Impact of NFV and SDN on Connectivity Networks

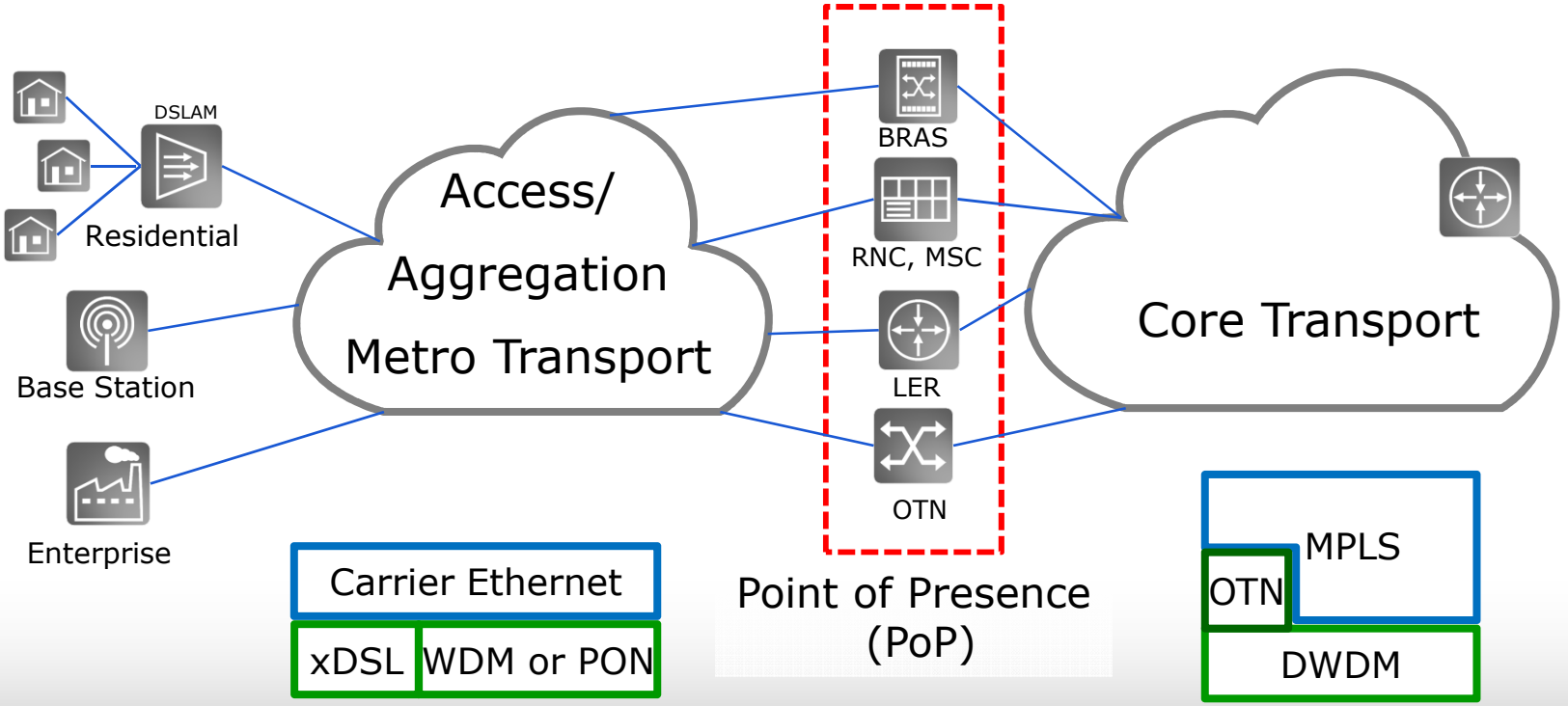
October 2014

Anthony Magee – Business Development Director

Agenda

- Present network architecture and technology layering
- Introduction to NFV
- Impact of NFV and SDN
  - Connectivity Provisioning
  - What Functions to Virtualize
- Network Demarcation in NFV and SDN Networking
- Collaboration activities

Typical Legacy Network Scenario



Technology trend: MPLS to the edge, increasing Bandwidth Requirements

Technology trend: switched OTN layer, high scalability, CP interworking

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Virtualization Is Not A New Concept

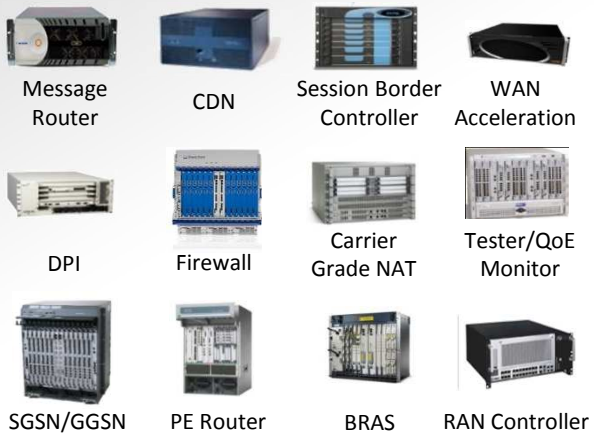
Switch Board
Dedicated hardware for single application

Soft Switch
Application running on shared servers

Virtualization impacts architecture and technology of operator networks

What is Network *Functions* Virtualisation?

