Analysis of basic Architectures used for Lifecycle Management and Orchestration of Network Service in Network Function Virtualization Environment

Ramya J
PG Student
Dept. of CS&E
SJCE, Mysore
ramya.gowda.sjce@gmail.com

Trisiladevi C. Nagavi
Assistant Professor
Dept. of CS&E
SJCE, Mysore
trisiladevi@sjce.ac.in

Abstract**—**The Network Function Virtualization (NFV), Software Defined Networking are technologies, so which are in combination inorder to provide a high flexibility for network and dynamical continuum of resources for the deployment of services in the environment of high network programmability. A Network Function Virtualization Orchestration (NFVO) is an important topic played a major role in above scenario and in high availability of Virtual Network Functions (VNF), lifecycle and configuration management of network elements. However, the hardware usage is one of the obstacle towards network programmability and is generally considered as a contrast with respect to NFV concepts. In this paper shows many architectures, workflow in virtualization environment, compatibility, flexibility is discussed. These architectures involve in great enhancement of network infrastructure in virtualized environment. Each architecture is needed to gain better results in network function virtualization environment.

Keywords*-Network Function Virtualization, Network Service Graph, Network Programmability, CloudNFV, TOSCA-based clustering service, NFVO.*

*****

I. INTRODUCTION

Telecommunication Service Providers (TSPs) have faced with rentless decline in revenue from many years. The telecommunication networks will use to undergo changes radically and explode of data traffic too, that is acknowledged as a universal truth. The origin of these changes affect many factors [1]. The demand for physical network expansions by subscribers will increase the operational expenses and capital expenses [2] in one side. On other side, service providers facing difficulties in increased costs along with subscriber fees. Therefore, the above problems consider as NFV [3] has been better solution. The NFV's main feature is decoupling the functionality from basic infrastructure such as physical capacity and increasing flexibility will provide compatibility for resources utilization. The networking components evolution will allow ultra-broadband connectivity and provide highly interactive services along with quality perceptive. The developing n standards for NFV is main objective for ETSI NFV group1 and use experiences for early implementation and development. Some of the architectures are comes around for management and lifecycle of network elements in virtualized environment, all those architectures discussed in coming sections. All architectures have their own participation in the virtualized environment.

II. ETSI MANO FRAMEWORK

The functional block of ETSI MANO framework is divided into three sub-entities such as NFV Management and Orchestration, Network Management Systems and NFV architectural layers.

The fig 1 shows ETSI MANO framework [4]. The functional block of ETSI MANO framework and sub-entities have connected each other. A NFV Management and Orchestration's (NFV-MANO) functional blocks are Network Function Virtualization Orchestrator (NFVO), Virtual Network Function Manger (VNFM) and Virtual Infrastructure Manager (VIM). NFV MANO have data repositories are used to store different types of information. There are four types of data repository comes under NFV-MANO such as Network Function Virtualization Infrastructure (NFVI), Network Service Graph (NSG) catalog, Virtual Network Function (VNF) catalog and Network Function Virtualization (NFV) instances repository.

Network Function Virtualization Orchestrator (NFVO) is used for deployment of various network services and on-boarding of new network service, lifecycle management of network service, Virtual Network Function (VNF) packages and it also act as interface for cloud application manager.

Virtual Network Function Manger is used in same or different types of single or multiple instances, these includes single VNFM for all active VNF instances for a certain domain. Cloud Application Manager (CAM) is one of the VNFM product from ETSI.CAM is specified by Management and Network Optimization, which act as an interface for management of VNF lifecycle. The interface is a standard interface which all NFVO will interact with. CAM will provide coarse grained interface which is used by NFVO.

Virtual Infrastructure Manager (VIM) is used to manage and control the basic infrastructures such as storage, network

ISSN: 2321-8169
704 – 708

resources. VIM is combined with application programming interface inorder to work efficiently with the NFVO in existing system. Orchestrator layers works with templates for standards VNFs, and gives users the influence to pick and choose from existing NFVI resource to deploy their platform or element.

