



SOFTWARE AND FUNCTIONS

AUTONOMES FAHREN IST DER TREND DER ZUKUNFT

Synergien zwischen Automotive und Offroad / Agrartechnik

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AVL Software and Functions GmbH

Public

AGENDA







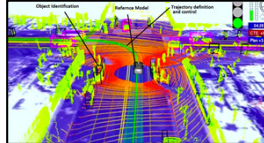


1. Introduction AVL Software and Functions GmbH
2. Basic definitions
3. Market drivers
4. Automation and connectivity features
5. R&D networks for automated systems
6. Summary



FACTS

- Founded in July 2008
- Meanwhile about to 250 employees. The team structure is characterized by a big number of very experienced engineers
- AVL Software and Functions GmbH creates prototyping and serial solutions (software and hardware) for different applications in the fields of for example passenger cars, racing, two wheelers, light and heavy duty vehicles
- AVL Software and Functions is the globally responsible competence center for software development inside the AVL group.
- 100% integrated into the worldwide AVL network

AVL POWERTRAIN CONTROLS OVERVIEW

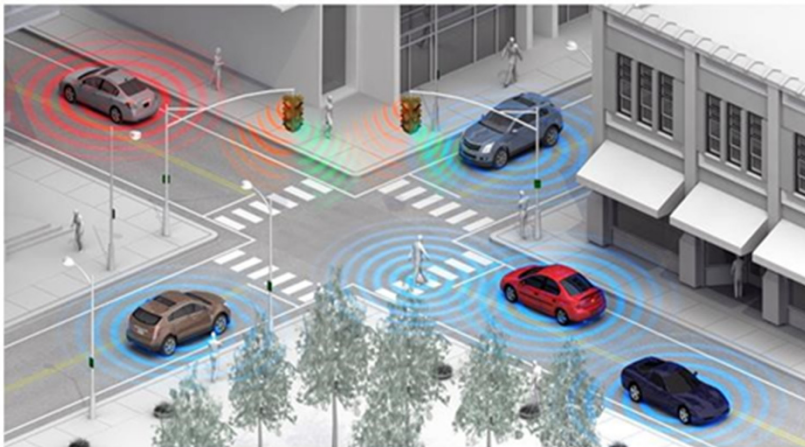
E-Mobility Controls	Combustion Controls	Test Engineering	Automated driving	Software	Electronics
<ul style="list-style-type: none"> Battery Management Systems Hybrid & EV Controls (VCU) E-Motor Controls Open SW development platform 	<ul style="list-style-type: none"> Diesel Controls Gasoline Controls EAS & OBD Control Algorithms Open SW development platform 	<ul style="list-style-type: none"> Software and System testing MiL / SiL / HiL Simulation Plant model development Testautomation Data post processing Test labs 	<ul style="list-style-type: none"> Vehicle state estimation Vehicle controls Sensor fusion Localization Decision making Trajectory planning 	<ul style="list-style-type: none"> Application SW Basic SW (I/O) Manual & Auto-Coding Software Architecture design 	<ul style="list-style-type: none"> Powertrain Control units HV-Inverter Battery Management Control unit Electronic control units EMC Simulation
Functional Safety and Cyber Security					
Quality, Process, Methods & Tools					
					

BASIC DEFINITIONS

Connectivity

The ability to link to and communicate with other computer systems, electronic devices, software, or the Internet. (Def. acc. to dictionary.com)

- Between vehicles (V2C, vehicle-to-vehicle)
- Between vehicles and infrastructure (V2I, vehicle-to-infrastructure)
- Between vehicles and centralized back-end systems ("cloud")



