

# Tutorial on Vehicular Networking: Applications, Standards, Protocols, Deployment Plans and Open Issues

Onur Altintas<sup>1</sup> and Falko Dressler<sup>2</sup>

<sup>1</sup> Toyota InfoTechnology Center, Co., Ltd.  
Tokyo, Japan  
Tel: +81-3-5561-8269  
onur@jp.toyota-itc.com

<sup>2</sup> University of Innsbruck, Austria  
Phone +43 512 507-96868, Fax +43 512 507-9888  
dressler@ieee.org  
<http://ccs.uibk.ac.at/~dressler/>

## Abstract

Vehicular networking serves as one of the most important enabling technologies required to implement a myriad of applications related to vehicles, vehicle traffic, drivers, passengers and pedestrians. Much progress has been achieved in this area during the past decade. In this tutorial we will look into applications and use cases of vehicular networking followed by an overview of the standardization activities. Next we will cover the communication protocol design as well as the deployment plans. We will also briefly talk about simulation tools for evaluation of various protocol designs. Before concluding, we will take a glimpse at the recently emerging reality of electric vehicles and issues surrounding them. Finally we will conclude with open issues that require further research.

## Topics

- Vehicular networking: what is it for?
- Applications and use cases: selected examples from US, Europe and Japan
- Requirements of applications ranging from safety to infotainment
- System level approaches and a brief comparison: V2V, V2R, V2I
- Standards: Comparison of IEEE 802.11p/WAVE, ETSI (Europe) and Japan (ARIB) standards
- Protocol design: A close look at protocol layers including ad-hoc routing, broadcast-based dissemination, geo-routing and delay-tolerant networking
- Deployment plans and field tests around the world
- Simulation tools: Overview of (integrated) network and traffic simulators
- EVs: Status, practical issues and networking for EVs
- Open issues and areas that require further research

## Intended audience

Audience will range from graduate students working in this area, academics who want to have an idea on the status and future research issues, and practitioners from communications and automotive industries.

### Speaker Bios



**Onur Altintas** is a principal researcher at the R&D Group of Toyota InfoTechnology Center, Co. Ltd, in Tokyo. From 1999 to 2001 he was with Toyota Motor Corporation and from 2001 to 2004 he was with Toyota InfoTechnology Center USA, and was also a visiting researcher at Telcordia Technologies between 1999 and 2004. Before joining Toyota Motor Corporation in 1999, he was a research scientist at Ultra High Speed Network and Computer Technology Labs (UNCL), Tokyo. Dr. Altintas received his B.S. and M.S. degrees from Orta Dogu Teknik University, Ankara, Turkey, and his Ph.D. degree from the University of Tokyo, Japan; all in electrical engineering. He served as the Co-Chair for Vehicle-to-Vehicle Communications Workshops (V2VCOM 2005 and V2VCOM 2006) co-located with ACM MobiQuitous, and V2VCOM 2007 and V2VCOM 2008 co-located with IEEE Intelligent Vehicles Symposium. He also served as the Co-Chair for the IEEE Workshop on Automotive Networking and Applications (AutoNet 2006, AutoNet 2007 and AutoNet 2008) co-located with IEEE Globecom. He is the co-founder and general co-chair of the IEEE Vehicular Networking Conference (IEEE VNC) held in Tokyo in 2009; in New Jersey in 2010, and in Amsterdam in 2011. He also served as a guest editor for a special issue on Vehicular Communications for IEEE Wireless Communications Magazine (2009) and EURASIP Journal on Wireless Communications and Networking (2009) and as Track Chair of Vehicular Electronics and Telematics for the IEEE Vehicular Technology Conference (IEEE VTC Spring 2009, 2011 and 2012). He is an IEEE VTS Distinguished Lecturer.



**Falko Dressler** is a Full Professor of Computer Science heading the Computer and Communication Systems Group at the Institute of Computer Science, University of Innsbruck. He teaches on self-organizing sensor and actor networks, network security, and communication systems. Dr. Dressler received his M.Sc. and Ph.D. degree from the Dept. of Computer Science, University of

Erlangen in 1998 and 2003, respectively. Dr. Dressler is an Editor for journals such as Elsevier Ad Hoc Networks, ACM/Springer Wireless Networks (WINET), and Elsevier Nano Communication Networks. He was guest editor of special issues on self-organization, autonomic networking, and bio-inspired computing and communication for IEEE Journal on Selected Areas in Communications (JSAC), Elsevier Ad Hoc Networks, and others. Besides acting as TPC chair for a number of high-profile conferences and workshops, he regularly acts in the TPC of leading networking conferences such as IEEE INFOCOM, IEEE ICC, IEEE Globecom, and IEEE WCNC. Among other, Dr. Dressler wrote the textbooks Self-Organization in Sensor and Actor Networks, published by Wiley in 2007. Dr. Dressler is an IEEE Distinguished Lecturer in the fields of inter-vehicular communication, self-organization, and bio-inspired networking. Dr. Dressler is a Senior Member of the IEEE (COMSOC, CS, VTS) as well as a Senior Member of ACM (SIGMOBILE), and member of GI (KuVS). He is actively participating in the IETF standardization. His research activities are focused on adaptive wireless networking and self-organization methods addressing issues in wireless ad hoc and sensor networks, inter-vehicular communication systems, bio-inspired networking, and adaptive network security techniques.