AUTOSAR Introduction

The vision, the partnership and current features in a nutshell

Presenter

Occasion (Meeting, Conference, etc.)

20 Jan 2020   Location @ Host

Agenda

› Introduction of the AUTOSAR Partnership

› Challenges in the automotive industry

› Architecture and recent features

› Smart solutions based on AUTOSAR

› Processes and quality

› Outlook

Agenda

Introduction of the AUTOSAR Partnership

Challenges in the automotive industry

Architecture and recent features

Smart solutions based on AUTOSAR
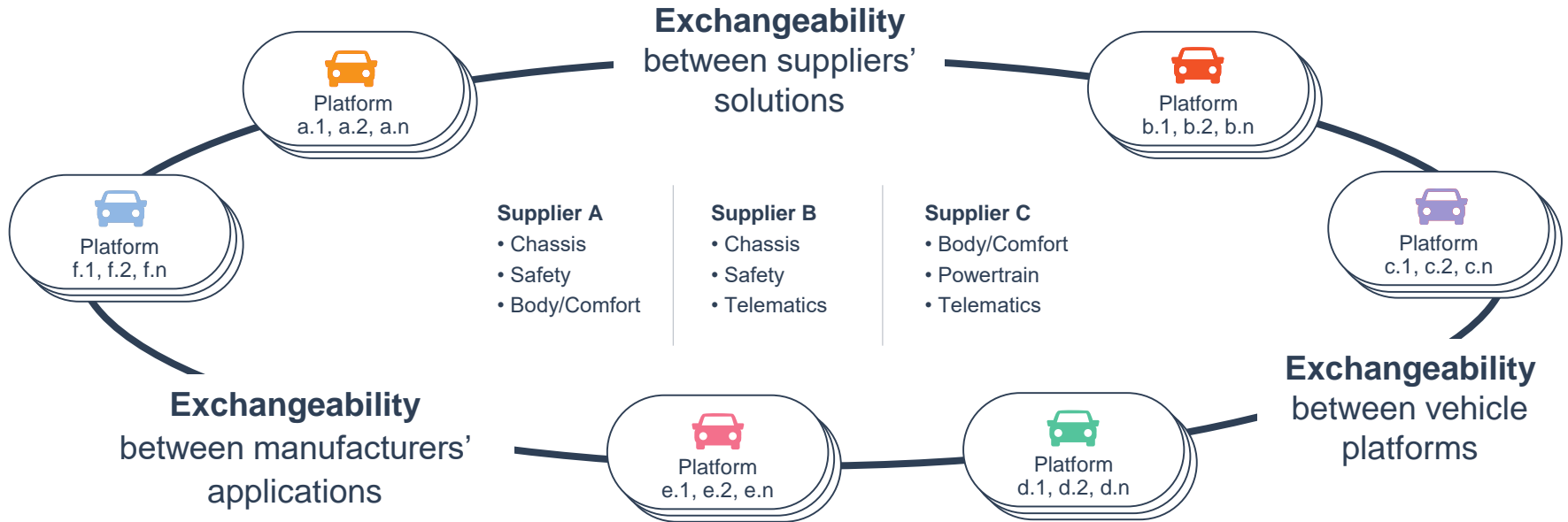
Processes and quality

Outlook

AUTOSAR Introduction

(**AUT**omotive **O**pen **S**ystem **AR**chitecture)

is a worldwide development partnership of car manufacturers, suppliers and other companies from the electronics, semiconductor and software industry.
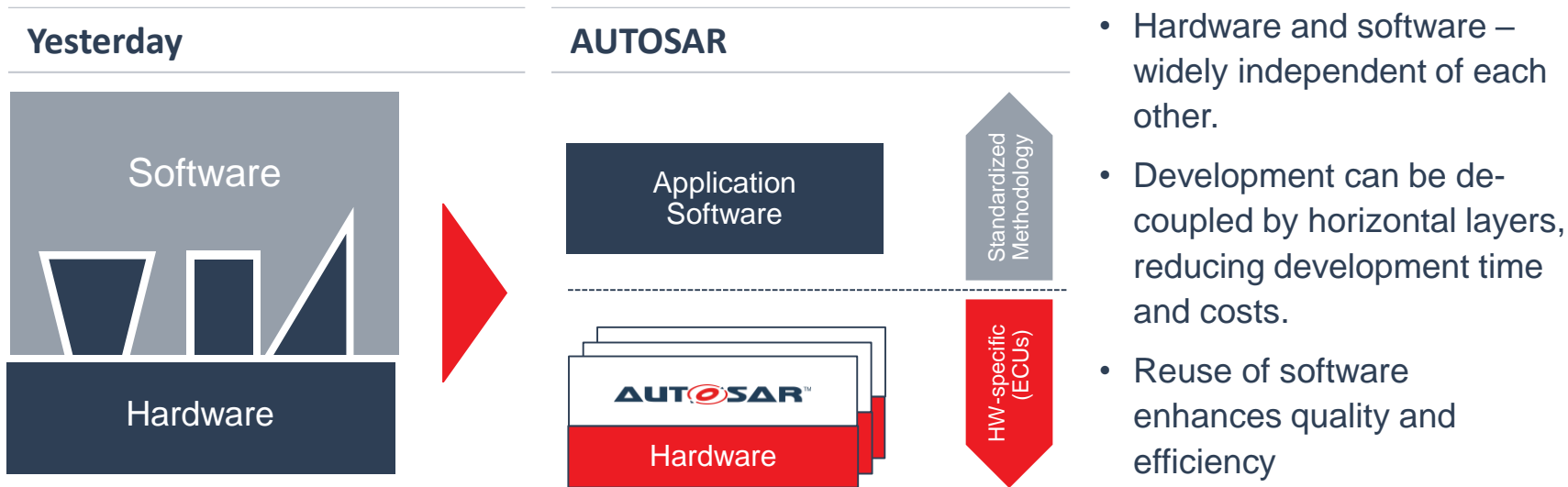
AUTOSAR Vision

AUTOSAR aims to improve complexity management of integrated E/E architectures through increased reuse and exchangeability of SW modules between OEMs and suppliers.
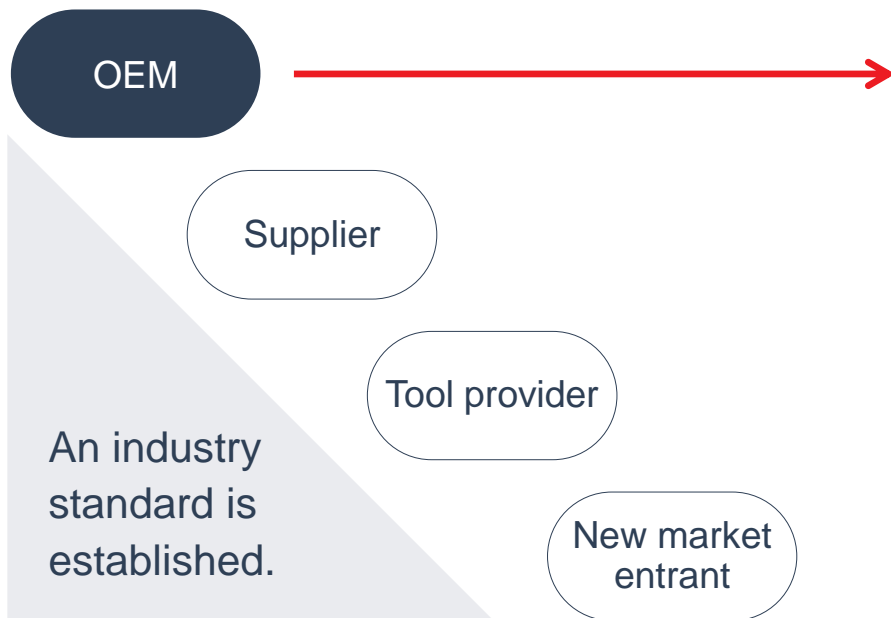

Exchangeability between suppliers' solutions

Exchangeability between manufacturers' applications

Exchangeability between vehicle platforms

Platform a.1, a.2, a.n

Platform f.1, f.2, f.n

Platform b.1, b.2, b.n

Platform c.1, c.2, c.n

Platform e.1, e.2, e.n

Platform d.1, d.2, d.n

Supplier A
• Chassis
• Safety
• Body/Comfort

Supplier B
• Chassis
• Safety
• Telematics

Supplier C
• Body/Comfort
• Powertrain
• Telematics

Aims and benefits of using AUTOSAR

AUTOSAR aims to standardize the software architecture of **E**lectronic **C**ontrol **U**nits (**ECUs**). AUTOSAR paves the way for innovative electronic systems that further improve performance, safety and environmental friendliness.
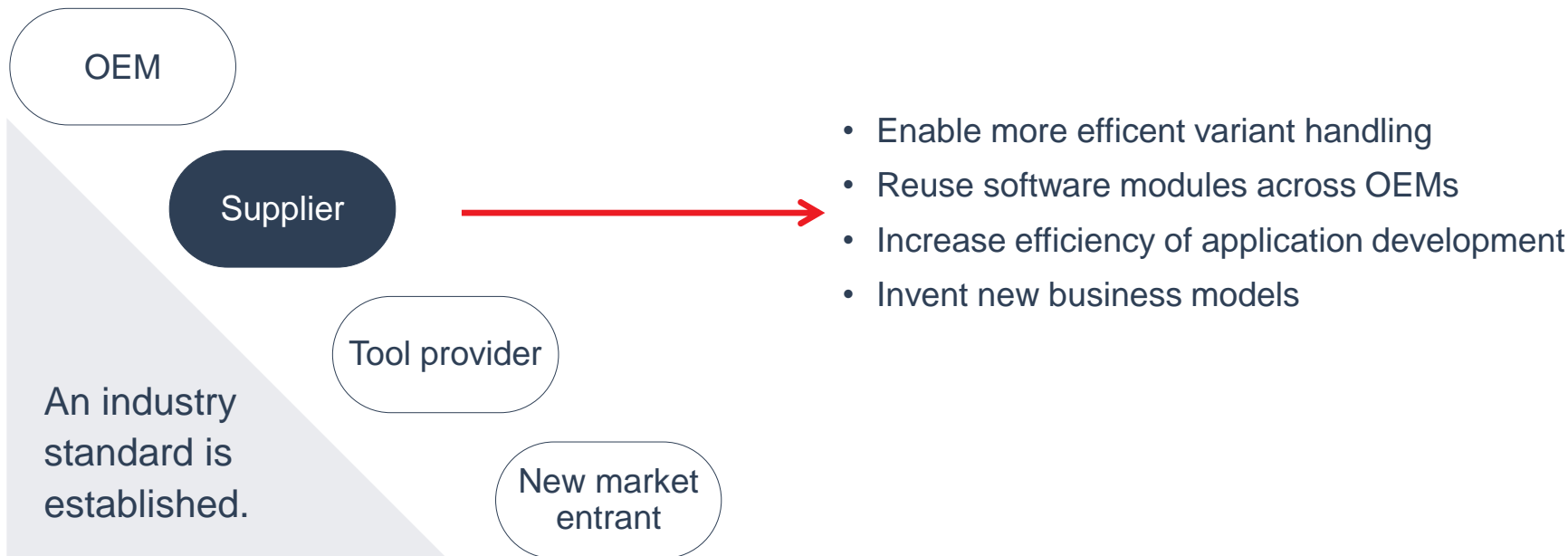

- Hardware and software – widely independent of each other.

- Development can be de-coupled by horizontal layers, reducing development time and costs.

