Network Function Virtualization (NFV) Platform for Wellness in High-Speed Network

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Abstract In recent years, cloud and virtualization technologies have received a lot of attention among network equipment vendors and service providers. Due to the flexibility and significant economic potential of these technologies, software defined networking and network functions virtualization are emerging as the most critical key enablers. SDN/NFV facilitating the design, delivery and operation of network services in a dynamic and scalable manner. On the other hand, with the emergence of a variety of wearable devices, wellness information platforms are undergoing major changes. To provide continuous monitoring of wellness service users, it is mandatory to provide agility and mobility support for the SDN/NFV. However, the end-to-end connectivity support across a whole SDN/NFV networks has not been fully addressed. This paper overviews available platforms used for end-to-end connectivity and proposes a new hybrid platform approach for wellness services in SDN/NFV.

Keywords Software Defined Networking · Network Function Virtualization · OPNFV · Platform

1 Introduction

In recent years, cloud and virtualization technologies have received a lot of attention among network equipment vendors and service providers. With such a huge trend, due to the flexibility and significant economic potential of these technologies, software defined networking (SDN) and network functions virtualization (NFV) are emerging as the most critical key enablers. SDN/NFV enhancing the infrastructure agility, thus network operators and service providers

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The original version of this chapter was revised.
An erratum to this chapter can be found at DOI: 10.1007/978-981-10-0557-2_145

K.J. Kim and N. Joukov (eds.), *Information Science and Applications (ICISA) 2016*,
Lecture Notes in Electrical Engineering 376,
DOI: 10.1007/978-981-10-0557-2_140

are able to program their own network functions (e.g., gateways, routers, load balancers) on vendor independent hardware substrate. They facilitating the design, delivery and operation of network services in a dynamic and scalable manner [1].

On the other hand, with the emergence of a variety of wearable devices, wellness information platforms are undergoing major changes to improve the quality of wellness services provided to the users. To provide continuous monitoring of wellness service users, it is mandatory to provide agility and mobility support for the SDN/NFV so it can always be connected to the network.

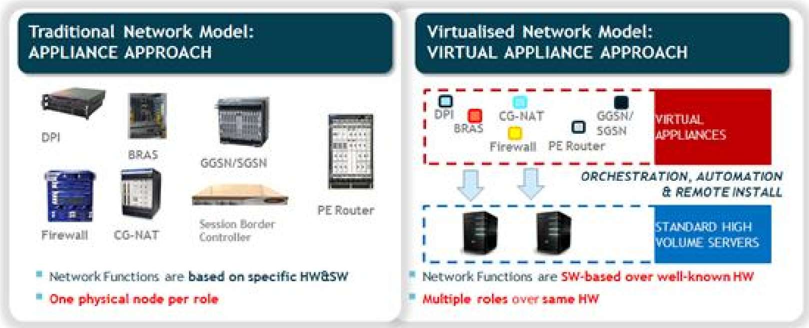

Fig. 1 NFV Concept

Thus, wellness information networks must guarantee and keep a certain level of transfer efficiency. They also want to know where the problem occurred and reason immediately, when the problem occurs on a network. If you can identify the cause and location of the problem, it is possible to treat. In addition, it is important to make plans that can predict in advance in order to transmit data safely [2][3]. However, the end-to-end connectivity support across a whole SDN/NFV networks has not been fully addressed. This paper overviews available platforms used for end-to-end connectivity and proposes a new hybrid platform approach for wellness services in SDN/NFV.

The rest of this paper is organized as follows. We first highlight some virtualizations challenges that is near in hand to the network and IT infrastructure in section 2. The SDN/NFV Platform for Wellness services are presented in section 3. We describe the implementation on our testbed of the proposed architecture for offering NFV services. Finally the paper concludes in section 4.

