

GEFÖRDERT VOM



Bundesministerium  
für Bildung  
und Forschung



# Research Project e performance

In-car-network optimization for Electric Vehicles

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AUDI AG



Audi  
Electronics Venture GmbH

Robert Bosch GmbH  
Bosch Engineering GmbH



**BOSCH**  
Technik fürs Leben

**RWTHAACHEN**  
UNIVERSITY

# Motivation

New way of energy supply effects the full vehicle

- ▶ New possibilities
- ▶ A lot of challenges



- ▶ Foundation of the research project **e performance** to demonstrate technical and economical feasibility

# Research Project e performance



**Funding:**

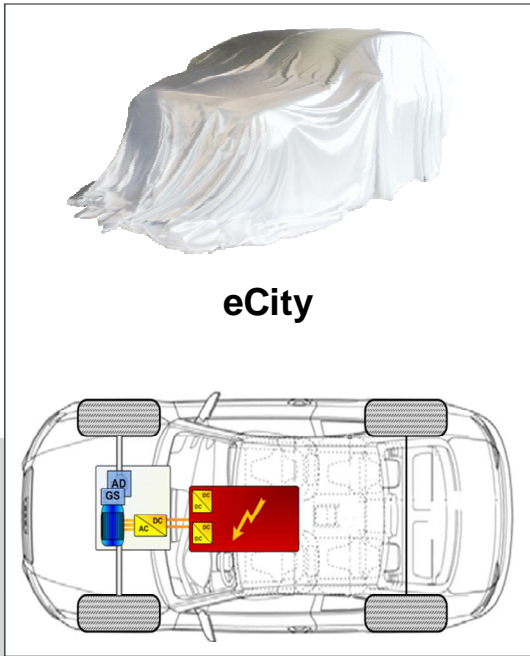
- ▶ Project volume: 36 Mio. €
  - ▶ ~ 10 Mio. € Funding RWTH Aachen
  - ▶ ~ 4 Mio. € Commisioning of other Universities

# Topics in e performance

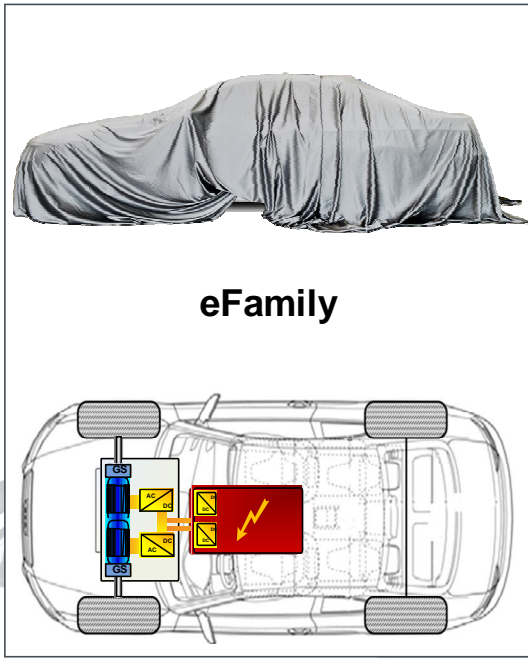
- ▶ **Vehicle concept**
- ▶ **Battery system**
- ▶ **Drive concept**
- ▶ **Energy management (thermal/electrical)**
- ▶ **Chassis**
- ▶ **Electrics/Electronics**
  - ▶ **Less complex in-car networking**



