



**MATLAB EXPO 2017**

**„Vom Halter-Bieger zum Bit-Schubser“**

Die digitale Herausforderung eines Truck OEMs auf dem Weg zum hochautomatisierten Fahren

**Electric/Electronic Systems**

**Senior Vice President**

**Stefan Teuchert**

# Agenda



**The world is changing**



**Global mega trends and truck business**



**Influence on Electric / Electronic systems**

# Agenda



**The world is changing**



Global mega trends & truck business



Influence on Electric / Electronic systems

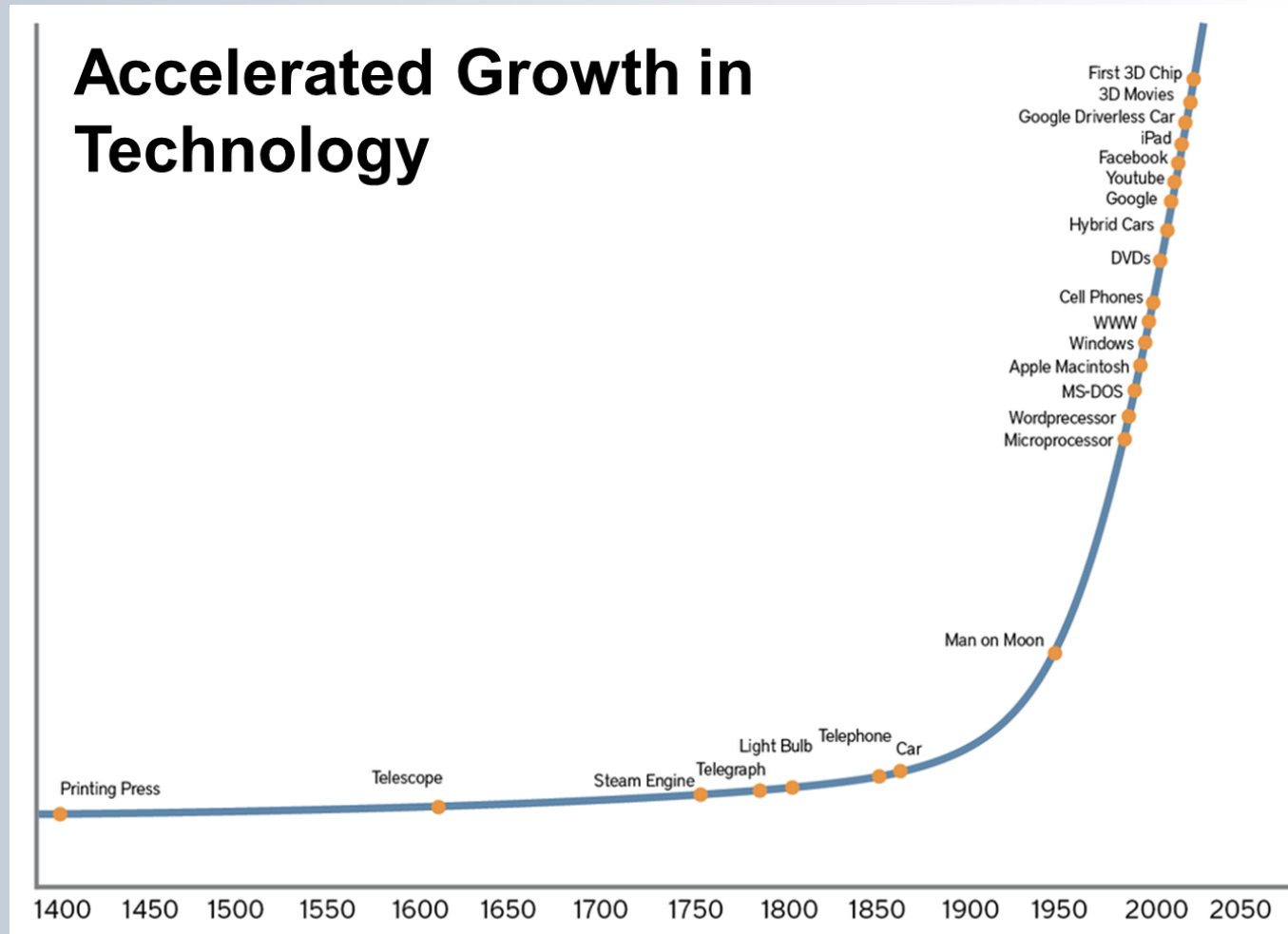
# The world is changing - MAN 1915



# The world is changing - MAN 2017



# The world is changing



# Agenda



The world is changing

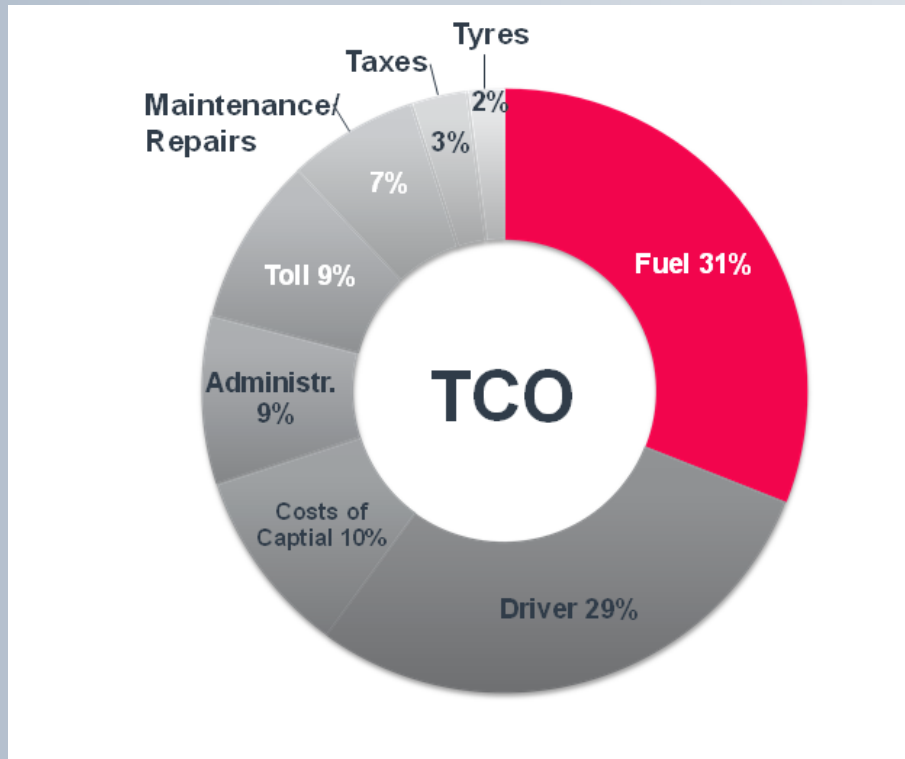


**Global mega trends and truck business**



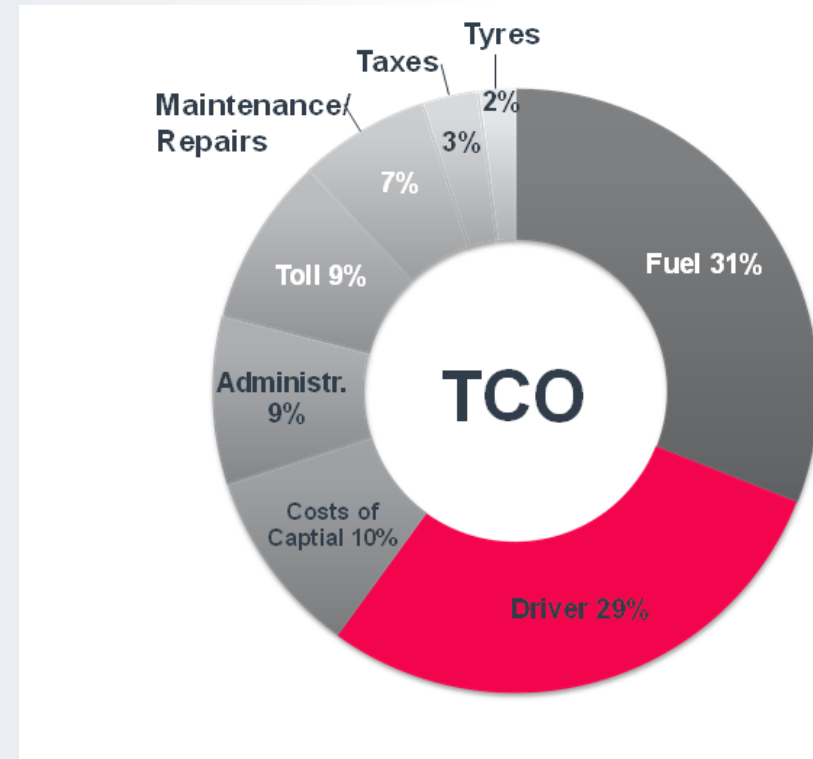
