A Modular and Scalable Application Platform for Testing and Evaluating ITS Components (MoSAIC)

Tobias Lorenz

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Content

- Short Introduction
  - German Aerospace Center (DLR)
  - Institute of Transportation Systems (TS)
- MoSAIC
  - Motivation and Introduction
  - DOMINION
  - Architecture Approaches
  - Test Scenario and Results

Short Introduction – DLR and Institute TS

German Aerospace Center

Areas of Research

- Aeronautics
- Space
- Transport
- Energy

DLR in numbers

- Budget:
  - 2006 1.168 M Euro
  - 2007 1.224 M Euro



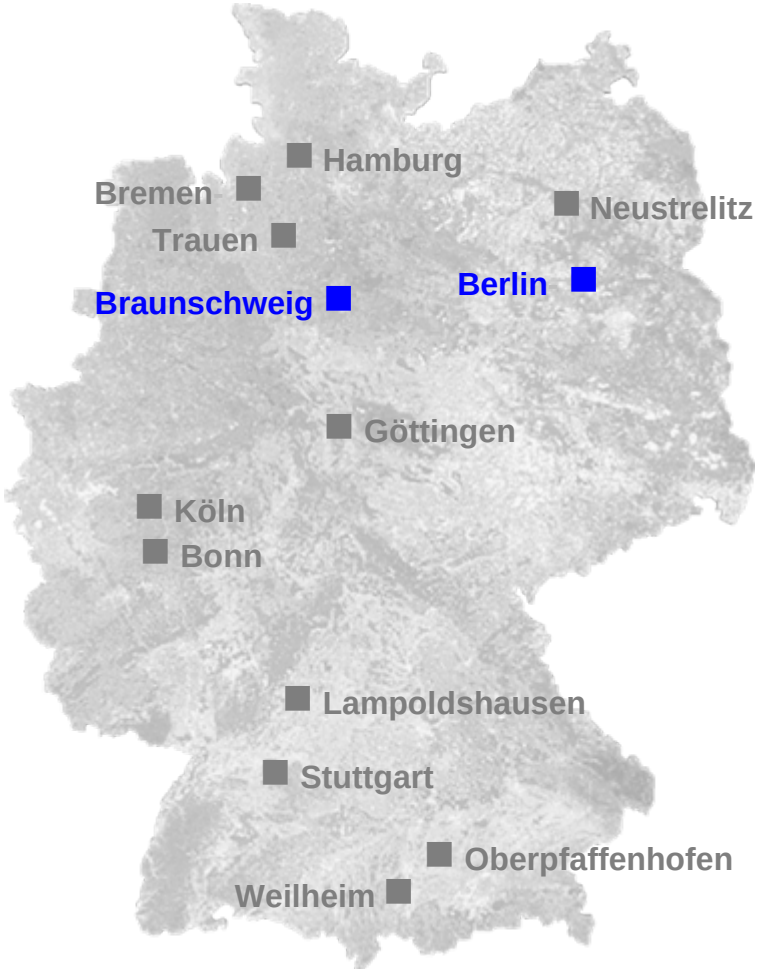


Locations and Employees

5.600 employees work at
28 research institutes and facilities at
13 locations (■ + ■).

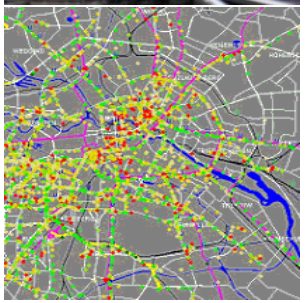
Offices in Brussels, Paris and Washington.

