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Siemens Corporate Technology

E/E Architecture for Electric Vehicles

Cornel Klein
Siemens AG
New Technology Field “eCar”
Cornel.Klein@siemens.com

Three independent development paths leading to the Smart eCar

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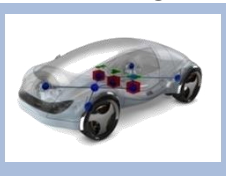
Function development

ADAS vertically integrated

ADAS horizontally integrated with strategy layer

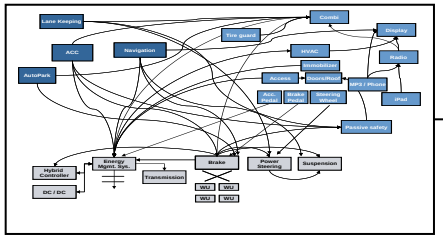
Zero Accidents with intervening decision

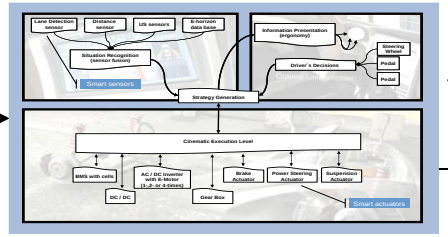


Revenue stream
- ICT
- Software / Apps

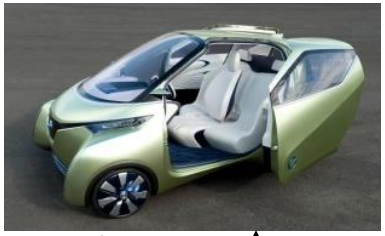
Design: 1E / 1M

In-vehicle ICT systems





Smart eCar autonomous driving



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Electro mechanical integration

- E-Motor
- Brake
- Damping
- Steering

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

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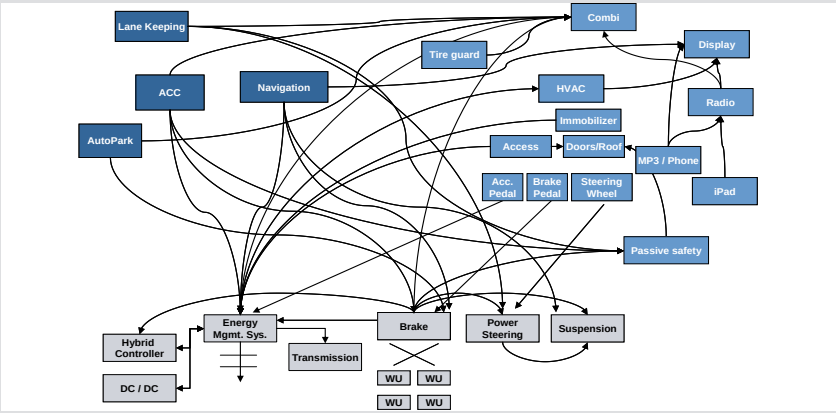
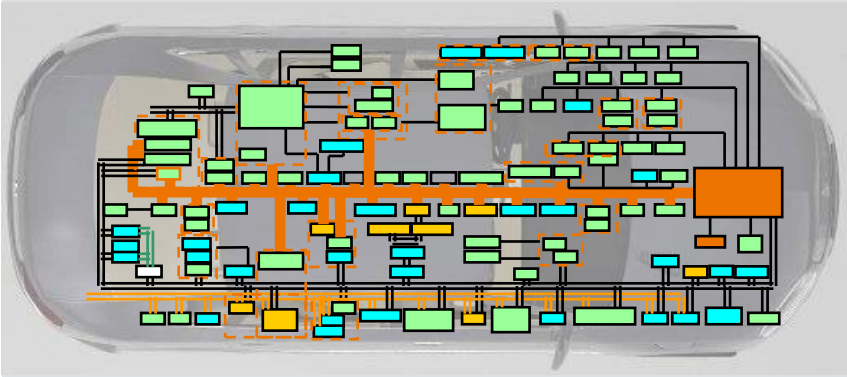
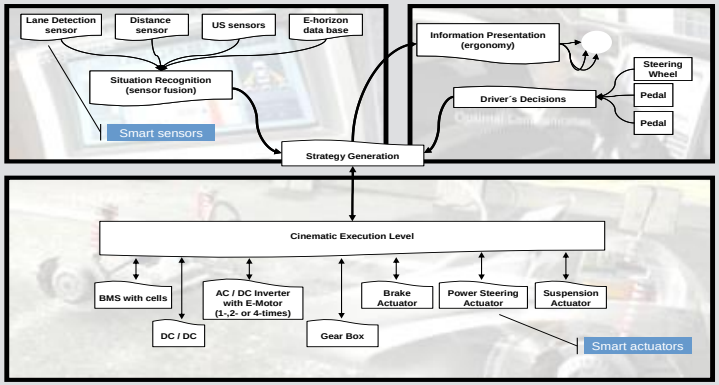
Symbolic pictures