2 Related Works

The explosive growth of Internet traffic has led to a dramatic increase in demand for data transmission capacity and service agility. However, the current Internet architecture are not flexible to satisfy these requirements in an efficient way and launching new services is difficult and takes too long. As a result, it took huge capital investment to deal with current traffic demands and reduced hardware lifecycles. There are large and increasing variety of proprietary hardware appliances in operator's network. Moreover, these network resources are immovable where and when needed. These issues have caused the emergence of new concepts, such as SDN and NFV, which are changing the way of managing and controlling networks [4].

SDN decouples the data and the control plane of the network devices in order to achieve the full network programmability. SDN is responsible for processing flexible forwarding and steering of traffic in a physical or virtual network environment. On the other hand, NFV is in charge of processing flexible placement of virtualized network functions across the network and cloud. SDN & NFV are complementary tools for achieving full network programmability, flexibility, and cost efficiency.

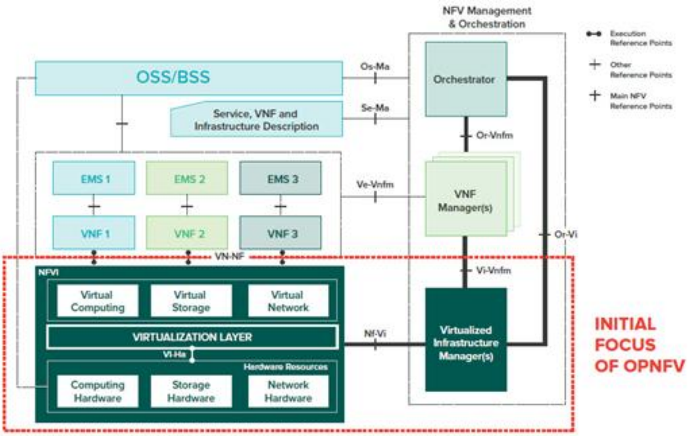

Fig. 2 OPNFV Reference Model

Major standardization efforts of the emerging NFV technology are being led by the European Telecommunications Standards Institute (ETSI) NFV is a means to make the network more flexible and simple by minimizing dependences on hardware constraints. Each time a new service is launched, required functions have implemented in proprietary commodity hardware. NFV is based on purely software applications, virtualized network functions (VNFs), which aim to reduce the expenditures related to the deployment and management of new network applications [3][5][6].

The NFV framework, as shown in Fig. 2, consists of the NFV infrastructure (NFVI), which logically partitions the resources from underlying physical hardware resources. One of the main outcomes from a virtualized infrastructure is adapting the use of resources to the actual demand to provide elasticity of resources instead of overprovisioning [7].

NFV management and orchestration (MANO) is the life cycle management of network service and the VNF instance. The VNF is purely a software application (i.e., network functions like load balancer) deployed in NFVI, and VNF is mapped into a VM running on top of NFVI. VNFs, which compose the service chain, are the basic elements to achieve the complete virtualization of service delivery and are commonly based on computing resources [5][8].

The MANO orchestrates other specific managers such as the virtual infrastructure manager (VIM) and the VNF Manager (VNFM). The VNFM is in charge of interacting with the VNFs, whereas the VIM is in charge of managing the NFVI, which includes computing, storage, and networking. The MANO has a total visibility of all VNFs running inside the NFVI. In addition, it is in-charge of the operation and configuration of VNFs, for example, through the operations support system (OSS)/base station subsystem (BSS) [5][9][10].

