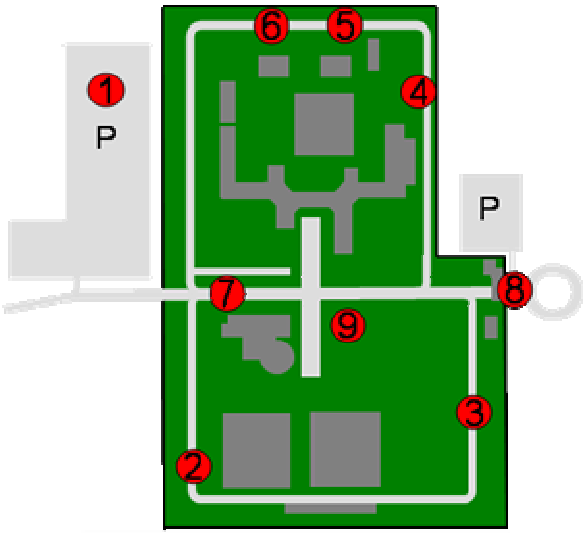
Agenda

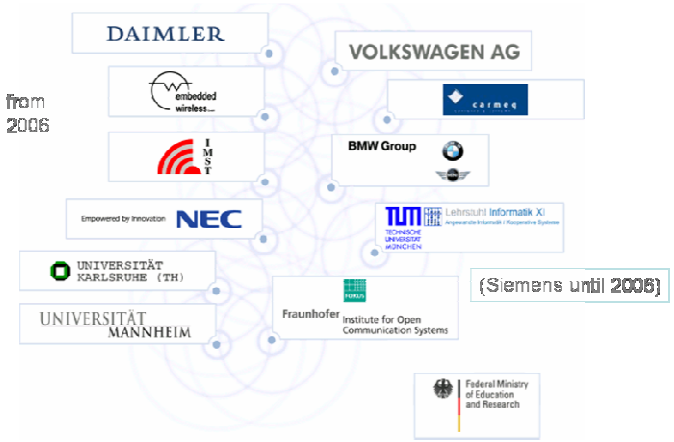
09:30	10:00	Eintreffen der Gäste
10:00	10:05	Begrüßung
10:05	10:15	NoW Ziele und Ergebnisse (G. Nöcker, Daimler)
10:15	10:30	C2X-Sicherheitsanwendungen (M.Straßberger, BMW)
10:30	10:45	C2X-Deploymentanwendungen I (R. Eigner, TU München)
10:45	11:00	C2X-Deploymentanwendungen II (A. König, FhG FOKUS)
11:00	11:15	C2X-Networking (A. Festag, NEC)
11:15	11:30	C2X-Simulationen (J. Härri, Uni Karlsruhe)
11:30	11:45	C2X-Messungen (A. Lübke, Volkswagen)
11:45	12:00	C2X-Security (M. Gerlach, FhG FOKUS)
12:00	12:10	C2X-Frequenzallokierung (D. Seeberger, Daimler)
12:10	12:15	Ausblick auf Demo (G. Nöcker, Daimler)
12:15	13:15	Mittagspause
13:15	15:00	Demonstratoren, Poster, Stände
15:00	15:30	Diskussion
15:30	15:45	Verabschiedung, Ende der Veranstaltung

Vehicle Demo



1. Slippery Road
2. Obstacle Warning
3. Warning Lights
4. Obstacle Warning
5. Forward Collision
6. Emergency Braking
7. Emergency Vehicle
8. E-Payment
9. Music-Download

Now Partners



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Network on Wheels

Final Workshop

Daimler AG

Research Center

Ulm, Germany

May 8th, 2008

Project Goals

Objectives

- Development & specification of communication protocols based on WLAN technology
- Submission of results to C2C-CC
- Support of EU frequency allocation

Technical challenges

- Scalable and reliable communication system
- Security concept and protocols
- Demonstrators for active safety and deployment applications
- Strategies for market introduction

Networking

Communication protocols for network and transport layer for IEEE 802.11 and ad hoc networking technology for car-to-car and car-to-infrastructure communication were designed.

Design particularly considers requirements from vehicular environments and applications, such as frequent topology changes, scalable and efficient communication, and fair resource sharing.

Protocols incorporate various novel mechanisms and algorithms: DFPAV, EMDV, information connector, information handler, digital signatures and certificates for multi-hop communication, temporal and revocable pseudonyms, IPv6 integration, and others.

Simulations

State-of-the-art tools to simulate car-to-car and car-to-infrastructure communication, for instance modeling IEEE 802.11a/p and including adapted radio propagation models have been developed.

A trade-off between transmission data rate and transmission power for efficient and fair car-to-car and car-to-infrastructure communication has been illustrated.

Simulative evaluations have shown that car-to-car and car-to-infrastructure communication for active safety was possible by jointly considering information dissemination and congestion control.

Security

Solutions for achieving a high level of privacy, authorizing nodes for participating in the network, authenticity and integrity protection, and the detection of manipulated data have been developed.

A comprehensive architecture has been designed including all relevant stakeholders, functional aspects, and a definition and specification of local and infrastructure components.

The NoW solutions and expertise is currently placed in a number of consortia, including the Car-2-Car Communication Consortium and the European standardization body ETSI.

Standardisation and Frequency Allocation

Now partners contributed to standardization issues in the Car-2-Car Communication Consortium in working groups PHY, MAC, NET, ARCH, SEC, and APP.

A protected spectrum (5.875 - 5.925GHz) for safety and efficiency related messages was successful allocated. The first 30MHz in this frequency band are reserved for safety relevant applications and the remaining 20MHz can be used for further extensions if the need for this is verified.

Hardware

A flexible and extensible IEEE 802.11a hardware platform, which manages in an efficient way the low level wireless communication interface has been developed and is used by the partners.

Measurements

Extensive on-road tests to evaluate the usability of Wireless LAN-based radio technology in vehicular environments were performed. The results are very promising: No influence of the vehicle speed was detected. A vehicle driving with a speed of 200 km/h by-passing a stationary vehicle has nearly a 5 second time-slot for message exchange. In an open environment the achievable communication range is more than 1 km. The round-trip latency time for a short warning message is less than 5 ms. However, obstacles might be a challenge. Other vehicles and buildings in the surrounding as well as the own vehicle in an inappropriate antenna position substantially reduce the communication performance.

All results are valid for the 2,4 GHz band as well as for the 5 GHz band. As expected the performance in the 2,4 GHz band is slightly better, but also the 5 GHz band will be usable without restriction for future Car-to-X applications.

Applications

One of the main goals of NOW applications is to improve road safety. In order to reach this target, several active safety applications like emergency electronic brake lights, emergency vehicle warning, forward collision warning and others have been designed.

Deployment applications that should help to overcome market entry barriers that cannot be tackled by active safety applications alone have been developed. Among others, these include vehicle-based access to multimedia systems, car-2-home media synchronization, wireless payment as well as location-based services like point-of-interest notification.

The integration of existing architectures and the usage of open standards have been primary design goals. The UPnP architecture has been proven to be a reasonable foundation for defining new deployment applications.