IoT, SDN, NFV & AI
Will networks be the same again?

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About Insight Research

- Founded in 1990, Insight offers comparative market research and competitive analysis exclusively for the telecommunications industry.

- Our research agenda includes NFV, SDN, vEPC, vRAN, Containers, LSO, IoT, 5G, AI OSS, BSS, BoD, CORD and Big Data.
What am I talking about?

- Overview of SDN and NFV
- IoT, SDN and NFV: The past, the present and the future
- AI and the future of IoT with SDN and NFV
- Conclusions
Overview of SDN and NFV

Definitions

- SDN: An architecture that decouples the network control and forwarding functions enabling the network control to become directly programmable and the underlying infrastructure to be abstracted for applications and network services. - The Open Networking Forum (ONF)

- NFV: The migration from physical networking hardware to virtualized network functions.

- Network virtualization: The creation of multiple virtual logical networks on a single underlying physical network.

Thus NFV virtualizes specific functions performed by specific network elements; while

Network virtualization creates a virtual topology by itself. These logical segments are often referred to as network slices.
Overview of SDN and NFV
SDN use-cases
# Overview of SDN and NFV

## NFV use-cases

<table>
<thead>
<tr>
<th>VNF Category</th>
<th>VNF Type</th>
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<tbody>
<tr>
<td>Switching and Routing</td>
<td>Virtual Load Balancer (vLB), Virtual Application Delivery Controller (vADC), Virtual WAN Optimizer (vWOC) vRouter, Virtual Carrier-Grade Network Address Translation (vCGNAT) vSwitch</td>
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<tr>
<td>Core WAN Functions</td>
<td>Virtual IP Multimedia Subsystem (vIMS), Virtual Call Session Control (vCSC), Virtual Policy and Charging Rules Function (vPCRF) Virtual Baseband Unit (vBBU), Virtual Radio Access Network (vRAN), extensible Radio Access Network (xRAN) Virtual Evolved Packet Core (vEPC), Virtual Voice over Long Term Evolution (vVoLTE)</td>
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<tr>
<td>Interfaces and Gateways</td>
<td>Virtual Advanced Media Software (vAMS), Virtual Session Border Controller (vSBC), Virtual Web Real-Time Communication (vWebRTC) Gateway (GW) Virtual Customer Premise Equipment (vCPE), Virtual Service Gateway (vSG) Virtual Wireless Access Gateway (vWAG)</td>
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<tr>
<td>Standard Device</td>
<td>Virtual Domain Name Server (vDNS) vFirewall Virtual Internet Protocol Security (IPSec), Virtual VPN (vVPN) Controller</td>
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<tr>
<td>IP Applications</td>
<td>Virtual Intelligent Messaging (vIM) Virtual Voice over Internet Protocol (vVoIP)</td>
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<tr>
<td>Testing</td>
<td>vProbe, Virtual Test Agent (vTA)</td>
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For telcos, IoT is

- a network design challenge of the past
- a virtualization staging ground of the present
- a fact of life of the future
IoT, SDN and NFV

The past

For telcos, IoT is

- M2M was a precursor to IoT
- IoT has surpassed M2M in application diversity and in service level demands
- IoT has made networks heterogenous
IoT, SDN and NFV
The present – SDN and IoT

- **SD-WAN** provides visibility and predictability in network performance – a key for IoT management
- **CORD** offers best practices in scalability and reliability of data centers to telco central offices
- **BoD** can channelize network resources to manage the ebb and flow of traffic patterns – generated to a large extent by IoT-enabled devices
- **Network slicing** carves out network segments to cater to specific applications and customer segments – IoT is a generator of network diversity
- **Service function chaining** customizes network function sequences in response to diverse traffic flow patterns – IoT is a generator of traffic flow diversity
IoT, SDN and NFV

The present – vEPC and IoT
IoT, SDN and NFV
The present – vRAN and IoT
IoT, SDN and NFV

