FTTH Council Europe

FTTH/B in a Virtualized & Software Defined Network

December 14th, 2017

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Webinar

- 40-45 minutes presentation
- 15-20 minutes Q&A

- Please write your questions in the question box of the webinar system
- Relevant questions that are not answered during the webinar will be answered by email

- The slides will be available for download after the webinar
- The webinar is recordded and can be viewed as video-stream afterwards. The video will be available on the website of the FTTH Council Europe within one week
- Slides and information about the availability will be sent to registered attendees by email

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FTTH/B in a Virtualized & Software Defined Network

Moderator:

Rong Zhao

Chair Deployment &Operations Committee

FTTH Council Europe

Presenter:

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Nokia

ERIC JOYCE

Adtran

Outline

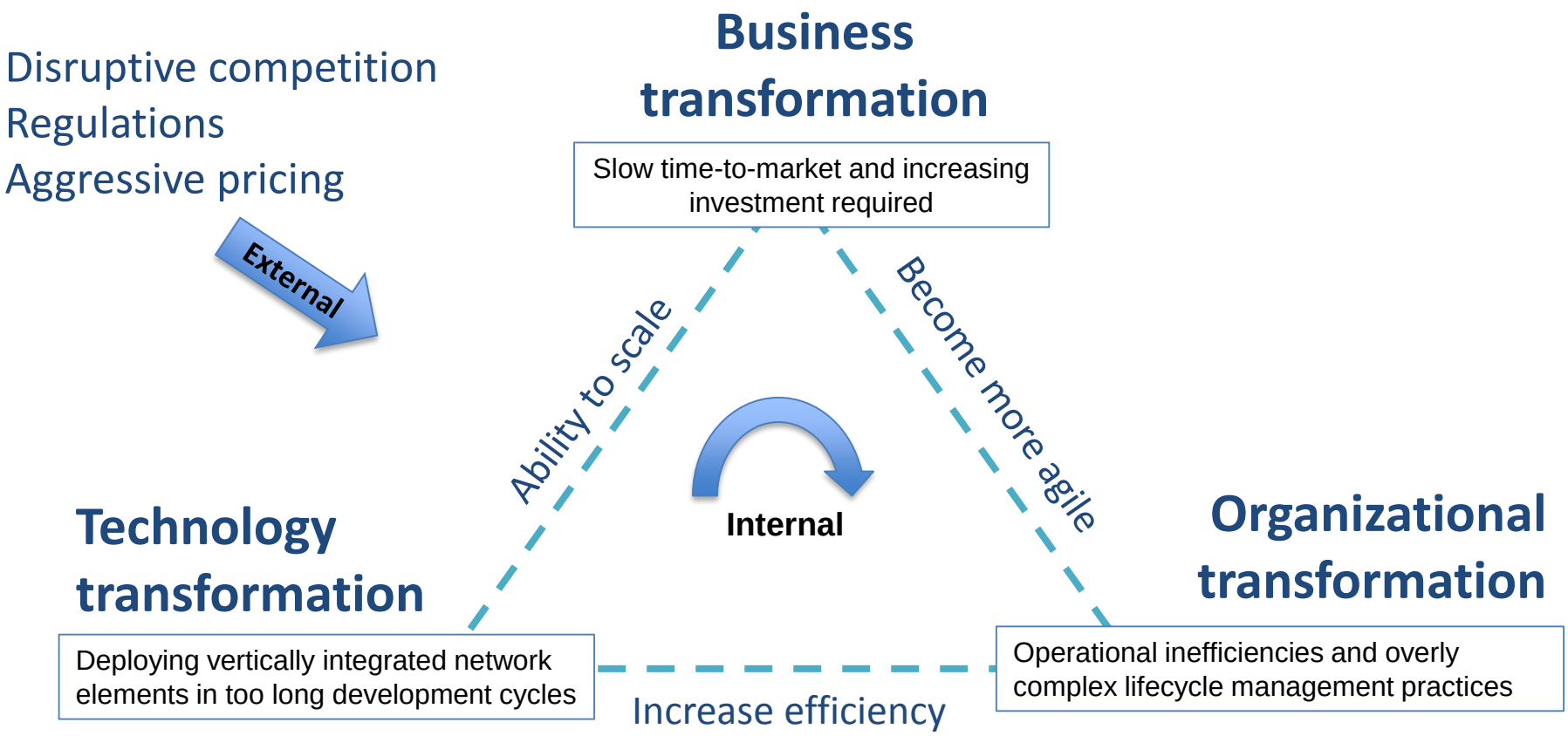
- Motivation
- What are SDN and NFV?
- Uses Cases in Fixed Access
- Benefits
- Take Away

Motivation

Sustaining the unrelenting data growth is not the only challenge anymore

- Broadband service offerings and customer broadband behavior are becoming increasingly sophisticated.
- The key question is how to grow networks and at that same time achieve **business agility** and **operational automation** to keep costs in control.
- Business models are unsustainable in the present market situation, where customer bandwidth demand is growing faster than revenues.
- Tackle network and service complexity in fixed access networks by leveraging **SDN/NFV** principles.

Motivation

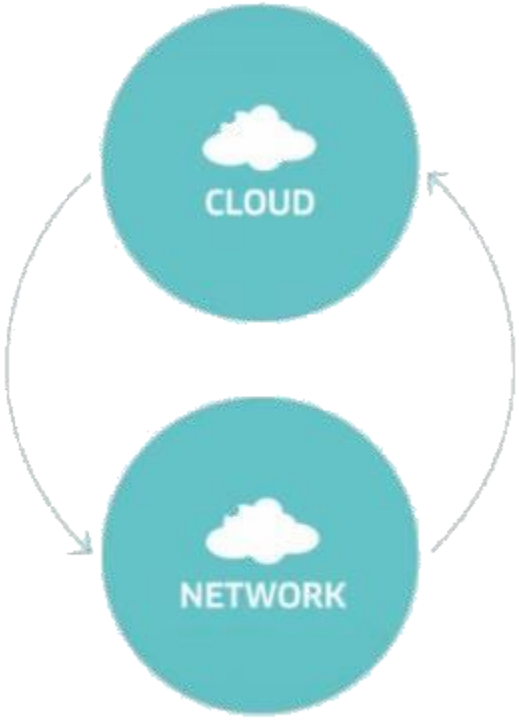

Disruptive competition
Regulations
Aggressive pricing
External
Business transformation
Slow time-to-market and increasing investment required
Ability to scale
Become more agile
Internal
Technology transformation
Deploying vertically integrated network elements in too long development cycles
Increase efficiency
Organizational transformation
Operational inefficiencies and overly complex lifecycle management practices

What are SDN and NFV?

