

Workshop on Wireless Vehicular Communications

November 11, 2015

Speakers – abstract and bio

9.30 *Vehicular communications via cellular networks*

Abstract:

JOACHIM SACHS is a principal researcher at Ericsson Research. He joined Ericsson in 1997 and has worked on a variety of topics in the area of wireless communication systems and is currently focusing on machine-to-machine communication and 5G system design. He studied electrical engineering at Aachen University (RWTH) in Germany, ENSEEIHT in France, the Norwegian University of Science and Technology (NTNU), and the University of Strathclyde in Scotland. He received diploma and doctorate degrees from Aachen University and Technical University of Berlin respectively. In 2009 he spent a sabbatical as visiting scholar at Stanford University, USA. Since 1995 he has been active in the IEEE and the German VDE Information Technology Society (ITG), where he is currently co-chair of the technical committee on communication networks and systems. In 2006, he received the Ericsson Inventor of the Year award, and in 2010 the research award of the Vodafone foundation for scientific research.

Joachim Sachs, Ericsson Research

Bio:

We see a development where vehicles and transportation infrastructures are increasingly becoming connected. Emerging intelligent transportation systems (ITS) will enable improved traffic safety and traffic efficiency. In addition new automotive services will appear that bring added value to drivers and passengers. Mobile broadband networks will be the foundation for future ITS and connected vehicles. This talk will provide an overview of the 4th generation mobile network standard LTE and highlight the standardization activities towards V2X communication. Some studies on vehicular networking based on mobile networks are presented and an outlook of ongoing research towards 5G is given.

11.00 *On Multilink Shadowing Effects in Measured V2V Channels on Highway*

Abstract:

Shadowing from vehicles can degrade the performance of vehicle-to-vehicle (V2V) communication systems significantly. It is thus important to characterize and model the influence of common shadowing objects like cars properly. For multilink systems it is essential to model the joint effects on the different links. However, the multilink shadowing effects in V2V channels are not yet well understood. In this paper we present a measurement based analysis of multilink shadowing effects in V2V communication systems with cars as blocking objects. In particular we analyze and characterize the joint large scale fading process for multilink communication at 5.9 GHz between four cars in a highway scenario. From our analysis it is found that the coherence time of the large scale fading process for different links can vary from a few seconds to minutes. The results show that it is essential to consider the correlation of the large scale fading processes as the correlation coefficients can have both large negative and large positive values. There is also a clear indication that multihop

techniques provide an efficient way to overcome the issue with shadowed cars in V2V systems.

Mikael Nilsson, Volvo Cars

Bio:

Mikael Nilsson (M'09) received his B.Sc. degree in Electrical Engineering - Radio electronics at Växjö University, Sweden, in 1997. From 1997 through 2003 he worked mostly as consultant within telecom and space industry. In 2003 he joined Volvo Cars and he have had different positions within the company. Since 2011 he hold the position as industrial Ph.D. student enrolled at Lund University, Sweden, department of Electrical and Information Technology, and his principle research areas are channel characterization of the 5.9 GHz band and measurement systems, namely the Over-the-air multi-probe setup for cars. Also since 2012 he holds the position as Technical Expert - Wireless Communication within Volvo Cars. Mikael Nilsson is dedicated to the Six Sigma methodology and has teaching several Design for Six Sigma and Green Belt courses within Volvo Cars.

13.00

Pathloss Modeling and Estimation for V2V Wireless Communications

Abstract:

For vehicle-to-vehicle wireless communications, pathloss is often modeled using a log-distance power law or, for line-of-sight (LOS) scenarios, using a two-ray ground reflection model. In this talk, we discuss the effect of censored samples, which can occur due to the limited dynamic range of the measurement system that is used to sound the channel. If the information about the censored samples is not included in the estimation method, it can result in biased estimation of the pathloss parameters. This can be solved by applying a Tobit maximum-likelihood estimator, which provides consistent estimates for the pathloss parameters of a log-distance power law model. The presented framework for censored pathloss data can also be applied to a two-ray ground reflection model. In LOS scenarios, V2V measurement data typically displays a two-ray behavior, indicating that this behavior should be included in the pathloss model. We also present results for two-ray models estimated based on measured data.

Carl Gustafson, Lund University

Bio:

Carl Gustafson received the Ph.D. degree in Radio Systems from the department of Electrical and Information Technology, Lund University, where he now is working as a post-doctoral researcher. His main research interests include channel measurements and modeling for mm-wave wireless systems, for cellular systems operating above 6 GHz and for vehicular wireless communication systems. Other research interests include massive MIMO, antenna array processing, statistical estimation and electromagnetic wave propagation.

13.30

Using stochastic geometry to model packet reception probabilities in vehicular networks

Abstract:

The current road transport system has large problems with safety and efficiency, and these problems do not only cost the society enormous amounts of money and affect the everyday life of people, but might in the long run also have devastating consequences for the environment and the global climate. Future intelligent transportation systems,

where vehicular communication systems play a key role, are envisioned to alleviate these problems and allow for a safer and more efficient coordination of vehicles. In particular, wireless communication is expected to increase the situational awareness in complex and accident-prone scenarios such as intersections, where the ability to coordinate the traffic flow otherwise would be limited by the range and quality of each vehicle's on-board sensors. However, by relying on wireless communication another form of uncertainty is introduced as the information exchange between nodes suffer from both packet drops and random latencies. This means that before deploying such systems we need to fully understand and be able to handle these uncertainties. As measurements campaigns or simulations to evaluate the reliability of packet transmission are slow and scenario-specific it is desirable to complement these with analytical key performance metrics that can give quick insights about performance and scalability. In this talk will give an overview of how tools from stochastic geometry can be used to analyze the impact of interference in vehicular network, and to analytically characterize the packet reception probability in an intersection scenario.