- Reuse of software enhances quality and efficiency

Exploitation of the standard provides significant benefits

OEM

Supplier

Tool provider

New market entrant
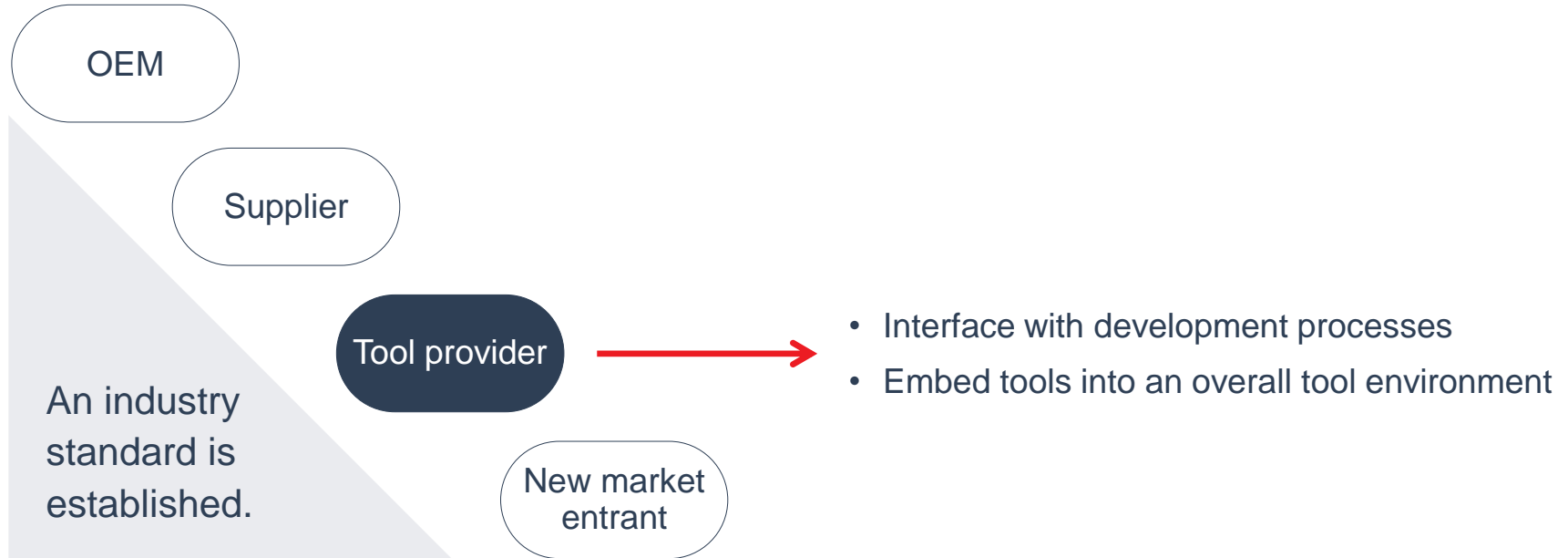
An industry standard is established.

- Establish development distribution among suppliers
- Compete on innovative functions with increased design flexibility
- Simplify software and system integration
- Reduce overall software development costs

Exploitation of the standard provides significant benefits

OEM

Supplier

Tool provider

New market entrant

An industry standard is established.

- Enable more efficent variant handling
- Reuse software modules across OEMs
- Increase efficiency of application development
- Invent new business models

AUTOSAR™

Exploitation of the standard provides significant benefits

OEM

Supplier

Tool provider

An industry standard is established.

New market entrant

- Interface with development processes
- Embed tools into an overall tool environment

Exploitation of the standard provides significant benefits

OEM

Supplier

Tool provider

An industry standard is established.

New market entrant

- Enable new business models by means of standardized interfaces
- Easily understand how automotive software is developed
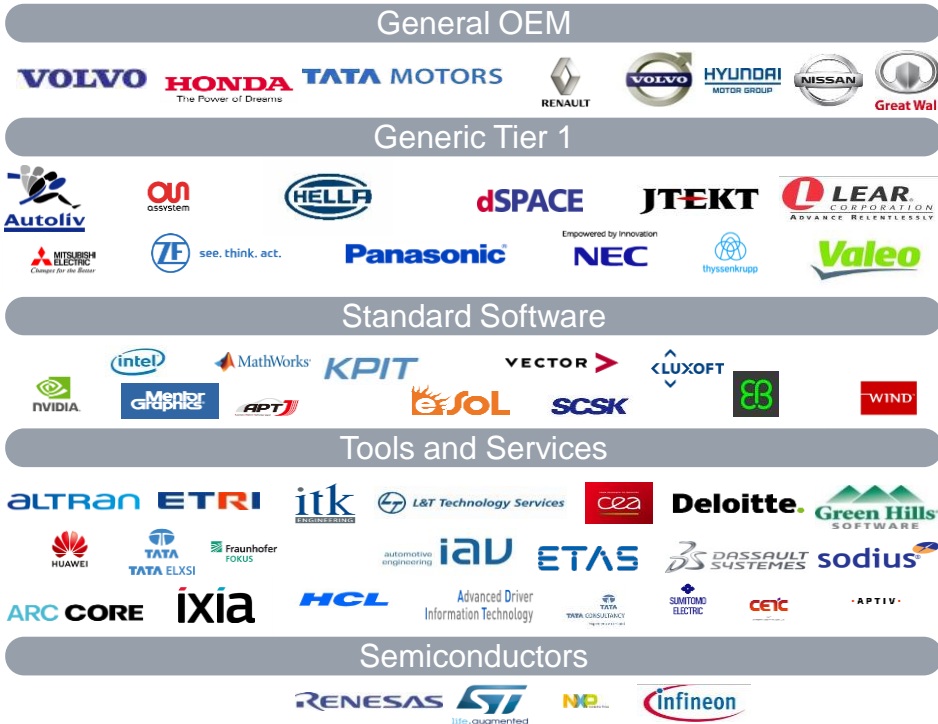
History and current state – Total: 280
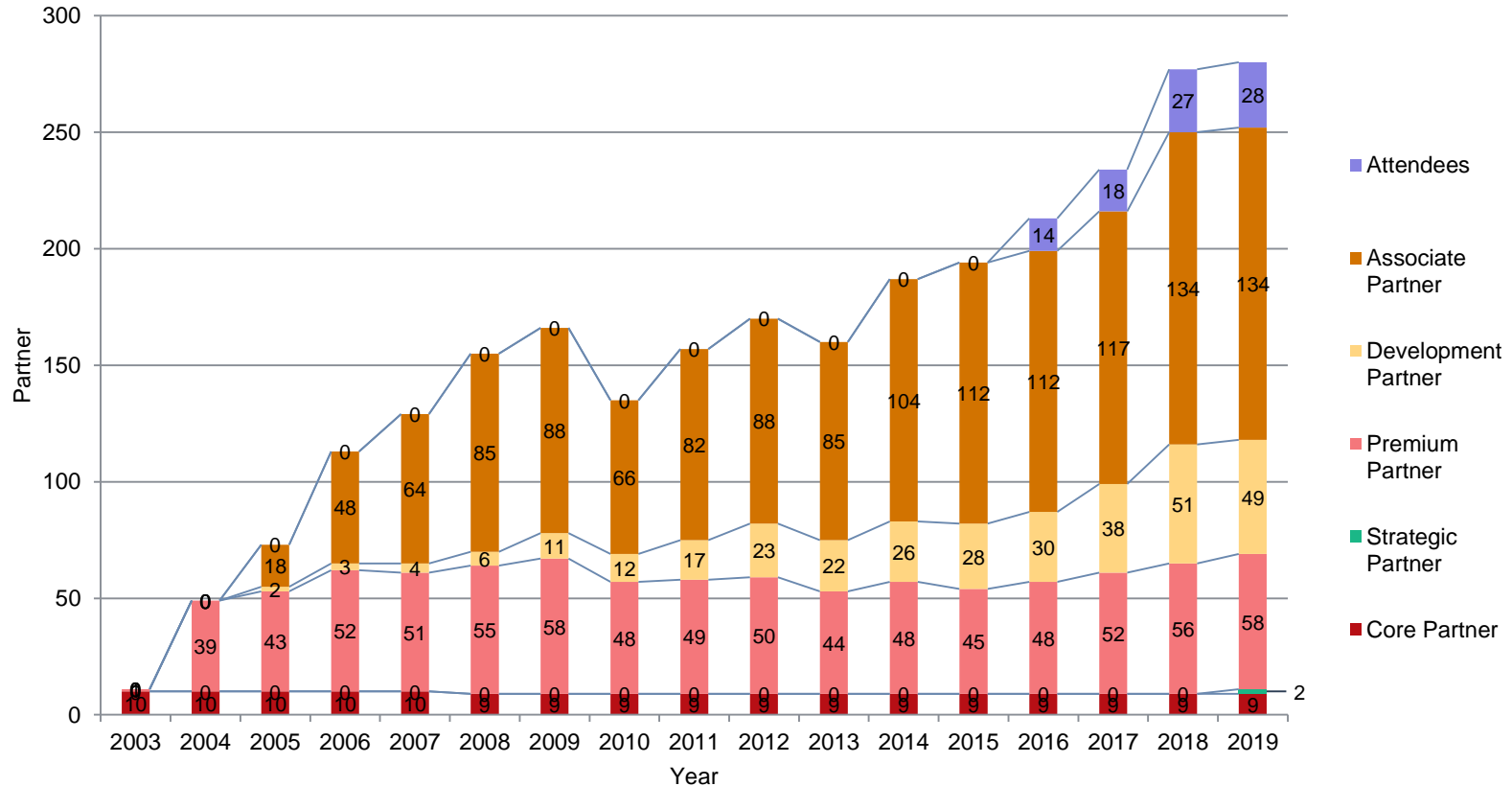
Geographical distribution of partners

Europe: 141
Core:	*6*
Strategic:	*0*
Premium:	*28*
Development:	*30*
Associate:	*50*
Attendee:	*27*

North America: 30
Core:	*2*
Strategic:	*0*
Premium:	*6*
Development:	*3*
Associate:	*19*
Attendee:	*0*

Asia: 107
Core:	*1*
Strategic:	*2*
Premium:	*24*
Development:	*14*
Associate:	*65*
Attendee:	*1*

Africa: 2
Core:	*0*
Strategic:	*0*
Premium:	*0*
Development:	*2*
Associate:	*0*
Attendee:	*0*

AUTOSAR Organization
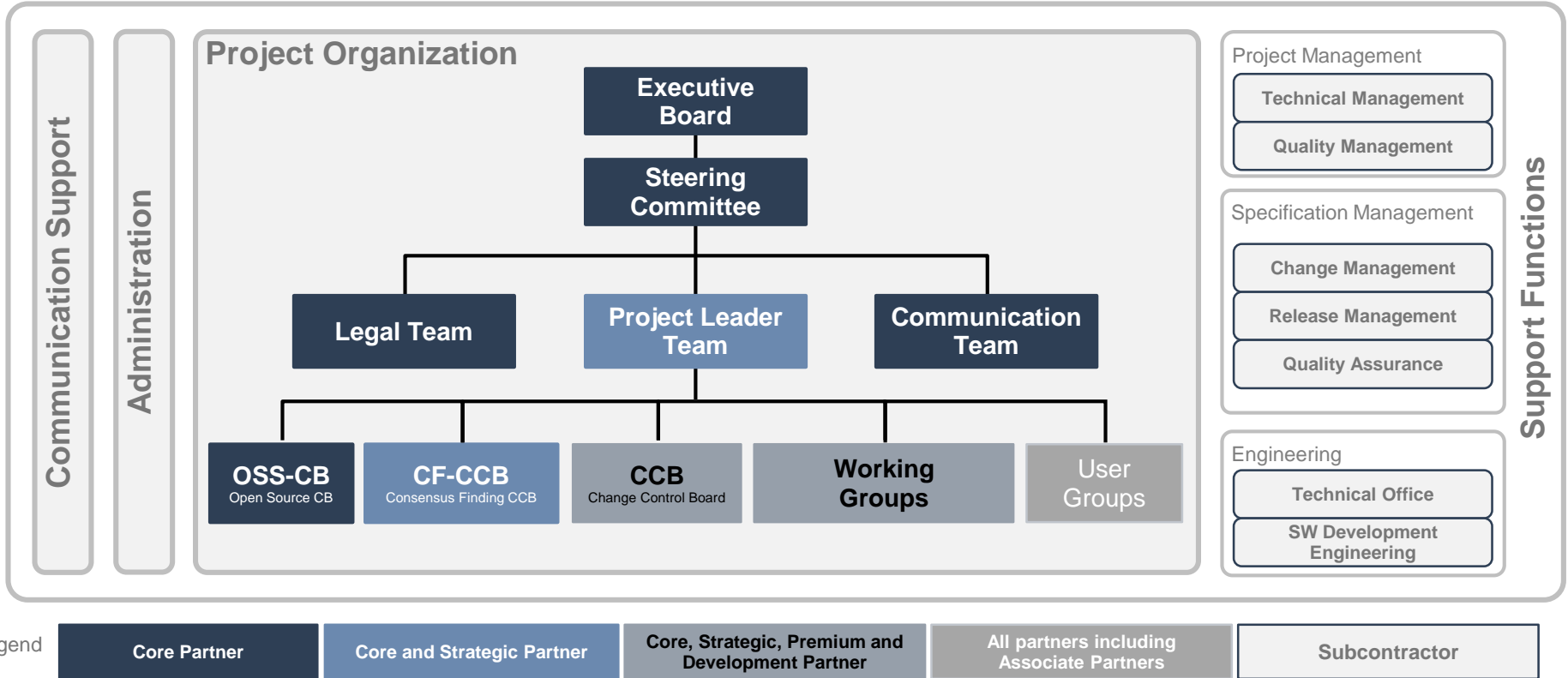
Working Group organization

