

Protocol Engineering for Vehicular Communications

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Much progress can be observed in the domain of Inter-Vehicular Communication (IVC), looking back at the last decade. The objectives of this lecture are twofold: In the first part, an introduction to recent developments in the field of IVC protocols and the used methods is provided. In particular, we discuss possible approaches to IVC based on flooding, peer-to-peer techniques, and periodic beaconing. From previous work, we see that centralized solutions and flooding based approaches each show benefits and drawbacks depending on traffic density, penetration, network utilization, and other parameters. This observation is in line with findings about intelligent transportation systems that have been developed for specific settings. In order to overcome this limitation, beaconing has been investigated as a key communication paradigm that is also used in the upcoming DSRC/WAVE standards based on IEEE 802.11p. Most recently, the Adaptive Traffic Beacon (ATB) protocol has been presented, which is adaptive in two dimensions: First, the beacon interval is adapted dynamically and, secondly, the protocol can dynamically make use of available infrastructure elements. ATB supports the exchange of delay-sensitive traffic information in a wide range of scenarios by flexibly adapting to the availability of infrastructure elements as well as to the network load. In the second part, we investigate the evolution of simulation techniques and how recent advances in bidirectional coupling of road traffic microsimulation and network simulation lead to more realistic results at comparably low computational cost. This approach has two major prerequisites: First, detailed network simulation of all layers of communication protocols is necessary as provided by a wide variety of tools by the networking community. Secondly, realistic simulation of vehicles' mobility, i.e. an exact modeling of road traffic, is needed to estimate positions and movements of involved components. We carefully study the Veins simulation framework, which integrates network and road traffic simulation and even supports models for the human driver behavior and realistic physical layer modeling.

Biography

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. In 2003, he joined the Computer Networks and Internet group at the Wilhelm-Schickard-Institute for Computer Science, University of Tuebingen. Between 2004 and 2011, he has been an Assistant Professor with the Computer Networks and Communication Systems chair at the Department of Computer Science, University of Erlangen, coordinating the Autonomic Networking group.

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. Dr. Dressler was general chair of IEEE/ACM BIONETICS 2007 and IEEE/IFIP WONS 2011. Besides chairing a

number of workshops associated to high-level conferences, he regularly acts in the TPC of leading networking conferences such as IEEE INFOCOM, IEEE ICC, IEEE Globecom, IEEE WCNC, and IEEE MASS. 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.