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

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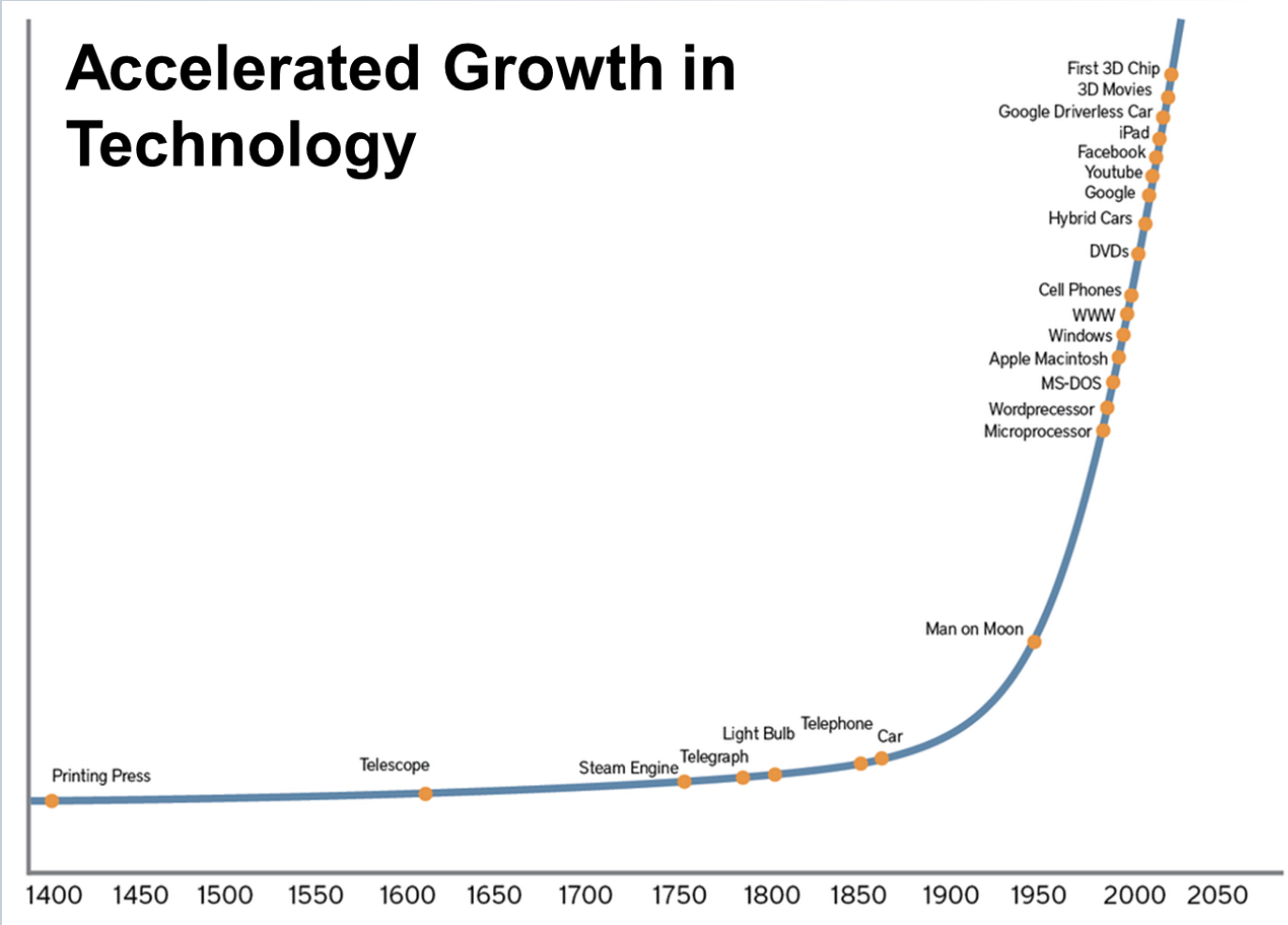
- **The world is changing**
- Global mega trends & truck business
- Influence on Electric / Electronic systems

