



# AUTOSAR Adaptive Platform – a trustable software framework for connected and autonomous driving

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Symposium Testen - Automatisiertes und Vernetztes Fahren  
Braunschweig, September 4th 2018

BMW  
GROUP



**BOSCH**



DAIMLER



PSA  
GROUPE

**TOYOTA**

VOLKSWAGEN  
AKTIENGESELLSCHAFT

# Topics

> AUTOSAR Introduction

> Challenges and Use Cases

> Developing the Adaptive Platform

> Roadmap, Achievements

# AUTOSAR

(AUTomotive Open System ARchitecture)

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

# AUTOSAR – Core Partners and Partners



## 9 Core Partners



**AUTOSAR**



## 53 Premium Partners



## 38 Development Partners



127 Associate Partners  
21 Attendees

# Why do we rely on standards?

## Share

efforts on non-differentiating parts

## Compete

on innovative functions with increased design flexibility

## Reduce

costs on overall software development

## Simplify

software and system integration

## Distribute

development among suppliers

## Enable

cooperation

## Create

markets and enable new business models

# What makes standardization successful?

## Yesterday

Paper standards with specifications only

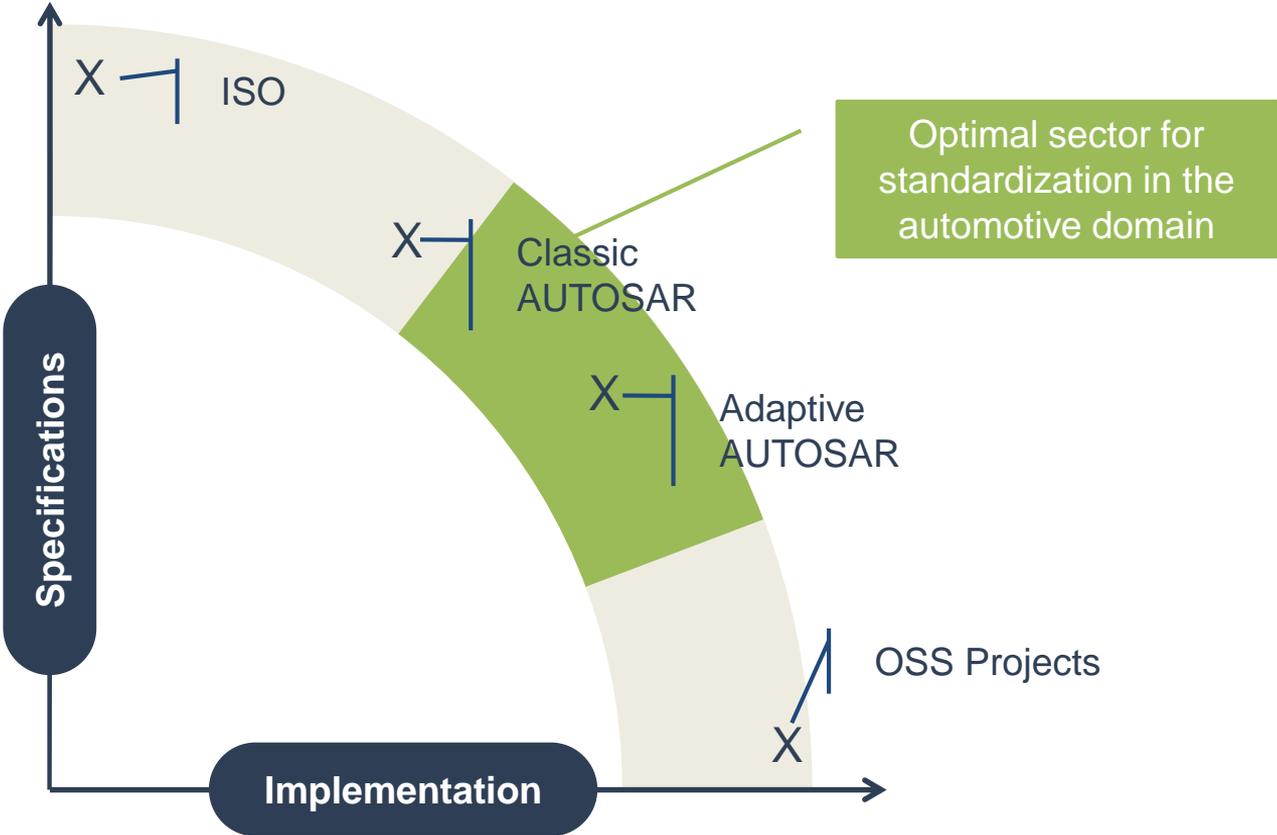
Introduction and functional overview .....	
Acronyms and abbreviations .....	1
Related documentation .....	1
Constraints and assumptions .....	1
Dependencies to other modules .....	1
Requirements traceability .....	2
Functional specification .....	3
API specification .....	6
8.1 Imported types .....	6
8.2 Type definitions .....	6
8.3 Function definitions .....	6
8.4 Call-back notifications .....	7
8.5 Scheduled functions .....	7
8.6 Expected Interfaces .....	7
Sequence diagrams .....	8
0 Configuration specification .....	8

## Today

Joint implementation  
based on specifications

```
21713   var watchExpr = attr.ngSwitch || attr.ngSwitchAs,
21714   selectedTranscludes = [],
21715   selectedElements = [],
21716   previousElements = [],
21717   selectedScopes = [];
21718
21719   scope.$watch(watchExpr, function ngSwitchMatchAction(value) {
21720     var i, ii;
21721     for (i = 0, ii = previousElements.length; i < ii; ++i) {
21722       previousElements[i].remove();
21723     }
21724     previousElements.length = 0;
21725
21726     for (i = 0, ii = selectedScopes.length; i < ii; ++i) {
21727       var selected = selectedElements[i];
21728       selectedScopes[i].$destroy();
21729       previousElements[i] = selected;
21730       $animate.leave(selected, function() {
21731         previousElements.splice(i, 1);
21732       });
21733     }
21734
21735     selectedElements.length = 0;
21736     selectedScopes.length = 0;
21737
21738     if ((selectedTranscludes = ngSwitchControl.$eval(attr.ngSwitchAs)) != null) {
21739       scope.$eval(attr.change);
21740       forEach(selectedTranscludes, function(selectedTransclude) {
21741         var selectedScope = scope.$new();
21742         selectedScopes.push(selectedScope);
21743         selectedTransclude.transclude(selectedScope);
21744       });
21745     }
21746   });
```

# Automotive software standardization at its best



# Advantages of AUTOSAR's licensing model

## AUTOSAR

### Licensing

- all contributed IP of any partner is royalty free for all partners
- Source code and specifications are covered

