Three independent development paths leading to the Smart eCar

Function development
ADAS vertically integrated

ADAS horizontally integrated with strategy layer

Zero Accidents with intervening decision
Revenue stream
- ICT
- Software / Apps
Design: 1E / 1M

In-vehicle ICT systems

Lane Detection sensor
Distance sensor
US sensors

Situation Recognition (sensor fusion)

Strategy Generation

Pedal
Pedal
Steering Wheel

Driver’s Decisions

Cinematic Execution Level

Electro mechanical integration
E-Motor
Brake
Damping
Steering

Smart actuators
Smart sensors

Transmission
ABS
Acc.
Pedal
Brake

New ergonomic concepts through mechatronic integr.
Revenue stream
- Mechatronic
- Mechanical components
Design: 2E

Time
To discover the full potential of electric vehicles a new E/E architecture is mandatory

- Get rid of position oriented partitioning
  - Well defined information flow
  - Hierarchical decision making

- Less controller
- Likely less copper
- Less different connector

**Symbolic pictures**
Major Vision: Build an embedded IT platform to realize autonomous driving on top of it

**Benefit**

- **Cost cutting and time to market**
  - Reduction of overall complexity.
  - Reusability of platform software.
  - Less effort to transfer know-how between different vehicle types.
  - More test automation feasible.

- **Selling new functionality (hardware & software) during whole lifecycle of vehicle (Plug and Play)**

**Key Requirement**

- Standardized hardware and communication interfaces

- Fail operational behavior is part of platform not of function (application)

- Dynamic resource sharing within vehicle network

- Even safety critical HW+ SW can be exchanged or added without losing certification

**Design Paradigm**

1. Perceive analyze act
2. Smart sensors and actuators
3. Hierarchisation and centralisation of higher-level control-algorithms
4. Homogenous in-vehicle communication technology
5. Run Time Environment (RTE) to ensure QoS and PnP
Basic structure and information flow

1. Scalable central processing units with physical access to all smart sensors and actuators.

2. Middleware to decouple vehicle functionality from architecture (including deployment) and BSW-functionality to ensure non-functional qualities (esp. fail-operational service and PnP).

3. Automotive functions.
Development paradigm #1

Perceive → Analyze → Act

Data capture → Data Fusion → Function processing → Arbitration → Output

Implementation concept

Sensor raw data → Data Fusion → Vehicle Data Model → Arbitration → Actuator Data
Ethernet-based redundant communication as communication backbone

- Drivetrain
- Energy source
- Sensor / Actuator connector
- Vehicle Control Computer 1
- Vehicle Control Computer 2
- Gateway
- Sensor / Actuator connector
- Entertainment
- Electric braking
- Electric steering
Project „RACE“: Robust and reliable Automotive Computing Environment for future eCars

Goal:
Open redundant and safe ICT architecture:
- Reducing overall complexity
- Plug-and-Play capability
- Support new, complex functions (e.g. (semi)autonomous driving)
  - Show that certification is basically possible
- Build up of 2 prototypes with RACE platform for demonstration

Project:
Project funded by the German ministry of economics
- Project Budget: 21’ EUR over a 3-year period
- Project is based on the results of the study “More Software in the Car”

Year 1: 2012
System specs, Component specs SW+HW, Design specs SW+HW

Year 2: 2013
Components, middleware, functions, platform integration

Year 3: 2014
Evolution EV, Revolution EV, SW functions integration on platform
Project „SafeAdapt“:
Safe Adaptive Software for Fully Electric Vehicles

Motivation:
Strong need for a new software architecture for safety-critical systems in FEVs:
• Improving robustness and energy consumption
• Adaptation is essential for a new architecture
• Adaptation is challenging due to safety concerns

Project Objectives:
Safe and controlled adaptation for the complex, networked control systems in EVs:
• Enhanced SW architecture for electronics in fully electric vehicles (based on AUTOSAR)
• Update and re-organize SW @ runtime
• Safe adaptation core, which encapsulates the basic adaptation mechanisms
• Integrated approach for engineering adaptive, complex and safe systems

Key Figures
Call: FP7-2013-ICT-GC (STREP)
Project duration: 07/2013 – 06/2016
Total costs: € 9.2 million
EU funding: € 5.9 million
Project Website: http://www.safeadapt.eu/

Consortium:
• Fraunhofer ESK (Coordinator)
• TTTech Computertechnik AG
• Fico Mirrors S.A.
• Fundación Tecnalia Research & Innovation
• CEA List
• Siemens AG, Corporate Technology
• Pininfarina SPA
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Questions ?