

Workshop on Emerging Technologies and Services for Current and Future Mobile Networks

Tuesday, 25th February, 2014

Department of Telecommunications, Brno University of Technology,

Technická 12, 616 00 Brno, room n. SC 7.53

Program:

10:00 – 12:30 Session 1: Novel Technologies and Services for 3G/4G/5G Mobile Networks

10:00 – 10:30 Sergey Andreev, Ph.D., Tampere University of Technology
Delivering Uniform Connectivity and Service Experience to Converged 5G Wireless Networks

With this overview talk, we consider a comprehensive set of technology innovations to (i) dramatically improve the available cellular network capacity, (ii) provide a uniform wireless connectivity experience, and (iii) deliver a higher level of service quality and user satisfaction. To achieve these ambitious goals, we explore the emerging concepts of enhanced spectral reuse via device cooperation, intelligent use of multiple radio access technologies, and improved power efficiency of, primarily, small-scale mobile devices. We believe that these directions will significantly benefit the uniform connectivity and service experience in the face of growing application, data, and device volume. The complex research summarized by this work is expected to result in both theoretical innovations and practical applications, as the topic itself may lead to rethinking the architecture of contemporary wireless networks. The outcomes of this work are primarily intended for academic experts and industry professionals, with the purpose to shed light on the most recent advances in fifth generation (5G) wireless networks.

10:30 – 11:00 Olga Galinina, MSc., Tampere University of Technology
Analyzing Future MTC-related Enhancements in 3GPP LTE

As massive deployments of autonomous MTC devices jeopardize current mobile access networks with their excessive signaling, wireless industry is taking decisive steps to protect future technology from such overloads. Whereas efficient mechanisms for overload control of 3GPP Long Term Evolution (LTE) system are now in place when the devices are connecting to the network, we investigate the situation when the connection has already been established and a large number of devices send their meaningful data. This talk intends to offer an overview of several MTC-related research efforts which are being developed within the W.I.N.T.E.R. group (TUT, Finland) towards constructing a unified simulation-analytical MTC framework. Hence, by covering a variety of techniques analyzing several important aspects of connected-mode MTC performance under 3GPP LTE-specific constraints, we conclude with our harmonized vision, which combines analysis and simulation as well as provides considerable flexibility in characterizing MTC system operation.

11:00 – 11:30 Franz Kröpfl, Telekom Austria Group

New Home Services on Home Gateways: A Operator's Point of View

Transforming an old ecosystem into a newer one will bring interaction with new partners and rise the main question how to unify it while still relying on international standards. Furthermore another question will follow close upon: How to avoid unjustifiably high costs but still providing a user friendly environment. The presumption points to higher utilization of existing assets. From network access and service nodes through to the home gateway. By starting to set a definition for the initial question "WHAT EXACTLY IS A HOME GATEWAY?" the approach from Buildingblock-Providing to Ecosystem-Interworking will be expounded.

11:30 – 12:15 Jiri Hosek, Ph.D., Brno University of Technology

Development of Universal Smart Home Gateway (demo presentation)

In our study we investigated the readiness of residential gateway access technology for the different smart home services. We proposed and demonstrate a middleware solution enabling the standard IP-based home gateway to serve as a universal multi-purpose enabler for home automation systems like smart metering, alarm systems, lighting systems, photovoltaic energy production systems, etc. In our study we were focusing on the IMS/SIP platform which has a very good potential to become a key communication technology for M2M and smart home domains. We demonstrate how the IMS/SIP platform is utilized in order to forward data from home automation system connected to an end-user device through the home gateway. This approach brings certain benefits for smart home application providers, telecommunication operators and end-users as well. The user friendly interface enabling the interaction either locally or remotely with smart home services or appliances through mobile devices is also very important. For this purpose, we used the openHAB platform. Moreover, to be able to monitor and report actual status of gateway and running smart home services, the live management system was implemented within our demonstrator. This talk will provide practical presentation of the developed smart home gateway system within the joint project with the Telekom Austria Group.

12:15 – 13:00 Lunch break

13:00 – 16:00 Session 2: Testing and Modelling of Quality of Experience in Mobile Networks

13:00 – 13:40 Jiri Hosek, Ph.D., Brno University of Technology

Study on Quality of Experience for Multimedia Services in Mobile Networks

Intensive competition between network operators as well as steady increase in mobile traffic call for additional investments into the networking infrastructure. Keeping current mobile networks profitable, the following criteria should be satisfied: end-user quality expectations need to be fulfilled on the one hand and service quality overprovisioning should be eliminated on the other. Our work provides extensive QoE study for different conditions in sense of mobile multimedia service, content, network conditions and end user device. Finally, the obtained results create basis for more dimensional overview of mobile web QoE and allow to recognize quality and saturation thresholds based on network parameters. The talk will provide the key outputs from the research project realized in cooperation with T-Mobile, Czech Republic.

