Future cars and connected mobility – impacts

22.05.2019 SwissRe Deutschland-Tour 2019: Zukunft
Agenda

01  Company Overview
02  Autonomous Driving
03  Connected Mobility
04  CyberSecurity for Mobility
05  TeleOPeration
06  Infrastructure based Driving (MaaS)
07  Sharing Economy
08  Validation, Functional Safety (Methods)
09  New Business Models
Luxoft Automotive at a Glance

- 3,200+ Employees Worldwide
- 40+ Active Clients, 40% OEMs
- <10% Attrition

- 13 years Automotive Practice
- 45% Compound Annual Growth Rate
- 5 new locations in the last 12 Month

3 Geographies | 3 Continents | 17 Countries | 16 Delivery offices
Future Mobility
The Mobility Revolution
The Mobility Revolution
Key industry challenges

TECHNICAL AND ORGANIZATIONAL CONSEQUENCES

1. Mechanical engineering companies become Software Companies

2. Autonomous Driving + ECU consolidation => driving the need for NEW software platforms

3. Digitalization of the Customer Relationship and need for holistic Customer Experience design => Smashing lead-in

4. Personal Digital Lifestyles Eco-systems => One company cannot do all anymore.

www.luxoft.com
Thanks to our collaboration with Luxoft, we are able to bring webOS into automotive and beyond,” said I.P. Park, CTO at LG Electronics.
MBUX – the benchmark in User Experiences

**Challenge**

- Design & Develop the best User-Experience (UX) in the industry
- In-source development of UI Software to the OEM
- Ensure long-term innovation with eco-system of partners

**Achievements**

- Co-creation of the SW Platform on which MBUX is build
- Scaling a large project team to implement and deliver complete #MBUX software on behalf of Daimler
- **TechCrunch**: "If you’d have told me a week ago that one of my favorite things from CES would be an automaker’s infotainment software, I’d have laughed, but here we are."
- Software House using Scaled Agile way of working enabling integration of 3rd party innovations for coming product generations
Autonomous Driving

- Precise Positioning
- Environmental Modelling
- Prediction and Decision
- Trajectory Planning and Control
- HD Maps
Highly automated driving on the motorway.
Focus: Sensing & Fusion

Input: RAW analog signal

Output: Reliable, de-noised, aligned 3D geometry

Classic Platforms, Embedded Software, Firmware

Vehicle Networking

High-performance ECUs, AI-based Algorithms

Camera Sensor, Camera ECU SW

Lidar Sensor, Lidar ECU SW

Radar Sensor, Radar ECU SW

Ultrasonic Sensor, Ultrasonic ECU SW

Sensor Fusion ECU or SW

Focus: Sensing & Fusion

Classic Platforms, Embedded Software, Firmware

Vehicle Networking

High-performance ECUs, AI-based Algorithms

Input: RAW analog signal

Output: Reliable, de-noised, aligned 3D geometry
Environment Model: What the Car Sees
Connected Mobility
Cloud Software

UI/UX

Hybrid-Navigation

Speech

Connected services

MBiENT

Mercedes me
Most modern cars are connected to the internet already. This trend will only increase, especially when V2V communication is ready for prime time.

Teleoperated connectivity will allow to take over control remotely.

Each year, vehicles also are getting more automated functionality, leading to L4/L5 autonomous driving capability in the next years.

Ideally, all communication subsystems are segregated for each use case, but this is not always desired:

- Separate entertainment system from vehicle functions? Not so fast!
  - E.g. some comfort functionality, like adjusting entertainment volume needs to know the vehicle speed...
- Tradeoffs required and special care for interfaces handling this
Incidents are increasing. 2019 is still fresh and will surpass all previous years according to Trend Micro’s research. 70% of the incidents are related to OEMs.
These were the **entry points of attacked vehicles**. Since most money currently can be made by criminals by simply stealing the cars, mostly key access was attacked.

But in the future, any vehicle subsystem that can be used to start a denial of service is critical or any hacked ECU can be used as beachhead to launch attacks on other internal systems, e.g. via the internal vehicle’s networks:

Think cryptolocker for cars, when your infected, new luxury automotive will start immediately after you paid this little, tiny amount of 30 ZCash to the criminals who infected your car with malware via Cloud or Bluetooth or V2V connection...
**Connected Car Architecture and Solution**

**Network Anomaly Detection**
- TMIS - CAN Bus Anomaly Detection
  - Machine Learning based to detect abnormal network behavior within the CAN Bus

**End Point Security**
- TMIS for Cars
  - Agent based solution integrated with External Gateway. Vulnerability, Anonymity detection, File integrity check, IPS, Whitelisting

**Network Security**
- TMVNS
  - Trend Micro Virtual Network Function Suite
- TMDS

**Connectivity**
- Telecom
- Cloud

**Service**
- Cloud Security
- SOC Enable Security Operation

**Business Management**
- Agent based solution integrated with External Gateway. Vulnerability, Anonymity detection, File integrity check, IPS, Whitelisting
- Trend Micro Virtual Network Function Suite

**Machine Learning based to detect abnormal network behavior within the CAN Bus**
TeleOP Mobility
Use Cases

LOGISTICS, AIRPORTS
ROADWORKS / MINES, FALBACK SOLUTION FOR AV
WORKSHOPS / REPAIRING, FIRST MILE DELIVERY
VALET PARKING, CAR SHARING
Teleoperated Driving: Concept

Control Center

Core Network
- vehicle data
- control signals
- video stream

Mobile Edge Cloud

Communication Channel
- e.g. LTE

Car
- safety-critical features
Teleoperated Driving: Car
Teleoperated Driving: VR Experience
Mobility as a Service (MaaS)
New Markets for Mobility Services