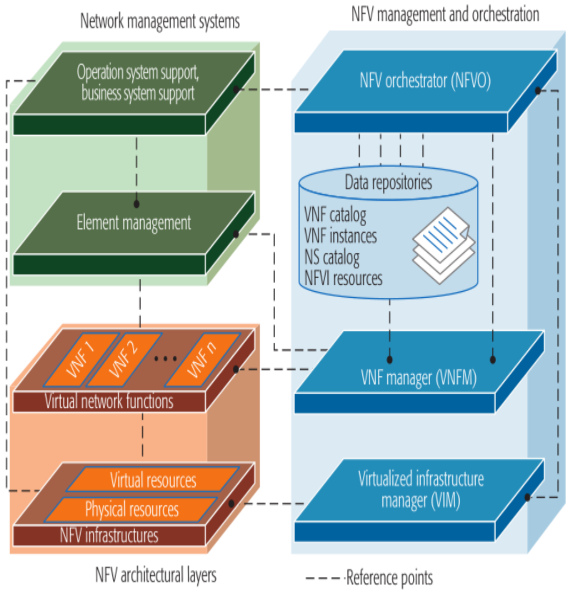

Fig 1: NFV MANO Framework.

III. NETWORK FUNCTION VIRTUALIZATION

In Telecoms networks, hardware appliances are in an increasing manner. Finding a space and power for accommodation of new network service is creating complexity to deploying of its appliance in network. Hardware products will usually end their life so soon and their lifecycles might be involving in reducing the results of deploying network services and graph of world's network growing chart will be in down state. The main aim of Network Functions Virtualization (NFV) is address to these problems by using the concept of virtualization inorder to overrides the equipment such as server, hard drive etc. It managed with usage of software for installation and instantiation. Network Function Virtualization (NFV) is an enterprise by European Telecommunications Standards Institute (ETSI) that establish the usage of the standard IT virtualization technologies inorder to provide building blocks from virtualization for entire classes of network code functions, those are connected to provide services [5]- [7].

The Virtual Network Functions (VNF) has a virtualized code of network functions. The different software running on virtual machines (VM's), and VM's usually run on top of high-volume storage, servers etc. rather than using proprietary dedicated hardware for each network function [6]. The outcome is, reducing the usage of more hardware devices such as firewall, DHCP and some more [6]. Therefore, concept of virtualization in network services will lessen the number of hardware appliances to establishes a network services.So, admins no need to buy a dedicated hardware appliances for to deploy or to do any operations. If in the case any additional requirements needed, can be include via software facility. Admins no more overprovision about extra spaces, some more requirements and operational expenses and capital expenses.

For instance, if some process going on a VM while executing it may need additional resources to give better output. To achieve the better output, we can move the VM on different physical server which one have all qualities to reach the goal. This portability feature doesn't available on the single physical hardware device if complete dependency is on that only [7]. A NFV Architecture ETSI has a working group (WG) called the Industry Specifications Group (ISG) that is currently developing requirement specifications and architecture for NFV [5]. A NFV architecture is shown in Fig. 4 and is proposed by ETSI-ISG, was more helpful for me to analyse on NFV.

IV. CLOUDNFV

CloudNFV is one of the open and real-world platform for testing the integration of cloud computing, Network Function Virtualization, Telemanagement Forum (TMF) and Software Defined Network. CloudNFV is a product of six vendors, that is 6WIND, CIMI Corporation, Dell,

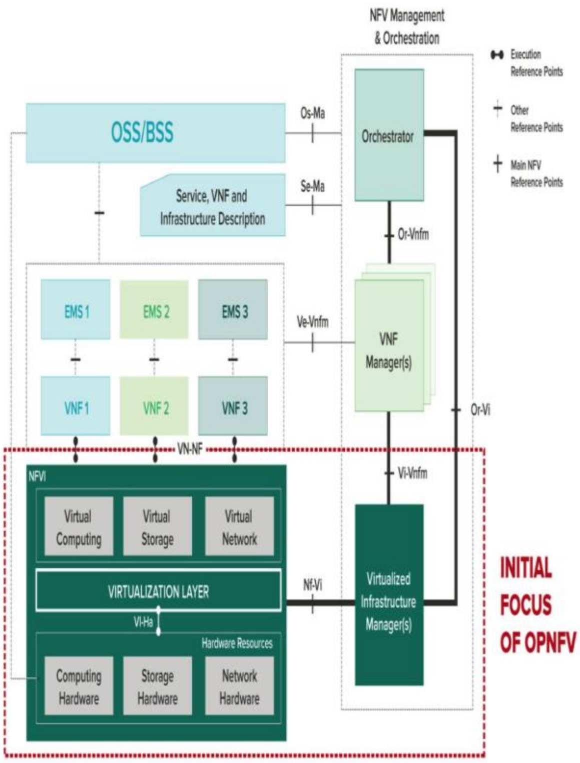

Fig. 2 NFV Architecture Block Diagram

Enterprise Web, Overture Networks and Qosmos. CloudNFV is not a splinter standards group and will produce no standards of its own. CloudNFV will only demonstrate technologies and provide some direction for NFV. Cloud Network Function Virtualization (NFV) is a product for deploying of NFV in an open management architecture and also an open platform for NFV based implementation on cloud computing. The architecture of CloudNFV is shown in Fig. 3. CloudNFV architecture is made up of combining three elements such asNFV orchestrator, NFV Manager and Active virtualization. The Network Function Virtualization Orchestrator (NFVO) which manages the lifecycle of virtualized network resources in full consistency with the defined business services, their priorities and the relevant service level agreement parameters. NFV orchestrator act as interface for cloud application manager for maintaining deployment.