The world is changing - MAN 1915

The world is changing - MAN 2017

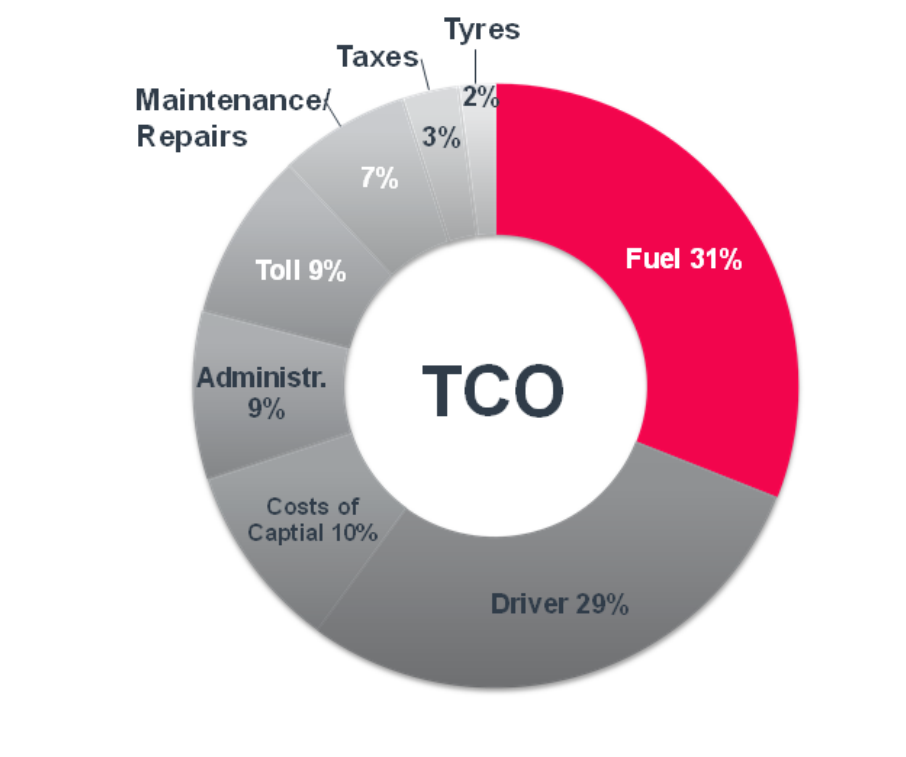
The world is changing



Agenda

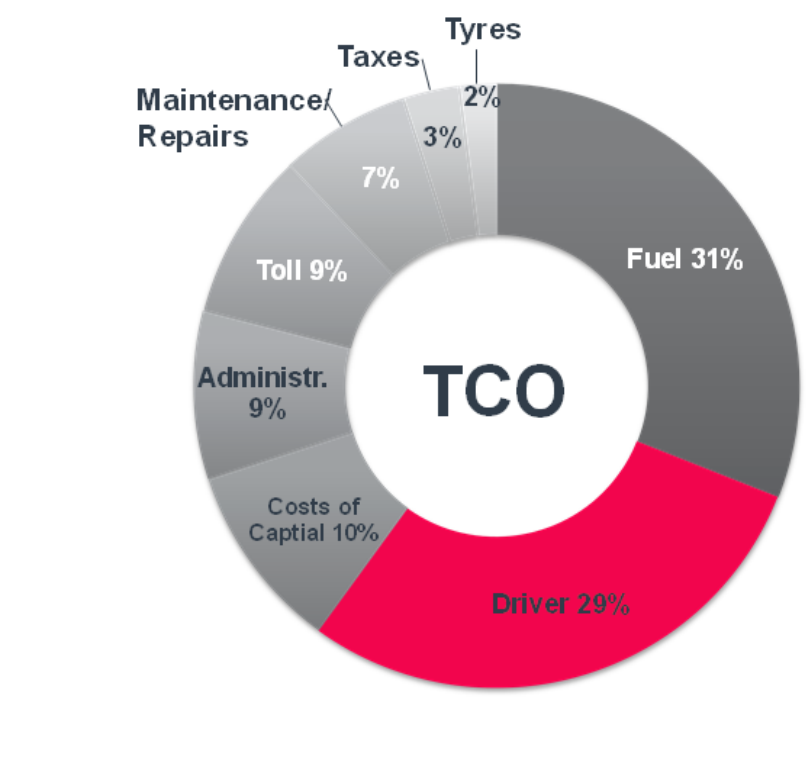
- The world is changing
- **Global mega trends and truck business**
- Influence on Electric / Electronic systems

Truck business – TCO oriented



Today

Optimizing the route costs (fuel)



Next Step

Optimizing the driver costs

Global mega trends

Impact on MAN

Economy

Urbanization

Society

Environment

Action Fields

- Dedicated vehicle concepts
- Alternative powertrains
- Connectivity & automation
- Business models

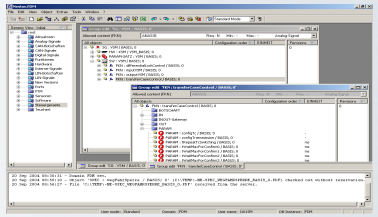
Impact on MAN

Connectivity & automation

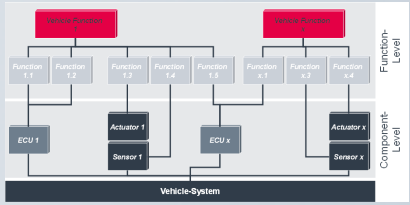
Agenda

- The world is changing
- Global mega trends and truck business
- **Influence on Electric / Electronic systems (methods, tools)**

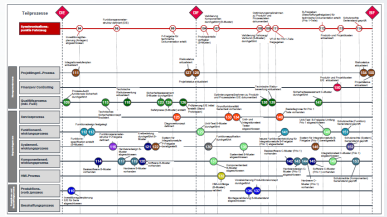
The elements of the E/E development at MAN



Tool Chain

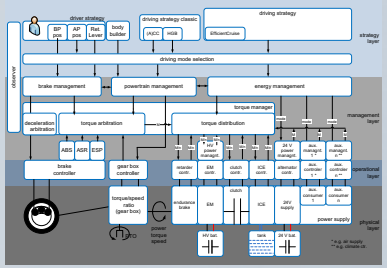


Design Methods



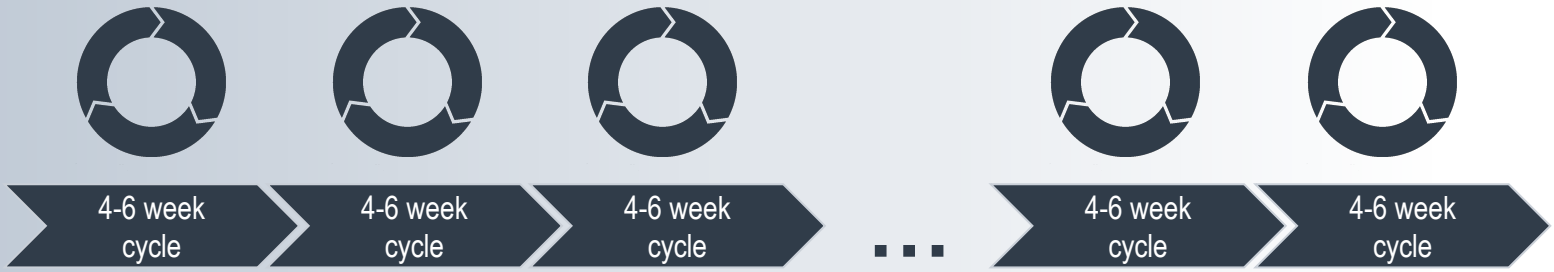
Development Process

Component Architecture (Topology)