- **Institute of Transportation Systems (■)**



Institute of Transportation Systems

Residence:	Braunschweig and Berlin
Since:	March 2001
Director:	Prof. Dr.-Ing. Karsten Lemmer
Employees:	Currently 100 employees from various scientific disciplines



Range of tasks

- Basic research
- Creating concepts and strategies
- Prototype development

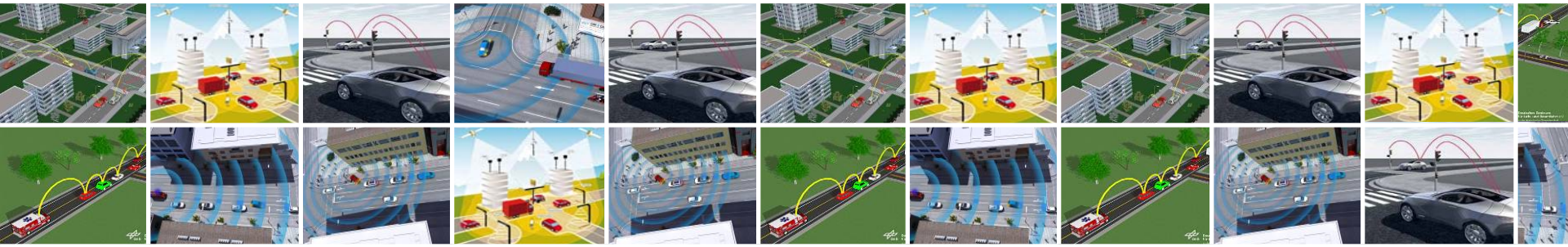
Fields of Research

- **Automotive**
- Railway Systems
- Traffic Management

MoSAIC – Motivation and Introduction

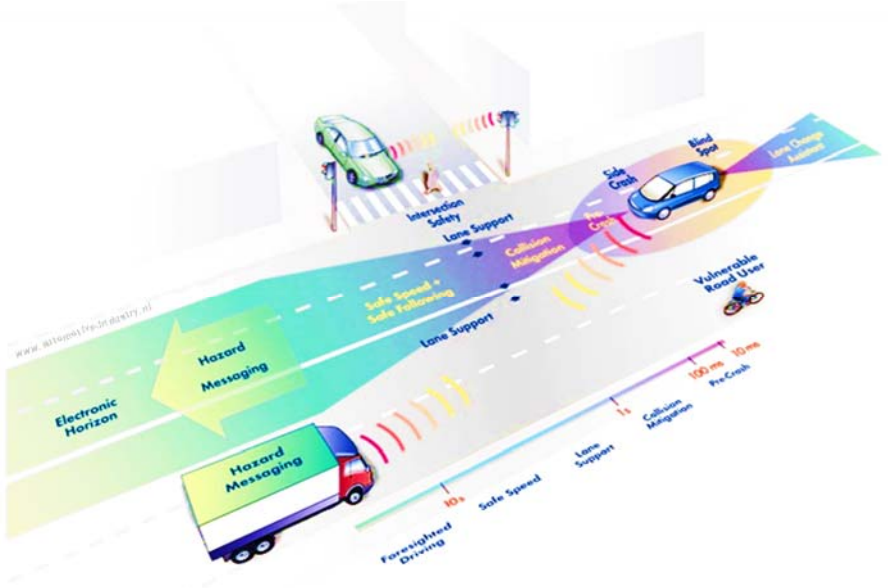
Motivation and Introduction

- The determination of requirements for cooperative assistance and automation based on *Vehicle-to-X* technologies emphasize research questions on different levels – for example:
  - Reliability / availability
  - Interaction between human and machine
  - Interoperability of assistance and automation systems / security
  - Different penetration rates and their influence on the function of the system, traffic safety/-efficiency, driver behavior and acceptance



