The AUTOSAR Adaptive Platform for Connected and Autonomous Vehicles

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Overview

Game changers

- New challenges and use-cases
- New functions

➢ Future of AUTOSAR – AUTOSAR Adaptive Platform
  - Architecture
  - Key functions

➢ Framework of the AUTOSAR Adaptive Platform
  - Novelties from 1 January 2017 onwards
  - Timeline

➢ Summary
Starting Point: selected main drivers

Main drivers for new automotive software systems have been determined.

Highly automated driving

Car-2-X applications

Vehicle in the cloud

Increased connectivity
Influence by new players

Open to cooperate with others

Define standardized interfaces to …
Cooperation with other standards

Open to connect with others

Identifying / monitoring open source projects

AUTOSAR Adaptive Platform for Connected and Autonomous Vehicles
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➢ Summary
Another platform for different applications

Real time requirements

Safety relevance

Classic Platform

Runtime Environment
Service Layer
ECU Abstraction Layer
Microcontroller Abstraction Layer
Microcontroller

Platform supporting „Planned dynamics“

Infotainment

Security

Computing power
A new AUTOSAR standard: The AUTOSAR Adaptive Platform

The new platform will close the gap. It will support adaptive deployment, complex micro-controllers and interaction with non AUTOSAR systems.
### Classic Platform vs. Adaptive Platform

#### Technical characteristics

<table>
<thead>
<tr>
<th>Classic Platform</th>
<th>Adaptive Platform</th>
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<tbody>
<tr>
<td>Based on OSEK</td>
<td>Based on POSIX (PSE51)</td>
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<tr>
<td>Execution of code directly from ROM</td>
<td>Application is loaded from persistent memory into RAM</td>
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<tr>
<td>Same address space for all applications (MPU support for safety)</td>
<td>Each application has its own (virtual) address space (MMU support)</td>
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<td>Optimized for signal-based communication (CAN, FlexRay)</td>
<td>Service-oriented communication</td>
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<td>Fixed task configuration</td>
<td>Support of multiple (dynamic) scheduling strategies</td>
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AUTOSAR runtime for adaptive applications - functional clusters

AUTOSAR Runtime for Adaptive Applications

- Application
- Application
- Application
- Application
- Application

Adaptive AUTOSAR Foundation

- (Virtual) Machine / Hardware
- API
  - Time Management
- API
  - Operating system
  - Bootloader
- API
  - Execution Management
- API
  - Persistence
- API
  - Platform Health Management

Service Interface of a Functional Cluster. API is generated according to ara::com specification.

Programming language specific API for a Functional Cluster as specified in SWS.

Behavioral specification of Functional Cluster.

The first programming language supported by the Adaptive Platform will be C++.

APIs and services exposed to applications by functional clusters.

Services provided via Communication ARA API.

Language specific APIs as part of ARA.
Adaptive Platform – technical architecture (communication)

Technical architecture
- Shows standardized and non-standardized interfaces of the Adaptive platform
- Give informative example for SW architecture of a platform implementation

Public Interface
Part of the adaptive AUTOSAR API and specified in the SWS.

Protected Interface
Interaction between functional clusters. Informative.

Private Interface
Interaction between elements within a functional cluster. Informative.
Intrinsic safety - freedom from interference

Each application lives in its own address space

Access to platform functionality via libraries

Communication via implementation specific IPC

- Operating system
- Bootloader
- Time Management
- Execution Management
- Persistency
- Platform Health Management
- Service
  - Software Configuration Management
- Security Management
- Diagnostics
- Logging and Tracing
- Hardware Acceleration
- Communication Management

Adaptive AUTOSAR Foundation

(Virtual) Machine / Hardware

Application 1
- API(libc)
- API
- API

Application 2
- API(libc)
- API
- API

Application 1
- API(libc)
- API
- API

Application 2
- API(libc)
- API
- API

AUTOSAR Adaptive Platform for Connected and Autonomous Vehicles
ara::com – Service-oriented communication

Adaptive AUTOSAR Foundation

Operating system

Bootloader

API(libc)

