

ELECTRIC/ELECTRONIC ARCHITECTURE AS AN ENABLER FOR CONNECTED MOBILITY AND AUTOMATED DRIVING.

TERATEFORUM 2019.



June 2019.
Dr. Matthias Traub



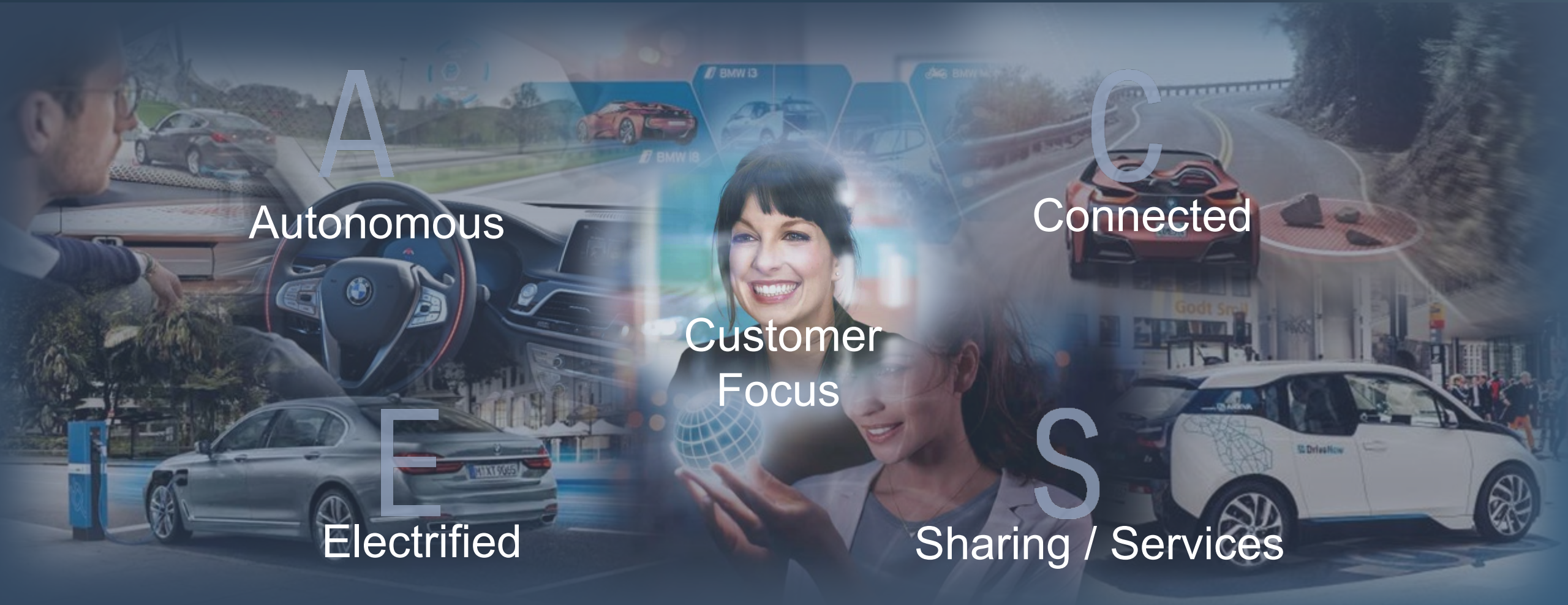
Rolls-Royce
Motor Cars Limited

BMW GROUP GLIMPSE INTO THE FUTURE WITH VISION VEHICLES.

THE NEXT
100 YEARS



ACES—A CORE ELEMENT OF BMW'S STRATEGY NUMBER ONE > NEXT.



A
Autonomous

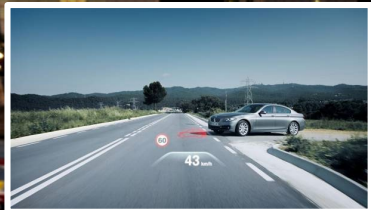
C
Connected

Customer
Focus

E
Electrified

S
Sharing / Services

THE LATEST BMW 5 SERIES. COMFORT AND SAFETY AT THE HIGHEST LEVEL.