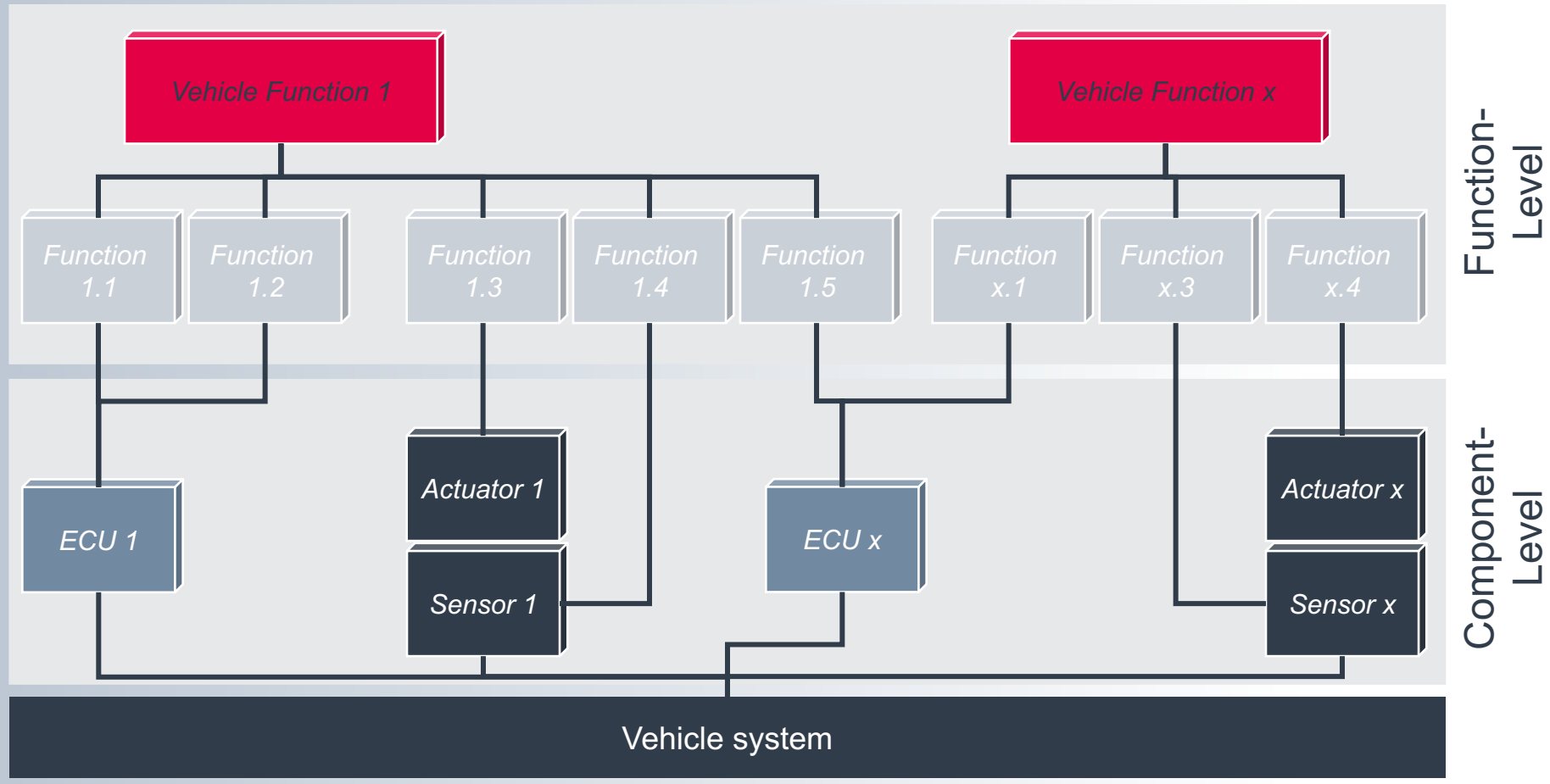
Functional Architecture

Decoupling the software development process

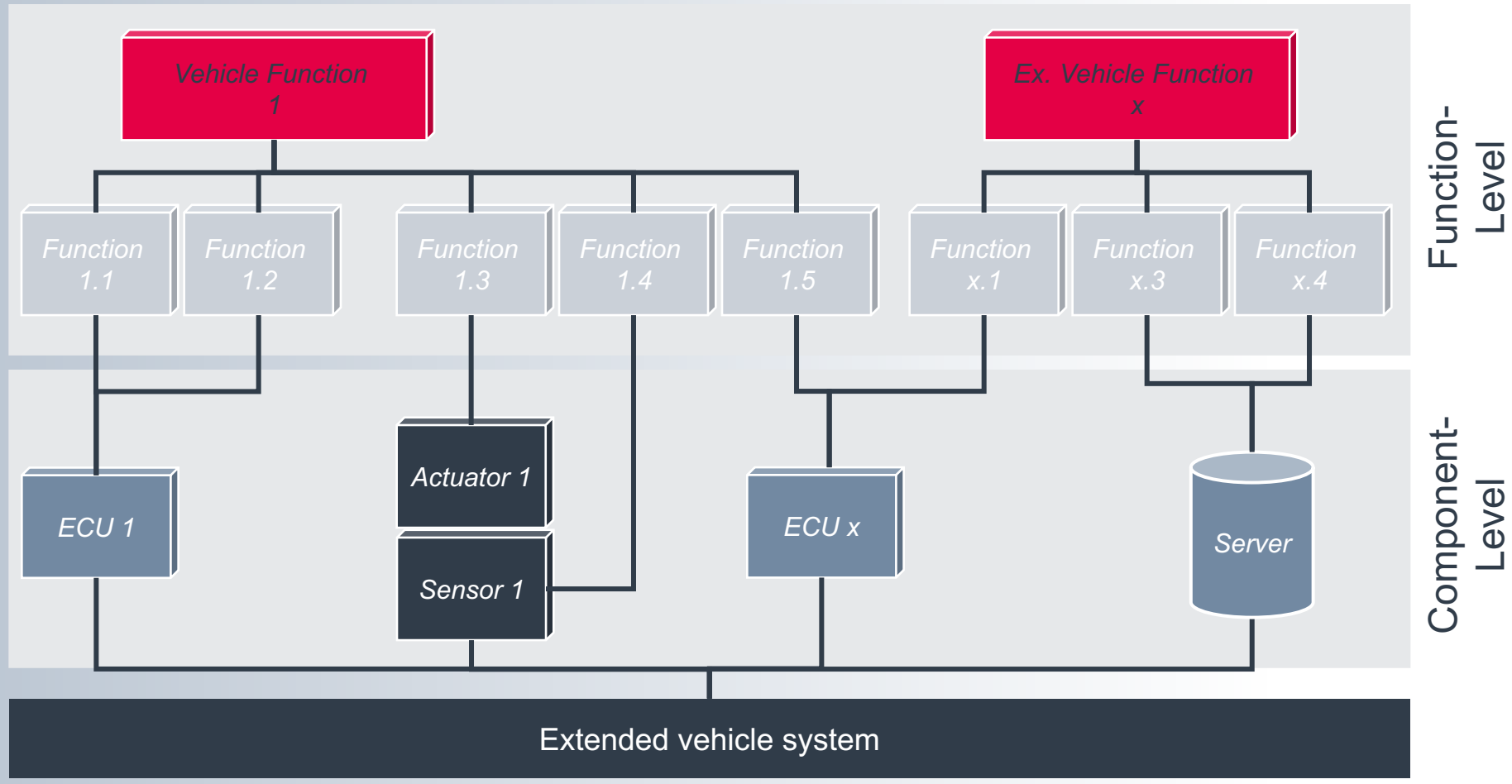


MAN (OEM) Product development process