Automated (autonomous) driving

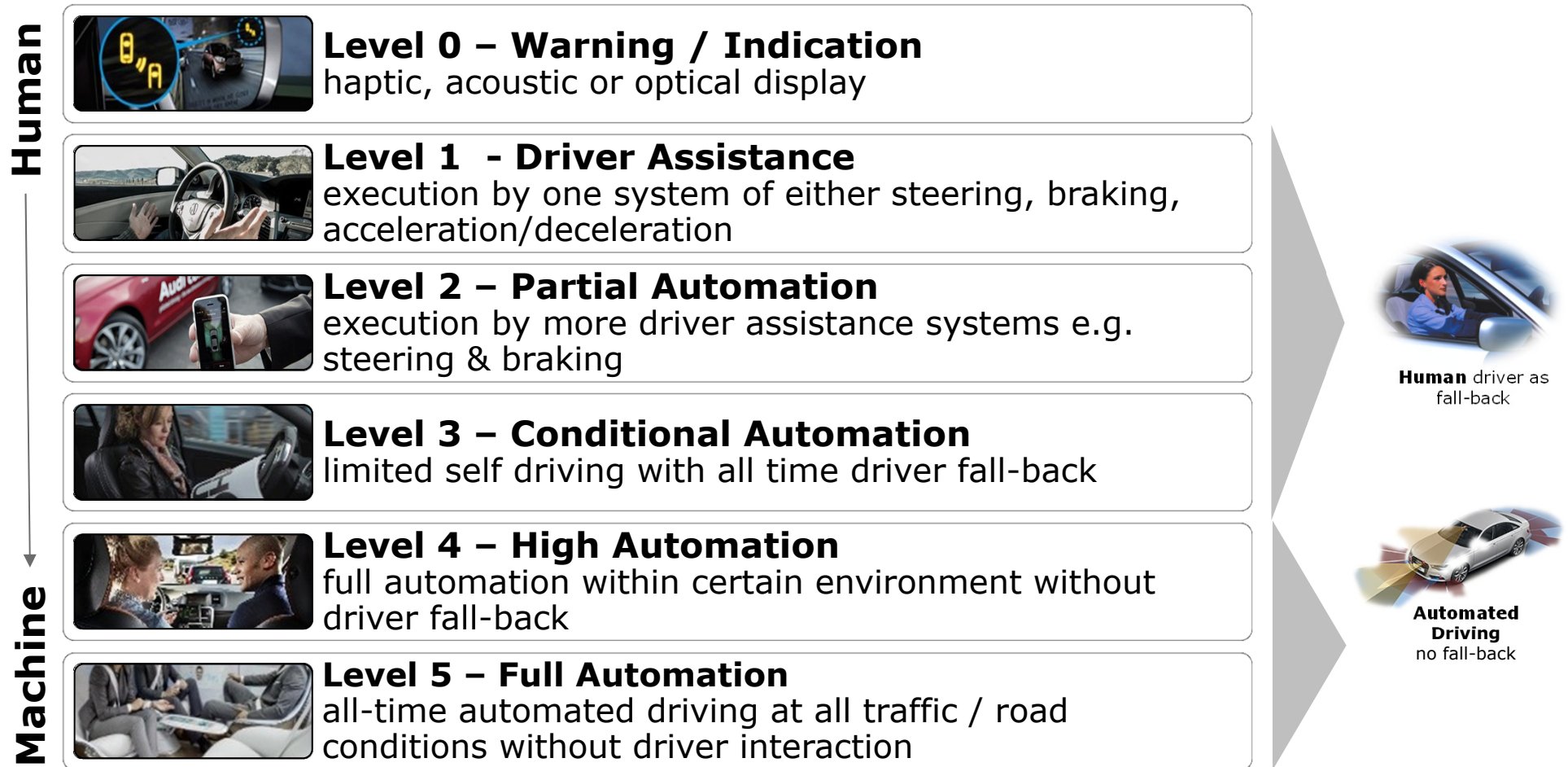
Moving the responsibility from the human driver to an electronic system for the following tasks:

- longitudinal and lateral control of the vehicle (steering, braking, acceleration / deceleration)
- monitoring of driving environment
- fallback performance of dynamic driving task



BASIC DEFINITIONS

LEVELS OF AUTOMATED DRIVING FEATURES



Levels definition according German Federal Highway Agency (BASt) & SAE
ADAS = Advanced Driver Assistance Systems
ADF = Automated Driving Functions

AUTOMATED AND CONNECTED DRIVING FUNCTIONS MARKET DRIVERS AUTOMOTIVE



- **Accident free driving**
active safety functions e.g. emergency braking, lane keeping assistant
- **Driver relief and comfort functions**
e.g. parking assistant, adaptive cruise control
- **Connectivity**
e.g. smart phone interaction, real time traffic information, car2x
- **Fuel/energy efficiency**
e.g. EV driving range, predictive fuel saving