Project Leader Team

Cross-standard Working Groups (FO, CP, AP)

WG-A	WG-MT	WG-SEC	WG-SAF
Architecture Team	Methodology and Templates	Automotive Security	Functional Safety

WG-IVC	WG-AIF	WG-V2X	WG-DIA	WG-RES	WG-UCM
In-Vehicle COM	Application Interfaces	Vehicle to X	Diagnostics	Resources	Update & Conf. Management

WG-VAL
Validation

Classic Platform Working Groups (CP)

WG-CP-RTE	WG-CP-MCBD	WG-CP-LIB
Runtime Environment	Multicore BSW Distr.	Libraries

WG-CP-MCL
MCAL and NVRAM

Adaptive Platform Working Groups (AP)

WG-AP-EMO	WG-AP-DI	WG-AP-ST
Execution Man. & OS	Demonstrator Integration	System Tests

WG-AP-PER	WG-AP-CCT	WG-AP-CLD
Persistency	Central Coding Team	Cloud Services

Legend:
Lead Working Group
Working Group

User Group Structure
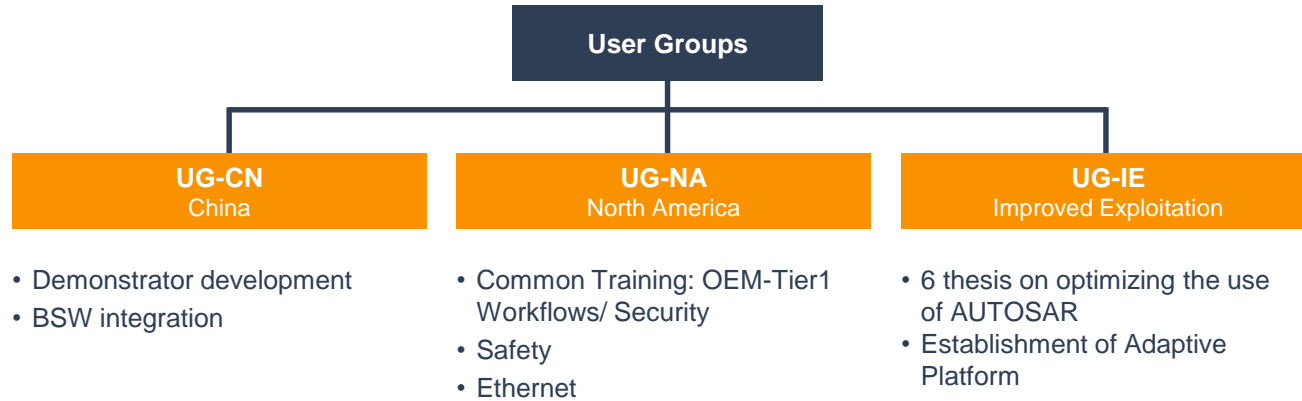
Groups, Boards and Task Forces

| Group	Type	Initiated by	Main Tasks	Coaching	Contact person	Reporting to
Lead WG	Permanent	PL Team	- Technical supervision of WGs and concept groups - Harmonization of technical content - Assignment of concepts to WGs	PL Coach	WG Speaker	PL Team
WG	Permanent	PL Team	- Expert statements - Responsibility for documents and code development - Assessment of concepts	PL Coach	WG Speaker	PL Team
Subgroup	Permanent	WG	WG substructure for a dedicated branch of WG content	-	Subgroup Speaker	WG
Control Board	Permanent	PL Team	Controlling task within AUTOSAR processes (e.g. CM, QM, SDE or RM) such as CCB, CF-CCB and OSS-CB	PL Team	CM, QM or RM	CM, QM or RM
Concept Group	On demand (project-based)	CP/SP/PP/DP	Creation and processing of a concept or a set of concepts according to concept process Responsibility for concept validation	-	Concept Owner(s)	Lead WG, WG, PL Team; cf. concept handling process
Task Force	On demand (project-based)	WG or PL Team	Dedicated task with defined due date	-	TF Speaker	WG or PL Team
UG	On demand (project-based)	PP/DP/AP	Creation of documents or implementations based on existing releases	PL or SC Team	UG Speaker	PL-Team

AUTOSAR Deliverables
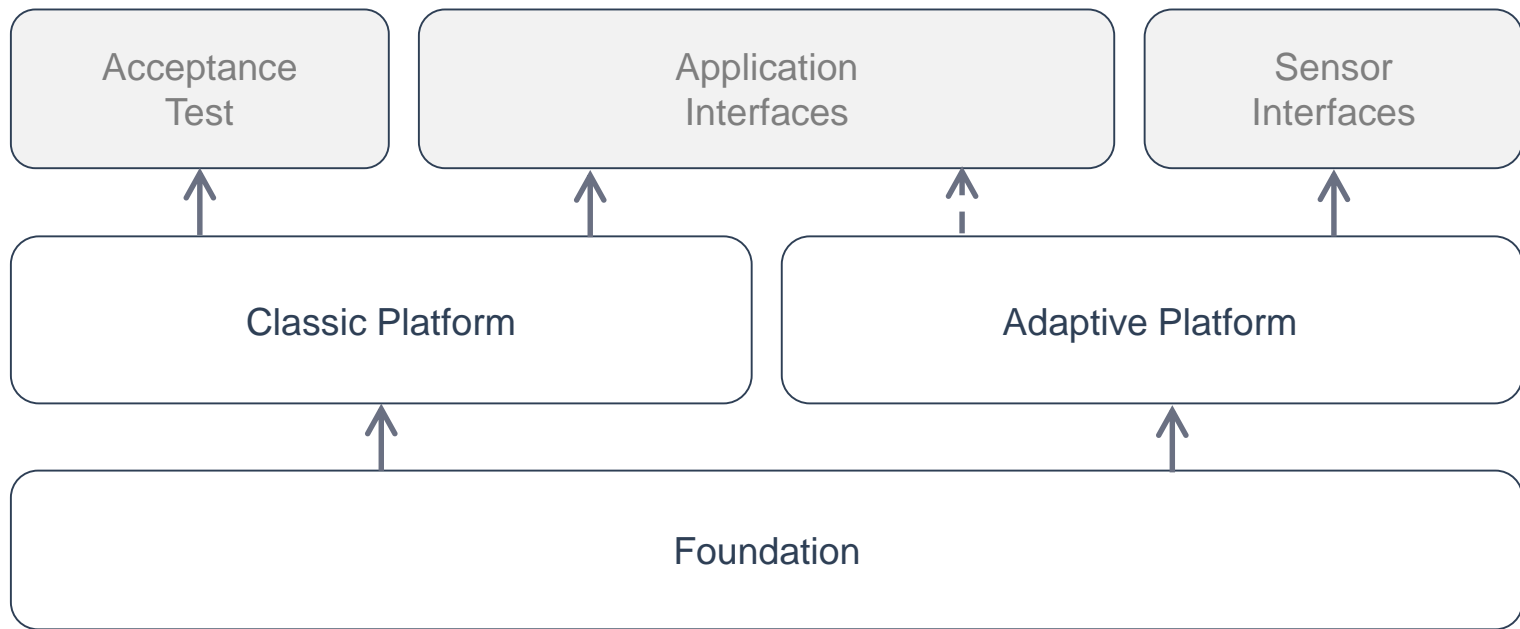
Agenda

> Introduction of the AUTOSAR Partnership

> Challenges in the automotive industry

> Architecture and recent features

> Smart solutions based on AUTOSAR

> Processes and quality

> Outlook
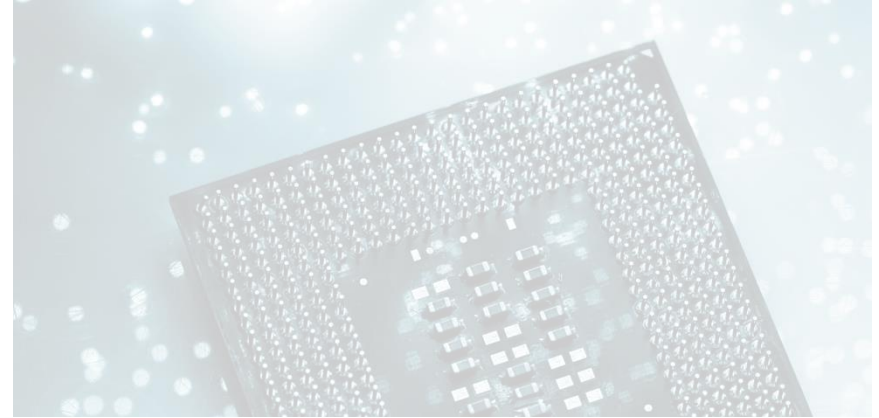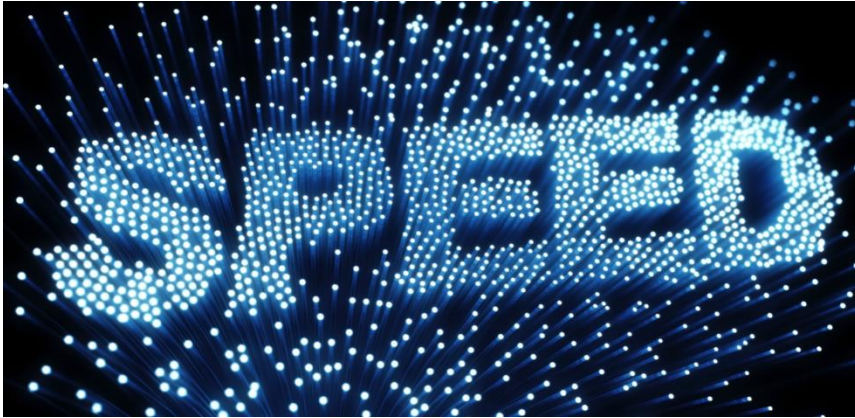
Challenges – selected main drivers

> Highly automated driving
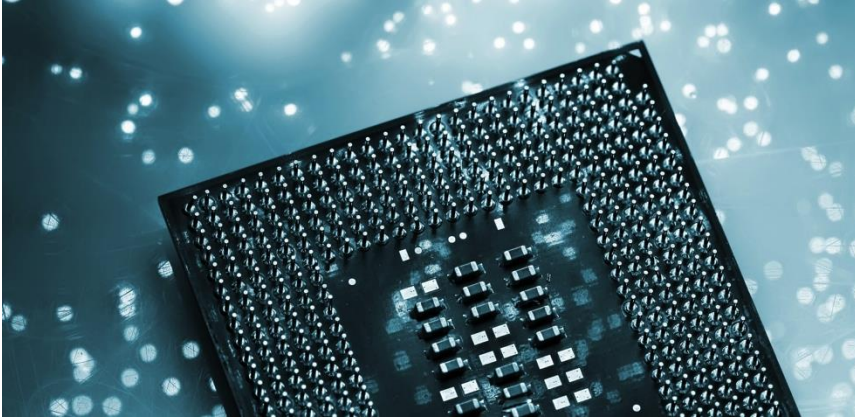
Challenges – selected main drivers

- Car-2-X applications
- Internet of Things and cloud services

Challenges – selected main drivers

> Increasing data rates

Challenges – selected main drivers

> New processor technologies
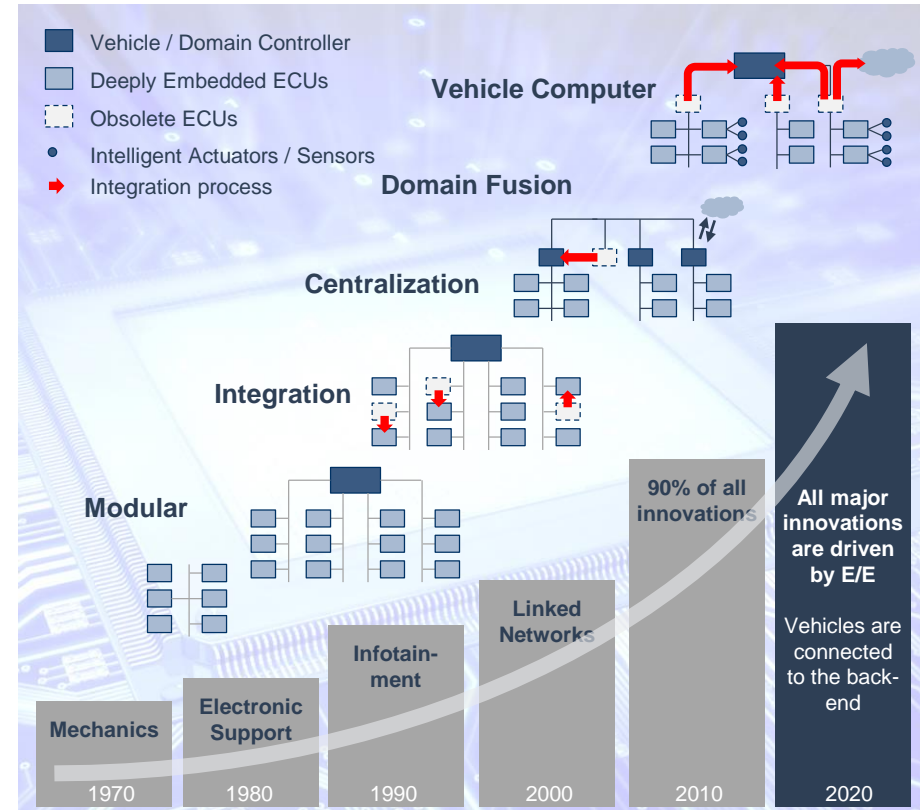
Challenges – selected main drivers

