NETWORK FUNCTION VIRTUALIZATION & ITS IMPACT ON 5G

Rahul Sharma, Priya Panwar, Dr. K.K Sharma
Dept. of Electronics and Communication Engineering, Lingaya's University

Abstract— ***In this paper of network function virtualization and its impact on 5G has been reviewed. Network function virtualization that virtualizes entire classes of network node functions into building blocks that may connect, or chain together, to create communication services. The goal of NFV is to shift the network functions from dedicated hardware devices and allow network services that are now being carried out by router firewalls load balancers and other dedicated hardware devices to be hosted on virtual machines (VMs). The NFV is important because it helps the network administrators no longer need to purchase dedicated hardware devices in order to build a service chain. Because server capacity will be able to be added through software, there will be no need for network administrators to add on their data centers, which will reduce both capital expenses (CAPex) and operating expenses (OPex). If an application running on a VM required more bandwidth, then the administrator could move the VM to another physical server or provide another virtual machine on the original server to take part of the load. This flexibility will allow an IT department to respond in a faster manner to change business goals and network service demands. The Aim of Network Function Virtualisation is to transform the way, the network operator's designs networks, by evolving standard IT virtualisation technology to consolidate many network equipment types onto industry standard high volume servers, switches and storage, which could be located in Data centres, these virtual appliances can be instantiated on demand without the installation of new equipment.***

Index Terms— Introduction, Benefits of Network Function Virtualisation, NFV Use Cases, SDN, NFV and SDN Relationship, SDN and NFV Are Better Together, IMPACT OF NFV ON 5G, Conclusion, Reference

1 INTRODUCTION

THIS **Network functions virtualization** (**NFV**) is a concept that virtualizes entire classes of network node functions into building blocks that may connect, or chain together, to create communication services. The goal of NFV is to shift the network functions from dedicated hardware devices and allow network services that are now being carried out by router firewalls load balancers and other dedicated hardware devices to be hosted on virtual machines (VMs).

Founded in November 2012 by seven of the world's leading telecoms network operators NFV became the home of the Industry Specification Group [ISG] for NFV. The group of the European Telecommunications Standards Institute (ETSI), was made up of representatives from the telecommunication industry from Europe

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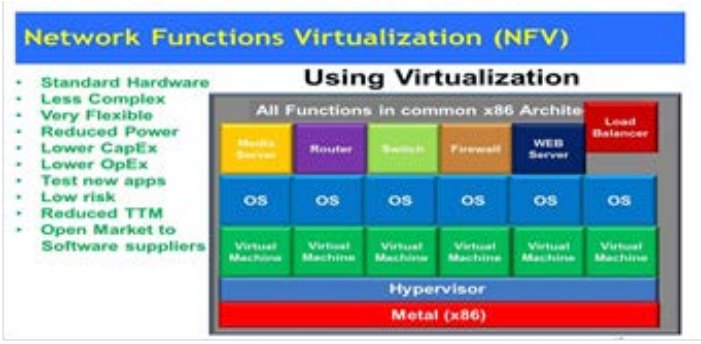
Network Function Virtualization aims to transform the way, the network operator's designs networks, by evolving standard IT virtualization technology to consolidate many network equipment types onto industry standard high volume servers, switches and storage, which could be located in Data centers, these virtual appliances can be instantiated on demand without the installation of new equipment. It involves the implementation of network functions in software that can run on a range of industry standard servers and can be moved to or instantiated in various locations in the network as required, without the need for installation of new equipment. For example, network operators may run an open-source software-based firewall in a Virtual Machine (VM). In other words, Network Function Virtualization promotes the implementation of network functions in software that can run on a range of standard IT hardware in data centers and can be managed (e.g. moved, or replicated) without the need of modifying the physical infrastructure



2 Benefits of Network Function Virtualization

Network functions virtualization (NFV) is an emerging theme within the telecoms industry, and over the past few years, it has become a catalyst for major transformational changes in the network. Application of Network Functions Virtualization brings many benefits to network operators, contributing to significant changes in the telecommunications industry.

Advantages includes:-

i. Reduced equipment costs and reduced power consumption through consolidating equipment. Cost efficiency is a main advantage of NFV.

ii. NFV allows to abstract underlying hardware, and enables elasticity, scalability and automation. Improves the flexibility of network service provided and reduce the time to deploy new services.

iii. The possibility of running production, test and reference facilities on the same infrastructure provides much more efficient test and integration, reducing development costs and time to market.

iv. Services can be rapidly scaled up/down as required. In addition, speed of service deployment is improved by provisioning remotely in software without any site visits required to install new hardware.

v. Improved operational efficiency by taking advantage of the higher uniformity of the physical network platform and its homogeneity to other support platforms.