Active virtualization is a data model (based on TM Forum's SID [5]) is used to represent some services, resources and functions. Active virtualization is a combination of active resource and active contract. The status of resources described by active resources in particular infrastructure. The Characteristics of available Network Function is defined by service templates which are included by active contract. VNF Manager take care about the lifecycle management of VNF instances. VNF Manager manages the overall coordination and adaptation role for configuration and event reporting between NFVI and the E/NMS. The management processes running against active resources allows for reflection of this status using Management Information Bases (MIBs). The main difference between the ETSI NFV MANO and CloudNFV is that unlike the former, the latter considers both management and orchestration as applications those can run as a unified data model.

V. OPNFV

OPNFV- Open Platform for NFV, which is used for evolution, development of some components of NFV in open source environment. The OPNFV describe the number of core technologies and those are all part of open source NFV platform. The openstack with core technologies are Nova, Cinder, Horizon, Neutron, Glance etc. and integration with network controller. The platform of NFV is created by an OPNFV for the transformation of enterprise and service provider networks, these happening through deployment, system level integration and one more that is testing.

The OPNFV project usually have its own JIRA issue and JIRA project. In OPNFV, for validation of existing standard specifications some projects use to follow some common practices of OPNFV plans and enable the project

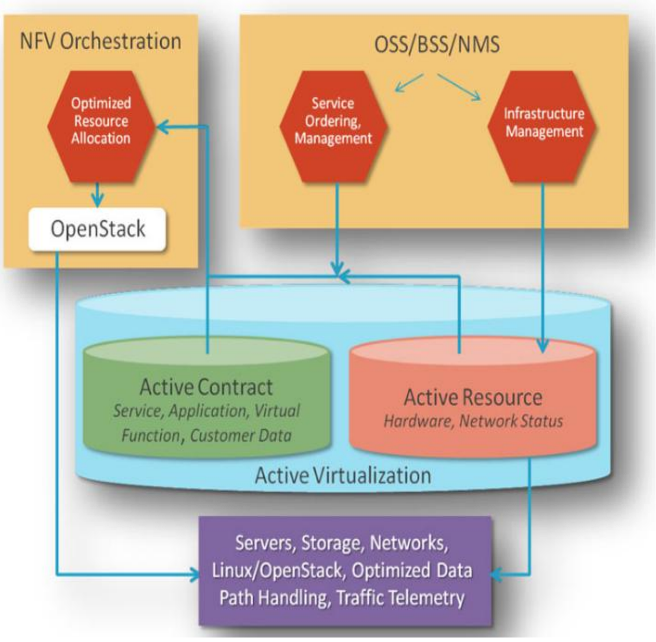

Fig. 3 CloudNFV Architecture

management with status evaluation at OPNFV level and support for development of new necessary functionality within both OPNFV and in upstream projects, by contributing more improvements in upstream projects but they are open source and more relevant. At the end, it is focused on NFV requirements for implementation purpose and provided by ETSI.

VI. TOSCA-BASED CLUSTERING SERVICE FOR MANO

Figure 5 shows the architecture of TOSCA-based clustering service for MANO. This cluster-integrated MANO architecture consists of APIs, extended TOSCA template, Heat driver, and monitoring driver. APIs are used to create user interfaces, command line interfaces, or provide MANO services to Operation Subsystem and Business Subsystem (OSS/BSS). Cluster management capabilities and related policies are described by extension of TOSCA template. ETSI defined that each VNF is combination of several Virtual Network Function Component (VNFC).To enable auto-scaling and high availability for VNF, we enable clustering management for each VNFC. A load balancer is used for each VNFC cluster. In this way, the entire VNF becomes more reliable and scalable. To enable this mechanism, the TOSCA template needs to define the'scalable' capabilities for