SDN and NFV are complementary technologies

Network programmability and automated service creation

SDN



NFV

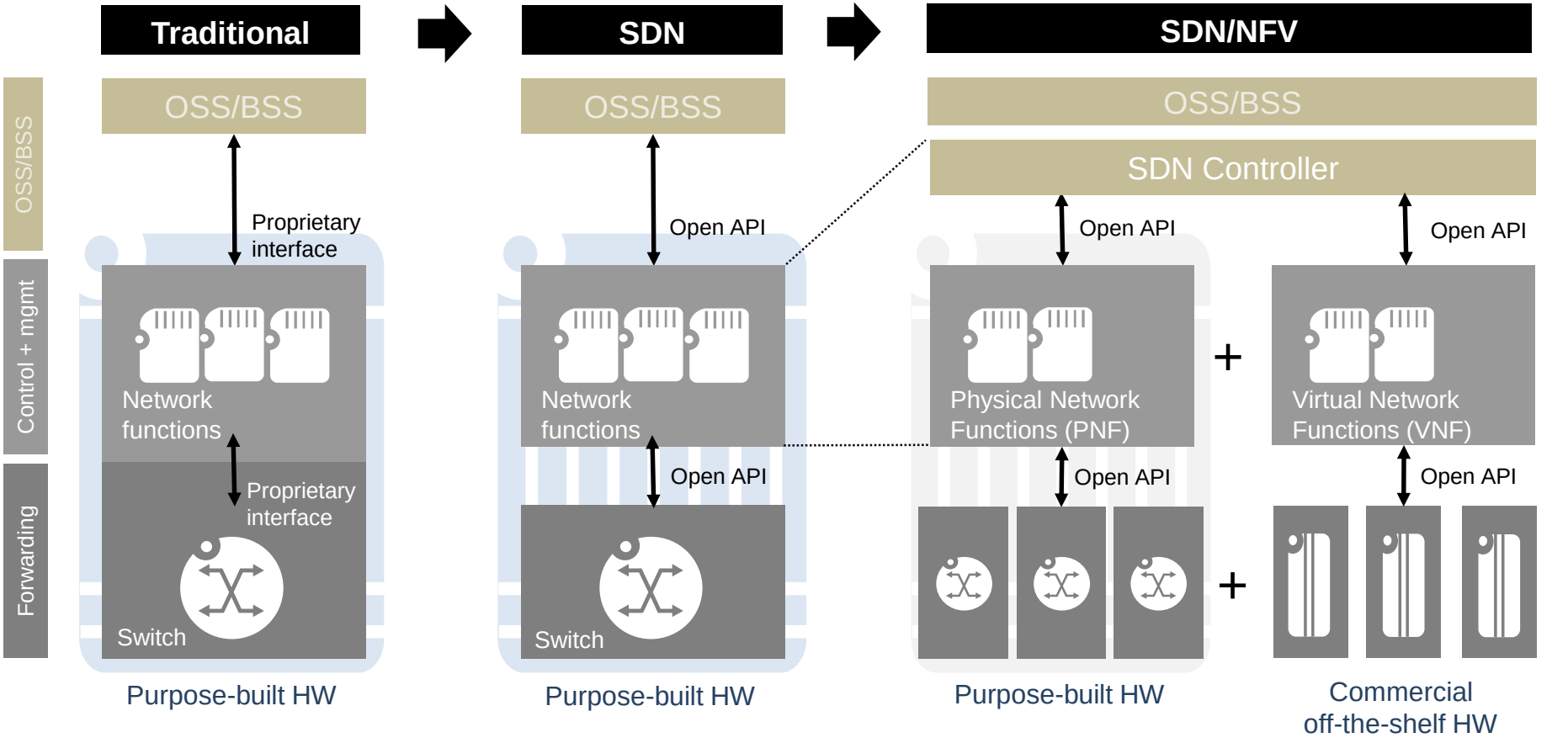
Create & manage virtual network functions (VNFs)

Scale your network and scale your business

The SDN/NFV Ingredients

- SDN/NFV is embracing next generation architectures that borrow heavily from web scale data centers and cloud providers.
- **Decoupling SW from HW** – SW and HW cycles can evolve independently of each other.
- **Flexible programmable networks** – Supporting centralized and distributed architectures to fit a wider range of deployment models.
- **SDN-enabled applications** communicate their intent to an **SDN controller**, and put them into action through programming of each **network element**.
- Many **network applications** traditionally mandated by specialized hardware can instead **run on x86 hardware** platforms
- **Dynamic operation** - Instantiation, distribution and management of network functions, including instantiation and interaction of VNFs across server resources without significant increase in operational expenditure