OEM Competitiveness
Innovative high quality features

AUTOMATED AND CONNECTED DRIVING FUNCTIONS MARKET DRIVERS AGRICULTURE

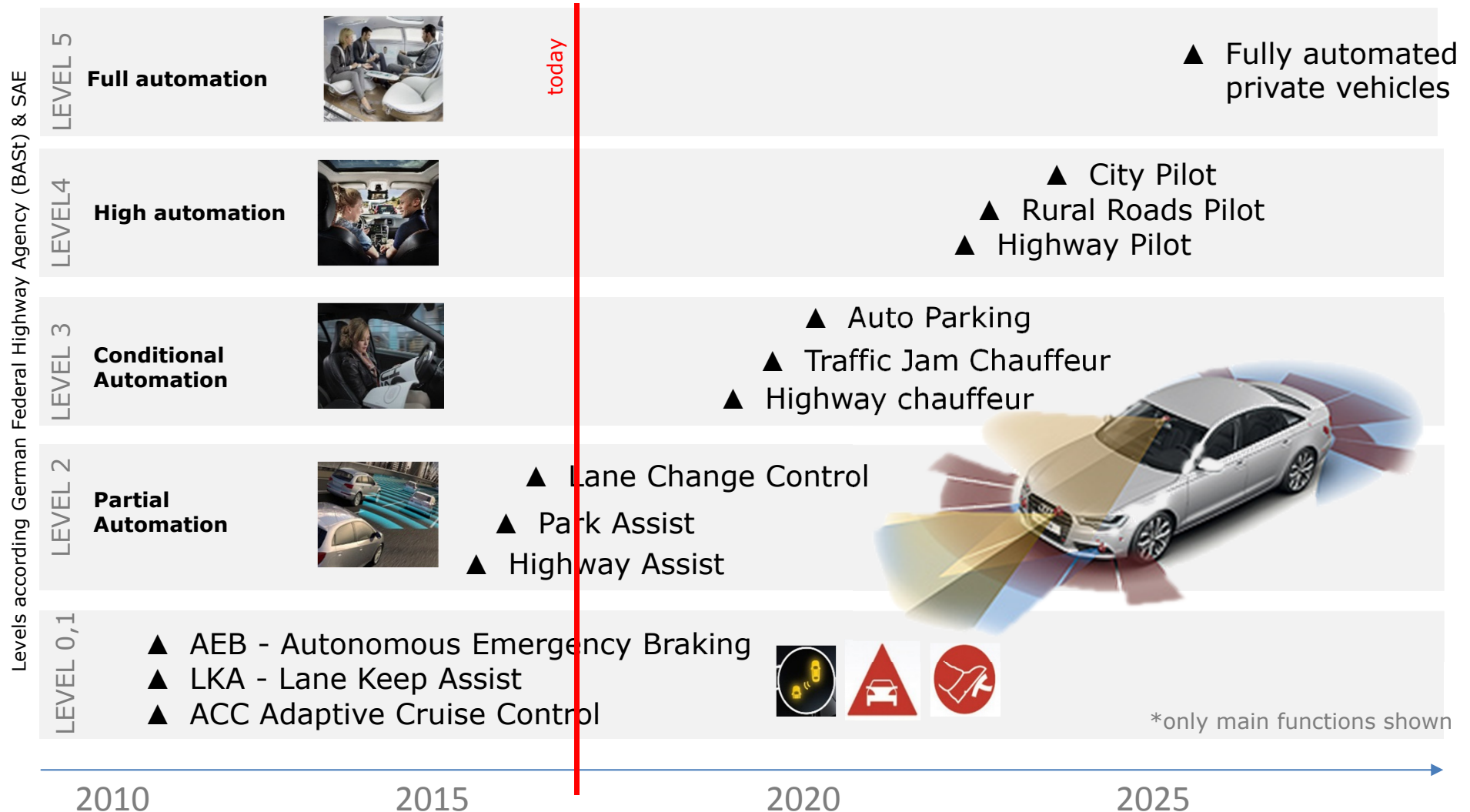
- **Optimization of harvesting time**
e.g. GPS guided movement of agricultural machinery
- **Optimization of crop yields**
e.g. use of collected data to optimize usage of fertilizers
- **Use of cloud data ("big data")**
e.g. topology maps handling and specific crop scouting
- **Driver comfort**
e.g. relieve driver through automated driving
- **Fuel/energy efficiency**
e.g. automated logistics and maintenance