### Liability

- Minimized for all partners

## Open Source Software

### Licensing

- Only contributed IP of specific partner is royalty free



### Open Innovation Network

- All complements licensing for Linux

### Liability

- Excluded

# Key factors to make AUTOSAR Adaptive Platform a success



Short development cycles



Frontloading of validation



Precision and quality of the standard

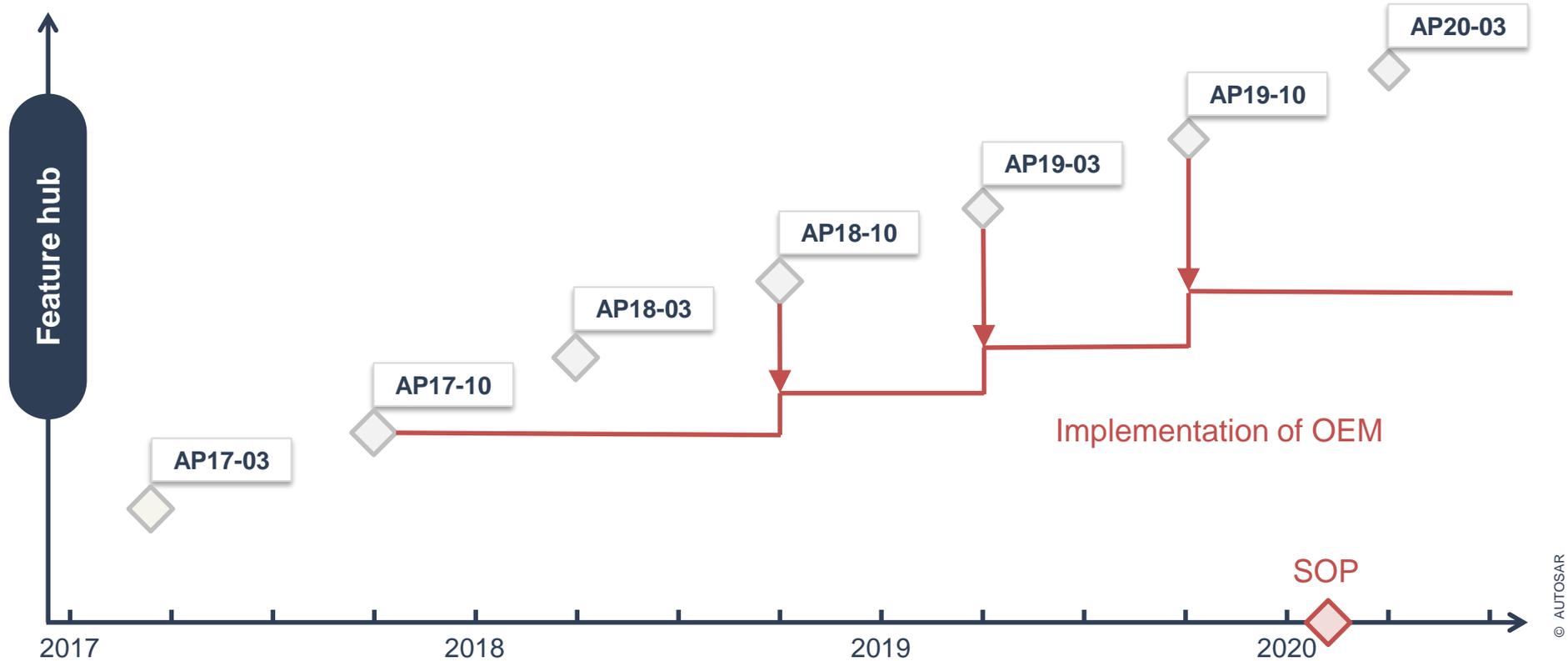


Early availability of exemplary implementation



Interoperability and increased quality

# Flexible implementation of AUTOSAR Adaptive Platform



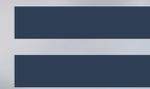
# AUTOSAR Adaptive Platform

## Making the series product

AUTOSAR AP  
Specification and  
Source Code

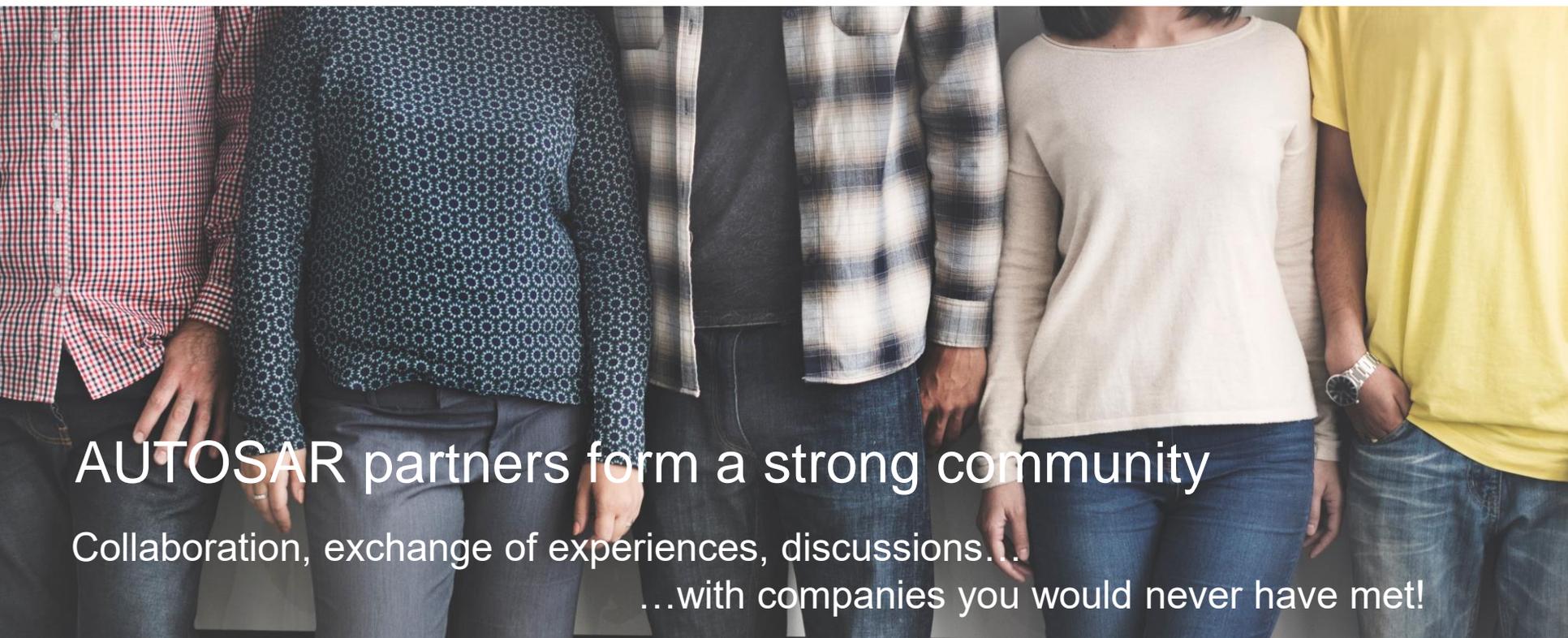


Validation  
Maintenance  
Documentation  
HW Adaption  
Configuration  
Liability  
Testing



