AUTOSAR Introduction

The vision, the partnership and current features in a nutshell

Presenter

Occasion (Meeting, Conference, etc.)

27 October 2020

Location @ Host

BMW GROUP | BOSCH | Continental | DAIMLER | Ford | GM | PSA GROUPE | TOYOTA | VOLKSWAGEN AKTIENGESELLSCHAFT

Agenda

- Introduction of the AUTOSAR Partnership
- Challenges in the automotive industry
- Architecture and recent features
- Smart solutions based on AUTOSAR
- Processes and quality
- Outlook

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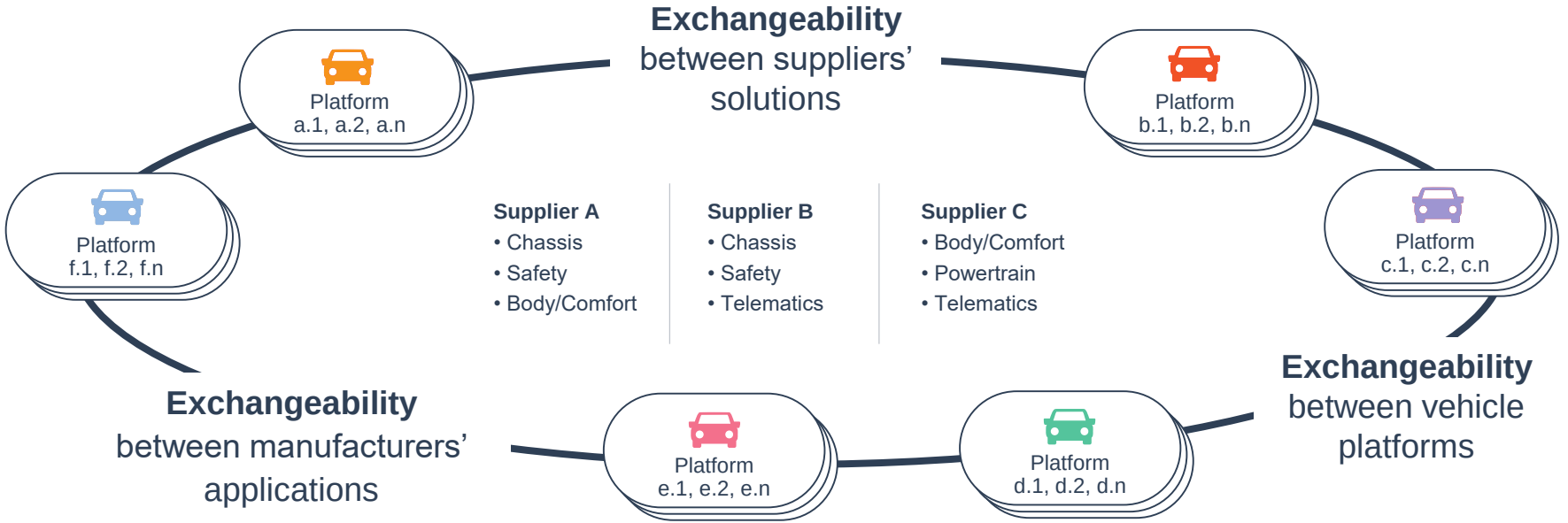
AUTOSAR Introduction

(**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.

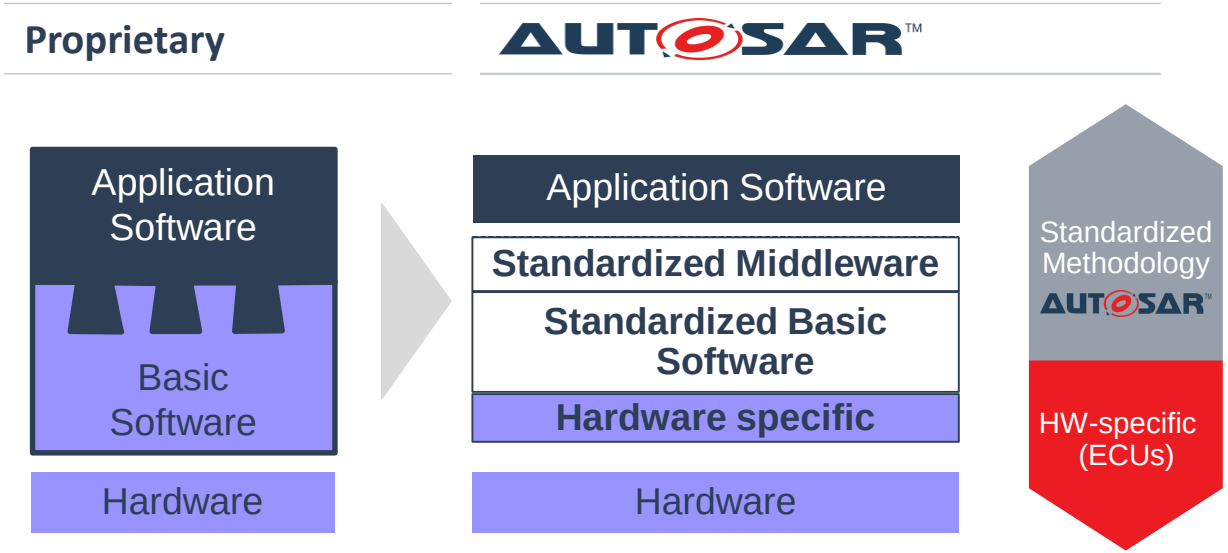
AUTOSAR Vision

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



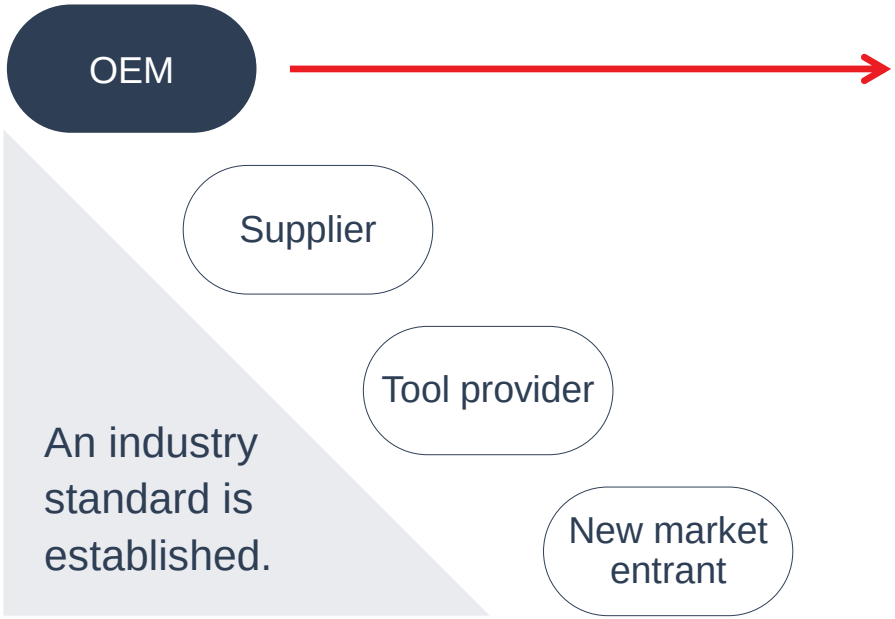
Aims and benefits of using AUTOSAR

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 security.



- Hardware and software – widely independent of each other.
- Development can be de-coupled (through abstraction) by horizontal layers, reducing development time and costs.
- Reuse of software enhances quality and efficiency

Exploitation of the standard provides significant benefits

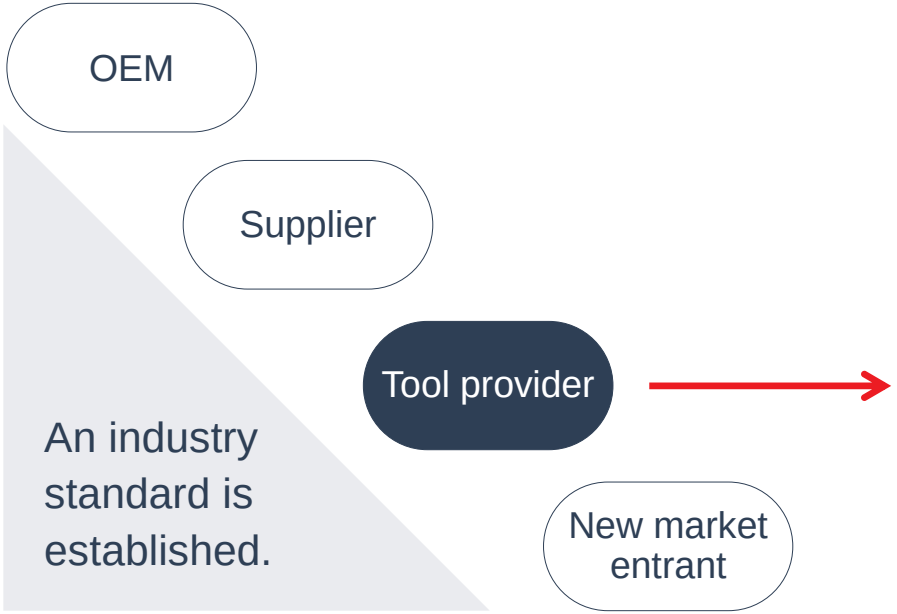


- Establish development distribution among suppliers
- Compete on innovative functions with increased design flexibility
- Simplify software and system integration
- Reduce overall software development costs

Exploitation of the standard provides significant benefits

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

Exploitation of the standard provides significant benefits



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

Exploitation of the standard provides significant benefits

- Enable new business models by means of standardized interfaces
- Easily understand how automotive software is developed

