Changing the automotive electronic landscape

Berthold Hellenthal, AUDI AG, Semiconductor Strategy – Progressive SemiConductor Program (PSCP)
SEMICON West 2016, San Francisco, USA, July 12th, 2016
Audi – Dogs
80% of all innovations are directly or indirectly enabled by semiconductors.
Electronic components share of vehicle production cost

Data source: http://www.pwc.de

Electronic components share of vehicle production cost

Value share of electronics
Outlook

Electronic components share of vehicle production cost

(in addition:)

- continuously increasing number of lines of software code
- continuously increasing amount of data traffic within and from/to the vehicle

(forecast for 2020 and 2030)
Data source: http://www.pwc.de
Audi comprehensive semiconductor strategy
Audi Progressive SemiConductor Program (PSCP)

AUDI PSCP
Progressive SemiConductor Program

Demands on semiconductors and their application

Prelaunch | Launch | Application | Lifetime support

On time | Competence | Communication | Innovation | Quality

Partnership with semiconductor manufacturer at eye level

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Innovation Environment – Disruptive Change

Continued intense competition within the Automotive Industry

- 360° electric mobility, Over-the-air updates
- Approaches for own vehicles
- New competitors from Silicon Valley
- Share economy

Shift of power toward suppliers

New Giants from China
- Imminent dependency

New customer needs due to digitization

- Connectivity
- Urban mobility

Substitutes / new business models

- New competitors from silicon valley
- Google
- Apple
- Baidu
- Alibaba
- UBER
- mytaxi
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The Next Era of Automotive Innovation
Success Factor: End-2-End-Architecture

Era Mechanics
Era Electronics
Era Software / Networking
Era End-2-End User Experience Cloud / Data / Business Model

E/E-Architecture based on "Microcontroller"
E2E-Architecture based on "Central Computing Unit"

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Future: End-2-End User Experience

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End-2-End User Experience
Autonomous Driving

Booking Delivery Charging Allocation
Allocation Booking Delivery
Payment Usage Services
Charging Arrival

Booking Delivery Usage Charging Allocation
New requirements due to “all” autonomous driving
...new dimensions

Today: 8,000h on-time
(approx. 1.5h per day, 15 years)

Tomorrow: 121,500h on-time
(approx. 22.5h per day, 15 years)
Possible Solution Space
Four possible dimensions

- Redundancy
- Failsafe Operation
- Operation in an "electronics friendly environment"
- Failure becomes a regular use case
Basic Structure of an End-2-End-Architecture
From Semiconductors to the Backend for Swarm Data

OEM-overarching Backend

OEM-specific Backend

Connectivity/External Networking

Central Access Point

Gigabit Ethernet

Domain Level/Internal Networking

Cross-/Vertical-Domain

Drivetrain Domain

IS Domain

DAS Domain

Cockpit Domain

Energy Domain

Comfort Domain

Semiconductor Level

NVIDIA

Qualcomm Snapdragon

Mobileye

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Requirements:

- Update of existing functions
- Download of new functions
- Upgrade of central hardware elements
- Shortening of innovation cycles (time to market)
- Realization of synergies from consumer-, cloud-, mobile technologies
- Software synergies between ECUs
- Scalability
- Controllability / reduction of system complexity
- Cloud usage to realize distributed intelligence and swarm functions
- Broadband data communication in real-time within the vehicle and with the cloud
- Guarantee of highest security standards
- Maximum availability and fault tolerance
Function shift:
from Sensor/Actuator Level to Computing Level(s)
<table>
<thead>
<tr>
<th>End-2-End-Architecture</th>
<th>Relevant Key Technologies / Processes (II)</th>
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<tr>
<td><strong>5G</strong></td>
<td><strong>Cloud Computing</strong></td>
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<td><strong>Gigabit Ethernet</strong></td>
<td><strong>Data Analytics</strong></td>
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<td><strong>End-2-End Security</strong></td>
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<td><strong>Virtualization</strong></td>
<td><strong>Sensor Fusion</strong></td>
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<td><strong>Safety certified Realtime OS</strong></td>
<td><strong>Platform Services &amp; Tools</strong></td>
</tr>
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End-2-End-Architecture
Radical Approach - „Twin Peaks“
End-2-End-Architecture
HERE - Vision of an Open Location Platform

The goal is to create the world's best Reality Index...


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Smart Car – the learning vehicle
Security, Comfort, Traffic Control, Time Saving

The car...
... senses
... communicates
... decides
YouTube – „rush hour“
The car...
... senses
... communicates
... decides

Smart Car – the learning vehicle
Security, Comfort, Traffic Control, Time Saving
Thank You.