Total effort  
to create  
a product

# Besides all technical advantages

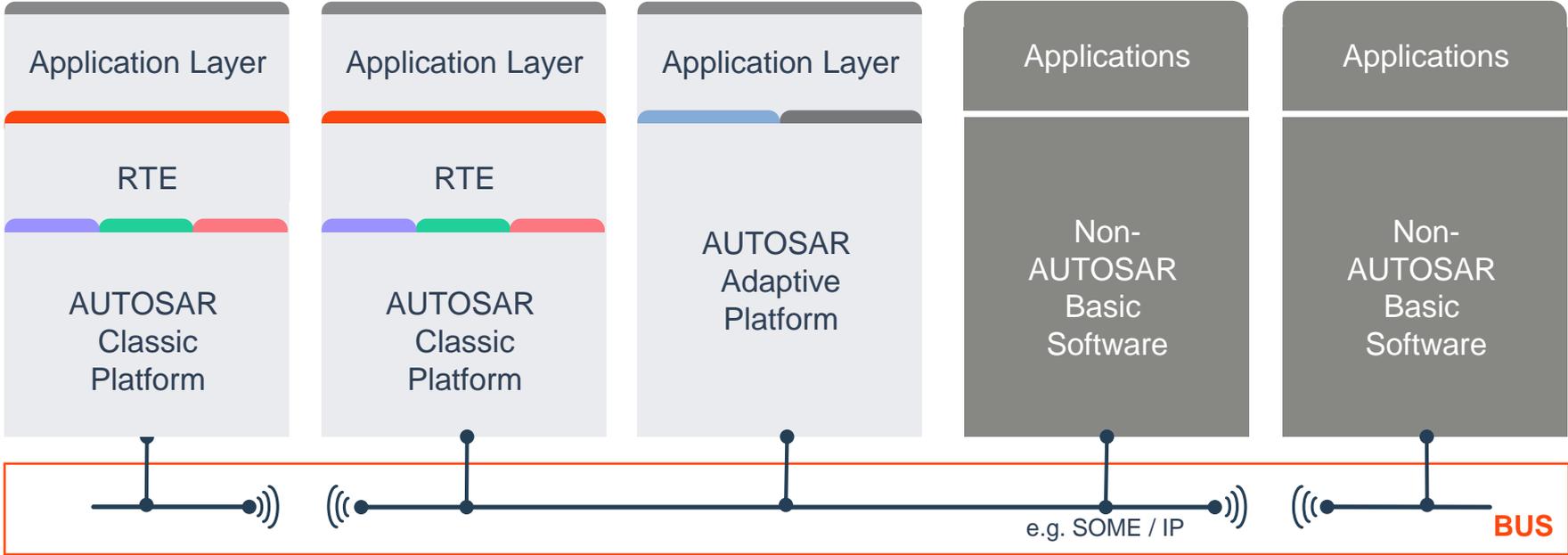


AUTOSAR partners form a strong community

Collaboration, exchange of experiences, discussions...

...with companies you would never have met!

# AUTOSAR standardizes two software platforms – Classic and Adaptive



Common Bus Interface Specification

# Topics

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> Challenges and Use Cases

> Developing the Adaptive Platform

> Roadmap, Achievements

# Game changer for AUTOSAR – selected main drivers

Main drivers for new automotive software systems have been determined.



➤ Highly automated driving

# Game changer for AUTOSAR – selected main drivers

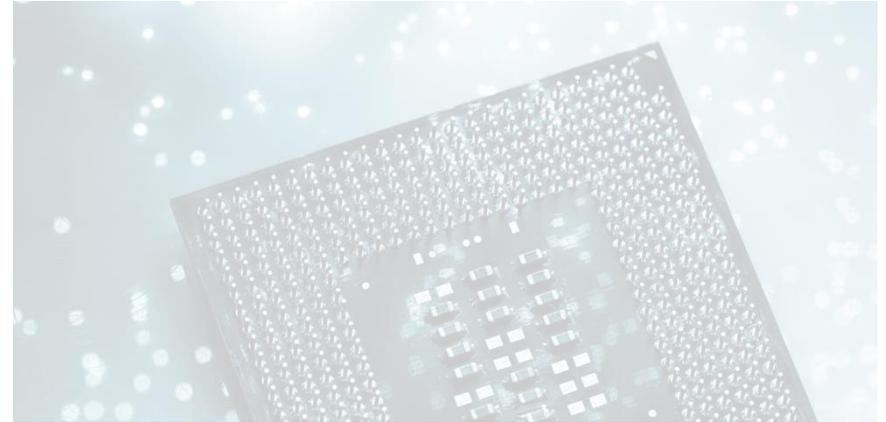
Main drivers for new automotive software systems have been determined.



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

# Game changer for AUTOSAR – selected main drivers

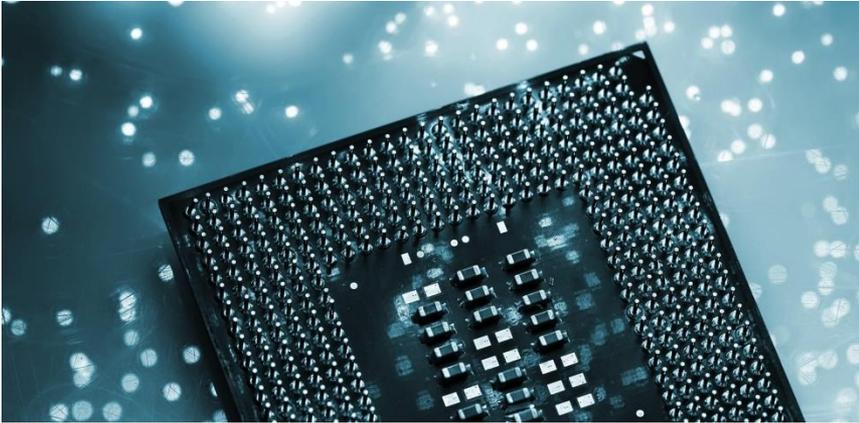
Main drivers for new automotive software systems have been determined.



➤ Increasing data rates

# Game changer for AUTOSAR – selected main drivers

Main drivers for new automotive software systems have been determined.



- New processor technologies

# Autonomous vehicle: It's all about trust !



The basis of autonomous driving is **Trustability**.

Trustability means **Reliability** at any instance of operation. Reliability is

based on **Availability, Safety** and **Security**.

(Basic Picture: Volkswagen Concept Car Sedic, Geneva Car Salon 2018)

# Timeline to full automation



**Level 3 automated driving - Conditional automation:**  
Trustworthy software platform enables developers by safety and security measures to develop onboard software for automated driving.

**Level 4 highly automated driving:**  
E/E Systems cope with all situations automatically in defined use cases. SW platform provides the framework to cope with sensor and data fusion. Perception supports algorithm processing.

**The Future: Level 5 full automation**  
Localization and backend systems providing filtering, data mining and data provision capabilities to support E/E onboard system development.

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# AUTOSAR Adaptive Platform – emerging from deeply embedded systems

## Application framework

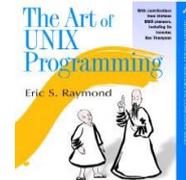
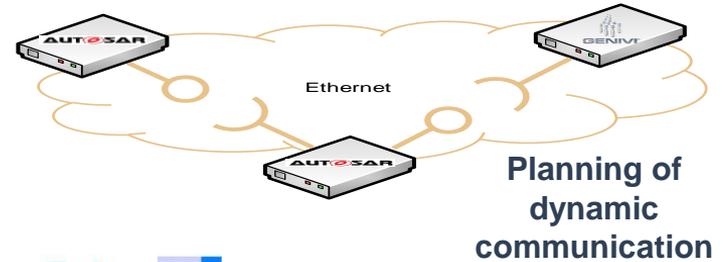
- Support for run-time configuration
- Service-oriented communication
- Partial update, system update and upgrade capabilities

## Formats for design data

- Configuring of dynamic behavior (e.g. constraints for scheduling and communication)
- Consider automotive specific cooperation scenarios
- Support integration with existing systems (Classic Platform)