Motivation and Introduction

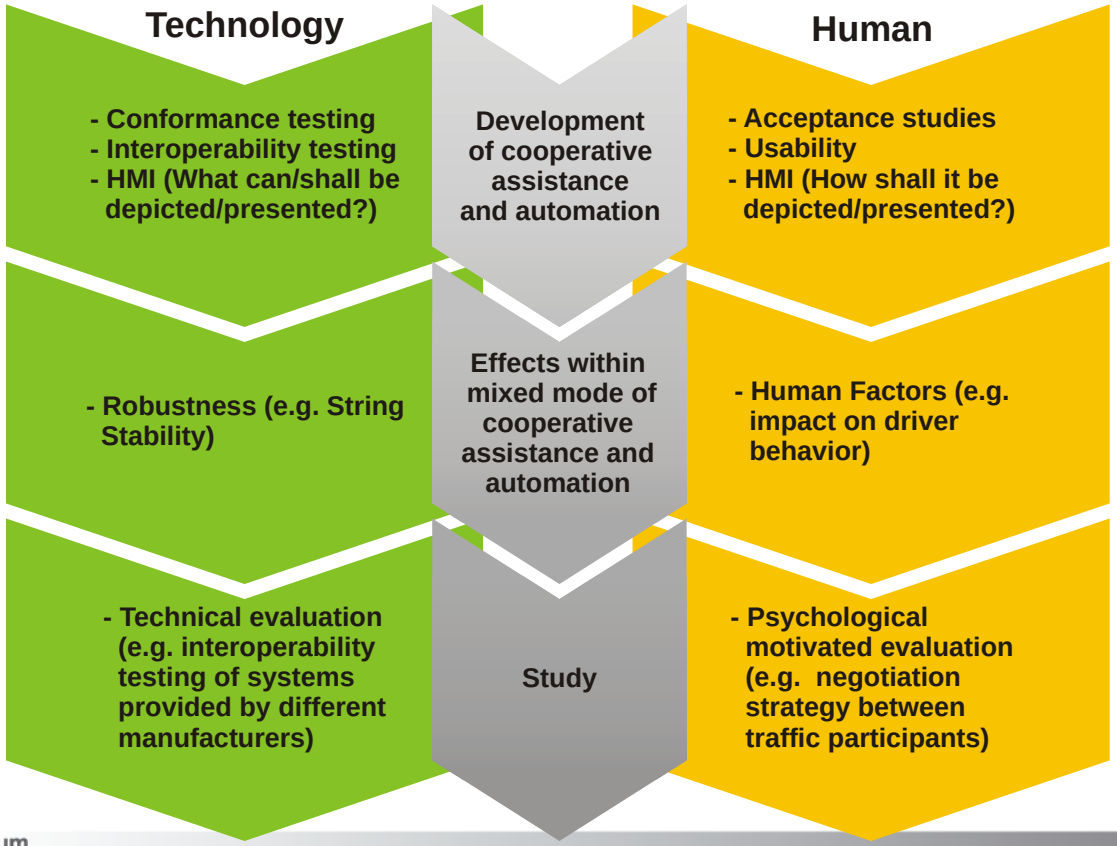
- Modular and Scalable Application-Platform for ITS Components
  - Laboratory infrastructure to determine requirements for cooperative assistance and automation in a context of urban traffic scenarios and their real-virtual instantiation



  - Design and development tool for real-virtual assistance and automation systems

Motivation and Introduction

- Requirements for MoSAIC are presented based on the addressed technology-driven and the human-centered fields of research



