



ABSTRACT

Licentiate thesis

Real-Time Communication Support for Cooperative Traffic Safety Applications

Author: Annette Böhm, IDE, Halmstad university

Abstract

Future cooperative traffic safety applications based on vehicular networks rely heavily on the support for real-time inter-vehicle communication. The Medium Access Control (MAC) mechanism proposed for the upcoming IEEE 802.11p standard intended for Intelligent Transport Systems (ITS) applications does not offer deterministic real-time support, i.e., the channel access delay is not upper bounded. In this thesis, we therefore propose a vehicle-to-infrastructure (V2I) communication solution extending IEEE 802.11p by introducing a collision-free MAC phase based on real-time schedulability analysis. A static or semi-static access point on the road side (Road Side Unit, RSU) coordinates the vehicles' access to the communication medium by polling them for data according to a schedule based on the Earliest Deadline First (EDF) principle. It is thereby possible to provide real-time support such that the access point can guarantee collision-free channel access within its transmission range. Part of the bandwidth remains unchanged and best-effort services like ongoing vehicle-to-vehicle (V2V) applications can continue. We enhance our MAC solution by introducing a prioritization mechanism based on vehicle positions and the overall road traffic density. This further improves the throughput of both real-time and best-effort data traffic by focusing the communication resources to the most hazardous areas of the road infrastructure. The MAC concept (with and without position-based prioritization) is evaluated based on a realistic task set from a V2I merge assistance scenario. We even target connection setup, associating a passing vehicle to an RSU, and handover between widely spaced RSUs. Position data is utilized to proactively forward connection setup information from RSU to RSU. Hereby, a vehicle is already integrated into the communication schedule of our MAC protocol when it arrives at the next RSU, eliminating handover delays and further supporting the timely delivery of traffic safety application data.