Influence on Electric / Electronic systems

# Truck business – TCO oriented



## Today

Optimizing the route costs (fuel)



## Next Step

Optimizing the driver costs



# Global mega trends



**Economy**



**Urbanization**



**Society**



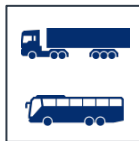
**Environment**

# Impact on MAN

Economy

Society

## Action Fields



Dedicated vehicle concepts



Alternative powertrains



Connectivity & automation



Business models

Urbanization

Environment

# Impact on MAN



Connectivity & automation



# Agenda



The world is changing



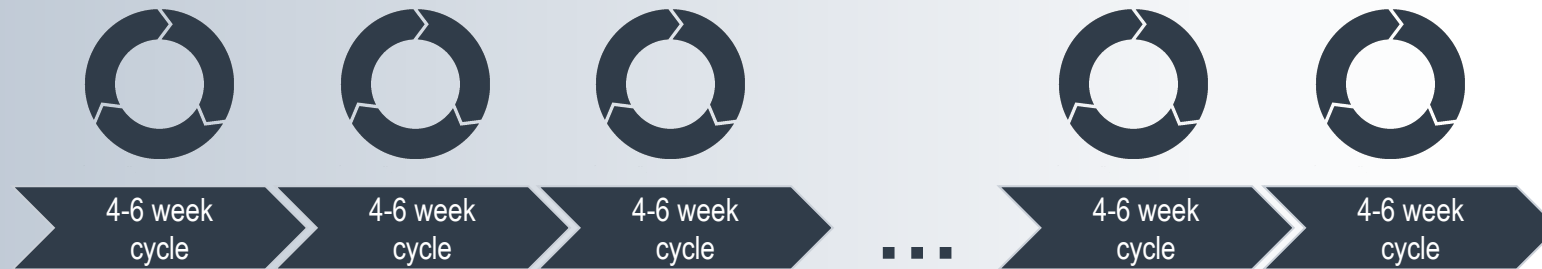
Global mega trends and truck business



**Influence on Electric / Electronic systems (methods, tools)**



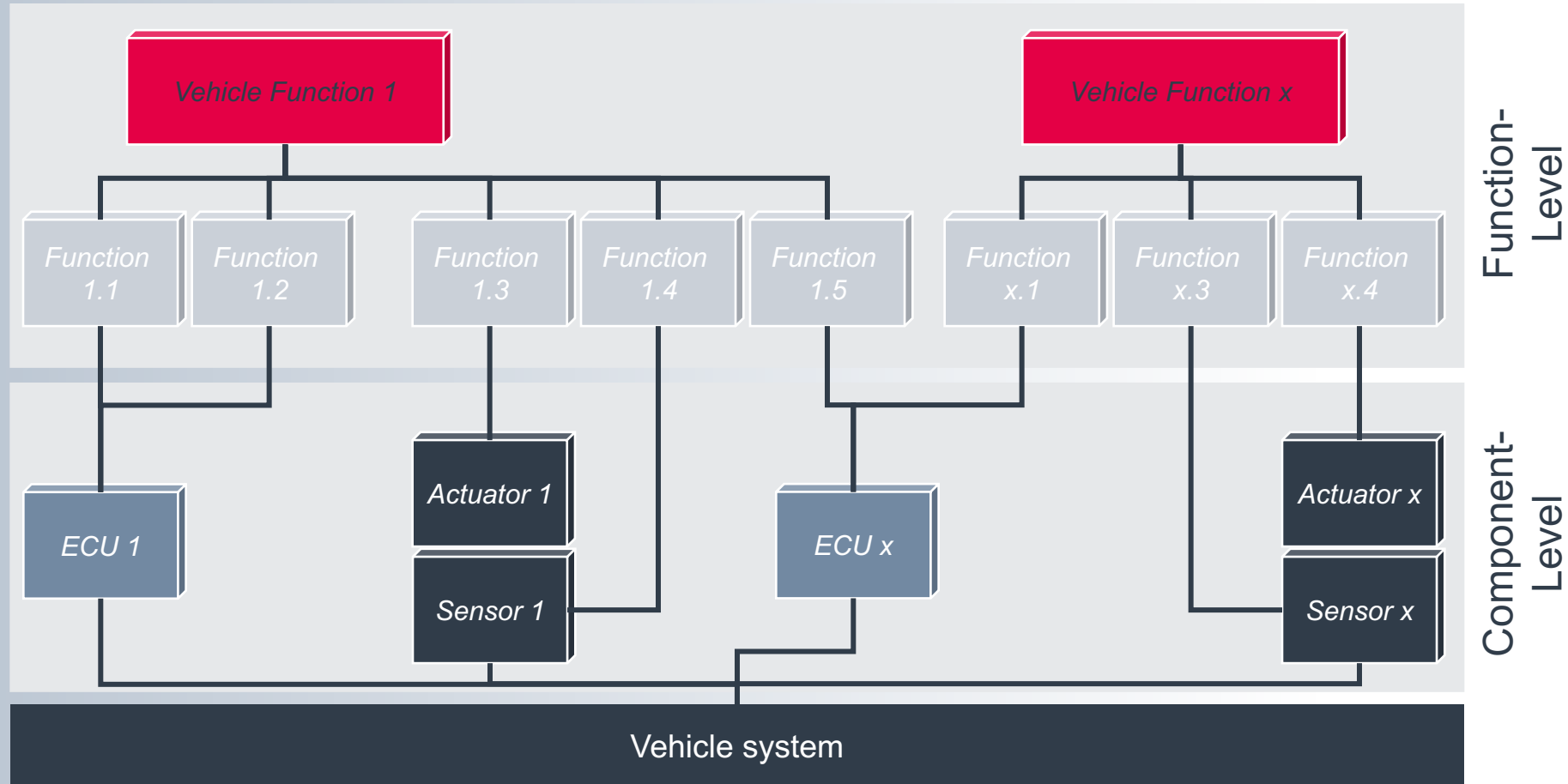
# Decoupling the software development process