Communication API

Application

Service Consumer
Proxy

Service Implementation
Skeleton

SOME/IP-Serialization
E2E Protection

Provided Interface
Events
Methods
Files

SOME/IP

Service Discovery

Service Interface
Definition

(Virtual) Machine / Hardware

AUTOSAR Adaptive Platform for Connected and Autonomous Vehicles
Service-oriented communication
Dynamic establishing of communication path

- ServiceDiscovery finds all local and remote ServiceInstances in the System.
- Available ServiceInstances are represented by Proxies (P1 … P3) to the Application.
- Application can choose which ServiceInstance(s) to use.
**Execution model**

**Classic Platform** vs. **Adaptive Platform**

- **Software Component Description** specifies SWC Runnables and executes RTE.
- Influences generated code.

- **Manifest** configures Application.
- Creates Callbacks and threads.
- Executes void main().
- Communication Management configures Execution Management.

**Classic Platform**

- **ECU**
  - **SWC**
    - Specifies Runnables
    - Executes RTE

**Adaptive Platform**

- **ECU**
  - **Application**
    - Creates Threads and Callbacks
    - Executes void main()
Architecture – machine level

One Machine is generally occupied exclusively by one Software Platform Instance

Virtual Machines

Physical Machine

... MCU ... MCU ... MCU ...

ECU

ECU may contain multiple MCUs

Software Platform Instances

Classic AUTOSAR

Adaptive AUTOSAR

Adaptive AUTOSAR

Core Mem IntC I/O

Core Mem IntC

Core Mem IntC I/O IntC

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➤ Summary
What are the mayor novelties from 1 January 2017 onwards?

**AUTOSAR Software Implementation**
- Joint development of exemplary software

**Collaboration**
- Collaboration and joint use of specifications with third parties by sublicensing

**Derived Applications**
- Revised definition
New from 1 January 2017 onwards: Joint development of exemplary software implementations for the AUTOSAR Adaptive Platform

Development in AUTOSAR Work Packages

AUTOSAR Specifications

validate

improve

AUTOSAR Software Implementations

Licensing for exploitation

Exploitation of released Specifications and exemplary Software Implementation by AUTOSAR partners
Standardization process and specification validation

Specifications will be validated in parallel with the standardization.

- Operating system definition based on POSIX
- Middleware technologies for the implementation of service oriented communication, e.g. SOME/IP
- Definition of execution model(s) to support the different use cases of access freedom, e.g. full access, sandboxing
- Use of package format and managers for application deployment
Work mode and how-to contribute

Joint expert group meeting

Run 3 – 4 months

Sprint planning meetings per feature team defined by FBO

Continuous development according to Scrum

Sprint 4 weeks*

Active and passive members

Sprint Meetings (2-5 per week)

Feature Backlog refinement

Sprint planning

Scrum Meetings

Sprint Review

Retrospective

Active members

Autosar Adaptive Platform for Connected and Autonomous Vehicles
**New from 1 January 2017 onwards:**
**Definition of Derived Applications**

**Automotive applications**
Use-cases related to engine powered, land-based, non-railed vehicles, such vehicles intended for primary transportation purposes.

**Derived applications**
Use-cases that are neither an Automotive Application nor in a field of use of products or services that falls into the categories of ultra-hazardous activities.

**Ultra-hazardous activities**
Aerospace and aviation, nuclear power, chemical and/or biological reactors, petrochemical, or military (except for military marine transportation vessels).

**Original target**

**Extended**

**Excluded**
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Achievements

- Established a worldwide software standard focusing on automotive applications
- Classic Platform is massively used in series production

Game changers

- New use-cases such as autonomous driving, Car-2-X applications, vehicle in the cloud etc.
- New players in the market
- Cooperation with other standardization bodies required

Future of AUTOSAR

- AUTOSAR Adaptive Platform designed to meet new use cases
- Development of exemplary software
- New Development Agreement to form the legal baseline

AUTOSAR will continue to be THE creator of automotive software standards.
More information available online

More information about AUTOSAR:
http://www.autosar.org

Become a partner and get exploitation rights for the AUTOSAR standards
request@autosar.org

Published Releases

For information only (see disclaimer)
Thank you for your attention!

Do you have questions?