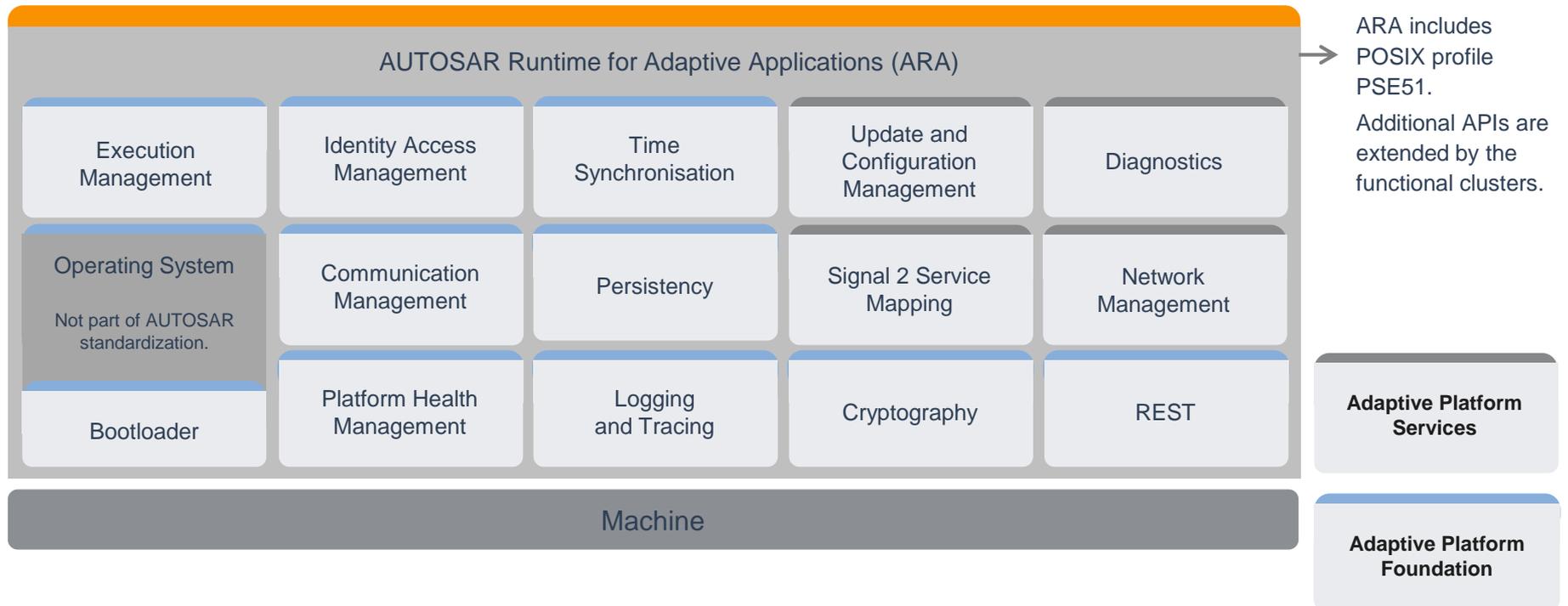
## Reference architecture

- Reuse existing (non-automotive) standards
- Ease software development
- Support automotive use-cases and protocols
- Reference Implementation



... and many more

# AUTOSAR runtime for adaptive applications – logical architecture



# Classic Platform vs. Adaptive Platform

## Technical characteristics



Based on OSEK

Execution of code directly from ROM

Same address space for all applications  
(MPU support for safety)

Optimized for signal-based communication  
(CAN, FlexRay)

Fixed task configuration

Specification



Based on POSIX

App. is loaded from persistent memory into RAM

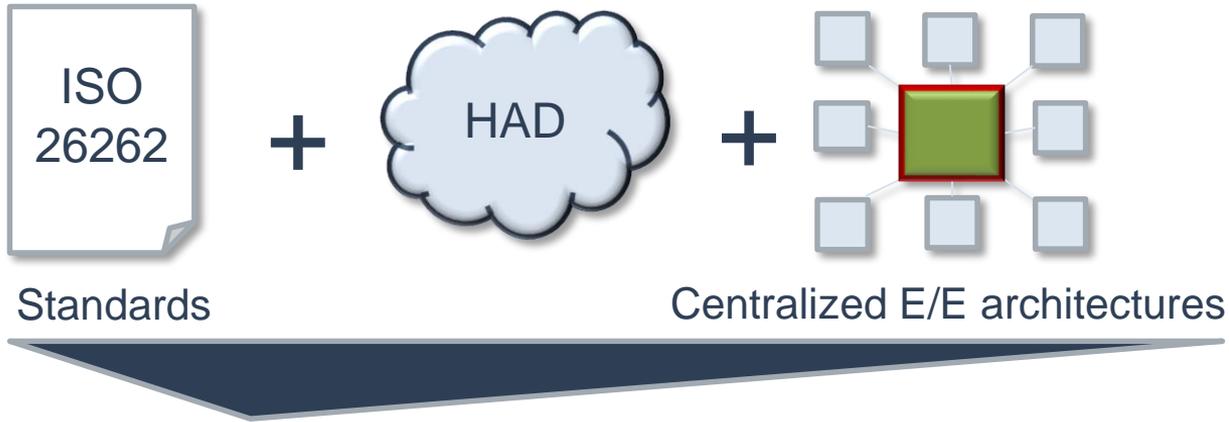
Each application has its own (virtual) address  
space (MMU support)

Service-oriented communication

Support of multiple (dynamic) scheduling  
strategies

Specification and code

# Safety expectations, where do they come from?



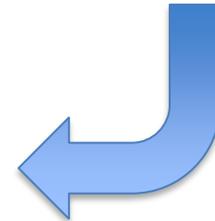
- **System architectures** capable up to ASIL D
- **Reliable system architectures**

Demand

- Separation
- Failure mitigation
- Freedom from interference
- ...

