Towards IP & Transport Network Transformation Using Standardized Transport NorthBound Interfaces

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Abstract: This demo proposes the usage of standardized YANG data models for multi-vendor and multi-layer optical control interoperability. L2/L3 network service establishment will be demonstrated as part of the network transformation strategy for SDN/NFV.
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1. Introduction

Telefonica's UNICA program is the TelcoCloud architecture to support network virtualization [1]. The resource connectivity is strategic across different network layers and technologies (network domains, such as access, core, metro and backhaul layers, and physical, IP/MPLS, optical and microwave technologies). Software Defined Networking (SDN) is a key enabler of network virtualisation, in order to set up network connectivity. Typically, UNICA users need this network connectivity in the same programmable way that they create compute and storage resources to support their VNFs and network services. UNICA therefore needs to work not only with the elements in the data-center, but also with the network elements.

SDN provides a common abstraction of network resources in each network domain, allowing them to be managed and controlled programmatically through standardized APIs. In Fig.1, it can be observed that the SDN architecture has a concept of Software Defined Transport Networks (SDTN) with end-to-end visibility across network domain-specific SDN controllers to support the programmability of the entire network. This hierarchical approach allows better resource usage as well as specific vendor extensions inside a domain under a SDTN controller.

This demo shows a set of standard APIs used as the north and south bound API of a SDTN controller. These APIs are defined by various working groups in the IETF standardization organization, and the syntax and semantics of those APIs are described by using the YANG modeling language [2-6], which is also defined by the IETF NETMOD working group. This demo extends the previously presented demo based on Cross Stratum Orchestration (CSO) as a feasible solution for NFV points of presence interconnection [7]. The demo architecture and the interfaces/APIs are aligned with IETF Abstraction and Control of TE networks (ACTN) [8].

2. Description

This demo proposes a novel Proof-of-Concept (PoC) that demonstrates a multi-layer network SDN controller based on IETF Transport NBI (T-NBI) YANG data models. The TE service mapping YANG model [6] describes how operator's end to end orchestrator interacts with the SDTN, so that the SDTN then can coordinate the control and management of L3VPN MPLS TE tunnels that traverse both IP/MPLS and Transport networks.