Motivation and Introduction

connected by DOMINION

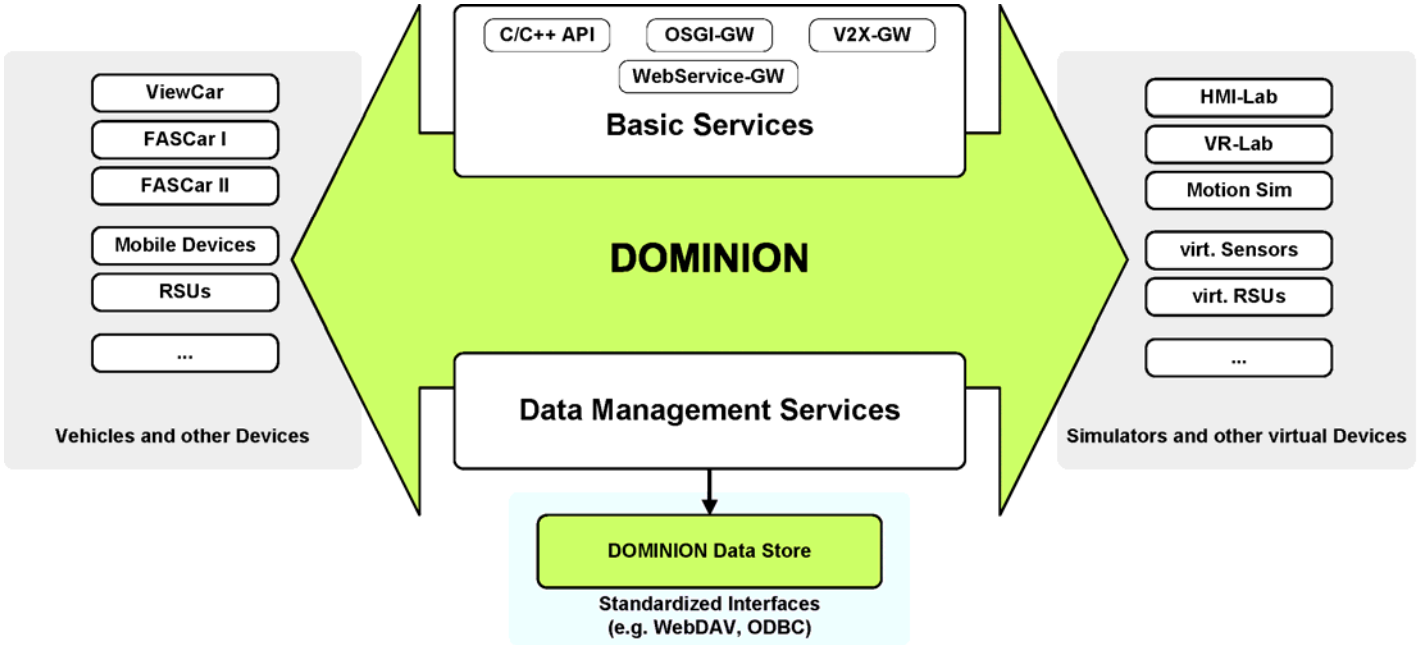
MoSAIC – DOMINION

DOMINION

- Developed by DLR
- Follows the paradigm of service-oriented architecture (SOA)
  - A service represents a delimited and defined performance, which is produced by an application module and consumed by other application modules
  - The service interface and the functional specification is strictly defined between using and providing application module
  - Services are able to collaborate – services from different context could be integrated within a new overall context (orchestration)
  - The loose coupling offers a high level of autonomy to service developers and providers

DOMINION

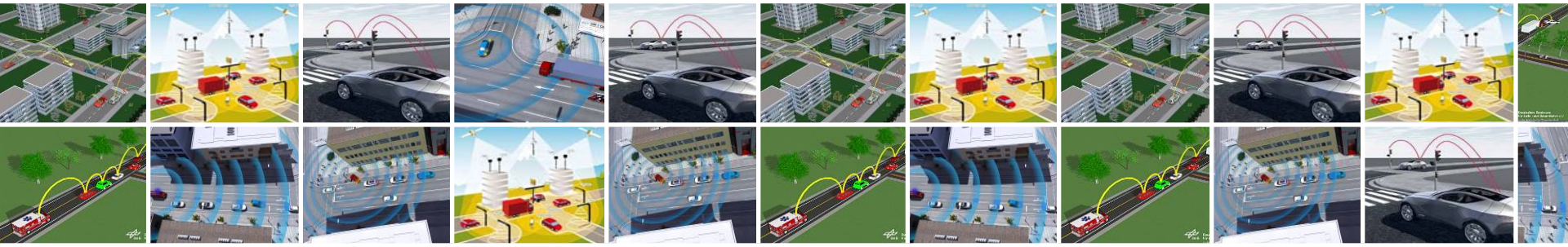
- Continuous development and runtime environment in all laboratories
- Formal description of services through VSDL (in-Vehicle-Service-Description-Language) derived from WSDL (WebService-Description-Language)
- Standardized, database supported collection of (test) data
- No expert knowledge about the research facilities necessary for the developer
- Fast development cycles on multiple platforms
- Different RTE