> Trust

Challenges – Driving changes in E/E Architectures

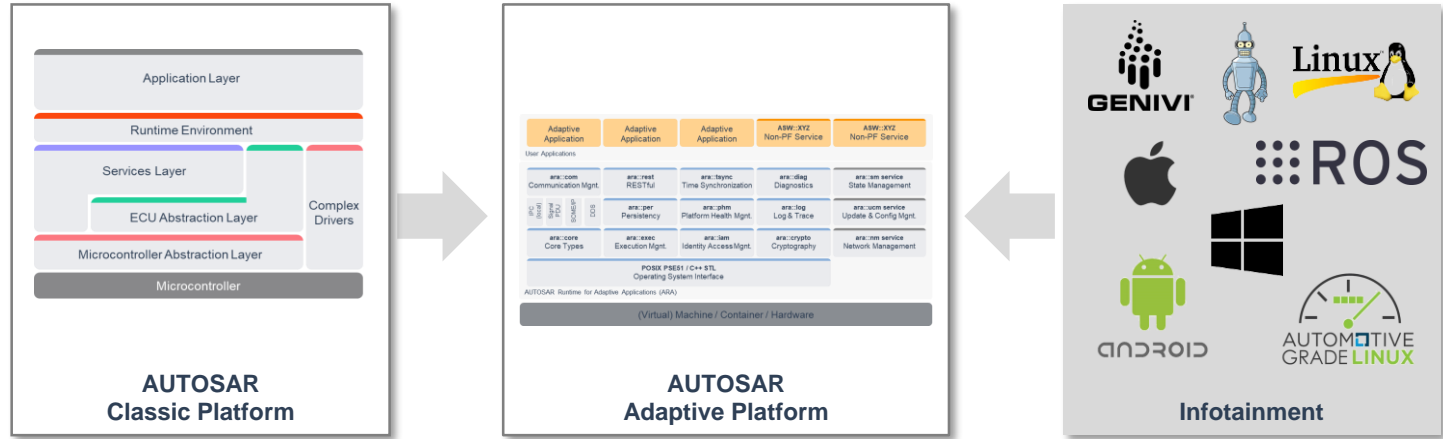New types of in vehicle computers are required to fulfill the needs of

- **performance**,
- **flexibility** and
- **connectivity**

But

- **backwards compatibility** with existing solutions,
- fulfillment of increasing requirements for **safety** and **security**

is **a must** as well.

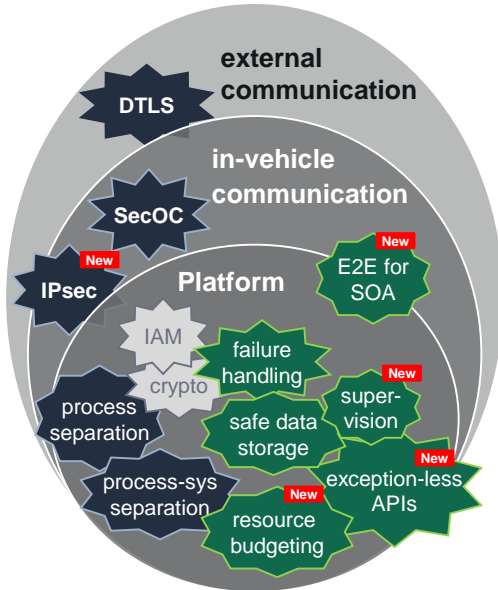# AUTOSAR's answer to the upcoming challenges

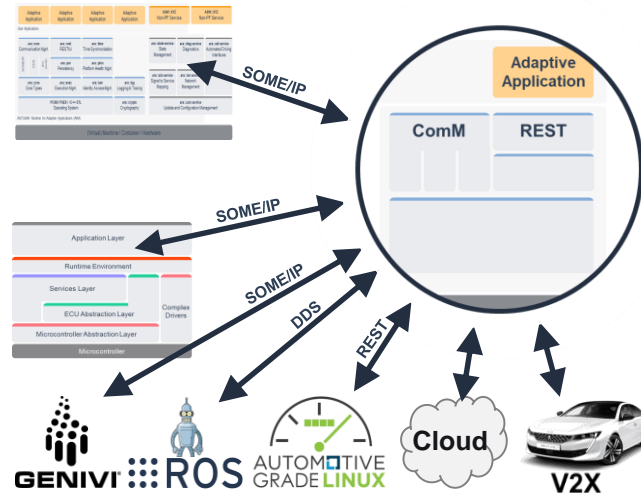| **Real time Requirements**	High, in the range of micro-sec	Mid, in the range of milli-sec	Low, in the range of sec
Safety Criticality	High, up to ASIL-D	High, at least ASIL-B	Low, QM
Computing power	Low, ~ 1000 DMIPs	High, > 20.000 DMIPs	High, ~ 10.000 DMIPs

AUTOAR Adaptive Platform
The 3 Pillars of the Adaptive Platform …

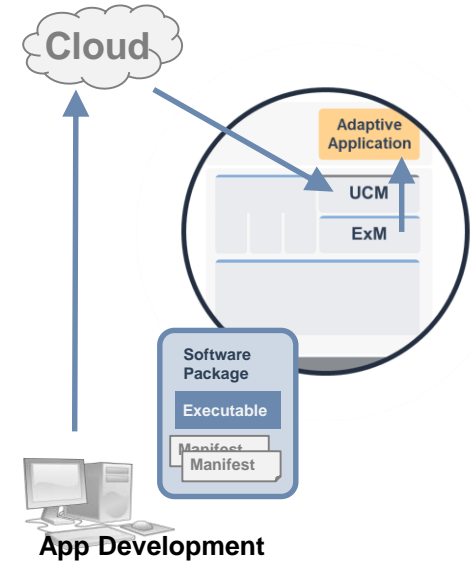**… are the prerequisite for ADAS applications**

Strengthen and Extend Pillars of AUTOSAR
## AUTOSAR USP

Strengthen Safety & Security

➔ Support standard failure and attack scenarios

➔ Extend test and verification

➔ Improve processes

Strengthen connectivity

➔ Extend standard cloud services

➔ Think about AUTOSAR App store

➔ Enable connectivity to smart phones and zone ECUs

Develop flexible updates during life time

➔ Improve modularity e.g. define cluster interfaces

➔ Provide means for system description
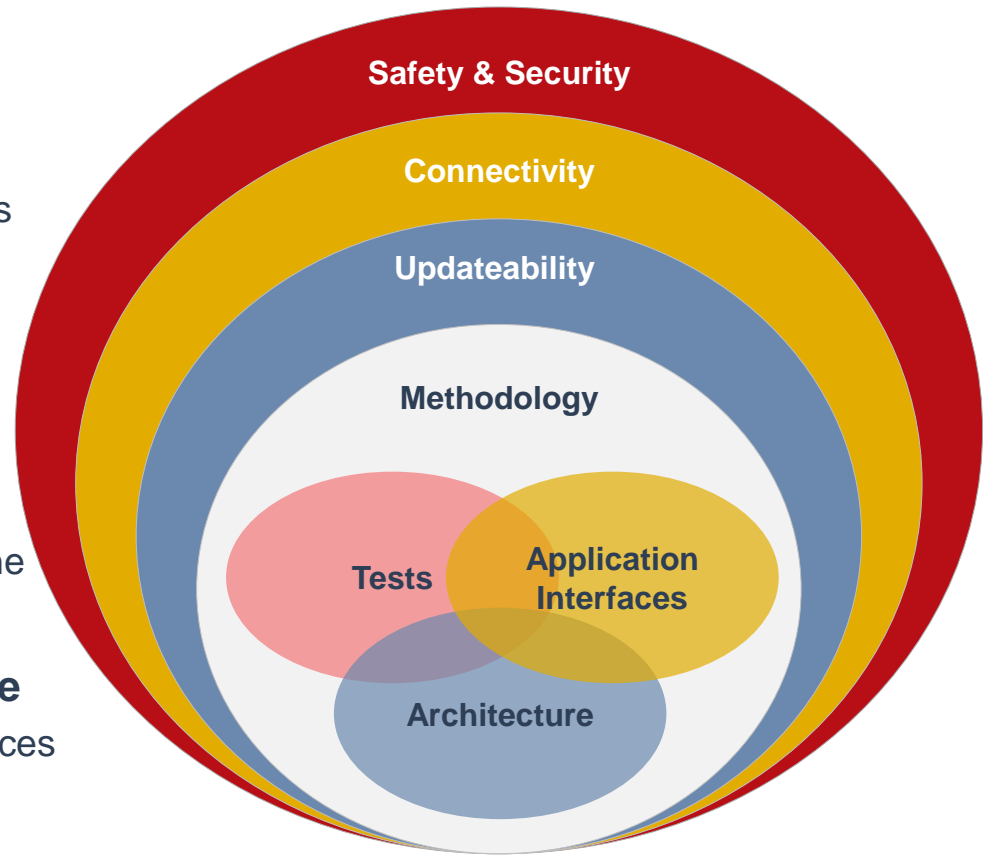
Safety & Security

Connectivity

Updateability

Methodology

Tests

Application Interfaces

Architecture

Agenda

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AUTOSAR in a Vehicle Network
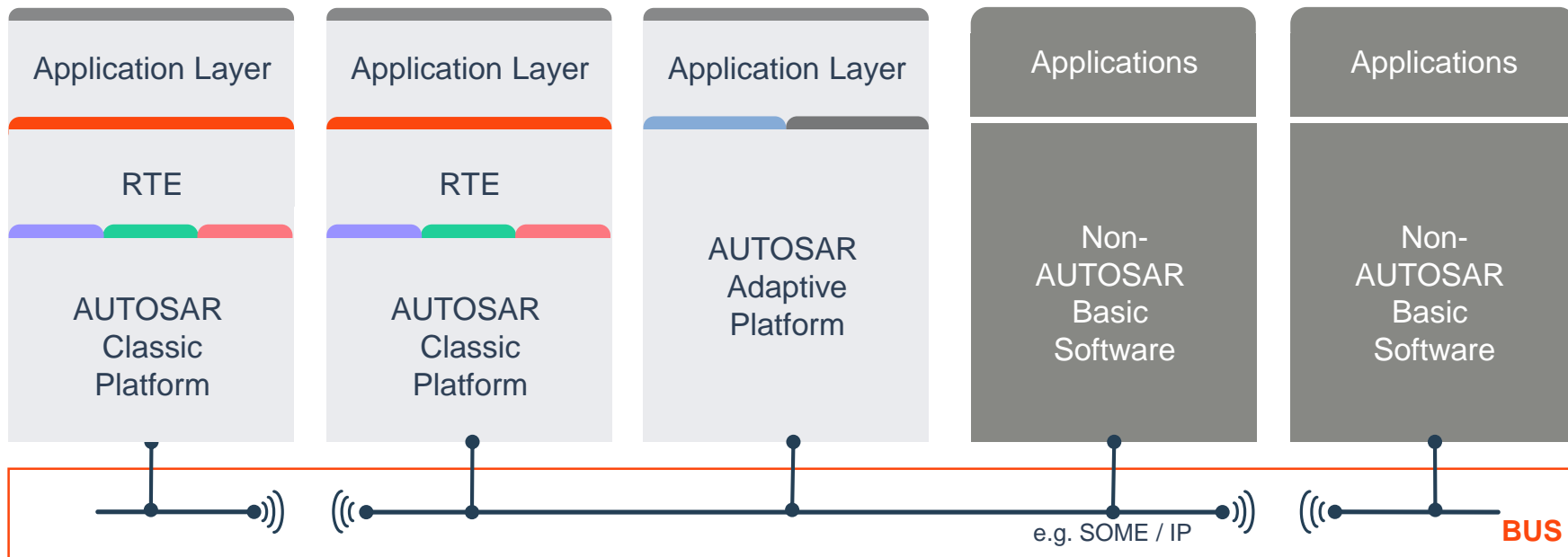
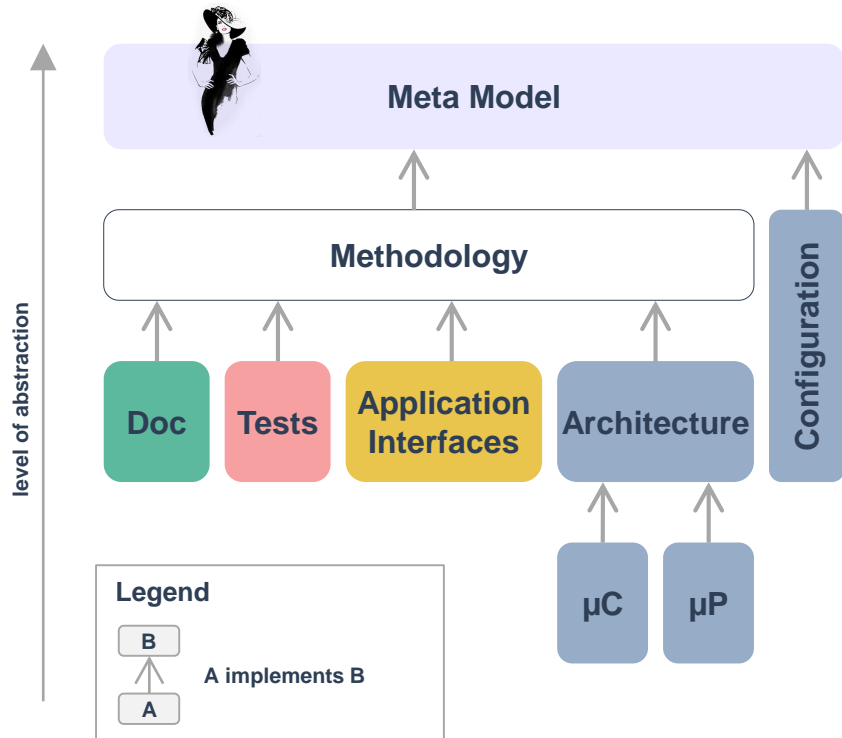Common Bus Interface Specification

