NFV and Telco-Clouds
Introduction and challenges

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What are Clouds?

‘Classical’ Datacenters

Clouds

Operational Models

Management + Virtualization

SaaS: Software as a Service
PaaS: Platform as a Service
IaaS: Infrastructure as a Service
MaaS: Metal as a Service
Why Clouds were a big business success:

Reduction of Total Cost of Ownership (TCO)
- Reduction of Capital Expenditure (CAPEX)
- Reduction of Operational Expenditure (OPEX)

New Business Opportunities
- New un-solved problem/un-addressed need
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Key enabling technologies vs. Business drivers
Virtualization technology to increase utilization

Virtualization technology reduced datacenter CAPEX
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Cloud OS management technology = toolbox for easy operations

Cloud OS technology reduced datacenter OPEX: 1 IT person = 10000 Servers
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Key enabling technologies vs. Business drivers
Elastic scaling technology: ultimate solution for the unpredictable WWW

Elastic scaling is key for the new IT/Web-scale world

New web-scale reality:
- Unpredictable Load Patterns
- Easy scaling from 1 → 10⁹ requests

Elastic scaling is key for the new IT/Web-scale world
Network Function Virtualization (NFV)

... Clouds for the Telecom industry
Intro to Network Function Virtualization
e.g. typical enterprise network

Examples of ‘Network Functions’:
- Routers
- Firewalls
- Network Address Translators (NAT)
- Proxies (e.g. HTTP, SIP,...)

NFV is about Cloud + Networking (SDN)
Which ‘Network Functions’ are we talking about a practical telco point of view
Which ‘Network Functions’ are we talking about a practical point of view
Which ‘Network Functions’ are we talking about from a practical point of view?
Which ‘Network Functions’ are we talking about a practical point of view

- IPTV
- IP Multimedia Subsystem (IMS)
  - SIP Proxies
  - Session Border Controllers
  - Media Mixers (Voice/Video)
  - Media Servers

Every success has its network
Which ‘Network Functions’ are we talking about a practical point of view

IPTV systems & CDNs
Which ‘Network Functions’ are we talking about
a practical point of view

Operational Support Systems (OSS)

- Management
- Accounting
- Billing
- Fault Handling

...
Which ‘Network Functions’ are we talking about a practical point of view

Home Devices /IoT (CPE)
Which ‘Network Functions’ are we talking about a practical point of view

Source: Analysys Mason, 2015
Network Function Virtualization

Software

Cloud-like infrastructure (NFVI)

& SDN for networking

Standardization started End 2012 in ETSI NFV
Why NFV is an even bigger disruption than Clouds for IT?
Disruptive Innovation & Innovator’s dilemma

![Diagram showing performance vs. time with different technologies like x86-COTS, DPDK, SR-IOV, OVS, VT-d, and VT-x.](image)

- Highest Market Needs
- Network Equipment
- Market shifts to operational advantages
- Lowest Market Needs

Every success has its network
Virtual Network Functions (vNF): Every vNF is different

COST GAIN (CAPEX & OPEX)

HIGH

DYNAMIC CONTROL GAIN

LOW

LESS

CORE ROUTERS & 100G+ SWITCHES

FTTx, RF, COHERENT OPTICAL

EDGE ROUTERS

PACKET GATEWAYS

MEDIA GATEWAYS

MEDIA SERVERS & CDN

NETWORK APPLIANCES

NETWORK APPS (IMS)

CONTROL PLANE FUNCTIONS

CHARGING APPLICATIONS

EMS/NMS

OSS/BSS

ANALYTICS PLATFORMS

NFV/SDN CONTROL

Customer Premises Equipment

Yes

Maybe

Never

Every success has its network

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The NFV Solution/Architecture by ETSI NFV
Why NFV is becoming a big business success:
(+ differences with IT Clouds)

Reduction of Total Cost of Ownership (TCO)

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Every success has its network
Key enabling technologies & NFV Business drivers
Virtualization technology to decoupling SW & HW

Virtualization technology reduces multi-vendor HW complexity

Compared to IT-Clouds:
- CPU’s highly utilized
- Predictable Loads
- 5-9s Reliability is key!

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Every success has its network

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Why NFV is becoming a big business success: (+ differences with IT Clouds)

- Reduction of Total Cost of Ownership (TCO)
  - Reduction of Capital Expenditure (CAPEX)...
  - Reduction of Operational Expenditure (OPEX)...

- New Business Opportunities...
  - New un-solved problem/un-addressed need
Key enabling technologies & Business drivers
SDN & Service Chaining technologies to reduce network operations

SDN technology to easily manage your complex network overlays & policies

Compared to IT-Clouds:
- More complex than public & private IP
- Lots of private networks (VPNs)
- Service Level Agreements (SLAs)
SDN: The need for Network automation

New Tenant / Application Request

Compute Management

Network Configuration

Auto-instantiation

00:01

Compute Request completed in Minutes

Help Desk Change Control

Network Change completed in days/Weeks

VLAN Address

LAN (VLAN) Configuration

IP Address

WAN (IP) Configuration

Security / QA Team

The Network
Cumbersome, constrained, manual processes, inefficient

Compute and Storage Virtualized, instantly available, easily consumable

The Network
Cumbersome, constrained, manual processes, inefficient

Every success has its network
SDN: Network as a Service (NaaS)

New Tenant / Application Request

Compute / Storage Management

- Auto-instantiation

SDN Controller

- Auto-Configuration

templates

- IP address
- Policy / Security Zones
- WAN interconnect
- L2 / L3 Service AD
- Service chaining

Compute and Storage
Virtualized, instantly available, easily consumable

The Network
Automated, agile, programmable

Every success has its network
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MANO: the ultimate solution for NFV/OSS operation

VNF MANAGER

Full Life-cycle management for Telco Apps tuned to operators’ needs

NFV ORCHESTRATOR

SPEED
Future/Research Challenges

- Meet the performance of most demanding apps
  - Network offload, latency, jitter, reliability, availability
- Correlated data
  - Fine grained analytics
- NFVI
  - Open/shared Infrastructure with full guarantees
- Software decomposition
  - VMs vs. Containers

Every success has its network
Conclusions

2 Technologies have changed drastically the telecom industry

- Network Function Virtualization (NFV)
- Software Defined Networks (SDN)

... and they will keep on doing this the next 10 years

Technology in this domain is evolving **extremely fast**

Hot technologies of today didn’t even exist 3 years ago...
Every success has its network