Intelligent Voice Assistant

Natural Language Understanding

Advanced Real-time Traffic Information

3D View

WrongWay Assistant

Top View Remote

RemoteControl Parking

Gesture Control

LaneChange Assistant

Distance Information

Crossroad Assist

Lane Keeping Assistant with
Active Side Collision Protection

WiFi Hotspot

Crossing Traffic Warning

Night Vision

BMW Selective Beam

Lateral Parking Aid

ActiveCruise Control with Stop&Go

On Street Parking Information

RearCollision Prevention

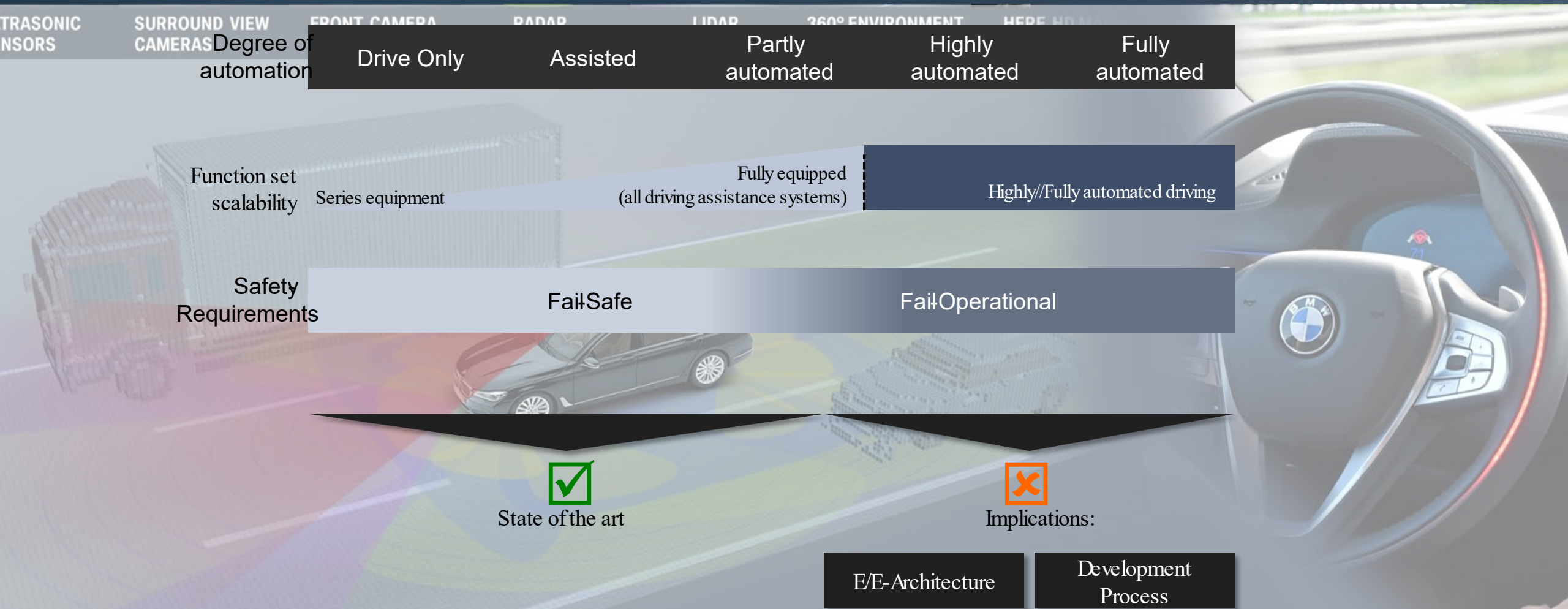
Steeringand Lane Control Assistant

Lane Departure Warning

up to 210 km/h

SpeedLimit and No Pass Information

AUTOMATED DRIVING GENERATES NEW CHALLENGES FOR THE E/E ARCHITECTURE AND THE DEVELOPMENT PROCESS.



THE FUTURE E/E ARCHITECTURE INCLUDING ITS DEVELOPMENT PROCEDURE REQUIRES SUSTAINABLE CHANGES.