13:40 – 14:20 Olga Galinina, Tampere University of Technology

Analytical Modelling of User Satisfaction in Current Mobile Networks

Keeping current mobile networks profitable and fulfill end-users expectations generates growing demand for adequate QoE estimation models accounting for dominant mobile data services. Basing on our joint paper accepted to the IEEE ICC 2014 conference, we detail an advanced QoE estimation model for the most popular mobile web services: browsing, download, and upload. The discussed model utilizes the bitrate together with the initial loading delay as well-measurable input parameters. First, a brief introduction to linear regression analysis will be provided. Then, we cover the analysis of recent extensive QoE assessment data as well as look at the design of our analytical QoE model. Finally, we show that the proposed model demonstrates excellent convergence across the considered practical scenarios.

14:20 – 15:00 Sergey Andreev, Ph.D., Tampere University of Technology

Cellular Traffic Offloading onto Network-Assisted Device-to-Device Connections

While operators have finally started to deploy fourth generation broadband technology, many believe it will still be insufficient to meet the anticipated demand in mobile traffic over the coming years. Generally, the natural way to cope with traffic acceleration is to reduce cell size; and this can be done in many ways. The most obvious method is via pico-cells, but this requires additional capital (CAPEX) and operational (OPEX) investment to install and manage these new base stations. Another approach, which avoids this additional CAPEX/OPEX, involves offloading cellular traffic onto direct device-to-device (D2D) connections whenever the users involved are in proximity. Given that most client devices are capable of establishing concurrent cellular and WiFi connections today, we expect the majority of immediate gains from this approach to come from the use of the unlicensed bands. However, despite its huge commercial success, WiFi-based direct connectivity may suffer from stringent session continuity limitations, excessive user contention, and cumbersome manual setup/security procedures. In this talk, we detail our vision of integrating managed D2D communications into current cellular technology to overcome the limitations of WiFi. We also quantify the estimated network performance gains from offloading cellular traffic onto D2D connections. Our analysis is based on an advanced system-level simulation toolkit which captures the relevant details of the network environment and on a detailed characterization of dynamic D2D communications based on stochastic geometry. We conclude that D2D communications provide a significant boost to network capacity as well as user energy efficiency and quality of service perception.

15:00 – 15:30 Assoc. Professor Vit Novotny, Ph.D., Brno University of Technology

Presentation of unique University LTE network deployed in the laboratories of SIX Research Center

Speakers:

Sergey Andreev is a Senior Research Scientist in the Department of Electronics and Communications Engineering at Tampere University of Technology, Finland. He received the Specialist degree (2006) in Information Security and the Cand.Sc. degree (2009) in Wireless Communications both from St. Petersburg State University of Aerospace Instrumentation, St. Petersburg, Russia, as well as the Ph.D. degree (2012) in Technology from Tampere University of Technology, Tampere, Finland. Sergey (co-)authored more than 80 published research works. His research interests include wireless communications, energy efficiency, heterogeneous networking, cooperative communications, and machine-to-machine applications.

Olga Galinina is a PhD Candidate in the Department of Electronics and Communications Engineering at Tampere University of Technology, Finland. She received her B.Sc. and M.Sc. degree in Applied Mathematics from Department of Applied Mathematics, Faculty of Mechanics and Physics, Saint-Petersburg State Polytechnical University, Russia. She has publications on mathematical problems in the novel telecommunication protocols in internationally recognized journals and high-level peer-reviewed conferences. Her research interests include applied mathematics and statistics, queueing theory and its applications; wireless networking and energy efficient systems, machine-to-machine and device-to-device communication.

Franz Kröpfl worked in the telecommunications industry for the last twenty years. During this time, he has worked in the areas of Service, Operations & Maintenance, Product Management, Marketing, Business Development and for the last years, in the area of Innovation and Application Service Provider Partnerships. Over the last time he has primarily focused on strategy and industry relations. Currently he is employed as a Senior Innovation Expert at Telekom Austria Group Headquarters in Vienna/Austria. He runs dedicated strategy projects to cooperate cross industrial and to take advantage of the next business opportunities for Telekom Austria Group.

Jiri Hosek is a postdoc researcher in the Department of Telecommunications, Brno University of Technology. He received the B.S., M.Sc. and Ph.D. degrees in Electrical Engineering from the Faculty of Electrical Engineering and Communication at the Brno University of Technology in 2005, 2007 and 2011 respectively. His research work deals with the technologies and services for wireless communications, quality of service and quality of experience in fixed and mobile data networks and machine-to-machine applications.

Vit Novotny is an Associated Professor at the Department of Telecommunications, Faculty of Electrical Engineering and Communication, Brno University of Technology. He received the M.Sc. degree in the field of telecommunications electrical engineering in 1992, Ph.D. degree in the field of communications in 2001 and the Assoc. Professor degree in the field of communication technology in 2005. His professional activities are focused primarily on issues of mobile and wireless technologies, the convergence of telecommunications technologies and integration of communication services, terminal equipment in telecommunications, electrical filters, electronic circuits and simulation of electronic circuits.

This workshop is supported by the project CZ.1.07/2.3.00/30.0005 of Brno University of Technology