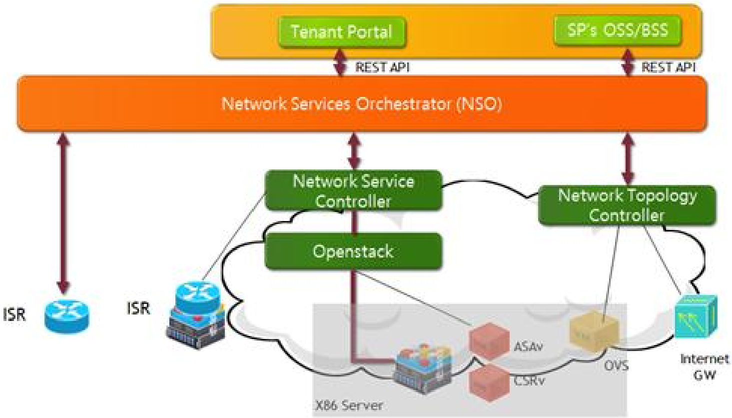

Fig. 3 NSP Architecture

3 NFV Platform for Wellness

This section details the implementation of the proposed SDN/NFV architecture for wellness information in the cloud computing platform. As shown in Fig. 3, the NFV-based cloud computing platform is an experimental testbed. For the cloud-computing platform, we have deployed OpenStack Juno. OpenStack controller and OpenStack compute hosts act as VM instantiation.

For the intra-area networks, OpenFlow switches have been deployed with multiple 1Gbps Network Interface Cards (NICs) and running OpenVSwitch (OVS), which is an OpenFlow software switch. The intra-area network is controlled with OpenDayLight (ODL) SDN Controller.

As shown in Fig. 3 and Fig. 4, the Network Service Orchestrator (NSO) is introduced in order to support end-to-end connectivity by orchestrating the different network domains. NSO is responsible for handling all the processes involved and to provision end-to-end connectivity services. The NSO must take into account the heterogeneous underlying network resources (e.g., multi-domain, multi-layer and multi-control).

The Network Topology Controller (NTC) is the responsible for providing the real time connectivity between underlying virtualized network resources and non-virtualized network resources. The NTC is a network hypervisor, which is introduced to dynamically deploy virtual networks on top of physical networks. The NTC is responsible for receiving VN requests, processing them and allocating physical resources. Moreover, the NTC is responsible for the mapping between the allocated physical resources and the abstracted resources

The Openstack takes over the creation/migration/deletion of VM instances (computing service), disk images storage (image service), and the management of the VM network interfaces (networking service).

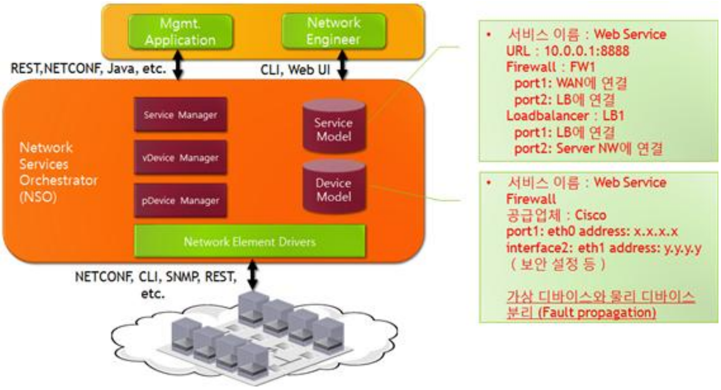

Fig. 4 NSO Architecture

4 Conclusions

The explosive growth of Internet traffic has led to a dramatic increase in demand for data transmission capacity and service agility. However, the current Internet architecture are not flexible to satisfy these requirements in an efficient way and launching new services is difficult and takes too long. As a result, it took huge capital investment to deal with current traffic demands and reduced hardware lifecycles.

There are large and increasing variety of proprietary hardware appliances in operator's network. Moreover, these network resources are immovable where & when needed. These issues have caused the emergence of new concepts, such as SDN and NFV, which are changing the way of managing and controlling networks. The NFV concept is one of the major revolution on the information communication technology field.

To provide continuous monitoring of wellness service users, it is mandatory to provide agility and mobility support for the SDN/NFV so it can always be connected to the network. Thus, wellness information networks must guarantee and keep a certain level of transfer efficiency. This paper overviews available platforms used for end-to-end connectivity and proposes a new hybrid platform approach for wellness services in SDN/NFV.

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Funding for this paper was provided by Namseoul University.