Traditional Network Appliances



Virtualized Network Functions

Standard, High-Volume Servers

Standard, High-Volume Storage

Standard, High-Volume Switches

http://www.etsi.org/technologies-clusters/technologies/nfv

Common hardware, software-based provisioning, accelerate innovation

Initial NFV Implementations

Mobile Networks

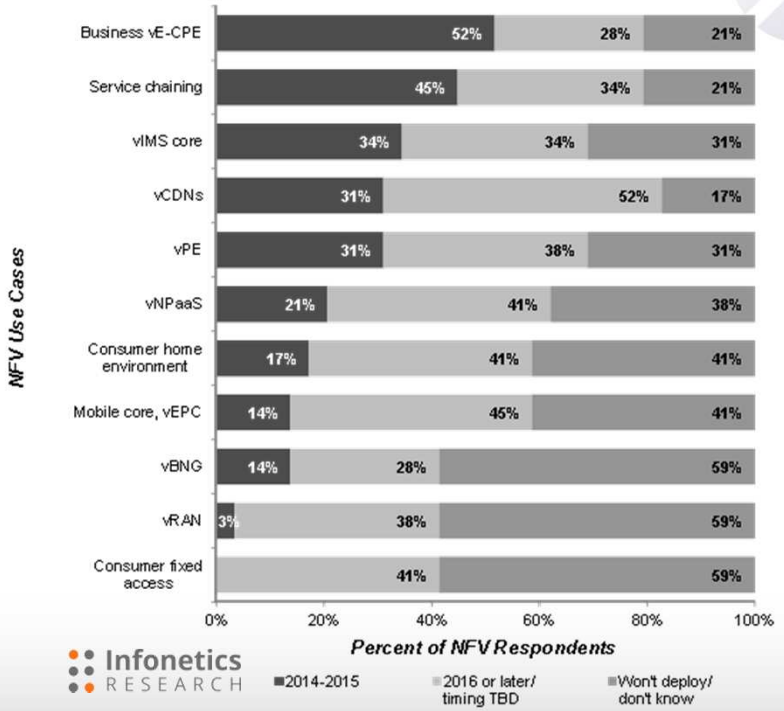
- Virtual EPC (vEPC), Centralized RAN (C-RAN)

Residential Services

- Virtual Home Gateway (vHG)

Business Services

- Virtual Customer Premises Equipment (vCPE)



Targeting mobile, residential and business applications

ADVA™ Optical Networking

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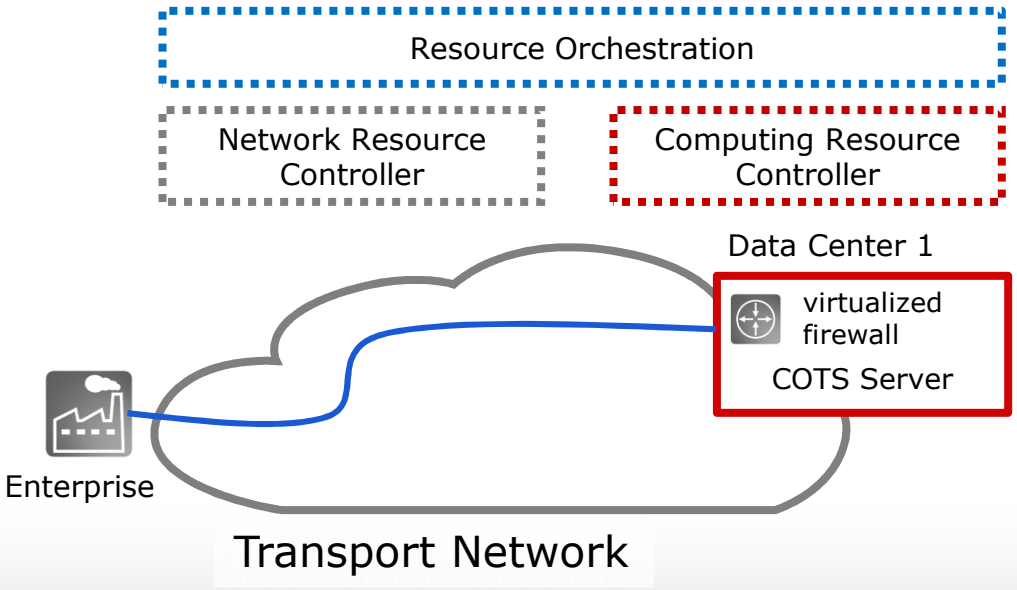
Impact of NFV on Network Control and Connectivity Network



1. **Start**: Firewall runs as virtualized network function (VNF) in DC 1;

