



VOLKSWAGEN

AKTIENGESELLSCHAFT

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Volkswagen Group Research

Final Event
Aachen, Germany
28 June 2017

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*Automated Driving Applications and
Technologies for Intelligent Vehicles*

Automated driving on highways



// Partners

The main objective is the development and demonstration of automated and cooperative driving functionalities intended for motorways or motorway-like roads with velocities up to 130 km/h.



Bayrische Motoren Werke AG



Continental AG



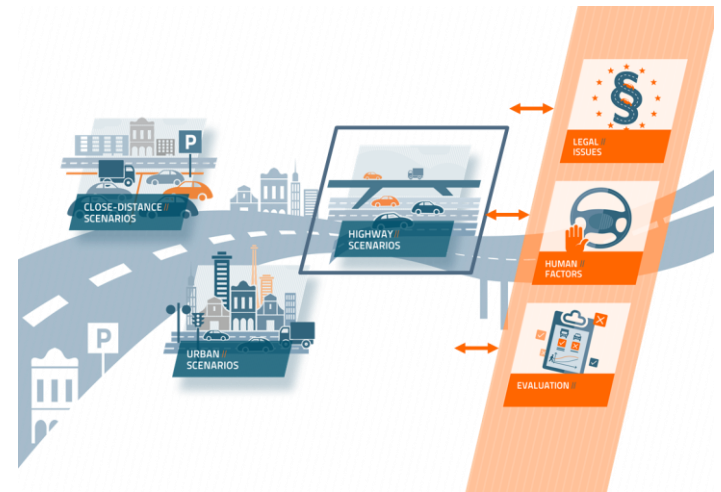
Ika, RWTH-Aachen



Volvo Group



Volkswagen AG



// Challenges and motivation



Traffic conditions'
variety



Human failures



Demanding and
repetitive tasks

// Automated driving on highways: Objectives

- **Conditional automated driving** up to 130 km/h on highways for long distances
- From entrance to exit, on all lanes, incl. overtaking
- Driver must activate the system, but does not have to monitor the system
- Driver can at all times **override** or switch off the system
- Take over request in time, if automation gets to its system limits
- **Comfort benefit** via relaxing and use of selected infotainment functionalities
- **Safety benefit** via relief of the driver: no exhausting, manual driving during long-distance driving



// Automated driving on highways: Achievements

- **Continuous automated driving** from entrance to exit for long distances
- **Driver take-over situations** e.g. from “partial automated” to “driver only” or “conditional automated” to “driver only” demonstrated and evaluated
- Improve **energy efficiency** using information of digital maps and vehicle sensors, **predictive automated driving style**