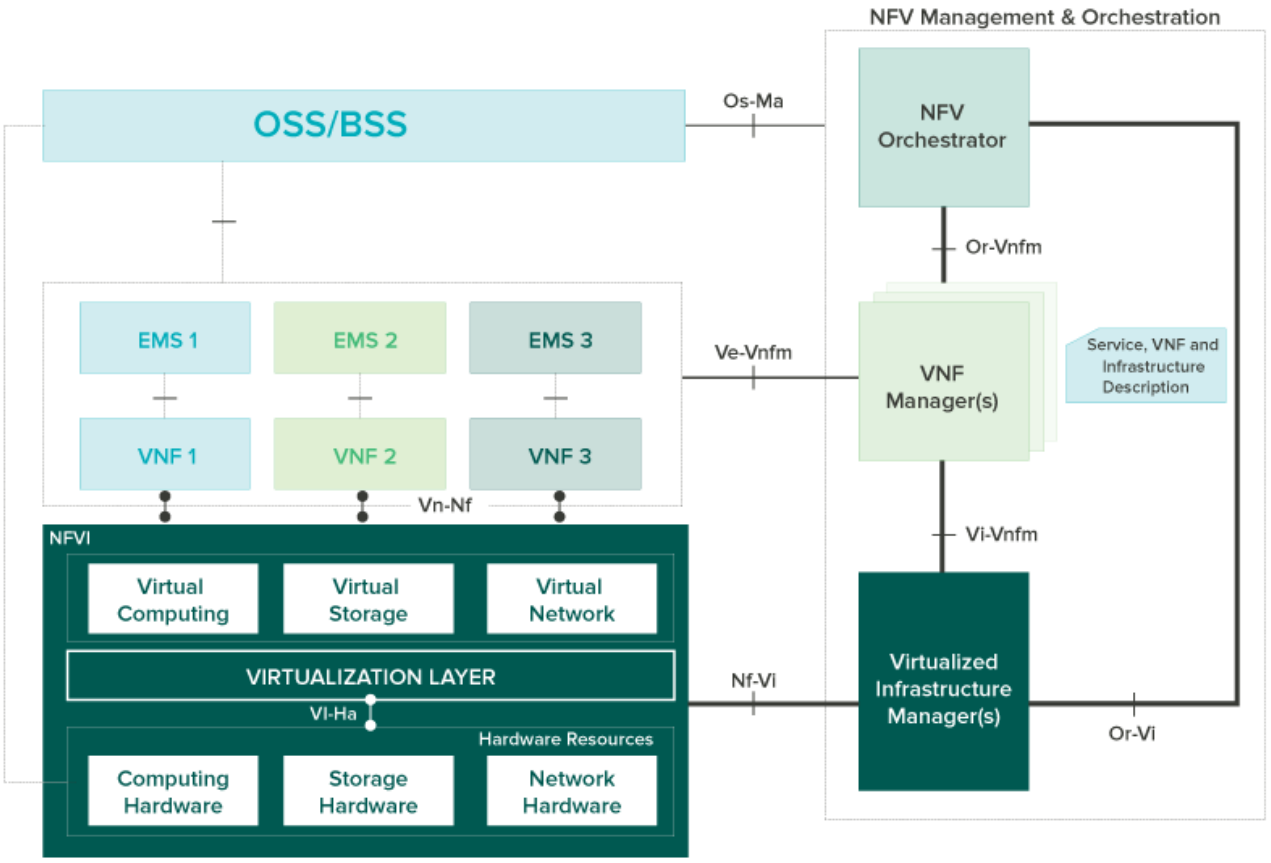
SDN and NFV combined



Standardization Organizations

broadband forum	Evolution of broadband network systems towards the NFV/SDN paradigm in transport and fixed access networks
tmforumzoom	Create a living blueprint for a new generation of NFV/SDN based service provider support systems
ETSI World Class Standards	Design principles and the high-level functional decomposition of NFV and MEC architectures
3GPP A GLOBAL INITIATIVE	Evolution of 3GPP mobile network architecture towards 5G goals, which encompass widespread utilization of NFV/SDN paradigm
ITU	Study Group 13 (SG13) is the lead study group of SDN in ITU-T, and develops the SDN framework, including SDN terminology, as the baseline for all ITU-T SDN std. activities
IETF	Multiple activities: service function chaining (SFC), NFV Research Group (NFVRG), SDN Research Group (SDNRG), NETCONF, YANG.
IEEE	The IEEE P1903 WG (NGSON) is currently working on the specification of service-enabling functions which can be provided as VNFs to support NFV applications.

ETSI NFV Reference Architecture by OPNFV



- Modular and layered architecture, adopting the “separation-of-concern” principle
- Orchestration systems, SDN controllers, NFVI, NFV MANO & NFV hardware resources
- Orchestration layers are cornerstone pieces to go from POCs & technical trials to production deployments.
- Increasing abstraction towards the cross-domain & higher levels

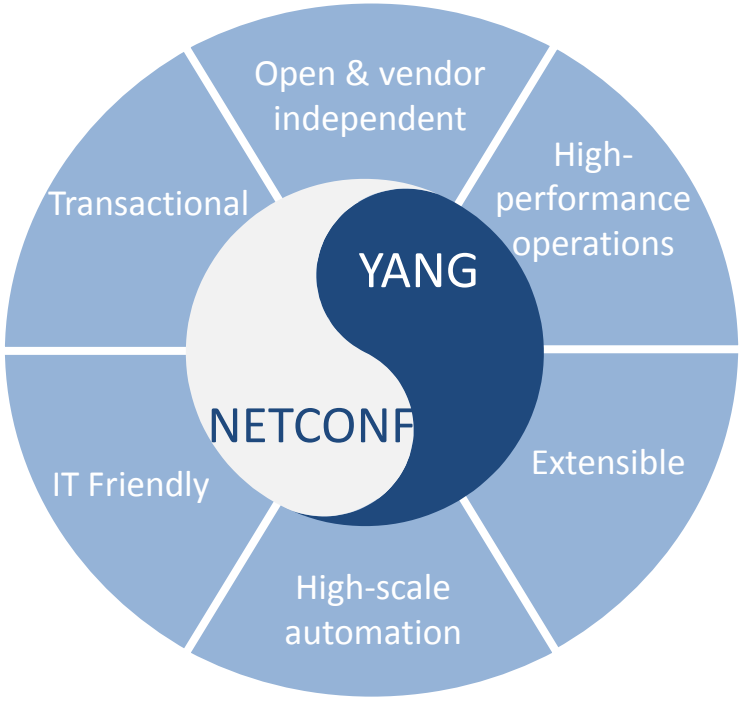
Open Source Initiatives

ONF OPEN NETWORKING FOUNDATION	Open standards development through the SDN; Introduces the OpenFlow std.
OPEN DAYLIGHT	Platform for programmable, SDN – under the stewardship of the Linux Foundation
onos	Platform for programmable SDN. Under the scope of the Open Networking Lab
openstack	Cloud operating system controls large pools of compute, storage, resources
OPNFV	Open Platform facilitates the development and evolution of NFV components
Open Source MANO	Develop an Open Source NFV Management and Orchestration software stack aligned with ETSI NFV
docker	Lightweight, stand-alone, executable package of software
CORD	Central Office Re-architected as a Datacenter
OvS Open vSwitch	Multilayer virtual switch designed to enable massive network automation
Open Broadband	Collaborative space for open source, standards-based and vendor provided implementations

NETCONF/YANG

Programmability for software defined access networks

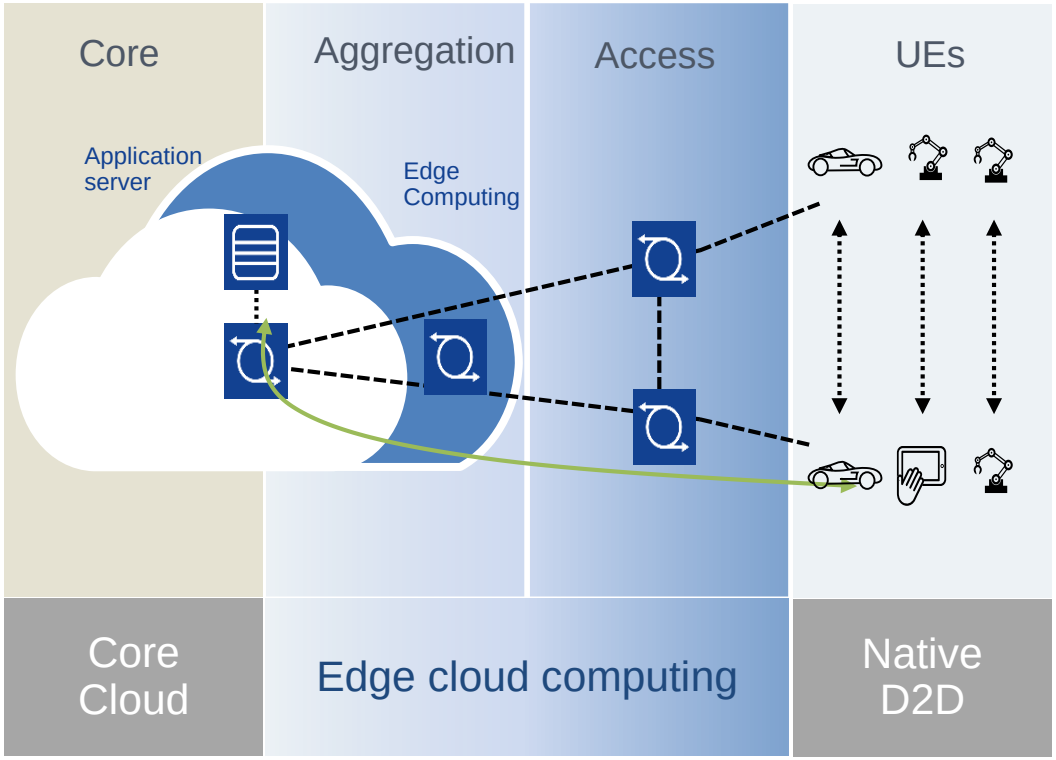
NETCONF is a proficient management protocol, alternative to labor-intensive CLI/SNMP



YANG is a optimized data modeling language for nodal integration & abstraction in management systems

YANG model standardization and open source best practices to accelerate adoption of software-defined access networks