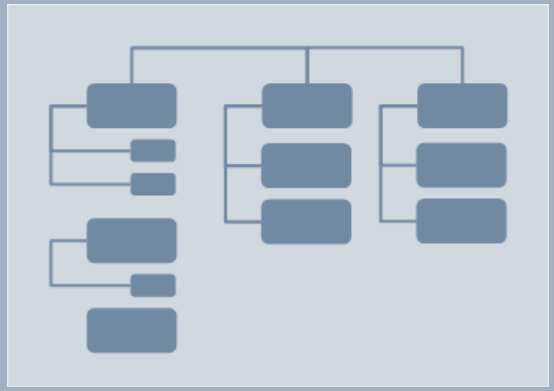
Separation function / component - the philosophy behind (method)



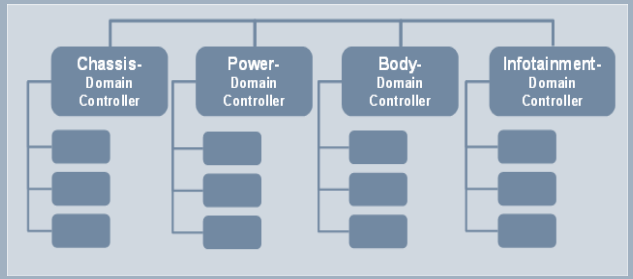
Connectivity influence: → extended vehicle function / system