More Than 280 AUTOSAR Partners

9 Core Partners

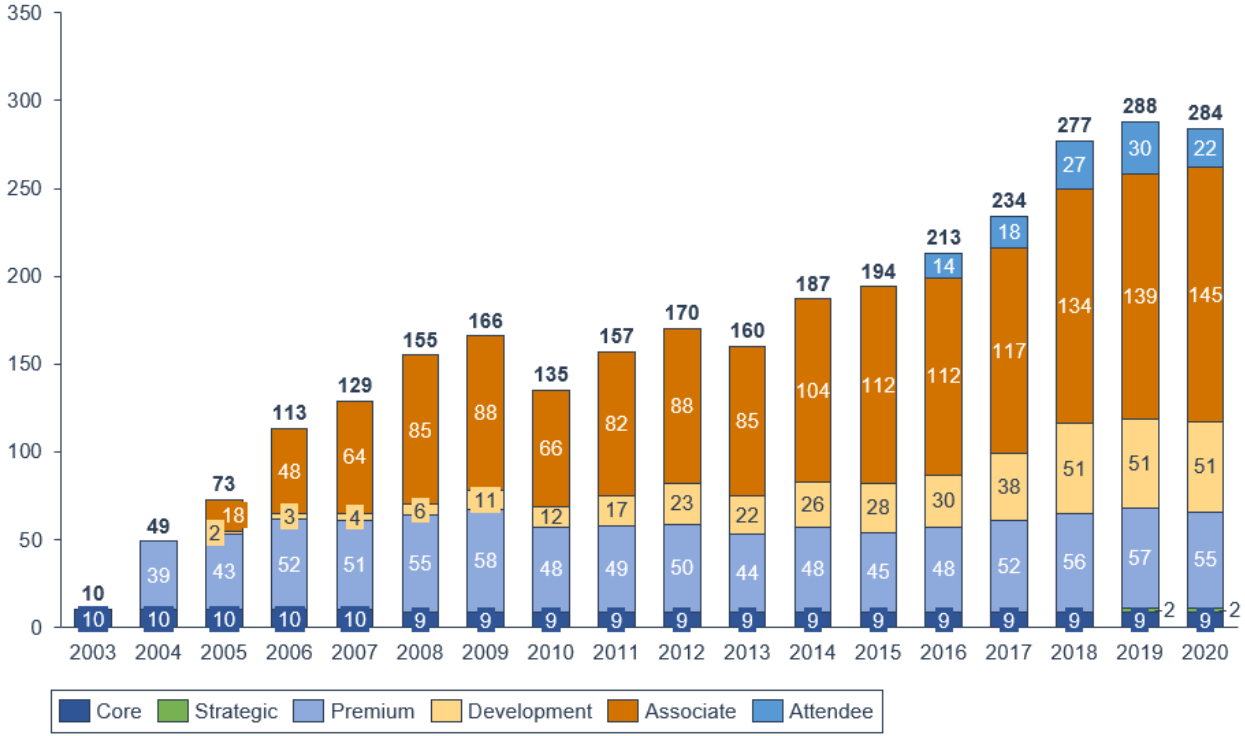
56 Premium Partners

2 Strategic Partners

51 Development Partners

+ 144 Associate Partners
+ 24 Attendees

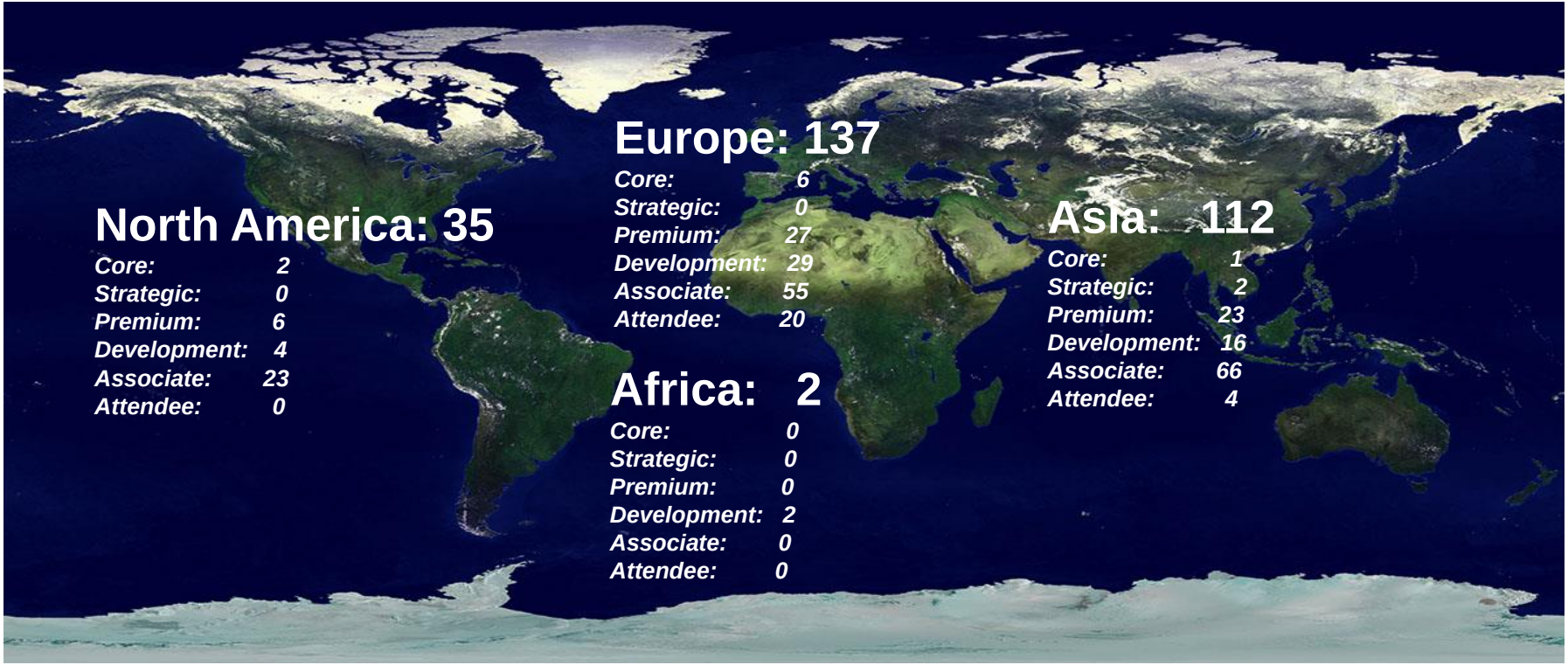
History and current state – Total: 284



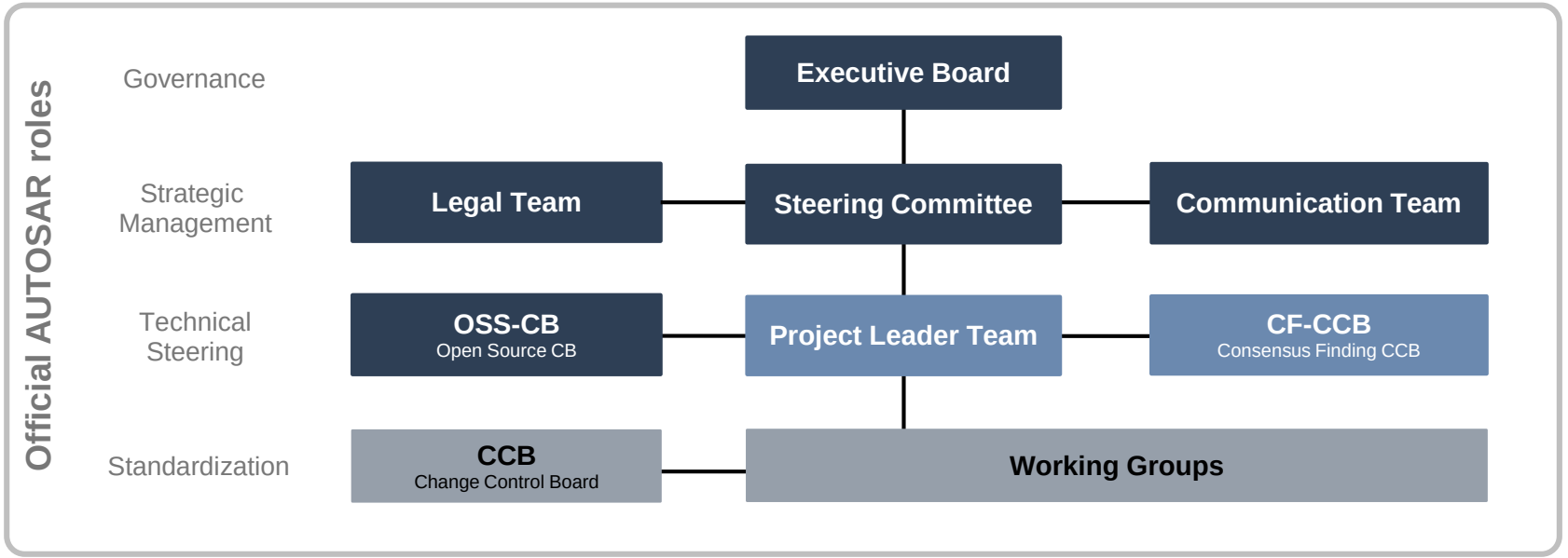
Geographical distribution of partners

(last update 02.09.2020)

Info



AUTOSAR Organization



Legend

Core Partner	Core and Strategic Partner	Core, Strategic, Premium and Development Partner

Working Groups

Legend: Lead Working Group | Working Group

Project Leader Team

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

- **WG-A** Architecture Team
- **WG-MT** Methodology and Templates
- **WG-SEC** Automotive Security
- **WG-SAF** Functional Safety
- **WG-IVC** In-Vehicle COM
- **WG-TSY** Time Synchronization
- **WG-AIF** Application Interfaces
- **WG-V2X** Vehicle to X
- **WG-DIA** Diagnostics
- **WG-RES** Resources
- **WG-UCM** Update & Conf. Management

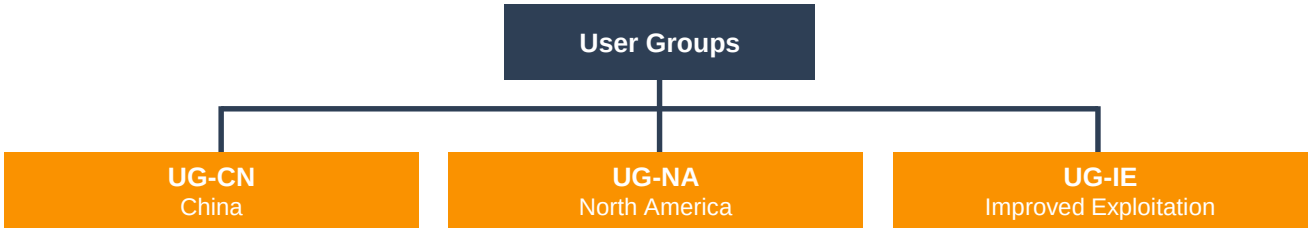
Classic Platform Working Groups (CP)

- **WG-CP-RTE** Runtime Environment
- **WG-CP-MCBD** Multicore BSW Distr.
- **WG-CP-LIB** Libraries
- **WG-CP-MCL** MCAL and NVRAM

Adaptive Platform Working Groups (AP)

- **WG-AP-EMO** Execution Man. & OS
- **WG-AP-DI** Demonstrator Integration
- **WG-AP-ST** System Tests
- **WG-AP-PER** Persistency
- **WG-AP-CCT** Central Coding Team
- **WG-AP-CLD** Cloud Services

User Group Structure



- Demonstrator development
- BSW integration

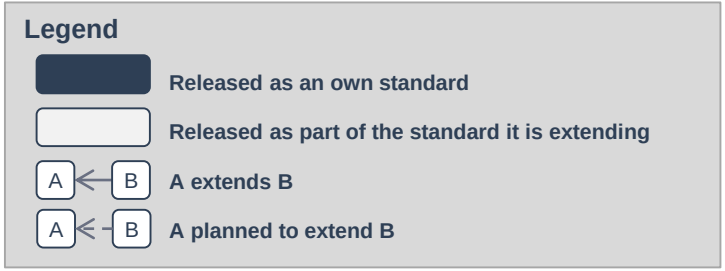
- Common Training: OEM-Tier1 Workflows/ Security
- Safety
- Ethernet