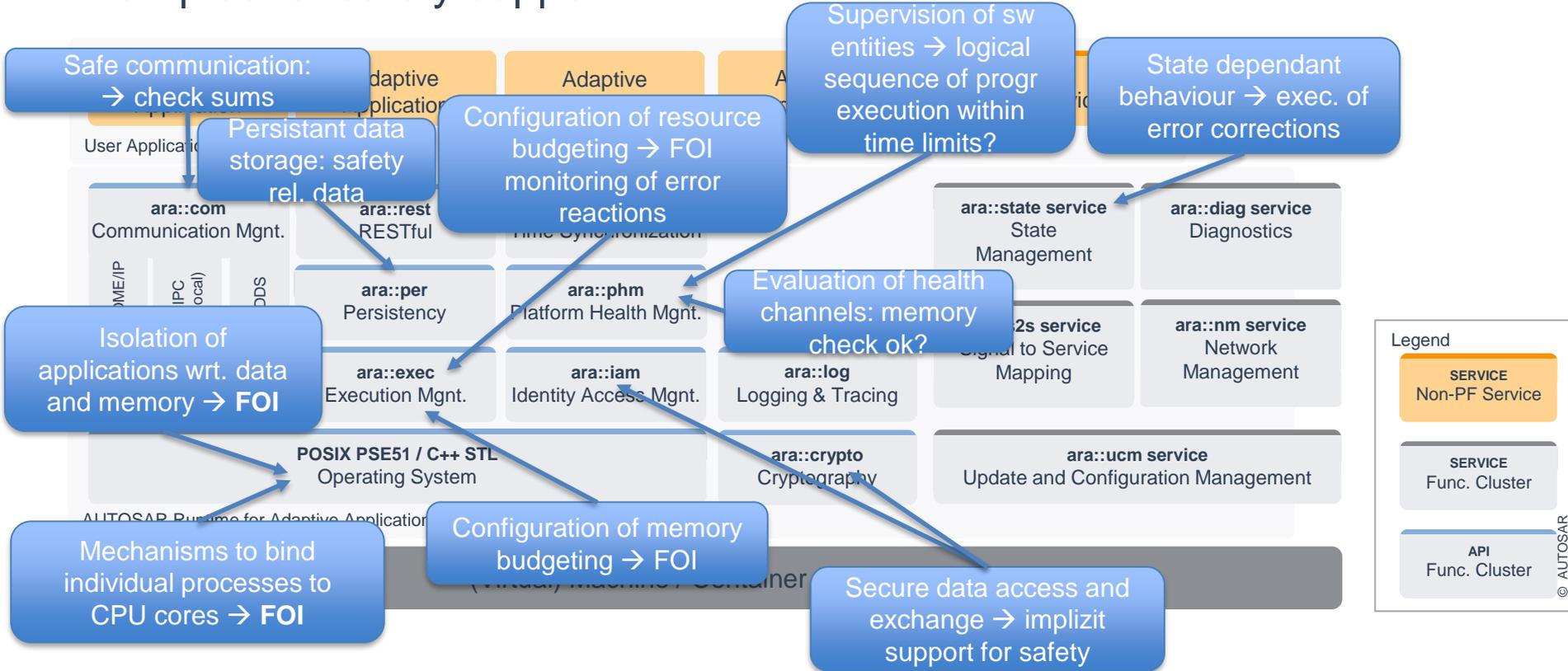
**Supported** by Autosar Adaptive Platform:

- Architectural decisions
- Features
- ...



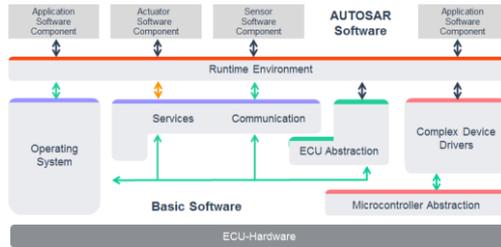
# Features and architectural constraints

## Examples for safety support



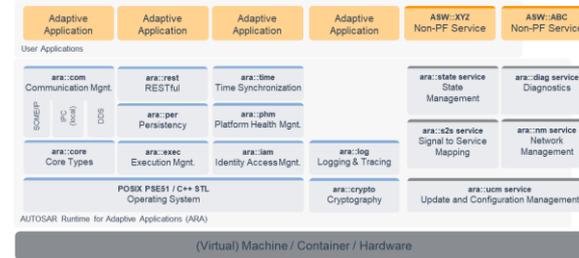
# Safety approach

## Classic Platform



- Definition of Safety mechanisms integrated into the Layered Architecture
- Possibility to tailor Safety mechanisms to project needs
- SEooC approach applicable

## Adaptive Platform



- Definition of Safety mechanisms integrated into the service oriented approach
- Possibility to tailor Safety mechanisms to project needs
- Definition of the Platform Health Manager

➔ Interoperability between Classic and Adaptive Platform on bus level ( e.g. E2E communication)

# Security

- AUTOSAR goals
  - Support the development of secure systems through the two standards
  - To provide layered automotive security approach, to define measures at specific layers:
    - Individual ECU
    - In vehicle network
    - E/E architecture
    - Connected vehicle
  - Provide and support Coexistence and Interoperability of Security measures between CP and AP
- Adaptive Platform Security Feature Team
  - Responsible for providing features that enable the development of a secure system
  - Provide security controls to platform functional clusters and for secure deployment of adaptive platform application

# Classic Platform vs. Adaptive Platform

## Technical characteristics – additional security features

**AUTOSAR**

Classic Platform

Based on OSEK

Execution of code directly from ROM

Same address space for all applications (MPU support for safety)

Optimized for signal-based communication (CAN, FlexRay)

Fixed task configuration

Specification

**AUTOSAR**

Adaptive Platform

Based on POSIX

App. is loaded from persistent memory into RAM

Each application has its own (virtual) address space (MMU support)

Service-oriented communication

Support of multiple (dynamic) scheduling strategies

Specification and code

POSIX compliant OS security features

Applications must be authenticated

Individual process tree / no awareness of other processes

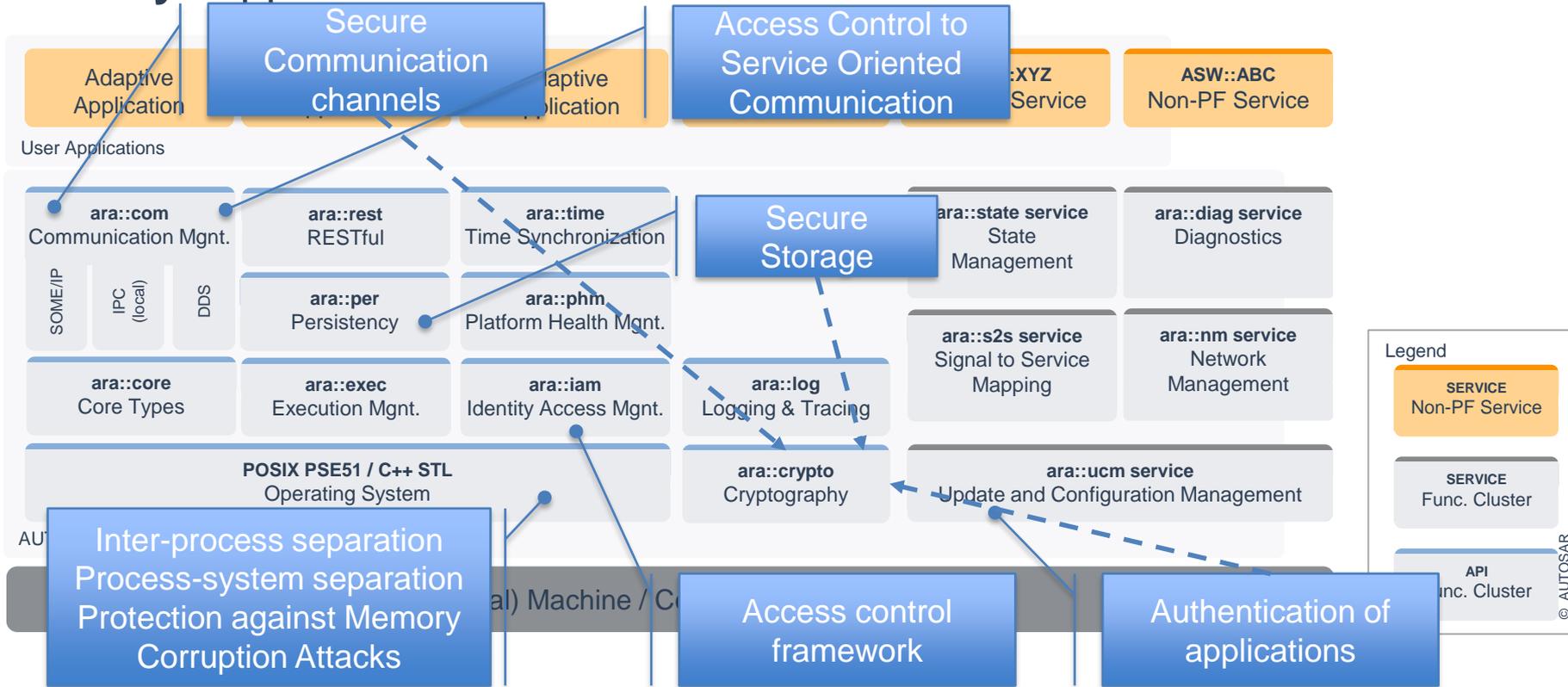
Secure communication channels (TLS, IPsec)  
Access control to services

