Cooperative ITS Corridor – Joint Deployment

Business Model Consideration for the C-ITS-Corridor in Germany

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• Motivation

• Applications

• Operational Concept

• Organisational Interfaces between Stakeholders
• Federal government has responsibility for public easement for arterial roads traffic

• 16 Federal States
  – responsible for road operation in each respective territory
  – very heterogeneous state of the art of traffic management infrastructure due to different kinds traffic related frame conditions

• No formal commitment to C-ITS deployment by the automotive industry in entirety
  – high risk of investment in C-ITS infrastructure – Return on Investment unsure
  – no business models for support of traffic management related applications could be identified (PVD e.g.)

• Operation of C-ITS in federal structure with a lot of different stakeholders has to be ensured
Limited Functional Scope in Day 1 Deployment

Paths for C-ITS Deployment in theory

Application Width

Starting Point

Application Depth

Final C-ITS Deployment
Objectives for C-ITS deployment from a road operators perspective

- **Support of C-ITS-Deployment**
  - Provision of comprehensive C-ITS-Services from the start
  - Avoid „island solutions“

- **Generation of benefits on road user and road operator issues**
  - Applications have to serve all stakeholders interests
  - Generate „Win-Win-Situations“

- **Minimization of investment risks**
  - Responsible investment in road side and central infrastructure
  - Applications with less amount of Roadside Stations have to be identified

- **Assure unobstructed operation in federal infrastructure surroundings**
  - Small portfolio of functionality eases implementation of operational infrastructures
  - After organisational issues are solved implementation of further functionality is easier to achieve
## C-ITS Day One Services

<table>
<thead>
<tr>
<th>#</th>
<th>Day 1 Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Emergency electronic brake light</td>
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<tr>
<td>2</td>
<td>Emergency vehicle approaching</td>
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<tr>
<td>3</td>
<td>Slow or stationary vehicle(s)</td>
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<tr>
<td>4</td>
<td>Traffic jam ahead warning</td>
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<td>5</td>
<td>Hazardous location notification</td>
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<tr>
<td>6</td>
<td>Road works warning</td>
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<tr>
<td>7</td>
<td>Weather conditions</td>
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<tr>
<td>8</td>
<td>In-vehicle signage</td>
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<td>9</td>
<td>In-vehicle speed limits</td>
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<td>10</td>
<td>Probe vehicle data</td>
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<tr>
<td>11</td>
<td>Shockwave damping</td>
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<tr>
<td>12</td>
<td>Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)</td>
</tr>
<tr>
<td>13</td>
<td>Signal violation/Intersection safety</td>
</tr>
<tr>
<td>14</td>
<td>Traffic signal priority request by designated vehicles</td>
</tr>
</tbody>
</table>

Support of C-ITS-Deployment

• Support deployment of innovative technologies in the EU and contribute to increased productivity, growth and skilled jobs in Europe

• Support for the penetration of C-ITS technology in the vehicle fleet by communicating up-to-date, precise and direct information in vehicles

• Support driver experience of C-ITS services by contributing to a richer bundle of services, which is especially relevant in the phase of initial deployment where the critical mass to enable V2V communication is not yet reached
Generation of benefits on road user and road operator issues

• **Road User**
  – improved road safety in general due to early notification of roadworks in the motorway network
  – avoiding accident caused congestion

• **Road Operator**
  – increased safety of the site personnel due to warning of approaching vehicles in the vicinity of roadworks
  – better (on-line) information on the actual position of short-term roadworks and the ongoing phase of long-term roadworks for traffic control centres
  – more reliable information for roadworks planning and management
  – potential for improving network control of road operators
• **Minimization of investment risks**
  – Functional scope limited to Road Works Warning (short term)
  – limited fleet of Road Works Safety Trailers (3000 in Germany)
  – limited to high level road network (Bundesautobahn and Bundesstraßen)
  – rather short lifetime of assets (approx. 2 years)

• **Assure unobstructed operation in federal infrastructure surroundings**
  – collecting hands-on experience with new communication channels
  – make know-how transferable/usable for further service deployment of road authorities and operators
Business Model Canvas (Osterwalder Pigneur 2009) as tool for mapping partnerships, cost and revenues, value propositions etc.