Picture: Castle Neuschwanstein



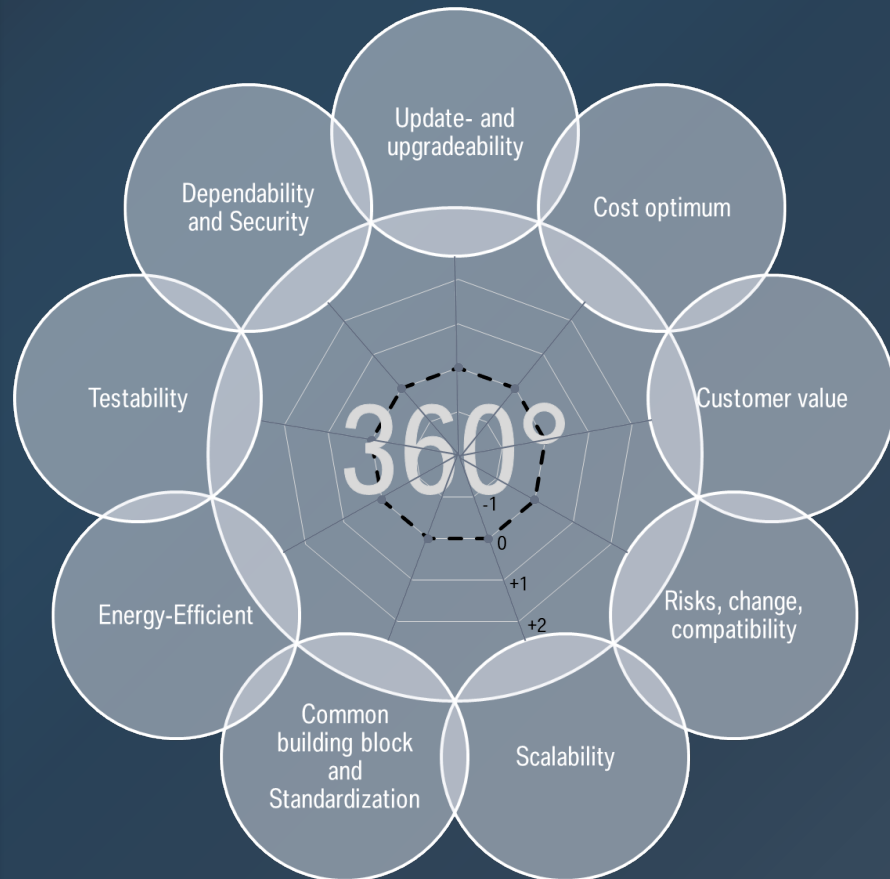
Picture: BMW plant Leipzig



- Technical changes: Using more and more IT standards and establishing a homogenous system structure.
- Collaboration: Systemic thinking without borders using agile working methods.

THE NEXT GENERATION AND VISION OF THE E/E ARCHITECTURE ARE ALL OVER THE MAIN OBJECTIVES.

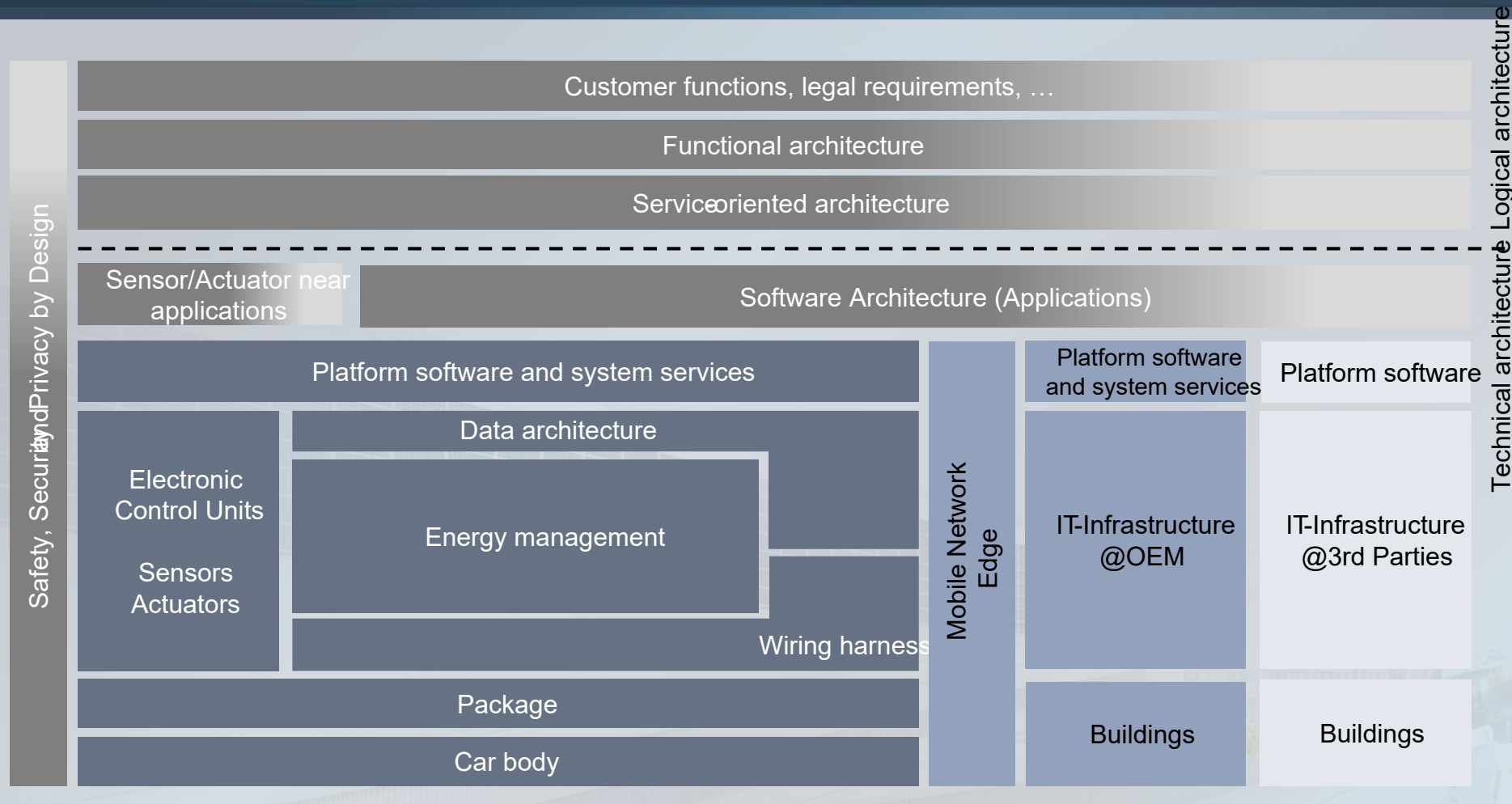
Main objectives.