Predefined quota of memory allocation and fair distribution of processor time

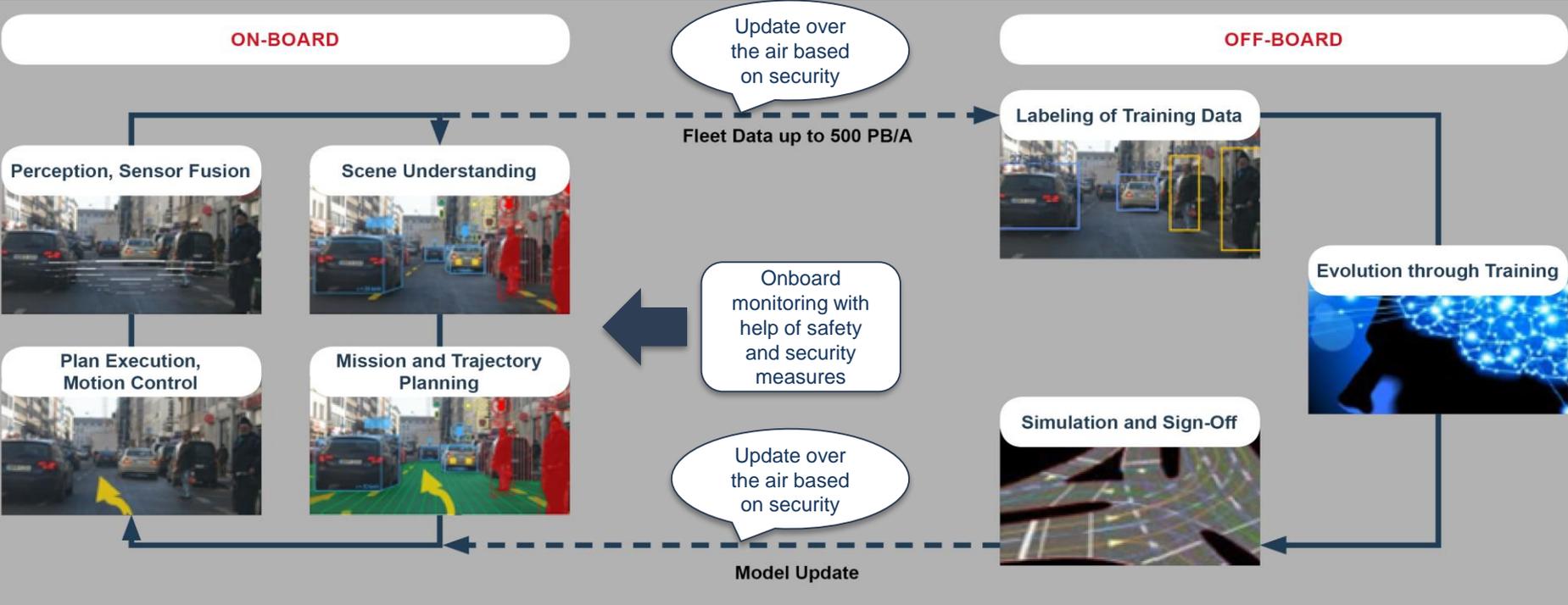
**AUTOSAR**

# Features and architectural constraints

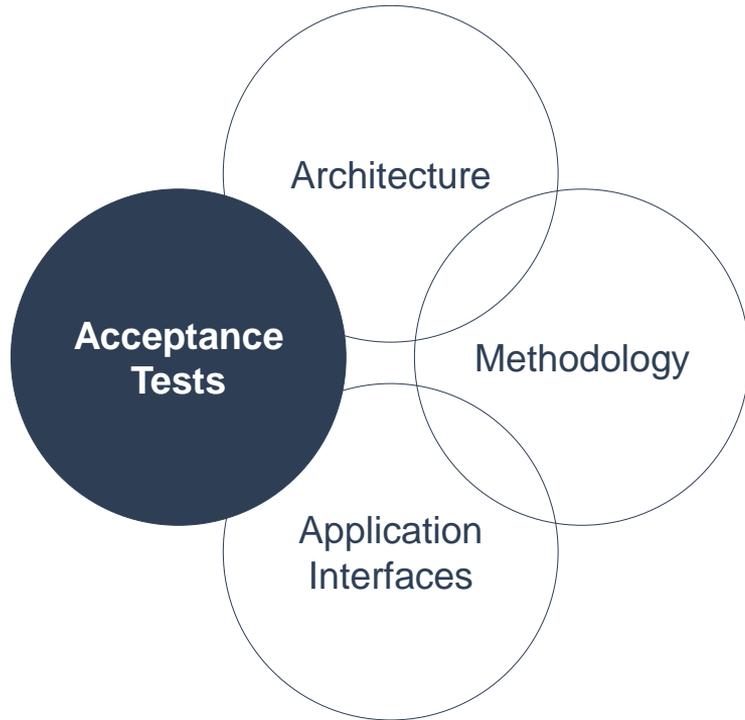
## security support



# Intelligence functionality within the vehicle should run on a trusted platform based on safety and security



# TESTING

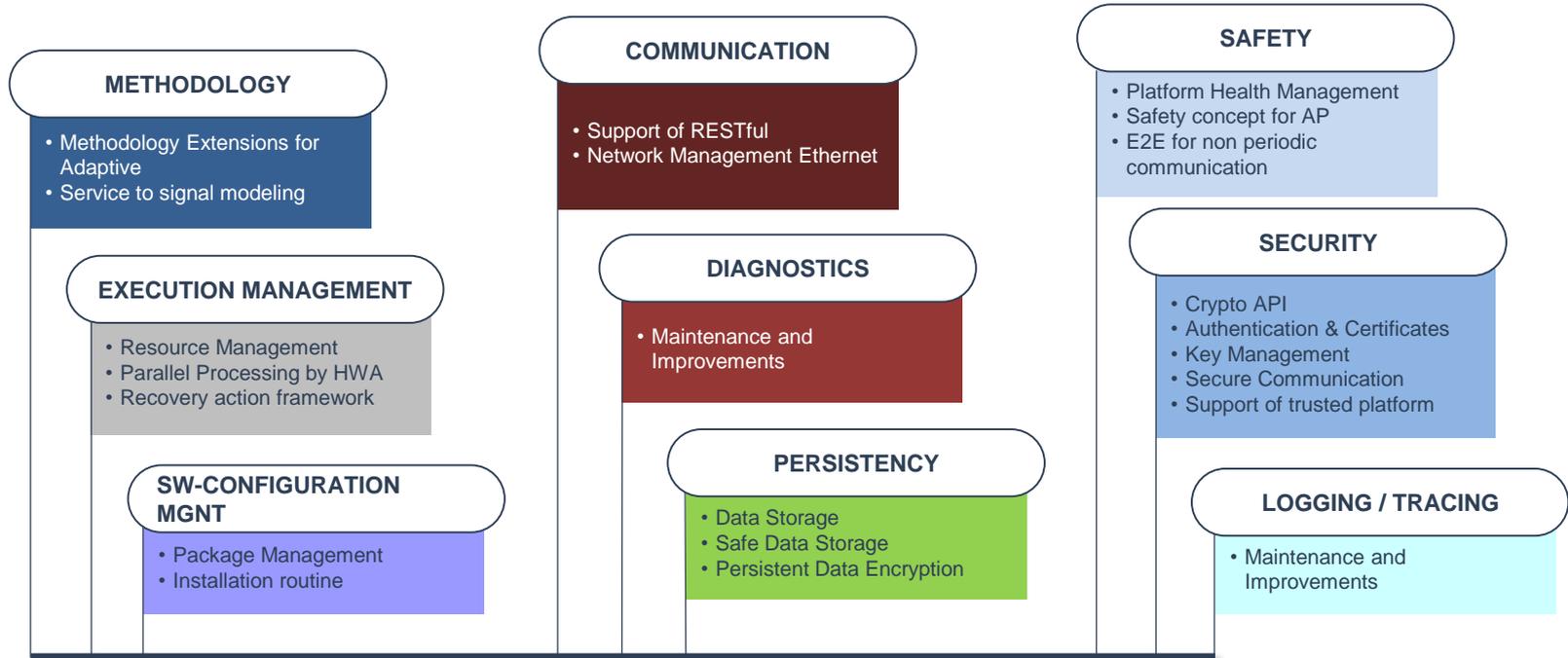


Specification of test cases intending to validate the behavior of an AUTOSAR implementation with AUTOSAR application software components or within one vehicle network.