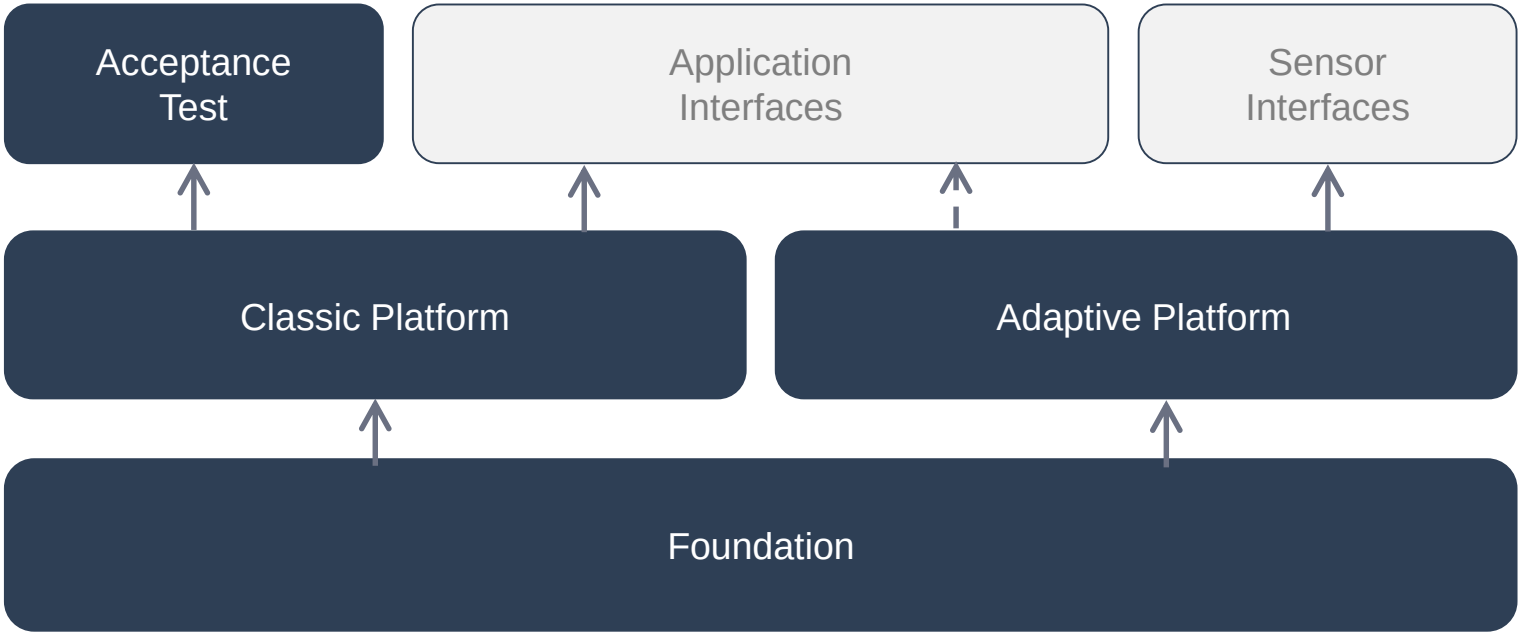
- 6 thesis on optimizing the use of AUTOSAR
- Establishment of Adaptive Platform

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

AUTOSAR Deliverables





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Challenges – selected main drivers

- Highly automated driving

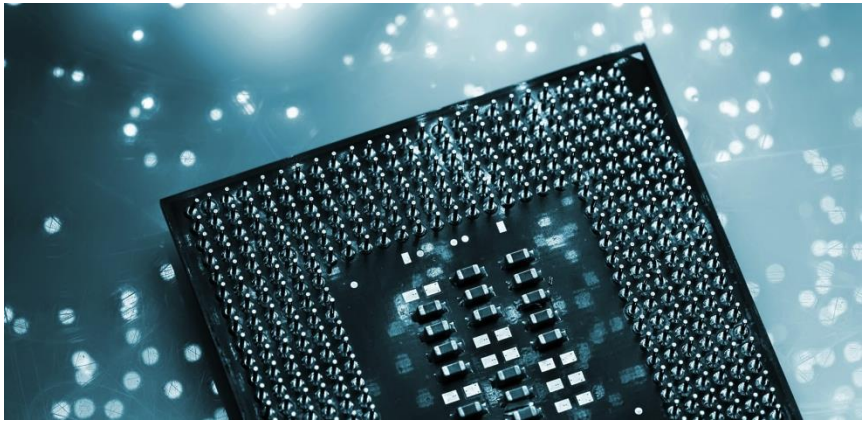
Challenges – selected main drivers

- 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

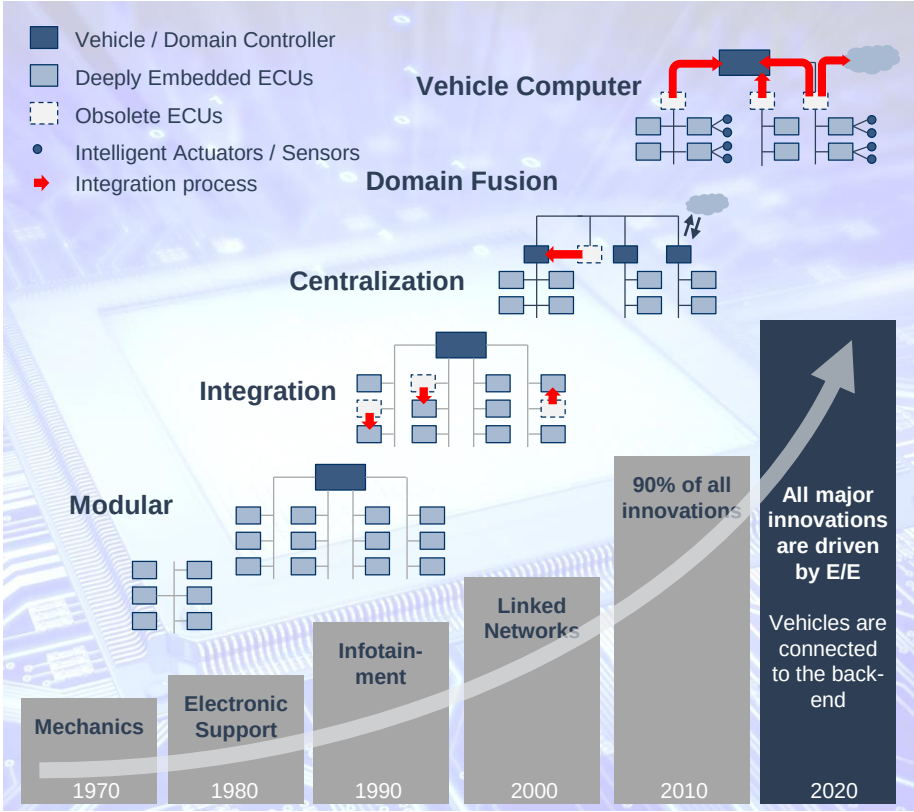
New types of in vehicle computers are required to fulfill the needs of

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

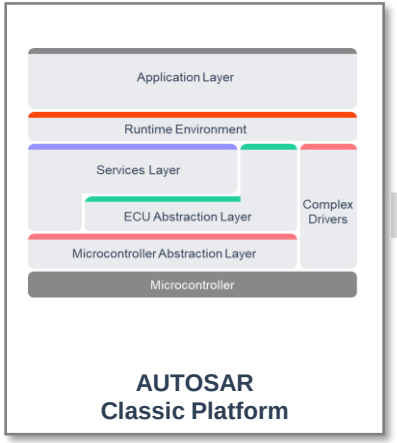
But

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

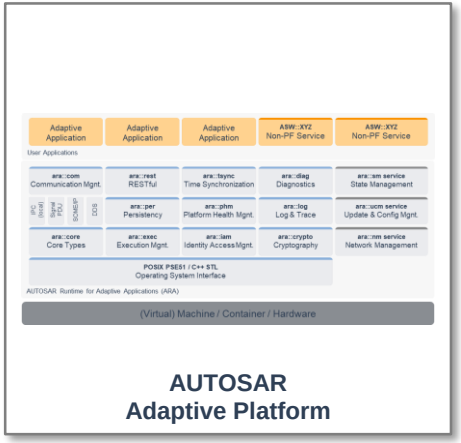
is **a must** as well.



AUTOSAR's answer to the upcoming challenges



AUTOSAR
Classic Platform



AUTOSAR
Adaptive Platform

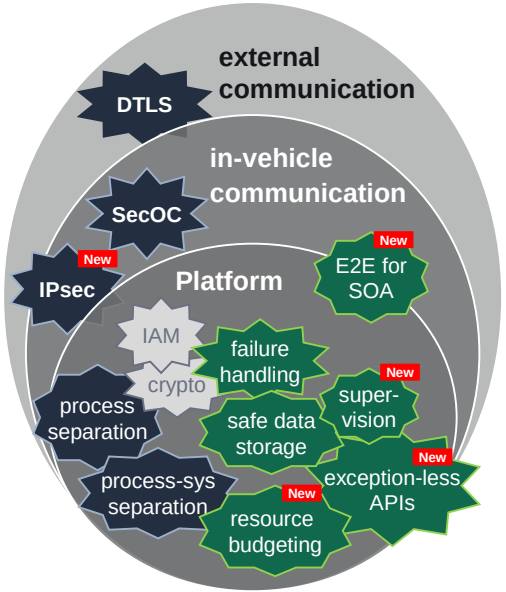
Infotainment

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

AUTOSAR Adaptive Platform

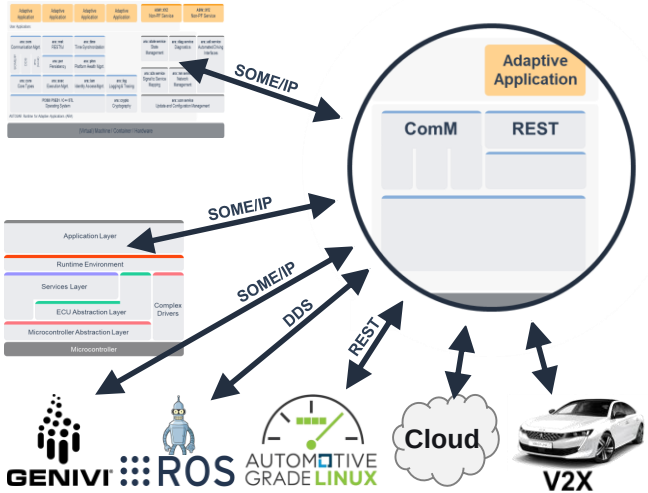
The 3 Pillars of the Adaptive Platform …

I – Safe & Secure

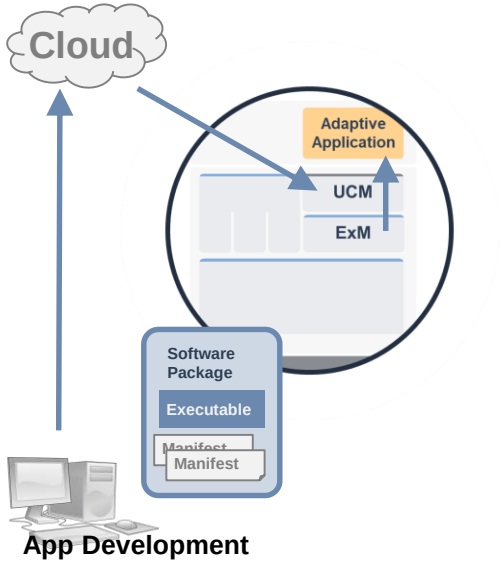


II – Connected

Service-Oriented Communication



III – Dynamic & Updateable



… are the prerequisite for ADAS applications

AUTOSAR Classic Platform

The 4 Pillars of the Classic Platform…

I – Functional Safety

- Mature safety features (e.g. watchdog, E2E communication protection,…)
- Scalable from QM up to ASIL D