Edge cloud – Introducing Latency



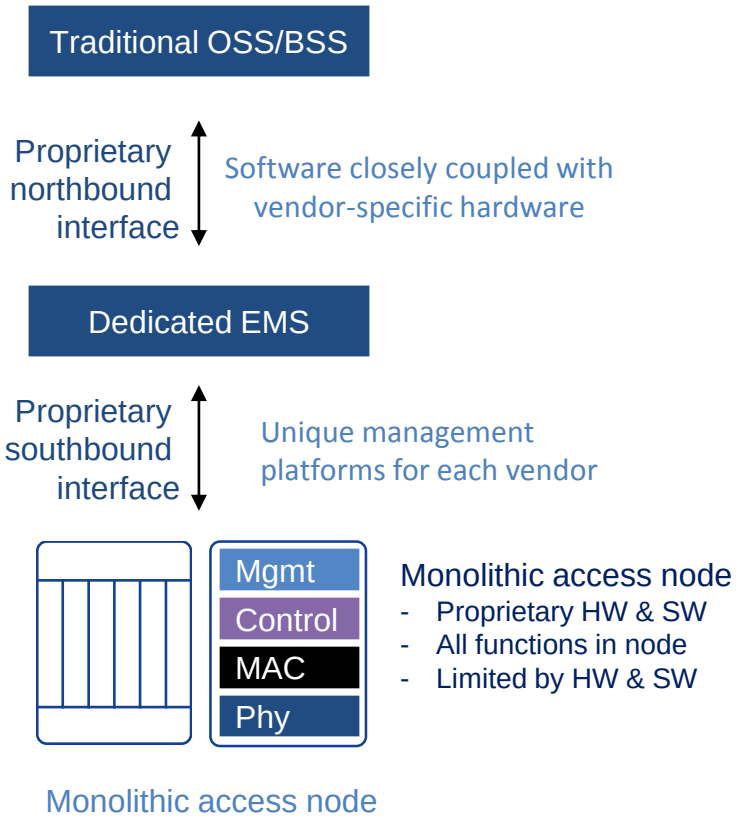
Central cloud based	> 50 ms latency
Edge Cloud	≈ 10 ms
Access Edge	≈ 2 ms
D2D	≈ 1 ms

Moving
virtual networks

Mission-critical
services, in V2X or industrial applications

Application latency enabling a new generation of latency critical services

Today's network



High integration effort

- New effort for every vendor, solution, and release

Closed environment

- No direct access to functions or data
- Proprietary interfaces APIs and software

Static architecture

- New features require equipment upgrade
- Limited flexibility

Slow innovation

- Fixed release cycle
- Massive testing & validation
- Limited to vendor-specific HW & SW

Software-defined network

Open eco-system

- Innovative, purpose-built applications
- Different vendors & open source
- Integrate easily across systems

Programmable

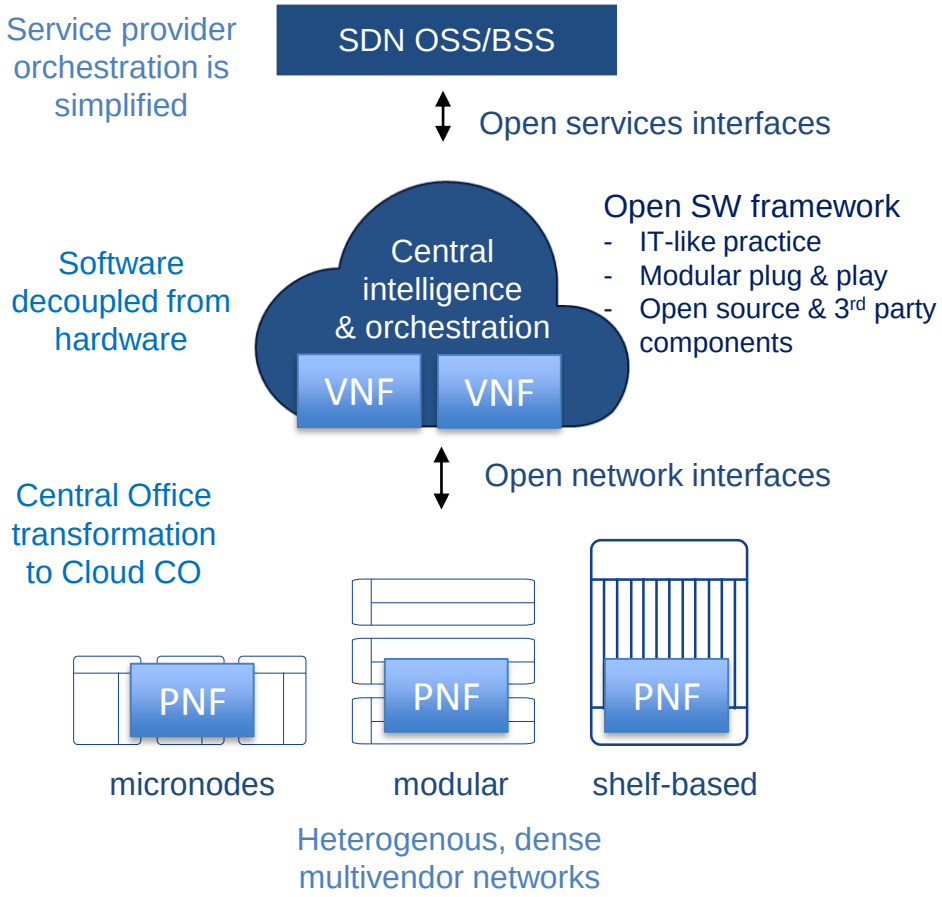
- Distributed architecture
- Open standardized interfaces
- Increase automation

Scalable & flexible

- Scale physical and service layers separately
- Embedded, virtualized or in cloud

IT-like practice

- Plug & play
- Dev Ops approach
- Continuous integration
- High upgradability

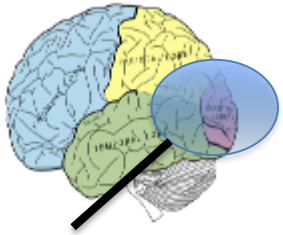


Use cases in Fixed Access

Software Defined Service Edge
Leverages modern hardware with Software Virtualisation.

Disruption with Virtualisation!

SDN Case Study
Power Savings with Wavelength Mobility
Machine Learning and SDN orchestration allows for significant operational savings