OEM Competitiveness
Optimize efficiency and productivity



AUTOMATED FEATURES FOR AUTOMOTIVE

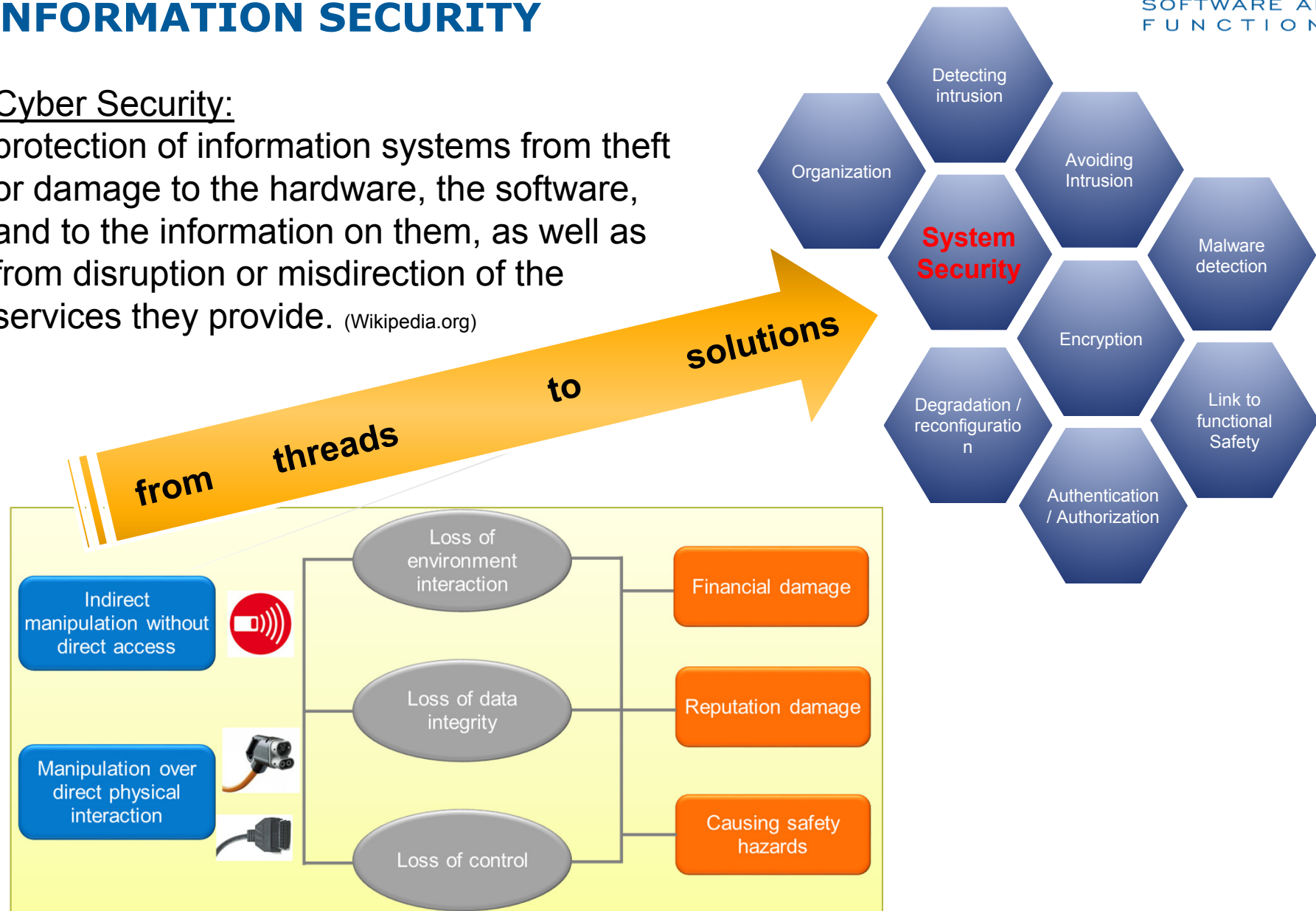
▲ accident free driving / NCAP



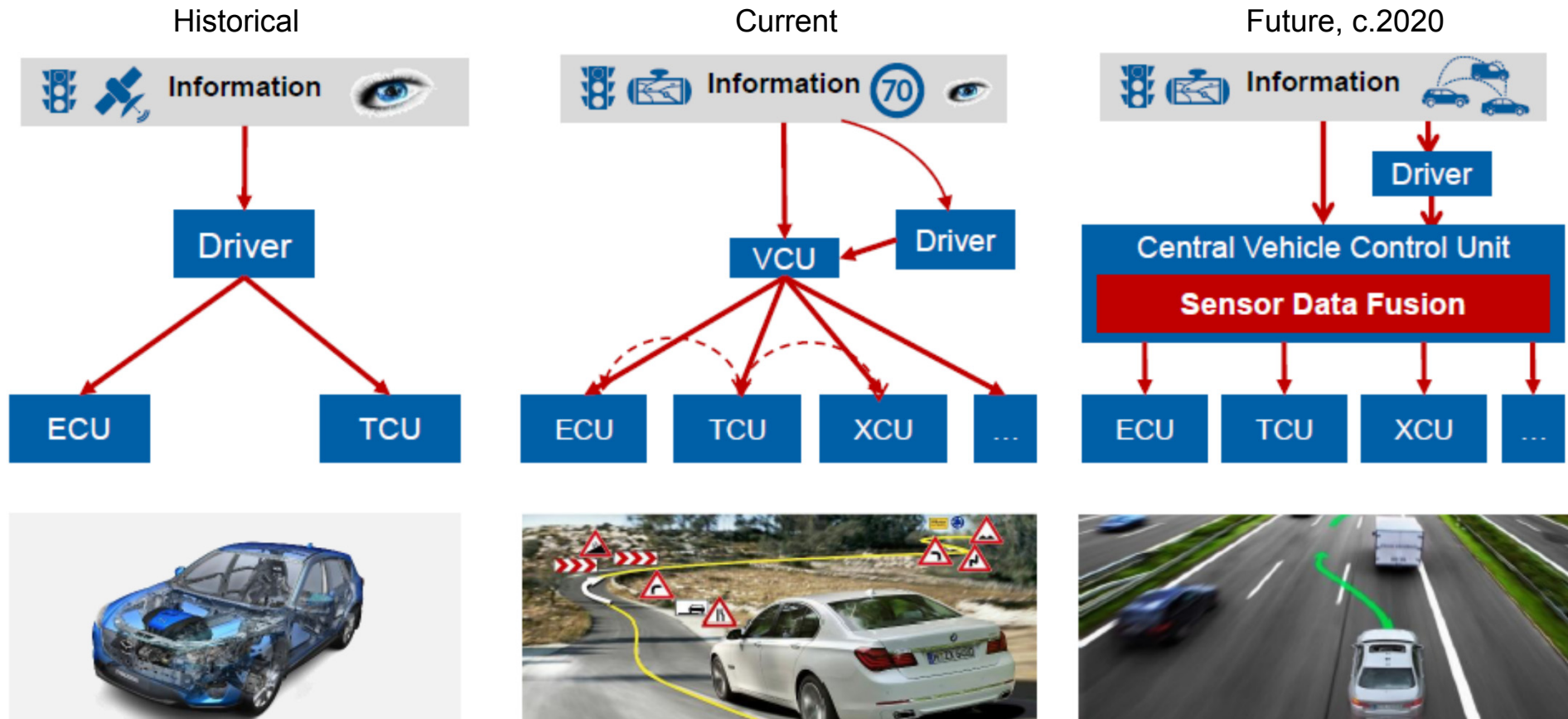
TECHNOLOGIES FOR AUTOMATED DRIVING INFORMATION SECURITY

Cyber Security:

protection of information systems from theft or damage to the hardware, the software, and to the information on them, as well as from disruption or misdirection of the services they provide. (Wikipedia.org)



TECHNOLOGY TREND SUMMARY



MAIN CHALLENGES FOR AUTONOMOUS DRIVING



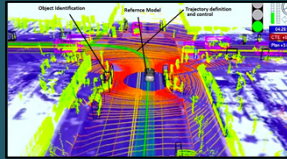
Quelle: © http://www.nordbayerischer-kurier.de/nachrichten/aerger-am-stoppschild_145886

**What is necessary to handle such a situation safely
as autonomous vehicle?**

How to validate and proof technological state-of-the-art?