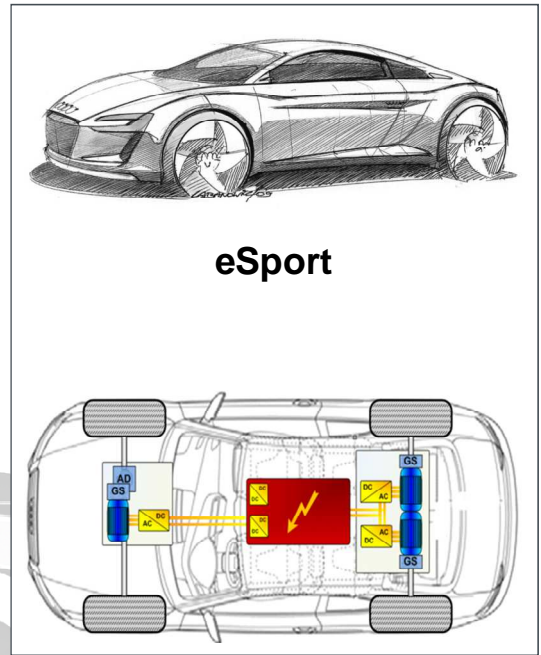
# System modules for components



eCity



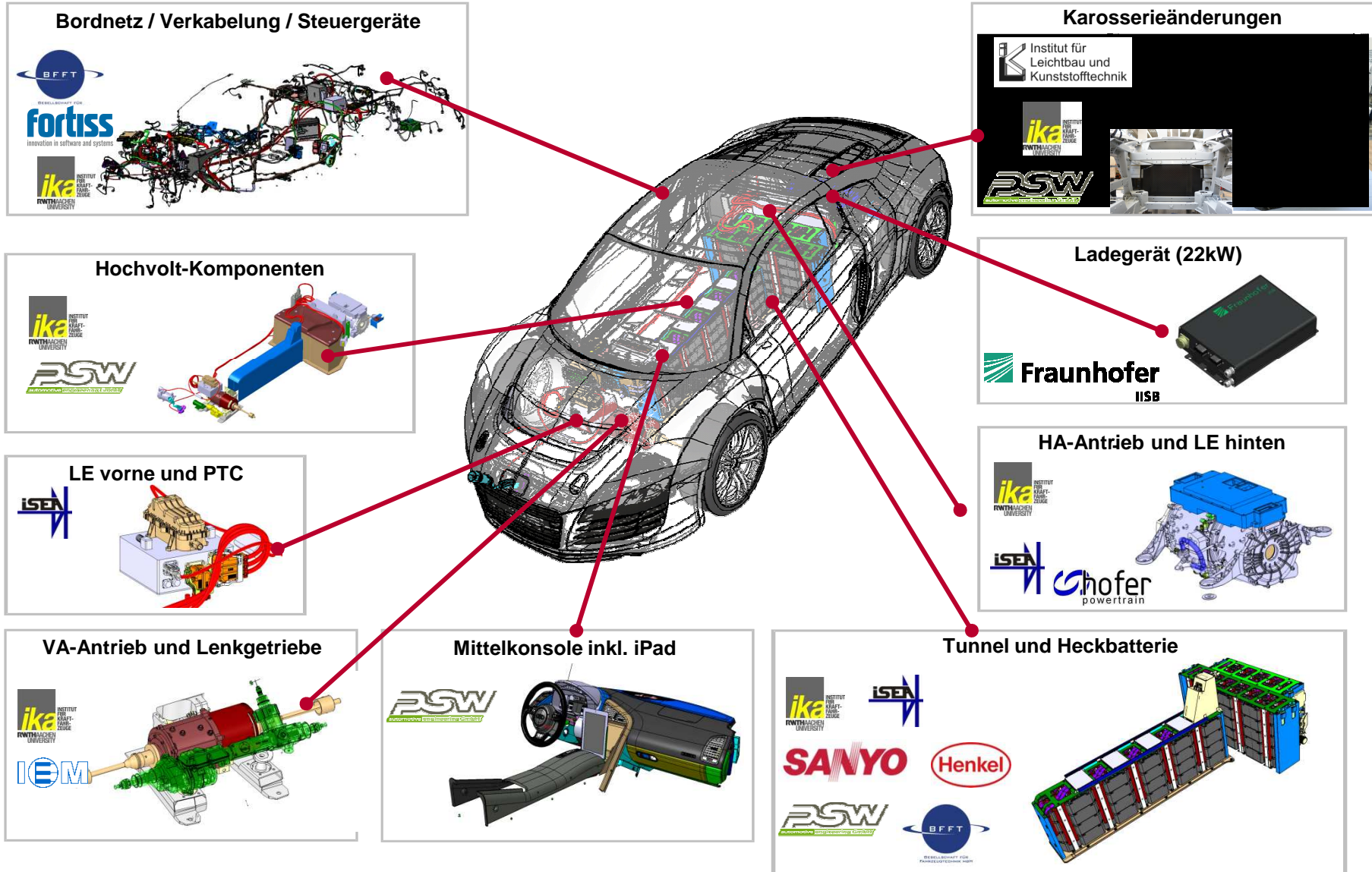
eFamily



