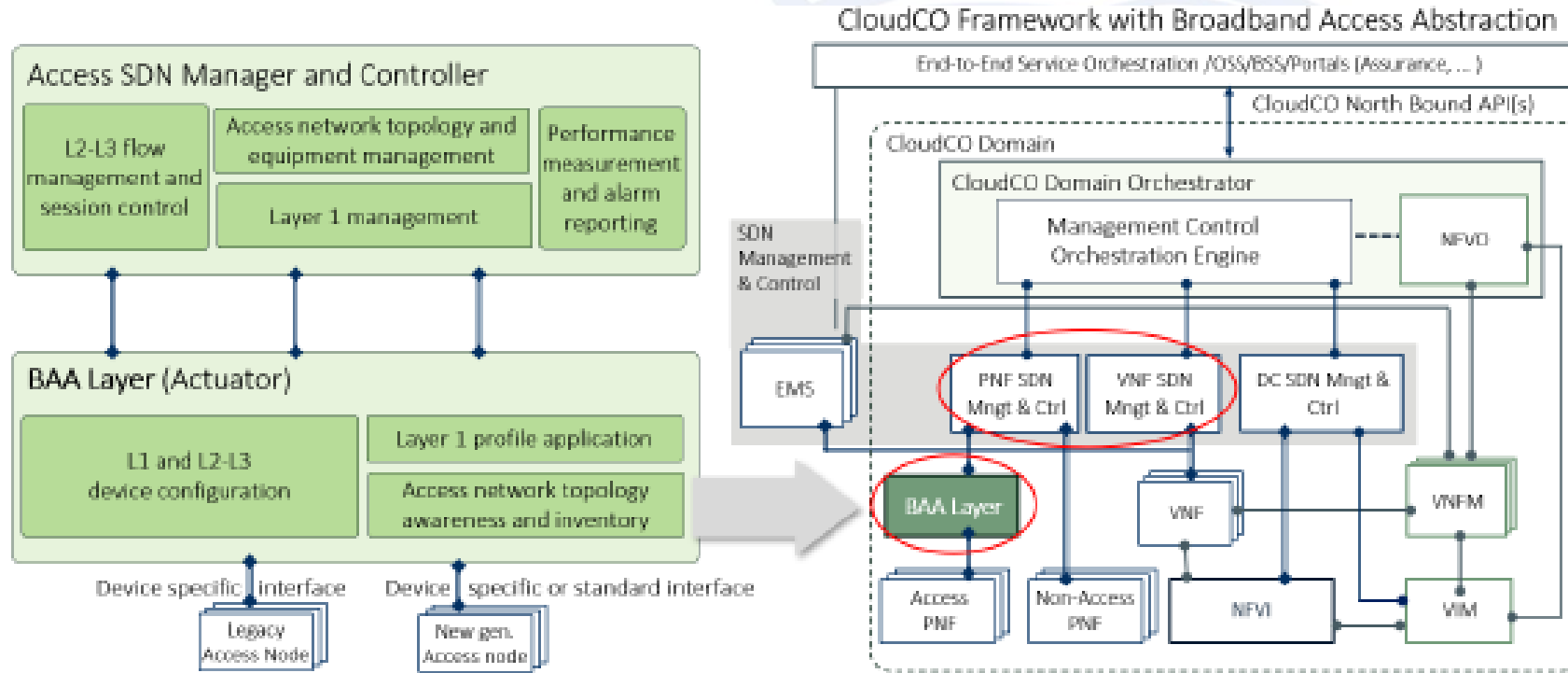
✓ A clear **abstraction** that **isolates service functionalities from specific device** implementations

✓ **Multi-vendor innovation** at the device and network service layers; allowing for **easy interoperability** via standardized interfaces

✓ The functionality and **flexibility** needed to be used in **different types of orchestration, management and control** environments

Source: *Broadband Forum OB-BAA 2018*

The BAA layer integrates into the CloudCO Framework



- ✓ In CloudCO the virtual network functions (VNFs) are deployed on a generic computing infrastructure, interconnected by a generic switching fabric with Access and Edge Network Elements.
- ✓ Access SDN Manager & Controller and BAA layer control the interaction to the Access Nodes