⇒ application to Road Works Warning service
# Business Model Canvas for RWW

**The Business Model Canvas**

<table>
<thead>
<tr>
<th>Key Partners</th>
<th>Key Activities</th>
<th>Value Propositions</th>
<th>Customer Relationships</th>
<th>Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Federal Government</td>
<td>- Development and implementation of technical system components</td>
<td>- Precise, reliable, real time information of road users about short term road works sites</td>
<td>- B2B: Service Providers (content for Services)</td>
<td>- ETG/ITS OS (IEEE 802.11p)</td>
</tr>
<tr>
<td>- Ministries</td>
<td>- Implementation operational infrastructure (traffic and org.)</td>
<td>- Increases of overall traffic safety at short term road works sites</td>
<td>- B2C: Road Users getting RWW Message</td>
<td>- Cellular Communication via background</td>
</tr>
<tr>
<td>- Agencies</td>
<td>- Securing Interoperability between deployment partners</td>
<td>- Increased safety of the road works site personnel</td>
<td>- Universal service</td>
<td>- Digital Audio Broadcast</td>
</tr>
<tr>
<td>- Federal State Road Operators</td>
<td>- Operation of C-ITS infrastructure</td>
<td>- Improved state of information for strategic route planning</td>
<td>- No customisation envisioned</td>
<td>- Internet services</td>
</tr>
<tr>
<td>- Road Infrastructure Industry</td>
<td>- Ensuring IT-Security and privacy</td>
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<td></td>
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<tr>
<td>- Incl. Suppliers</td>
<td>- Further development of functionality</td>
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<tr>
<td>- Automotive Industry</td>
<td>- Problem. Change, and Rekswagenagement</td>
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<tr>
<td>- Incl. Suppliers</td>
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<tr>
<td>- Information Brokers</td>
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<tr>
<td>- Public and Private Service Providers</td>
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<tr>
<td>- Road Users</td>
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<tr>
<td>- Communication Network Operators</td>
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<tr>
<td>- Private Road Works Contractors</td>
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<tr>
<td>- other Deployment Partners</td>
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<tr>
<td>- Neighboring Countries</td>
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<td>- Legal Framework Providers</td>
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<tr>
<td>- Standardization Organizations</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Customer Segments</th>
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<td>- Mass market (B2B, B2C)</td>
<td>- Targeting passenger and freight transport</td>
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<tr>
<td></td>
<td>- Universal service</td>
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<tr>
<td></td>
<td>- No customisation envisioned</td>
</tr>
</tbody>
</table>

**Key Resources**

- Roadside and central C-ITS infrastructure (C-ITS-G, RV-ITS-G)
- Financial resources (investment and operational cost)
- Human resources for operation (personnel not available yet, cultural awareness)
- Intellectual resources (multi disciplinary skills)

**Cost Structure**

- Investment costs
- Operating costs
- Maintenance costs
- Cost for predevelopment and testing (cross testing)

**Revenue Streams**

- No revenues from road users and service providers
- Falls under scope of Del. Reg. 868/2013
- Non monetary revenues by means of
  - Road and maintenance worker safety
  - Improved state of information for traffic control, road works management
  - Improved traffic safety at short term road works site
Going live with the C-ITS Corridor poses some major challenges ... 

- C-ITS Corridor is not a mere research project, it is deployment
- Reliability of system and processes essential prior to deployment
- Smooth cooperation with different stakeholders (authorities, automotive industry, etc)
- Cooperation across regional borders in the Federal State of Germany
- Cooperation across national borders

 ➔ A framework is needed that delivers:
   - A common understanding of the processes to be implemented
   - A clear outline of responsibilities
In view of the upcoming trial operation and system roll-out of the C-ITS Corridor in Germany, Hessen Mobil began work on an operational framework for Cooperative Systems in the 4th quarter of 2015.

The operational framework includes:

- generic role model
- definitions and assignments of processes
- definitions of interfaces with external parties
- allocation of responsibilities for the German part of the C-ITS Corridor.
- a framework for a generic operating concept
Main objectives of the operational framework

- Provision of an organisational description for the operation of cooperative systems to ensure an effective usage by all parties
- Provision of guidelines and recommendations for the development of stakeholder-specific operating concepts and manuals

Scope of the operational framework

- Operational framework addresses
  - German Federal public road operators with soon to be operating cooperative systems
  - German Federal Government as the overall regulatory instance
- Operational framework includes descriptions of interfaces to
  - Private stakeholders (i.e. automotive industry)
  - Third-parties
  - Neighbouring countries or road operators.
Methodology and approach of the operational framework