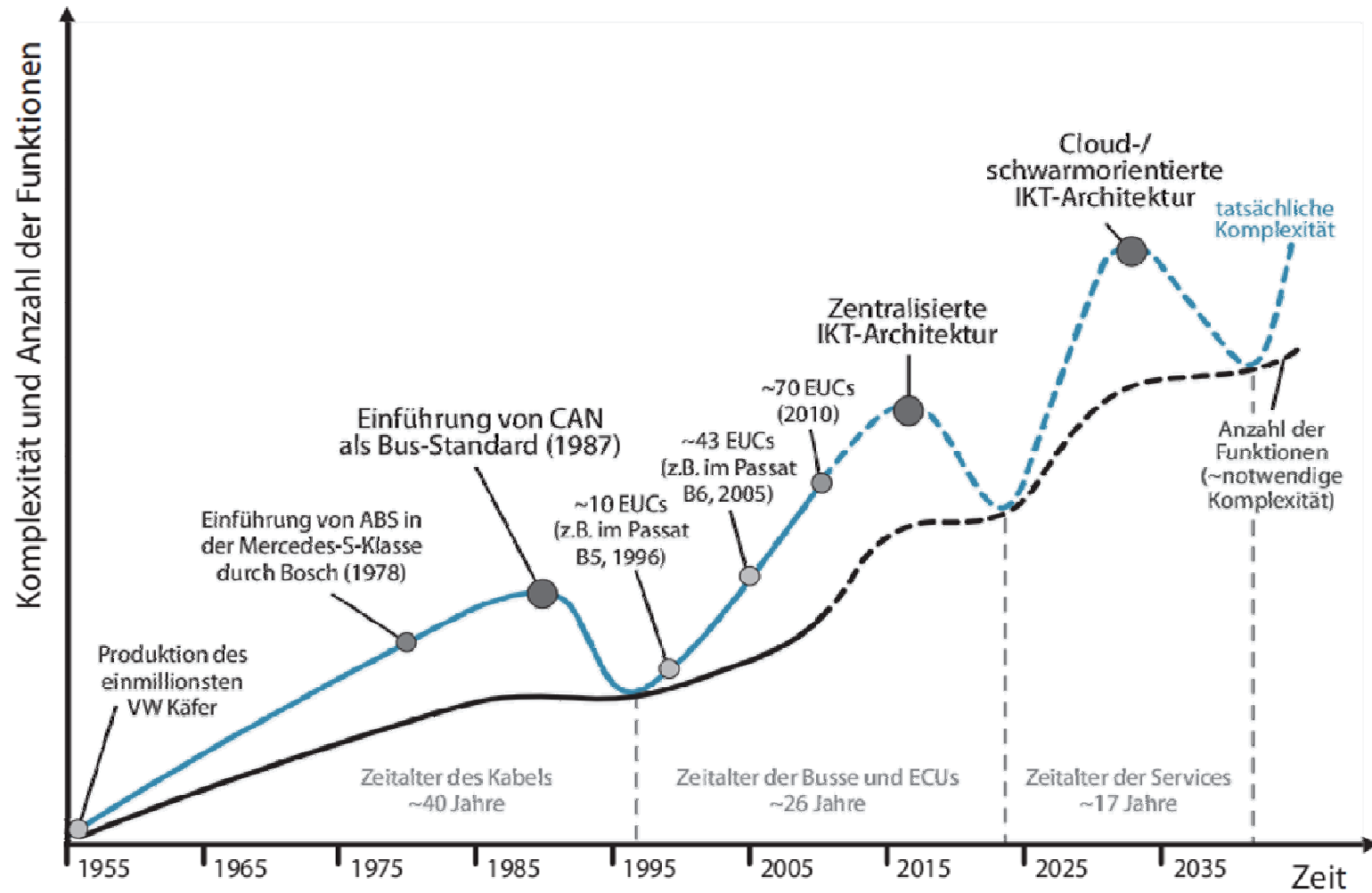
eSport



# Research Project e performance (2)

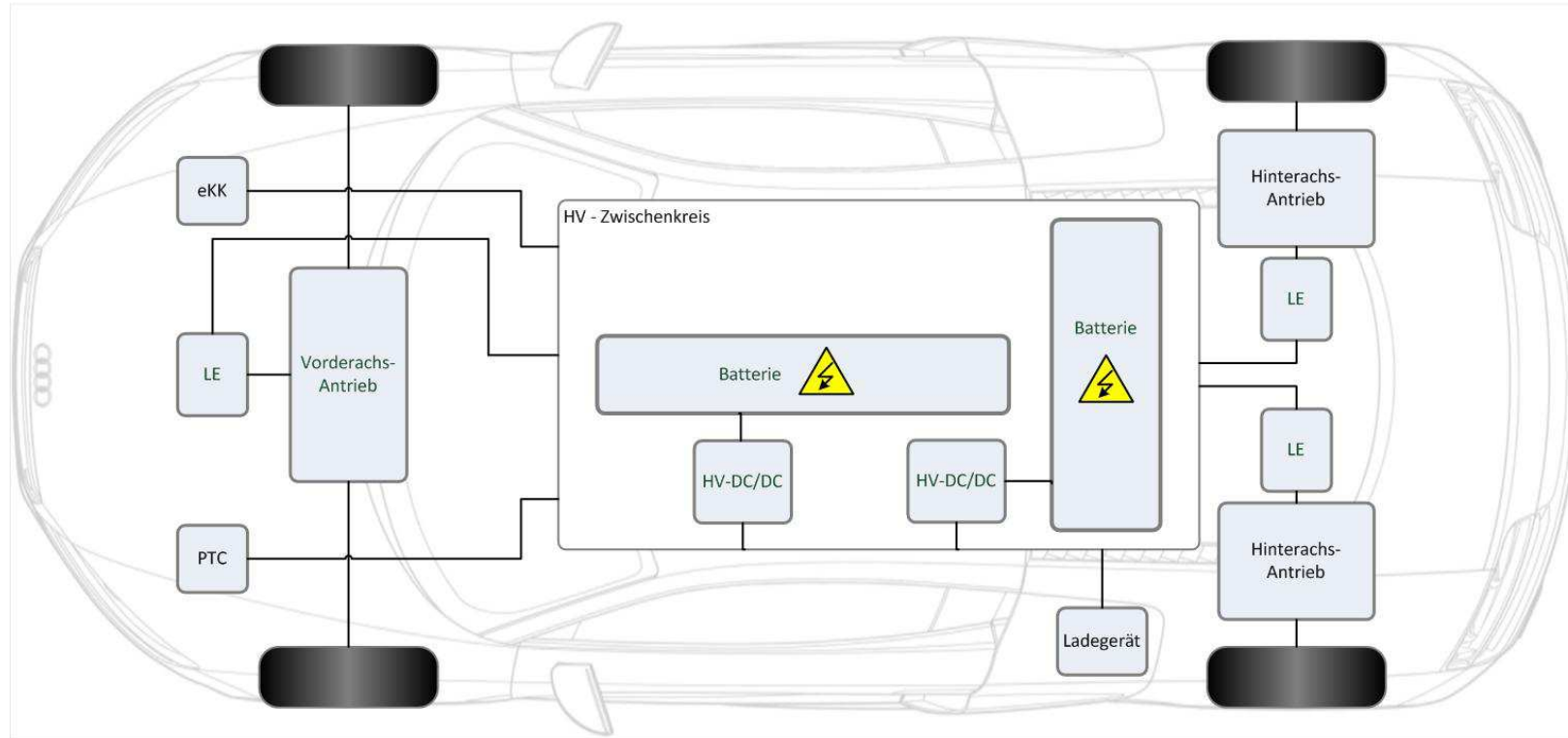


# Permanent increase in functionality



Ref: ForTISS GmbH, Mehr Software (im) Wagen, Verbundvorhaben „eCar-IKT-Systemarchitektur für Elektromobilität“, 2011

