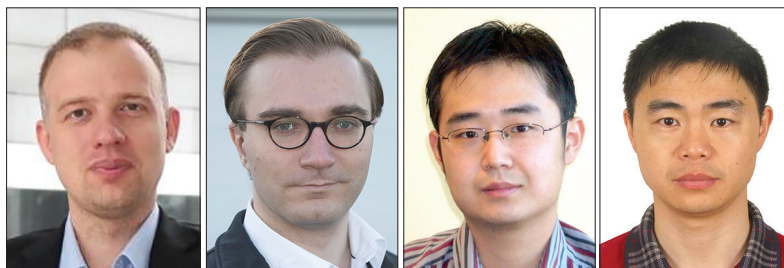# Emerging Technology for 5G-Enabled Vehicular Networks

Alexey Vinel   Jakob Breu   Tom H. Luan   Honglin Hu

Connected telematic services such as online media streaming, social networking, real-time traffic report acquisition, and online navigation are key features for future vehicles. Additionally, communication among vehicles and their neighbors enables a vast number of new applications in the automotive safety and efficiency domain.

While IEEE developed 802.11p as the main communications standard for vehicular networking, the emerging 5G cellular networks promise to provide practical and convenient mass market solutions to enable ubiquitous and reliable connections to vehicles in the densely populated urban areas. With ample bandwidth, low latency, and lowered cost, 5G cellular networks will enable rich engaged service applications to vehicles and, more importantly, efficiently drive the convergence of vehicular networking to the existing Internet framework and applications, such as cloud computing and video streaming. For specific use cases, IEEE 802.11p still may offer better technology and gives the automotive industry more strategic independence from the cellular communication providers. As a result, both the automotive industry and the authorities have not yet fully decided on which technology to support and concentrate on. Currently, parallel technology stacks seem to be rolled out in the short term. However, concepts to combine both technologies in a hybrid solution exist.

The purpose of this Special Issue is to provide the academic and industrial communities a venue in which to present the vision, research, and dedicated efforts on the key technologies emerging for 5G-cellular-communication-enabled vehicular networks. The issue sought original contributions that address the fundamental research challenges in related topics that can help the community analyze the current state, identify future goals, and refine the architectures and technologies of vehicular networks with the emerging 5G technologies.

This Special Issue includes nine articles, which cover different aspects of vehicular 5G. The physical-layer transmission techniques are discussed in the articles "V2X Meets NOMA: Non-Orthogonal Multiple Access for 5G-Enabled Vehicular Networks" and "Statistical Signal Transmission Technology: A Novel Perspective for 5G-Enabled Vehicular Networking." For an introduction to the spectrum allocation problems, the reader is referred to "Toward 5G Spectrum Sharing for Immersive Experience Driven Vehicular Communications," "5G Network Slicing for Vehicle-to-Everything Services," and "Vehicular Radio Access to Unlicensed Spectrum." The software defined network aspects are presented in "Exploring Mobile Edge Computing for 5G Enabled Software Defined Vehicular Networks" and "Cell-Less Communications in 5G Vehicular Networks Based on Vehicle-Installed Access Points." Finally, the challenges of handover and high-precision positioning are presented in "Enhancing Vehicular Communication Using 5G-Enabled Smart Collaborative Networking" and "5G mmWave Positioning for Vehicular Networks," respectively. We hope you enjoy reading!

Biographies

ALEXEY VINEL [M'07, SM'12] (alexey.vinel@hh.se) received his Bachelor's (Hons.) and Master's (Hons.) degrees from Saint-Petersburg State University of Aerospace Instrumentation, Russia, in 2003 and 2005, respectively, and his Ph.D. degrees from the Institute for Information Transmission Problems, Russia, in 2007 and Tampere University of Technology, Finland, in 2013. Since 2015 he has been a professor of computer communications with the School of Information Technology, Halmstad University, Sweden. His research interests include wireless communications and vehicular networking.

JAKOB BREU received his B.Eng. degree in information technology from Baden-Wuerttemberg Cooperative State University, Stuttgart, Germany, in 2009. In 2011 he graduated (M.Sc.) in computer science at Eberhard Karls University, Tübingen, Germany. In 2011, he joined Mercedes-Benz Research & Development, Sindelfingen, Germany, where he works on the topic of vehicle-to-vehicle communications. In 2017 he received a Ph.D., and currently he is a project manager for the series development of next-generation services for parking transactions.

TOM H. LUAN received his B.Sc. degree from Xi'an Jiaotong University in 2004, his M.Phil. degree from Hong Kong University of Science and Technology in 2007, and his Ph.D. degree from the University of Waterloo in 2012. He was a lecturer at the School of Information Technology, Deakin University, Australia, from 2013 to 2017. He is now with Xidian University, China, as a professor. His research includes vehicular networking and mobile content distribution.

HONGLIN HU [M'04, SM'13] received his Ph.D. degree in 2004 from the University of Science and Technology of China. Since 2009, he has served as a professor at Shanghai Institute of Microsystem and Information Technology. Also, he has served as an adjunct professor at ShanghaiTech University and the vice director of the Shanghai Research Center for Wireless Communications since 2013. In 2016, he joined the Shanghai Advanced Research Institute, Chinese Academy of Sciences. He has been a Finland Distinguished Professor (FiDiPro) with VTT since 2015.