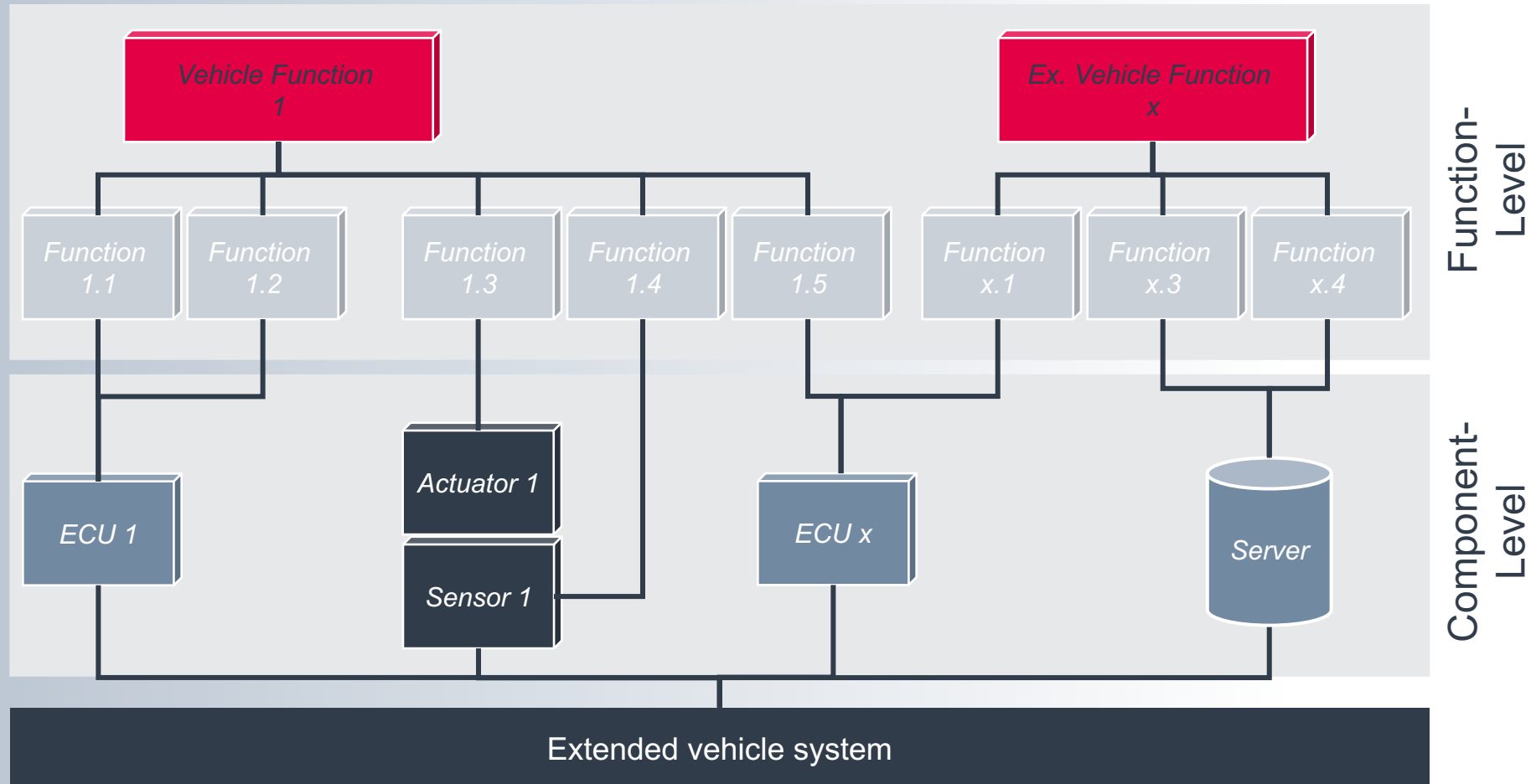
## MAN (OEM) Product development process