Component Architecture



Hardware driven Approach
New Function → New ECU

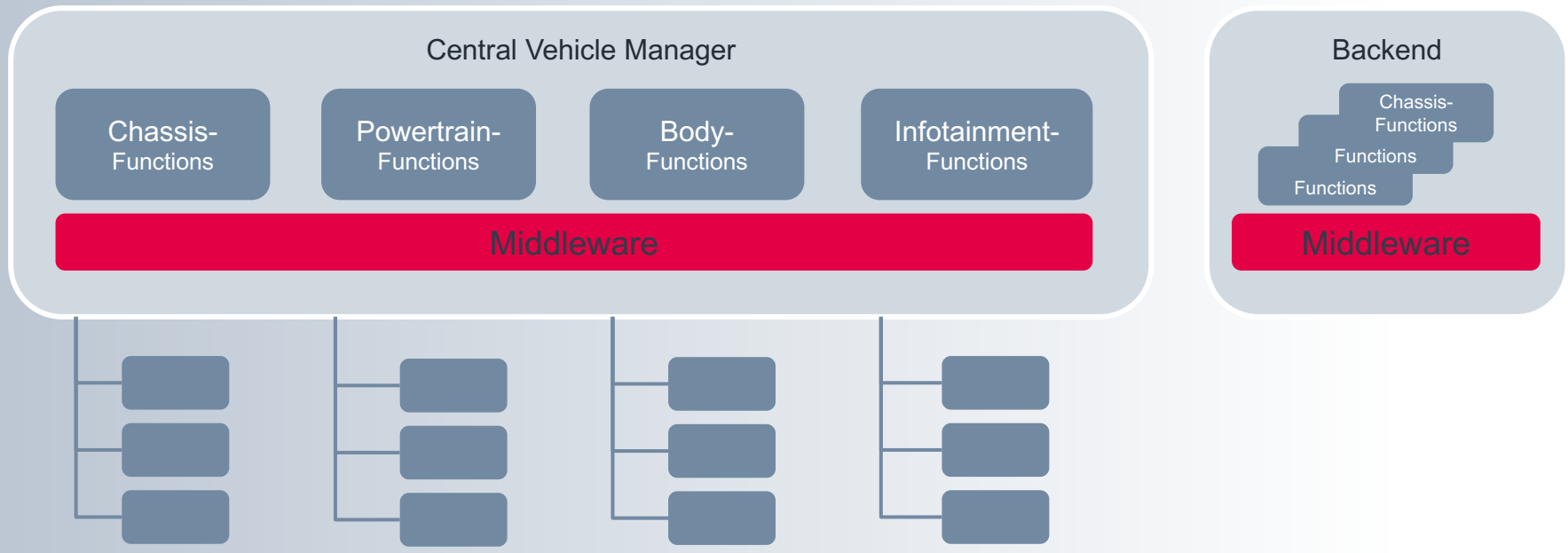


Domain Controller Approach
Domain Functions → One ECU

?

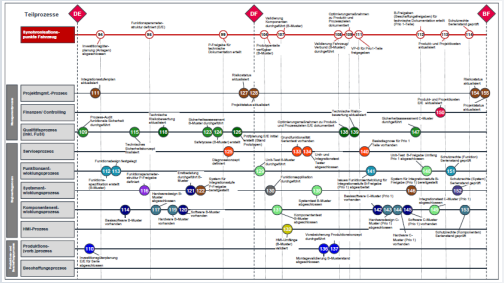
Centralized Middleware
Approach

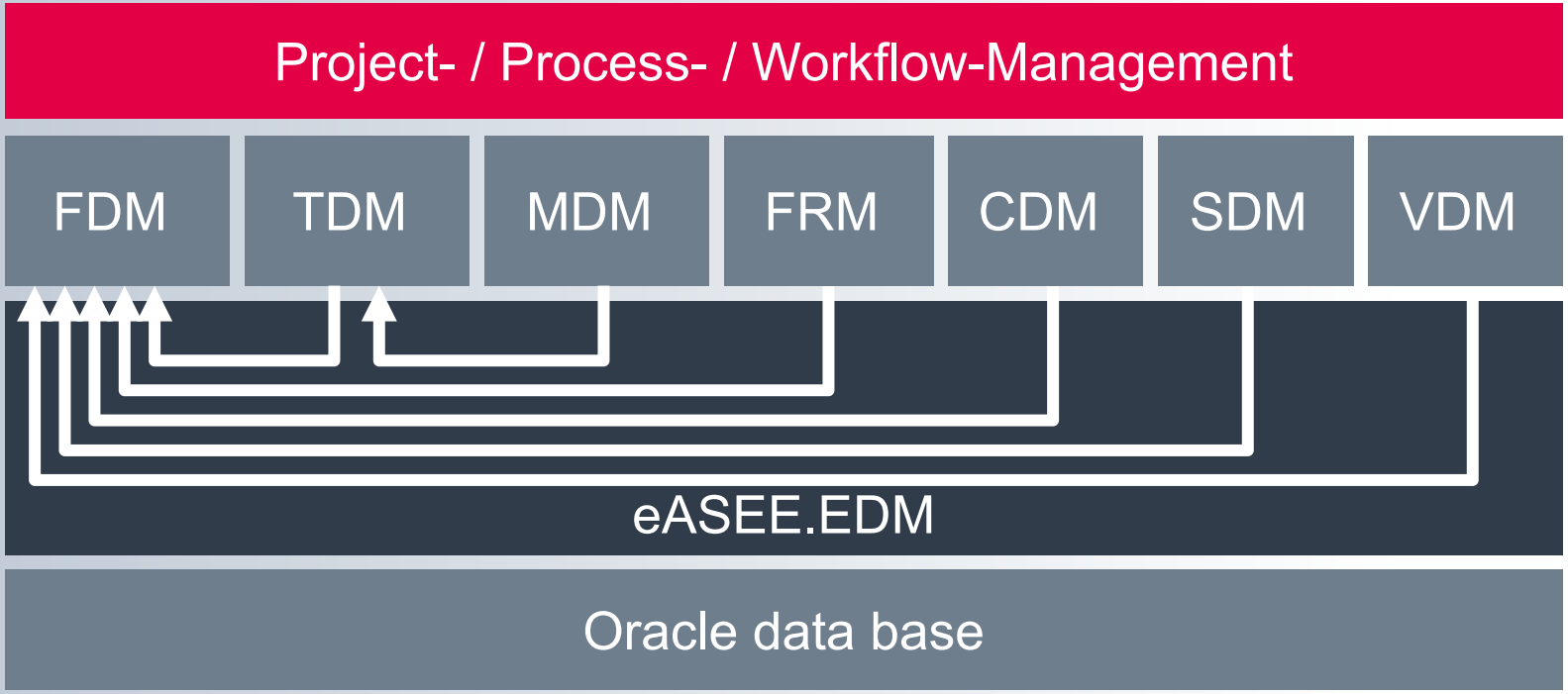
Centralized virtualized component architecture



