Reliable and Timely Vehicle-to-Vehicle Communication: Latency, Age-of-Information, and Analog Antenna Signal Processing

Erik Ström

Professor in Communication Systems, Chalmers University of Technology, Gothenburg, Sweden

Abstract

Vehicular communication for traffic safety and traffic efficiency application is often claimed to require ultra-reliable low-latency communications (URLLC). In this talk, we will argue that this claim is not always justified, at least not for a periodic broadcast of status messages. Indeed, latency as such is not a perfect performance metric for this data traffic model. A more appropriate metric is age-of-information (AoI). Shifting the focus from latency to AoI allows degrees of freedom in the design of communication systems that can be exploited in different ways. As an example, we will present how periodic broadcast vehicle-to-vehicle communication can be made robust against unfavourable propagation conditions by analog processing of imperfect transmit and receive antennas.

Bio

Erik G. Ström received the M.S. degree from the Royal Institute of Technology (KTH), Stockholm, Sweden, in 1990, and the Ph.D. degree from the University of Florida, Gainesville, in 1994, both in electrical engineering. In 1996, he joined the Chalmers University of Technology, Göteborg, Sweden, where he is now a Professor in Communication Systems. Dr Ström currently heads the Division of Communications, Antennas, and Optical Networks, is the director of ChaseOn, a Vinnova Competence Center focused on the antenna system, and the director of Chalmers' Area-of-Advance Information and Communication Technology. He is a Fellow of the IEEE. Ström was awarded the Chalmers Pedagogical Prize in 1998, the Chalmers Ph.D. Supervisor of the Year award in 2009, and the Chalmers Area of Advance Award in 2020.

On ultra-reliability and channel characteristics in cluttered industrial environments

Fredrik Tufvesson

Professor, Lund University, Lund, Sweden

Abstract

Ultra-reliable low latency communication is one of the key application spaces for 5G. In order to simultaneously provide ultra-reliability and low latency, we need to study the channel characteristics and identify challenging situations in the particular user scenarios. In this talk, we build on a recent measurement campaign in a large cleanroom environment performed within the EU project 5G-SMART and discuss channel behavior both at mid-band at 3.7 GHz and at high-band at 28 GHz. We analyze channel hardening effects with massive MIMO at mid-band and angular characteristics at high-band. We look at some critical scenarios and discuss how to support ultra-reliable low latency communication there.

Bio

Fredrik Tufvesson received his Ph.D. in 2000 from Lund University in Sweden. After two years at a startup company, he joined the department of Electrical and Information Technology at Lund University, where he is now professor of radio systems. His main research interest is the interplay between the radio channel and the rest of the communication system with various applications in 5G/B5G systems such as massive MIMO, mm wave communication, vehicular communication and radio based positioning. Fredrik has authored around 100 journal papers and 150 conference papers; he is fellow of the IEEE and his research has been awarded with the Neal Shepherd Memorial Award for the best propagation paper in IEEE Transactions on Vehicular Technology and the IEEE Communications Society best tutorial paper award.

The IoT 6G

Roberto Verdone

DEI, Università di Bologna / WiLab, CNIT

Abstract

The Internet of Things (IoT) paradigm, after two decades of development based on non-3GPP short and long range radio technologies, is entering a new phase with the deployment of 5G networks. 5G will open the door to new IoT applications like in the Industrial domain for predictive maintenance. However, 5G will not be able to cover all requirements posed by the most advanced applications. With the advent of 6G, challenging IoT applications will be boosted further. This talk discusses the evolution from 5G towards 6G under the IoT viewpoint.

Bio

Roberto Verdone got his PhD in Electronic Engineering from the University of Bologna (UniBO). Since 2001 he is Full Professor in Telecommunications at UniBO, where he leads a research group (Radio Networks) working on Radio Resource Management for mobile systems, MAC, routing and topology aspects of wireless sensor networks, architectures and technologies for the IoT. In particular, he is currently active in the field of the integration of the IoT in 5G networks, 6G systems using THz communications, and UAV-aided mobile radio networks. In the past two years, he has been researching the field of psychology, with application to the assessment of soft skills. Since 2020 he is the Director of the CNIT National Laboratory of Wireless Communications, WiLab, participated by more than 50 researchers. He is also co-Director of the WiLab-Huawei Joint Innovation Center on Intelligent IoT for 6G. He published about 200 research papers, on IEEE journals/conferences. He has been involved/has coordinated more than ten European projects, and acted as responsible for many industrial contracts (with TIM, Microsoft, CEA-LETI, and others) in the past 20 years.