AUTOSAR Foundation
Common Features

The Foundation **assures compatibility** of the different
AUTOSAR standards and therefore **contains** all
common artifacts such as …

Debugging
Specification
(DLT)

Meta-Model

Protocols
(SOME/IP, DDS, …)

Main Requirements
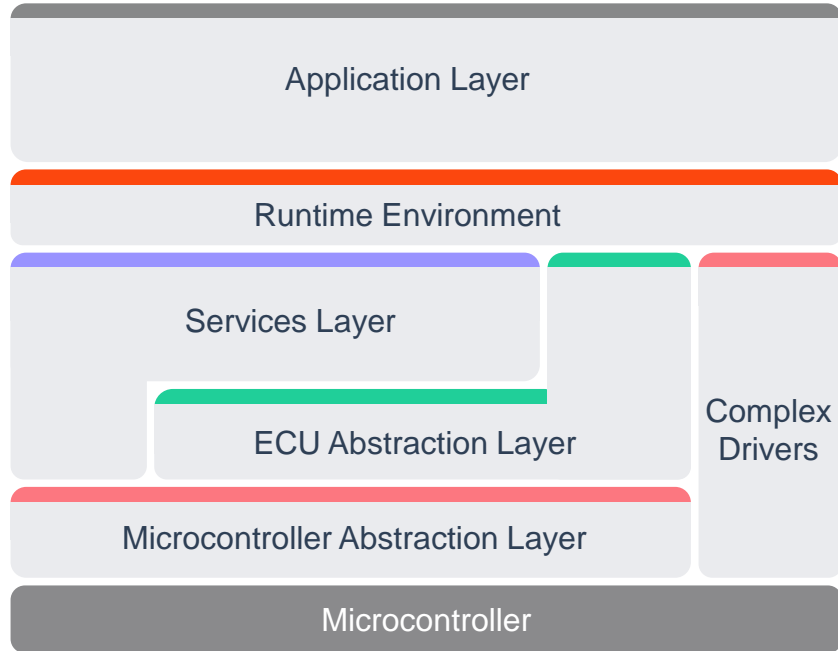&
Glossary

Templates and
Blueprints

AUTOSAR Foundation
The Methodology, derived out of the Meta Model, …

- … provides means to describe the AUTOSAR **architecture** with all its **interfaces**
- … defines **exchange formats** and description **templates** (e.g. manifest) to enable
  - a seamless integration of the complete vehicle E/E architecture,
  - the automatized configuration of the µC- and µP-software stacks and
  - the seamless integration of application software
- … supports means to **ensure safety** and **security** of the system
- … provides templates to **document the standard**

AUTOSAR Classic Platform
Layered Software Architecture (1/2)

Application Layer

Runtime Environment

Services Layer		Complex Drivers
ECU Abstraction Layer		

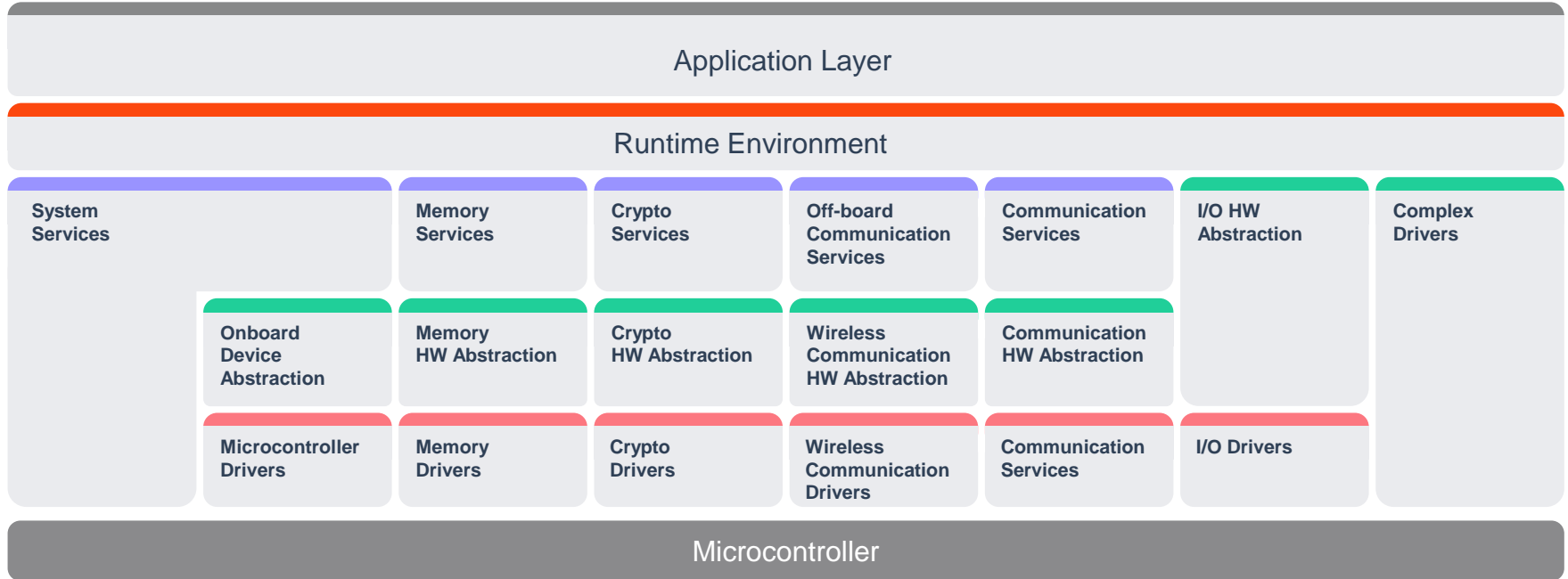| Microcontroller Abstraction Layer	

Microcontroller

The layered architecture of the classic platform basically supports

- Hardware abstraction

- Scheduling of runnables and tasks (OS)

- Communication between applications on the same hardware and over the network

- Diagnosis and diagnostic services

- Safety- and

- Security Services

AUTOSAR Classic Platform
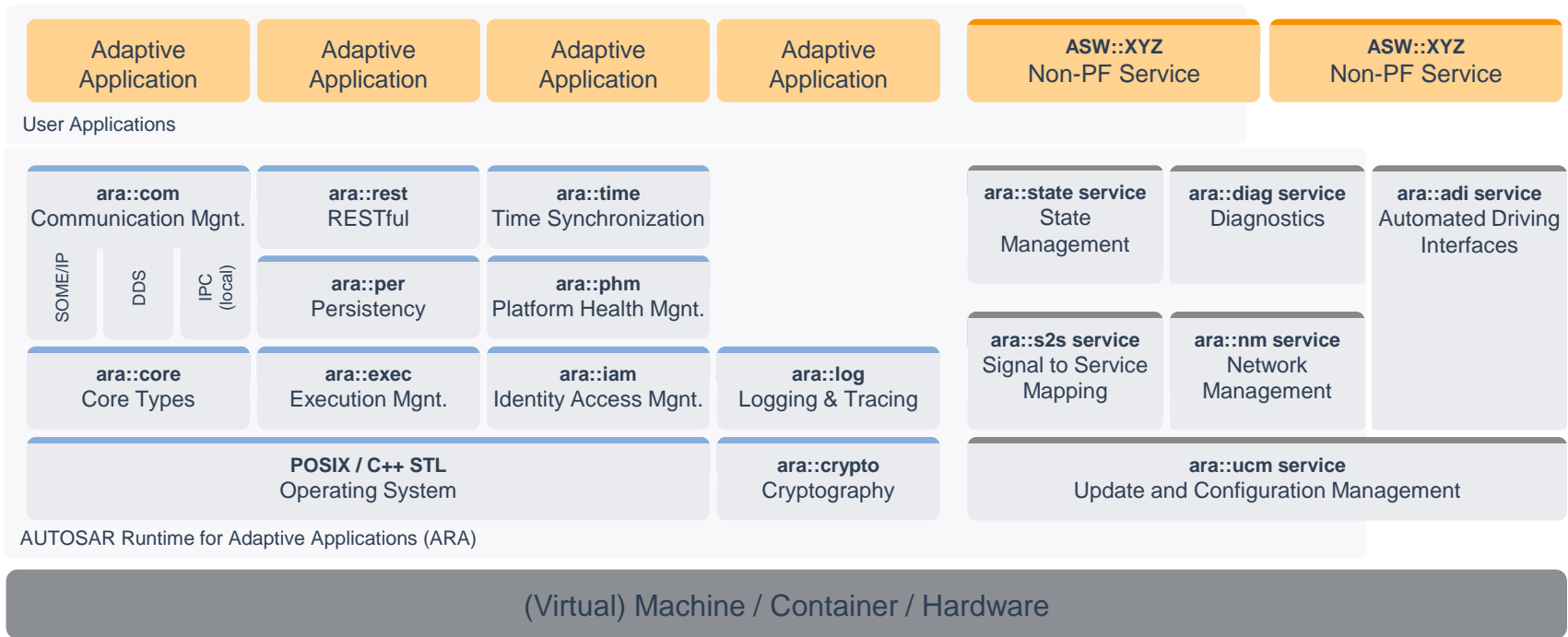## Layered Software Architecture (2/2)

Application Layer

Runtime Environment

System Services	Memory Services	Crypto Services	Off-board Communication Services	Communication Services	I/O HW Abstraction	Complex Drivers
	Onboard Device Abstraction	Memory HW Abstraction	Crypto HW Abstraction	Wireless Communication HW Abstraction	Communication HW Abstraction	
	Microcontroller Drivers	Memory Drivers	Crypto Drivers	Wireless Communication Drivers	Communication Services	I/O Drivers

Microcontroller

AUTOSAR Adaptive Platform
Logical view

Legend

| SERVICE Non-PF Service | SERVICE Func. Cluster | API Func. Cluster |

User Applications

| Adaptive Application | Adaptive Application | Adaptive Application | Adaptive Application | ASW::XYZ Non-PF Service | ASW::XYZ Non-PF Service |

ara::com Communication Mgnt.
- SOME/IP
- DDS
- IPC (local)

ara::rest RESTful

ara::time Time Synchronization

ara::per Persistency

ara::phm Platform Health Mgnt.

ara::core Core Types

ara::exec Execution Mgnt.

ara::iam Identity Access Mgnt.

