Integrating C-ITS in existing ITS infrastructure – strategy and practical experiences of a road operator

Dr. Achim Reusswig, Gerd Riegelhuth, Dr. Carsten Kühnel
Hessen Mobil – Road and Traffic Management
• Why does Hessen Mobil want C-ITS – Motivation
• How to get Stakeholders Interests in line – Organisational Issues
  – Harmonization of Stakeholder Interests
  – Legal Framework
• How to get the System Running – Functional and Technical Issues
  – System Architecture
  – Roadside Infrastructure
  – Backend Level
  – Security
• Résumé
Hessen aims at securing mobility and accessibility despite growing challenges
- growing business allocation in Hessen especially in Frankfurt RhineMain Area leads to growing population density
- growing traffic loads because of commuting and transit traffic

Hessen Mobil has been frontrunner in operation of advanced traffic management systems for years

Hessen Mobil began to invest in development of future technologies starting in the early 1990s lasting until today

Cooperative ITS is the next step towards solving current challenges of future traffic

Motivation – Why does Hessen want to join C-ITS-Deployment?
• Collaboration of different groups of private and public stakeholder gives new challenges

• In this context "cooperative" does not only refer to interacting technical components, but also to stakeholders behind the technology

• Actors, who in the traditional roles were in no relation to one another, might become partners, because of (partly) common objectives.

• For a smooth operation a closely networked and meticulously coordinated cooperation of national public operators and vehicle manufacturers is required

• The international dimension makes this change of roles and responsibilities even more complex

• Because of the international EU market, many roles and responsibilities can no longer be defined at the national level
Harmonization in Cooperative Systems

Cooperative ITS Corridor

– International Strategic Coordination Team for harmonization on the strategic level

– International Operational Coordination Team for harmonization on an operational level

– National Steering Groups for country-specific stakeholder harmonization
Harmonization in Cooperative Systems

• **Car to Car Communication Consortium**
  – Harmonization of many aspects regarding C-ITS deployment by European vehicle manufacturers and their suppliers with little participation of road operators for I2V-services on different levels
  – e.g. compliance assessment, road maps...

• **Amsterdam Group**
  – Facilitation of information exchange, discussion and creation of solutions between the involved stakeholders in the context of C-ITS
System Architecture – Main Challenges

- Setting up an interoperable decentralized system architecture for use in 16 federal states with heterogenous framework requirements
  - Development of ITS Roadside Station with countrywide harmonized interface to ITS Central Station
  - Development of ITS Central Station with federal state specific interface to the respective Traffic Control Center

- Setting up a communication system compliant to standards specified by vehicle manufacturers
  - Harmonizing vehicle requirements with road operator facilities for RWW Service
  - Harmonizing road operator requirements with vehicle manufacturers business cases for improved traffic management service
ITS Roadside Station

- **Existing ITS Infrastructure**
  - DORA System for *Dynamic POsitioning of Short Term Roadworks*
    - Detection of timestamp, position, speed, heading, arrow position of the warning trailer
    - Transmission to Traffic Control Center
    - Data procession and usage in roadworks management systems

- **Integration of I2V-Communication via ETSI ITS G5 in existing DORA Infrastructure**
  - Using DORA-Infrastructure to generate Road Works Warning Message Content
  - Using content to generate Decentralized Environmental Notification Message (DENM) for transmission to vehicle
ITS Central Station

• Existing ITS Infrastructure
  – 16 Federal States in Germany with heterogeneous framework requirements
    • Few federal road operators have technical know how regarding cooperative technologies
    • Few federal road operators have dynamic positioning of short term roadworks services in operation
    • Many different types of Traffic Control Centers and interfaces in operation

• Centralized Approach of ICS Development and Decentralized Approach of ICS Operation
  – Hessen Mobil develops ICS modules on behalf of the Federal Ministry of Traffic and Digital Infrastructure (BMVI)
  – ICS modules shall be vastly transferable to all kinds of Traffic Control Centers
  – Modular approach for ICS modules to ease integration in existing TCC architectures
ITS Central Station

- ICS Architecture for TCC Integration
Privacy & Security

• **Anonymous Information**
  – Can not be linked to one user → private access
  – Technical means to restore identity must not exist
  – Possible threat to security, no prosecution possible

• **Pseudonyms**
  – Certificates are not explicitly linked to one user
  – Technical means to restore identity may exist
  – Compromise between security and privacy needed

• **Personally Identifiable Information**
  – Explicitly linked to one user → secure access
  – Technical means to restore identity not needed
  – Possible threat to privacy, PII can be gathered & fused

---

How to get the System running – Functional / Technical Issues

Random numbers, salted&hashed, etc....

Pseudonyms

- Varying technical complexity
- Varying organisational complexity
- Various levels of security
- Various levels of privacy

Credit card, license, passport, etc....
• Public and private Root Certificate Authorities separated
  – PCs exchanged – common rules ensure interoperability
  – Only valid within public PKI – different policies used

• Allows to update policies independently
• Different security levels possible while being interoperable
  – Public LTCs might start with different certificate format and key length
• Public road operators have interest in joining C-ITS-Deployment to counter increasing challenges in future traffic
• C-ITS-Corridor builds foundation for European deployment
• Different challenges to overcome in each of the 3 countries
• Integration of new technologies in existing ITS infrastructures of different characteristics necessary
• Harmonization with different groups of stakeholders necessary
  – road operators ↔ automotive industry
  – national road operators ↔ other national road operators
  – national road operators ↔ International road operators
  – ...
• Creative solutions and willingness to accept compromises inevitable
Thank you for your kind attention

Project lead Cooperative ITS Corridor
Federal Ministry of Transport and Digital Infrastructure
Dipl.-Ing. Konstantin Sauer
Robert-Schuman-Platz 1, 53175 Bonn
Ref-StB12@bmvi.bund.de

Project office Cooperative ITS Corridor
c/o K&S GmbH Projektmanagement
Dr. Andreas Kreutzer
Fon +49 (241) 160 1959,
Fax +49 (241) 160 1963,
office@c-its-corridor.de

www.c-its-corridor.de
• Backup
Simplified Scheme of Services

Communication via ETSI G5
Communication via cellular networks
Communication via internet/cable

Service #1: I2V
Service #2: V2I

* Mobility Data Marketplace www.mdm-portal.de
System Architecture contains:

• General overview
• Detailed description of both services
• Description of separated process steps
• Draft specification of functional modules
• Definition of interfaces and data flows

• System Architecture developed in PG 1
• First implementation in development phase in Hessen (PG 2 & PG 4)
• Adjustment of architecture aspects <-> Feedback from implementers

• Detailed specification of modules in PG 2 (ICS) and PG 4 (IRS)

Download available: www.c-its-corridor.de
• Trust Models with one domain
  – Potentially less complex
  – Common policy requires agreement of all stakeholders
  – Mutual trust: highest security level needs to be agreed on

• Trust Models with several domains
  – Potentially more complex
  – Different policies according to individual requirements
  – Mutual trust: baseline security needs to be agreed on