# Electric Vehicles: What really changes



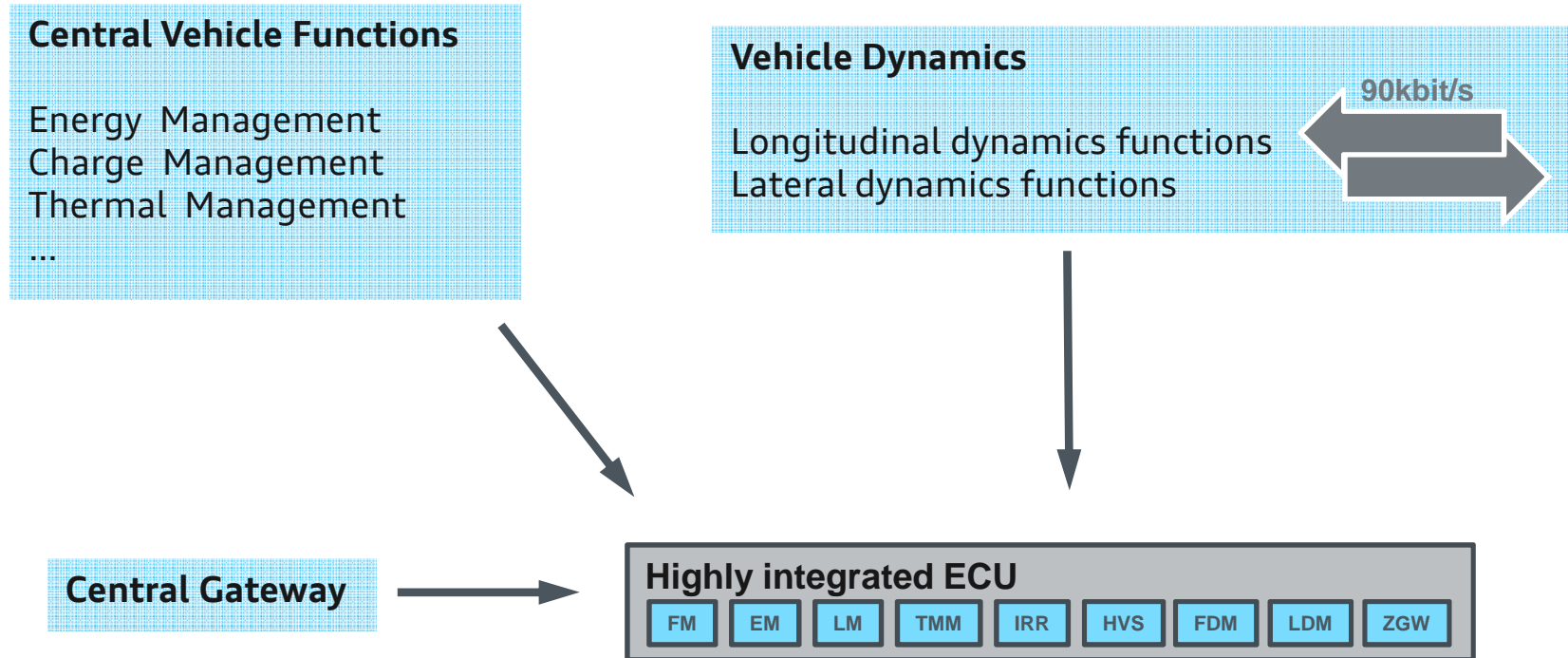
**Central Vehicle Functions**

- Energy Management
- Charge Management
- Thermal Management
- Functionality Safety (extended for EVs)