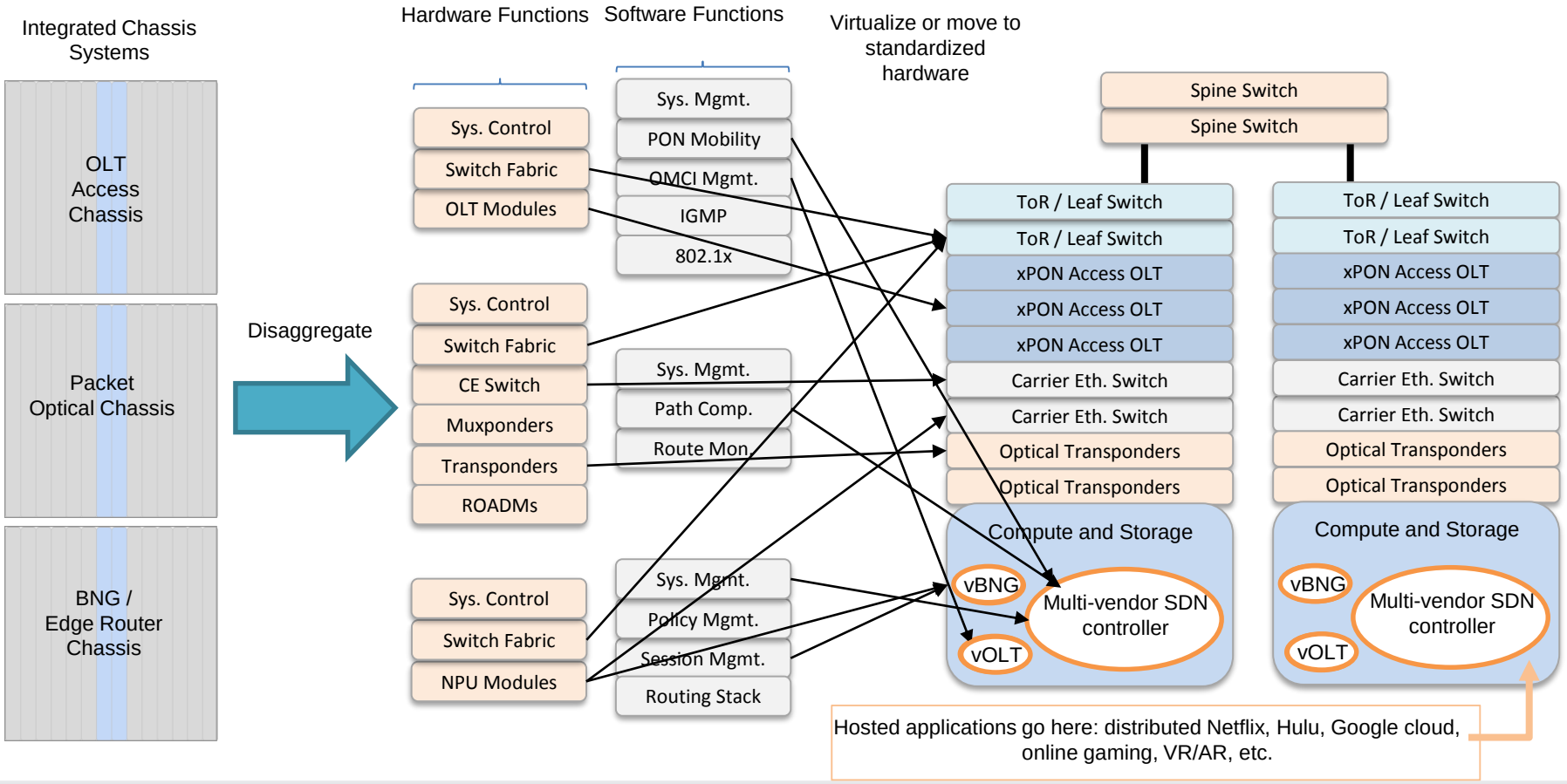
SDN Analytics – Sample Use Cases for Realtime Traffic analysis

vCPE – Leveraging Data Centre or micro server compute infrastructure for best in class service chains with NFV.

Pushing Virtualisation Further.!

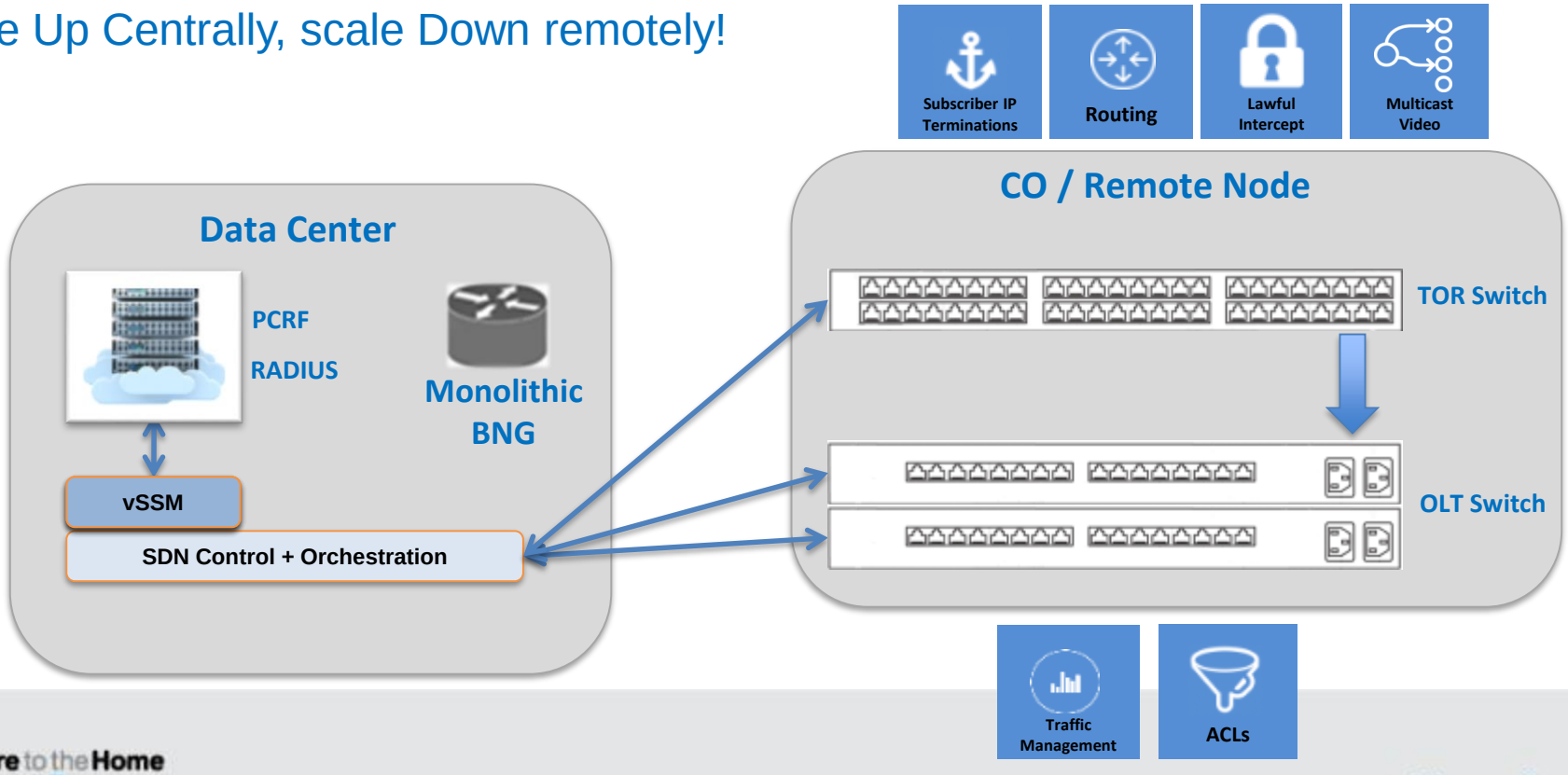
Hardware Disaggregation Drives Virtualization (Recap)

