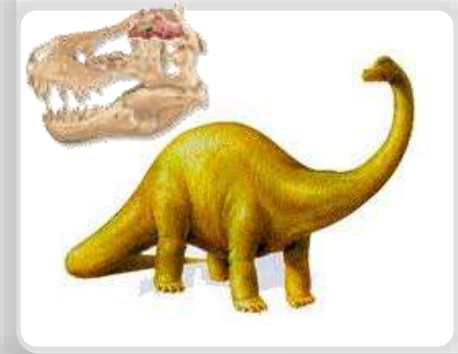
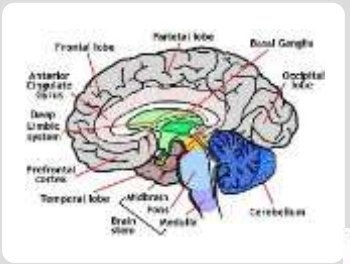
Enter the Software-Defined Era

Traditional telcos



- Very **intensive in hardware**
- Software not at the core

Internet players



- Very **intensive in software**
- Hardware is a necessary base

HARDWARE — SOFTWARE

AT&T, Cisco, BT etc

Google, Facebook

Adapt to survive: Telco evolution focus shifting from hardware to software

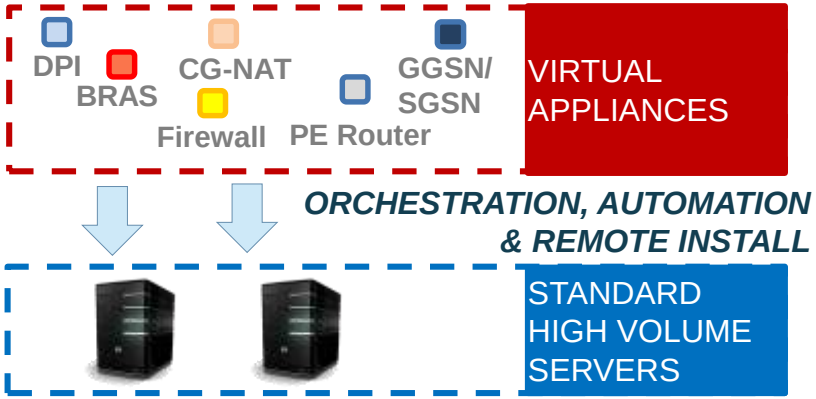
The NFV Concept

A means to make the network more flexible and simple by minimising dependence on HW constraints

Traditional Network Model:
APPLIANCE APPROACH

- Network Functions are **based on specific HW&SW**
- **One physical node per role**

Virtualised Network Model:
VIRTUAL APPLIANCE APPROACH



- Network Functions are **SW-based over well-known HW**
- **Multiple roles** over **same HW**