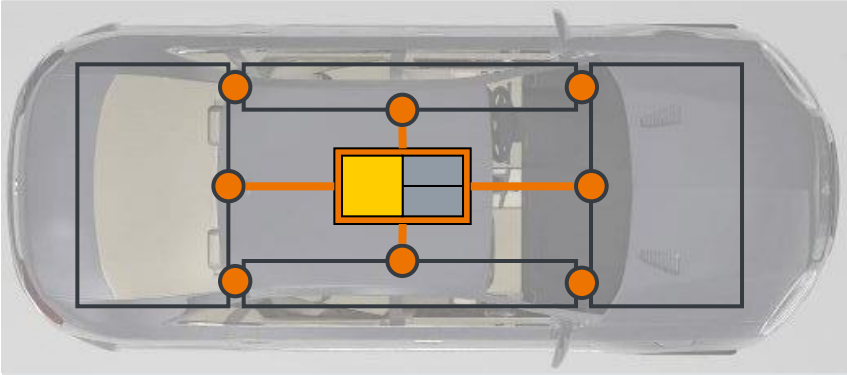




- Get rid of position oriented partitioning
  - Well defined information flow
  - Hierarchical decision making

- Less controller
- Likely less copper
- Less different connector





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

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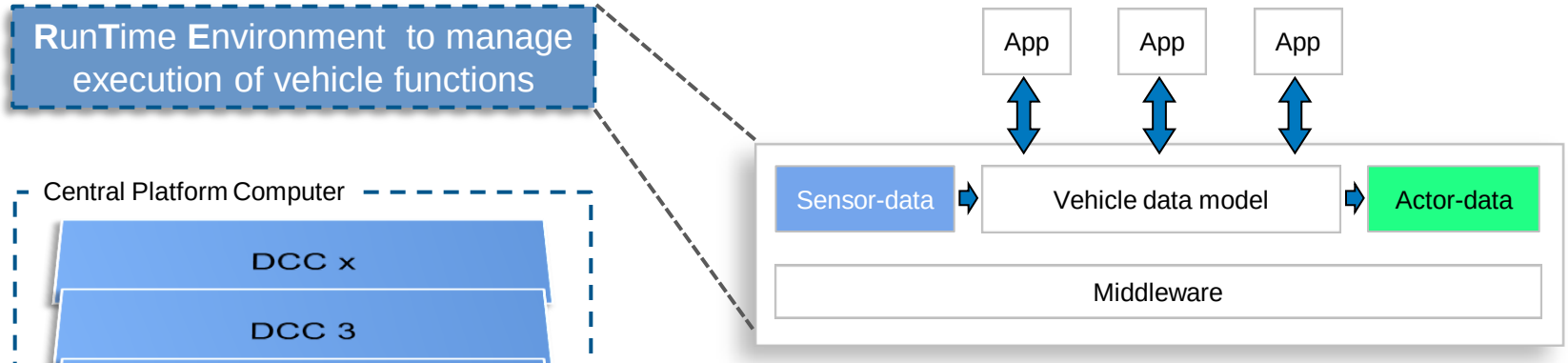
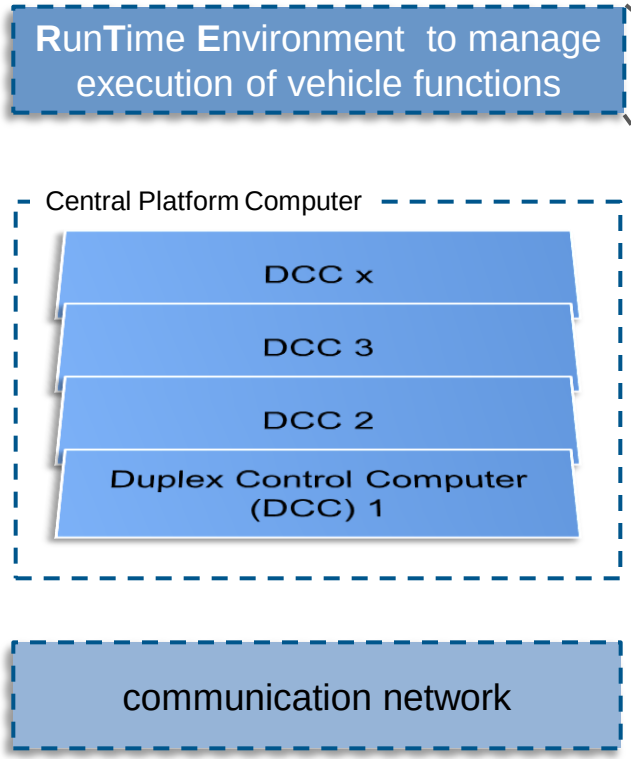
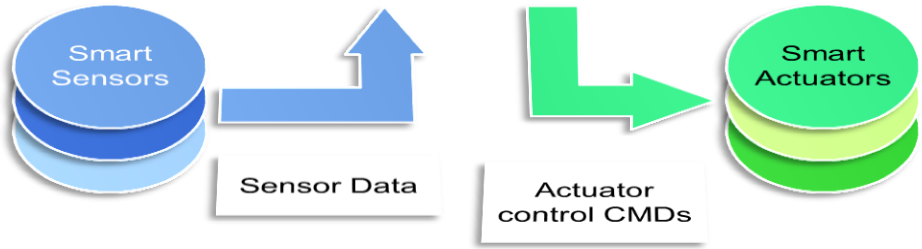
Benefit	Key Requirement	Design Paradigm
Cost cutting and time to market • Reduction of overall complexity. • Reusability of platform software. • Less effort to transfer know-how between different vehicle types. • More test automation feasible.	Standardized hardware and communication interfaces Fail operational behavior is part of platform not of function (application) Dynamic resource sharing within vehicle network	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
Selling new functionality (hardware & software) during whole lifecycle of vehicle **(Plug and Play)**	Even safety critical HW+ SW can be exchanged or added without loosing certification	

