Series Editorial

"Telecom Software, Network Virtualization, and Software Defined Networks"

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Network Softwarization is changing how we build and operate communication networks. It is expected to enable the fifth-generation (5G) networks to provide logically-independent and fully programmable network slices by flexibly, efficiently and securely partitioning the network infrastructure. End-to-end network services are then dynamically provisioned on those slices to meet the diverse requirements of vertical industries. Extensive research and development effort is currently conducted to explore several aspects of network softwarization including network architecture, management frameworks, and open-source software. The fourth issue of "Telecom Software, Network Virtualization, and Software Defined Networks" series features five papers that deal with critical challenges related to 5G networks, such as network slicing, security and trust, access and usage control, service development and open-source tools deployment.

The first article, "Automating Vertical Services Deployments over the 5GT Platform" by Xi Li et al., investigates a 5G mobile transport network platform based on Network Function Virtualization (NFV) and Mobile Edge Computing (MEC). The aim is to deploy vertical services in dedicated or shared network slices spanning across several data centers, radio access networks, transport technology domains and administrative domains offering control to the verticals, and allow automated service creation, provisioning and management. Three novel mechanisms are defined to meet these challenge in an automated manner: (i) a Vertical Slicer as the entry point to create services and request slices, (ii) a Service Orchestrator to manage the services and decide their placement and allocation of the required resources and (iii) a Mobile Transport and Computing Platform virtualizing infrastructure networking and computing resources in an integrated manner. The article reports the overall design of the system architecture, the capabilities for supporting various vertical services, the initial experimental evaluation of the open-source solution showing its feasibility, and confirms some of the expected benefits.

The second article, "Service Development Kit for Media-Type Virtualized Network Services in 5G Networks" by Refik Fatih Ustok et al., addresses the issue of NFV-based service development by means of suitable software tools, which must support heterogeneous architectures and platforms to manage the complete service lifecycle from development to operations. After an overview of existing NFV Service Development Kits (SDKs), the authors focus on the development of media services in highly dynamic 5G networks. They share the experience gained in the framework of the 5G-MEDIA project with the design of an SDK architecture that harmonizes different virtualization technologies, including unikernels, containers and the emerging Function-as-a-Service (FaaS) serverless computing paradigm. The authors show how FaaS, whose execution is more responsive to load variations, could be beneficial to service development, particularly in case of event-based, session-oriented, media-intensive workloads. The article illustrates the service development workflow in an immersive media use-case.

The third article, "Controlling Next-Generation Software-Defined RANs" by Arled Papa et al., presents a new Radio Access Network Control Function (RANCF) that implements a Software-Defined RAN (SD-RAN) controller in a 5G Next Generation RAN (NG-RAN) architecture. RANCF ensures the control and coordination of multiple evolved NodeBs (eNBs)/5G base-stations (gNBs) thanks to a centralized network view that could potentially increase radio resource efficiency and reduce signalling overhead. RNACF

allows also to deploy and manage network slices through a coordination mechanism between NG-RAN and the 5G Core. The authors discuss interfaces and protocols for the interaction of RANCF with existing 5G functions and describe its control functionalities. They also show how RANCF ensures network slice selection, lifecycle and management in the 5G networks.

The fourth article, "Pushing forward Security in Network Slicing by leveraging Continuous Usage Control" by Barbara Martini et al., focuses on the MANagement and Orchestration (MANO) security functions within the ETSI NFV Architectural framework and, particularly, on the security challenges related to the high-dynamicity of NFV- operations and the interdependence of multiple slices running on top of a shared infrastructure. They hence discuss how to enhance access control and authorization functions by integrating continuous and closed-loop Usage CONtrol (UCON) mechanisms to regulate the access and the use of network slices throughout their entire lifecycle according to customizable security policies. They also present a Proof of Concept of a MANO framework extended with UCON capabilities and show the effectiveness and quick reaction to security violation policies with minimal impact on user experience.

The fifth article, "Securing outsourced VNFs: challenges, state-of-the-art and future directions" by Enio Marku et al., focuses on security issues related to VNF outsourcing. Indeed, a malicious third party (e.g., a public cloud) hosting an outsourced VNF could easily peek at the exchanged traffic and modify it, and could even alter the hosted VNF code, input policies and state. The authors look at these particular security issues and discuss architecture, threat model and requirements of a trusted hardware platform for VNF outsourcing. They also provide an overview of existing solutions to mitigate such threats, highlighting the gaps of state-of-the-art approaches. Then they present the main features of their proposed solution, called SafeLib, that is capable of filling those gaps.

The papers published in this and other issues of the series are focusing on the latest advances and technical innovations of research and development, including open-source projects, dealing with all aspects related to Telecom Software, Network Virtualization, and Software Defined Networks. They are selected after a thorough peer-review process.

In our role as Series Editors, we strive to achieve a fast, quality and selective review process for all submissions in order to quickly publish high-quality and cutting-edge papers on relevant topics in this area. We would like to thank all the authors and reviewers who contributed to the series, as well as the IEEE Communications Magazine editors and staff for their continuous support. We hope that you will enjoy this fourth series issue and find these papers as inspiring and impactful as we do. We invite interested authors to submit their work as per the Call for Papers available at http://bit.ly/commag-telcosw.

Biographies

Walter Cerroni [M'01, SM'16] (walter.cerroni@unibo.it) is an Assistant Professor of communication networks at the University of Bologna, Italy. His recent research interests include software-defined networking, network function virtualization, service function chaining in cloud computing platforms, intent-based northbound interfaces for multi-domain/multi-technology virtualized infrastructure management, modelling and design of inter- and intra-data centre networks. He co-authored more than 130 articles published in the most renowned international journals, magazines and conference proceedings. He serves/served as Associate Editor for the IEEE Communications Letters and Technical Program Co-Chair for IEEE-sponsored international workshops and conferences.

Alex Galis is a Professor in Networked and Service Systems at University College London (UCL) - www.ee.ucl.ac.uk/~agalis/. His current interests are on 5G and beyond networking, management, AI and networking, virtualization and softwarization, network and cloud programmability. He has co-authored more than 250 publications in the future Internet areas and standards including 11 research books. He is a co-editor of IEEE Communications Magazine series on Telecom Software, Network Virtualization, and Software Defined Networks, IEEE JSAC series on Network Softwarization and Enablers, ETRI Journal published by Wiley. He has served as general chair/TPC chair/keynote and panel chair/tutorials in IEEE conferences such as NOMS/IM/CNSM/ICIN/CloudNet/NetSoft.

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Mohamed Faten Zhani is an Associate Professor at ÉTS Montreal, University of Quebec, Canada. His research interests include network function virtualization, software-defined networking and resource management in large-scale infrastructures. Faten co-authored several research papers published in renowned conferences and journals. He served as the general/technical program chair of several international conferences and workshops. He is co-editor of IEEE Transactions on Network and Service Management and IEEE softwarization newsletter. Faten received the IEEE/IFIP IM 2017 Young Researchers and Professionals Award for outstanding research contribution and leadership in the field of network and service management.