Target

Classical Network Appliance Approach

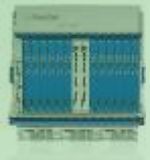

Message Router

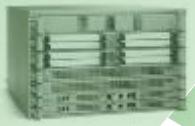

CDN


Session Border Controller


WAN Acceleration


DPI


Firewall


Carrier Grade NAT


Tester/QoE monitor


SGSN/GGSN

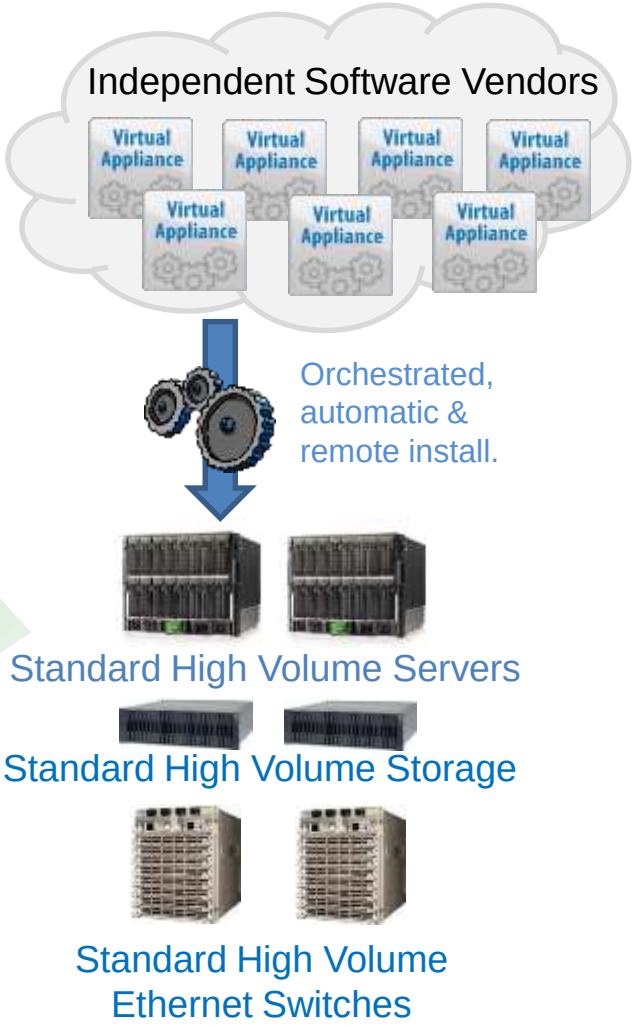

PE Router


BRAS


Radio Access Network Nodes

- Fragmented non-commodity hardware.
- Physical install per appliance per site.
- Hardware development large barrier to entry for new vendors, constraining innovation & competition.

Source: NFV



Network Virtualisation Approach

Network Functions Virtualization

- Network Functions Virtualization is about implementing network functions in software - that today run on proprietary hardware - leveraging (high volume) standard servers and IT virtualization
- Supports multi-versioning and multi-tenancy of network functions, which allows use of a single physical platform for different applications, users and tenants
- Enables new ways to implement resilience, service assurance, test and diagnostics and security surveillance
- Provides opportunities for pure software players
- Facilitates innovation towards new network functions and services that are only practical in a pure software network environment
- Applicable to any data plane packet processing and control plane functions, in fixed or mobile networks
- NFV will only scale if management and configuration of functions can be automated
- NFV aims to ultimately transform the way network operators architect and operate their networks, but change can be incremental

Source: Adapted from D. Lopez Telefonica I+D, NFV

Benefits & Promises of NFV

- Reduced equipment costs (CAPEX)
  - through consolidating equipment and economies of scale of IT industry.
- Increased speed of time to market
  - by minimising the typical network operator cycle of innovation.
- Availability of network appliance multi-version and multi-tenancy,
  - allows a single platform for different applications, users and tenants.
- Enables a variety of eco-systems and encourages openness.
- Encouraging innovation to bring new services and generate new revenue streams.

Source: NFV

Benefits & Promises of NFV

- Flexibility to easily, rapidly, dynamically provision and instantiate new services in various locations
- Improved operational efficiency
  - by taking advantage of the higher uniformity of the physical network platform and its homogeneity to other support platforms.
- Software-oriented innovation to rapidly prototype and test new services and generate new revenue streams
- More service differentiation & customization
- Reduced (OPEX) operational costs: reduced power, reduced space, improved network monitoring
- IT-oriented skillset and talent

Source: Adapted from D. Lopez Telefonica I+D, NFV

So, why we need/want NFV(/SDN)?

1. Virtualization: Use network resource without worrying about where it is physically located, how much it is, how it is organized, etc.
2. Orchestration: Manage thousands of devices
3. Programmable: Should be able to change behavior on the fly.
4. Dynamic Scaling: Should be able to change size, quantity
5. Automation
6. Visibility: Monitor resources, connectivity
7. Performance: Optimize network device utilization
8. Multi-tenancy
9. Service Integration
10. Openness: Full choice of modular plug-ins