II – Efficiency

- AUTOSAR stacks from different vendors
- Cost effective by supporting a wide range of µControllers
- Flexibility due to CDD

III – Field Proven

- Mature by many years of application
- High quality due to widespread implementations
- Established development processes

IV – Performance

- Hard real time capabilities
- Event triggered applications
- Flexible by supporting a wide range of protocols and networks
- Scalability by configuration

… to form the standard solution for today´s automobiles

Strengthen and Extend Pillars of AUTOSAR

AUTOSAR USP

Strengthen Safety & Security

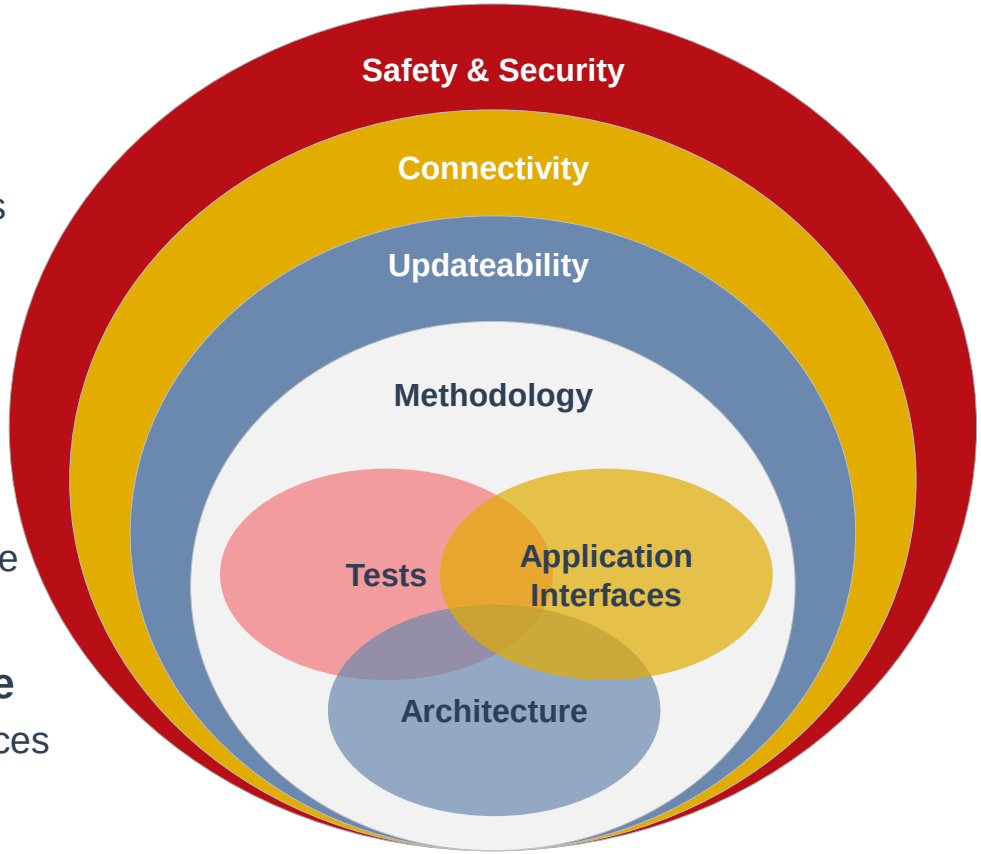
- ➔ Support standard failure and attack scenarios
- ➔ Extend test and verification
- ➔ Improve processes

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



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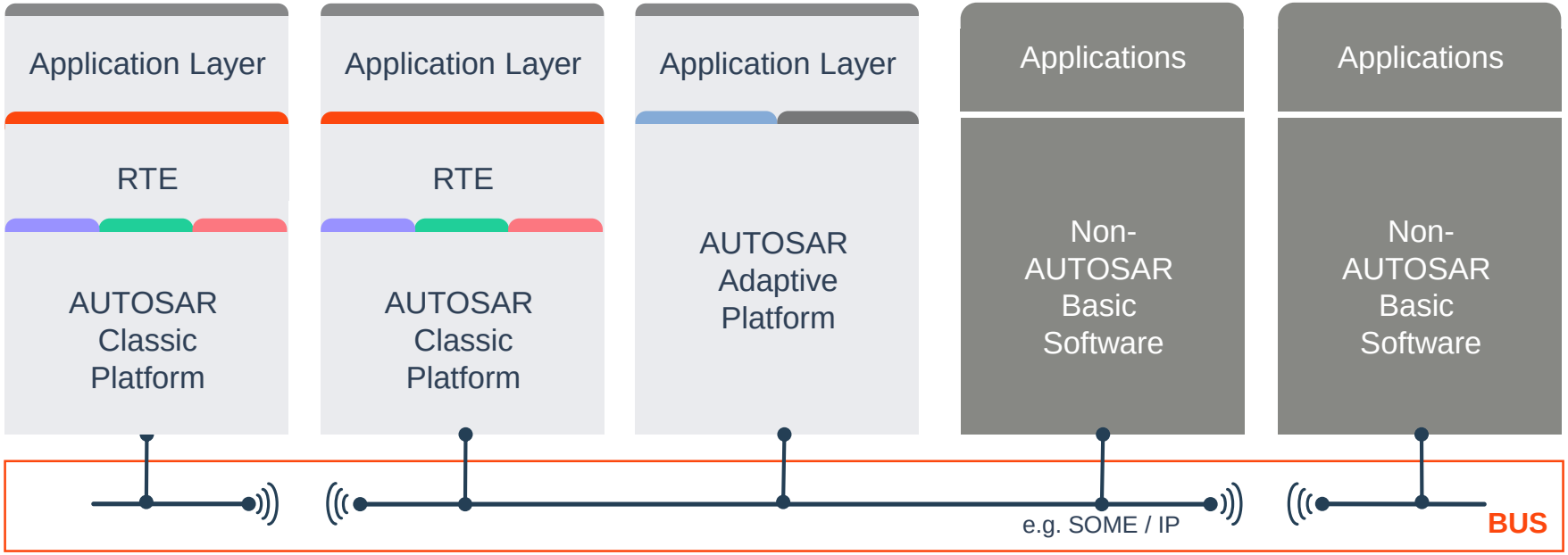
AUTOSAR in a Vehicle Network



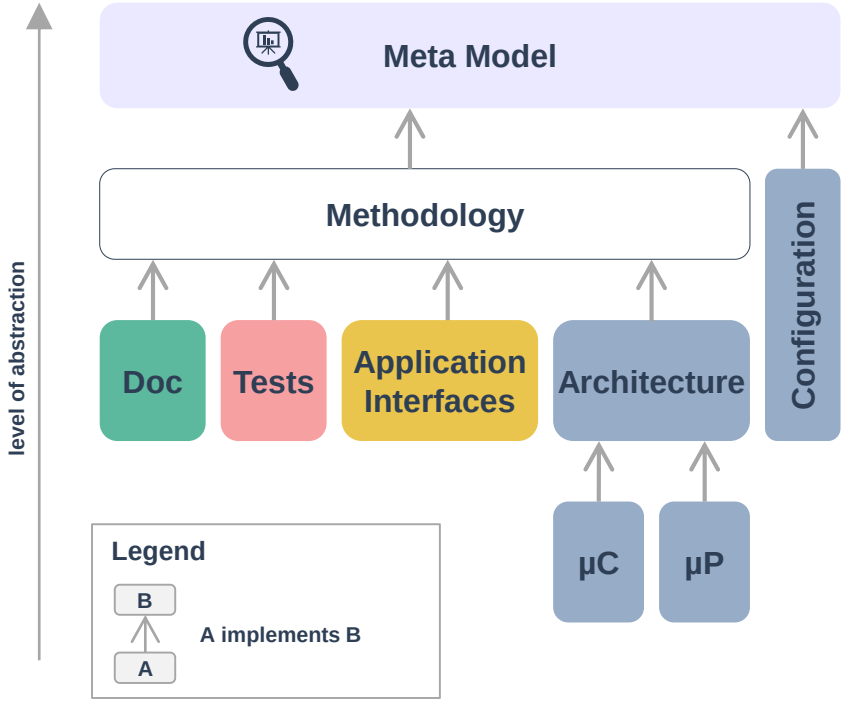
Common Bus Interface Specification

AUTOSAR Foundation
Common Features

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

AUTOSAR Foundation

The Methodology, derived out of the Meta Model, …



… provides means to describe the AUTOSAR **architecture** with all its **interfaces**

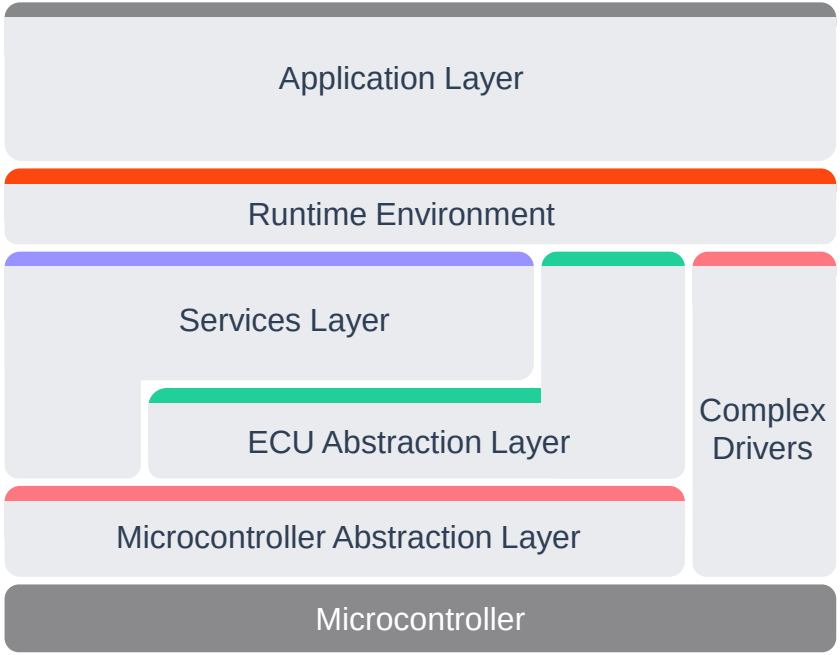
… defines **exchange formats** and description **templates** (e.g. manifest) to enable

- 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)

