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 2006:
appr. 420,000 injured pers.
appr. 5000 fatalities
in Germany
(Source Statistisches Bundesamt Germany, 2008)

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
  • PRE-SAFE® (since 2002)

• Today: „See“
  • Observe vehicle environment with radar
  • PRE-SAFE® Brake (S-class since 2006)

• 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
How Can Communication Help?

Reduce CONGESTION

- Improve Traffic Information
- Improve Situational Roadway Awareness
  - Real Time Traffic Information*
  - Emergency Situation Management*

Reduce ACCIDENTS

- Improve Driver Situational Awareness
- Minimize Effects of Driver Error
  - Extended Electronic Brake Light*
  - Intersection Collision Warning*

*Representative examples
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 (approx. 300 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
On the Way to a Communication System for Improving Road Safety and Efficiency - Cooperation Model

Hazard warning triggered by hazard flashers

WLAN based vehicular ad hoc networks

Driver information and warning

Cooperative driving

Communication based vehicle control

*Non-exhaustive list of projects with focus on communications, many other candidate projects for cooperation in the area of applications.
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 trial (FOT) is needed to answer these questions.

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

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 (RSUs), networking of RSUs 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 unit (RSU)

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 Education and Research (BMBF),
  - the Federal Ministry of Economics and Technology (BMWi), 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 Consortium.
- Duration: September 1, 2008 – August 31, 2012
- Budget / Funding: appr. 53 Mio. € / appr. 30 Mio. € plus infrastructure investment
## Consortium

### Vehicle Manufacturers
- Audi
- BMW
- DAIMLER
- Ford
- Opel
- VOLKSWAGEN

### Suppliers
- BOSCH
- Continental
- Deutsche Telekom

### Network Operator
- T

### Science
- Fraunhofer
- TU Berlin
- Technische Universität München
- HTW
- IZVW

### Public Institutions
- Hessische Landesregierung für Verkehrswirtschaft
- Stadt Frankfurt am Main

### Federal Ministries
- Federal Ministry of Economics and Technology
- Federal Ministry of Education and Research
- Federal Ministry of Transport, Building and Urban Development

### Supporters
- Hessen
- VDA
Test Field Germany

- Obstacle Warning
- Road Works Information
- Congestion Warning
- Invehicle 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
**Schedule**

### Phase 1
- Requirements
- Specification of architecture
- Prototype implementation of CCU and RSU

### Phase 2
- Equipped research vehicles and system test
- Production of CCUs and RSUs
- Ramping-up of test fleet and test region
- Start of FOT execution

### Phase 3
- Test region equipped
- Several hundred vehicles and RSUs available
- Large-scale FOT
- Evaluation

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Start of project | End of project
Current Status of simTD

- Subproject 1 „Requirement Analysis“ finished
- Focus of work currently in subproject 2 „System Design“
  - simTD system architecture derived
  - Milestone MS2 “System architecture” achieved
  - Main topic is currently the implementation of all system components and functions.
  - Next milestone MS4 („subsystems available“) scheduled for YE 2010
- Further work:
  - Subproject 3: Preparation of test site and selection of fleet.
  - Subproject 4: Work on experiment design
  - Subproject 5: Continuation of work on introduction scenarios and operation models, preparation of evaluation of experiment results.
## List of sim\textsuperscript{TD} Functions

### 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 situation
  - 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

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See also newsletter and website

www.simTD.de
Requirements on the simTD 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 $\leftrightarrow$ car or car $\leftrightarrow$ infrastructure
- „Consumer WLAN“ (IEE 802.11 b/g)
  - C2X communication, car $\leftrightarrow$ car or car $\leftrightarrow$ infrastructure
  - IPv6-based communication, e.g., car $\leftrightarrow$ ITS central station
- ITS IMT Public (UMTS)
  - IPv6-based communication, e.g., car $\leftrightarrow$ ITS central station
  - C2X communication, e.g. car $\leftrightarrow$ „geo-server“ $\leftrightarrow$ cars in neighborhood
- Support/application of Mobile IPv6
- Security architecture integrated from scratch
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)
Summary and Conclusion

sim\textsuperscript{TD} is worldwide the first field operational trial 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.

sim\textsuperscript{TD} is the next necessary step to prepare for an informed deployment decision.
The simTD project provides the basis for increased traffic efficiency and road safety by researching and testing car-to-x communications in a real-world environment.

To this end, the potential of communication-based applications as well as operator and roll-out models will be investigated and evaluated in a large-scale test field.
Thank you for your attention