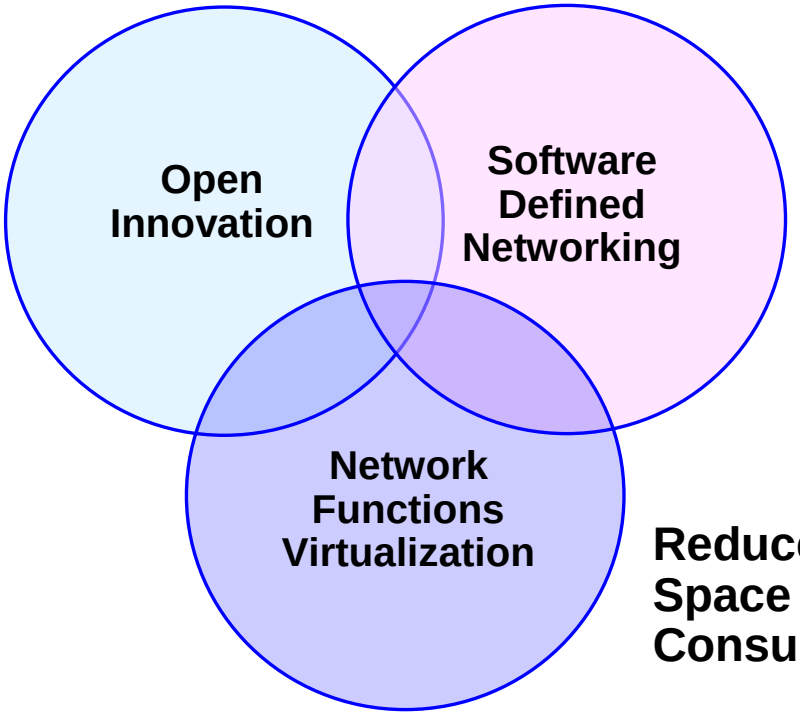
Note: These are exactly the same reasons why we need/want SDN.

Source: Adapted from Raj Jain

NFV and SDN

- NFV and SDN are highly complementary
- Both topics are mutually beneficial but not dependent on each other

Creates competitive supply of innovative applications by third parties



Creates network abstractions to enable faster innovation

Reduces CAPEX, OPEX, Space & Power Consumption

Source: NFV

NFV vs SDN

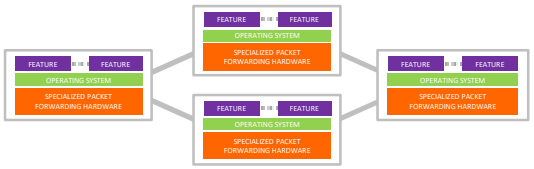
- NFV: re-definition of **network equipment architecture**
- NFV was born to meet Service Provider (SP) needs:
  - Lower CAPEX by reducing/eliminating proprietary hardware
  - Consolidate multiple network functions onto industry standard platforms
- SDN: re-definition of **network architecture**
- SDN comes from the IT world:
  - Separate the data and control layers, while centralizing the control
  - Deliver the ability to program network behavior using well-defined interfaces