Disaggregation in Hardware – leads to Software Virtualisation Opportunities



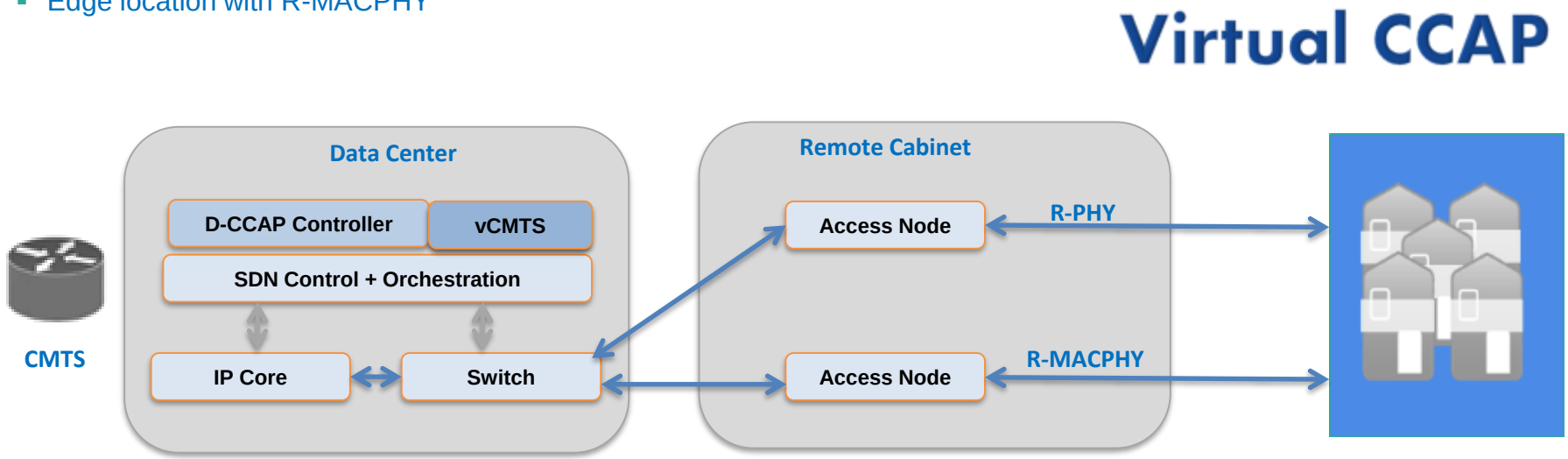
Software Defined Service Edge
Virtualizing the Network Gateway - BNG

- Current BNG Hardware is expensive at scale
- vSSM (Subscriber Session Management) at the edge improves User Experience
- Leverage modern hardware and software more efficiently
- Scale Up Centrally, scale Down remotely!

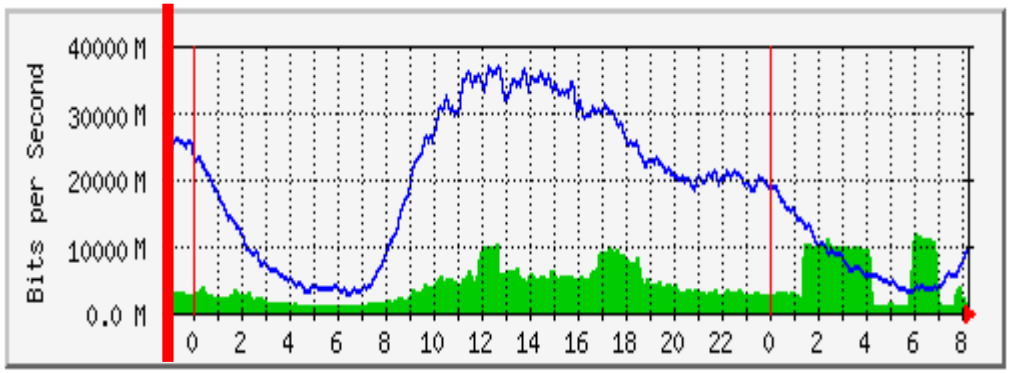


Software Defined Service Edge
Virtualizing the Network Gateway - CMTS

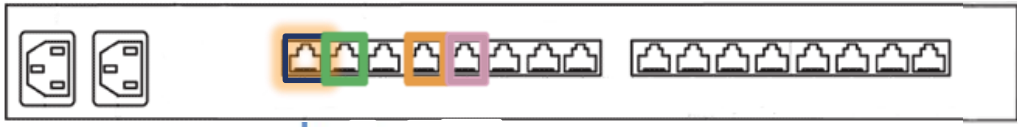
- DOCSIS World leveraging Distributed CCAP to Virtualize the CMTS
- Moves higher layer functions into the low cost Virtual Environment.
- SDN Controlled components allow removal of legacy CMTS equipment
- Micro Server capabilities allows for flexible placement of end user IP termination
  - Central Data Center location with R-PHY
  - Edge location with R-MACPHY



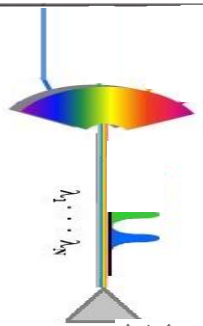
Case Study
Power Savings with NGPON2 λ-Mobility



- 17Million Households
- FTTH via PON deployment
- Cost of Power €0.125 kWh
- Approximately 300,000 PONs using 1:64 Split



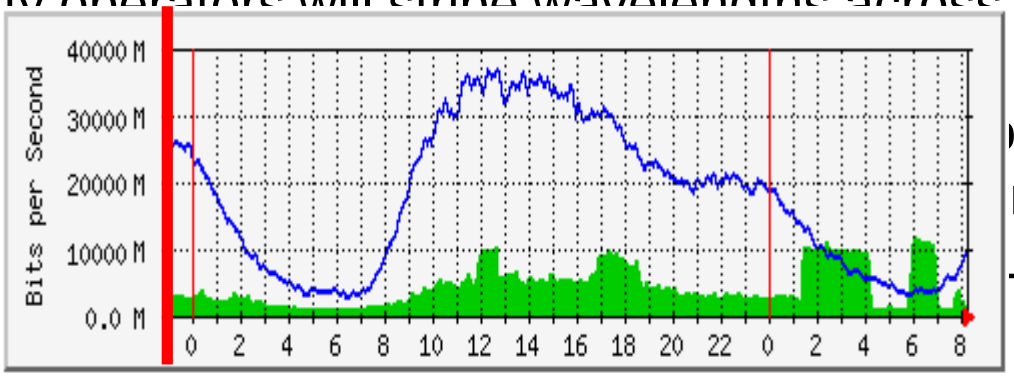
- 1.2Million 10Gbps Transceivers For 40Gbps Capacity
- 4W per Transceiver = 42M kWh PA
- €5.248M PA for Always on OLT Ports