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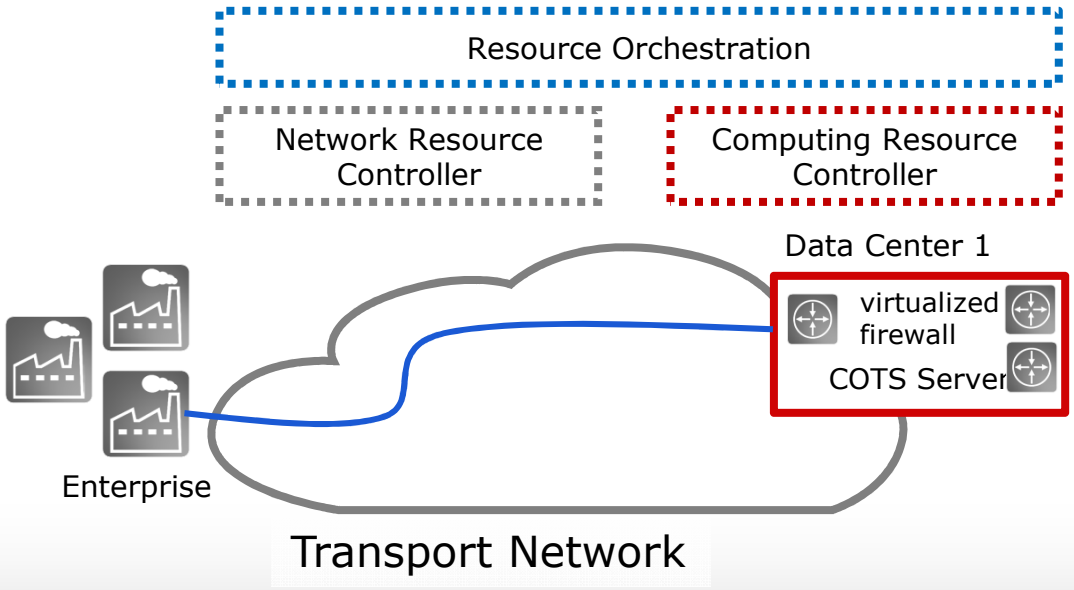

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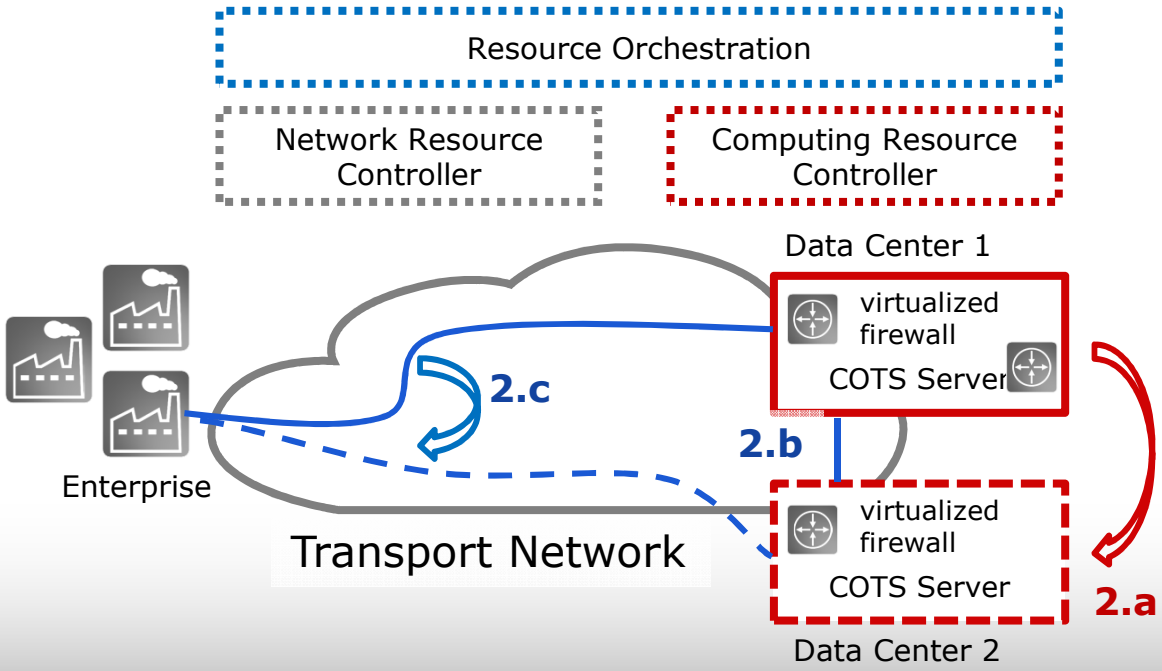

1. **Start**: Firewall runs as virtualized network function (VNF) in DC 1; as Enterprises scale, and new VNFs are deployed DC1 resource alarms start ringing !!!
2. **Orchestrator** decides to move some VNFs to DC 2
   - a) **Computing Resource Controller** moves some VNFs from DC 1 to DC 2
   - b) **Network Resource Controller** allocates capacity for moving data between DC1 and DC2
   - c) **Network Resource Controller** sets-up new flows from enterprise to DC2