# Separation function / component - the philosophy behind (method)

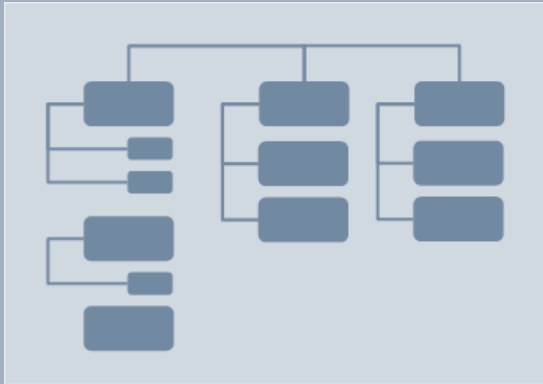


# Connectivity influence: → extended vehicle function / system

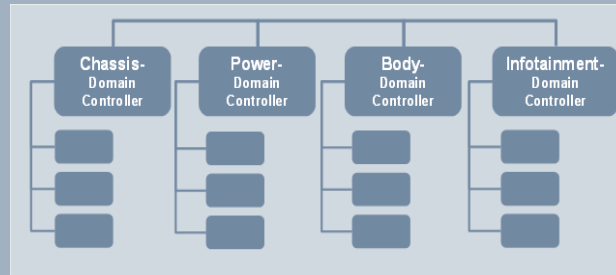




# Component Architecture



Hardware driven Approach  
New Function → New ECU

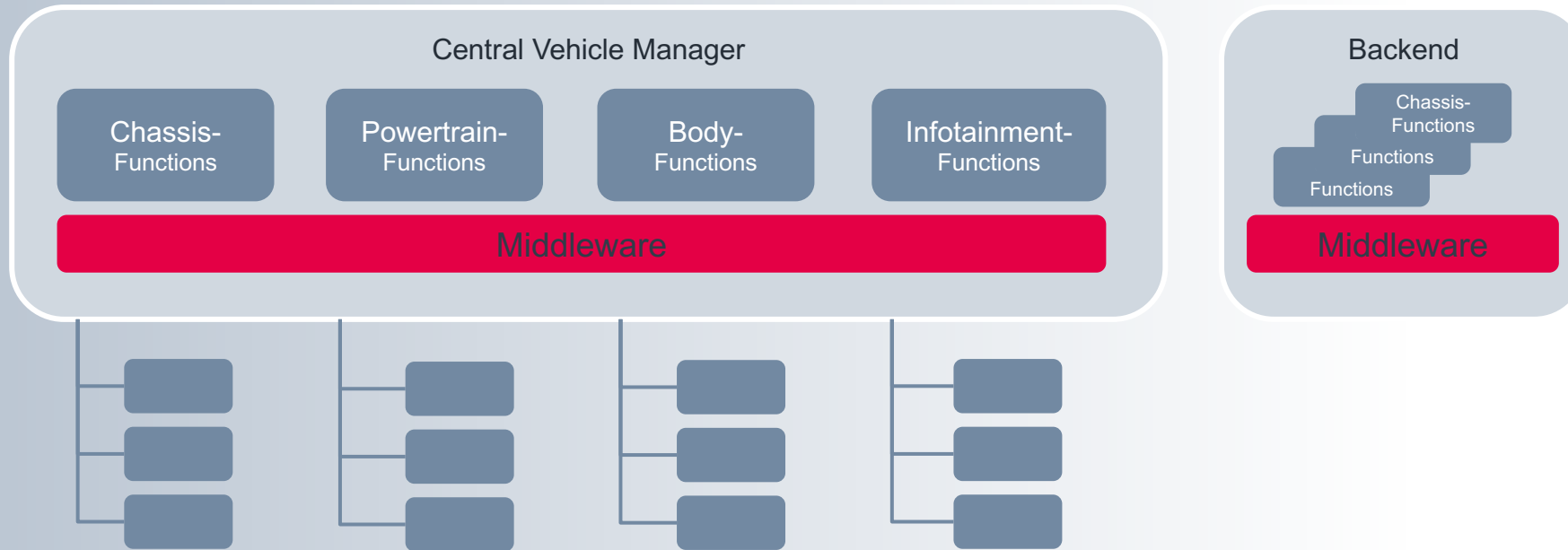


Domain Controller Approach  
Domain Functions → One ECU



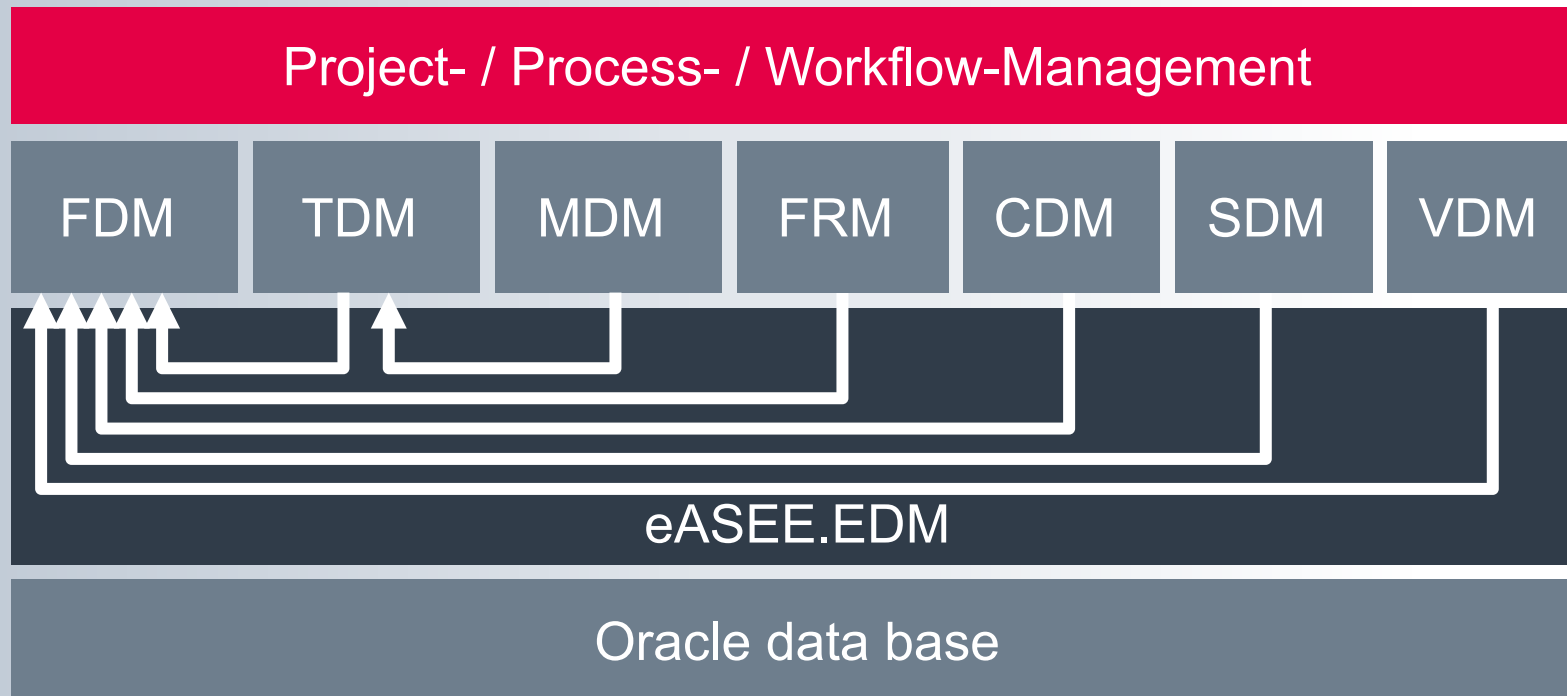
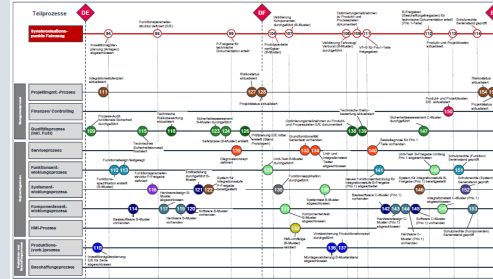
Centralized Middleware  
Approach