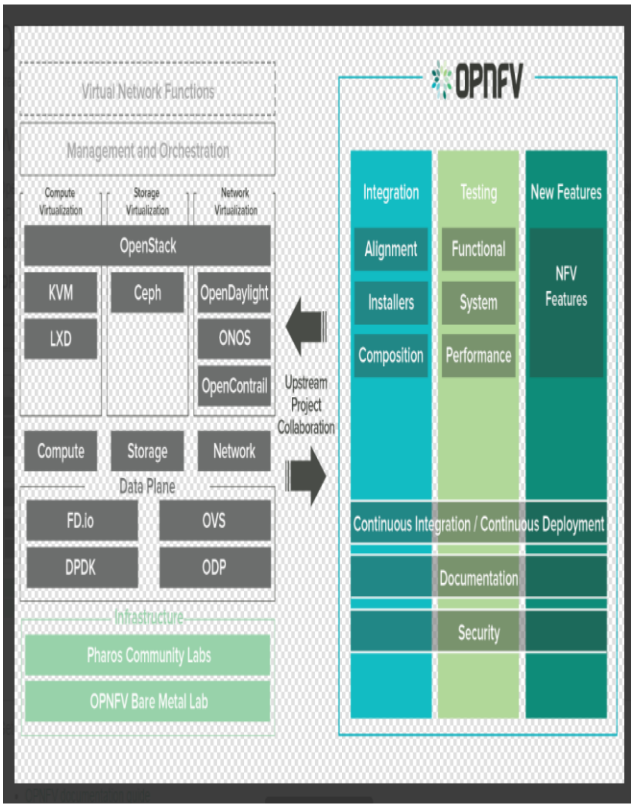

FIG. 4 OPNFV DANUBE RELEASE

compute node type and network that cluster is connected to. In the TOSCA template, we also define some policies to create a load balancer and to enable auto-scaling for the cluster. Those TOSCA template definitions and policies can be translated into cluster resources of cloud platform-specific templates using a specific driver. Here, for example, Open stack is used in our architecture as a virtual infrastructure manager (VIM) and NFVI (network function virtualization infrastructure).

Therefore, Heat driver will be used to translate the extended TOSCA template into clustering resources (here in our implementation, Senlin is used) in HOT (Heat Orchestration Template) template. Then, the VIM could deploy this Heat template in the NFVI. Heat Driver consists of TOSCA Parser and Heat Translator. The TOSCA Parser is used to verify TOSCA template and instantiate TOSCA objects. Heat Translator provides translation services from TOSCA objects to HOT template. A monitoring driver is also included in our architecture to monitoring the health status of each VNFC in the cluster.

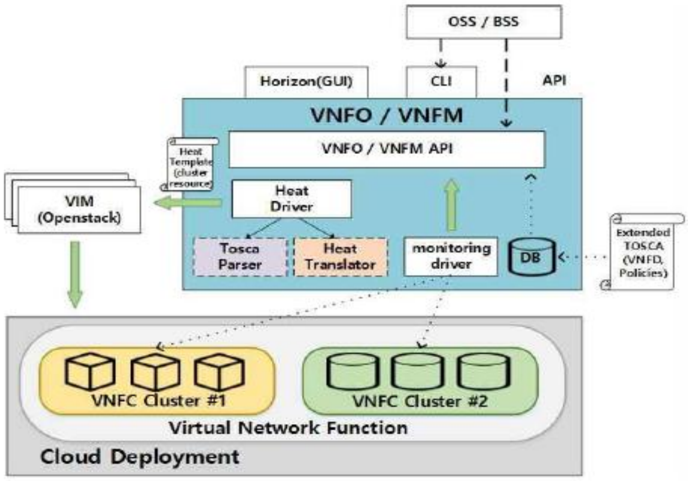

Fig. 5 Architecture of TOSCA-based clustering service

VII. CONCLUSIONS

The combination of the main NFV concepts with the use of High Performance Computing h/w accelerators based on Graphical Processing Units has been analysed and discussed. These architectures integrate clustering service into the MANO framework and define policies for cluster management in TOSCA template**.** Thesearchitectures are analysed to get know about their functionalities in lifecycle and configuration management of network services in virtualized environment.The analysis results tell, open source upstream projects are modified for fulfilling new proposal. The NFV architecture proposed by the T-NOVA project is a meaningful example of how such a combination can create an innovative scenario for the flexible and dynamic management of innovative services exploiting hardware acceleration devices.

REFERENCES

[1] "Network Function Virtualization-White Paper,"

[2] A. Checko, H. Christiansen, Y. Yan, L. Scolari, G. Kardaras, M. Berger, and L. Dittmann, "Cloud ran for mobile networks □ a technology overview," Communications Surveys Tutorials, IEEE, vol. 17, no. 1, pp. 405–426, Firstquarter 2015.