Services for automated Cars

Automated Driving on Public Roads
- Traffic rules and regulations
- Individual Mobility
- Primarily driving to target destination

Automated Driving on Business Site 1
- Managed Business, specific Terms and Conditions
- Temporary and real fleets
- Specific facility and Infrastructure
- Primarily professional-, or duty-rides
Infrastructure-based Driving

Architecture

Cloud → Network Infrastructure → Capture Sensor (LiDAR / Camera) → Environment → Car

Telematic Control Unit
Infrastructure-based Driving

Architecture

**Infrastructure**
(Sensor equipped)

**Vehicle**
(no sensors)

**Automated Control**

**Cost-efficient**
No sensors at the vehicle
Infrastructure investment only

**Time savings & efficiency**
Process is automated

Enabler for Mobility as a Service (MaaS)
Infrastructure-based Driving

Security potential attack vectors

- Disturb sensors (introduce noise / deny service by sending fake signals)
- Man in the middle attack. Or disturb/jam data transfer
- Vehicle must be able to reach safe state in case communication breaks down or contradicting local data
Infrastructure-based Autonomous Driving

AUTONOMOUS DRIVE.
FROM ASSEMBLY TO LOGISTICS
Infrastructure-based Autonomous Driving
Infrastructure-based AD: Experience
Sharing Economy
Holistic Mobility View

ReachNow

Empowering a True Pioneer in Urban Mobility

ReachNow, the mobility services division of the BMW Group, is the first service to combine car sharing, ride hailing, and ride scheduling into a unified customer experience. Smashing was chosen as their partner to help re-design and re-architect this new service on iOS and Android.

The 10+ month engagement resulted in a mobility experience that is approachable, intuitive, convenient, and built for scale.
Virtual Validation and HIL Testing

Autonomous Drive
Need faster and cheaper validation method

>10 billion miles of test drive to validate AD functions

24/7 driving at 25MPH requires ~50k years per vehicle

...the Hardest Part is Sensor Physics!
Virtual Validation Areas of Focus

Controls for Actuators

Environment

Sensor Model

V-ECU

Fusion/Decision/Plant model

Workflow setup & scalable execution

Transformation from real drive to simulate driving scenarios.

Coupling to Sensor Models, Algorithmic enhancement of SM(s)

Luxoft Focus Areas

Scenarios
HIL for Sensors

Sensor control-unit

Sensor (Camera/Radar/Lidar)

Control-Unit

Image information

Vehicle bus

ON VEHICLE

Sensor control-unit

Sensor (Camera/Radar/Lidar)

Control-Unit

Images

Vehicle Recording

Vehicle bus

ON HIL
Operational Safety

Performance & reliability evaluation of sensor systems for highly automated driving functions - collaboration insurances industry?
Differentiation of Safety in the Context of Autonomous Driving

<table>
<thead>
<tr>
<th>Standard</th>
<th>Functional Safety</th>
<th>Safety of the intended functionality SOTIF</th>
<th>Cyber Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 26262</td>
<td>ISO/PAS 21448</td>
<td>ISO/SAE CD 21434</td>
<td></td>
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</tbody>
</table>
| Essential contents | • Functional failure of hard- & software of E/E systems  
• Requirements & method for dev. process | • Safety of the target function  
• Control of hazard-events | • Prevention of manipulation of functions  
• Process-Requirements & Attack Protection |
| Qualitative classification | QM, ASIL A – D | Not defined | (CAL 0 – X) |

Focus of the IABG Method
Presentation of the IABG Method: Overview

**Targets:**
- Evaluation of sensor architectures for highly automated driving functions
- Derivation of sensor requirements & application limits of the system

**User Function**

**IABG Method & Framework**

**Results:**
- Quantitative measure of safety & residual risk of driving functions
- Probabilities of occurrence & severity of accidents
Motivation of the IABG Method - Differentiation of scenario-based testing

Classical approach: The reliability of highly automated driving functions is analysed, simulated and tested by means of selective scenarios.

- Only parts of the multidimensional test space are investigated
- Unknown corner cases are not taken into account

Approach of the IABG method: Holistic consideration of the driving function and the application context

- Identification of Corner Cases
- Quantitative Validation remaining risk
- Detection method & system optimization in early phase of development

IABG-Method

Characteristics:

- Conform to ISO / PAS 21448
- Enlargement of the known event space through systematic (pre-) analysis
- Use as a framework for various applications
Presentation of the IABG method: Potential applications

Possible applications:

- Analysis & evaluation of highly automated driving functions already at the beginning of the development process
- Reliability testing of systems & algorithms incl. sensor failures and redundancy concepts
- Analysis & identification of weak points in the system
- Sensor Performance Requirements & Specifications
- Derivation of KPIs and benchmarking of different sensor architectures
IABG Method: Modelling & User Interface
New Business Model
Network Slicing

Teleoperation real time

QoS via Network slicing
Network Slicing

Teleoperation real time

VR TeleOP Driving
Thank you
Autonomous InfraDrive: Time Line

- Design Phase
  - IR Camera
- Full Car-to-Cloud integration
- Award of version 2
- New Location based system
  - Lidar System
- TMC DEMO
  - Other plants research
- 3rd Party Integration
  - ANFLUG v3

ANFLUG v1
First Phase
November 2017

F40 Full Control
February 2018

ANFLUG v2
First Phase
April 2018

Multi Car Control
October 2018

ANFLUG V2 Demo
November 2018

ANFLUG V3
December 2018

ANFLUG v3
November 2017

ANFLUG v2
First Phase
February 2018

ANFLUG v1
First Phase
April 2018

ANFLUG V2 Demo
October 2018

ANFLUG V3
November 2018

ANFLUG v3
December 2018