Erik Steinmetz, Chalmers University of Technology

Bio:

Erik Steinmetz received his MSc in Electrical Engineering from Chalmers University of Technology, Göteborg, Sweden in 2009. He is currently a Research and Development Engineer with SP Technical Research Institute of Sweden, Borås, Sweden. He is also affiliated with the Department of Signals and Systems at Chalmers University of Technology, Göteborg, Sweden where he works towards his PhD. His research interests are vehicular communication, positioning, sensor fusion, and naturalistic field tests, with focus on active safety.

14.00

A Reliable Token-Based MAC Protocol for Delay-Sensitive Platooning Applications

Abstract:

Timely and reliable inter-vehicle communications in vehicular ad hoc networks (VANETs) is a critical requirement to support traffic safety applications, especially those with delay constraints. Vehicle platooning is an example of such critical applications, where low-delay communications allow the platoon to react quickly to unexpected events. In this scope, having a reliable and highly effective medium access control (MAC) method is of utmost importance. However, the currently available IEEE 802.11p technology is unable to adequately address these challenges. We propose a token-based medium access mechanism able to transmit beacons within required time constraints but with higher reliability level than IEEE 802.11p, and while concurrently enabling efficient dissemination of event-driven messages. The protocol circulates the token within the platoon based on beacon data age, i.e., the time that has passed since the previous collection of status information, thereby automatically offering repeated beacon transmission opportunities for increased reliability. In addition, we propose three different methods for supporting event-driven messages co-existing with beacons and provide a performance comparison with IEEE 802.11p for single and multi-hop scenarios. It is shown that, by providing non-competitive channel access and frequent retransmission opportunities, our protocol can guarantee beacon delivery within one beacon generation interval while fulfilling the requirements on low-delay dissemination of event-driven messages for traffic safety applications.

Annette Böhm, Halmstad University

Bio:

Annette Böhm received her BSc in Information and Communication Technology and MSc in Computer Systems Engineering from Halmstad University, Sweden, in 2003 and 2004, respectively, where she completed her PhD in Information Technology in 2013 with a thesis on delay-sensitive wireless communication for cooperative driving applications. Her research interests are within the areas real-time and dependable communications for vehicular networks, the focus of her current work as post-doctoral researcher.

15.00

Service Discovery and Access in Vehicle-to-Roadside Multi-Channel VANETs

Abstract:

A wide portfolio of safety and non-safety services will be provided to drivers and passengers on top of Vehicular Ad Hoc Networks (VANETs). Non-safety services are announced by providers, e.g., road-side units (RSUs), on a channel that is different from the one where the services are delivered. The dependable and timely delivery of the advertisement messages is crucial for vehicles to promptly discover and access the announced services in challenging vehicle-to-roadsides scenarios, characterized by intermittent and short-lived connectivity. In this paper, we present an analytical framework that models the service advertisement and access mechanisms in multi-channel vehicular networks. The model accounts for dual-radio devices, and computes the mean service discovery time and the service channel utilization by considering the disruption periods due to the switching of the RSU from the advertising channel (where announcements are transmitted) to the advertised channel (where services are exchanged), under different channel and mobility conditions. It provides quick insights on parameter settings to allow providers to improve service provisioning.

Alexey Vinel, Halmstad University

Bio:

Alexey Vinel received the bachelor's (Hons.) and masters' (Hons.) degrees in information systems from Saint-Petersburg State University of Aerospace Instrumentation, Saint Petersburg, Russia, in 2003 and 2005, respectively, and the Ph.D. degrees in technology from the Institute for Information Transmission Problems, Moscow, Russia, in 2007, and the Tampere University of Technology, Tampere, Finland, in 2013. He is currently a professor of data communications at the School of Information Technology, Halmstad University, Halmstad, Sweden. He has been involved in research projects on vehicular networking standards, advanced driver assistance systems, and autonomous driving. He has been an associate editor for the *IEEE Communications Letters* since 2012.

15.30

Cooperative ITS + Active Safety = Platooning

Abstract:

Short-range wireless communication is what enables vehicles to form platoons, a.k.a. road trains. Platooning is probably the application that puts up the highest requirements on connected automated vehicles because of the close distance between vehicles. Platooning is very appealing due to the promising fuel savings that can be achieved but also due to the reduction in CO2 emissions. However, platooning is also so much more than just communication. Platooning challenges many areas such as functional safety, liability, human machine interface, communication, road

infrastructure, control of the vehicle, etc. Modern vehicles have several sensors onboard that are used for active safety functions such as automatic braking but also for more comfort-like features such as adaptive cruise control. By connecting the active safety functions with cooperative intelligent transport systems more tighter the full potential of connected automation can be explored and platooning can become a reality.

Katrin Sjöberg, Volvo Group Trucks Technology

Bio:

Katrin Sjöberg works as connected vehicle technology specialist at Volvo Group Trucks Technology in Göteborg, Sweden. She is working with wireless access to the vehicle both short-range technologies (e.g., 802.11p, WiFi, Zigbee) as well as long-range technologies (e.g., 3G/4G) for connecting the vehicle. Her research interest ranges from channel modeling to applications for the vehicular environment. She is actively contributing to vehicle-to-vehicle standardization in SAE DSRC Technical Committee in the US and within ETSI Technical Committee on ITS in Europe, where she is also holding a vice chairmanship of working group 4. Further, she is actively participating in the different working groups in the CAR 2 CAR Communication Consortium. In April 2013, she defended her PhD thesis “Medium Access Control for Vehicular Ad Hoc Networks” at Chalmers University of Technology.