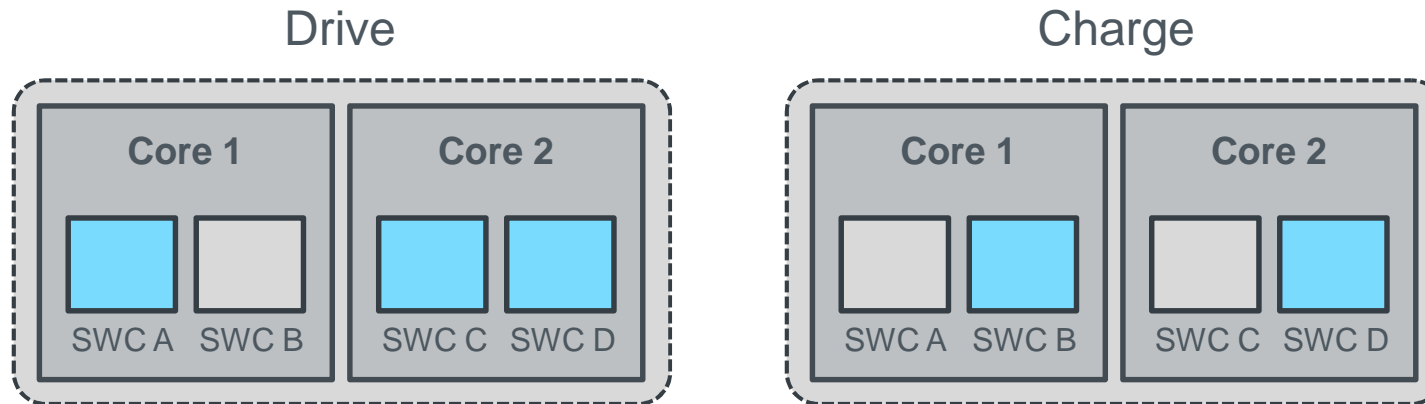




# Shifting in-car-networking complexity into software

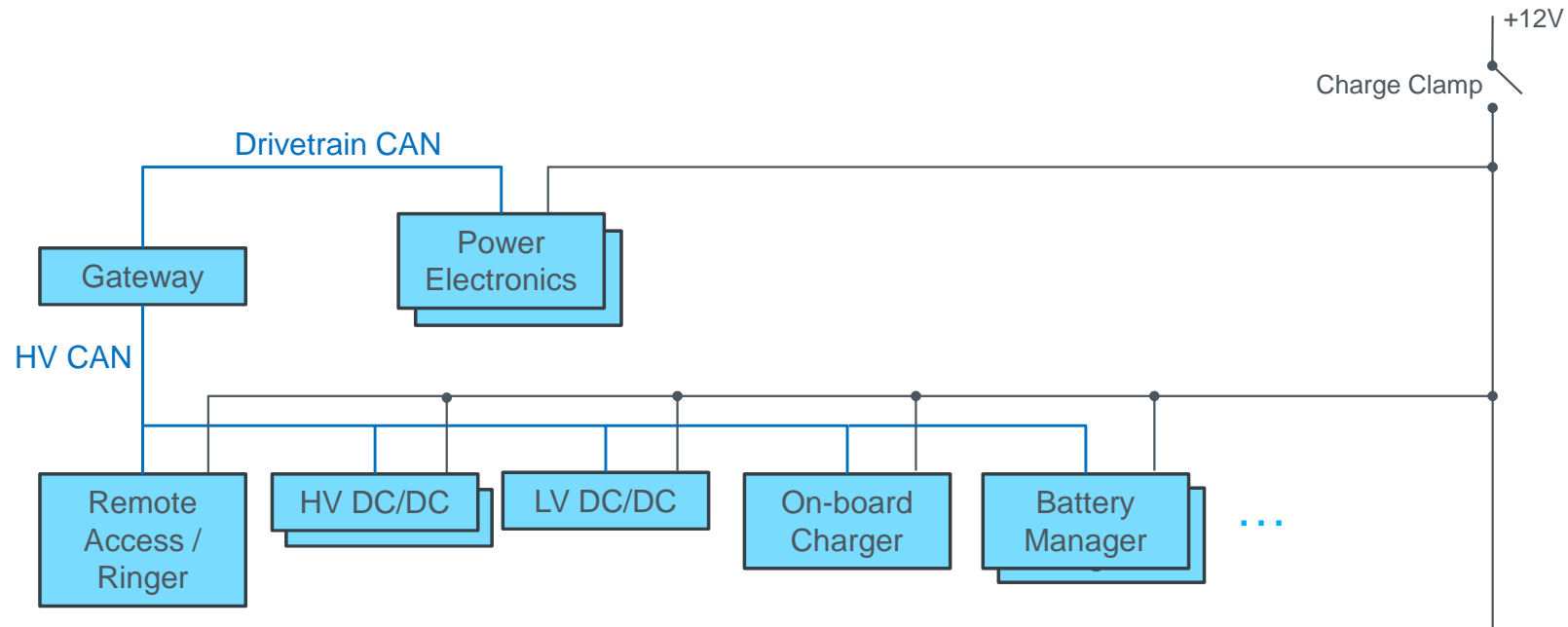


# Loading and unloading software components



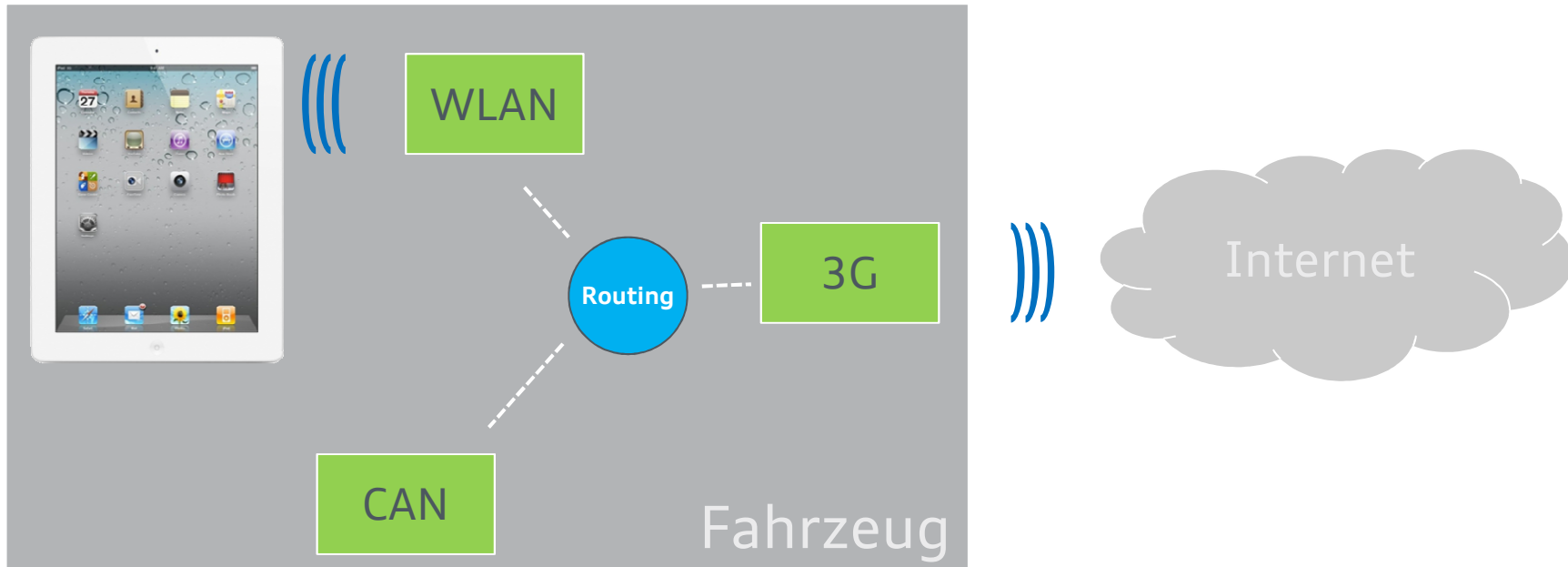
- ▶ Integrate even more software components on a single ECU
