Body of European Regulators for Electronic Communications

BEREC

BoR (16) 09

BEREC Workshop on "Regulatory Implications of SDN and NFV" - Introduction

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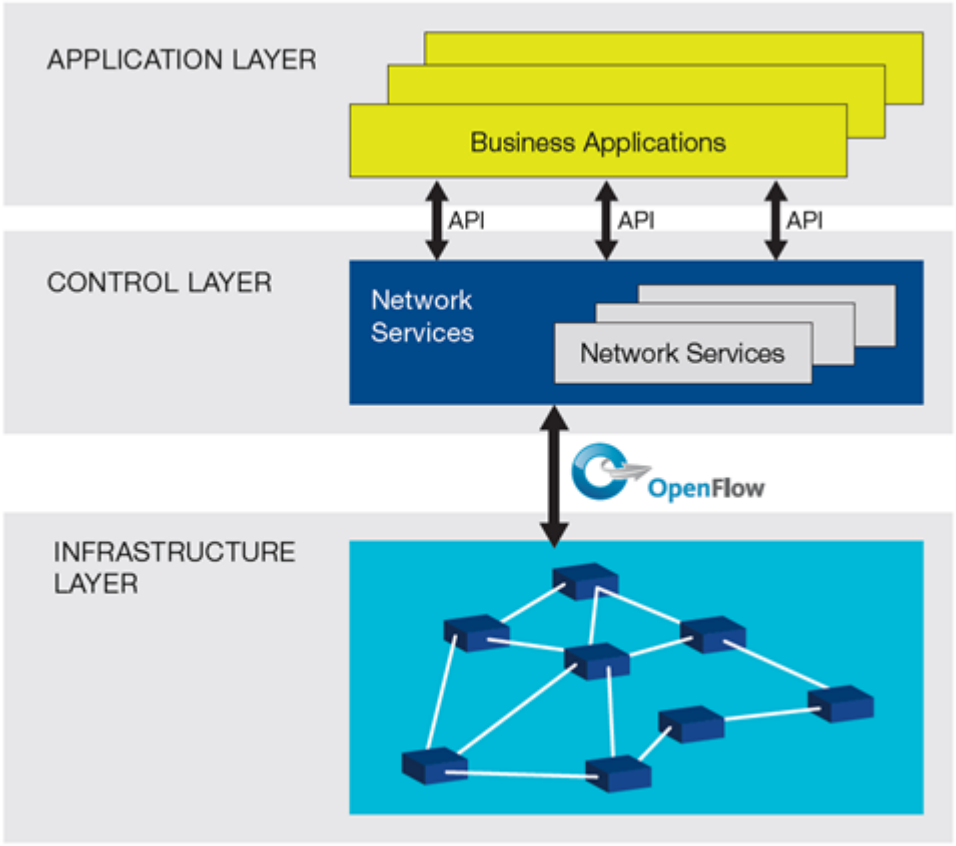
Background and goal

- In recent years the electronic communications sector together with the IT sector started to work very intensely on two new fundamental technological developments:
  - Software-Defined Networking (SDN) and
  - Network Functions Virtualisation (NFV)
- SDN and NFV
  - have the potential to completely change the way how networks are built and operated today and
  - are still in a state of dynamic developments
- At this workshop experts in the area of SDN and NFV will present their view on the regulatory impact that SDN and NFV will have
- The workshop will help BEREC to form it's opinion on the topic of SDN/NFV with regard to the Review of the Regulatory Framework

What is SDN?