Basic structure and information flow

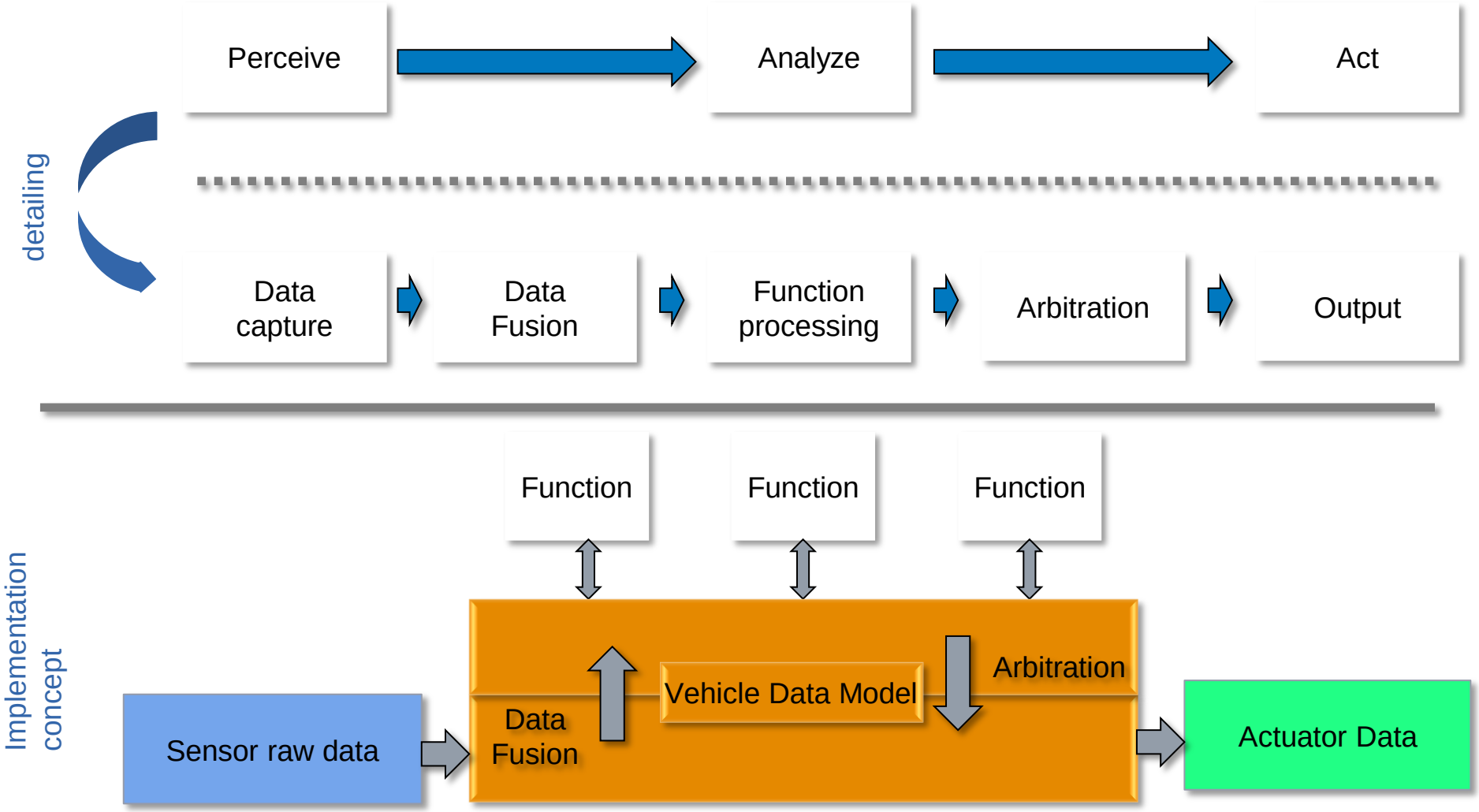






1. Scalable central processing units with physical access to all smart sensors and actuators.
2. Middleware to decouple vehicle functionality from architecture (including deployment) and BSW-functionality to ensure non-functional qualities (esp. fail-operational service and PnP).
3. Automotive functions.

Development paradigm #1



Ethernet-based redundant communication as communication backbone

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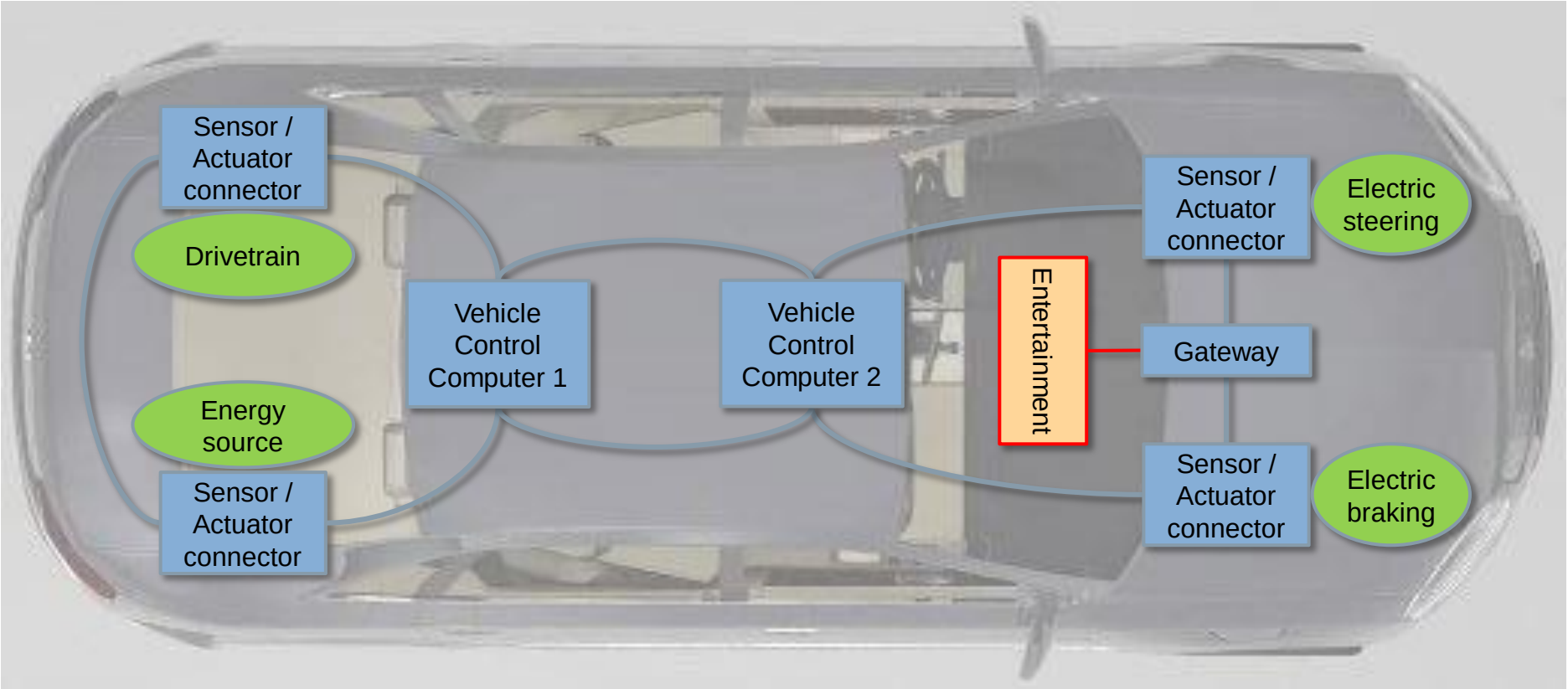

Project „RACE“: Robust and reliable Automotive Computing Environment for future eCars

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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

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”

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Project „SafeAdapt“:
Safe Adaptive Software for Fully Electric Vehicles

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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
- Duracar Holding B.V.
- AWEFLEX Systems B.V.
- Delphi Deutschland GmbH

Questions ?