# Centralized virtualized component architecture

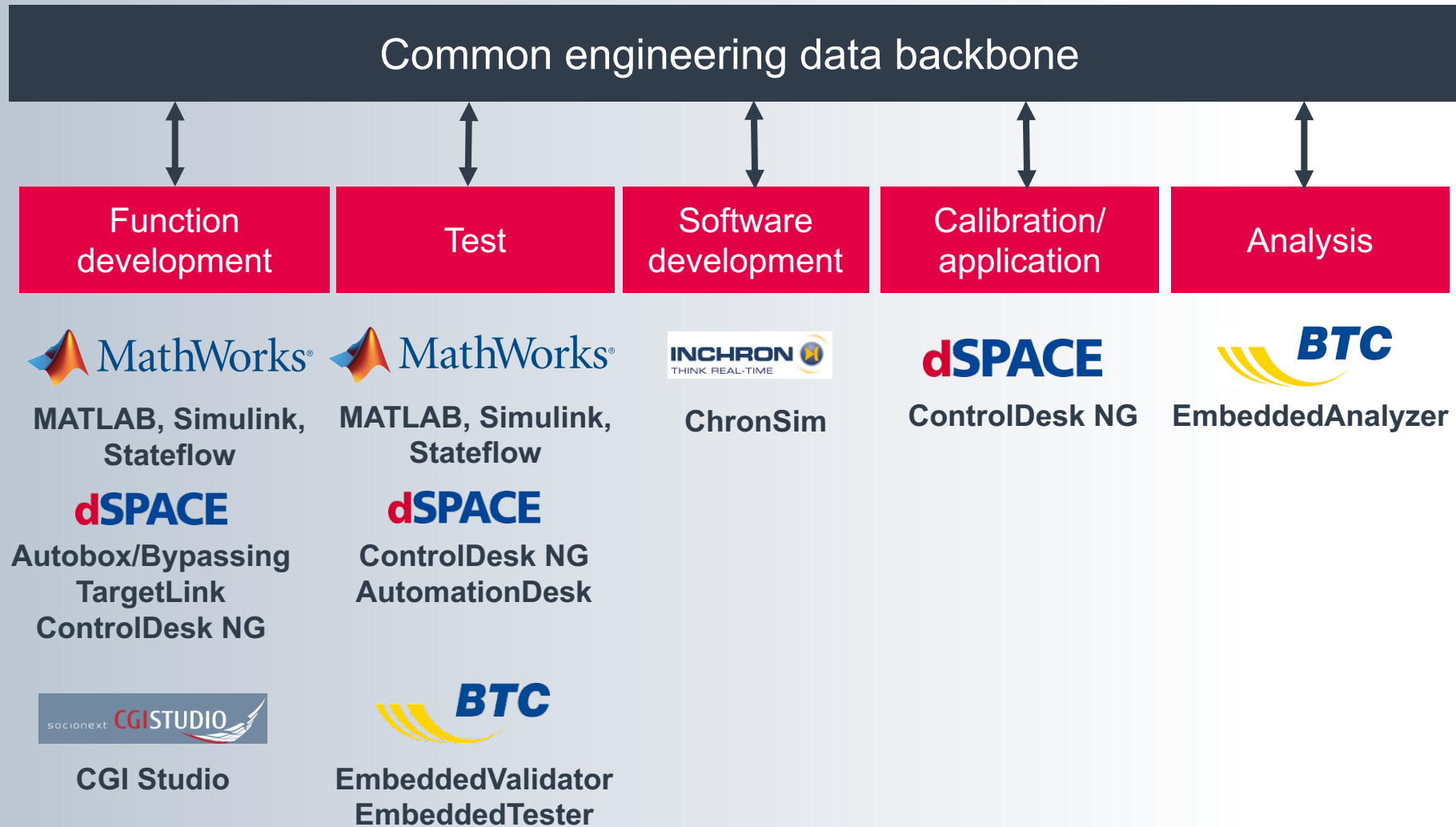


- Standard middleware functionality / attributes
- Complete truck signal information on the middleware available
- Function communication only via the middleware
- Function integration on software-/function-level