ara::log Logging & Tracing

POSIX / C++ STL Operating System

ara::crypto Cryptography

ara::state service State Management

ara::diag service Diagnostics

ara::adi service Automated Driving Interfaces

ara::s2s service Signal to Service Mapping

ara::nm service Network Management

ara::ucm service Update and Configuration Management

AUTOSAR Runtime for Adaptive Applications (ARA)

(Virtual) Machine / Container / Hardware

AUTOSAR AP and CP Features
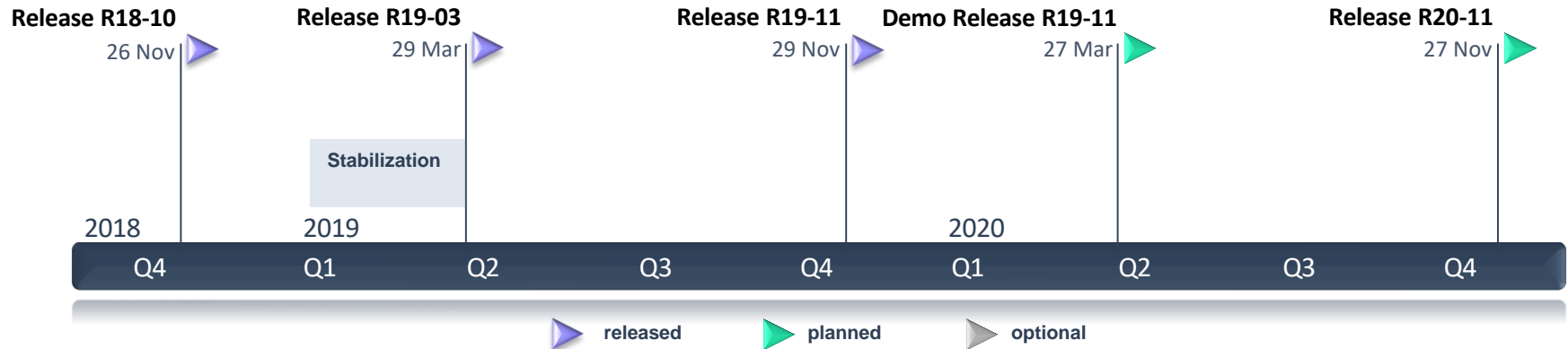
Release R18-10
26 Nov

Release R19-03
29 Mar

Stabilization

Release R19-11
29 Nov

Demo Release R19-11
27 Mar

Release R20-11
27 Nov

2018

2019

2020

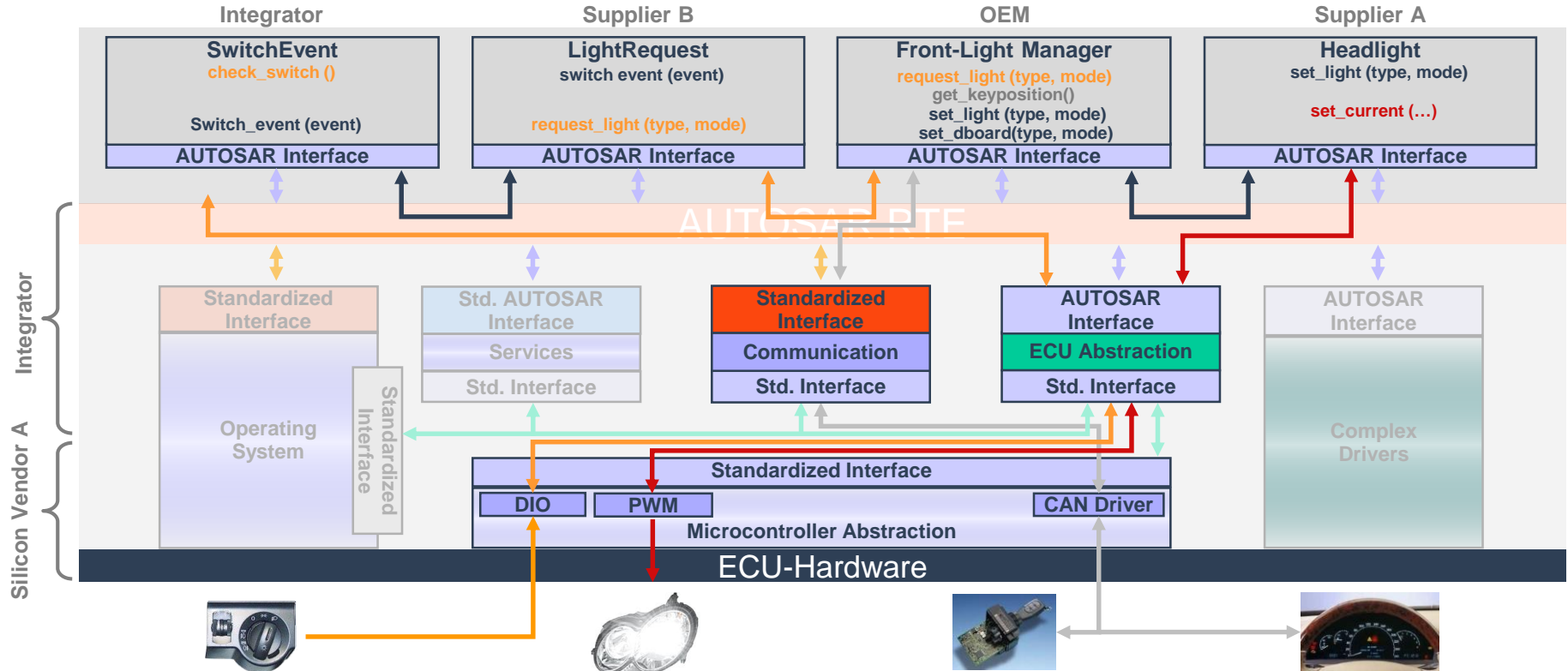| Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |

released   planned   optional

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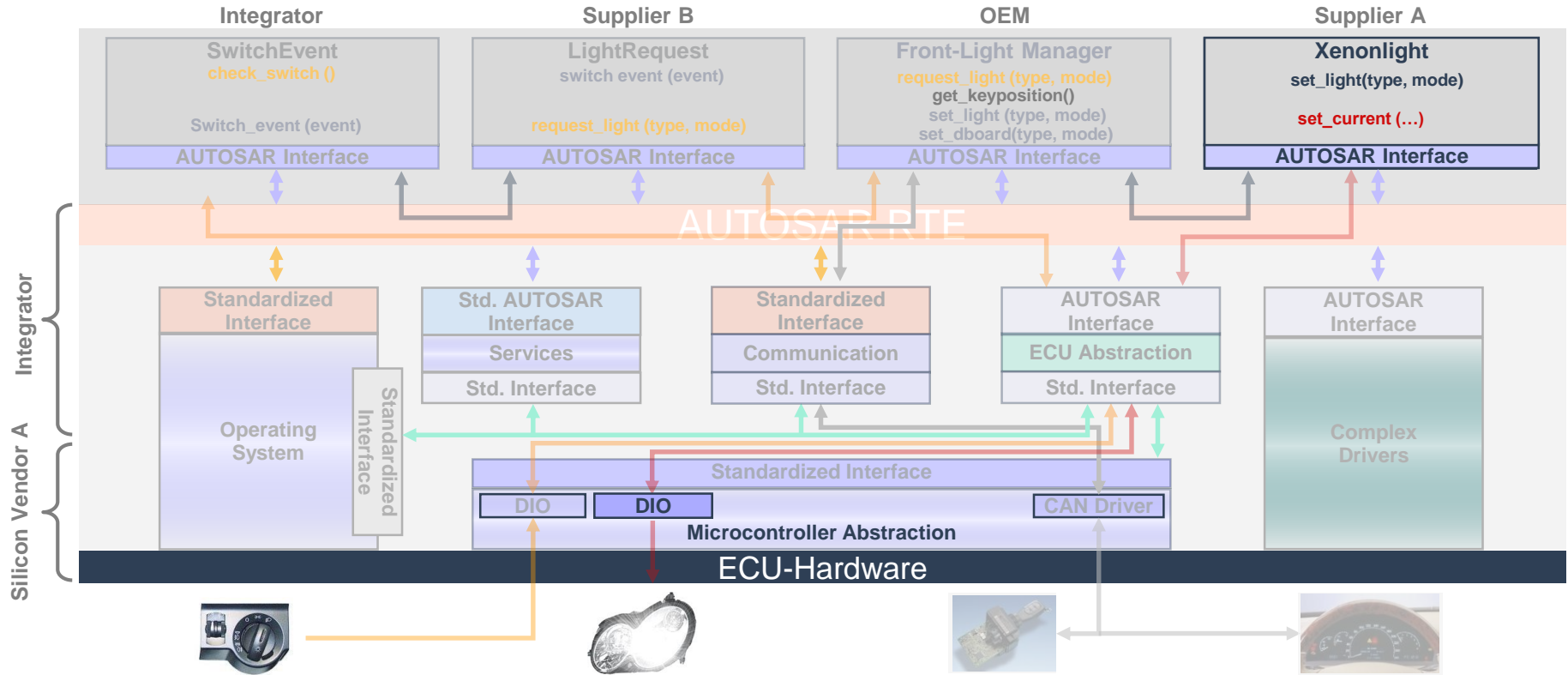> Smart solutions based on AUTOSAR

> Processes and quality

> Outlook

Software Architecture – AUTOSAR Defined Interfaces
Use Case 'Front Light Management': Exchange Type of Front Light

Software Architecture – AUTOSAR Defined Interfaces
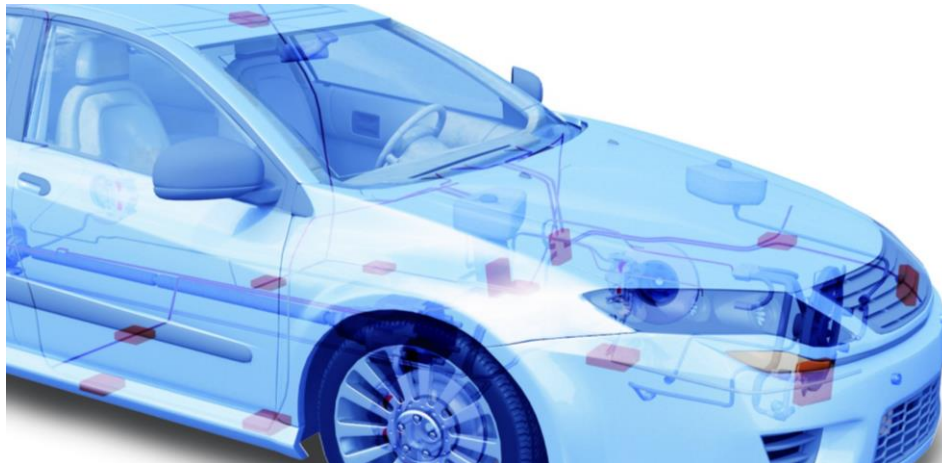## Use Case 'Front Light Management': Exchange Type of Front Light

Distribution ECUs

SwitchEvent	LightRequest	Front-Light Manager	Xenonlight
		request_light(type, mode)	set_light(type, mode)
switch_event (event)	switch_event(event)		
	request_light (type, mode)	set_light(type, mode)	set_current (…)
AUTOSAR Int.	**AUTOSAR Interface**	**AUTOSAR Interface**	**AUTOSAR Interface**

Distribution on ECUs – 'Front-Light Management'