Source: broadband forum/ broadband Access Absraction Overview

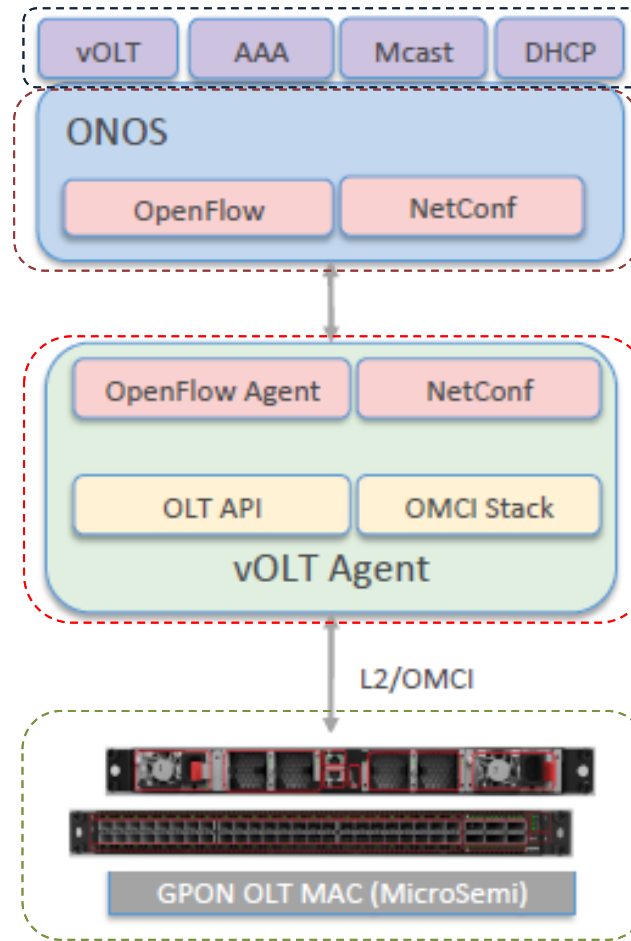


Other Industry initiatives

OLT Disaggregation



GPON OLT



Applications



SDN Controller



vOLT Agent
(Abstraction Layer)



white-box OLT

Source: ONF 2018 VOLTHA Overview and Roadmap



vOLT functionality

vOLT
Agent



- ✓ **vOLT agent runs in a container or VM** and facilitates a connection between the SDN controller and the hardware
- ✓ **The agent exposes an OpenFlow interface northbound** which enables it to be controlled by the SDN controller
- ✓ **It then maps OpenFlow messages to the native APIs of the hardware device** and OMCI messages that manage the PON ONTs

SDN Controller
Applications



vOLT Application;

Configuring VLAN tags on the OLT

- ✓ **AAA application;** for brokering the **authentication** between the residential gateway (home CPE) and the Radius server

- ✓ **Multicast:** Performs **IGMP snooping** and **adds/removes OLT ports to/from multicast groups**