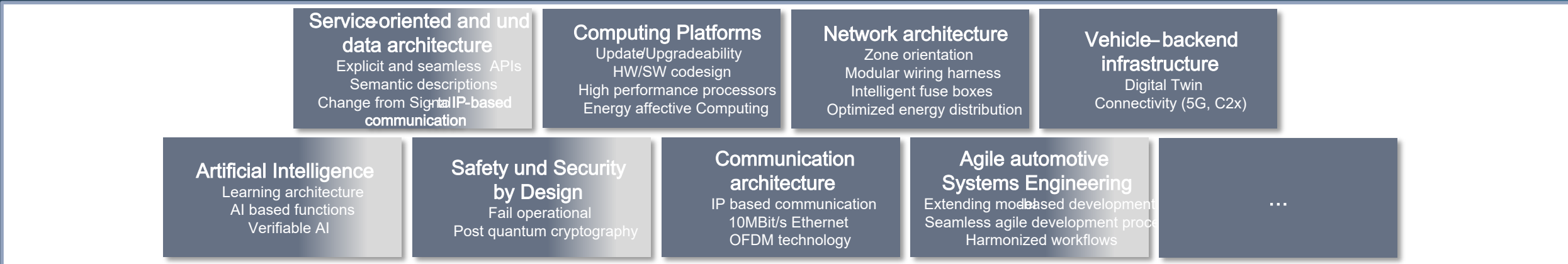
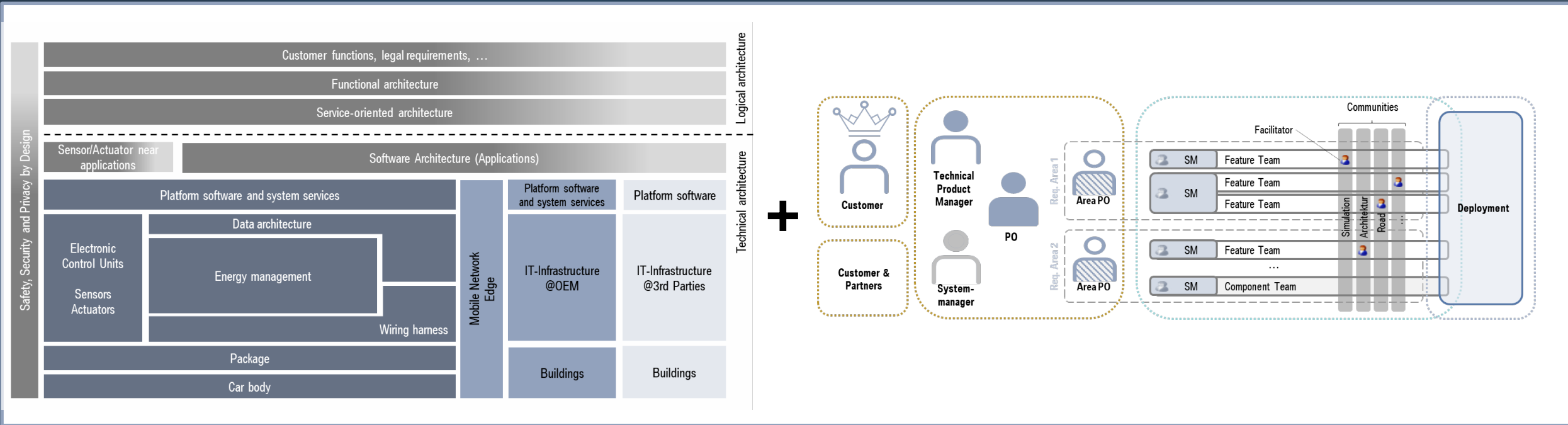
The e/e architecture strategy – Three step approach.

- 1 The corporate strategy, legal requirements and game changers are important inputs for the e/e architecture vision.
- 2 Starting point is set by lessons learned based on the actual e/e architecture
- 3 The step size for the next generation of e/e architecture has been decided by the actual generation and the future vision.