TECHNICAL CHALLENGES FOR AUTONOMOUS DRIVING

Environment understanding



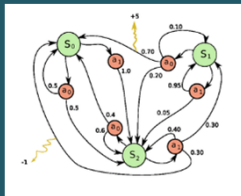
- Sensors
- Sensor data fusion
- Environment model

Connectivity



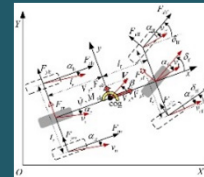
- V2V
- V2I
- Back-end-systems (e.g. online maps)

Trajectory & Decision making



- Maneuver planning
- Trajectory calculation
- Decision making

Control & Actuation



- Vehicle dynamics
- Tire models
- Actuator controls

Functional and operation safety



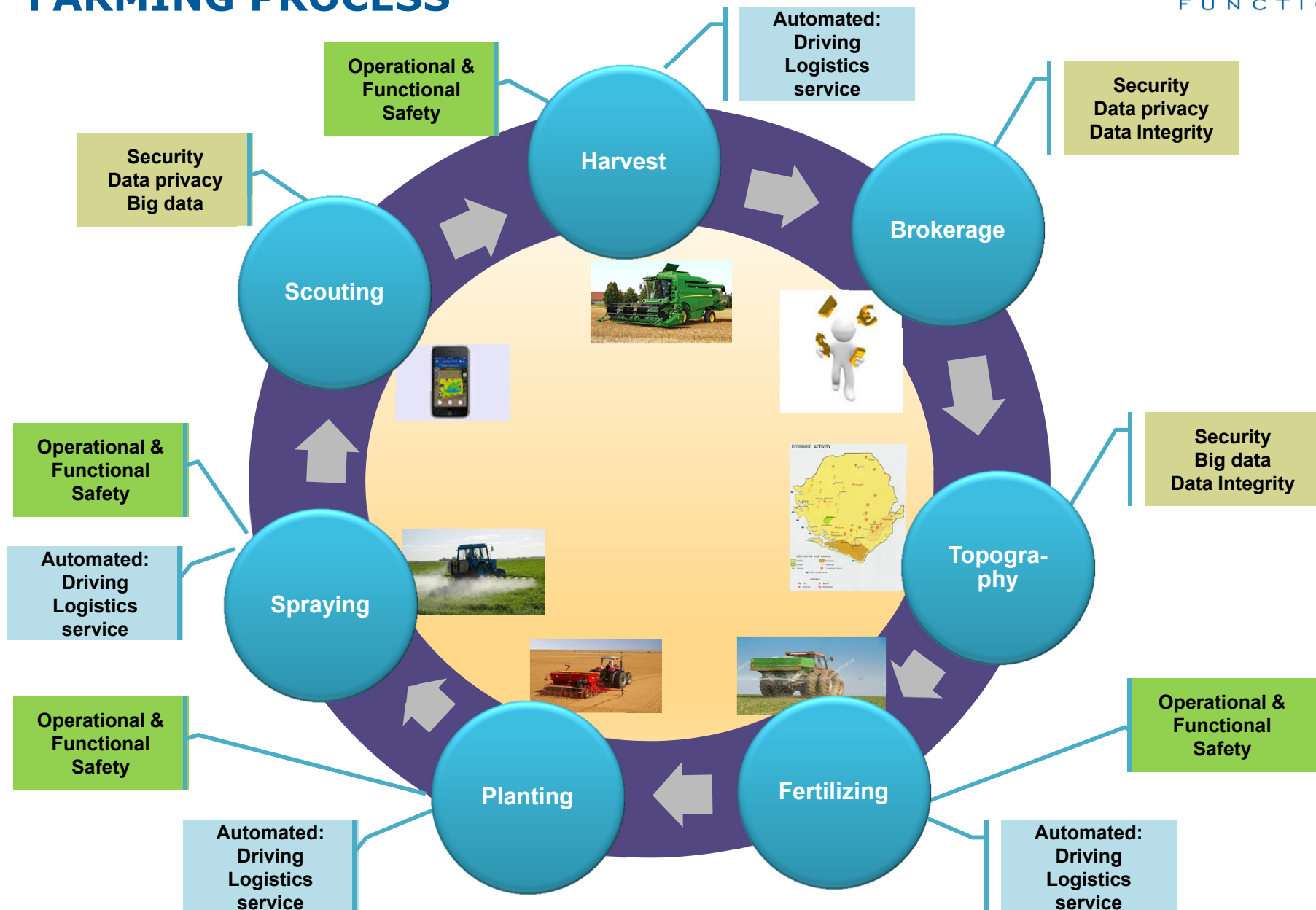
- Development process (ASIL D according to ISO 26262)
- Fault detection and fail-operational functions
- Highly available actuators (steering, braking)

Test and validation



- Paradigm change in test and validation (infinite number of test cases)
- Virtual test strategies incl. driving simulators
- Scenarios based on machine learning algorithms