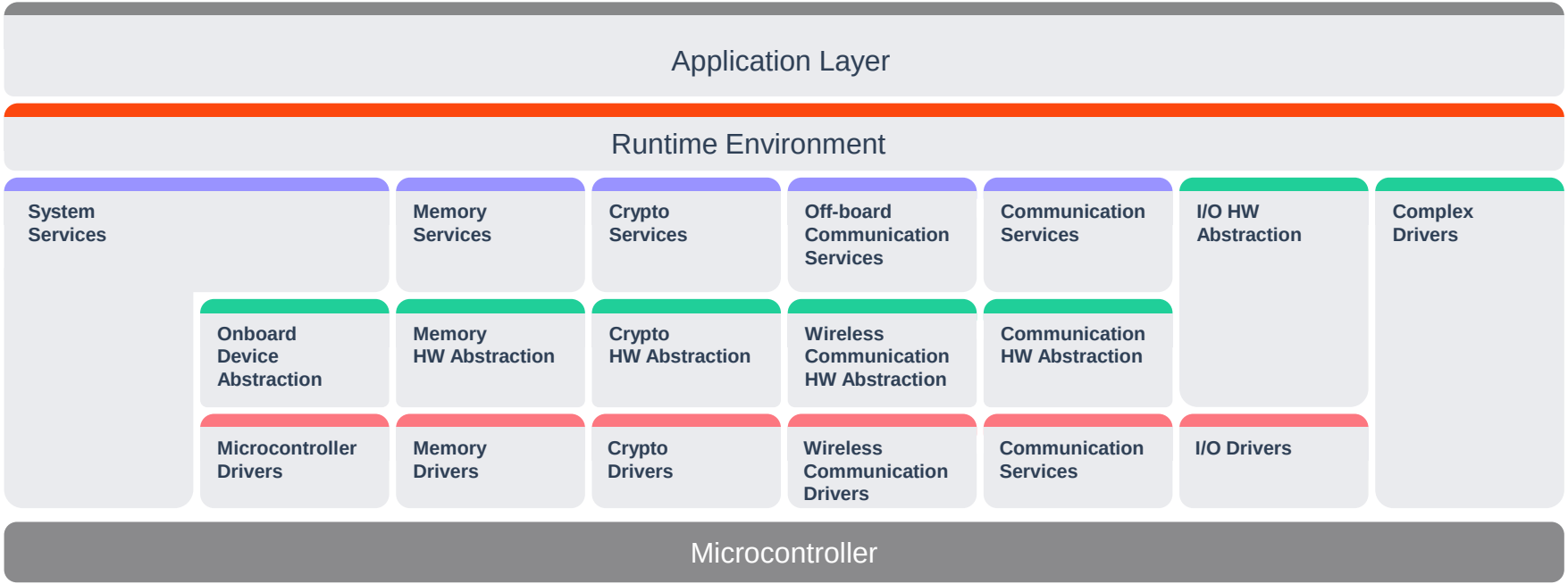


The layered architecture of the classic platform basically supports

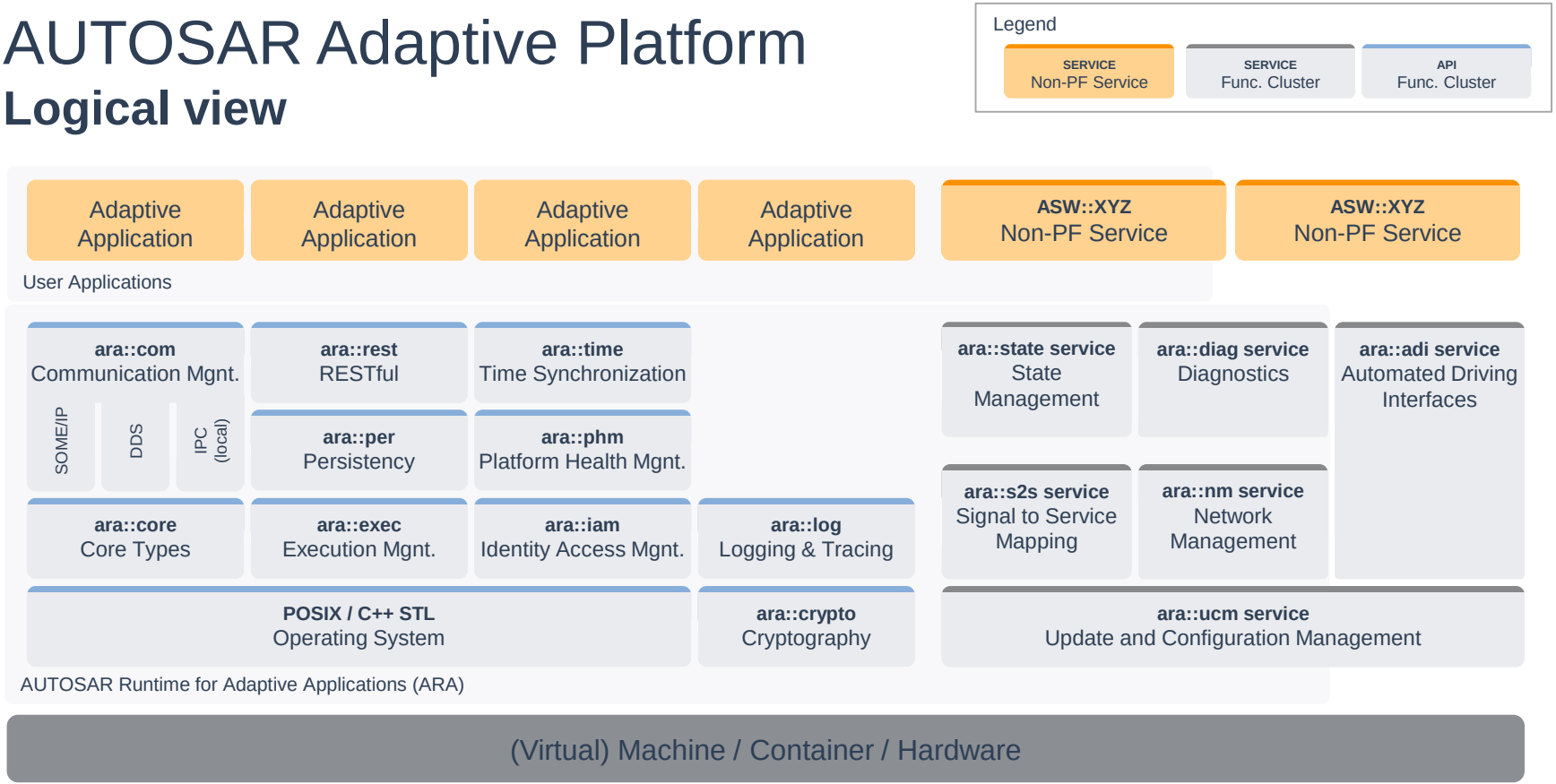
- Hardware abstraction
- Scheduling of runnables and tasks (OS)
- Communication between applications on the same hardware and over the network
- Diagnosis and diagnostic services
- Safety- and
- Security Services

AUTOSAR Classic Platform

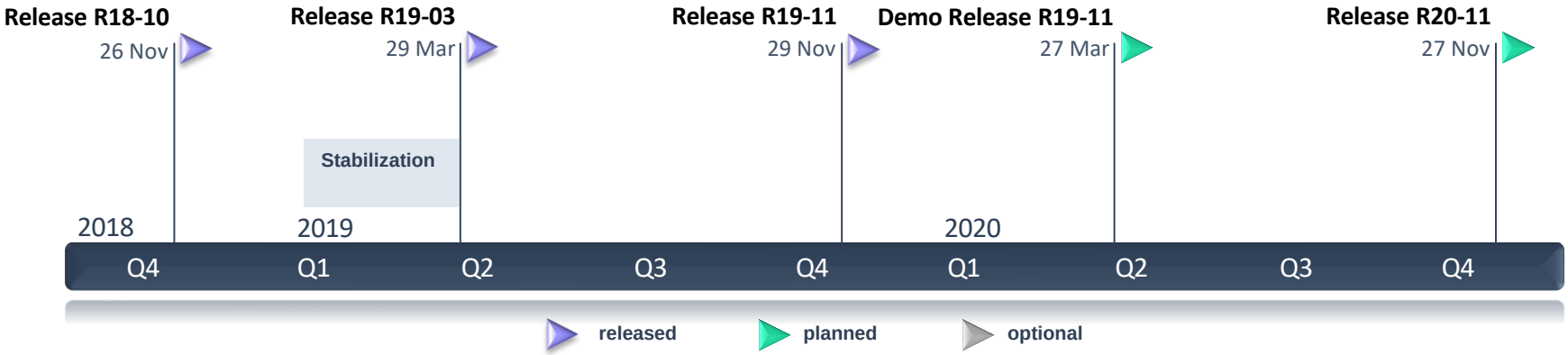
Layered Software Architecture (2/2)



AUTOSAR Adaptive Platform
Logical view



AUTOSAR AP and CP Features



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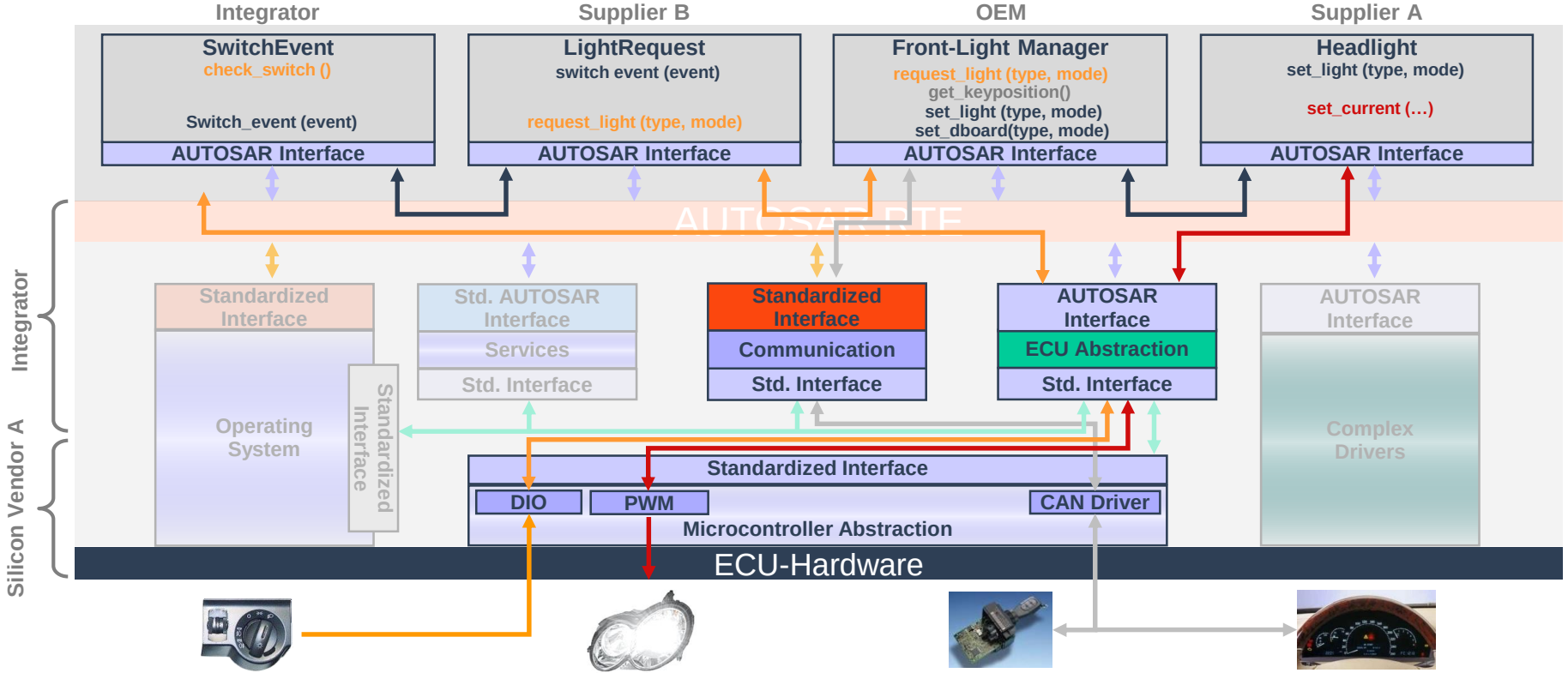
Software Architecture – AUTOSAR Defined Interfaces