MoSAIC – Architecture Approaches

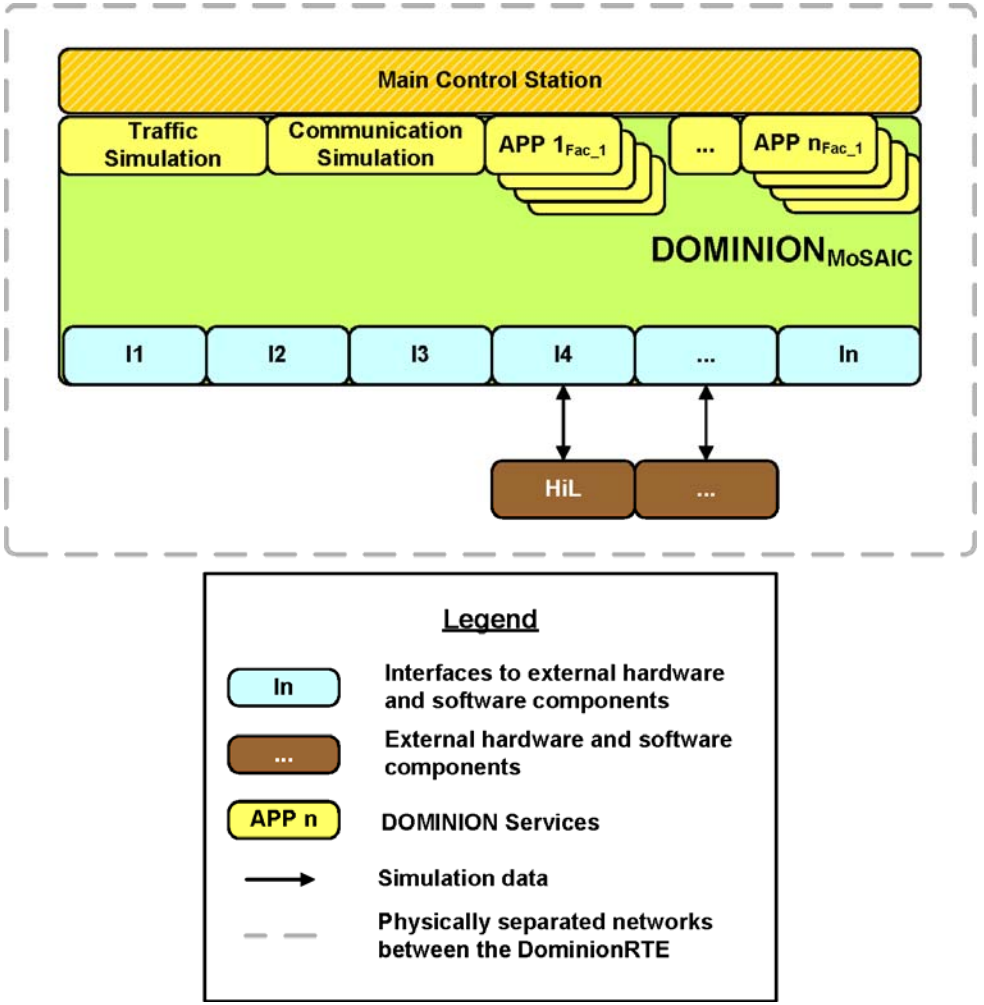
Architecture Approaches
Boundary Conditions

- Research facilities are spatial separated
- Each research facility has to be useable within MoSAIC and self-sufficient without huge efforts
- Maintenance effort should be kept on the same level



