

Tutorial T-11: Towards 5G: Carrier-Grade Programmable Virtual Mobile Networks

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Tutorial Overview

This tutorial will be shedding light on carrier grade virtual mobile networks, an important vision towards the realization of 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 carrier-grade 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 mobile cloud networking arena. Tutorial contents are:

1. Current 3GPP mobile networks

- a. Overview
- b. 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

3. Cloud computing and virtualization technologies

- a. Cloud computing and datacenter architectures
- b. Cloud management
- c. Virtualization technologies
- d. Carrier grade consideration for cloud computing

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
- e. Concluding remarks

6. Programmable virtual mobile networks

- a. NFV management framework (OpenStack)
- b. SDN Management framework
- c. Supporting protocols
- d. Concrete examples
- e. Open issues and future work

7. Conclusion

Presenter Biography

Dr. Tarik Taleb is an IEEE ComSoc Distinguished Lecturer. He is a Professor at the School of Engineering, Aalto University, Finland. He has been 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. Prior to his work at 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 was working as research fellow with 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.

Dr. Taleb's research interests lie in the field of architectural enhancements to mobile core networks (particularly 3GPP's), mobile cloud networking, mobile multimedia streaming, inter-vehicular communications, and social media networking. Dr. 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. Dr. Taleb is a board member of the IEEE Communications Society Standardization Program Development Board. As an attempt to bridge the gap between academia and industry, Dr. Taleb has founded the "IEEE Workshop on Telecommunications Standards: from Research to Standards", a successful event that got awarded "best workshop award" by IEEE ComSoc and converted to the IEEE Conference on Standards in Communications and Networking (IEEE CSCN). Dr. Taleb is serving as chair of the Wireless Communications Technical Committee. He is a recipient of many awards such as the 2009 IEEE ComSoc Asia-Pacific Best Young Researcher award. Some of Dr. Taleb's research work has been also awarded best paper awards at prestigious conferences.