# Verification & Validation

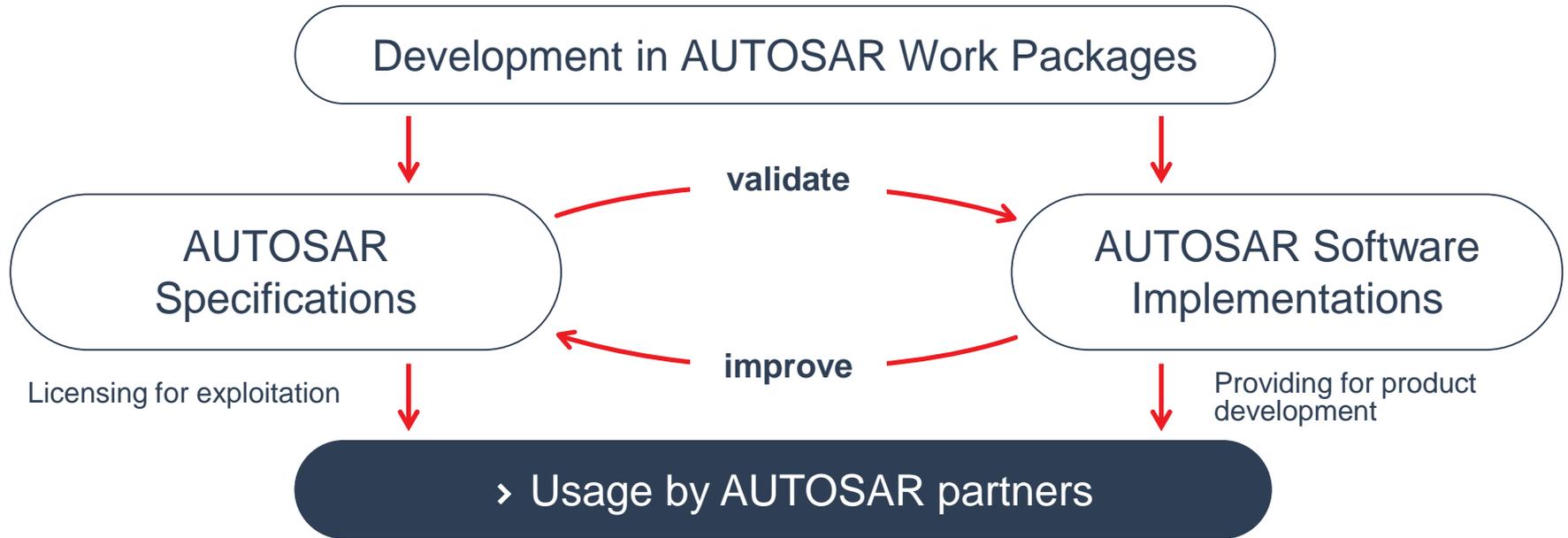
- AUTOSAR Platforms via Acceptance Tests are straight due to supplied test cases.
- AI input increases complexity because of non deterministic behaviour.
- UoA applications need to supply diagnostic functionality for safety by themselves w.r.t. required diagnostic coverage.
- V&V needs to be tailored to criticality, requirement maturity and complexity of application → Efficiency of V&V.