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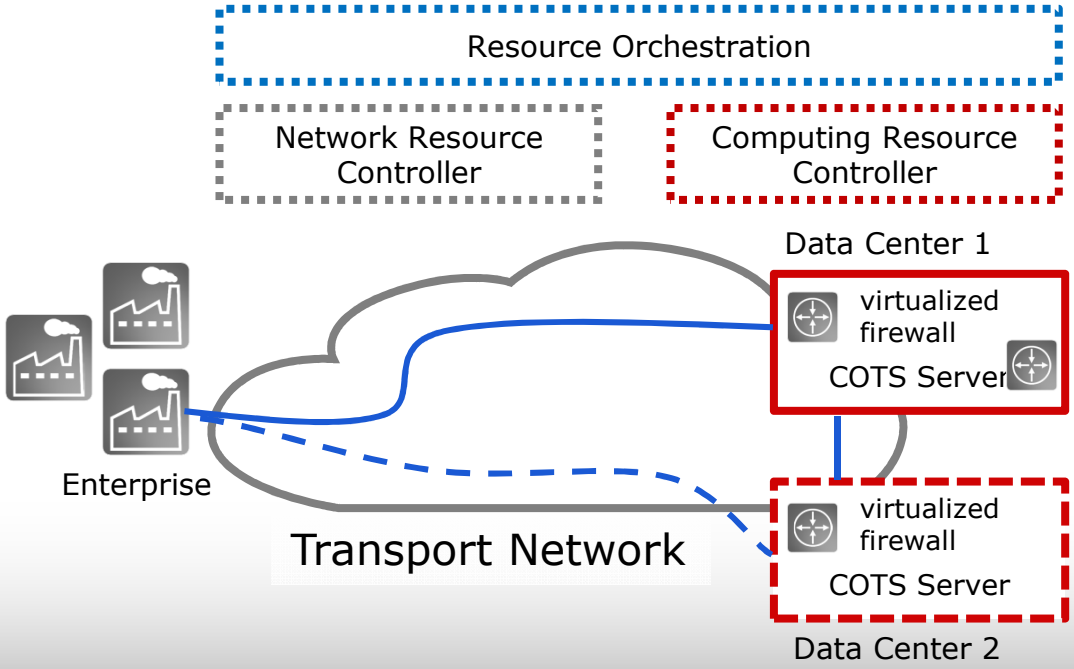
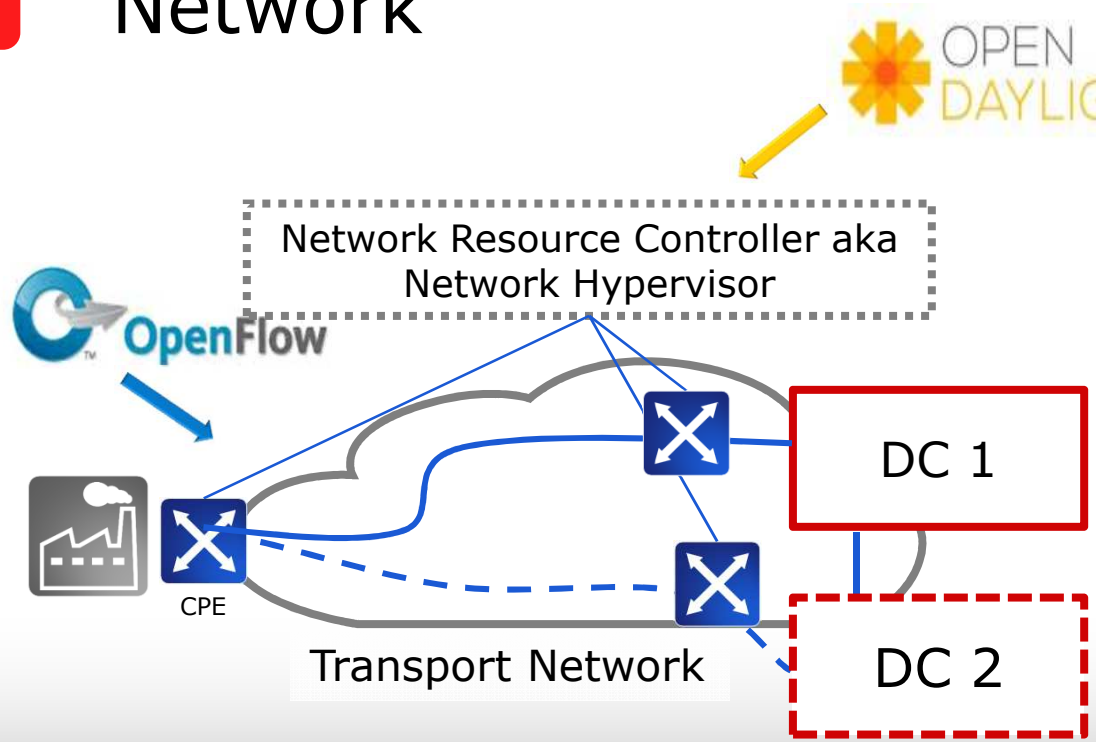


- **Software Defined Networking**: network, computing and storage resources can be allocated by software
- **Virtualization:** hypervisor shares resources among multiple users/ applications
- **Orchestration:** coordinated allocation of network resources and computing/ storage resources
- **Transport SDN:** flow-based PtP connectivity network, centrally "programmed" (= real-time, software provisioning)

