Fully Automated Peer Service Orchestration of Cloud and Network Resources Using ACTN and CSO

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Abstract: This demo proposes the fully automated establishment of a network service using a peer inter-CSO interface in ACTN. The underlying network resources have been abstracted and virtualized in order to provide a network slice.

OCIS codes: (060.4250) Networks; (060.4510) Optical communications

1. Introduction

Abstraction and Control of Traffic Engineered networks (ACTN) enables virtual network CRUD operations using abstraction and virtualization mechanisms [1]. It allows customers to request a virtual network over operator's transport networks which are often multi-layer and multi-domain TE networks. The resources granted for a virtual network in the operator's TE networks are referred to as a network slice. This network slice is presented as an abstract topology to customers. The customers would make use of this abstracted topology to offer applications over its virtual network. Therefore, ACTN enables multi-tenant virtual network services with flexibility and dynamicity.

Cross Stratum Optimization (CSO) involves a cooperation between the Application Stratum and Network Stratum to efficiently utilize cloud and network resources and provide for overall application level quality of service [2]. Coupling the ACTN with the CSO, an end-to-end automated orchestration of services/applications is made possible with the joint optimization of cloud and network resources the applications consume. The Multi Domain Service Coordinator (MDSC) of the ACTN architecture is a network orchestrator of multi-layer and multi-domain networks. A CSO is able to requests virtual networks to each MDSC. The CSO is the entity that has the application requirements knowledge and the necessary cloud/DC resources associated with the application. A CSO in one operator domain interacts with another operator domain's CSO as the applications are provided across multiple operator domains.

2. Joint SDN and NFV demonstration

This demo proposes a novel Proof-of-Concept (PoC) that demonstrates a fully automated multi-entity orchestration and optimization based on abstraction capability using data models. Multi-entity orchestration is both vertical and horizontal orchestrations. Firstly, the demonstrated CSO controller will be able to interact with another peer CSO controller in order to provide a network service (for demo purposes we demonstrate virtualized deep packet inspection – vDPI). Each CSO will be controlling a DC controller (e.g., using OpenStack API [3]) and a transport network orchestrator (e.g., using ACTN VN [4] and RESTconf [5]). Fig. 1.a shows the proposed scenario for the automated service orchestration PoC.

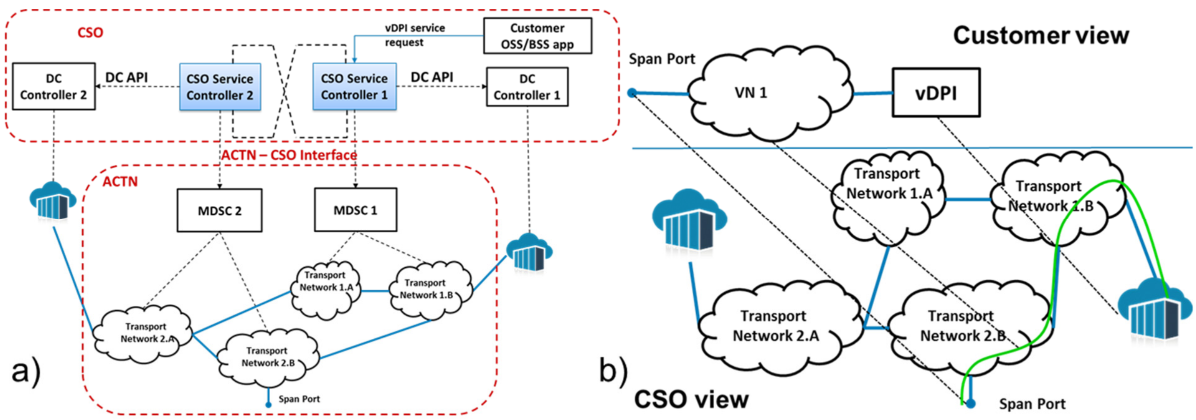

Figure 1. a) Fully automated Service Orchestration using ACTN and CSO Proof-of-Concept scenario; b) Offered customer view and its relationship towards CSO resources view

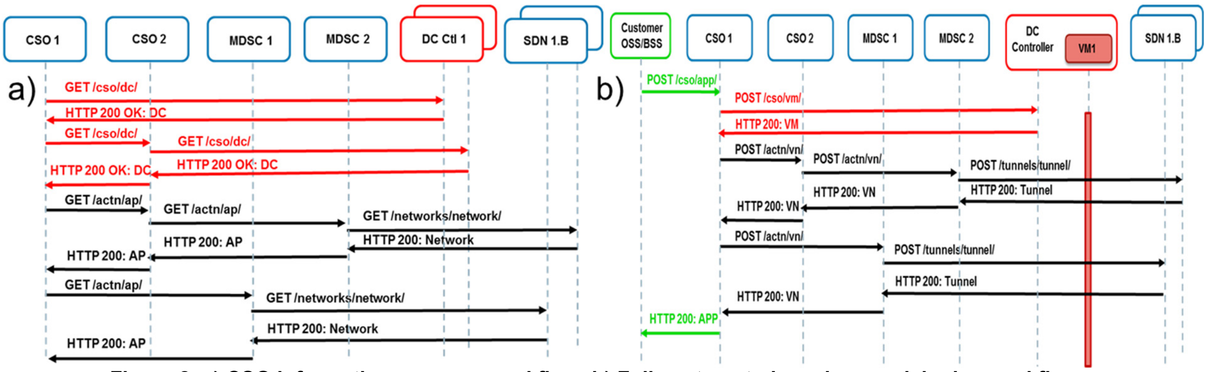

Figure 2. a) CSO information recovery workflow; b) Fully automated service provisioning workflow

Customer Network Service and Inter-CSO Peering model

Fig.1.b shows the customer view offered from CSO 1 to the Customer app. A virtual network is provisioned using ACTN, using VN members. Each VN member is an e2e tunnel from the customer perspective. Fig.2.a shows the information recovery workflow from the CSO1 perspective in order to discover all the cloud and network available resources in a peer hierarchical approach as has been presented in [6].

YANG models for Application, Data Center and Virtual Network

YANG data models have been designed for CSO information, including application and data center profiles. Moreover, a YANG model for the ACTN virtual network [4] has also been integrated for both discovering the access points and to request virtual networks using the EAGLE Project [7].

Resource allocation algorithm which considers Compute and Network resources

A heuristic algorithm for the CSO has been developed. Once the CSO receives a request, it allocates the necessary compute and networking resources by using the previously recovered information. The CSO heuristic algorithm receives the following inputs: Network Service requested (including compute requirements, and network interconnections and span ports). The algorithm outputs are the VM allocation per DC, and the necessary VM interconnections though transport networks.

Fully Automated Service Provisioning

Fig.2.b show the workflow in order to dynamically deploy a network service on top of the proposed scenario. Once a customer requests a service to CSO1, the resource allocation algorithm is triggered and allocates the necessary VM in DC1. It also computes the necessary virtual network members, and it triggers the virtual network creation. Firstly, CSO1 requests to CSO2 a virtual network, in order to reach the requested span port. CSO2 forwards the request to the MDSC under its domain. Secondly, a virtual network is directly requested to MDSC1. Each request triggers the creation of a TE tunnel. Finally, the CSO1 offers the resource view to the customer, as seen in Fig.1.b.

3. Innovation

Several innovations are presented in this demonstration: a) Inter-CSO interface is introduced, by extending descriptions to consider DC/cloud resources [2]; b) Intra-CSO virtual network request though ACTN VN [2]; c) SDN controller support for TEAS Topology/Tunnel interfaces; d) CSO interaction through OpenStack API [4].

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.

References

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