Sichere Intelligente Mobilität – Testfeld Deutschland
Safe Intelligent Mobility – Field Test Germany

The German Approach to Field Testing of Cooperative Systems

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Sichere Intelligente Mobilität
Testfeld Deutschland
Motivation

Challenges

Mobility

Congestion generates annual economic cost of 17,4 bn. €
(Estimate EU commission, 2006)

Traffic Safety

Accident statistics 2010:
appr. 310,000 injured pers.
appr. 3650 fatalities
in Germany
(Source Statistisches Bundesamt Germany, 2010)

Objectives of the European white book will not be achieved with conventional systems alone

Leverage the potential of communications to improve this situation.
Evolution of Active Safety Systems

- **Up to now: „Feel“**
  - Detect critical driving situations via vehicle status and driver reaction

- **Today: „See“**
  - Observe vehicle surroundings with radar
  - Cameras enable vehicles to “interpret” images

- **In Future: „Communicate“**
  - Create a „Telematics Horizon“: Gather information about the road ahead exceeding autonomous systems both in distance and type of accessible information.
  - Warn approaching traffic about potential danger to protect others as well as one self (“cooperation”)
What Sort of Communication Is Needed? – Questions Answered So Far / Done Deals

Results of the various research projects on Car-to-X (C2X) communications:

• Short-range communication technology (based on ITS-G5 (European profile on IEEE 802.11)) can work well in vehicle environments
  • Low network acquisition time (under 100 msecs)
  • Fast transaction times (on the order of 100 msecs)
  • Priority mechanisms for safety applications installed
  • Spectral crowding/interference minimized through dedicated spectrum
  • Communication range (app. 500 m) can support envisioned safety apps
• Methods for geo-addressing are available
• Existing infrastructure can be effectively interfaced with roadside units
• Approaches for efficient use of existing cellular systems for event-based messages have been demonstrated.
• Breadth/applicability of applications based on this technology better understood
Open Questions / Issues

• To test and validate technologies and functions for car-to-infrastructure and car-to-car communications in a setup that is representative for a realistic deployment environment.
• To evaluate the effectiveness and benefits that can be gained by applications and services enabled by car-to-infrastructure and car-to-car communications.
• To gather sufficient information to support a deployment decision for a country-wide (if not cross-border-wide in case of Europe) introduction of car-to-infrastructure and car-to-car communications technologies.

A large scale field operational test (FOT) is needed to answer these questions.

**sim**\textsuperscript{TD} provides this FOT and is the next necessary step to prepare for an informed deployment decision for cooperative systems.
Topics of simTD

Demonstration and evaluation of the effectiveness of applications in three categories
- Mobility / traffic management
- Safety / hazard warning
- Additional / commercial services

Further refinement and validation of technologies/systems for C2X communication developed in recent years.

Prototypical setup of a communication network
- Integration of traffic management centers / traffic agencies via car-to-infrastructure communication (IRS), networking of IRS and servers
- Setup of a hybrid system: Cellular radio (e.g., GSM/UMTS) as baseline, short-range communication technology (based on ITS-G5A IEEE 802.11) to enable real-time operation.

Prototype car communication unit (CCU) and roadside station (IRS)

Assess deployment strategies and models for operation of C2X communication, economic implications
Project Facts

- simTD is a joint project by leading German automotive manufacturers, suppliers, telecommunication companies and research institutions as well as public authorities.
- The project is sponsored and supported by
  - the Federal Ministry of Economics and Technology (BMWi),
  - The Federal Ministry of Education and Research (BMBF), and
  - the Federal Ministry of Transport, Building and Urban Development (BMVBS).
- simTD is also supported by the state of Hesse, the German Automobile Industry Association and the C2C Communication Consortium.
- Budget / Funding: appr. 53 Mio. € / appr. 30 Mio. € plus additional infrastructure investment.
Consortium

**simTD: Partner**

- Automobilhersteller:
  - Audi
  - BMW Group
  - DAIMLER
  - Ford
  - VOLKSWAGEN

- Zulieferer:
  - BOSCH
  - Continental
  - Deutsche Telekom

- Wissenschaft:
  - Fraunhofer
  - TU Berlin
  - TUM
  - HTW
  - IZVW

- Öffentliche Einrichtungen:
  - Hessisches Landesamt für Straßen- und Verkehrswesen
  - Stadt Frankfurt am Main

- Bundesministerien:
  - Bundesministerium für Wirtschaft und Technologie
  - Bundesministerium für Bildung und Forschung
  - Bundesministerium für Verkehr, Bau und Stadtentwicklung

**simTD: Förderer**

- Hessisches Landesamt für Straßen- und Verkehrswesen

**Unterstützer**

- VDA: Verband der Automobilindustrie

CAR 2 CAR COMMUNICATION CONSORTIUM
Schedule

Phase 1

- SP 1 Requirements
- SP 2 System design
- SP 3 System integration
- SP 4 Field Test
- SP 5 Assessment and framework

Phase 2

Phase 3

Start of project

End of project

Penetration (#IVS, #IRS)