- 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



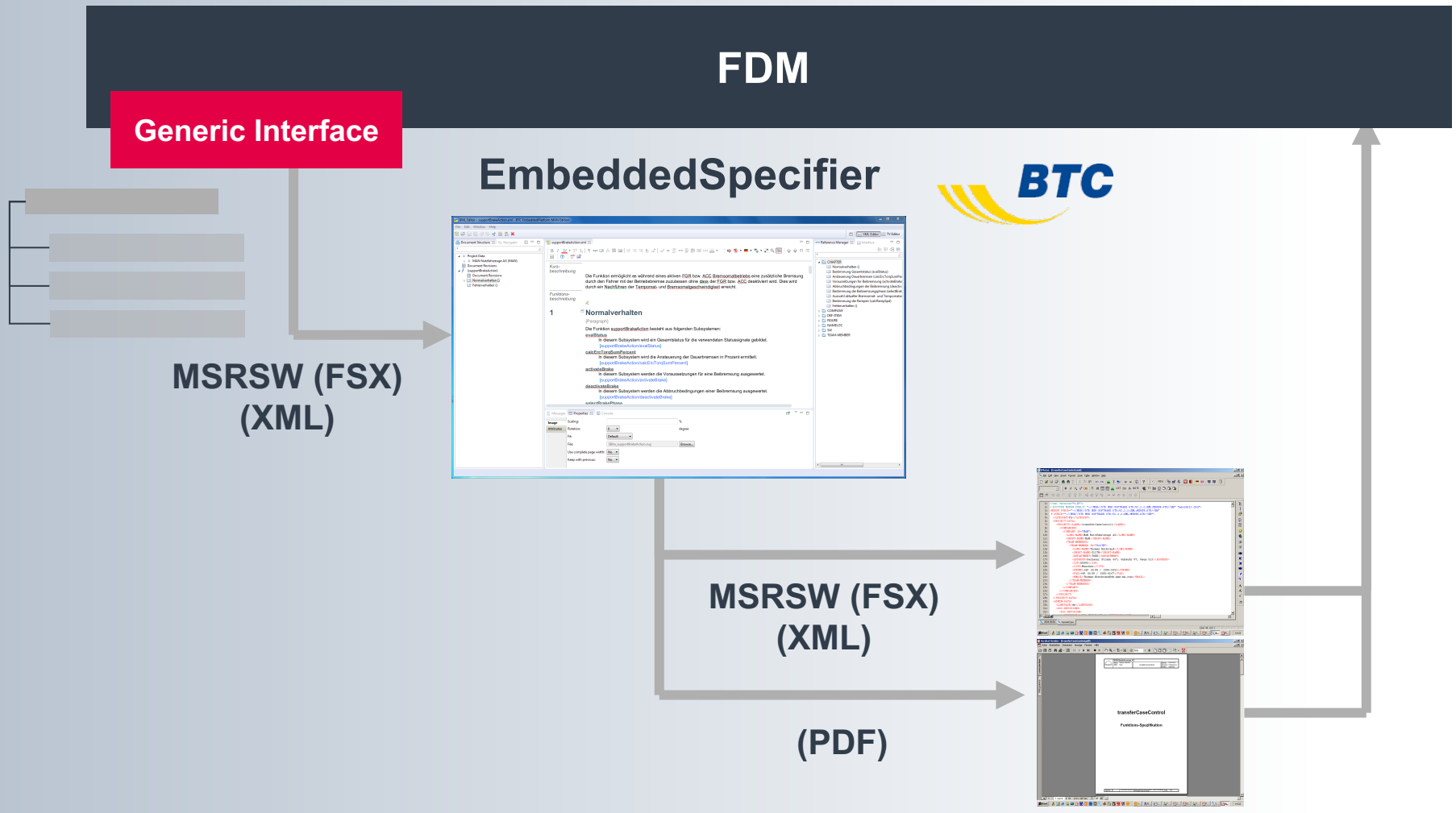


Current toolchain

Common engineering data backbone

Function development	Test	Software development	Calibration/ application	Analysis
MathWorks MATLAB, Simulink, Stateflow	MathWorks MATLAB, Simulink, Stateflow	INCHRON THINK REAL-TIME ChronSim	dSPACE ControlDesk NG	BTC EmbeddedAnalyzer
dSPACE Autobox/Bypassing TargetLink ControlDesk NG	dSPACE ControlDesk NG AutomationDesk			
socionext CGISTUDIO CGI Studio	BTC EmbeddedValidator EmbeddedTester			

Toolchain for specification



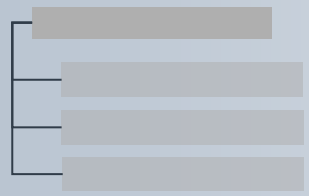
Toolchain for function development (modelling)

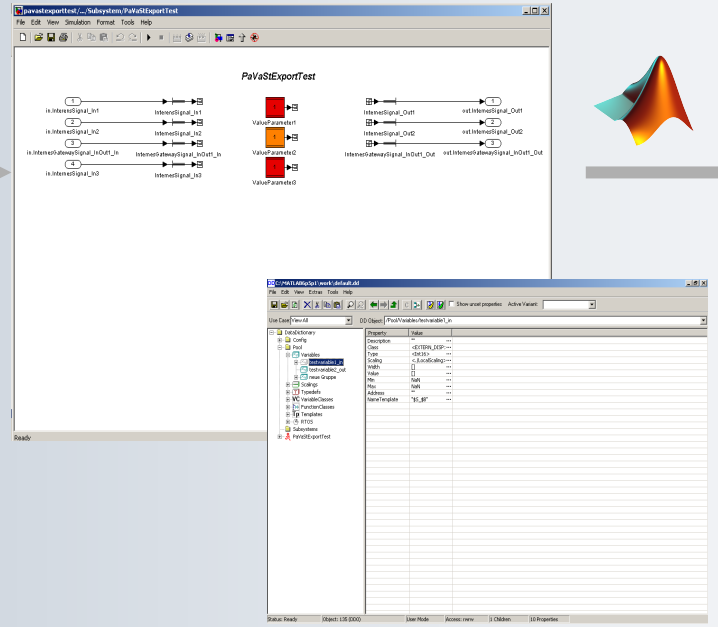
FDM

Generic Interface

MATLAB, Simulink
TargetLink model

MathWorks®
dSPACE



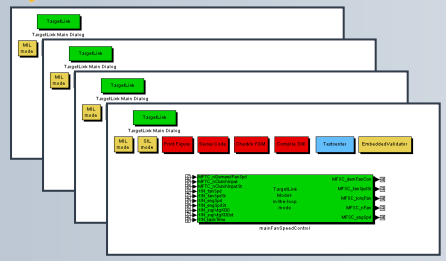


MSRSW (MDX)
(XML)