// Automated driving on highways: Achievements

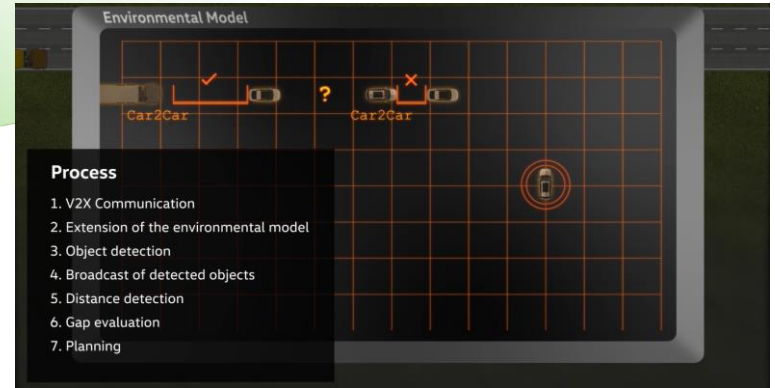
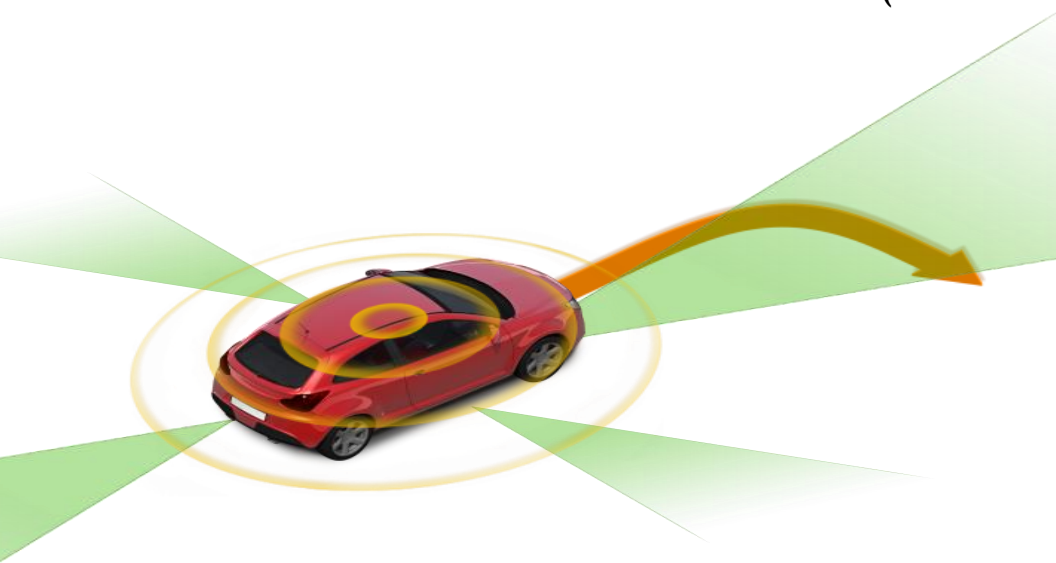
- **V2V communication** protocols based on ITS G5 specified to **enable dialog** before and during lane change or filter-in manoeuvres
- Fault-tolerant and resilient **system architecture** for highly automated driving functions



// Achievement: Cooperative merging on highways

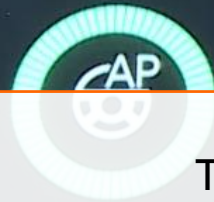
Use of V2V communication for cooperative merging

- status information
- information about the environment (collective perception)



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Automated Driving

08:29



To be continued...

Please attend presentation in exhibition room tomorrow at 10:45!

Executing maneuver

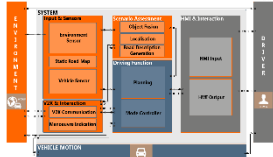
// Achievement: System Architecture

Hazard & Risk Assessment
→ Safety Goals
→ Functional Safety Requirements

Functional Safety Concept

Duo-Duplex Architecture

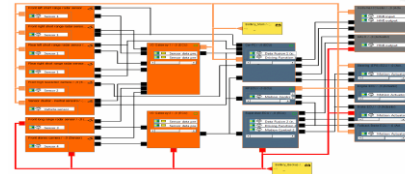
Logical System Architecture



Harmonization of Driving Maneuvers

Lane Change, Minimal Risk, Stop & Go, Green Driving

Technical Safety Concept

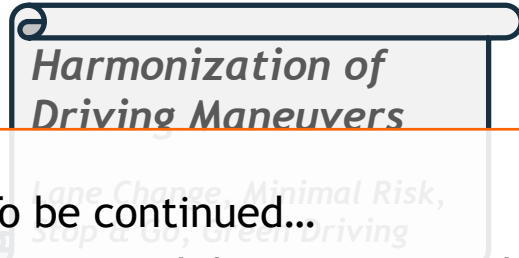
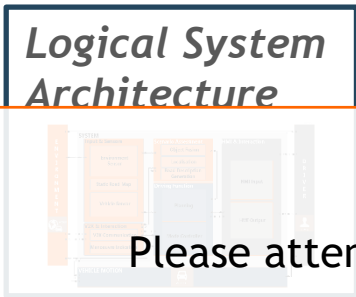
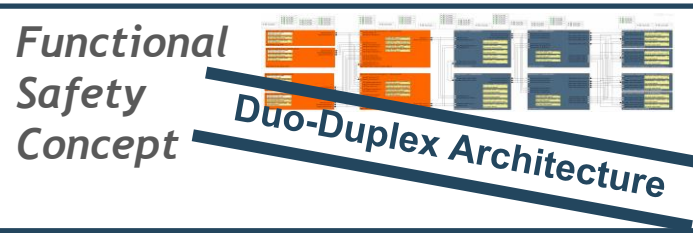


