VŠB-TECHNICAL UNIVERSITY OF OSTRAVA
Faculty of Electrical Engineering and Computer Science
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Invited Lecture

Ray-Guang Cheng

prof. in Wireless Communications, National Taiwan University of Science and Technology
IEEE Senior member, holding 18 US patents and has published more than 100 articles in journals

Venue: Faculty of Electrical Engineering and Computer Science, VSB-TU OSTRAVA
Room EC2, July 19, 2016

Agenda

9:00 – 9:15 Introduction, activities in field of IoT (Miroslav)
9:15 – 10:15 Talk 1: Machine Type Communications: Challenges and Perspectives (Ray)

10:30 – 11:30 Talk 2: Overview of LoRa Technology (Ray)

11:30 – 12:30 Discussion, opportunities

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BIOGRAPHY

Ray-Guang Cheng
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Brief Biography of the Speaker: Ray-Guang Cheng received the B.E., M.E., and Ph.D. degrees in communication engineering from National Chiao Tung University, Hsinchu, Taiwan, in 1991, 1993, and 1996,

respectively. From 1997 to 2000, he was with Advance Technology Center, Computer and Communication Laboratories, Industrial Technology Research Institute (ITRI), Taiwan, as a Researcher and a Project Leader. From 2000 to 2003, he joined BenQ Mobile System Inc., Taiwan, as a Senior Manager of R&D Division. He is currently a Professor with the Department of Electronic and Computer Engineering, National Taiwan University of Science and Technology (NTUST), Taiwan. His research interests include multi-hop wireless networks, massive machine type communications, ultra-reliable and low-latency communications, and Internet-of-Things (IoT) applications.

Dr. Cheng is a Senior Member of IEEE and a member of Phi Tau Phi scholastic honor society. He holds IEEE Wireless Communication Professional (WCP) certification and 18 US patents; and has published more than 100 international journal and conference papers and more than 30 IEEE/3GPP standard contributions. He led the 3G Protocol project and his team was named Top Research Team of the Year by ITRI in 2000. He received the Best Industrial-based Paper Award from Ministry of Education in 1998; Advanced Technologies Award from Ministry of Economic Affairs in 2000; and Teaching Award, Research Award, Excellence in Counseling Award and Outstanding Teaching Award from NTUST in 2006, 2009, 2011, and 2016, respectively.

Talk 1: Machine Type Communications: Challenges and Perspectives

Abstract: Machine type communications (MTC) enables a broad range of Internet-of-Things (IoT) applications over cellular networks. Among them, massive machine type communications (mMTC) and ultra-reliable and low latency communications (uMTC) have been identified as two major use cases of IMT-2020. Existing cellular networks adopted a connection-oriented approach to allocate channels to users. A user should transmit a preamble over a shared random-access channel (RACH) to obtain a channel from the base station for sending its information data. The high connection density and low power consumption natures of mMTC and the high-reliability and low-latency requirements of uMTC place new challenges on the design of the RACH for 5G cellular networks. This lecture presents challenges and analytical tools for designing and analyzing the RACH for 5G cellular networks. The fundamental concept of RACHs used in existing 3GPP Long Term Evolution Advanced (LTE-A) is briefly introduced. Challenges and possible solutions adopted to support the deployment of a massive number of MTC devices, the transmission of small data bursts, and provide low-latency communications will then be elaborated. Finally, we present an iterative contending-user estimation (ICE) method to analyze the transient performance of the LTE-A random access procedure. We further demonstrate the way to use the proposed ICE method to estimate the performance under different overload control schemes.

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Talk 2: Overview of LoRa Technology

Abstract: The Internet of Things (IoT) interconnects “things” and autonomously exchanges data between them. “Things” may be machines, parts of machines, smart meters, sensors or even everyday objects such as retail goods or wearables. Numerous services are envisioned for IoT, including utility meters, vending machines, automotive (fleet management, smart traffic, real time traffic information to the vehicle, security monitoring and reporting), medical metering and alerting. IoT is expected to be the next revolution in the mobile ecosystem and is likely to be a key driver for further growth in cellular. It is expected that there are more than seven billion of connections interconnected by low-power wide-area (LPWA) networks to support IoT services before 2025. LPWA can be divided into two categories: proprietary LPWA technologies and 3GPP standardized cellular IoT (CIoT) technologies. Proprietary LPWA technologies such as SigFox and LoRa typically operate on the 8-900 MHz unlicensed spectrum. CIoT refers to Internet of Things using 3GPP technology on licensed spectrum. This lecture gives a general overview of the LoRa technology. The network architecture defined in LoRaWAN standard will be briefly introduced. The basic concept of LoRaWAN will then be elaborated. Finally, a quick summary of LoRa hardware and software module and implementation considerations of LoRa will be addressed.