

**EDITORIAL**

# Softwarization of networks, clouds, and internet of things

## 1 | INTRODUCTION

The IEEE International Conference on Network Softwarization (IEEE NetSoft) was established in 2015, and the second edition (IEEE NetSoft 2016) was organized in Seoul, Korea, during June 6 to 10, 2016. NetSoft 2016 builds further on the successful first edition, held in London, UK, in April 2015 and is the flagship conference established as part of the IEEE software-defined networks (SDN) initiative of the IEEE Future Directions Committee. NetSoft is the primary IEEE forum for publication and technical exchange of the latest research and innovation results in this challenging area and brings together academia and industry to evaluate and ponder maturing developments related to all aspects of network softwarization.

NetSoft 2016 focused on the theme, “Softwarization of Networks, Clouds, and Internet of Things,” presenting recent, emerging approaches and technical solutions for dealing with future softwarized networks, clouds, and IoT infrastructures, as well as with novel services provided on top of these infrastructures. Software-defined networks, Network Function Virtualization (NFV), and SDN-based cloud computing (SDNCC) are different expressions of software-defined infrastructures (SDI). This transformation trend towards softwarization is deeply impacting telecom and ICT industries. In addition, this trend is also transforming several other industries, bringing softwarization to optimize costs and processes and to bring new values in the infrastructures. In particular, SDN, NFV, and network programmability are creating the conditions to reinvent network and service architectures.

## 2 | NETSOFT 2016 PROGRAM OVERVIEW

A total of 107 papers were submitted to the main track (74 full papers and 33 short papers) by authors from 32 different countries. All submitted papers underwent a rigorous review process with at least 3, but usually 4 reviews for each paper. After author rebuttals were submitted, a TPC meeting took place, where every paper was discussed taking into account its content, the reviews, and the submitted rebuttal. From the 107 submitted papers, 20 full papers were accepted for the plenary session track, and 36 promising papers were accepted for the technical session track.

The aforementioned papers—covering the topics such as efficient resource management and orchestration, service function chains for softwarized infrastructures, management of SDN/NFV-based systems, monitoring of softwarized networks, testbeds and experiments, traffic engineering in softwarized networks, quality guarantees in softwarized environments, transition strategies and pricing models—were presented, along the week, in 6 plenary sessions and 4 technical sessions. The program was also composed of 7 keynotes by distinguished speakers, 6 tutorials, 4 workshops, together with interactive demo/poster/exhibition sessions during the breaks. The 4 colocated workshops focused on the latest hot topics including software-defined 5G networks, SDN and IoT, open-source software networking, and security in virtualized networks.

In total, there were more than 230 attendees for NetSoft 2016, and all attendees took advantage of the content-rich and inspiring technical program.

## 3 | EXTENSIONS OF TOP-RANKED PAPERS

Authors from the top-ranked papers were invited to submit extended versions of their papers to the International Journal of Network Management (IJNM). The extended versions contain additional algorithms, more elaborate descriptions, and novel evaluation results, compared to the NetSoft 2016 conference papers. The extended papers were thoroughly reviewed, and based on the detailed review feedback, the authors recently submitted their final manuscripts.

In total, 6 extended NetSoft 2016 papers are published in this special issue. Two papers focus on efficient deployment of service function chains (SFCs) in NFV-based networks. In “Specification, composition, and placement of network services with flexible structures,”<sup>1</sup> Draexler and Karl present a model for describing the service structure in deployment requests in a flexible way that enables changing the order of functions, together with heuristic algorithms for the composition of the network functions and deployment of the service function chains. In “CATENAE: A scalable service function chaining system for legacy mobile networks,”<sup>2</sup> Bifulco et al introduce an efficient service function-chaining platform for mobile networks, which allows for seamless integration with legacy network management systems, without introducing

overhead in the virtual network functions. The throughput of the designed platform is characterized in detail.

The next 2 papers deal with failure detection and diagnosis in SDN/NFV networks. In “Fast failure detection and recovery in SDN with stateful data plane,”<sup>3</sup> Cascone et al propose a novel detection mechanism based on switches' periodic link probing and fast rerouting of traffic flows even in case of distant failures, regardless of SDN controller availability. The presented technique offers guaranteed short failure detection and recovery delays, with a configurable trade-off between overhead and failover responsiveness. In “Self-modeling based diagnosis of network services over programmable networks,”<sup>4</sup> Sanchez Vilchez et al present a multilayer self-diagnosis framework for networking services in SDN and NFV environments, including a service-aware root-cause analysis module that takes into account the networking services' views and their underlying network resource observations within the different layers.

Finally, the 2 last papers focus on performance modeling of software routers and a technoeconomical pricing model for resources in virtual networks. In “Towards performance prediction of multi-core software routers,”<sup>5</sup> Suksomboon et al present an analytical model and 2 performance prediction algorithms for multicore software routers. The first algorithm is based on CPU utilization statistics, while its simplified version does not require CPU utilization statistics. In addition, a detailed evaluation study is presented by the authors. In “A dynamic pricing algorithm for a network of virtual resources,”<sup>6</sup> Naudts et al present an advanced dynamic pricing algorithm for pricing the requested substrate resources in virtual networks. The proposed algorithm increases the infrastructure provider's revenue based on historic data, current infrastructure utilization levels, and the pricing of competitors. Experimental evaluation results show that the proposed algorithm increases the revenue of the infrastructure provider significantly, independent of the average network utilization.

#### 4 | NEXT EDITION—NETSOFT 2017

The third edition of the IEEE NetSoft conference will be held, July 3 to 7, 2017, in Bologna, Italy. General cochairs are Antonio Manzalini, Telecom Italia, and Roberto Verdone, University of Bologna, Italy. The location will be the School of Engineering and Architecture, University of Bologna, in the city center of Bologna, Italy. The theme of NetSoft 2017 will be “Softwarization Sustaining a Hyper-connected World: en route to 5G.” The conference will bring together academia and industry to jointly review and ponder maturing developments related to all aspects of softwarization and its first exploitation with the 5G. The technical sponsors of NetSoft 2017 are the IEEE Communications Society, the

IEEE Computer Society, the IEEE Signal Processing Society, and the IEEE Consumer Electronics Society.

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