Local Data Dictionary

Example: Display development

MathWorks



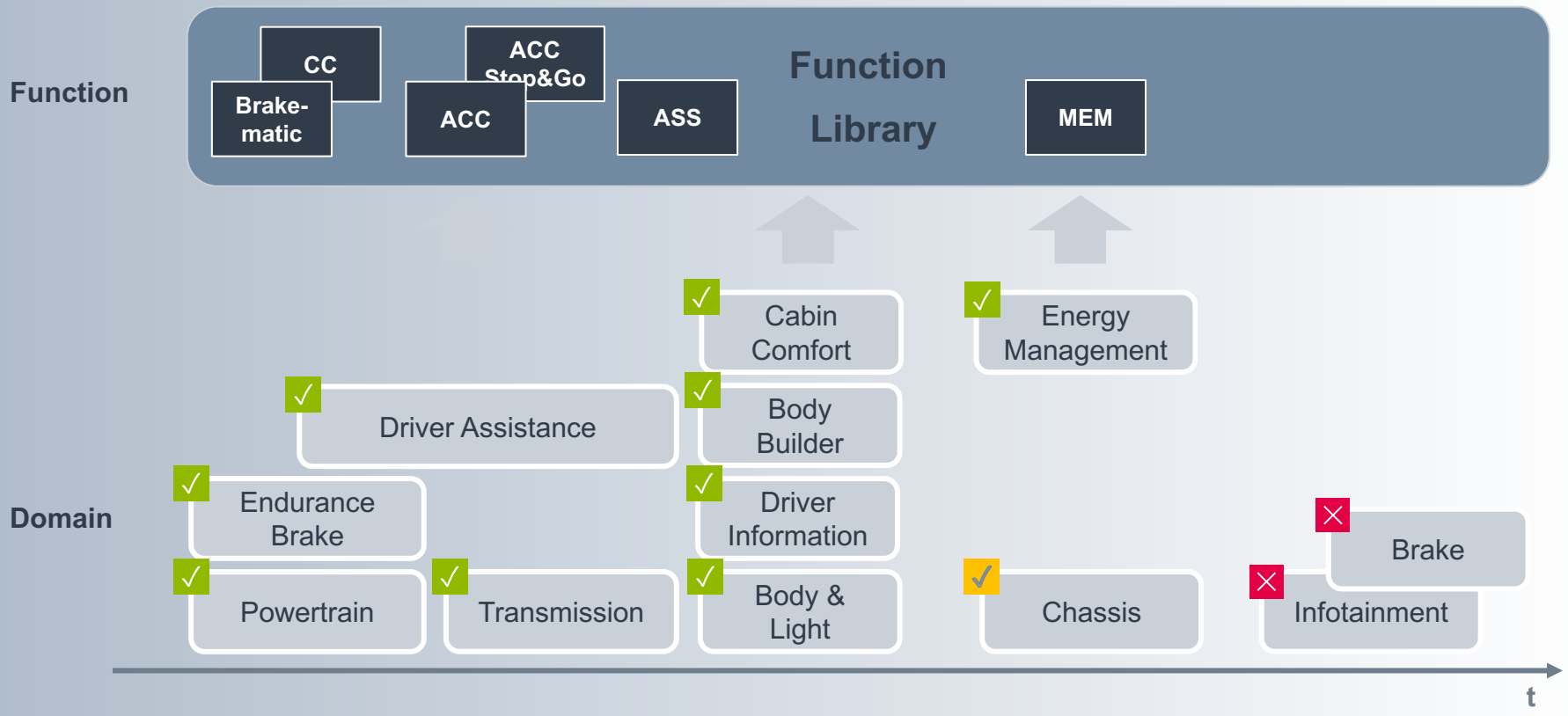
Logic Functions
Widget Control

CGI
Widgets
Screens

Processor 1	Processor 2	Memory	Hardware

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

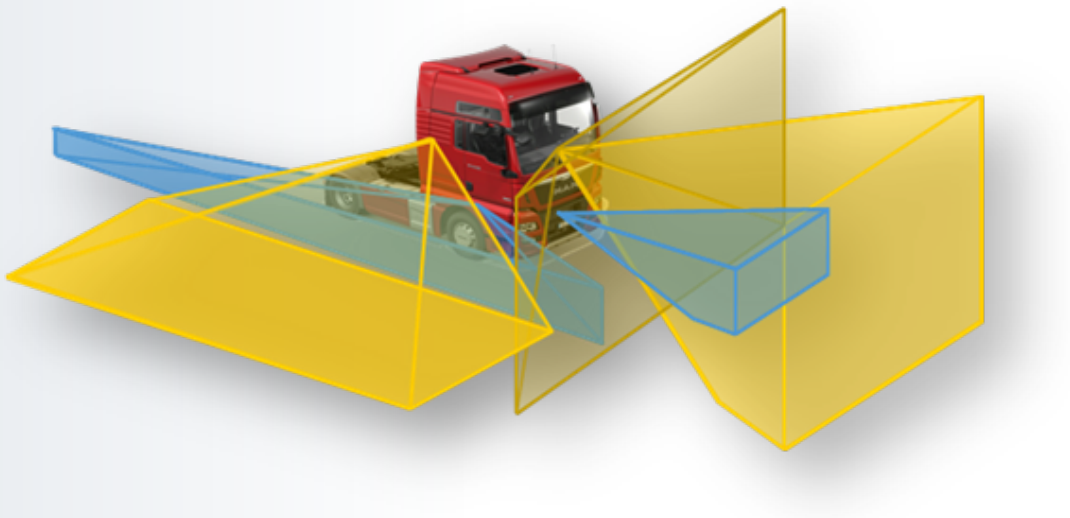
EE strategy – function development – since 2005