NFV/SDN Impact on Control of Connectivity Network



Distributed routing- and signaling e.g. IP/MPLS

Packed flows **programmed** through open interfaces and open software controllers

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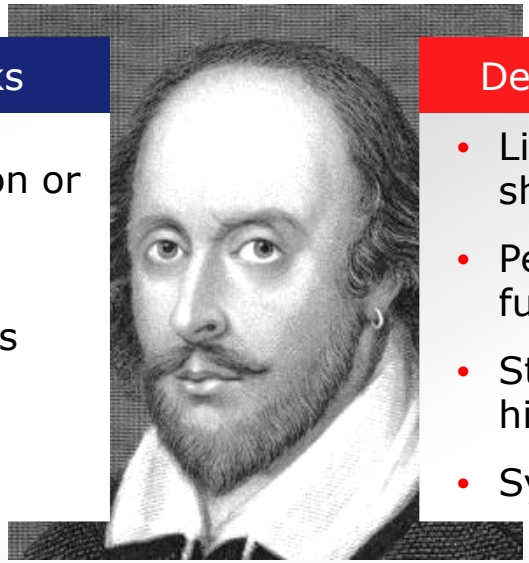
To Virtualize or Not to Virtualize

Where Virtualization Works

- Limited life-time of function or service
- Flexible adaptation of parameters and algorithms
- Moderate processing and storage load



Dedicated Hardware Preferred

- Limited gains from resource sharing
- Performance and delay-critical functions
- Static functions, deployed in high volume
- Synchronization

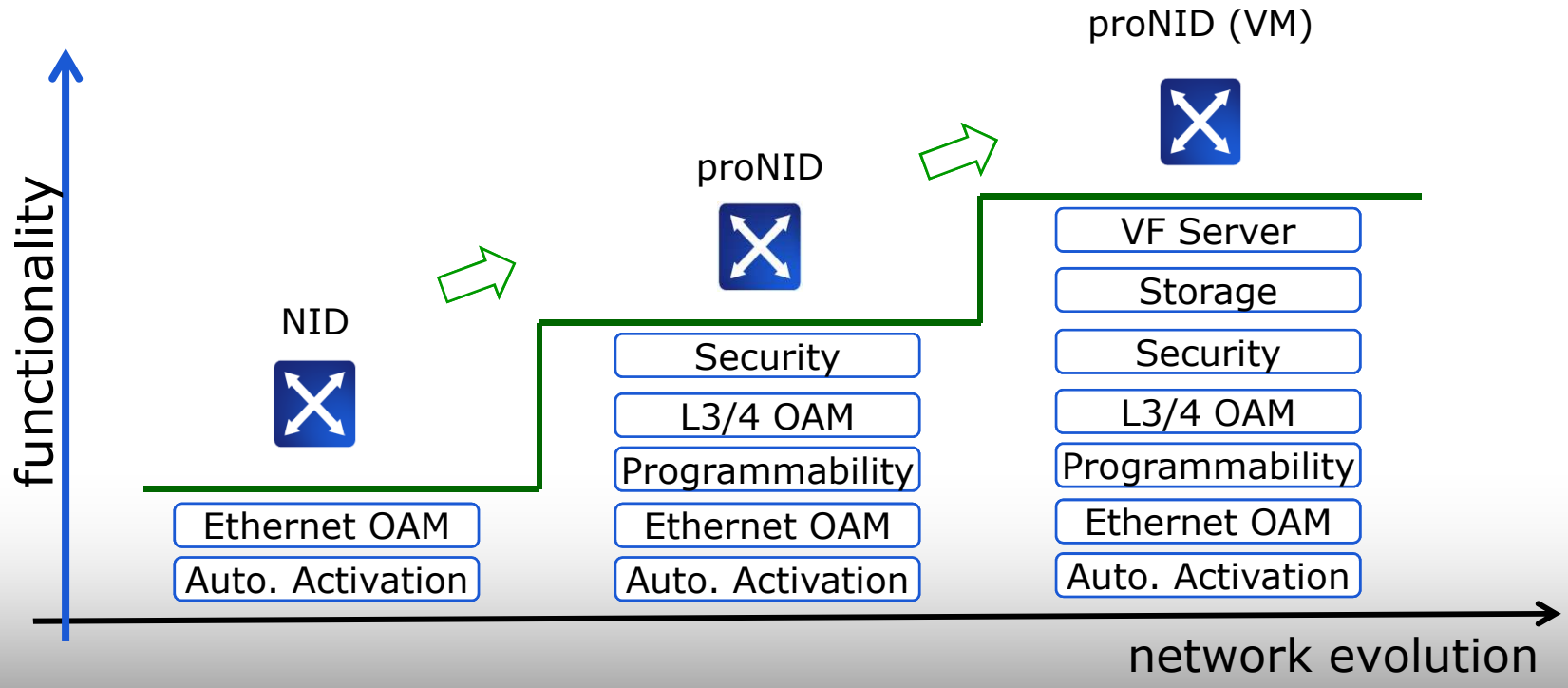
Not all network functions are perfect candidates for virtualization