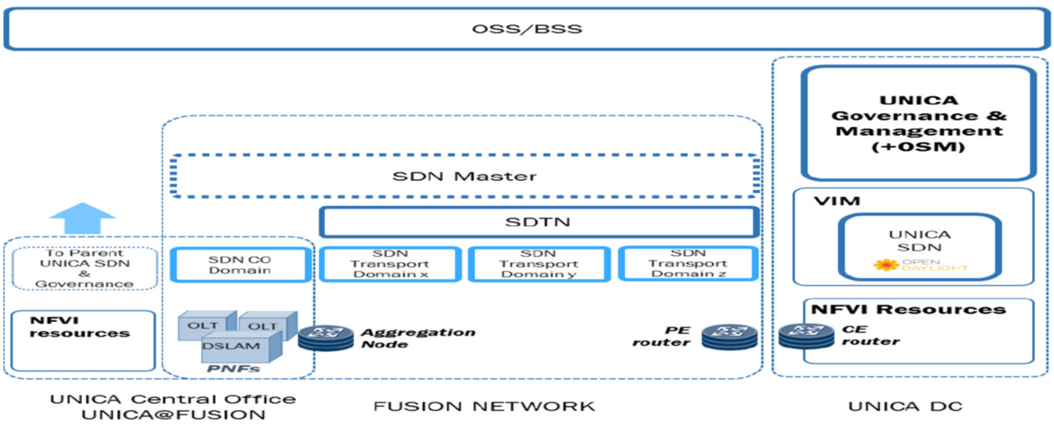

Figure 1. Proposed IP & Transport Transformation architecture

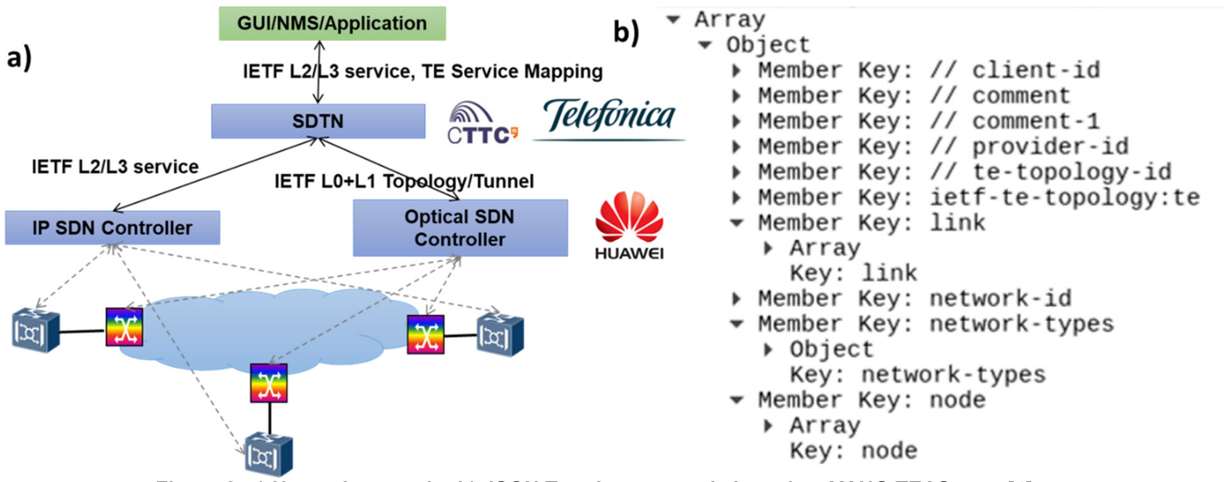

Figure 2. a) Network scenario; b) JSON Topology example based on YANG TEAS topo [4]

Fig.2.a shows architectural context of this demo. There are three main entities in the architecture:

a) SDTN Controller: responsible for coordinating a L3VPN service request (expressed in L3SM) with the IP SDN controller and the Optical SDN controller. One of the key responsibilities of the SDTN for TE services is to coordinate with both the IP and the Optical SDN controllers for the mapping of L3VPN Service Model and ACTN VN/TE-Tunnel models.

b) IP SDN Controller: This entity is responsible for device configuration to create PE-PE L3VPN tunnels for the VPN customer and for the configuration of the L3VPN VRF on the PE nodes. Each network element would select a tunnel based on the configuration.

c) Optical SDN Controller: This entity is responsible for device configuration for TE tunnels in the transport networks.

Fig 2.b shows an example of retrieved TE topology [4]. The model defines a topology graph and components from which it is composed: nodes, edges and termination points. Nodes represent graph vertices and links represent graph edges. Nodes also contain termination points that anchor the links. In order to setup network connections, TE Tunnel model is used [5]. It is a connection-oriented service provided by a layer network of delivery of a client's data between source and destination tunnel termination points. A TE tunnel in a server layer network may support a link in a client layer network (e.g., OCh layer TE tunnel supporting ODU4 link).

3. Innovation

Several innovations are presented in this demonstration: a) TE service mapping YANG model support in SDTN [6]; b) IP SDN Controller with support for IETF L2/L3 service [2,3]; c) Optical SDN Controller support for L0+L1 TEAS Topology/Tunnel interfaces [4,5]. Moreover, focus on service provider network transformation will also be provided with dynamic L2/3 service policy mapping to Traffic Engineering in place [6].

4. Relevance

This demo is of interest of audiences typically addressing N2 and N3 committees. By attending this demo, the participants will gain knowledge on open source and standardization initiatives regarding control and management of transport networks, as well as inter-domain NFV scenarios. They will get an overview of Telefónica's IP & Transport network evolution as well as multi-vendor interoperability.

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References

[1] D. Cooperson and C. Chappell, Telefónica's UNICA architecture strategy for network virtualisation, White paper, 2017.
[2] G. Fioccola (Editor), et al, A YANG Data Model for L2VPN Service Delivery, IETF draft-ietf-l2sm-l2vpn-service-model-03, 2017.
[3] S. Litkowski, L. Tomotaki, K. Ogaki, YANG Data Model for L3VPN Service Delivery, IETF RFC 8049, 2017.
[4] X. Liu et al, YANG Data Model for TE Topologies, draft-ietf-teas-yang-te-topo-12, 2017.
[5] T. Saad (Ed) et al, A YANG Data Model for Traffic Engineering Tunnels and Interfaces, IETF draft-ietf-teas-yang-te-08, 2017.
[6] Y. Lee, et al, Traffic Engineering and Service Mapping Yang Model, IETF draft-lee-teas-te-service-mapping-yang-01, 2017.
[7] R. Vilalta et al., Fully Automated Peer Service Orchestration of Cloud and Network Resources Using ACTN and CSO, OFC 2017.
[8] D. Ceccarelli and Y. Lee, Framework for ACTN, IETF draft-ietf-teas-actn-framework-08, 2017.