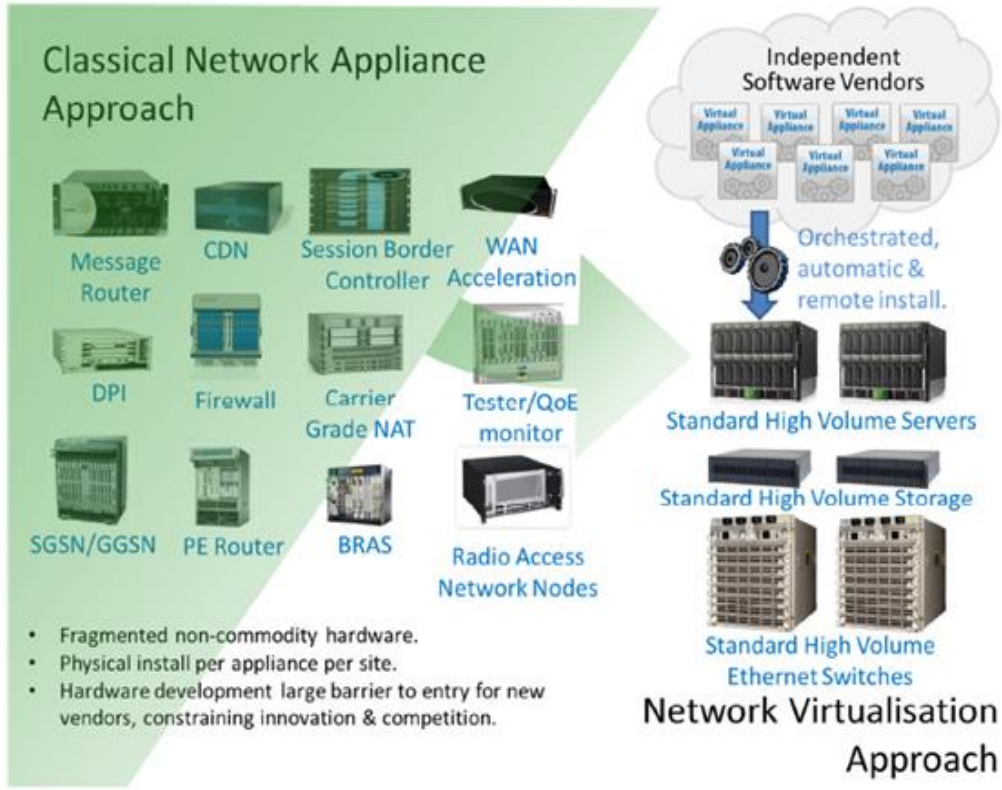
- ONF has defined an SDN architecture
- The ONF/SDN architecture consists of 3 distinct layers
- The ONF/SDN architecture has 3 key attributes
  - Logically centralized intelligence
  - Programmability
  - Abstraction



Source: ONF (2014), p. 3

What is NFV? (1)

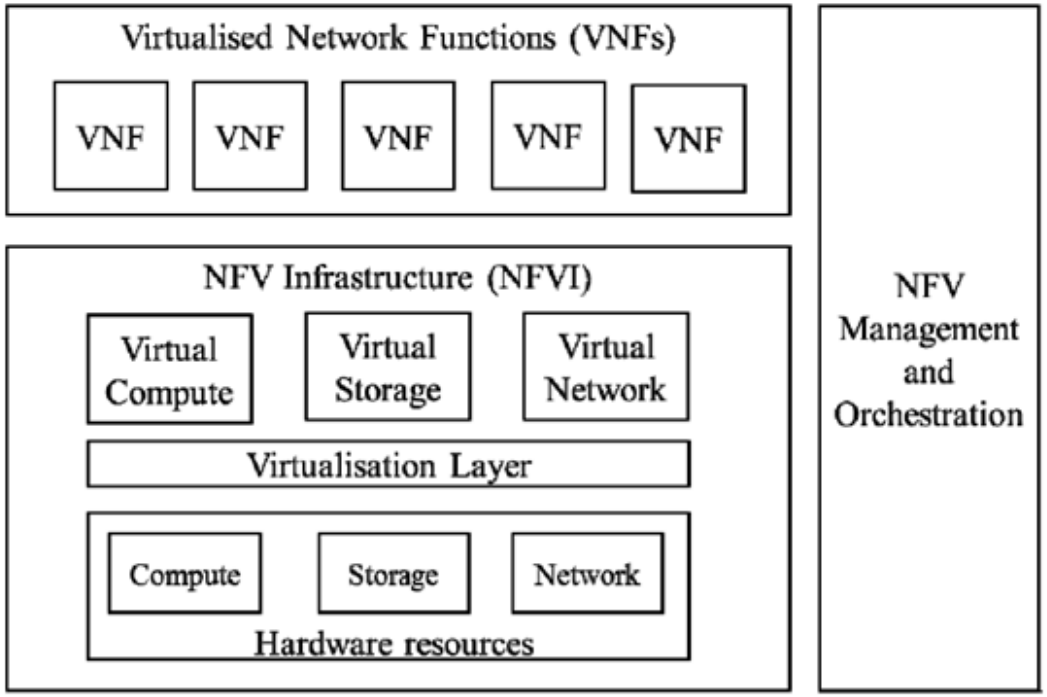
- NFV aims to transform the way that networks are built and operated
  - Evolving standard IT virtualisation technology
  - Consolidate many network equipment types onto “industry standard” high volume
    - servers,
    - switches and
    - storage
- Network functions are implemented in software