3. NFV Use Cases

Cloud:-

1. NFV infrastructure as a service (NFV IaaS) like IaaS
2. Virtual Network Functions (VNFs) as a service (VN FaaS) like SaaS
3. VNF forwarding graphs (Service Chains)
4. Virtual Network Platform as a Service (VN PaaS) like PaaS

Mobile:-

5. Virtualization of the Mobile Core Network and IMS
6. Virtualization of Mobile Base Station

Data Centre:-

7. Virtualization of CDNs

Access/Residential:-

8. Virtualization of the Home environment
9. Fixed Access NFV

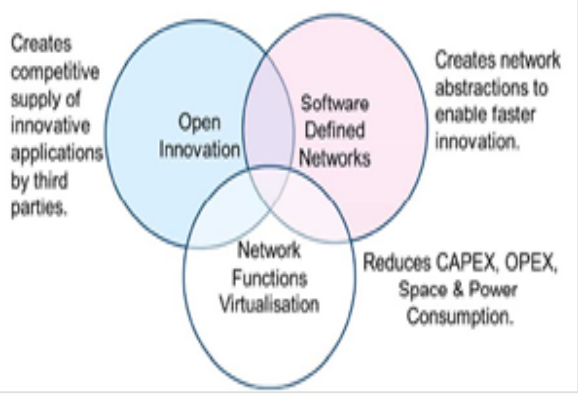
4 SDN

SDN: separates the network's control (brains) and forwarding (muscle) planes and provides a centralized view of the distributed network for more efficient orchestration and automation of network services.

The goal of Software-Defined Networking is to enable cloud and network engineers and administrators to respond quickly to changing business requirements via a centralized control console. SDN encompasses multiple kinds of network technologies designed to make the network more flexible and to support the virtualized server and storage infrastructure of the modern data center and Software defined networking was originally defined an approach to designing, building, and managing networks that separates the network's control (brains) and forwarding (muscle) planes enabling the network control to become directly programmable and the underlying infrastructure to be abstracted for applications and network services.

5 *NFV AND SDN RELATIONSHIP*

- Concept of NFV originated from SDN
- First ETSI white paper showed overlapping Venn diagram



- It was removed in the second version of the white paper.

- NFV and SDN are complementary. One does not depend upon the other. You can do SDN only, NFV only, or SDN and NFV.
- Both have similar goals but approaches are very different.
- SDN needs new interfaces, control modules, applications. NFV requires moving network applications from dedicated hardware to virtual containers on commercial-off-the-shelf (COTS) hardware.

6 SDN AND NFV ARE BETTER TOGETHER

These approaches are mutually beneficial, but are not dependent on one another. You do not need one to have the other. However, the reality is SDN makes NFV and NV more compelling and visa-versa. SDN contributes network automation that enables policy-based decisions to orchestrate which network traffic goes where, while NFV focuses on the services, and NV ensures the network's capabilities align with the virtualized environments they are supporting.

7 IMPACT OF NFV ON 5G

Last year at Mobile World Congress in Barcelona, the first inklings of 5G were discussed. This year, 5G will probably be all over the place — and software-defined networking (SDN) and network functions virtualization (NFV) will play important roles, especially in terms of a new network topology.

Today, twenty-three network operators published a white paper to guide the industry on priorities for NFV to deliver the industry vision for 5G systems: "Network Operator Perspectives on NFV priorities for 5G". The network operator co-authors include Bell Canada, BT, Cable Labs, CenturyLink, China Mobile, China Unicom, Colt, Deutsche Telekom, KDDI, KT, NTT, NTT DOCOMO, Orange, Portugal Telecom, Rogers, SK Telecom, Sprint, STC, Swisscom, Telecom Italia, Telefonica, Telenor, and Vodafone.

The evolved 5G network will be characterized by fixed/mobile networks based on NFV and SDN technologies and capable of supporting network functions and applications containing many different networks and services domains. The 5G use cases and environments imply high scalability, ultra-low latency and ability to support a massive number of concurrent sessions, as well as ultra-high reliability and security. To achieve these ambitious goals, Network Slicing, Cloud-native design principles, End-to-end Service Management, Edge Computing, RAN Cloudification, Multi-site/domain Services, NFV License Management, Security, Reliability, and Scalability are important

As the 5G frontier continues refinement, definition and specification over the next 5 to 10 years, it is apparent that the mobile network landscape will mandate a total facelift to address the demands of the new services, capacity loads, bandwidth targets, QoE (infinite Internet, RTT latency response), QoS (ubiquitous access, robustness, reliability) and scalability dynamics that are the underlying tracks leading to 5G.

5G is characteristics include:-

- More connected devise (1000 x)
- Higher subscriber densities (up to 12,000 devices per km^2)
- Low latency (<1ms RTT)
- Higher data rates (>10,000 Mbps)

This means 5G will require an infrastructure that is highly flexible, dense, fast, accessible, resource efficient and can scale as needed to meet the dynamic needs of the underlying network services. In order to get to that leading edge, it is with no uncertainty that this transition will not happen without the networking architecture of NFV and SDN. 5G will introduce a new lifestyle to the masses, and it will ride on the NFV-SDN train that is currently taking the CSP eco-system by storm.

8 Conclusion

To generalize NFV is a core structural change in the telecommunication infrastructure marketplace. NFV will bring cost efficiencies, time-to-market improvements, and innovation to the telecommunication industry infrastructure and applications. NFV will achieve this through disaggregation of the traditional roles and technology involved in telecommunications applications. NFV aims to reduce OpEx by automation and scalability provided by implementing network functions as virtual appliances. NFV allows all benefits of virtualization and cloud computing including orchestration, scaling, automation, hardware independence; NFV and SDN are independent and complementary. You can do either or both.NFV requires standardization of reference points and interfaces to be able to be utilized in upcoming generations of 5G.NFV can be done now. Several of virtual functions have already been demonstrated by carriers. NFV is prospectively the unifying revolution among the three, offering more revenue opportunities in the services value chain. We are looking forward to more initiatives from the networking research community to tackle various challenging issues introduced by NFV and its widespread and successful adoption.

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