Time
Current Status of sim\textsuperscript{TD}

- Subproject 1 „Requirements“ finished.
- Subproject 2 „System Design“ finished. Main results:
  - sim\textsuperscript{TD} system architecture derived.
  - Milestone MS2 “System architecture” achieved.
  - First implementation of all system components and functions finished.
  - Milestone MS4 („subsystems available“) achieved.
- Focus of work currently in subproject 3 „System Integration“.
  - MS5 („Setup of OEM test fleet finished“) achieved.
  - Setup of sim\textsuperscript{TD} test site (closed to the public, Ray Barracks, Friedberg) finished.
  - MS6 („Overall system works on closed sim\textsuperscript{TD} test site“) achieved.
  - Ongoing: Further system and function testing on sim\textsuperscript{TD} closed test site. Preparation of system freeze for rollout.
- Further work:
  - Subproject 4: Work on experiment design.
  - Subproject 5: Continuation of work on introduction scenarios and operation models, preparation of evaluation of experiment results.
The simTD Applications

Traffic
- Monitoring of traffic situation and complementary information/basic functions
  - Data collection in the infrastructure side
  - Data collection by the vehicle
  - Identification of road weather
  - Identification of traffic conditions
  - Identification of traffic events/incidents
- Traffic (flow) information and navigation
  - Foresighted road/traffic information
  - Road works information system
  - Advanced route guidance and navigation
- Traffic management
  - Alternative route management
  - Optimized urban network usage based on traffic light control
  - Local traffic-adapted signal control

Driving and safety
- Local danger alert
  - Obstacle warning
  - Congestion warning
  - Road weather warning
  - Emergency vehicle warning
- Driving assistance
  - In-vehicle signage/traffic rule violation warning
  - Traffic light phase assistant / Traffic light violation warning
  - Extended electronic brake light
  - Intersection and cross traffic assistance

Additional services
- Internet access and local information services
  - Internet-based usage of services
  - Location-dependent services

See also newsletter and website
www.simTD.de
System architecture of simTD

IVS: ITS Vehicle Station
IRS: ITS Roadside Station
VsZ: Versuchszentrale
VZH: Verkehrszentrale Hessen
IGLZ: Integrierte Gesamtleitzentrale
Requirements on the sim\textsuperscript{TD} Architecture

- Requirements of Functions
- Technical Restrictions
- Validation Goals
- Expectations of Project Partners
- Requirements of the FOT
- Properties of Available Systems
- Cost

System Architecture
Communication Channels within simTD

- ITS G5 (IEEE 802.11p)
  - C2X communication, car ↔ car or car ↔ infrastructure
- „Consumer WLAN“ (IEEE 802.11 b/g)
  - C2X communication, car ↔ car or car ↔ infrastructure
  - IPv6-based communication, e.g., car ↔ ITS central station
- ITS IMT Public (UMTS)
  - IPv6-based communication, e.g., car ↔ ITS central station
  - C2X communication, e.g. car ↔ „geo-server“ ↔ cars in neighborhood
- Support/application of Mobile IPv6
Vehicle Subsystem

- ITS Vehicle Station
  - Application Unit (AU) (Functions & System Services)
  - Communication and Control Unit (CCU) („Communication/Router“ Unit)
- HMI Device (Interaction with Driver)
- Optional: OEM Device (Equipment for OEM-specific special functions)
The simTD test site is closed to the public and used for system and function testing prior to experiment on public roads in the simTD test field.
Test Field Germany

Obstacle Warning
Road Works Information
Congestion Warning
In-vehicle Signage
Road Weather Warning

Advanced Route Guidance
Road/Traffic Information
Alternative Route Mgmt.
Traffic Light Phase Assistant
Optimized Urban Network Usage Based on Traffic Light Control
Location-Based Services

The entire simTD Test Field Hesse, centred around the Hessian metropolis Frankfurt am Main.

- The motorway sections
- The rural roads
- The inner-city roads

All Areas: Detection of Traffic Situation
Summary and Conclusion

simTD is the first field operational test that is large enough to

- test and validate technologies and systems for C2X communication in a real-life environment that exceeds the demonstrator status,
- to examine the entire spectrum of applications with regard to the effects on traffic safety and efficiency, and
- to assess operating models and introduction scenarios.

simTD is the next necessary step to prepare for an informed deployment decision.
Today's demonstration

- Road works information
- Obstacle warning
- Road weather warning
- Emergency vehicle warning
- Traffic sign assistant
- Extended electronic brake light
- Traffic light assistant
- Parking lot information
Today’s exhibits

Roll-Ups
• General project information
• simTD test field
• Use cases (overview)
• Log station

Poster mit Demo
• Monitoring
• Experiment control
• simTD test bench
• HMI
• simTD vehicle & motor bike (IVS)
• IRS
• CCU
• Driving simulation
• Traffic simulation
• Traffic situation & ICS
DRIVE C2X @ simTD
Organisation of the day

9:30  Welcome
10:00 Demonstrations & Expositions
12:00 Lunch
13:00 Workshop – System Architecture
14:00 Workshop – FOT Operations
15:00 Coffee
15:30 Evaluation Methodology
16:30 Conclusion

• Driving demonstration are organized in groups. Please find the time corresponding to your name tag label at the registration
• Please find the translations of the roll-up posters in the agenda
Thank you for your attention