Source: NO ETSI NFV ISG (2012), p.5

What is NFV? (2)

- ETSI has defined a high-level NFV framework with 3 domains:
  - Virtualised Network Functions
  - NFV Infrastructure and
  - NFV Management and Orchestration
- A VNF is a virtualisation and software implementation of a network function
- The NFVI consists of the virtualisation layer and the hardware resources



Source: ETSI GS NFV 002 (2014), p. 10

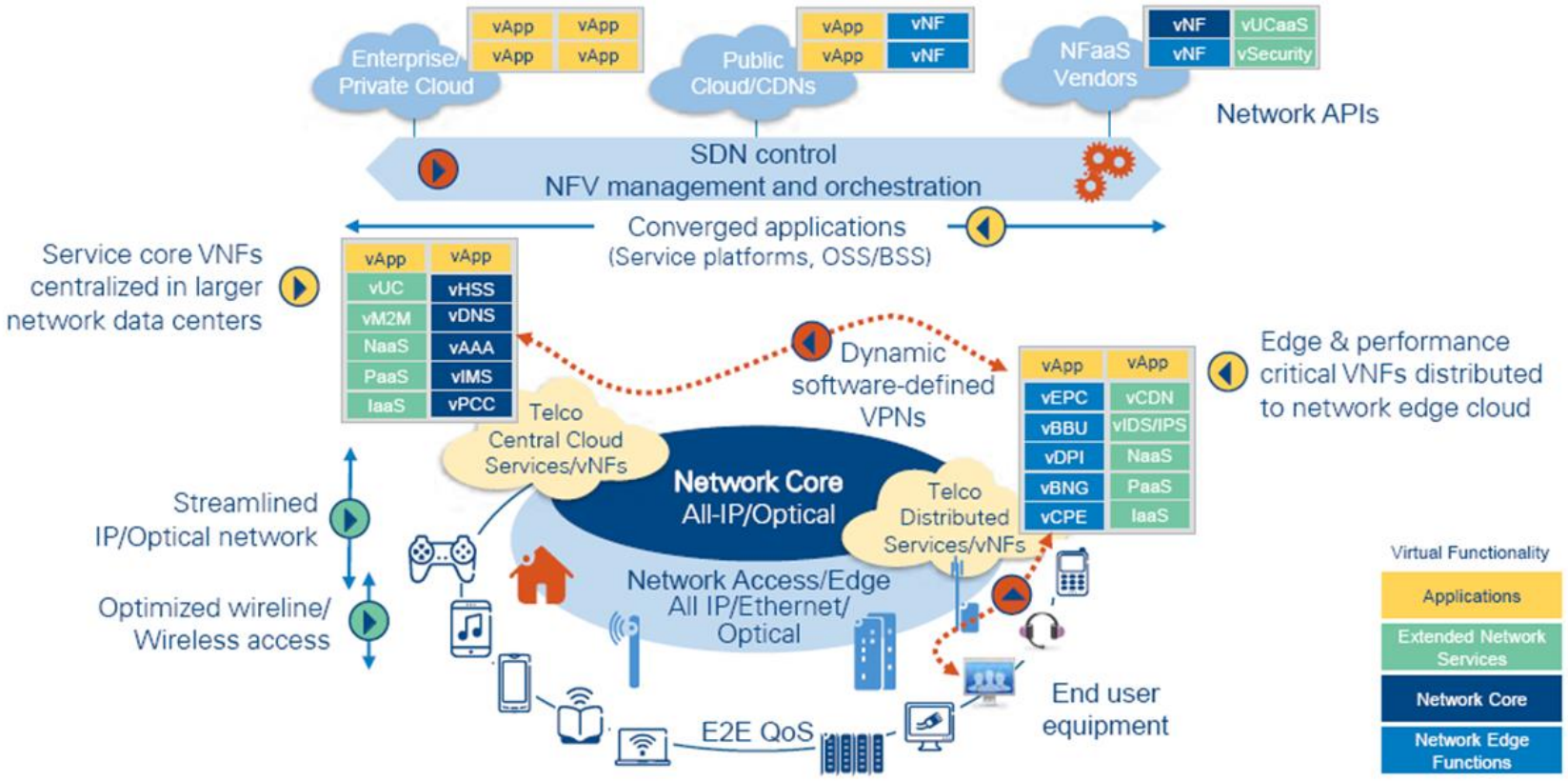
What is the relation between SDN and NFV?

