Functional validation of the cooperation between Virtual Network Topology Manager (VNTM) and Path Computation Element (PCE)

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I. Extended Abstract

CURRENT core networks are based on several layers, progressing towards an IP/MPLS network over reconfigurable wavelength switched optical network (WSON). Two key elements have been proposed to help in the management and coordination of such multi-layer architectures: the Path Computation Element (PCE) and the Virtual Network Topology Manager (VNTM). The aim of the PCE is to calculate the route between two endpoints, especially in complex scenarios (e.g. WSON with physical impairments, multilayer or multidomain) [1]. On the other hand, the VNTM is in charge of maintaining the topology of the upper layer by connections in the lower layer [2].

In this work, we have carried out an experimental validation of cooperation between a simple NMS, a multilayer PCE and a VNTM in an IP/MPLS over WSON scenario with commercial equipment. The testbed is composed by three Juniper MX240 routers and three ADVA optical nodes with wavelength switching capabilities. The NMS, multilayer PCE and VNTM have been developed by Telefonica I+D [3].

The operator can request a new MPLS path via the NMS, which consults the multilayer PCE. The PCE, in case that there are enough resources in the MPLS layer, returns a MPLS only path. On the other hand, if there is a lack of resources at the MPLS layer, the response may contain a multilayer path with MPLS and WSON information. In case of a multilayer path, the NMS sends a TE link suggestion to the VNTM. When the VNTM receives this suggestion, based on the local policies, accepts the suggestion and configures the lower layer LSP via UNI signaling in the routers and the TE link in the

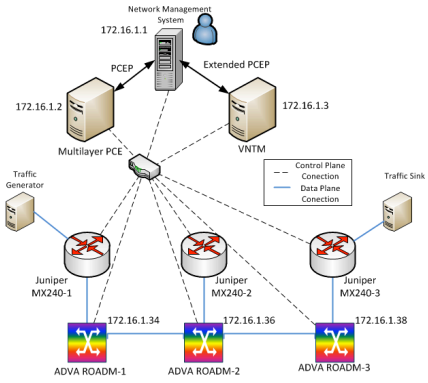

Fig. 1. Experiment set-up

upper layer. Once the TE link is ready, it sends the confirmation to the NMS. The MPLS path is configured by the NMS with standard procedures. This configuration is done in both cases, single and multilayer response from the PCE (in the second case after the VNTM has sent the confirmation).

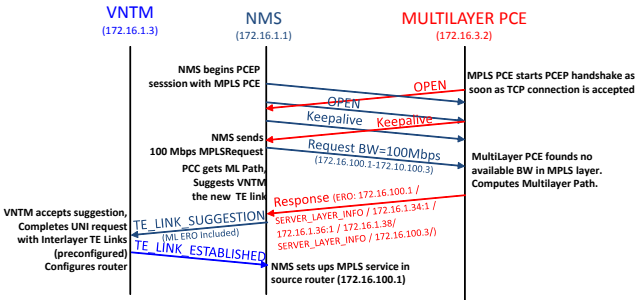

Fig. 2. Messages exchange between VNTM, NMS and Multilayer PCE

Time	Source	Destination	Protocol	Length	Info
3.356252	172.16.1.2	172.16.1.1	PCEP	78	OPEN MESSAGE
3.357628	172.16.1.1	172.16.1.2	PCEP	78	OPEN MESSAGE
3.360678	172.16.1.2	172.16.1.1	PCEP	70	KEEPALIVE MESSAGE
3.363184	172.16.1.1	172.16.1.2	PCEP	70	KEEPALIVE MESSAGE
9.918286	172.16.1.1	172.16.1.2	PCEP	134	PATH COMPUTATION REQUEST MESSAGE
9.924206	172.16.1.2	172.16.1.1	PCEP	150	PATH COMPUTATION REPLY MESSAGE
9.938584	172.16.1.1	172.16.1.3	PCEP	78	OPEN MESSAGE
9.950277	172.16.1.3	172.16.1.1	PCEP	78	OPEN MESSAGE
9.951355	172.16.1.1	172.16.1.3	PCEP	70	KEEPALIVE MESSAGE
9.955123	172.16.1.3	172.16.1.1	PCEP	70	KEEPALIVE MESSAGE
10.038387	172.16.1.1	172.16.1.3	PCEP	122	TE LINK SUGGESTION MESSAGE
12.197983	172.16.1.3	172.16.1.1	PCEP	70	TE LINK CONFIRMATION MESSAGE

Fig. 3. Wireshark Capture of messages between NMS, ML PCE and VNTM

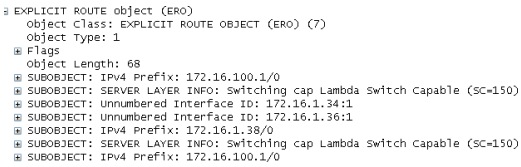

Fig. 4. Multilayer ERO

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35.500376 172.16.100.1   172.16.100.3   RSVP      300 PATH Message. SESSION: IPv4-LSP, Destination 172.16.100.3,
35.602948 172.16.100.3   172.16.100.1   RSVP      208 RESV Message. SESSION: IPv4-LSP, Destination 172.16.100.3,
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Fig. 5. UNI signaling captured at Juniper router

During this implementation process we have identified PCEP as a suitable protocol to communicate to the VNTM. However, there is a lack of suitable messages in the current standards to suggest new configurations (e.g. new TE Links) to the VNTM. To such end, we propose new PCEP protocol extensions, which have been implemented and validated.

Acknowledgments

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References

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