Use Case 'Front Light Management': Exchange Type of Front Light



Software Architecture – AUTOSAR Defined Interfaces

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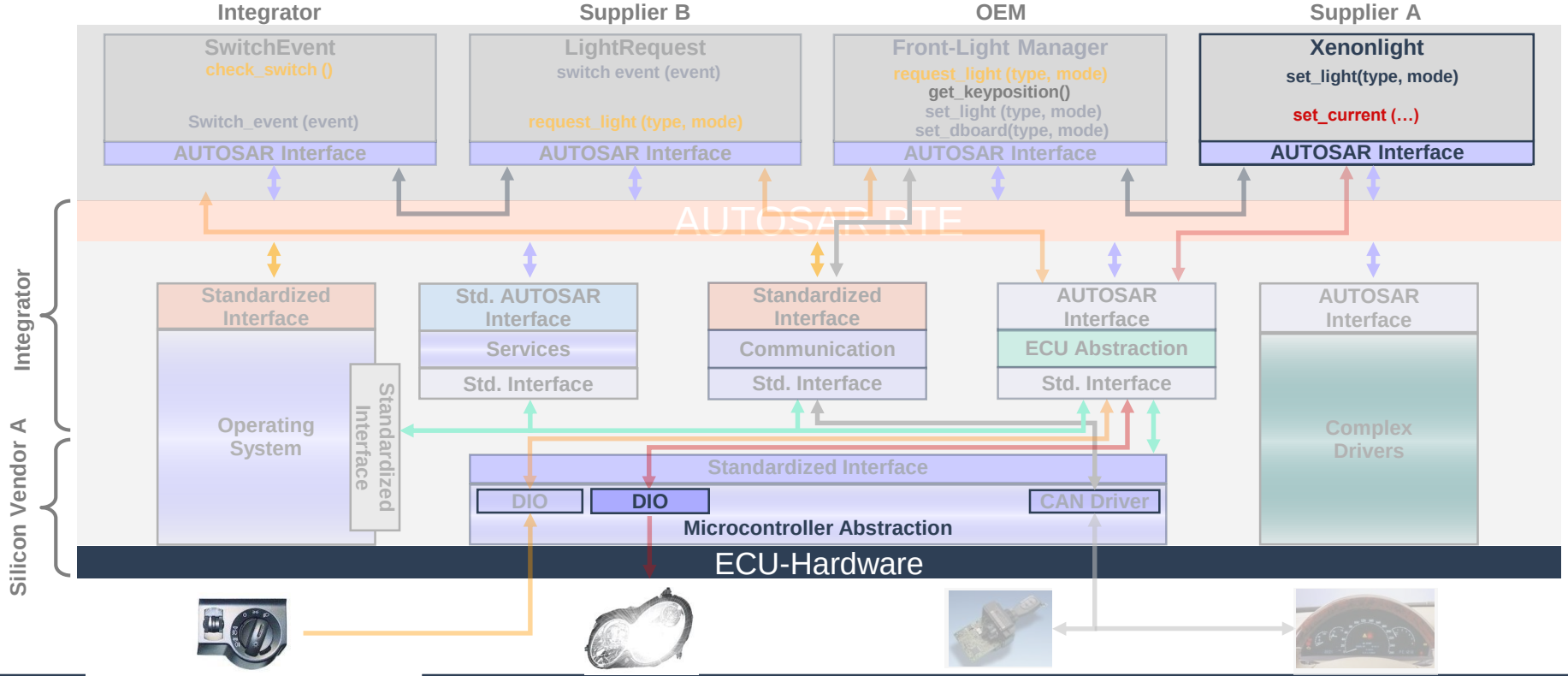
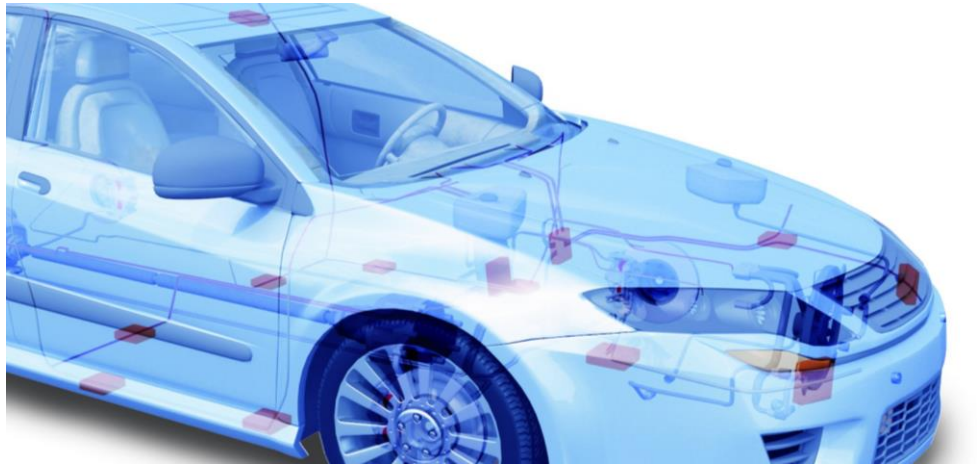
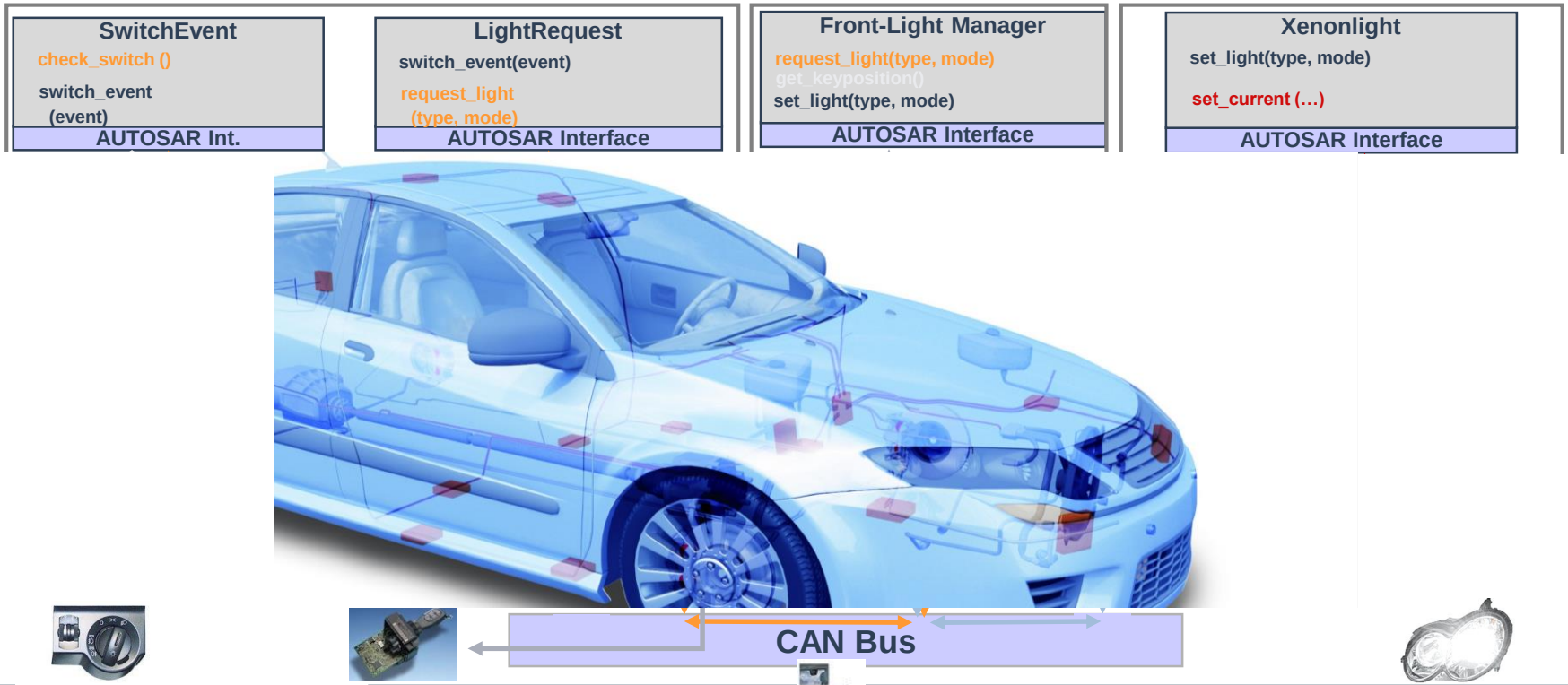


Distribution ECUs

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

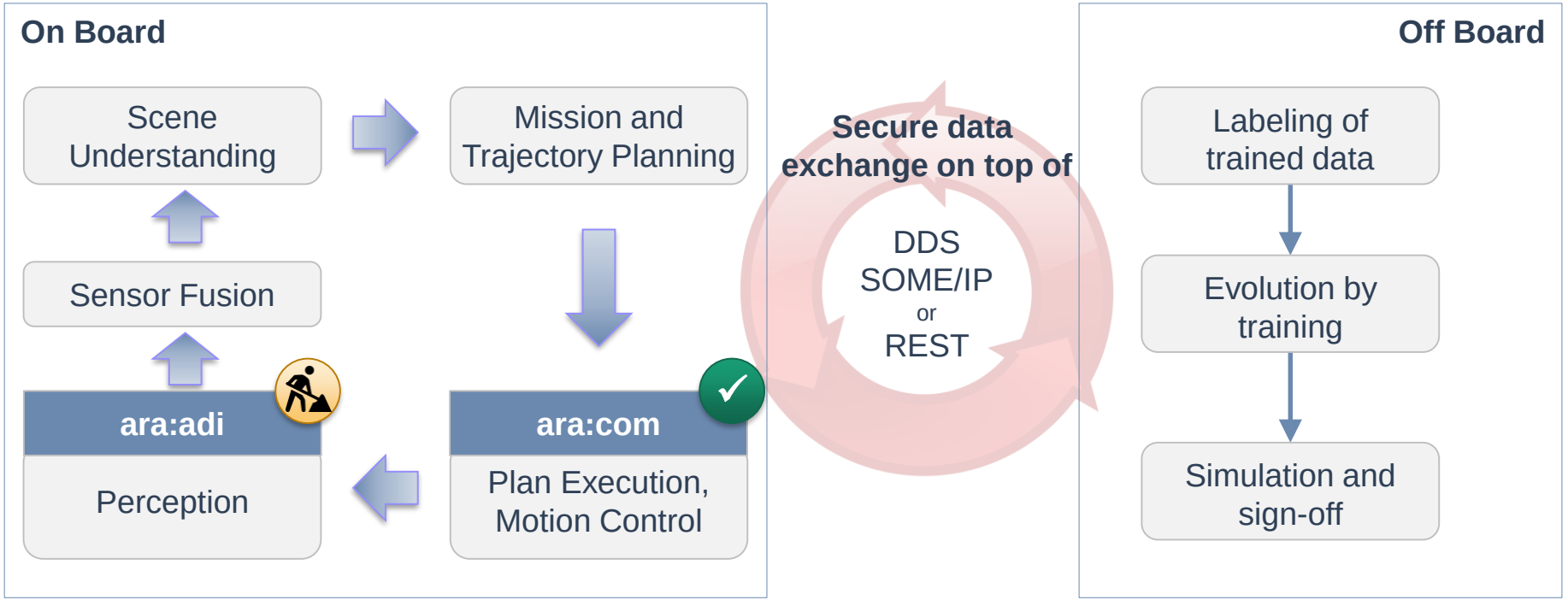


Distribution on ECUs – ‘Front-Light Management’