Intermediate Summary

- Connectivity network becomes “programmable”: connectivity is established by central control through open interfaces with pre-defined service parameters
- Some functions will require hardware support e.g. network synchronization, encryption at lower network layers
- Each network element in a connectivity network will also provide processing and storage capacity

Data Centre becomes Network / Network becomes Data Centre

Evolution of Network Demarcation towards NFV/SDN-Centric Networking



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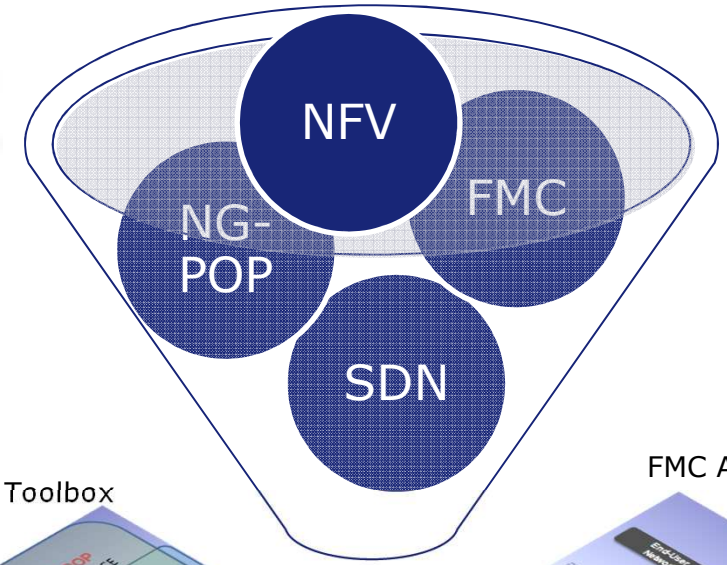
EU Project - Fixed Mobile Convergence



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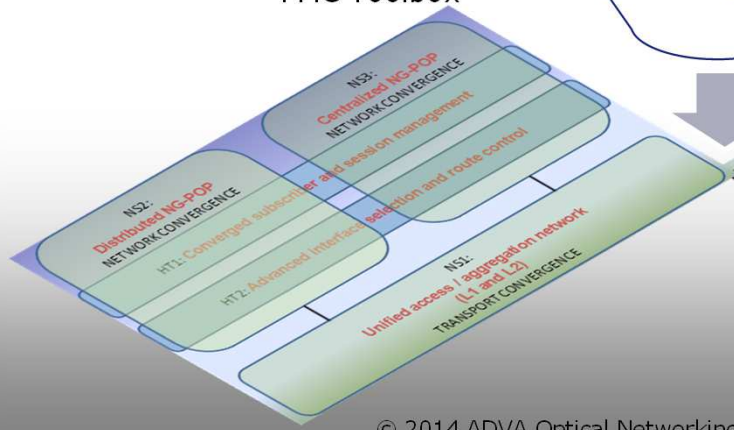
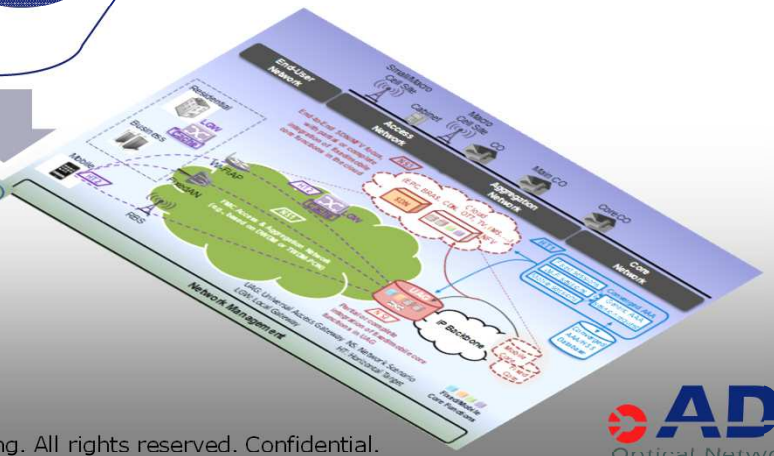
FMC Toolbox



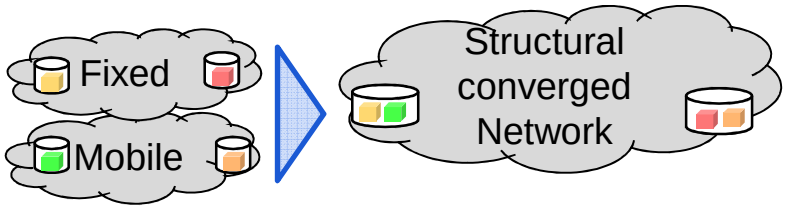
FMC Architectural Blueprint



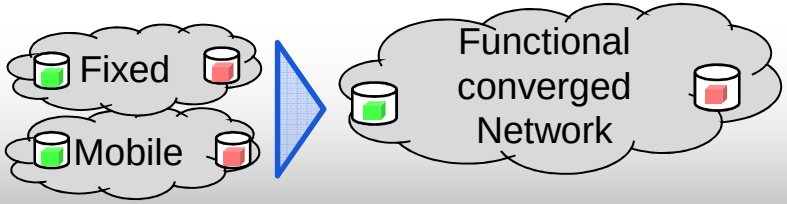
ADVA Optical Networking

NFV and Structural vs Functional Convergence

- **Structural convergence** is defined as sharing/mutualization of network equipment and infrastructure resources for several network types. The moving of existing functions of different network types to a unified network entity for a better distribution of functions belongs to structural convergence.

