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Multimedia Real-Time Communication Over A Packet Network.

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Abstract: *This demo shows how to deploy two network segments with different QoS using packet and optical networks to deploy multiple real-time communication suites. Two new features of the SONATA service platform are demonstrated: QoS-based network segmentation and WIM support via the ONF transport API.*

Keywords: Packet Network

I. INTRODUCTION

Network slicing allows multiple deployments. Services that require different network requirements on the same network infrastructure [1]. Network segments are typically laid out on top of a virtualized network infrastructure at multiple NFV Infrastructure Points of Presence (NFVI-PoPs). These NFVI-PoPs are interconnected using multiple transport networks. WAN Infrastructure Manager (WIM) is designed to connect distributed network services. The purpose of this demonstration is to present the experience gained by deploying multiple real-time communication (RTC) suites with different QoS using the Network Slice Manager developed on the SONATA Service Platform (SP)[2]. Key innovations in this demonstration include: a) Network segmentation through QoS control of network services; b) The WIM plugin can communicate with the SDN Transport Controller using the ONF Transport API (T-API). This allows control of the resources of various VIMs in a network with multiple points of presence (PoPs), another component being developed by the SONATA SP.

II. PROPOSED ARCHITECTURE

2.1 Overall Architecture

The presented demonstration works with the entire network architecture (edge to core and back to back) using both types of networks. One side is a packet network and the other side is an optical network. At the top of the architecture (Figure 1) is the SONATA Services Platform (SP), which is responsible for deploying network segments and network services (NS) to all data centers (DCs) or VIMs registered to the SONATA SP [2]. The SP has a WIM TAPI component that manages the resources of each WIM to create and manage transport connections, such as DC interconnects or I/O port connections to DCs.

2.2 Network Slice Manager

The SONATA Network Slice Manager is based on the 3GPP technical specification [1] and, it aims to allow the management of multiple interconnected Network Services (NS) as one single unit called Network Slice. Even though this component has new features since its first version [3]; "Network Service Composition", to link all the multiple NS within a network slice among them, or, "Network Service Sharing", to share an equal NS among multiple network slices allowing to be resource efficient. The current demonstration aims to show a possible way to introduce Quality of Service (QoS) within a Network Slice. The idea is, based on the network slice type; Ultra-Reliable Low-Latency Communication (URLLC), Enhanced Mobile Broadband (eMBB) or Massive Machine Type Communication (mMTC), to assign one Service Level Agreement (SLA) to each one of the NSs composing the Network Slice Template descriptor (NSTd) before this is uploaded to the SP. When a new NSTd is being created, the NSTd developer must know which SLA Templates are available for each NS in the SONATA SP. In this way, the correct SLA template is assigned to each NS, and any SLAs assigned at the network segment level meet the requirements of the selected type.

When an NSTd instance is created, the corresponding SLA template is applied to each NS instance, which translates into an agreement between the customer and the SP owner.

2.3 WIM TAPI Wrapper

As previously described, the SONATA SP interacts with Virtualized Infrastructure Managers (VIMs) and WAN Infrastructure Managers (WIMs) in order to request and manage infrastructure resources. In the SONATA SP lower layer architecture, there is the Infrastructure Abstraction (IA) module with a southbound interface implementing the APIs needed to communicate with the registered VIMs and WIMs. On the VIMs side, the IA generates HEAT templates to orchestrate the resources, uses Neutron to handle the DC networking and Keystone for authentication among other OpenStack APIs. On the WIMs side, the IA implements an interface (WIM TAPI) in order to deploy a service across the network. The WIM TAPI is in charge of enforcing the end-to- end service connectivity between PoPs. So as to reach its objective, the WIM TAPI makes uses of ONF Transport API to build any WAN connection. The workflow for deployment of a Network Slice is as follows. A new Network Slice Instance request is received at SONATA SP. This request is related to NSTd and includes incoming/outgoing connections, QoS, and required NS (see Figure 2). After the SP deploys the NSs and the VNFs are deployed, it must generate connection service requests on the In/Out network ports. This is done by the SONATA WIM plugin to WIM using ONF Transport API connection service requests. After the link is deployed, users are notified that a network segment has been created.

2.4 Real-Time Communication Network Service

The demonstration selected NS is a videoconference service and it is designed with five VNFs: a) Reverse Proxy (VNF-RP) composed by an Nginx to receive all the HTTP and WebSocket traffic; b) WebRTC Application Controller (VNF-WAC), which is a Sippo Server and a Signalling Server (QSS) in charge of the WebRTC communication; c) Backend Services (VNF-BS), that includes a MongoDB to safe information and a RabbitMQ for the communication among VNFs; d) Media Server (VNF-MS) composed by a Janus and a Wrapper in charge of receiving and relaying the media during the videoconferences and also in charge of measuring the QoS achieved in the media flows of each video-conference; and e) Dispatcher (VNF-DS), which is used to ask for media rooms and create/manage the multimedia sessions. Any Media Server must register itself to the Dispatcher. Moreover, to the previous VNFs, the NS has two more components; Function Specific Manager (FSM) and Service Specific Manager (SSM). These two managers allow the option to configure any of the VNFs (FSM) and also the overall configuration of the NS (SSM).

III. MULTIPLE NETWORK SLICES FOR RTC DEMONSTRATION

The demonstration provides multiple real-time communications suites using multiple network slices with the aim to provide flexibility when deploying different Quality of Services (QoSs) over the same physical network. The idea is to create two network slices, both using the same exact NSs but each network slice with a different QoS. By doing this, the physical resources operator is able to create and manage multiple network slices by fulfilling QoS requirements requested by the different users. The network slices used were composed by the NS previously described in section II.D, each one of them with a different QoS levels defined by two SLA descriptors; called GOLD (high performance) and SILVER (low performance). It should be mentioned that a set of specific Service Level Objectives (SLOs) is considered for each SLA level, by specifying the maximum values and thresholds allowed for a set of service specific parameters (i.e. audio and video bitrate). When instantiating any of the two Network Slices, the first step to verify is that the NS deployment follows all the steps defined in II.C. Initially the user must pass a token to be verified (by the SP) and then, it can request the deployment of the network slice. Once deployed (with its NSs and VNFs), then, the WAN connection creation starts; the SONATA SP requests to the WIM the "service-interface-points" so as to know where to connect the VNFs connection points and finally, requests to the WIM the end-to-end connection between VIMs creation. Once both Network Slices were deployed, it was possible to carry on tests to validate the complete NSs functionality. Fig.3 shows the bitrate of the audio stream (a), which was stable at 25Kbps. Meanwhile, the video stream (b) had a mean value of 300Kbps.

IV. CONCLUSION

This demo introduces the SONATA SP, which can deploy multiple real-time communication services across network segments through end-to-end transport channels.

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