- NFV is highly complementary to SDN
- Ultimately, NFV and SDN will be subsumed into a unified software-based networking paradigm

- Network operators have the possibility to use both, SDN and NFV, and to combine SDN and NFV appropriately
- SDN and NFV are in a state of dynamic developments. This includes also how to combine SDN and NFV (see e.g. ETSI GS NFV-EVE 005)

Source: NO ETSI (2012), p. 5, NO ETSI (2014) p. 16.

Future network based on SDN and NFV



Source: Athur D. Little, Bell Labs (2015), p. 12

Benefits of SDN and NFV

SDN and NFV have the following benefits:*)

- A new dimension of programmability, automation, and network control
  - Enables to build highly scalable, flexible networks
- Reduced equipment costs (CAPEX) and reduced power consumption (OPEX)
- Rapid innovation
- Targeted service introduction depending on geography or customer sets
  - Services can be rapidly scaled up/down as required
- Optimizing network configuration and/or topology in near real time
- Much more efficient test and integration
- Further benefits

*) NO ETSI NFV ISG (2012), p. 8, ONF (2012), p. 2

Regulatory implications of SDN and NFV? (1)

- Will SDN and NFV enable fixed network access which gives alternative network operators more control over the network of the incumbent compared to current layer 2 wholesale access products?
- Will SDN and NFV enable or facilitate new forms of network interconnection based on which data (Ethernet) connections can be set up dynamically on-demand (similar to a phone call)?
- Will SDN and NFV enable further new forms of network access or network sharing?

Regulatory implications of SDN and NFV? (2)

- Will SDN and NFV have (further) impacts on the current value chain? Which?
- Will SDN and NFV have an impact on the relation between OTT players and telecommunications service providers? Which?
- Will SDN and NFV have further regulatory implications?

Agenda of the workshop

- Presentations of 3 standard development organisations
  - Open Networking Foundation (ONF)
  - ETSI NFV Industry Specification Group
  - MEF
- Presentations of 3 network operators
  - Colt, QSC and Telefonica
- Presentations of 3 vendors
  - Alcatel-Lucent, Fujitsu and Hewlett Packard
- Panel discussion

Thank you

Literature (1)

- Athur D. Little, Bell Labs (2015), Reshaping the future with NFV and SDN. The impact of new technologies on carriers and their networks, 2015
  - http://sdn.ieee.org/images/pdf/adl_belllabs_2015_reshapingthefuture.pdf
- ETSI GS NFV (2014), Network Functions Virtualisation (NFV); Architectural Framework, V1.2.1, Dec. 2014
  - http://www.etsi.org/deliver/etsi_gs/NFV/001_099/002/01.02.01_60/gs_NFV002v010201p.pdf
- Network operators (NO) of the ETSI NFV ISG (2012), Network Functions Virtualisation, White Paper, October 22-24, 2012
  - https://portal.etsi.org/NFV/NFV_White_Paper.pdf

Literature (2)

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  - https://portal.etsi.org/Portals/0/TBpages/NFV/Docs/NFV_White_Paper3.pdf
- ONF (2012), Software-Defined Networking: The New Norm for Networks, White Paper, April 13, 2012
  - https://www.opennetworking.org/images/stories/downloads/sdn-resources/white-papers/wp-sdn-newnorm.pdf
- ONF (2014), OpenFlow-enabled SDN and Network Functions Virtualization, ONF Solution Brief, February 17, 2014
  - https://www.opennetworking.org/images/stories/downloads/sdn-resources/solution-briefs/sb-sdn-nvf-solution.pdf