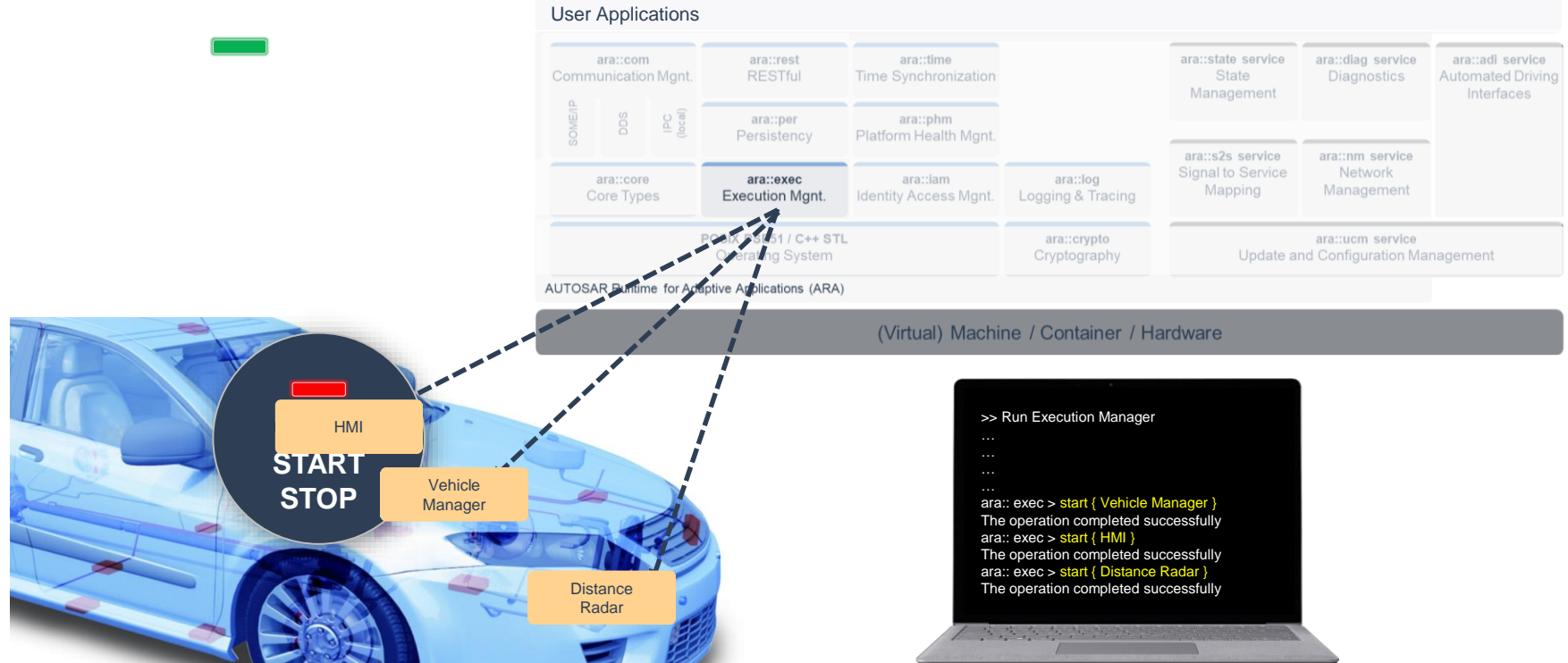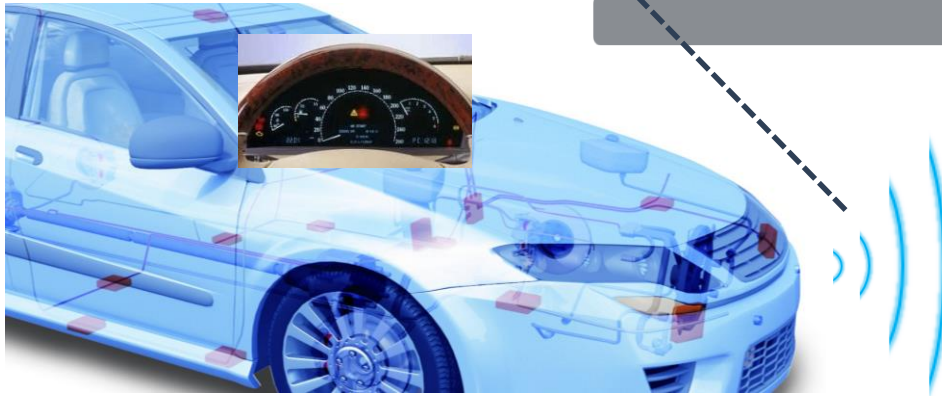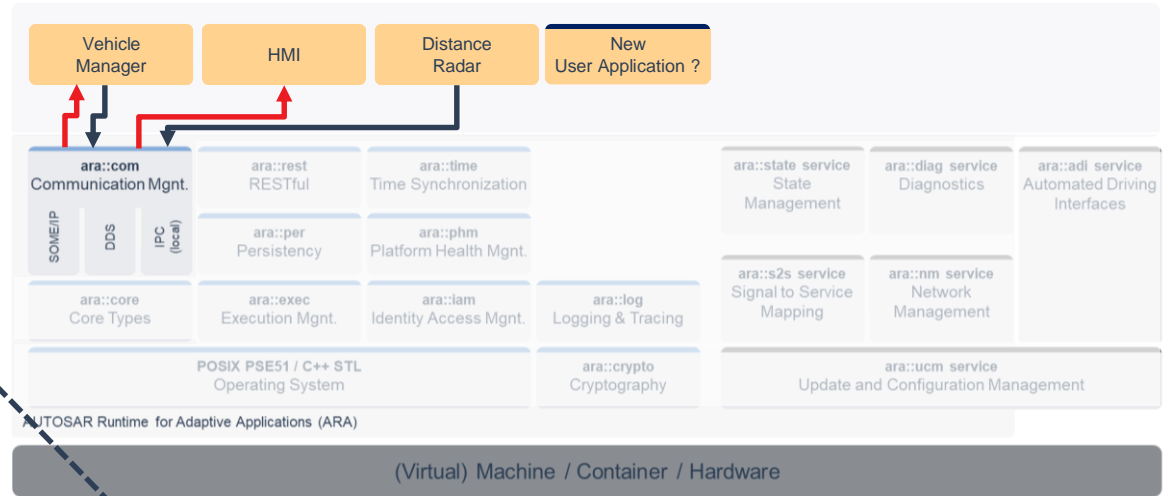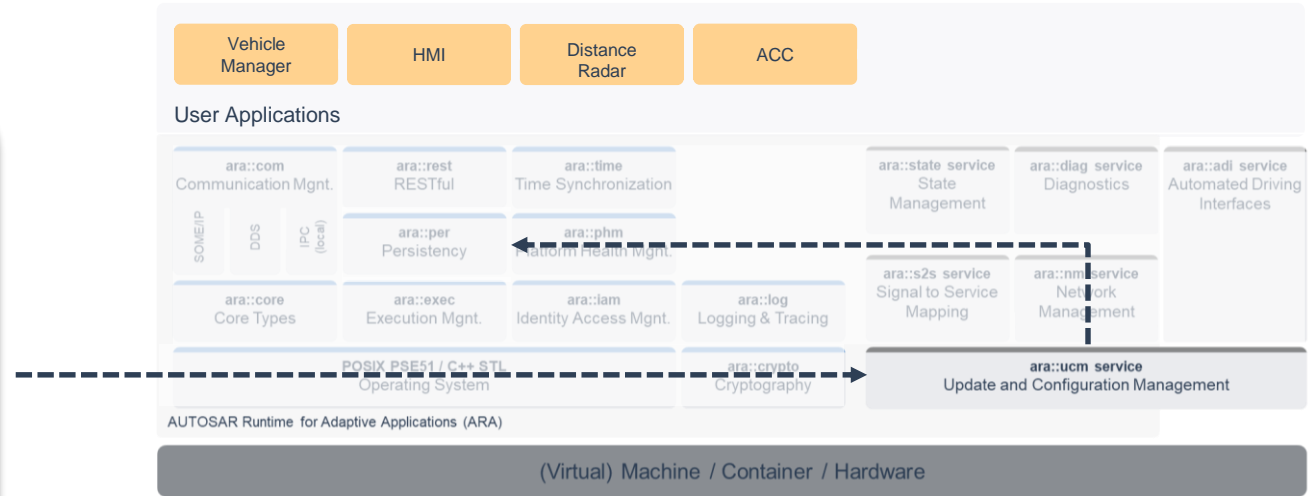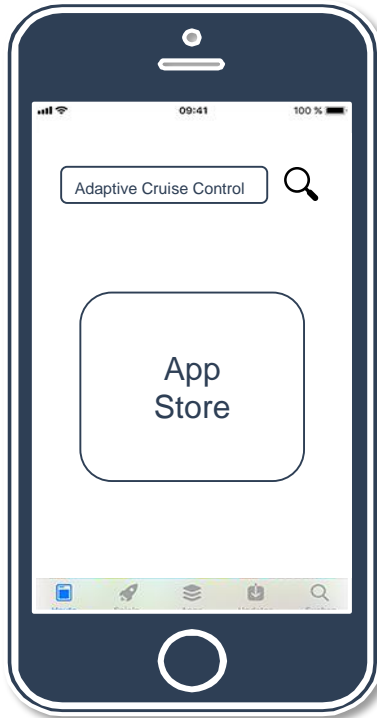| SwitchEvent	LightRequest	Front-Light Manager	Xenonlight
check_switch ()	switch_event(event)	**request_light(type, mode)**	set_light(type, mode)
switch_event (event)	**request_light (type, mode)**	get_keyposition()	**set_current (…)**
		set_light(type, mode)	
AUTOSAR Int.	**AUTOSAR Interface**	**AUTOSAR Interface**	**AUTOSAR Interface**

CAN Bus
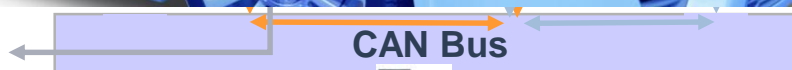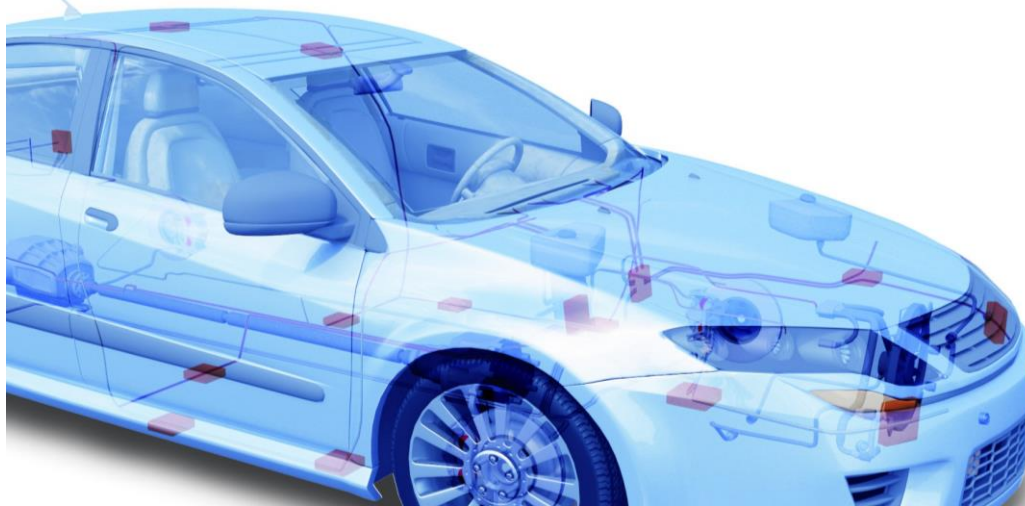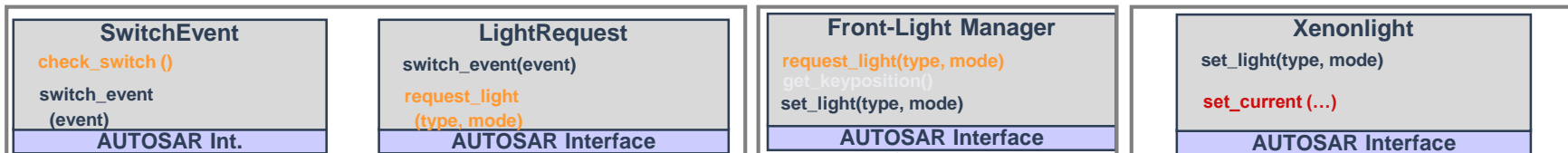
AUTOSAR Platform Application
Continuous improvement cycle for ADAS systems