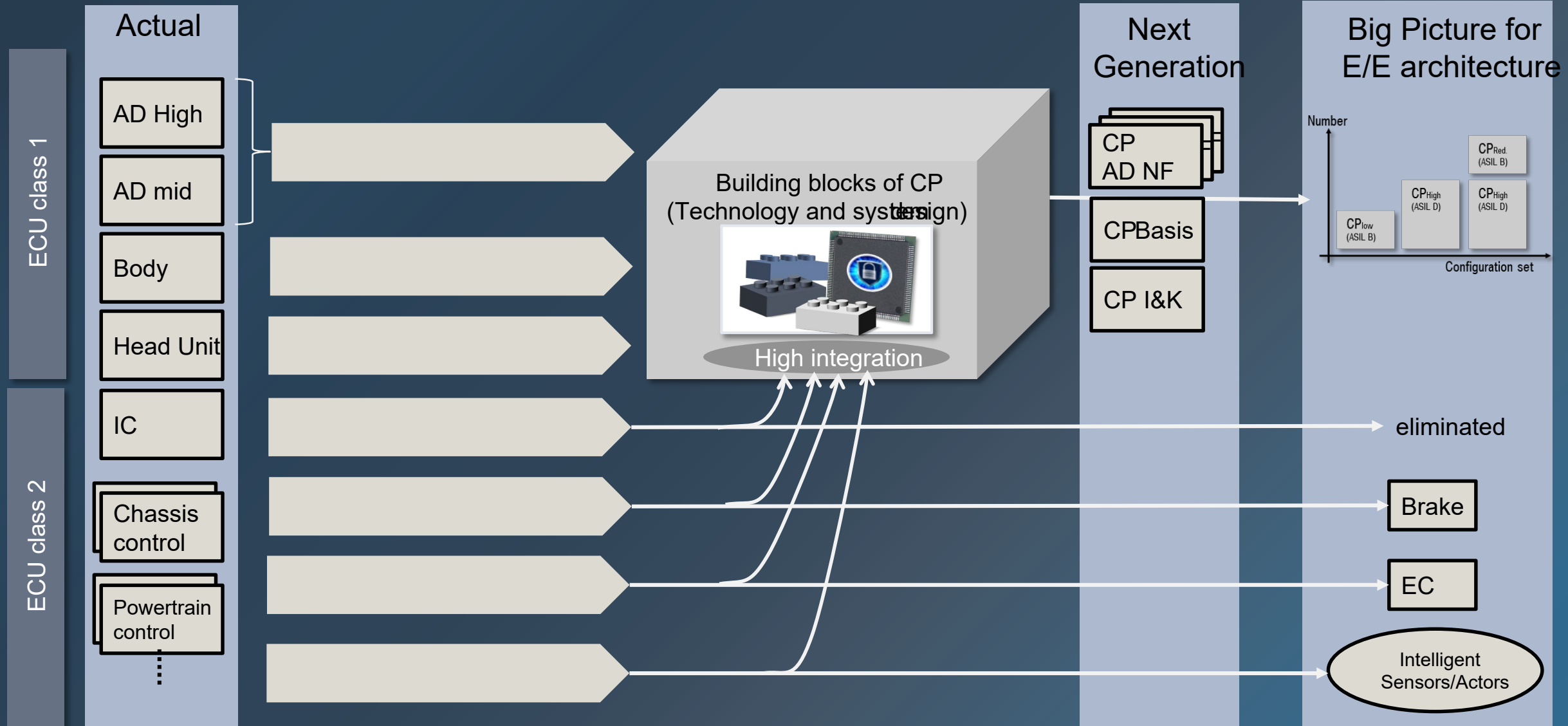
DERIVATION OF NECESSARY BUILDING BLOCKS FOR A SUSTAINABLE DIGITAL AUTOMOTIVE INFRASTRUCTURE.



DERIVATION OF NECESSARY BUILDING BLOCKS FOR A SUSTAINABLE DIGITAL AUTOMOTIVE INFRASTRUCTURE.