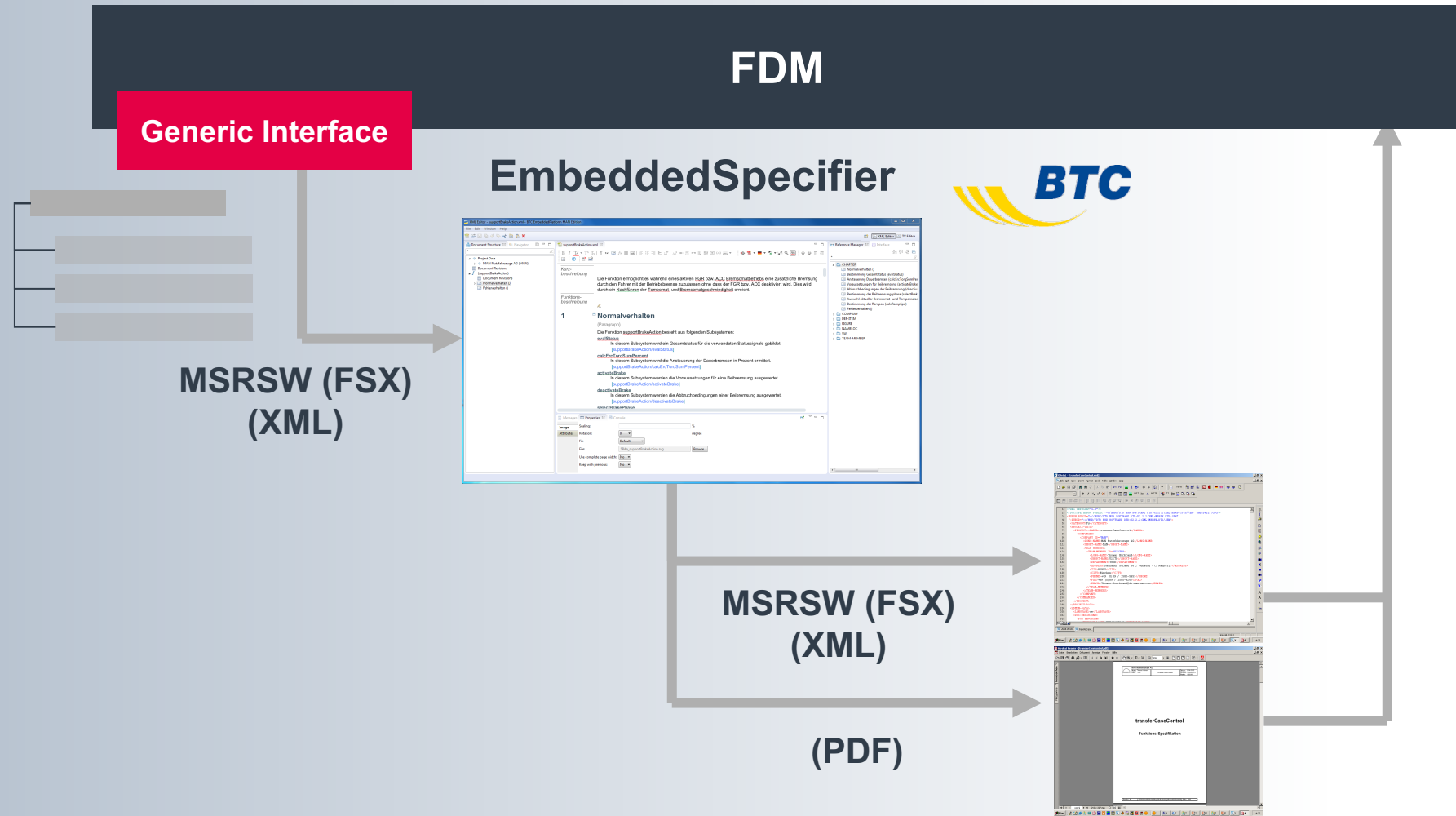
# Working with one database – the common engineering data backbone