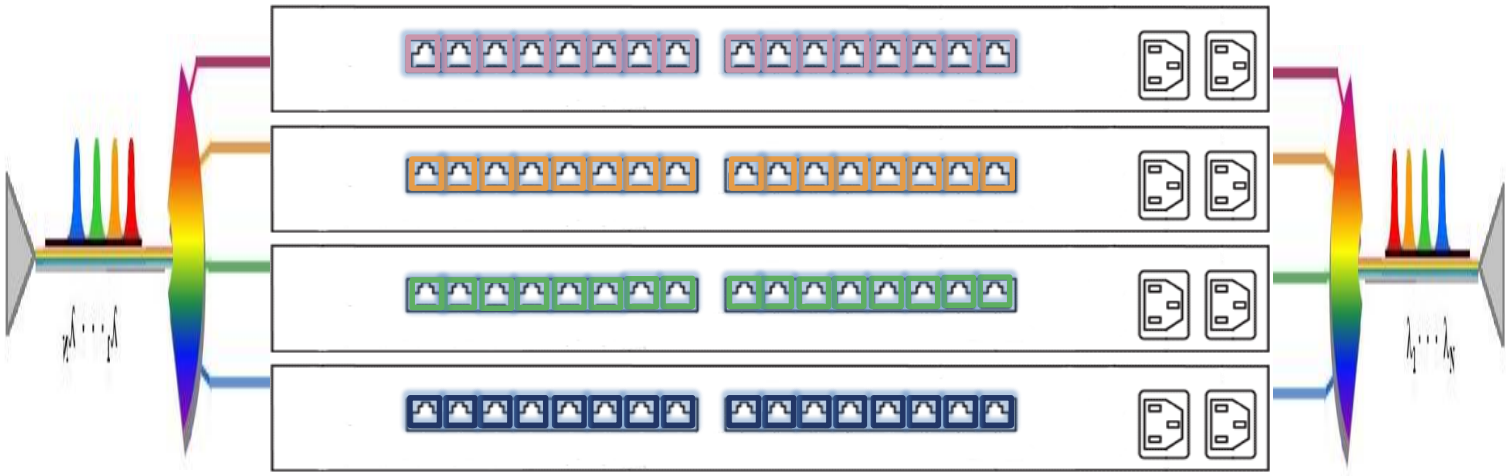


Up to €4.27M PA with AI SD-Access Power Saving

Orchestrated SDN – Scale Power Saving Further

- High Densit[illegible] multiple disaggrega
- This create[illegible]rtunities
- Virtualised [illegible]n and coordinate [illegible]T's





SDN Analytics
Real Time Traffic Analysis Use Cases

Control Activity
Centralized Classification

Issues of National Importance

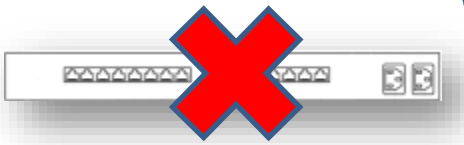
User Activity

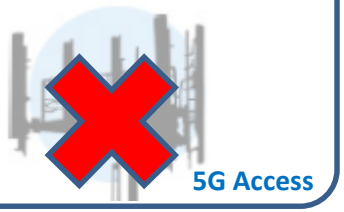
DDOS

Block Flow

Block Flow

Block Flow





Network Activity

Real Time Optimal Path Selection

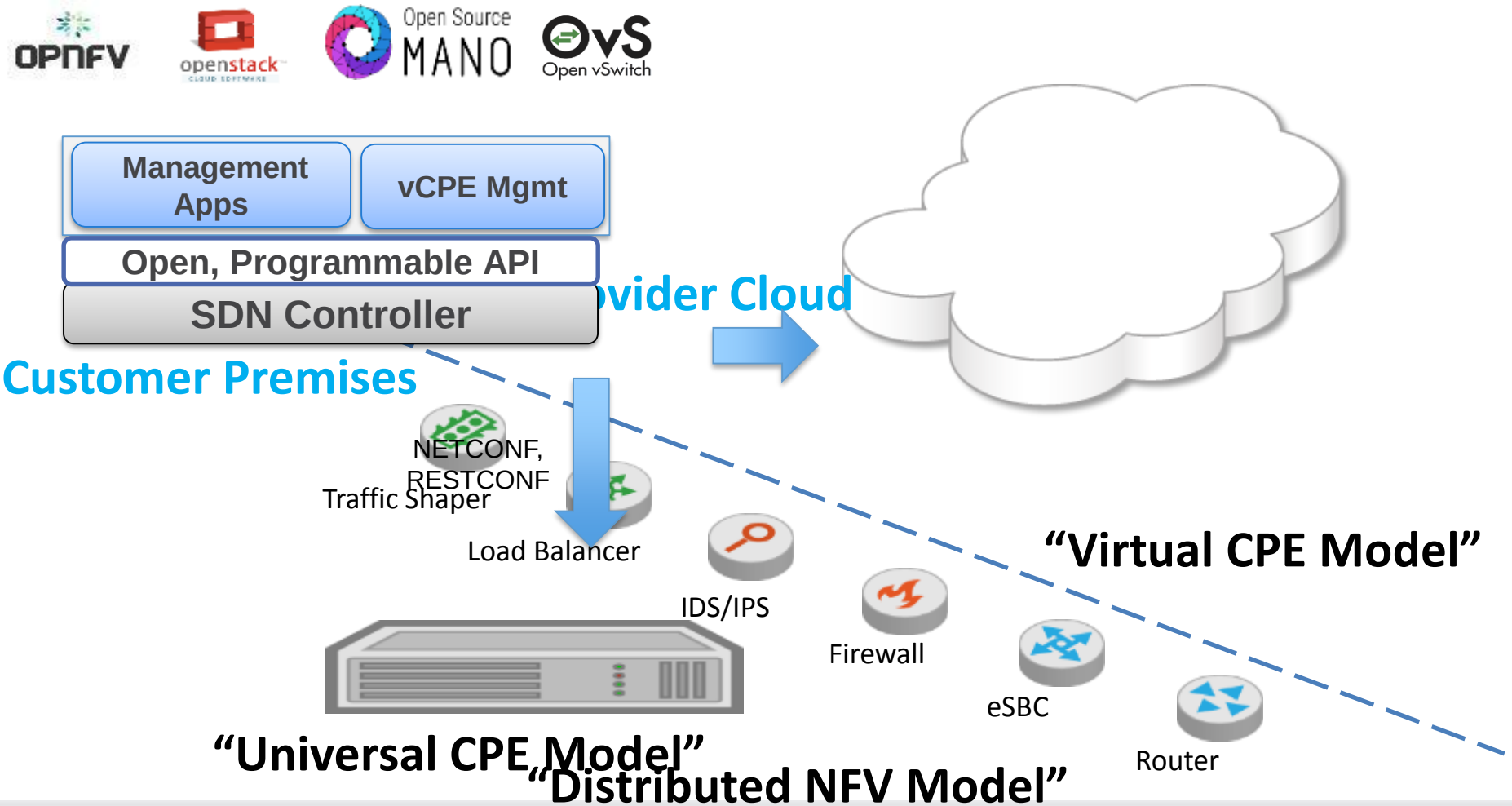
vCPE – Pushing Virtualization Further

- SDN and Network Feature Virtualisation provides a coordinated platform for flexible service offerings.