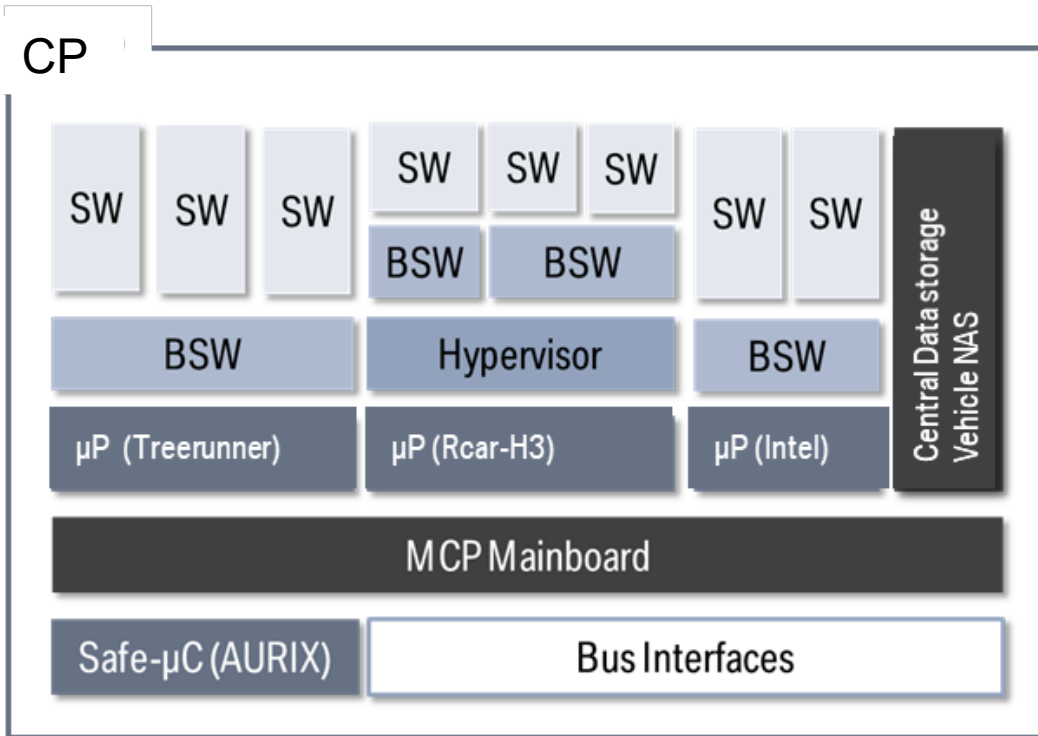


VISION: THE COMPUTING PLATFORM (CP) CREATES SYNERGIES AND OFFERS THE POSSIBILITY FOR A HOMOGENOUS SYSTEM STRUCTURE.



REALIZING SUCH A COMPUTING PLATFORM (CP) THE TECHNICAL DESIGN AND THE DEVELOPMENT PROCESS HAS TO BE ENABLED.

Technical Design.

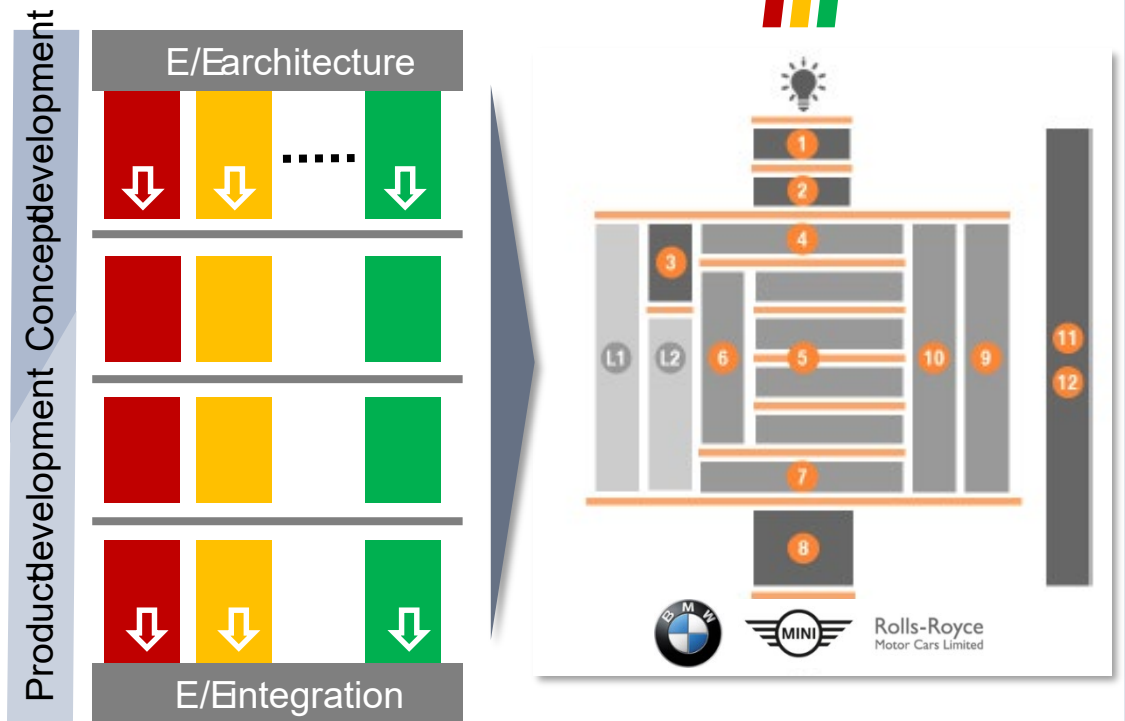


SW: Software
 HPC: HighPerformance
 BSW: Basis Software
 µC: Microcontroller
 µP: Microprocessor

Agile automotive Systems and Software Engineering (SE).