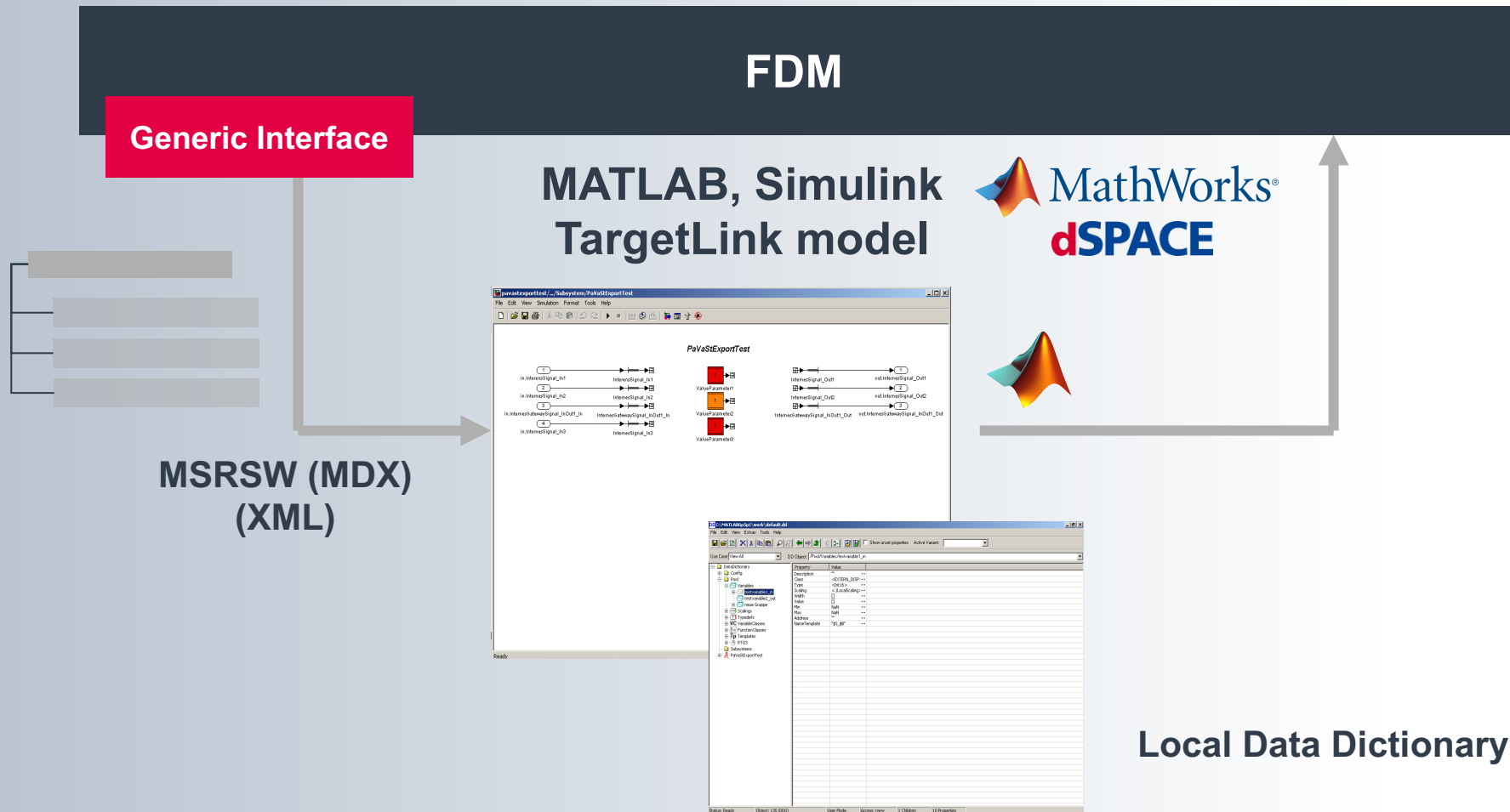
# Current toolchain



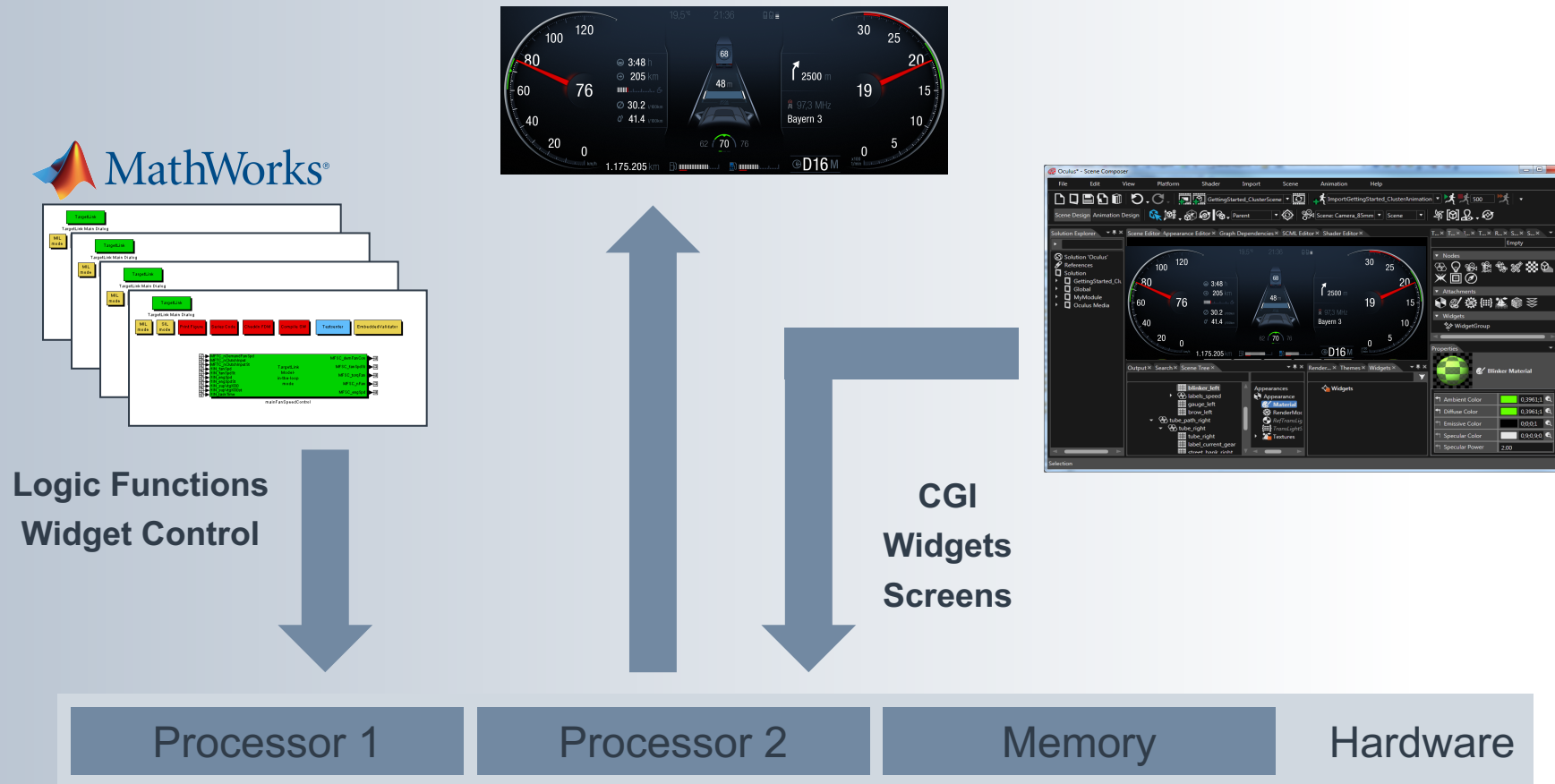
# Toolchain for specification



# Toolchain for function development (modelling)

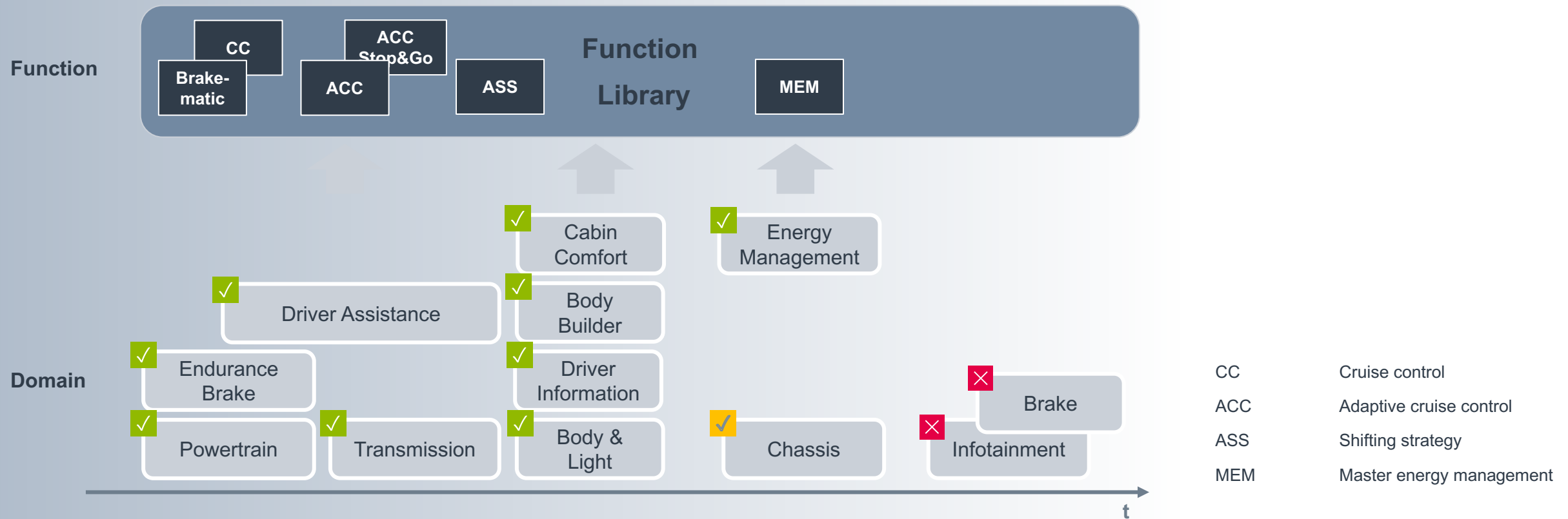


# Example: Display development



- Same toolchain for instrument cluster development (additional tool for graphic application)