  - ▶ Taking advantage of the different vehicle states of EVs

# Charging: Aggregation of ECUs and selective Wakeup



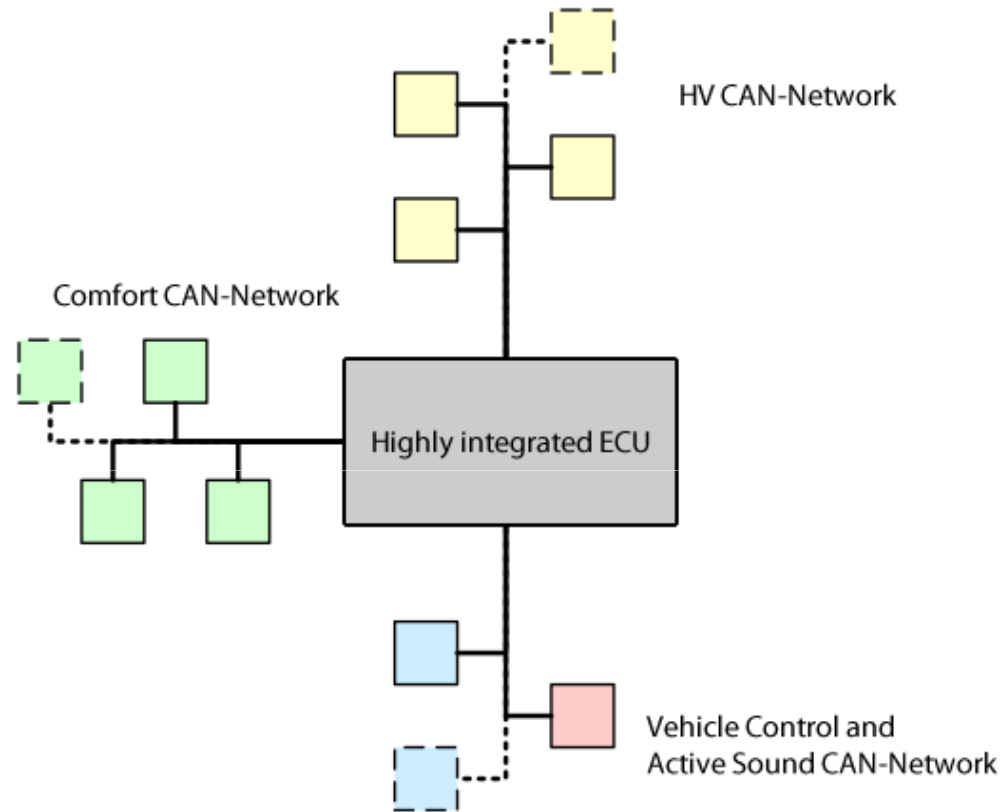
- ▶ Intelligent partitioning of ECUs participating in the charge process reduces
  - ▶ Energy
  - ▶ Bus load
  - ▶ ECU hardware requirements (processor, memory)