The present: Key vendor and telco initiatives

- Ericsson’s Cloud Packet Core can support up to fifty million devices in a single deployment
- Nokia’s Cloud Packet Core focuses only on IoT and M2M applications
- Amarisoft eNodeB supports Release 14 compliant narrowband IoT (NB-IoT) and LTE for machines (LTE-M) networks
- In 2016, AT&T launched its vEPC-based IoT implementation involving General Motor’s OnStar service in some European markets
- In April 2016, China Mobile announced that it will leverage NFV technologies for large scale development of VoLTE network, virtualization of IoT network platform and development of fixed network
- In January 2018, China Mobile used its test system to complete a performance verification test for core networks from four vendors to verify that the NFV-based networks can individually support 5 million narrowband IoT (NB-IoT) devices
- Samsung and SK Telecom deployed NFV technology to support the development of IoT in February 2015
- In February 2018, SoftBank selected the Affirmed Network's MCC to deliver IoT services and mobile connectivity to enterprise customers
vEPC is ideal for slicing the network into such segments governed by specific and largely independent objectives
Most initial vEPC deployments are in the area of M2M and IoT setups
APN methodology has been instrumental in cellular operators opening their IoT and M2M setups to vEPC
Inserting specific gateway nodes and offering in conjunction with service capability exposure function and service capability server
NB-IoT capabilities such as extended discontinuous reception (eDRX), power saving mode (PSM) and utilization of control and user plane are also added to vEPCs
Distributed antenna systems (DAS) vendors are showing considerable interest in the vRAN market
DAS installations are used to provide enterprise or industry-specific coverage, including IoT installations
IoT, in many ways, is the *principal raison d'être* of SDN and NFV.
IoT, SDN and NFV

The future: IoT-driven revenue streams

- Wideband wide area connectivity
- Local area connectivity
- Narrow-band wide area connectivity
- Equipment sales
- Management platforms
- Hosting
- Information security
- Operations and monitoring
- Analytics
Telecom operators
The future: SDN/NFV opportunities and threats

- Service agility
- Centralized control
- Software-driven approach
- Cost savings
- Vendor neutral hardware
- Flexibility in network design
- Ownership of feature-rich services

- Unlearning and relearning
- Hardware to software transition
- Coping with open source
- Managing data explosion
- Interoperability between disparate SDN, NFV components
- Concerns about reliability and SLAs
AI and the future of IoT with NFV/SDN

The path ahead

• IoT opens numerous revenue streams for telcos
• NFV and SDN facilitate telco embrace of IoT
• Telcos continue to have apprehensions about several aspects of NFV and SDN including reliance on open source, DevOps methodologies and reliance on software-based product development
• IoT powered by NFV and SDN will lead to an explosion of data points in today’s telco networks

AI can help in making sense of this new look network and maximize revenue opportunities.
AI and the future of IoT with NFV/SDN

Information security

- AI automates threat detection by adapting to changes in threat patterns
- AI is capable of processing and analyzing large volumes of data
- AI offers superior response time to attacks
- AI is capable of withstanding strings of attacks
- AI is ideal for authentication of biometric logins
AI and the future of IoT with NFV/SDN
Operations and maintenance

- AI facilitates network policy settings when confronted with large amount of data points to analyse
- Cisco offers a tetration analytics platform that can generate access lists automatically
- AI facilitates predictive maintenance – employed by China Mobile
AI and the future of IoT with NFV/SDN

Analytics

- AI enables intuitive network planning
- AI helps in predicting usage trends
- Analytics, combined with SDN, can help the network become self-learning – Ciena Blue Planet Orchestrator combines SDN/NFV constructs along with Analytics
Conclusion

• IoT is acquiring an evergrowing presence in today’s new look telco networks

• SDN/NFV and IoT have a synergistic relationship

• AI can help assuage concerns about network stability and revenue maximization of the new look networks
Thank You

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