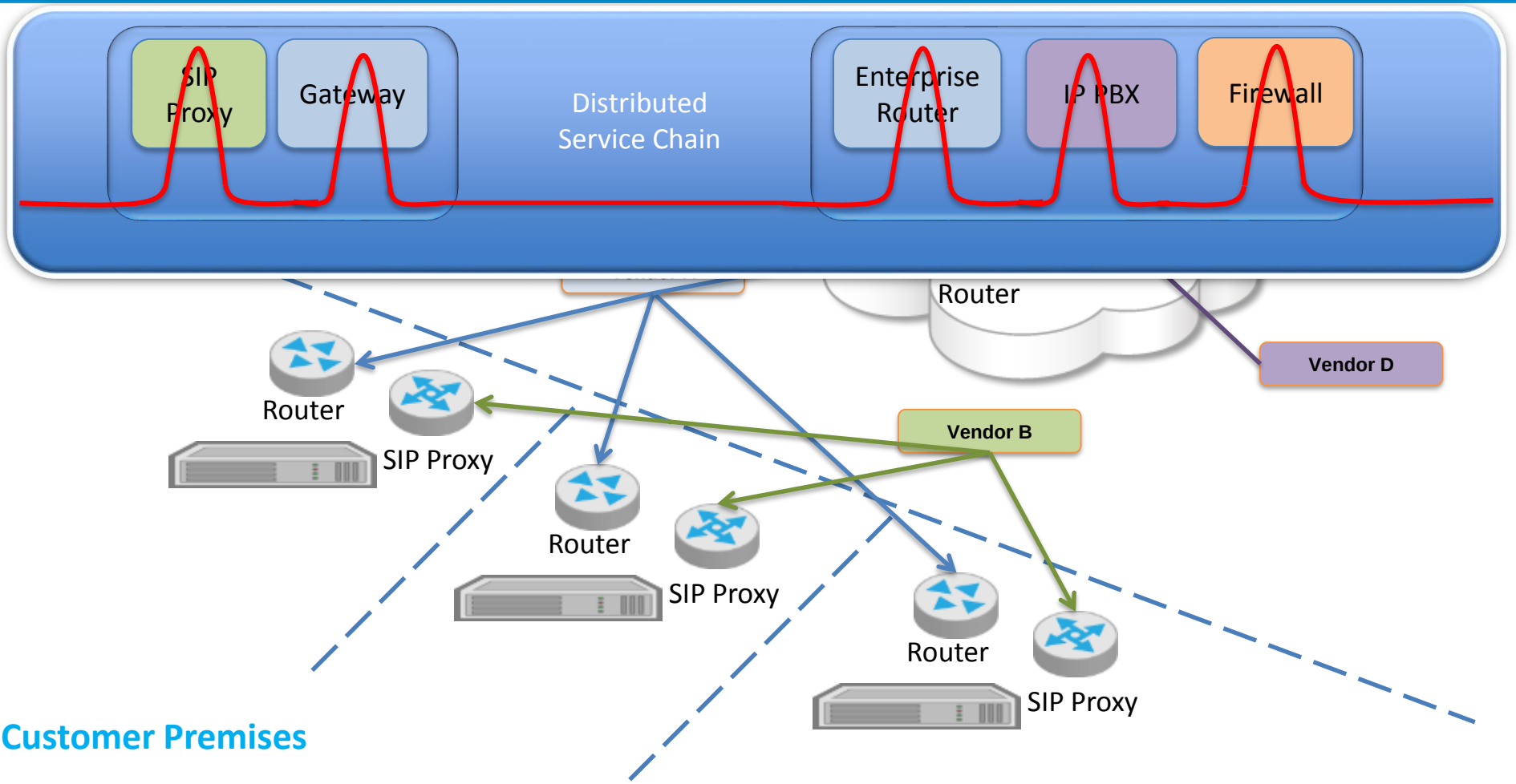
- Virtual CPE Model
  - Allows for simpler, less expensive but higher performing CPE
  - Optimised for shifting traffic at **Gigabit** rates
  - Allows user-driven service choices applied to their internet connection.

- Distributed NFV
  - New chipsets allowing ever smaller (and more powerful!) compute modules
  - Allows virtualisation in the CPE for edge processing applications
  - Example: SIP Proxy NFV on site / IDS in the Data Center

vCPE – Pushing Virtualisation Further



vCPE – Enterprise Voice Use Case



Benefits of SDN/NFV Virtualization in Access

- **OPEN**
  - Collaboration between Vendors and Service Providers
  - Interoperability is key for all participants
  - Use best of breed SW and HW elements
  - Lower CapEx by leveraging increased competition

- **SCALABLE**
  - Up to 10-fold increase in managed Nodes
  - Elastic Scalability of Virtualisation platforms makes this work with flexible and affordable server hardware.
  - Newer protocols more resilient and less intensive to interrogate.
  - Lower starting CapEx through scaled Software Licensing Models

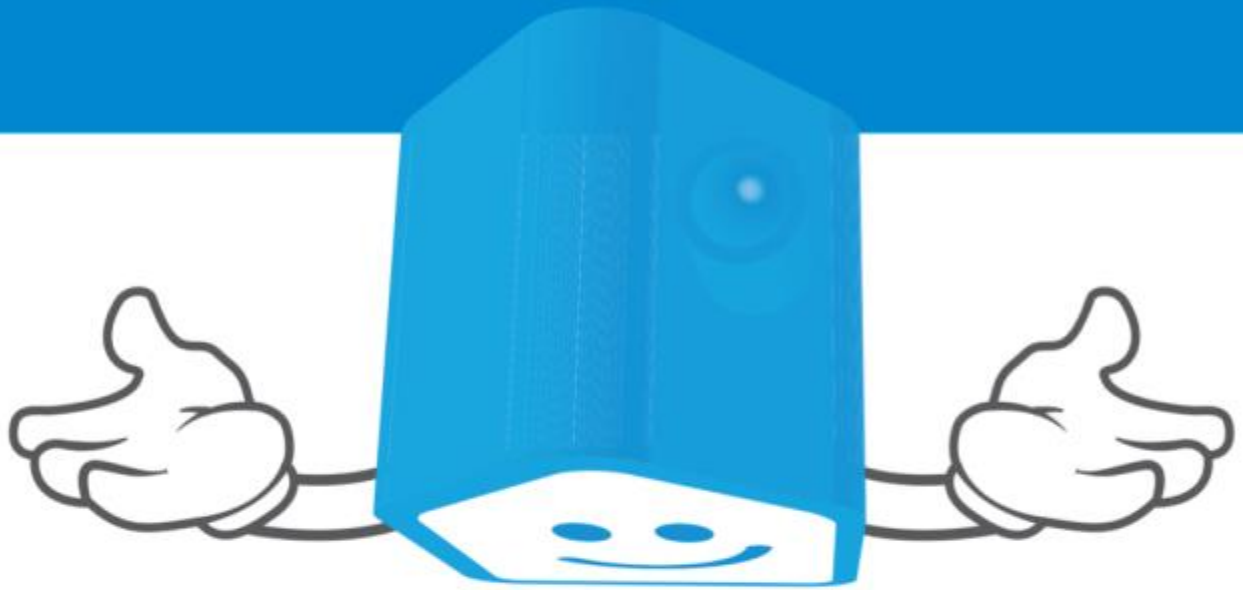
- **PROGRAMMABLE**
  - Accelerate new service delivery with a single management plane across the entire Access Network
  - Automation lowers OpEx up to 40%
  - Standardised API's will lead to more (and better!) applications
  - Network Flexibility increases dramatically with programmability

Take Away

- **Virtualized & Software Defined Network** is a **key enabler** for future communications infrastructure
- It will enable network operators to **flexibly provide services** and **cost-effectively across** their fixed and mobile networks
- **FTTH/B-based networks** will also benefit from the technologies of SDN/NFV
- **Research and development** into use cases for SDN and NFV are ongoing
- The challenges for the industry will be to **coordinate fixed and mobile networks** based on SDN/NFV, and **migrate networks** from the current infrastructure to a virtualized platform.

FTTH/B in a Virtualized & Software Defined Network

QUESTIONS?



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