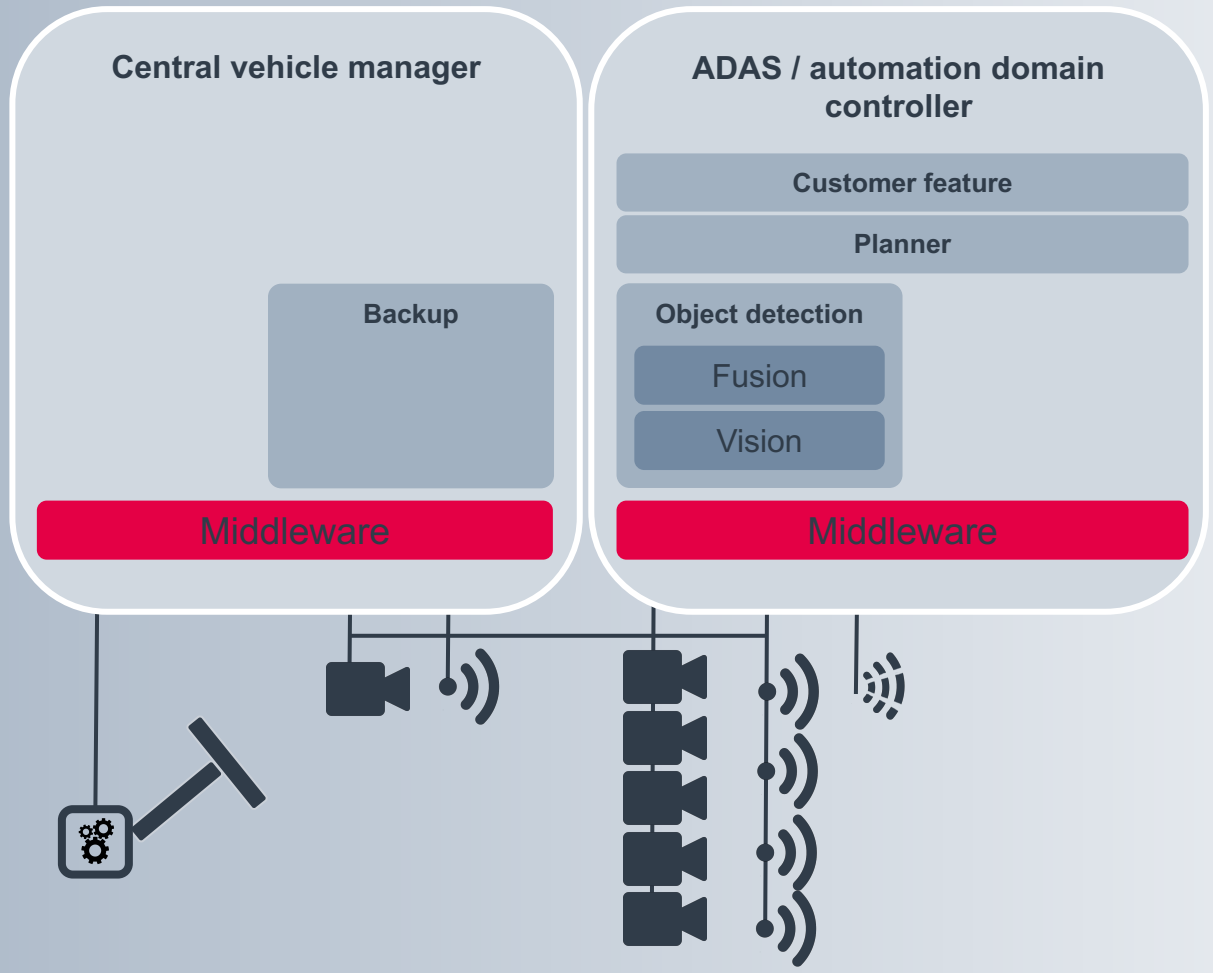
CC	Cruise control
ACC	Adaptive cruise control
ASS	Shifting strategy
MEM	Master energy management

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

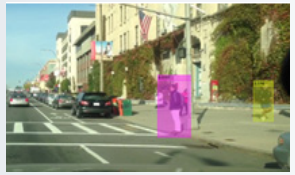


Toolchain for highly automated driving functions

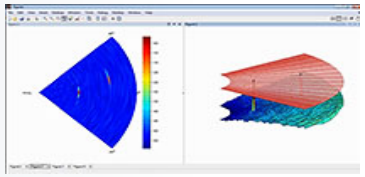


Automated Driving Systems Toolbox

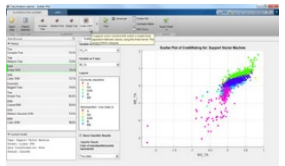
Vision (Computer Vision System Toolbox)



RADAR (Phased Array Systems Toolbox)



Statistics & Machine Learning Toolbox



Simulink, Stateflow

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

MATLAB

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Thank you very much for your attention!

Electric/Electronic Systems

Senior Vice President

Stefan Teuchert