# Infotainment and Configuration



- ▶ Completely wireless setup for data (cabling for power and sound output)
- ▶ Configure charge timers and pre-conditioning from remote locations (over UMTS)

# Simplified vehicle network



- ▶ A step towards a
  - ▶ centralized control and
  - ▶ decentralized intelligent actuator/sensor system

# Conclusion

- ▶ **We propose to**

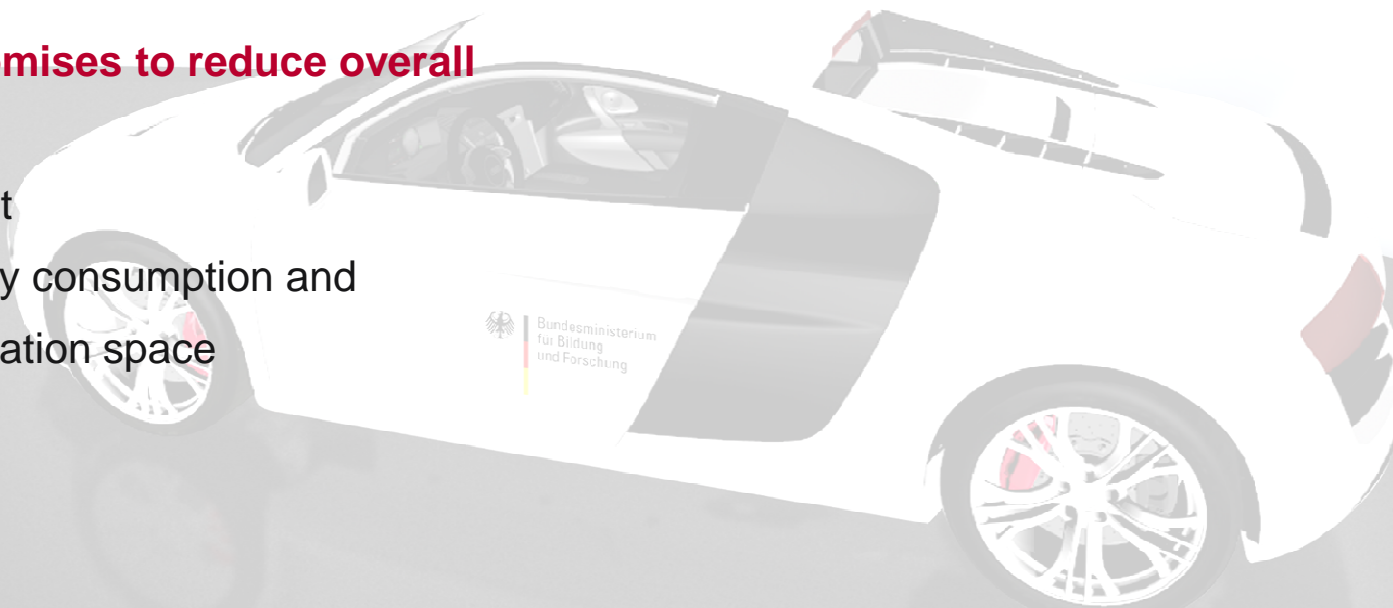
- ▶ highly integrate SWC in a communication and vehicle-state oriented manner
- ▶ but always by keeping the high number of influence factory in mind

- ▶ **A lot of to be solved issues in**

- ▶ timing- and safety planning
- ▶ analysis, integration and testing

- ▶ **This promises to reduce overall**

- ▶ costs
- ▶ weight
- ▶ energy consumption and
- ▶ installation space





# Research Project e performance

## Gratitude

... to all the project partners...



Thank you for your attention!