AUTOMATED / CONNECTED FEATURES FOR FARMING PROCESS



SYNERGIES AUTOMOTIVE VS. AGRICULTURE

Technical synergies:

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- Sensor principles, signal acquisition, diagnosis
 - Object recognition algorithms, environment models
 - Core functions for automated driving (actuator control)
 - Measures and solutions for information security
 - Functional and technical safety concepts
 - Learning SW structures and elements

Synergies on development process:

- Functional Safety Lifecycle (ISO 262621 / ISO 25119)
 - Verification and Validation by simulation
- Methods for online verification and validation
 - Methods for risk- and thread analysis

SAFETRANS – AK WORKING GROUP HIGHLY AUTOMATED SYSTEMS

Working Group on *Highly Automated Systems*



- Focus on technical challenges and regulatory needs in the overall development process for highly automated systems
- Experts from four application domains:
 - automotive, avionics, rail, and maritime
- Addressees on a national and European level:
 - Public Authorities (for regulatory changes and R&D frameworks)
 - Industry (for standardization)

03.06.2016

20. SafeTRANS Industrial Day, Berlin

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Overall Objective



- Enable development of complex highly automated mobility systems with high quality (especially: safe and secure) in a cost-efficient way.
- Strengthen the Competitiveness of the national and European industry



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20. SafeTRANS Industrial Day, Berlin

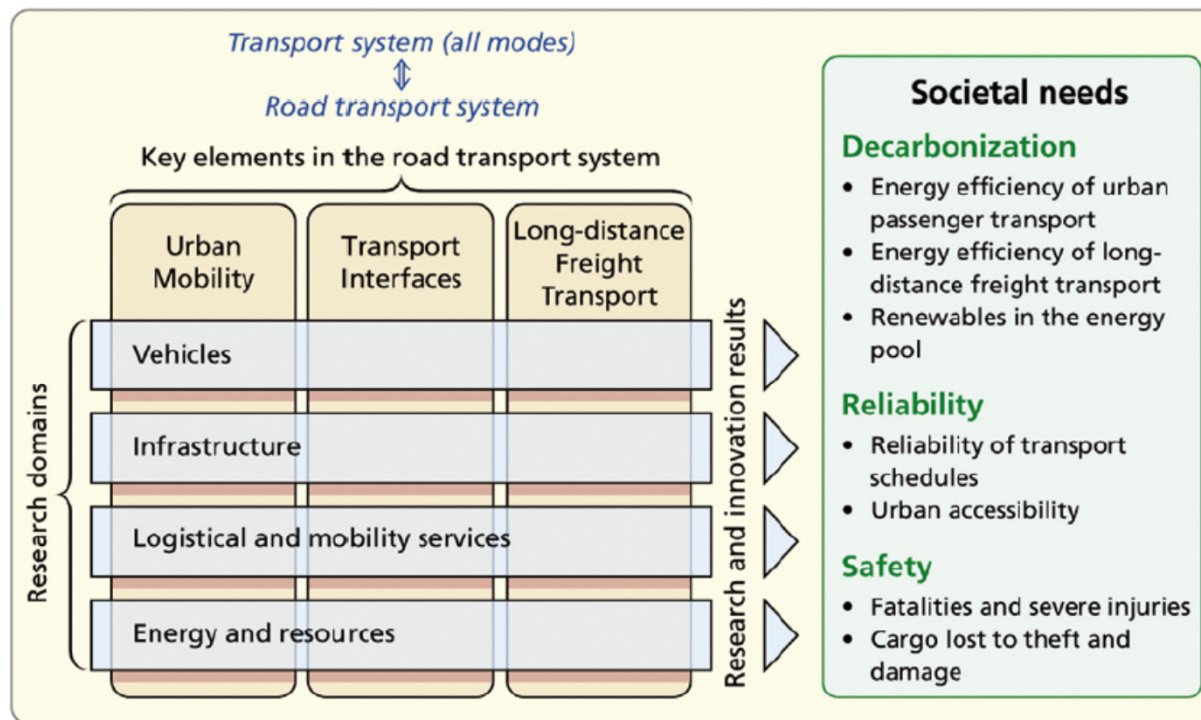
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<http://www.safetrans-de.org/>