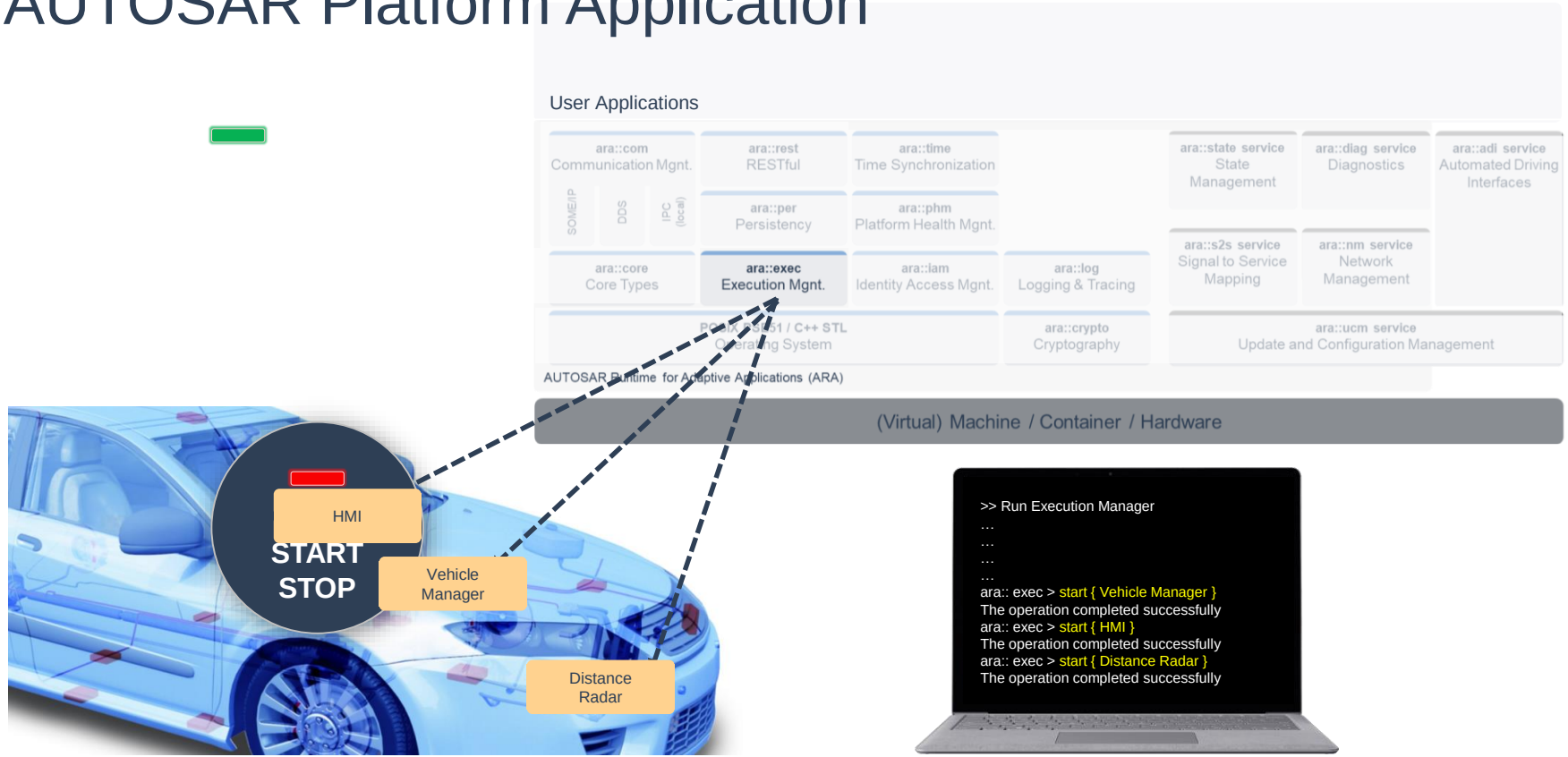


AUTOSAR Platform Application

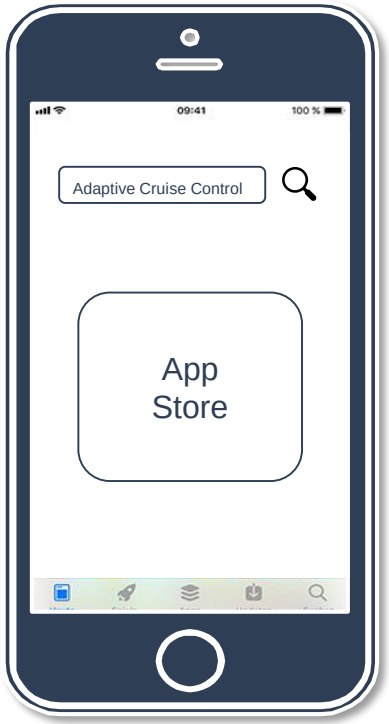
Continuous improvement cycle for ADAS systems