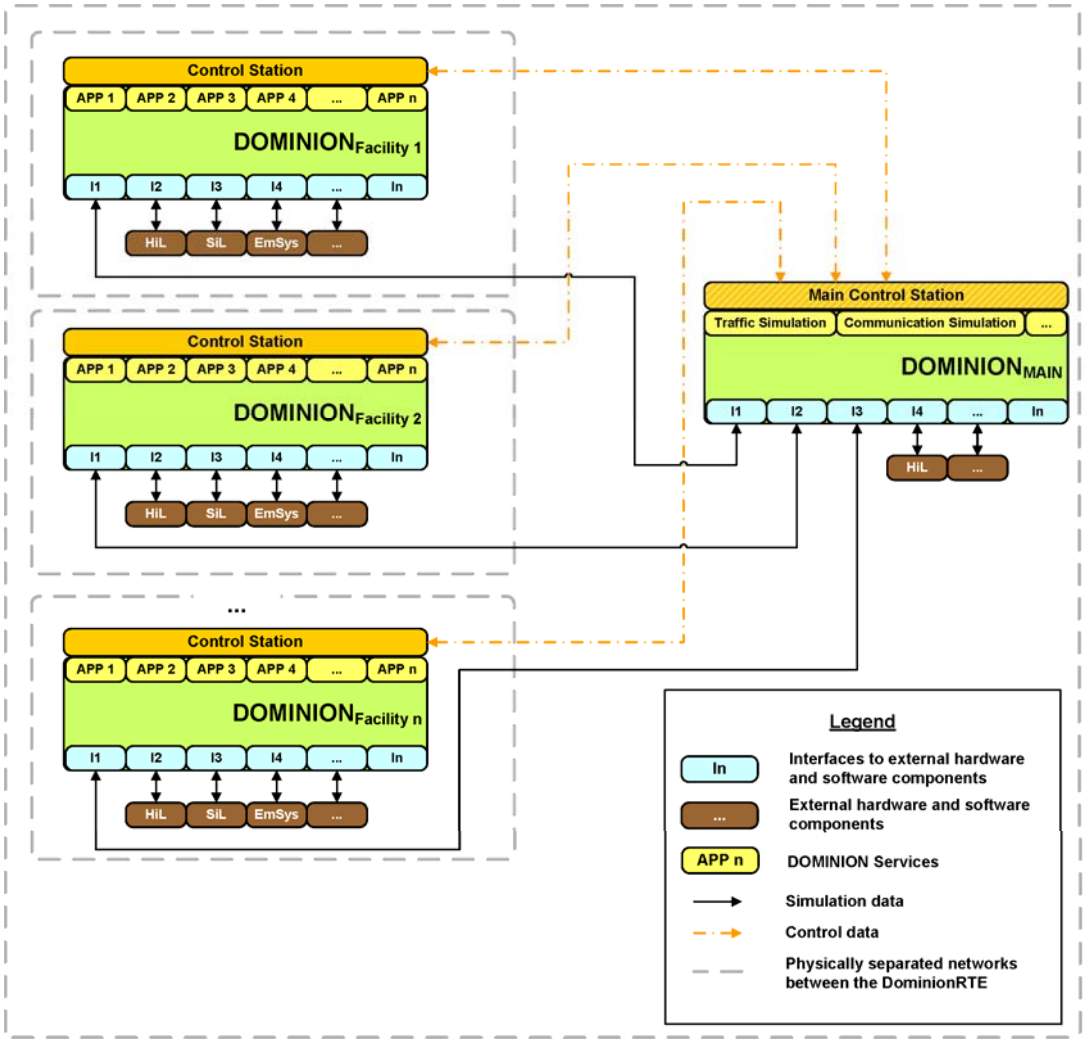
Architecture Approach I

- All research facilities are in the same communication sub-network
- One instance of DOMINION for all research facilities
  - Only one instance for Traffic, Communications simulation etc.
  - More than one instance for Driver Assistance Applications
- Only one MAIN Control station