Software Defined Networking

Network equipment as Black boxes

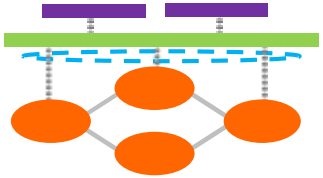
SDN

Open interfaces (OpenFlow) for instructing the boxes what to do

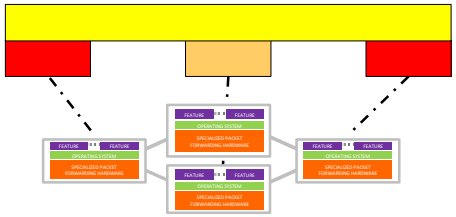


Boxes with autonomous behaviour

SDN

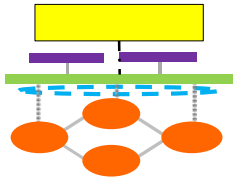


Decisions are taken out of the box



Adapting OSS to manage black boxes

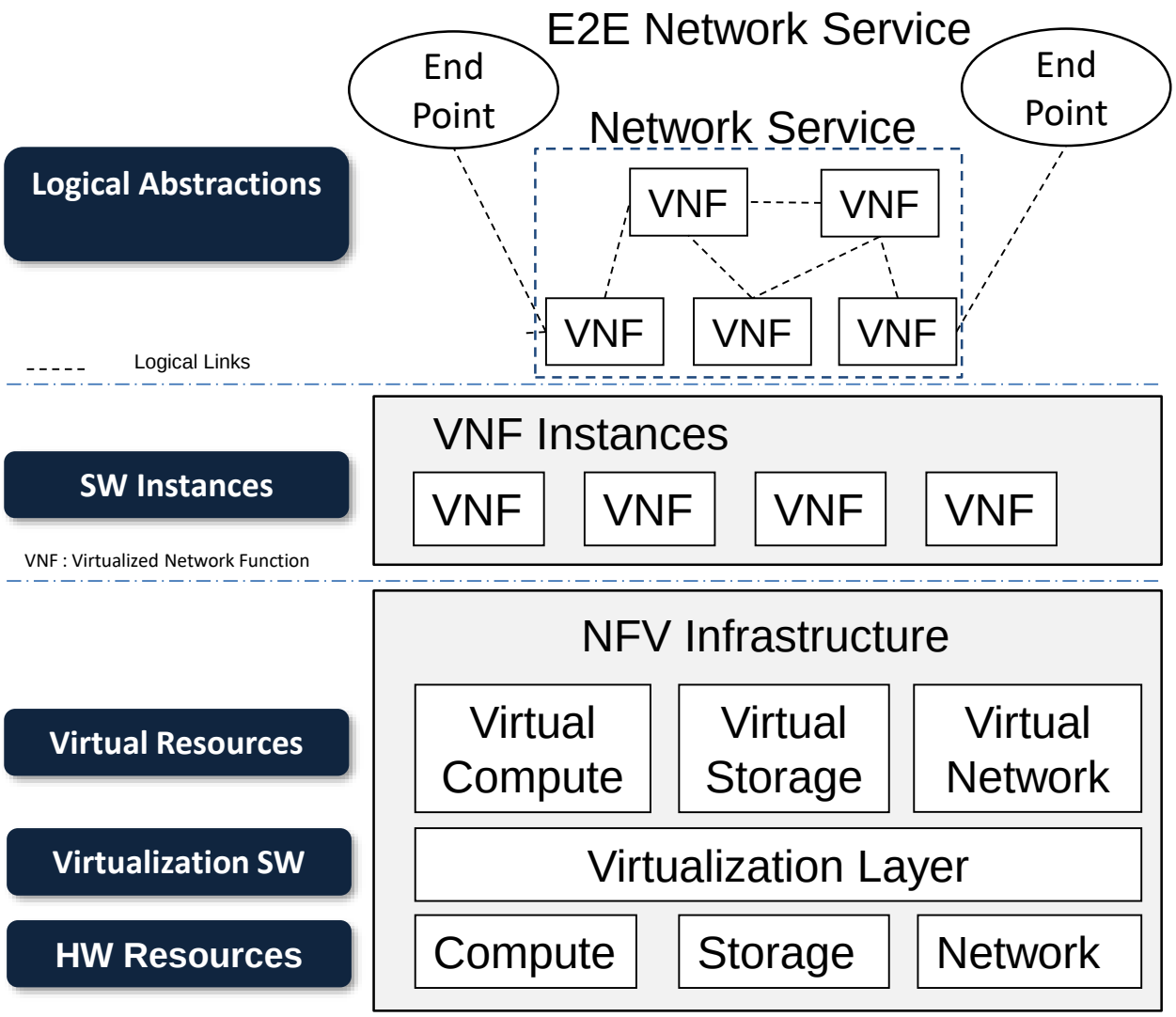
SDN



Simpler OSS to manage the SDN controller

Source: Adapted from D. Lopez Telefonica I+D, NFV

NFV Layers



Source: Adapted from D. Lopez Telefonica I+D, NFV