Function & Requirements Mapping

Use cases & Requirements

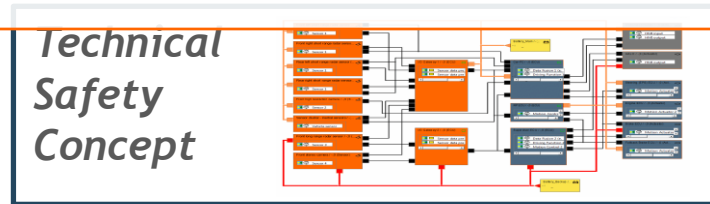
// Achievement: System Architecture

Hazard & Risk Assessment
→ Safety Goals
→ Functional Safety Requirements



To be continued...

Please attend presentation in exhibition room today at 16:00!

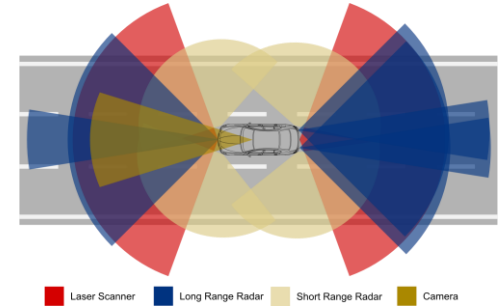


Function & Requirements Mapping

// Achievement: Demonstrators



- Combines highway and urban functions in a single car
- Automated changes between motorways



- Fail-tolerant, multimodal lane perception
- Driver- and system-initiated lane changes



// Achievement: Demonstrators



- Fully integrated Human-vehicle interaction
- Cooperative merging based on V2V communication

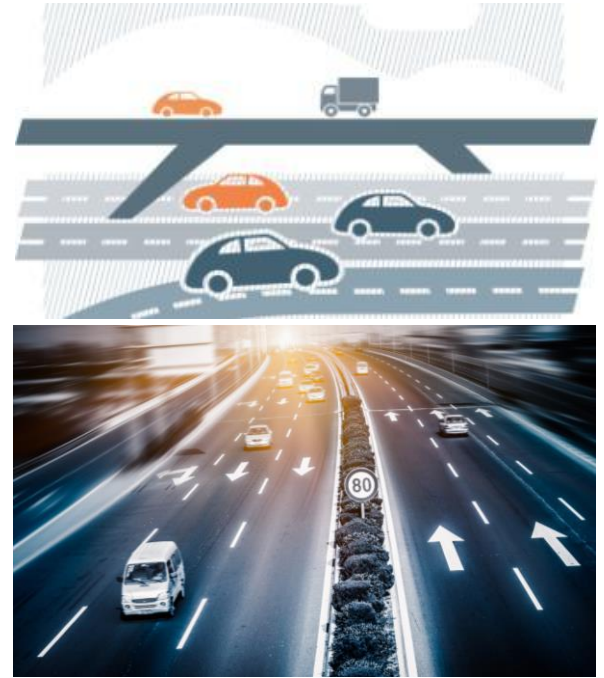


- Lane change request handling on drivers discretion
- Cooperative merging based on V2V communication



// Outlook

- **Handling complex scenarios** such as automated guidance through highway intersections and **cooperative manoeuver** planning in dense traffic
- Integrating precise maps and a **robust localization** into the environment representation using standard sensors, including **automatically updates of maps** via information aggregated from on-board perception
- Automated vehicles must be designed and implemented as **fail-operational systems** and need to ensure safe operations, even in case of a failure





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Thank you.



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