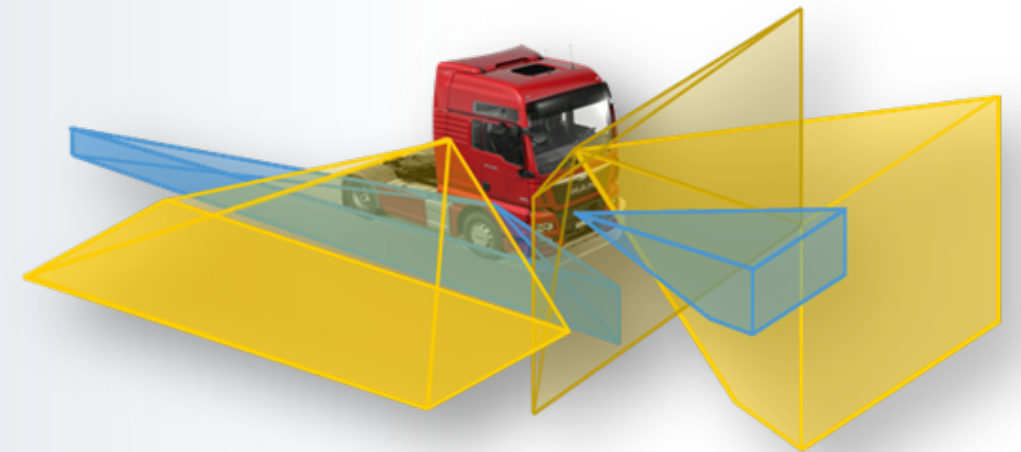
# EE strategy – function development – since 2005



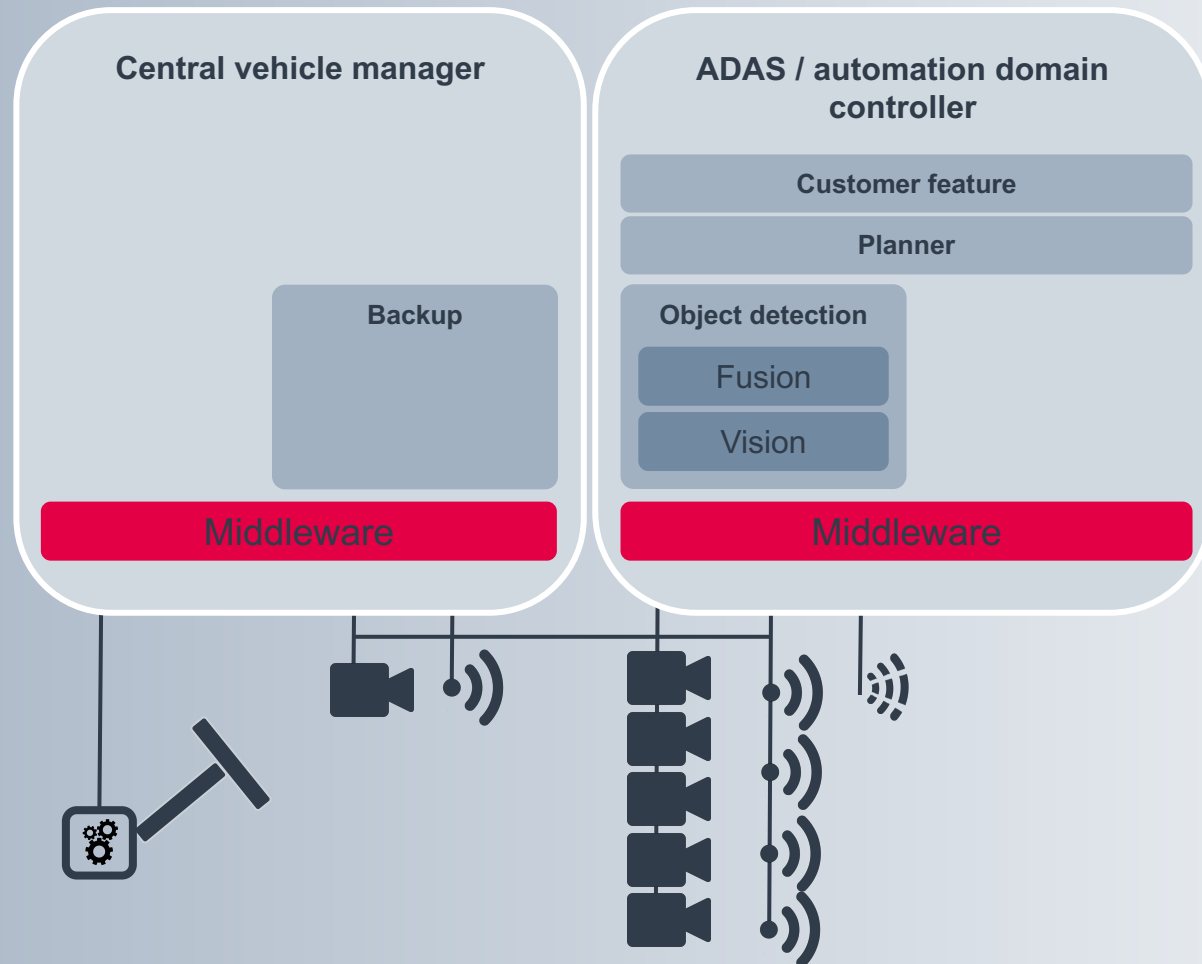


# New upcoming requirements for highly automated driving functions

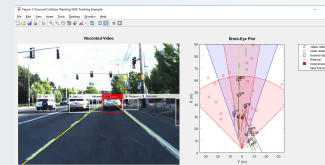
- Redundancy concept
- Object detection
  - AI: implementation – deep learning algorithms
  - AI: training – deep learning algorithms
- MAN extended meta model
  - object oriented
  - client – server based interfaces
- Scaling: integer to float
- Automated video data tagging
- New test methods



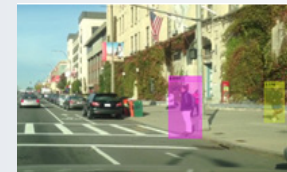
# Toolchain for highly automated driving functions



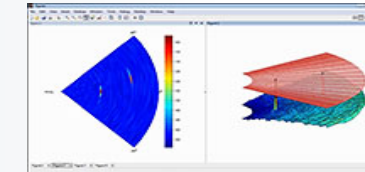
## Automated Driving Systems Toolbox



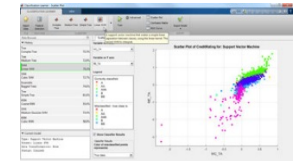
### Vision (Computer Vision System Toolbox)



### RADAR (Phased Array Systems Toolbox)



### Statistics & Machine Learning Toolbox



Simulink, Stateflow

MATLAB Coder, Embedded Coder, HDL Coder, Vision HDL Toolbox

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**Thank you very much for your attention!**

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