Explore new opportunity of 6G for sensing, communication and how to become more GREEN

Joseph Eichinger

Huawei Technologies, Munich, Germany

Abstract

Higher demand of bandwidth to satisfy the requirements of sub-ms latency, aggregated data rate required by the vertical industries. New frequency bands with high bandwidth will be assigned to 6G. What else can be done with the huge amount of radio spectrum? Don't waste bandwidth just for data exchange. The presentation gives some examples of what 6G could additionally get from radio signals by sensing technologies. Communication needs are much different in many of the vertical domains. Most traffic stays local and requires new architecture that matches better with the demands in the vertical domain. Traditional network optimization targets spectral efficiency, deterministic latency or extreme data rate. Besides, all of those 6G has to address sustainability in order to become the first GREEN radio generation.

Bio

Eichinger Josef joined Huawei Technologies in 2013 to strengthen the 5G Research team in Munich. He started his professional carrier as a technical expert in the field of industry energy and electronic systems. After the study, he joined Siemens AG in 1994 and was working in the development of high frequency radar systems, optical networks and as a researcher on radio technologies as HSPA and LTE. He changed to Nokia Siemens Networks 2007 as LTE Product Manager and was head of LTE-Advanced FastTrack Programs. Currently, he is leading research on 5G enabled industrial communication in Huawei Munich Research Center. The focus is 5G for industry 4.0 and vehicle-to-vehicle communication. Complementary to the research and standardization work, he is also responsible for the prove of the new concept by trials and live experiments. Since April 2018 he is also a member of the 5G-ACIA steering board and leading the Huawei delegation in 5G-ACIA.

Digitizing healthcare using 5G

Per H Lehne

Telenor Research, Norway

Abstract

The e-Health sector is identified as a priority in the European Digital Agenda and subsequently in many national digital agendas because of the amount of spending as well as the worrying rise in healthcare costs. On this background, digitization and virtualization of care have been considered a major driver for both improvement of health services and reducing costs. 5G has the potential to be a major enabler for a vision where monitoring, diagnosing and treating patients can take place, anyplace, anywhere, and anytime, essentially removing the walls of the hospital. The best medical experts can be involved instantly for fast diagnostics & treatment, for example acting remotely from an emergency department in a hospital, right into the back of an ambulance. In this talk, the motivation for digitizing healthcare will be presented, along with a number of use cases where 5G based trials and pilots are ongoing. Insights found from technical as well as business aspects will be presented.

Bio

Per Hjalmar Lehne is Senior Researcher in Telenor. He received his MSc from the Norwegian Institute of Science and Technology in 1988 and has since been with Telenor working with different terrestrial mobile communications technologies. His work has especially been in the area of radio propagation and radio access technologies, especially on multiple antenna systems and radio access technologies for mobile and wireless. He has also been engaged in spectrum management techniques and cognitive radio research. He is participating in several international research projects in the EU framework leading trials with 5G verticals. His current scientific interests are on 5G radio access and massive MIMO systems, as well as 5G evolution towards 6G.

5G for Connected Automated Mobility Across European Borders – Insights from EU H2020 ICT-18 and -53 Projects

Maciej Muehleisen

Ericsson

Abstract

Connected and Automated Mobility (CAM) services like Tele-operated Driving, High-Definition (HD) Mapping, and Anticipated Cooperative Collision Avoidance (ACCA) require uninterrupted network connectivity. This is a particular challenge in Europe where national borders can be passed without stopping while Mobile Network Operators (MNOs) usually only serve a single country. Today, vehicles keep the connection to the MNO of the country they come from until the signal is lost and then search and register with an MNO in the country they enter. This causes several minutes of service interruption, which is not acceptable for the aforementioned CAM services. Six Horizon 2020 ICT-18/-53 projects, therefore, conduct research on 5G cross-border/-MNO handover to enable seamless service continuity when crossing borders.

This talk will present the technical 5G solutions to enable service continuity across country borders with networks enhanced by Mobile Edge Computing/Cloud (MEC), end-to-end and predictive QoS, virtualization, and network support for precise positioning. Furthermore, results from the first trials of the 5GCroCo ICT-18 project at the Metz-Merzig-Luxembourg 5G Corridor will be presented.

Bio

Maciej Muehleisen received his Ph.D. on “Voice over LTE” from RWTH Aachen University in 2015 and worked as a group leader for vehicular communication at Hamburg University of Technology (TUHH) from 2012 until 2016, focusing on highly reliable aircraft and maritime networks.

He is with Ericsson Research since 2017 and leads the architecture work package of the EU funded 5GCroCo projects on 5G for CCAM in cross-border environments, where he also serves as deputy Technical Coordinator. As “Industry Verticals Coordination” in the Research Area “Networks”, he is furthermore supporting the technical coordination of Ericsson’s efforts in the Automotive Edge Computing Association (AECC) and 5G Automotive Association (5GAA). His key research interest is in end-to-end design, evaluation, and approval of safety-critical communication services.