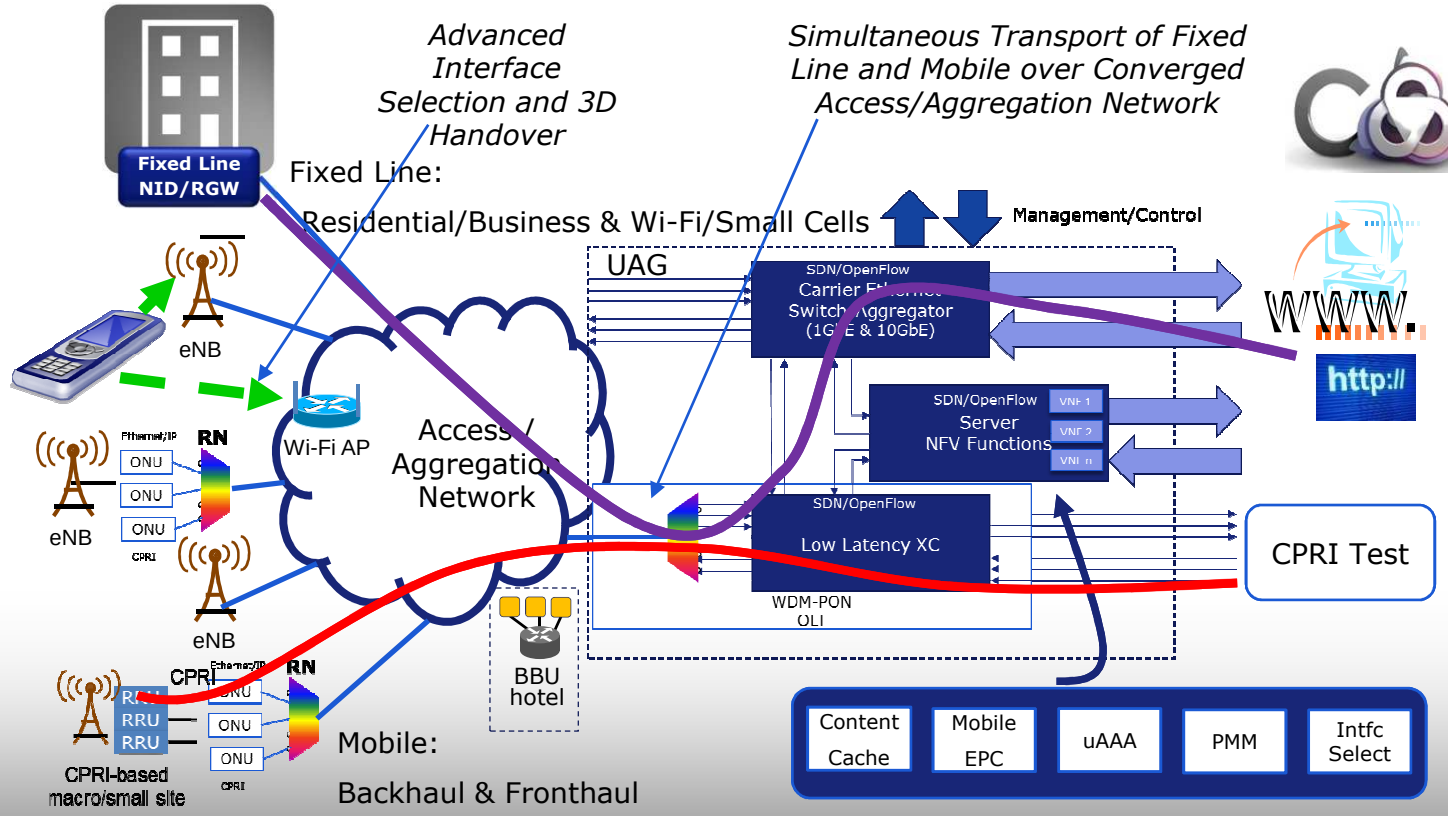


- **Functional convergence** means the implementation of a generic function to realize similar goals in different network types (fixed, mobile, Wi-Fi). This includes the moving of functions in order to merge specific fixed, mobile and Wi-Fi functions into some generic functions.