• Based on ITIL® V3 (IT Infrastructure Library) and on ISO TS 17427
• Representation of process chains for services (end-to-end)
• Development of a generic role model
• Assignment of
  – tasks to roles
  – roles to actors
• Provision of an overview of basic operational processes, based on task catalogues (to be detailed in operating concepts)
• Proposal for a gradual, step-by-step approach, in order to design the most important operational processes first
Part 1: Fundamentals

- Addresses Federal Government, states and road operators
- Environment, role definition, definition of tasks and responsibilities
- Assignment of roles to actors
- Derivation of process chains for services
- Requirements to external interfaces
- Criteria for design a framework of an operating concept

Part 2: Framework of an operating concept

- Addresses Federal Government, states and road operators
- Detailed elaboration of processes
- Detailed description of functions in tools and the usage of standard forms
- Detailed description of interfaces and description of general instructions
- Criteria for implement processes

Operational framework for Cooperative Systems

Operating concepts / manuals

- Addresses employees of actors
- Detailed elaboration of processes
- Assignment of roles to positions
- Detailed description of functions in tools and the usage of standard forms
- Adaption of processes to the organization of the actor
- Description of specific instructions
Operational Framework – Area of Design

Actors:
- Federal State Road Operators
- Federal Government (BMVI, BAdT)
- Automotive Industry
- Neighbouring Countries
- Service Provider
- Infrastructure PKI Operator

Interfaces:
- VRZ – Traffic control centre
- FAT – Road Works Safety Trailer
- ICS – ITS Central Station
- IRS – ITS Roadside Station
- IVS – ITS Vehicle Station
- PKI – Public key infrastructure
- SP – Service Provider
Operational Framework – Role Model

Role Model & Communication between Roles

Legend:
- Communication channel
- Actor Federal State Road Operators
- Actor Federal Government
Operational Framework – Process Chain

1. Service

1. Service/ Standard solution for short term Road Works Warning (RWW)
Communication channels: cellular network

- **Content detection**
  - Data pre-processing
  - Data reception
  - Communication

- **Content processing**
  - Data processing
  - Quality check
  - Content delivery

- **Service provision**
  - Content reception
  - Service generation
  - Pre-formatting
  - Service delivery

- **Service presentation**
  - Service reception
  - Service decoding
  - Service handing
  - Service presentation

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**IRS Operator**

**ICS Operator**

**Kommunikations-provider**

**Service Application Provider**

**IVS Operator**

**VRZ Operator**

**Road Infrastructure Operator**

**Infrastructure PKI Operator**
Sample Role *IRS Operator*: Role Characteristics

<table>
<thead>
<tr>
<th>Role description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IRS Operator</td>
<td>Ensures a reliable operation of the overall &quot;IRS&quot; subsystem within the C-ITS Corridor. IRS operate either in independent mode (no communication with the assigned ICS) or interacting with the assigned ICS.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area</th>
<th>Actor</th>
<th>Interfaces (internal)</th>
<th>Interfaces (external)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Operation</td>
<td>Federal States</td>
<td>ICS Operator</td>
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<tr>
<td></td>
<td></td>
<td>Service Manager</td>
<td></td>
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<td></td>
<td></td>
<td>Compliance Manager</td>
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<td></td>
<td></td>
<td>PKI Operator</td>
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<td></td>
<td></td>
<td>IVS Operator</td>
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</tr>
</tbody>
</table>
Sample Role **IRS Operator**: Task Catalogue (excerpt)

- Initial Operation of IRS
- IRS operation
  - monitoring
  - service reporting
  - problem management
- ...
Next steps

• Development of an operating concept for Hessen Mobil and the Ministry of Transport (Federal Govt.) with pertinent operation procedures

• Start of trial operation in October 2016
  – 20 safety trailers involved, operating in the Frankfurt Rhine-Main area
  – Hessian Traffic Control Centre and 4 road maintenance units involved
  – 2 Operating concepts /-manuals (Federal Govt. and State of Hessen) being put into practice → Test of described operational processes
  – Field Operational Test of privacy and security subsystems, incl. initialisation and revocation processes

• Collection & processing of operating figures (Evaluation)
  – Assessment of functional & organisational aspects
  – Impact assessments
Thank you for your kind attention
Suggestions or Questions?

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