Guest editorial

The Path Computation Element (PCE) was originally designed as the de-facto solution for constraint-based path computation in MPLS and GMPLS networks, turning into a suitable solution to mitigate complex multi-domain and multi-layer network problems. Aligned to the novel concepts linked to virtualization and functions decoupling, the PCE has become an important piece of the Software Defined Networking (SDN) paradigm. Moreover, the remarkable benefits PCE may bring have been highlighted by the fact that Open Source Industry initiatives, such as OpenDaylight or ONOS have included PCE as one of its cornerstone components.

The inherent capacity embedded in the PCE concept to outsource network functionalities to external network devices, is paving the way to extend the main PCE concept to different network scenarios, ranging from traditional telecom networks to new smart paradigms, such as sensor networks, Internet of Things or Intelligent Transportation Systems, just to name a few. Indeed, the role of PCE has widened from a mere path computation function to an entity able to control and optimize any kind of network. In fact, the IETF PCE is currently evolving into a powerful and flexible platform that can be applied to a variety of technology areas.

The set of papers received for this special issue certifies the wide scope envisioned for the Path Computation Element. In particular, this special issue includes six papers with significant advances related to extending the use of the Path Computation Element in different network environments. In particular, the first two papers are focused on the use of PCE for cloud applications. The next couple of papers are advances around the traditional network topics. Finally, the last two papers explore novel uses for PCE, extending its applicability towards IoT and Service Function Chaining.

The first article, by A. Mayoral López de Lerma *et al.*, presents different orchestration architectures for integrating IT and DCN controls with the WAN. Two architectures are considered, one based on ABNO (Application-Based Network Operations) and a second one with an SDN controller to orchestrate IT and Data center resources. Both approaches are experimentally validated and consistent results are presented and discussed in the paper. The Cross Stratum Optimization is, in the paper by Y. Hui, intended to jointly optimize application and network resources in the context of Data centers interconnected by means of Multi-domain and Multi-layer Optical Transport Networks. The authors propose a novel architecture as well as a dynamic global load balancing strategy to enable such optimization while simultaneously improving the ability of a data center to place service demands. The feasibility is experimentally validated and quantified against alternative approaches in an Optical as A Service testbed.

L. Griffe *et al.* explore a novel hierarchical content distribution architecture for the telecom cloud. Related problems, such as topology creation, anycast provisioning and recovery are formally stated, modeled as Integer Linear Programs (ILP) and finally some Heuristics are proposed. The validation strategy is supported by both an extensive simulation work showing an increase in the supported traffic and restorability as well as an experimental validation of the proposed architecture in the UPC's ABNO-based iONE test-bed. Building the Topology is key to ensure PCE computations outcome to be meaningful. In the next paper, J. Jin Seek Choi *et al.*, propose a novel topology discovery protocol for a Stateful Path Computation Element. The proposed protocol is an extended version of the PCE Communication Protocol (PCEP) –called the Generalized TOPology (G-TOP) protocol, which allows the PCE to automatically construct the network topology as a controller without using a distributed routing protocol. The authors implement their proposal, demonstrating a notable reduction in terms of update time and controller traffic.

The use of PCE in the Internet of Things (IoT) paradigm is explored by W. Ramírez *et al*. The deployment of innovative Internet paradigms, such as Cloud or Fog Computing, and services, such as Smart Cities or Smart Transportation, imposes hard constraints and requires agile coordination in heterogeneous scenarios. The paper brings an insight on how PCE may contribute to service composition in an agile manner, handling the specific constraints and requirements of IoT scenarios, leveraging a novel PCE strategy, referred to as Service-Oriented PCE. The last paper to be included in this special issue, by T. Li *et al.*, explore novel means of deploying and managing services based on the Service Function Chain (SFC), Software Defined Network (SDN) and Network Functions Virtualization (NFV) paradigms. The proposal is based on placing the services in a topology-independent way and steer traffic among them. The proposed paradigm is validated through a prototype analysis and the performance evaluated by means of simulation.

Finally, we hope that the readers will find this special issue to be relevant to their research and daily work. We would also like to thank authors for considering this journal as a venue for disseminating their research efforts as well as reviewers of this special issue submissions for their valuable comments during the review process. We also express our deepest gratitude to Profs. G. Rouskas and A.Jukan, Editors-in-Chief of this journal, for giving us the opportunity to work together on this special issue.

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