ERTRAC ROADMAP AUTOMATED DRIVING

European Road Transport Research Advisory Council

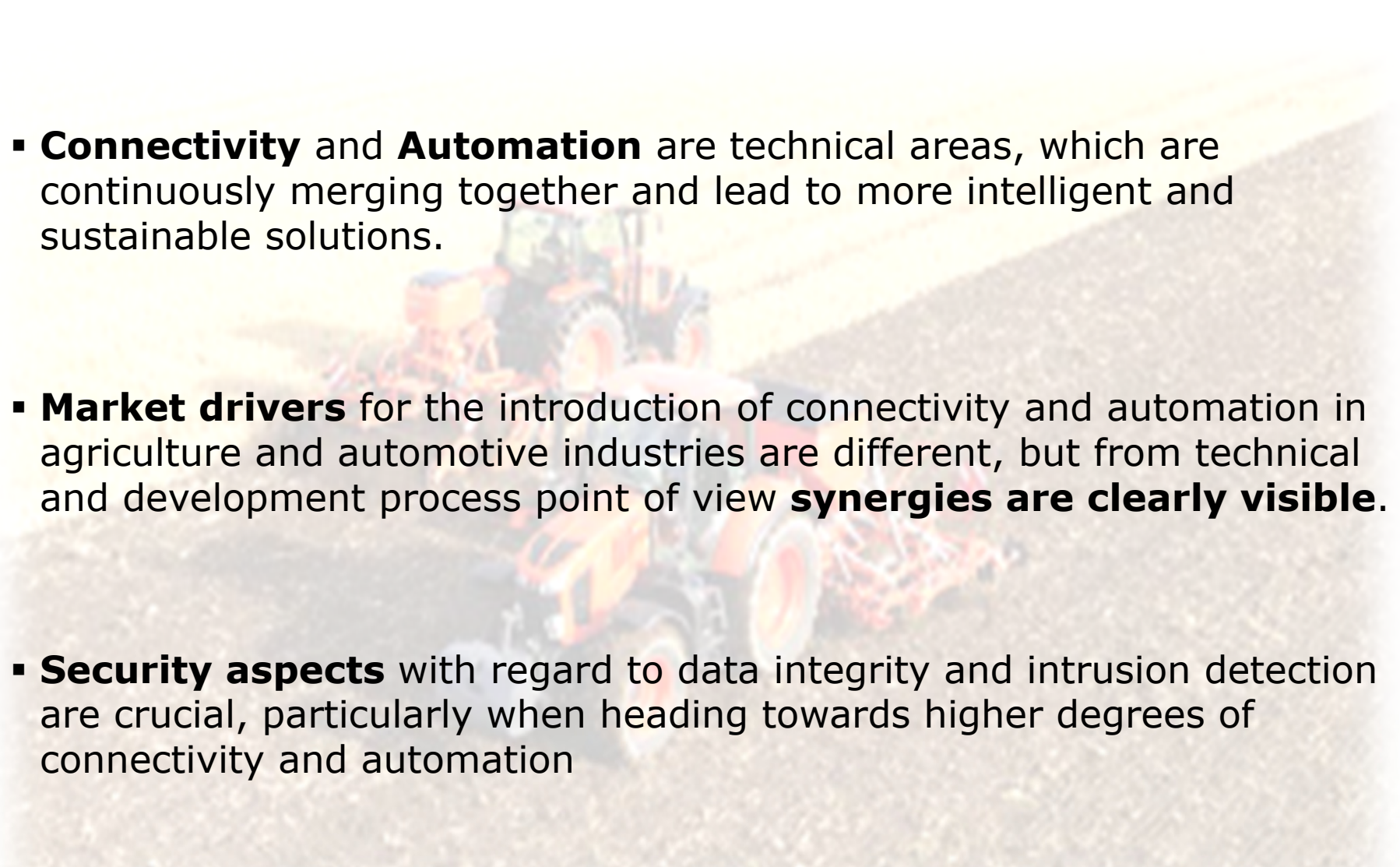
- **WG “Connectivity and Automated Driving” published Roadmap for Automated Driving 2016**



Research domains and key elements according to ERTRAC roadmap /2/

<http://www.ertrac.org/>

SUMMARY

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- **Connectivity** and **Automation** are technical areas, which are continuously merging together and lead to more intelligent and sustainable solutions.
 - **Market drivers** for the introduction of connectivity and automation in agriculture and automotive industries are different, but from technical and development process point of view **synergies are clearly visible**.
 - **Security aspects** with regard to data integrity and intrusion detection are crucial, particularly when heading towards higher degrees of connectivity and automation



THANK YOU



www.avl.com