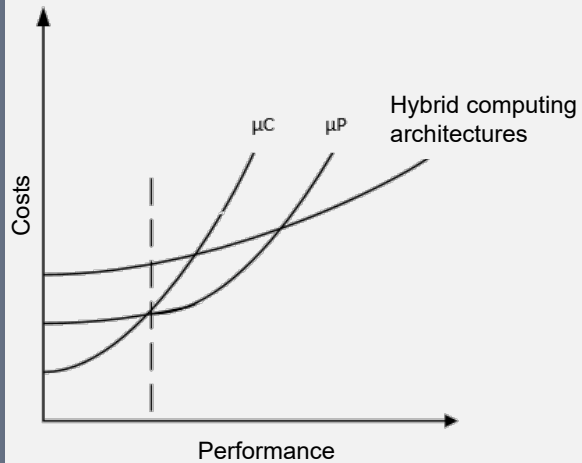
Individual e/e development

Homogenous e/e development



NEW WAYS FOR DERIVING THE NEXT GENERATION PERFORMANCE PROCESSORS FOR AUTOMOTIVE APPLICATIONS ARE NECESSARY.

Technology comparison

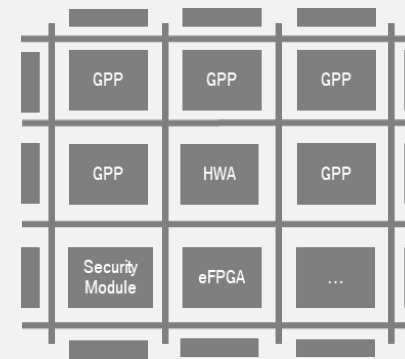


- For basic functions (e.g. brake and engine control) automotive microcontrollers (μ Cs) are ideal.
- A direct usage of microprocessors (μ Ps) of the CE world is not constructive.
- New approaches in the form of hybrid computing architectures are necessary.

Energy = Range

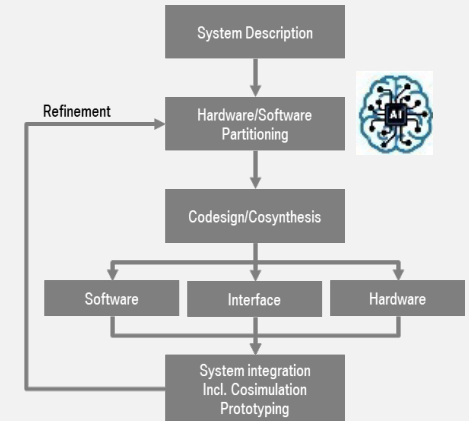


Energyefficient hybrid computing architectures



- Hybrid computing architectures enable a **efficient** allocation of the necessary performances by a optimal interaction of general purpose processors (GPP), dedicated hardware accelerators (HWA) and embedded field programmable gate arrays (eFPGA).
- A optimal composition on system level could be derived by using hardware/software codesign.

Hardware/Software Codesign



- Over the European Processor Initiative (EPI) the first steps on the way are started. For a sustainable ability there are further actions necessary.
- Enabling the automotive industry using hardware/software codesign is one of the main goals.

EUROPEAN PROCESSOR INITIATIVE (EPI) SUPPORTS THE FURTHER ROLLOUT HIGH PERFORMANCE COMPUTING (HPC) IN AUTOMOTIVE E/E SYSTEMS.

EC Horizon2020

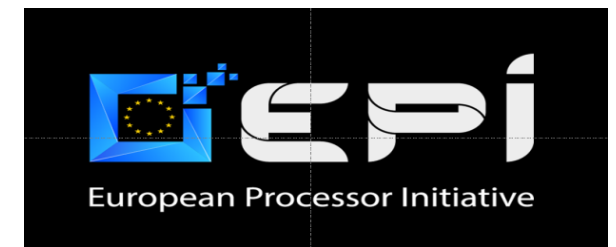


European 10 years research program

EUFPA call (ICT-42)

EPI European Processor Initiative

- European approach for HPC technology for exascale super computer including a scalable HPC General Purpose Processor (GPP) with special security and reconfiguration options and dedicated hardware acceleration.
- Project budget: 120 M€, 4 years, start: 12/18



Automotive stream in EPI

A dedicated work package for automotive:

- eHPC: MCU and GPP and Accelerators for automotive
- Total budget: 20M€

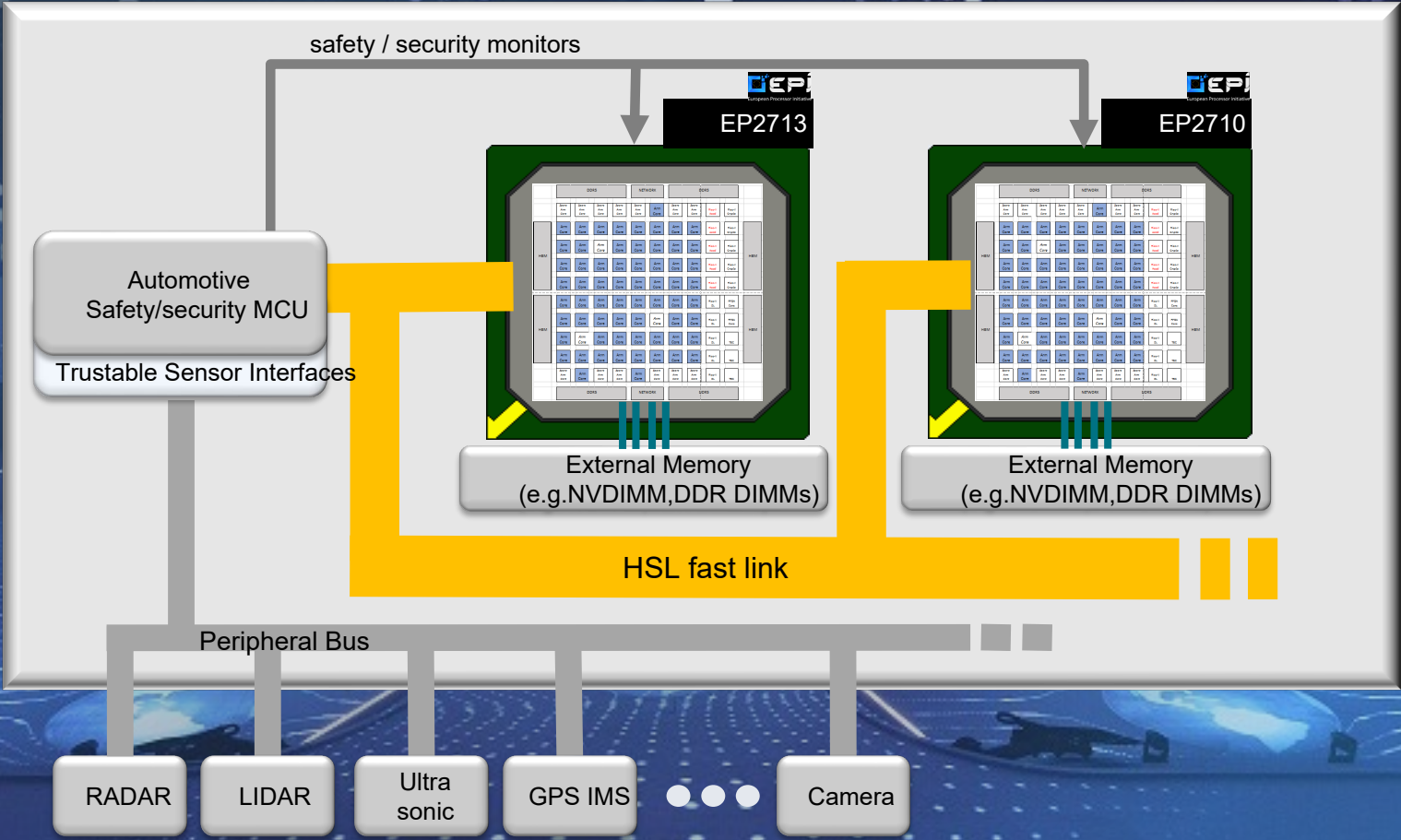
eHPC: Embedded High Performance Computing
MCU: Micro Controller Unit



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A FIRST REFERENCE IMPLEMENTATION OF AUTOMOTIVE ADAS WILL BE REALIZED OVER THE EPI PROJECT IN 2021.



WE HAVE TO HANDLE A LOT OF NEW TOPICS BUT TWO OF THEM ARE ESSENTIALLY.

**E/E
2025 +**

Digital Services

Conversational Commerce

Stream Analytics

Semantics

MQTT IoT

CoAP M2M

Communication

Edge Computing 5G

Cloud

Mixed Criticality

Power Efficiency

Virtualization Privacy

Hardware/Software codesign

Accelerators

Safety Security

Augmented Reality
Functionality

Intelligent
Personal Assistant

Affective Computing

AI

Machine Learning

Neuromorphic Hardware

Sensors

Intelligent Energy

Infrastructure

Fail Operational

**Computing
Platforms**

TSN

1

Technical view:
Using more and more IT standards and establishing a homogenous and energy-efficient system structure.

2

Methodical view:
Systemic thinking without borders, a trustful collaboration and agile working methods.

THANK YOU FOR YOUR ATTENTION.

THE NEXT
100 YEARS



„TO SEE THINGS
IN THE SEED,
THAT IS GENIUS.“

LAO-TSE

„WHAT IS NOW
PROVED
WAS ONCE ONLY
IMAGINED.“

WILLIAM BLAKE

„THE FUTURE
BELONGS TO
THOSE
BOLD ENOUGH
TO SHAPE IT.“

BMW GROUP

„TO ACCOMPLISH
GREAT THINGS
WE MUST
NOT ONLY ACT,
BUT ALSO DREAM.“

ANATOLE FRANCE

„ALL TRUTHS ARE
EASY TO
UNDERSTAND
ONCE THEY ARE
DISCOVERED, THE
POINT IS TO
DISCOVER THEM.“

GALILEO GALILEI

„KNOWING IS
NOT ENOUGH;
WE MUST
APPLY.
WILLING IS
NOT ENOUGH,
WE MUST DO.“

JOHANN
WOLFGANG
VON GOETHE