On Board

Scene Understanding

Mission and Trajectory Planning

Sensor Fusion

ara:adi

Perception

ara:com

Plan Execution, Motion Control

Secure data exchange on top of

DDS
SOME/IP
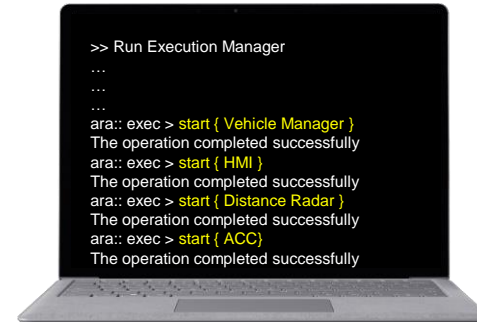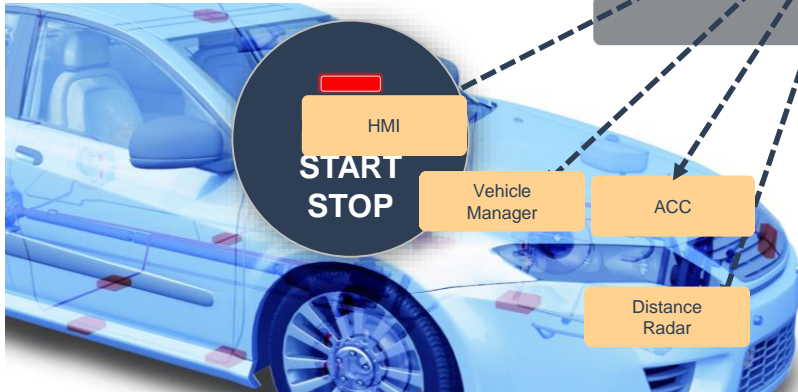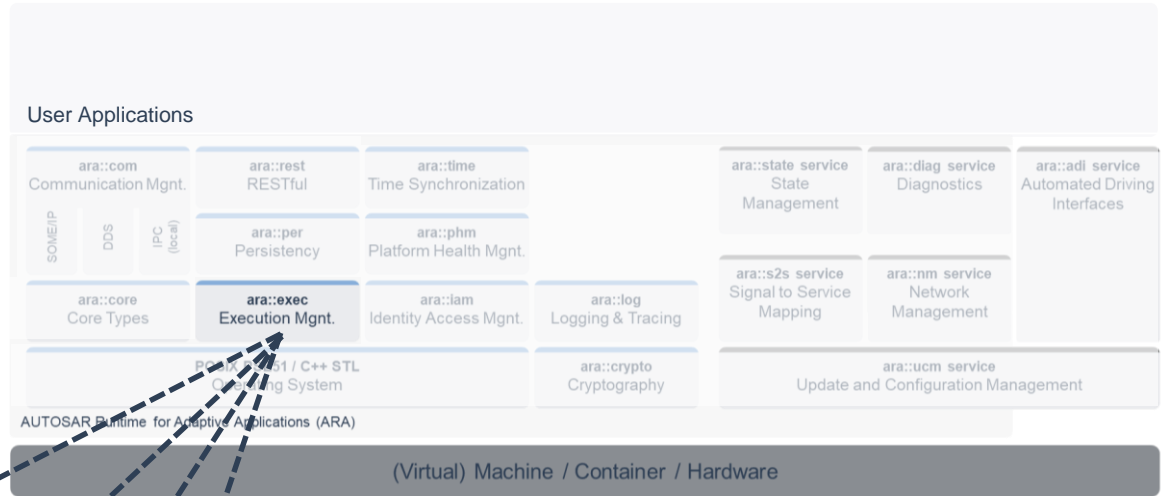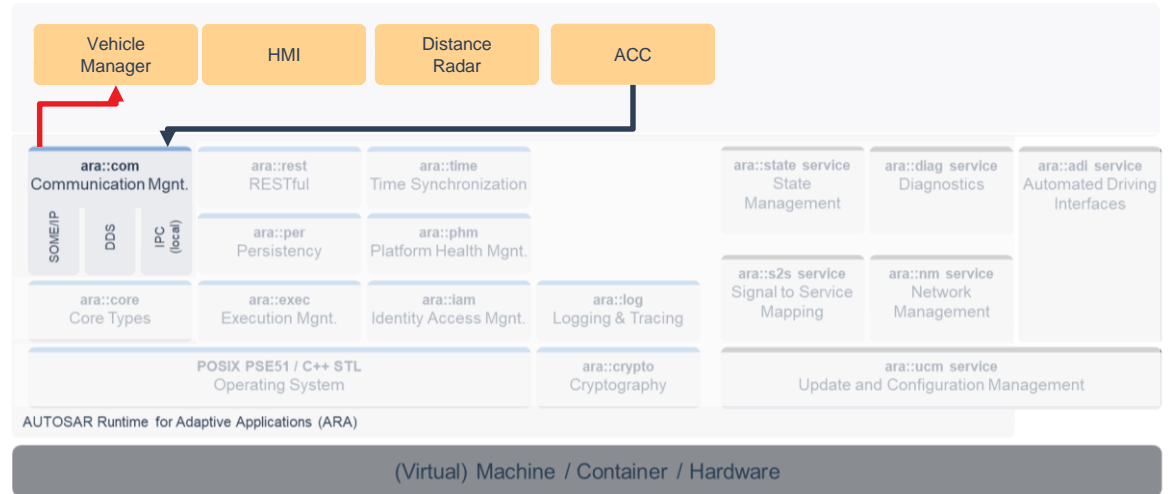or
REST

Off Board

Labeling of trained data

Evolution by training

Simulation and sign-off

AUTOSAR Platform Application

Vehicle Manager | HMI | Distance Radar | ACC

User Applications

ara::com Communication Mgmt. | ara::rest RESTful | ara::time Time Synchronization | ara::state service State Management | ara::diag service Diagnostics | ara::adi service Automated Driving Interfaces

SOME/IP | DDS | IPC (local) | ara::per Persistency | ara::phm Platform Health Mgmt.

ara::core Core Types | ara::exec Execution Mgmt. | ara::iam Identity Access Mgmt. | ara::log Logging & Tracing | ara::s2s service Signal to Service Mapping | ara::nm service Network Management

POSIX PSE51 / C++ STL Operating System | ara::crypto Cryptography | ara::ucm service Update and Configuration Management

AUTOSAR Runtime for Adaptive Applications (ARA)

(Virtual) Machine / Container / Hardware

App Store

Adaptive Cruise Control

```
>> Run Persistency
...
...
...
ara:: per > install new application software
from ara:: ucm service { ACC }
Ara:: per > deploy persistent data to
Key-Value Database:
> Vehicle Manager
> HMI
> Distance Radar
> ACC
```
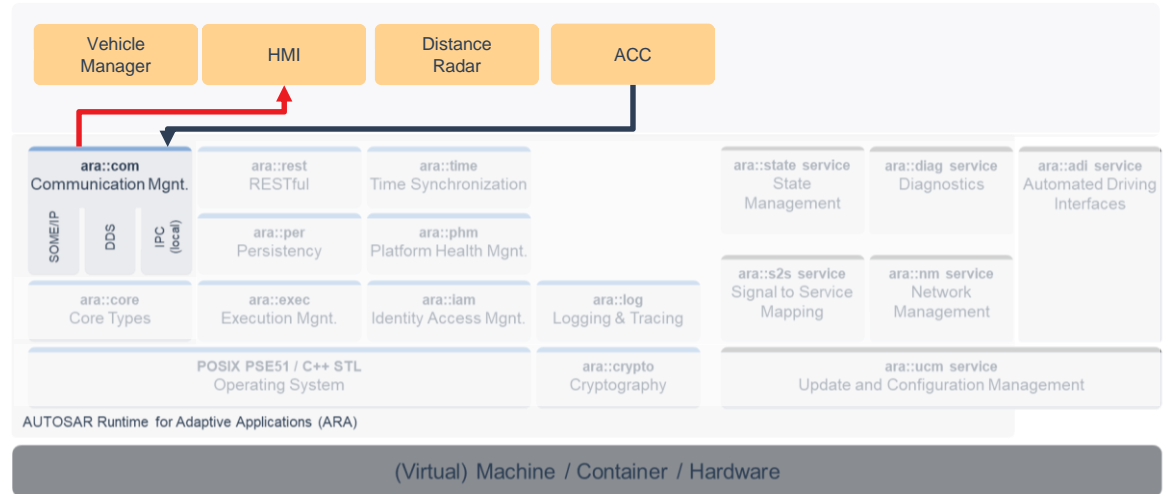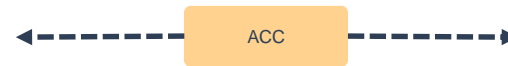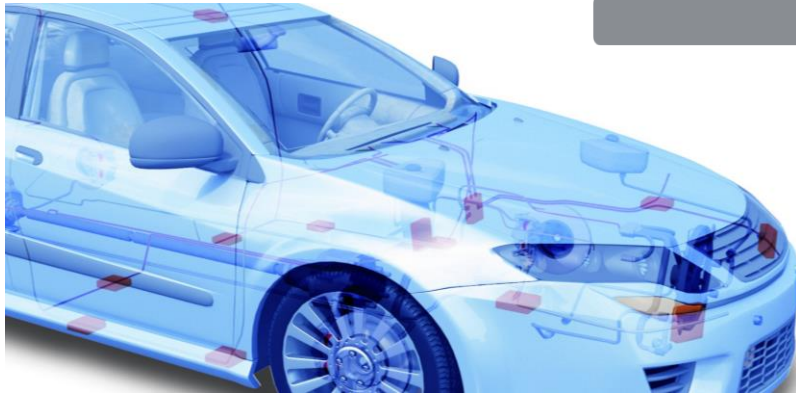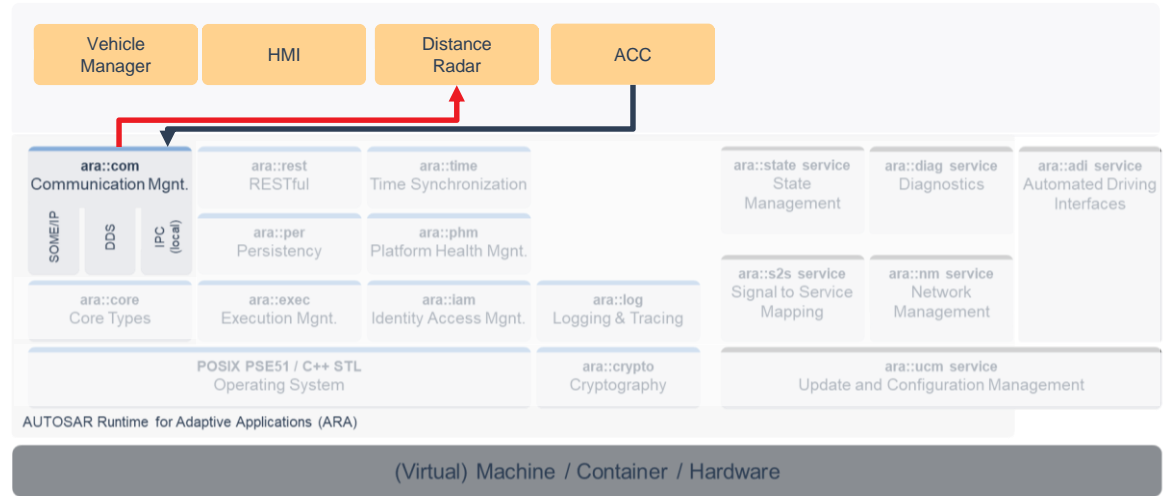
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AUTOSAR Adaptive Platform development approach

Specification

Identify needs & use-cases:

1) Concepts
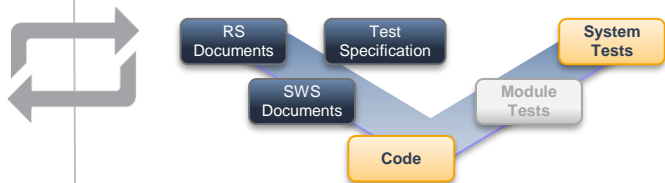2) Features
3) Requirements

Quality:

- TF-ARC approval
- Cross team review
- Lifecycle :
  preliminary → draft → valid

Implementation

Gain speed:

1) Spec validation
2) Reduce room for spec interpretation
3) Training / dissemination of AP

RS Documents — Test Specification — SWS Documents — Code — Module Tests — System Tests

Attracting environment for coders:

- Appealing technology (C++, Yocto, Git, …)
- Modern use case (ADAS EBA)
- Handy documentation (Wiki)
- Peer programming sessions

Demonstration

Gain trust:

1) Advertises the progress
2) Highlights some specific features

Classic Platform — Adaptive Platform — Others

Ethernet
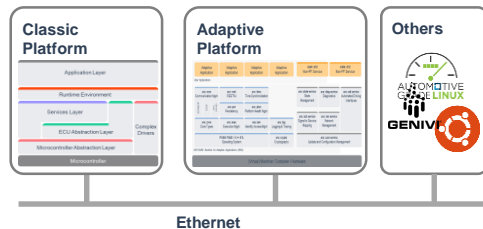
Show AUTOSAR interoperability

- of classic and adaptive platforms
- but also with others

Best tradeoff between commercial cooperation & compatibility between different vendors

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> **Outlook**

Timeline to full automation
AUTOSAR – a faithful ADAS companion

Automated Driving

Automated Driving

Level 5:
full automation

Automated Driving

Level 4:
highly automated driving

Level 3:
Conditional automation

New Features,
planning in progress

| R17-10 | R18-10 | R19-11 | R20-11 | R21-11 | … |

✓ ✓ ✓

R18-03

R19-03, Stabilisation

AUTOSAR™

2018　2019　2020　2021　2022　2023　2024　2025　2026