GPON OLT IO Blade

White-Box OLT

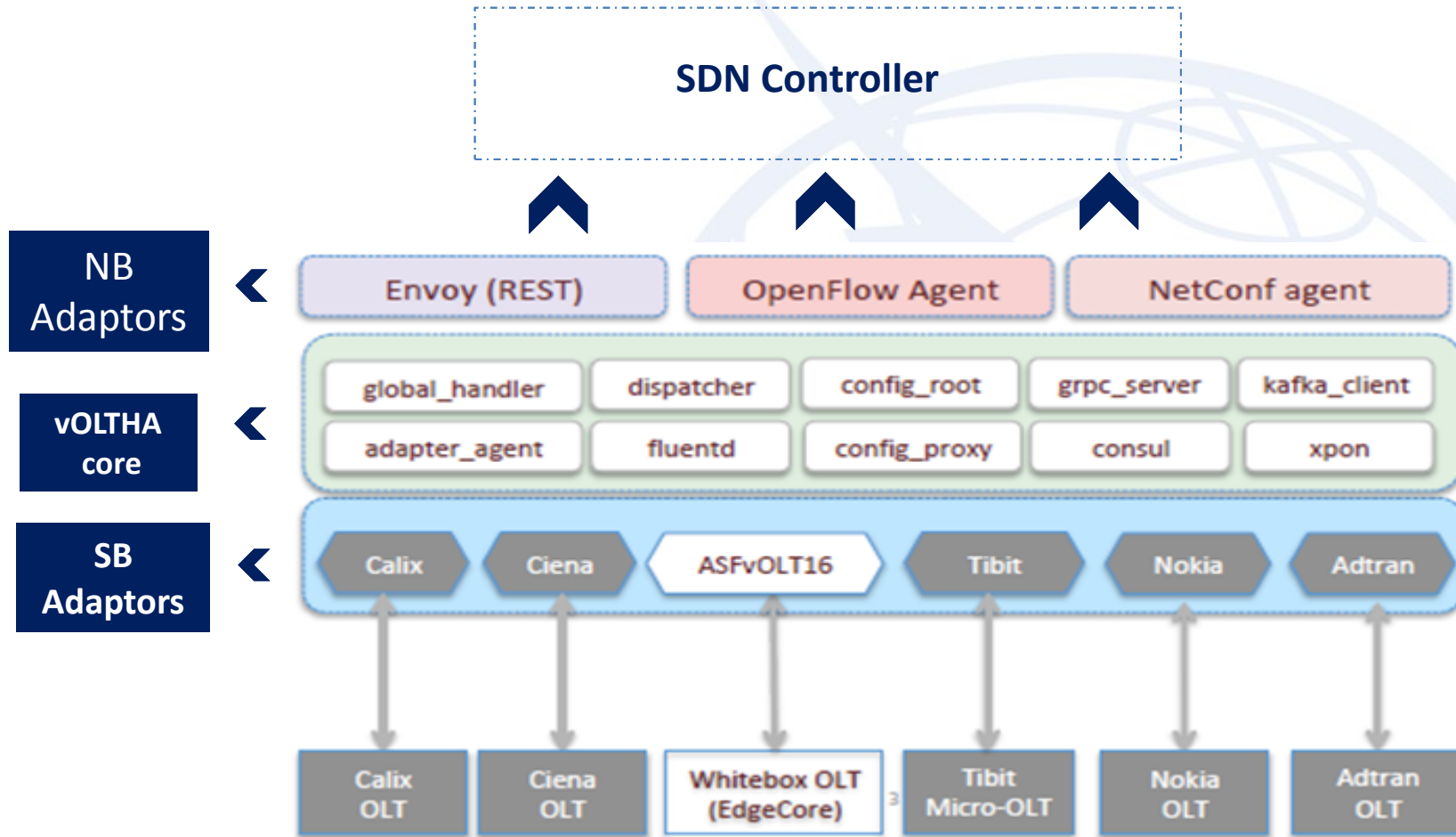


Source: R-CORD Project/ vOLT

✓ This blade includes the **essential GPON Media Access Control (MAC)** chip under control of a remote control program, which is, in turn, **controlled from high level applications via OpenFlow.**

✓ Functions that manage some of the **control plane functions** of a traditional OLT, like 802.1X, IGMP Snooping, VLAN bridging, and OAM. **These control functions are implemented as applications running on top of ONOS**, facilitate subscriber attachment, authentication (AAA), establishes and manages VLANs connecting consumer devices.

Virtual OLT Hardware Abstraction (VOLTHA)



✓ It Runs in a **container or VM** and facilitates a connection between ONOS and the hardware.

✓ The **agent exposes an OpenFlow interface northbound** which enables it to be controlled by ONOS.

✓ It then **maps OpenFlow messages to the native APIs of the hardware device** and OMCI messages that manage the PON ONTs

Source: ONF 2018 VOLTHA Overview and roadmap

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Thank you for attention