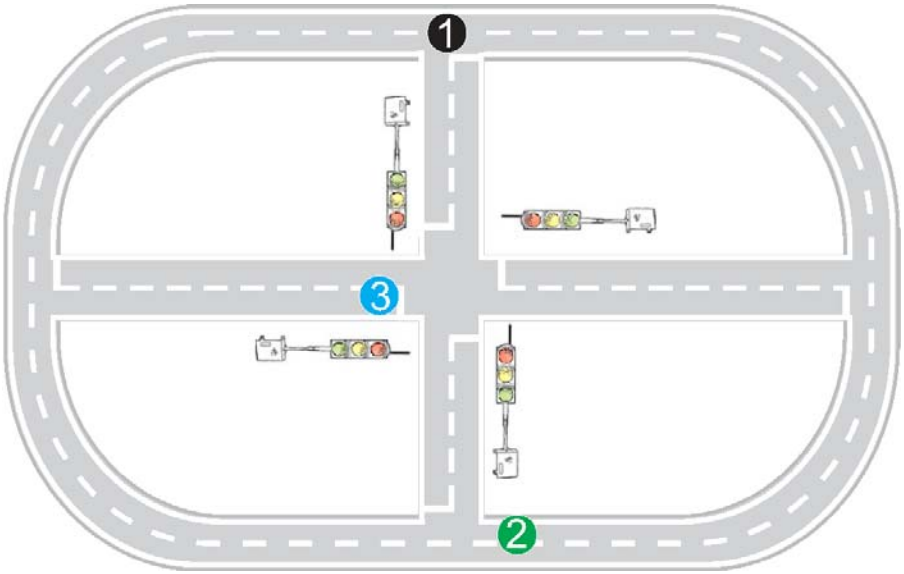
Architecture Approach II

- Every research facility has its own communication sub-network
- Every research facility uses its own DOMINION instance
  - $DOMINION_{MAIN}$ to connect the instances and to run “unique” applications
- Distributed Control Station concept



MoSAIC – Test Scenario and Results

Test Scenario and Results

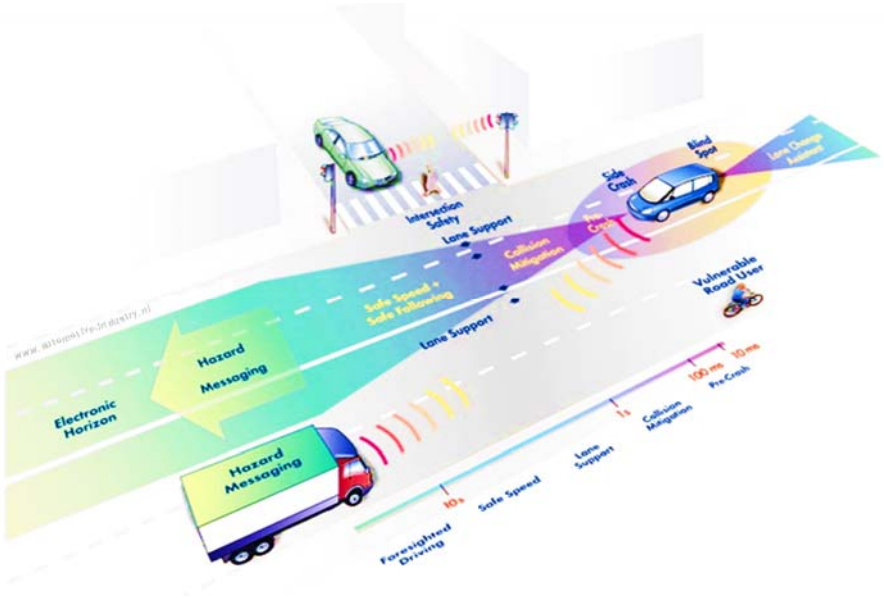


Test Scenario and Results

- The results show that both approaches are applicable for certain setups
- Architecture Approach I
  - For spatial non-separated setups like in the test scenario
    - More difficult for stand alone operation of simulators → one sub-network for all simulators
  - For less complex setups
    - Less modularity compared to Approach II
    - Easier data collection
- Architecture Approach II
  - For spatial separated setups with higher complexity
    - easy for stand alone operation of simulators → separated sub-networks for each simulator
    - Higher modularity compared to Approach I
    - Distributed data collection is more difficult

Conclusion and Next Steps

- Both architecture approaches are possible for the realization of MoSAIC
- Finally there will be a combination of both approaches
  - Approach I as first step for non-spatial separated studies
  - Approach II for spatial separated studies
- Methodology for the control and evaluation of driver studies with more than one real human driver (EU-Project – D3CoS)
- Solution for distributed data logging for Approach II



Tobias Lorenz

Institute of Transportation Systems
Lilienthalplatz 7
38108 Braunschweig

☎ +49 531 295-3475

✉ tobias.lorenz@dlr.de