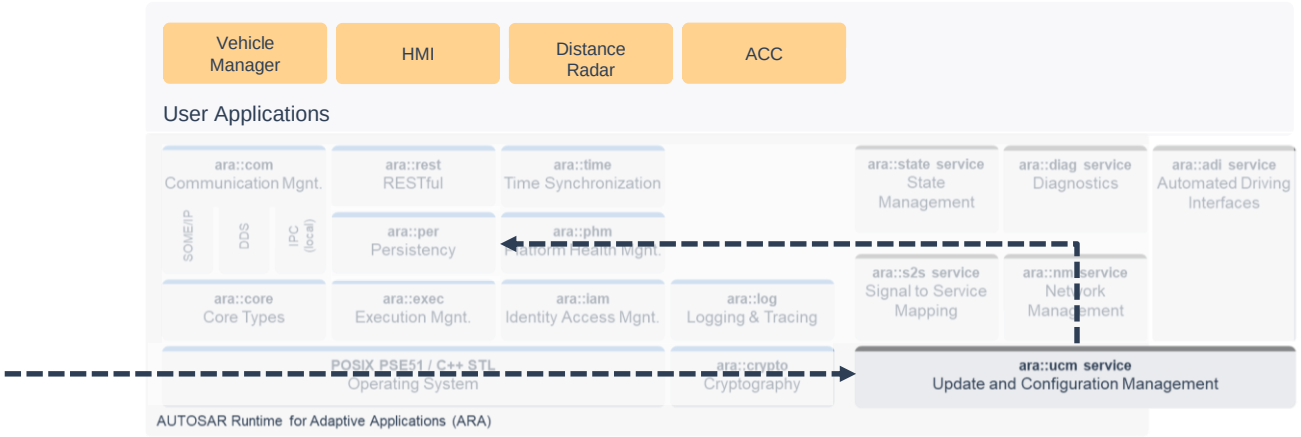


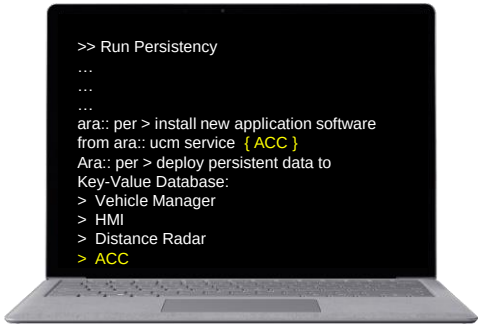
AUTOSAR Platform Application

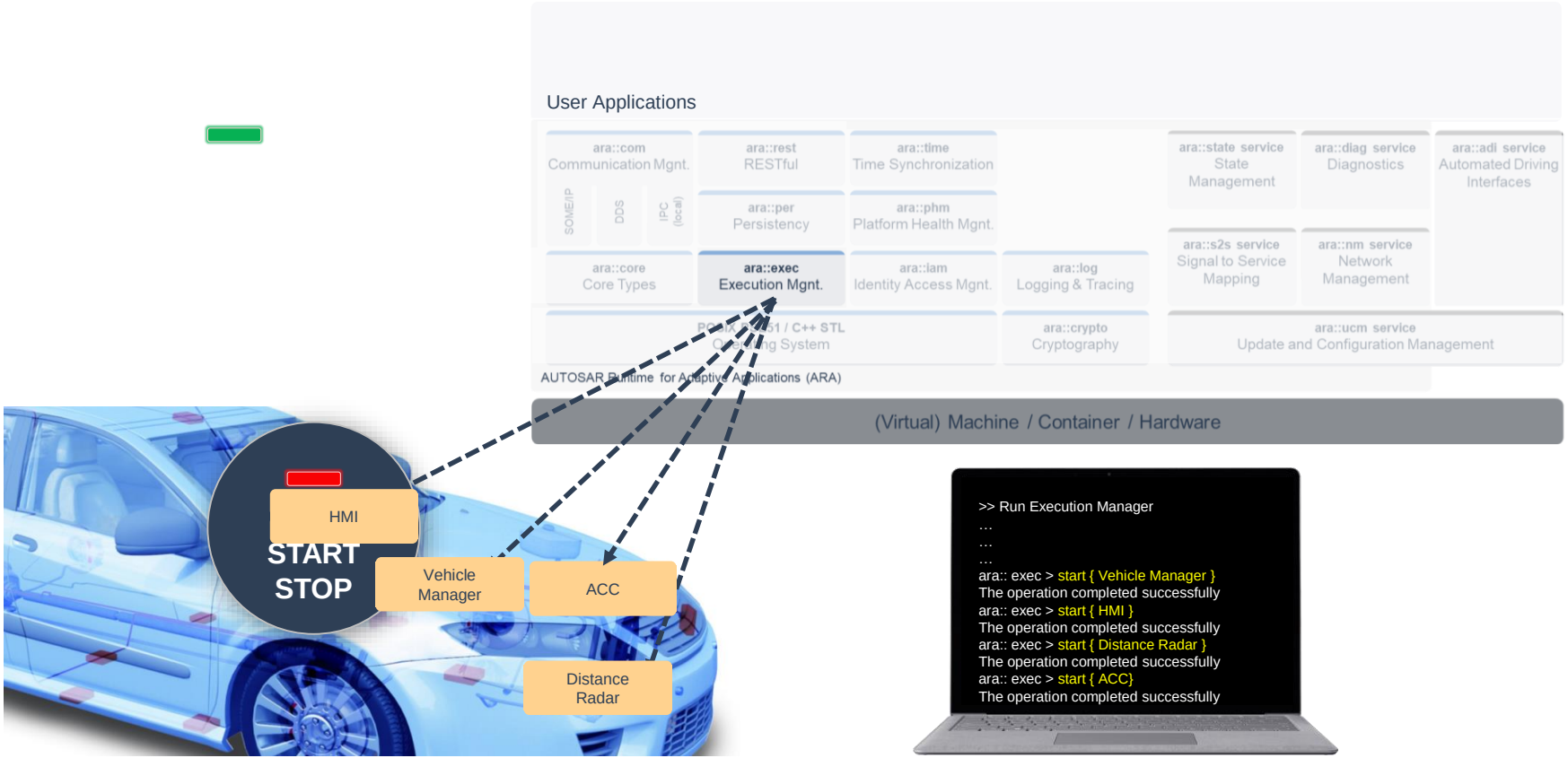


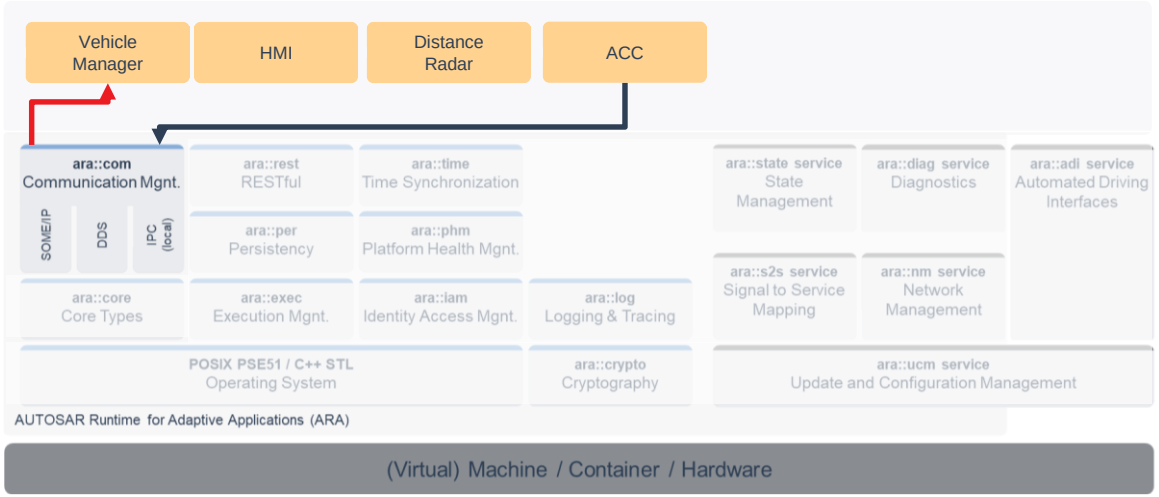
Vehicle Manager
HMI
Distance Radar
New User Application ?
ara::com Communication Mgnt.
SOME/IP
DDS
IPC (local)
ara::rest RESTful
ara::time Time Synchronization
ara::per Persistency
ara::phm Platform Health Mgnt.
ara::core Core Types
ara::exec Execution Mgnt.
ara::iam Identity Access Mgnt.
ara::log Logging & Tracing
POSIX PSE51 / 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


09:41
100 %
Adaptive Cruise Control
App
Store


Vehicle Manager
HMI
Distance Radar
ACC
User Applications
ara::com
Communication Mgnt.
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::s2s service
Signal to Service Mapping
ara::nm service
Network Management
ara::core
Core Types
ara::exec
Execution Mgnt.
ara::iam
Identity Access Mgnt.
ara::log
Logging & Tracing
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


>> 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


User Applications
ara::com
Communication Mgnt.
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 Mgnt.
ara::s2s service
Signal to Service Mapping
ara::nm service
Network Management
ara::core
Core Types
ara::exec
Execution Mgnt.
ara::iam
Identity Access Mgnt.
ara::log
Logging & Tracing
ara::crypto
Cryptography
ara::ucm service
Update and Configuration Management
AUTOSAR Runtime for Adaptive Applications (ARA)
(Virtual) Machine / Container / Hardware
HMI
START
STOP
Vehicle Manager
ACC
Distance Radar
>> Run Execution Manager
…
…
…
ara:: exec > start { Vehicle Manager }
The operation completed successfully
ara:: exec > start { HMI }
The operation completed successfully
ara:: exec > start { Distance Radar }
The operation completed successfully
ara:: exec > start { ACC}
The operation completed successfully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POSIX PSE51 / C++ STL
Operating System
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Cryptography
ara::state service
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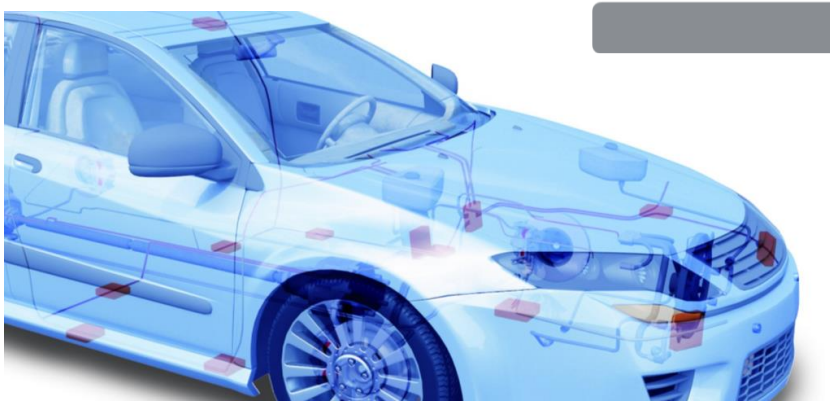
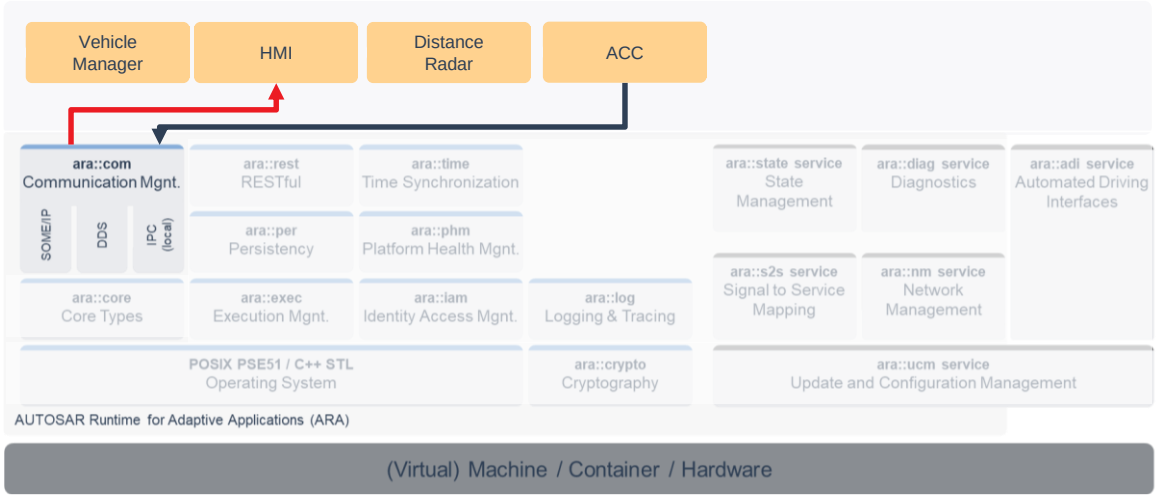



ACC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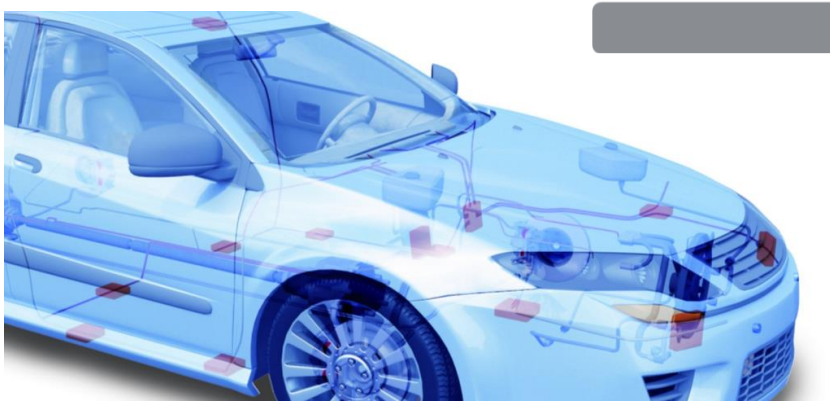
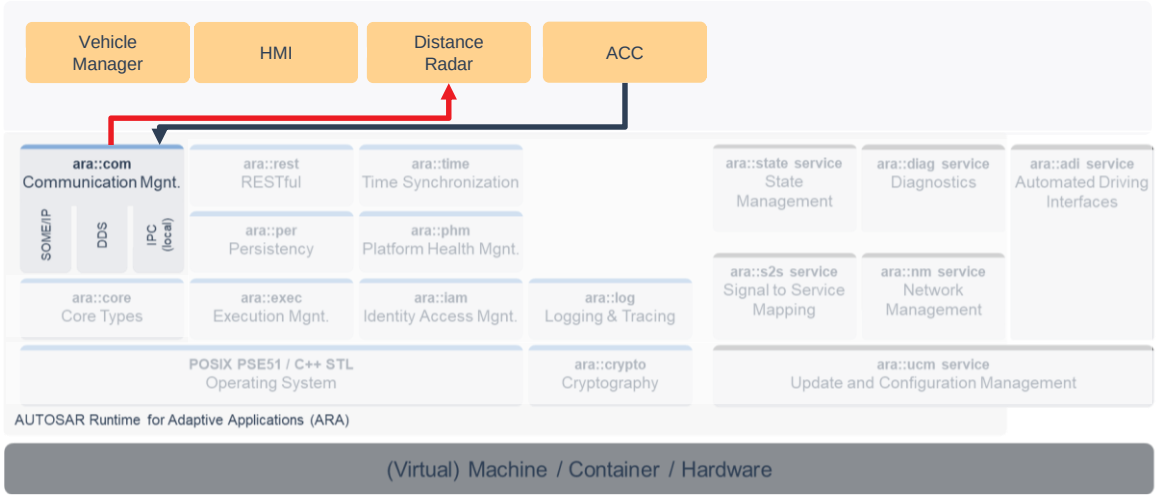



48°F
ACC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ACC

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 Adaptive Platform development approach

Specification

Identify needs & use-cases:

1) Concepts
2) Features
3) Requirements

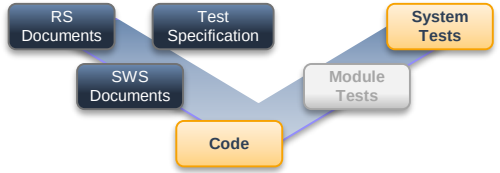
Quality:

- 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



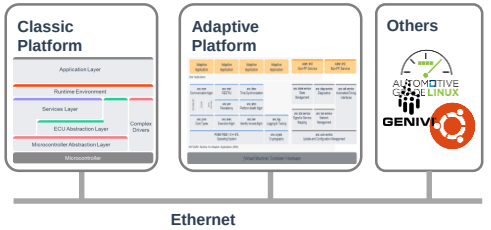
Attracting environment for coders:

- 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



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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Timeline to full automation

AUTOSAR – a faithful ADAS companion