Tutorial T-08: Towards Network Softwarisation

Presenter: Tarik Taleb (Aalto University, Finland)

Tutorial Overview

This tutorial will be shedding light on network softwarisation, an important vision towards the realization of elastic and flexible 5G mobile systems. The tutorial will commence with a brief introduction of major 3GPP wireless technologies, namely GSM, GPRS, UMTS and LTE, comparing amongst the different relevant architectures and their evolution to the nowadays' Evolved Packet System (EPS). After a short discussion on the basic principles of LTE, the tutorial presents the major architectural enhancements that have been already standardized within 3GPP for supporting EPS. The tutorial will subsequently lay emphasis on the functional and technical requirements of 5G mobile systems and discuss relevant opportunities, challenges, and expectations. The tutorial will be afterwards touching upon cloud computing technologies, virtualization techniques, and software defined networking (SDN). The main focus will be towards the use-case of these technologies in the context of network softwarisation to create programmable virtual mobile networks, highlighting the key performance indicators and aspects for ensuring carrier-grade service delivery. The tutorial will also cover the concept of network function virtualization (NFV), detailing virtual network function (VNF) management and orchestration, and showcasing NFV and SDN as key technology enablers for the creation of elastic and flexible 5G mobile systems. The tutorial will be then describing, using concrete examples, how cloud-based virtual mobile networks can be designed, instantiated, configured, managed, and orchestrated, and that using current cloud infrastructure management tools, such as OpenStack and OpenDaylight. The tutorial will finish by highlighting few open issues that are forming the focus of research efforts in the network softwarisation arena. Tutorial contents are:

1. Current 3GPP mobile networks
    a. Overview
    b. Brief intro to legacy mobile networks: GSM, GPRS, and UMTS
    c. LTE and EPS background
    d. EPS architecture
    e. Interoperability with non-3GPP accesses
    f. EPS challenges and relevant solutions
    g. Concluding remarks
2. 5G mobile systems
    a. Requirements and use cases
    b. Relevant standards activities
    c. Summary of state of the art research
    d. Programmable virtual networks in 5G
4. SDN
    a. Overview
    b. SDN protocols
    c. SDN in mobile networks
    d. Carrier grade performance consideration for SDN
5. NFV
    a. Requirements and use cases
    b. VNF management and orchestration
    c. Virtualizing mobile network functions – challenges and requirements
    d. SDN and NFV
6. Network softwarisation and programmable virtual mobile networks
    a. NFV management framework (OpenStack)
    b. SDN Management framework
    c. Supporting protocols
    d. Concrete examples: CDNaaS with Full Elasticity Support

e. Open issues and future work

7. Conclusion

Presenter Biography

Prof. Tarik Taleb is an IEEE Communications Society (ComSoc) Distinguished Lecturer and a senior member of IEEE. He is currently a Professor at the School of Electrical Engineering, Aalto University, Finland. Prior to his current academic position, he was working as Senior Researcher and 3GPP Standards Expert at NEC Europe Ltd, Heidelberg, Germany. He was then leading the NEC Europe Labs Team working on R&D projects on carrier cloud platforms, an important vision of 5G systems. He was also serving as technical leader of the main work package, Mobile Core Network Cloud, in EU FP7 Mobile Cloud Networking project, coordinating among 9 partners including NEC, France Telecom, British Telecom, Telecom Italia, and Portugal Telecom. Before joining NEC and till Mar. 2009, he worked as assistant professor at the Graduate School of Information Sciences, Tohoku University, Japan, in a lab fully funded by KDDI, the second largest network operator in Japan. From Oct. 2005 till Mar. 2006, he worked as research fellow at the Intelligent Cosmos Research Institute, Sendai, Japan. He received his B. E degree in Information Engineering with distinction, M.Sc. and Ph.D. degrees in Information Sciences from GSIS, Tohoku Univ., in 2001, 2003, and 2005, respectively.

Prof. Taleb's research interests lie in the field of architectural enhancements to mobile core networks (particularly 3GPP's), mobile cloud networking, network function virtualization, software defined networking, mobile multimedia streaming, inter-vehicular communications, and social media networking. Prof. Taleb has been also directly engaged in the development and standardization of the Evolved Packet System as a member of 3GPP's System Architecture working group. Prof. Taleb is a member of the IEEE Communications Society Standardization Program Development Board. As an attempt to bridge the gap between academia and industry, Prof. Taleb founded the "IEEE Workshop on Telecommunications Standards: from Research to Standards", a successful event that got awarded "best workshop award" by IEEE Communication Society (ComSoC). Based on the success of this workshop, Prof. Taleb has also founded and has been the steering committee chair of the IEEE Conf. on Standards for Communications and Networking.

Prof. Taleb is the general chair of the 2019 edition of the IEEE Wireless Communications and Networking Conference (WCNC'19) to be held in Marrakech, Morocco. He is/was on the editorial board of the IEEE Transactions on Wireless Communications, IEEE Wireless Communications Magazine, IEEE Journal on Internet of Things, IEEE Transactions on Vehicular Technology, IEEE Communications Surveys & Tutorials, and a number of Wiley journals. He is serving as chair of the Wireless Communications Technical Committee, the largest in IEEE ComSoC. He also served as Vice Chair of the Satellite and Space Communications Technical Committee of IEEE ComSoc (2006 - 2010). He has been on the technical program committee of different IEEE conferences, including Globecom, ICC, and WCNC, and chaired some of their symposia.

Prof. Taleb is the recipient of the 2009 IEEE ComSoc Asia-Pacific Best Young Researcher award (Jun. 2009), the 2008 TELECOM System Technology Award from the Telecommunications Advancement Foundation (Mar. 2008), the 2007 Funai Foundation Science Promotion Award (Apr. 2007), the 2006 IEEE Computer Society Japan Chapter Young Author Award (Dec. 2006), the Niwa Yasujirou Memorial Award (Feb. 2005), and the Young Researcher's Encouragement Award from the Japan chapter of the IEEE Vehicular Technology Society (VTS) (Oct. 2003). Some of Prof. Taleb's research work have been also awarded best paper awards at prestigious conferences.