# Features of Adaptive Platform Release 18-03.

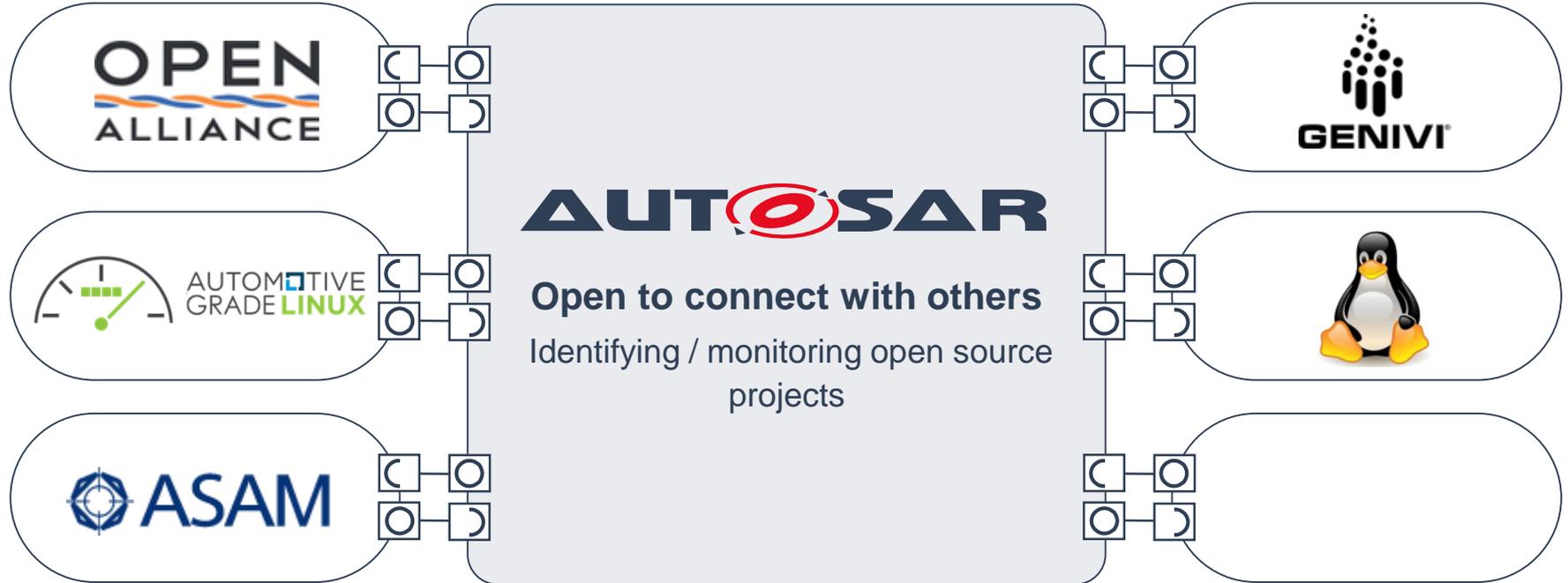


R18-03

# Joint development of AUTOSAR specifications and exemplary software implementations for the AUTOSAR Adaptive Platform



# Transparent to other standards



# Topics

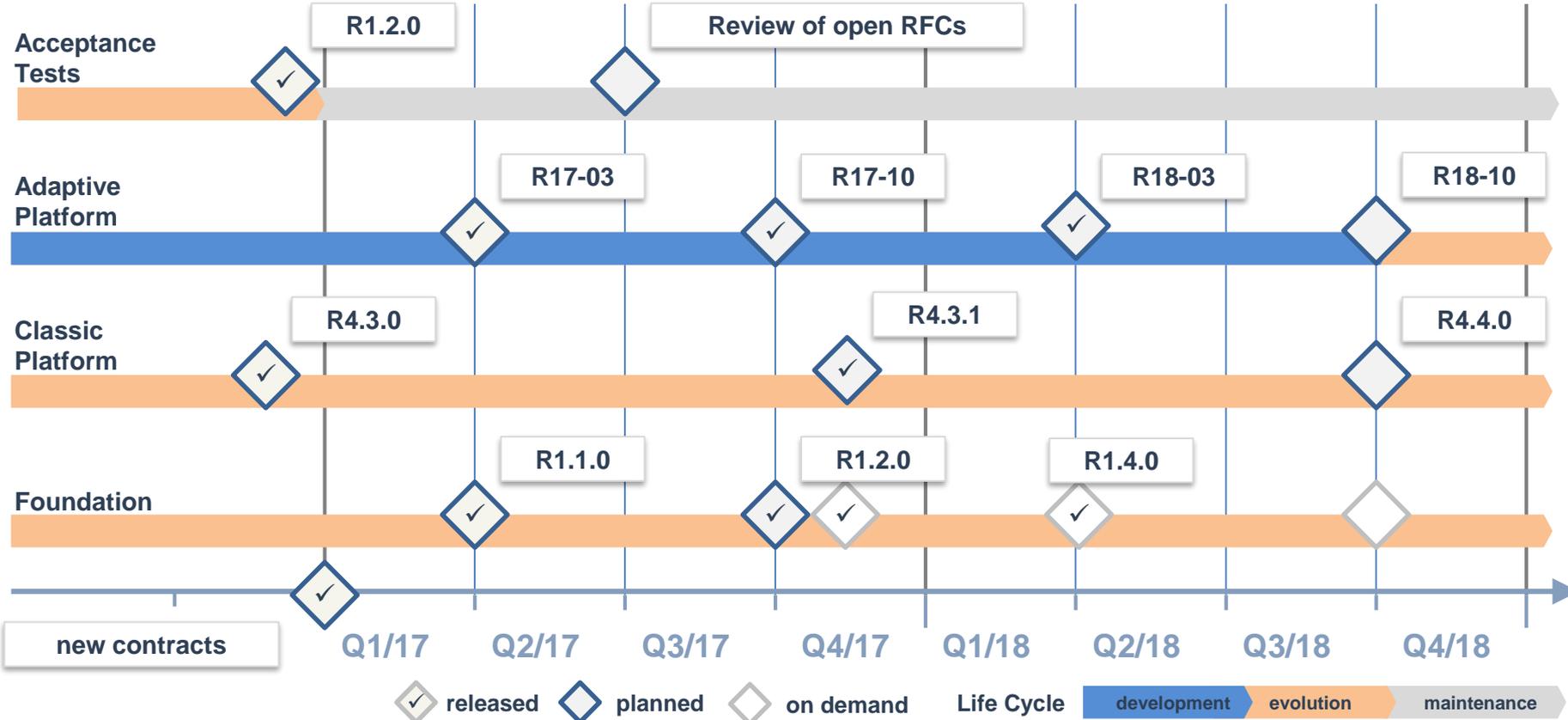
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# AUTOSAR Platform Roadmap



# The AUTOSAR Core Partners are fully committed to the standardization of the AUTOSAR Adaptive Platform

- Number-crunching algorithms and high interconnectivity are the demands of future technologies. The Adaptive Platform is exactly what we need.
- AUTOSAR is one of the key enablers for autonomous driving cars.
- AUTOSAR is our standard of choice for realizing new technologies such as autonomous driving and interconnectivity.



# 11<sup>th</sup> AUTOSAR



## Open Conference and Networking Reception

### Networking Reception

Tuesday,  
**November 6<sup>th</sup>, 2018**  
7:00 pm – 10:00 pm

+

### Conference

Wednesday,  
**November 7<sup>th</sup>, 2018**  
All-day

### Venue:

The Portman Ritz-Carlton Shanghai  
1376 Nanjing Xi Lu, Shanghai 2000-40, China



Further information:

<https://www.autosar.org/news-events/>



# Further information on AUTOSAR

For more information on AUTOSAR:

- Working results
- User Experiences
- Exploitation

You are welcome to have a look at AUTOSAR's publications available at the AUTOSAR website [www.autosar.org](http://www.autosar.org).

The image shows two overlapping screenshots of the AUTOSAR website. The top screenshot is the homepage, featuring a dark background with bokeh light effects. The header includes the AUTOSAR logo and navigation links: ABOUT, HOW TO JOIN, WORKING GROUPS, USER GROUPS, STANDARDS, NEWS & EVENTS. The main headline reads: "The standardized software framework for intelligent mobility". Below this, a section titled "AUTOSAR (AUTomotive Open System ARchitecture)" describes it as a worldwide development partnership of vehicle manufacturers, suppliers, service providers and companies from the automotive electronics, semiconductor and software industry. A "read more" button is visible. The footer of the homepage lists partner logos: BOSCH, Continental, DAIMLER, INTEL, PSA, TOYOTA, VOLKSWAGEN, and a link to "all partners".

The bottom screenshot shows a "PARTNERSHIP" page. It features two columns for "DEVELOPMENT PARTNER" and "ASSOCIATE PARTNER". The Development Partner section lists benefits: "An opportunity for small companies and start-ups", "Use the AUTOSAR technology (quality-free license for automotive and derived applications)", "Access to current information and news", and "Cooperation in working groups". The Associate Partner section lists benefits: "Use the AUTOSAR technology (quality-free license for automotive and derived applications)", "Access to information and the results of AUTOSAR development", and "Cooperation in working groups". Both sections have "How to join" buttons. Below this, a quote states: "ready widely accepted in the automotive industry." followed by a quote icon and a "FAQ" section with a "What is the goal of AUTOSAR" heading. The FAQ text describes the goal as standardizing a common methodology, basic system functions and functional interfaces. A "see all questions & answers" button is present. The bottom of the screenshot shows a "STANDARDS" section with a heading "The primary goal of the AUTOSAR development partnership is the standardization of basic system functions and functional interfaces. Find out more about our standards." and buttons for "Acceptance Tests", "Application Interfaces", "Classic Platform", "Adaptive Platform", and "Foundation".

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