[3] R. Mijumbi, J. Serrat, J. Gorricho, N. Bouten, F. De Turck, and R. Boutaba, "Network function virtualization: State-of-the-art and research challenges," Communications Surveys Tutorials, IEEE, vol. PP, no. 99, pp. 1–1, 2015.

[4] "Mobile-Edge Computing-Introductory Technical White Paper,"

[5] "Network Functions Virtualization— Introductory White Paper", ETSI, Oct. 2012, [Online]. Available: http://portal.etsi.org/NFV/NFV_White_Paper.pdf.

[6] "Network Functions Virtualization", ETSI ISG Portal, [Online]. Available: http://portal.etsi.org/portal/server.pt/community /NFV/367.

[7] J. Wolfgang, K. Pentikousis, G. Agapiou, E. Jacob, M. Kind, A. Manzalini, F. Risso, D. Staessens, R. Steinert and

ISSN: 2321-8169
704 – 708

C. Meirosu, "Research directions in network service chaining," In Future Networks and Services (SDN4FNS), IEEE pp. 1-7, 2013. [8] ETSI NFV ISG, "ETSI Network Functions Virtualisation (NFV) Industry Standards (ISG) Group Draft Specifications," http://docbox.etsi.org/ ISG/NFV/Open, December 2014, Accessed on May 26, 2015.

[8] D. R. Lopez, "OpenMANO: The Dataplane Ready Open Source NFV MANO Stack," Proc. IETF 92 Meeting Proc., Dallas, TX, Mar. 2015

[9] https://wiki.openstack.org/wiki/Tacker, accessed July 2016

[10] M. Peng, Y. Li, J. Jiang, J. Li, and C. Wang, Heterogeneous cloud radio access networks: a new perspective for enhancing spectral and energy efficiencies, Wireless Communications, IEEE, vol. 21, no. 6, pp. 126–135, December 2014.

[11] R. Wang, H. Hu, and X. Yang, Potentials and Challenges of C-RAN Supporting Multi-RATs Toward 5G Mobile Networks, Access, IEEE, vol. 2, pp. 1187–1195, 2014.

[12] T. C. B ˘ Alan, Network Policy Function Virtualization via SDN and Packet Processing, Review of the Air Force Academy, vol. 27, no. 3, pp. 73–78, 2014.

[13] S. Gebert, D. Hock, T. Zinner, P. Tran-Gia, M. Hoffmann, M. Jarschel, E.-D. Schmidt, R.-P. Braun, C. Banse, and A. Kopsel, Demonstrating the Optimal Placement of Virtualized Cellular Network Functions in Case of Large Crowd Events, in Proceedings of the 2014 ACM Conference on SIGCOMM, ser. SIGCOMM '14. New York, NY, USA: ACM, 2014, pp. 359–360.

[14] X. Ge, Y. Liu, D. H. Du, L. Zhang, H. Guan, J. Chen, Y. Zhao, and X. Hu, Open NFV: Accelerating Network Function Virtualization with a Consolidated Framework in Open stack, in Proceedings of the 2014 ACM Conference on SIGCOMM, ser. SIGCOMM '14. New York, NY, USA: ACM, 2014, pp. 353–354.

[15] A. Mandal, Y. Xin, I. Baldine, P. Ruth, C. Heerman, J. Chase, V. Orlikowski, and A. Yumerefendi, Provisioning and Evaluating Multi-Domain Networked Clouds for Hardtop-based Applications, in Cloud Computing Technology and Science (Cloud Com), 2011 IEEE Third International Conference on, Nov 2011, pp. 690–697

[16] R. Mulumba, Self-managed Resources in Network Virtualization Environments, Ph.D. dissertation, Technical University of Cataluña, Barcelona, Spain, November 2014.

[17] Allot, Evolution of Network Service Enablement Utilizing Network Functions Virtualization (NFV) Technical White Paper, Allot Communications, Tech. Rep., July 2013

[18] J. Wu, Z. Zhang, Y. Hong, and Y. Wen, Cloud radio access network (C-RAN): a primer Network, IEEE, vol. 29, no. 1, pp. 35–41, Jan 2015

[19] B. Han, V. Gopala Krishnan, L. Ji, and S. Lee, Network function virtualization: Challenges and opportunities for innovations, Communications Magazine, IEEE, vol. 53, no. 2, pp. 90–97, Feb 2015.

[20] From ETSI® NFV White Papers the NFV Use Cases are in https://www.google.co.in/search?q=NFV+datacom&oq=NFV+datacom+&aqs=chrome.69i57.31736j0j7&sourceid=chrome&ie=UTF-8#q=NFV+applications+in++datacom+ppt