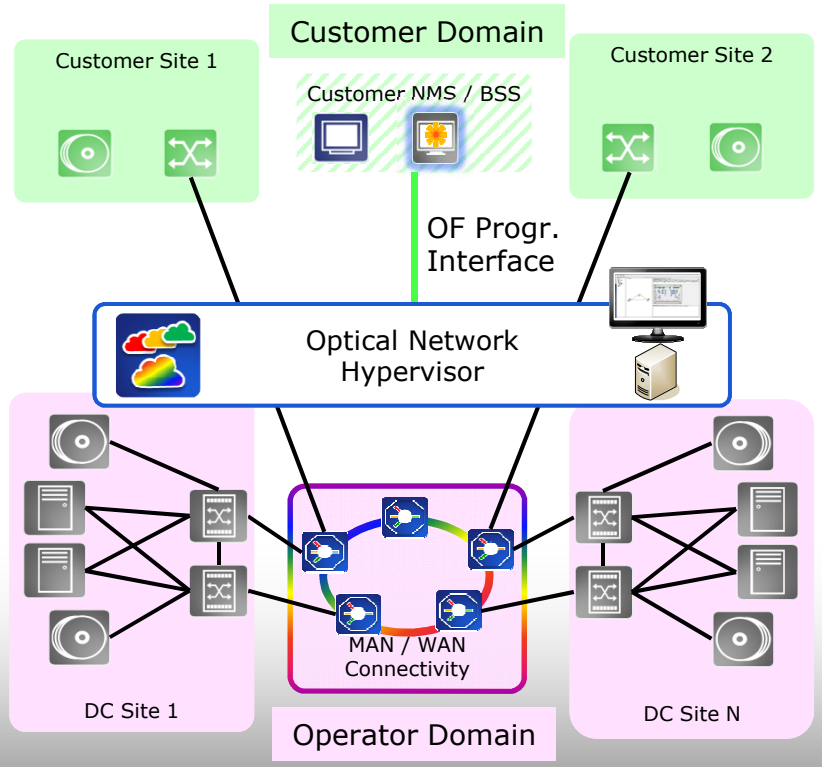


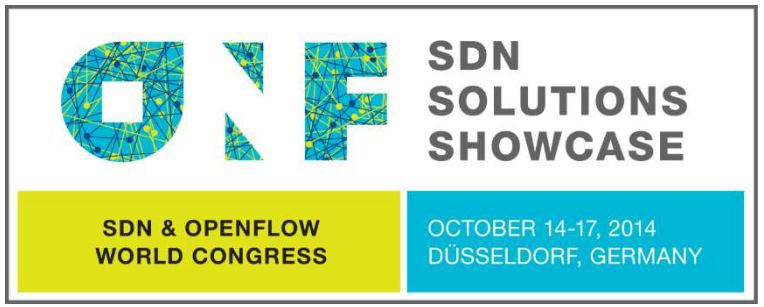
- Network Functions

COMBO UAG Deployment Models



Service Provider SDN Connectivity Demo

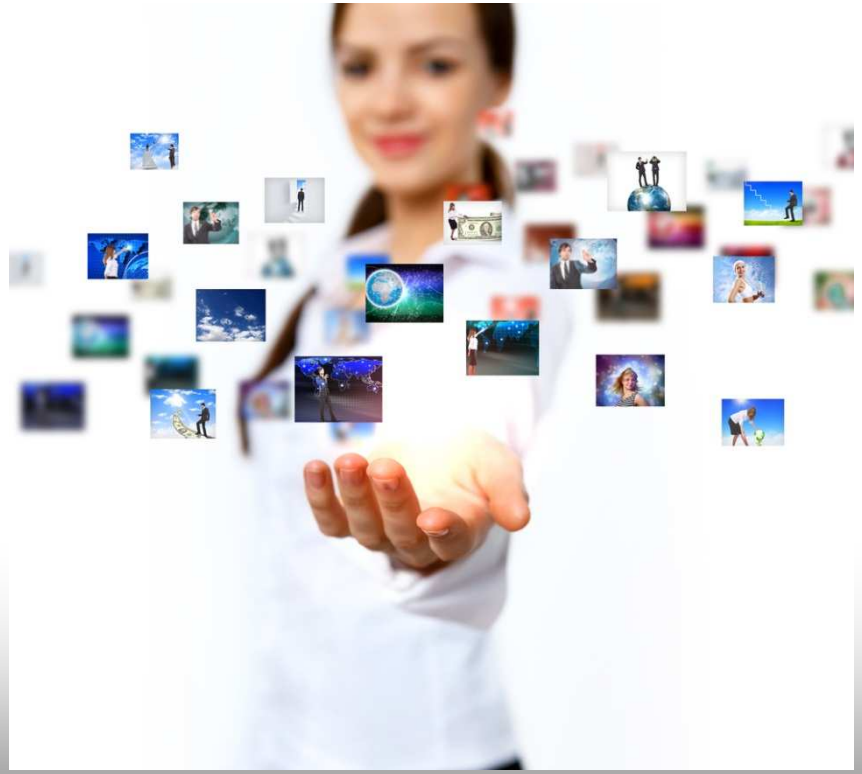




- Common optical connectivity network
- Self-provisioning / virtualized optical and Ethernet network resources
- Multiple concurrent clients such as DCs, customers, customer applications
- Network programmability by OpenFlow
- Open software DayLight controller programs the network

Key Takeaways

- Programmability is paradigm of SDN/NFV-centric networking
- Open interfaces and open software controllers for painless network integration
- Not all network functions can be virtualized
- Demarcation devices will become programmable and provide processing/storage resources
- New business models are enabled by adoption of NFV & SDN



Thank You

amagee@advaoptical.com

Acknowledgements:

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