Crucial Role of ICT for the Reinvention of the Car

Karl-Josef Kuhn
Siemens Corporate Research and Technologies
Berlin, June 30, 2011
eNOVA Strategy Board for Electric Mobility

www.strategiekreis-elektromobilitaet.de
Involved Stakeholders

Strategy Board

Scientific Board

Associated Partners

Federal Ministries

Others

Jun-11
Topics

- Safety + Reliability
- Lightweight Materials
- Standardisation
- Motors + Drives
- Materials
- Grid and Road Integration
- Energy Storage
- E/E Architecture
- Driver Assistance
- Education + Training
- Manufacturing Technologies
- Vehicle Technologies

Jun-11
Roadmap Part 1

Themes
- Drive
- Train
- Manufacturing Technologies
- Vehicle Integration
- Lightweight Materials
- E/E Architecture

Milestone 1
- Priority 1
- Priority 2

Milestone 2
- 2015
- 2020

Milestone 3
- 2025
Roadmap Part 2

Themes
- Safety
- Reliability
- Energy Storage
- Materials Recycling
- Infrastructure Integration
- Driver Assistance

Milestone 1
- Priority 1
- Priority 2

Milestone 2

Milestone 3

2015
2020
2025
Global Megatrends strongly influence the future of mobility

- **Climate change**
  - Spend less energy in total for mobility
  - "Zero Emission" by EV

- **Urbanization**
  - Utilize sustainable power source for mobility
  - "Intelligent mobility" through, telematics and Smart Grid integration

- **Demographic change**
  - High traffic density (commercial vs. private transportation)
  - Hurt less people through accidents
  - Safely extend mobility of elderly people
  - "Zero Accidents" by stability control and predictive ADAS systems

New kind of mobility concepts mandatory
“Zero Emission” can be achieved with electric vehicles

**E-Mobility** is the most efficient way to become independent from fossil fuels in road transportation, because

**Sustainable power** can be produced in many ways, but producing liquid fuel in a sustainable way is not possible even for today’s fleets.

Furthermore, E-Mobility will support the **expansion of renewable energy**, if the car’s battery is used as stationary storage (bidirectional)
“Intelligent Mobility” means that the vehicle becomes a part of a greater service network

Driven by socio economic trends, most of future business models will be based on new services where the electric vehicle is one player between many others:

Seamless Mobility
Optimization of traffic flow
Stabilizing the power grid
Location Based Services
“Zero Accidents“ becomes attractive if safety is combined with comfort

Autonomous driving is the major pillar for getting close to “Zero Accidents” wanted by legislators and insurances.

But

“Zero Accidents“ in itself is nothing customers want to spend too much money for, because it is not very exciting.

Solution

Autonomous driving is a comfort function and thus can be experienced by the driver as a valuable add on. Additionally, it could the basis and starting point for “Zero Accidents”.

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One major driver of today’s system architecture is the Evolution of complexity.

Source: “The Software Car: Information and Communication Technology as an Engine for the Electromobility of the Future”, page 48
An ever increasing inter dependability reaching the limits of integration for an affordable price
Physical complexity, power consumption and installation space used drives the integration of new functions to the limit
Time for a change – it happened before

1977

EVOLUTION

1957

Mechanics

Information processing view

Today

1987

Mechatronics

Information processing view

Today

Mechatronics
To cope with the challenges, mentioned before, a new kind of System Architecture is mandatory.

- Easier integration of new functions
- Advanced variant management
- Shorter development time
- Less integration cost

to ISO 26262

*Symbolic pictures
Conclusion of architectural goals

**Advantages**
- Increase functionality
- Refurbishment of functions
- Plug and play of SW/HW components

**Reduce complexity**
- Software independent from hardware
- Integration on software level
- Scalable, hierarchical computing resources

**Focus on information processing**
- Perceive, Analyze, Act
- Hierarchical modules
- Smart actuators
- Smart sensors
- Reduce communication within network to a minimum

**Qualities**
- reliability
- security
- safety
- expandability
Revolutionary steps driven by integration and new ICT system architecture

Source: “The Software Car: Information and Communication Technology as an Engine for the Electromobility of the Future”, page 49
Influences of a new system architecture on the automotive industry (1)
Scenario „Low Function / Low Cost“

<table>
<thead>
<tr>
<th>Characteristics of scenario</th>
<th>2011</th>
<th>2020</th>
<th>2030</th>
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<tbody>
<tr>
<td>Variety of functions</td>
<td>Low</td>
<td>Medium</td>
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<tr>
<td>Market</td>
<td>Low price segment</td>
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- In-Wheel drivetrain
- Partly Drive by Wire
- Software partly exchangeable
- Robust but simple chassis
Influences of a new system architecture on the automotive industry (2)
Scenario „High Function / Low Cost“

- In-Wheel drivetrain
- Full Drive by Wire
- High variety of smart sensors and actuators available
- High variety of software applications
- Fully implemented plug’n play (Hardware and Software)
- Less weight because of predictive intelligence

**Characteristics of scenario**

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A new kind of system architecture will change the automotive landscape...

…and be the basis for further embedded systems

Download link for the executive summary:

www.fortiss.org