Topics

› AUTOSAR Introduction

› Approaches and standards

› Developing the Adaptive Platform

› Achievements, plans, organization
Topics

› AUTOSAR Introduction

› Approaches and standards

› Developing the Adaptive Platform

› Achievements, plans, organization
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**

- **Supplier A**
  - Chassis
  - Safety
  - Body/Comfort

- **Supplier B**
  - Chassis
  - Safety
  - Telematics

- **Supplier C**
  - Body/Comfort
  - Powertrain
  - Telematics

**Exchangeability between vehicle platforms**

- **Platform a.1, a.2, a.n**
- **Platform b.1, b.2, b.n**
- **Platform c.1, c.2, c.n**
- **Platform d.1, d.2, d.n**
- **Platform e.1, e.2, e.n**
- **Platform f.1, f.2, f.n**
Aims and benefits of using AUTOSAR

AUTOSAR aims to standardize the software architecture of Electronic Control Units (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 decoupled by horizontal layers, reducing development time and costs.
- Reuse of software enhances quality and efficiency.

Yesterday

| Software | Hardware |

AUTOSAR

| Application Software | Standardized Methodology | HW-specific (ECUs) |

| Hardware | Hardware | Hardware | Hardware | Hardware |

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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

An industry standard is established.

OEM

Supplier

Tool provider

New market entrant
Exploitation of the standard provides significant benefits

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

An industry standard is established.

- OEM
- Supplier
- Tool provider
- New market entrant
Exploitation of the standard provides significant benefits

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

An industry standard is established.

OEM
Supplier
Tool provider
New market entrant

© AUTOSAR
Exploitation of the standard provides significant benefits

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

An industry standard is established.
# AUTOSAR – Core Partners and Partners

<table>
<thead>
<tr>
<th>Core Partners</th>
<th>Premium Partners</th>
<th>Development Partners</th>
</tr>
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<tbody>
<tr>
<td>BMW Group</td>
<td>General OEM</td>
<td>ANSYS</td>
</tr>
<tr>
<td>BOSCH</td>
<td>Generic Tier 1</td>
<td>Advanced Telematics</td>
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<tr>
<td>Continental</td>
<td>Standard Software</td>
<td>INCHRON</td>
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<tr>
<td>Ford</td>
<td>Tools and Services</td>
<td>RTI</td>
</tr>
<tr>
<td>DAIMLER</td>
<td></td>
<td>E.S.R.LABS</td>
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<tr>
<td>PSA Groupe</td>
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<td>BASELABS</td>
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</table>

- 9 Core Partners
- 53 Premium Partners
- 38 Development Partners

127 Associate Partners
21 Attendees
## Top-level goals of AUTOSAR – 9 Project Objectives

<table>
<thead>
<tr>
<th>PO 1</th>
<th>PO 4</th>
<th>PO 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferability of software</td>
<td>Definition of an open architecture for automotive software</td>
<td>Collaboration between various partners</td>
</tr>
<tr>
<td><strong>PO 2</strong></td>
<td><strong>PO 5</strong></td>
<td><strong>PO 8</strong></td>
</tr>
<tr>
<td>Scalability to different vehicle and platform variants</td>
<td>Development of dependable systems</td>
<td>Standardization of basic software functionality of automotive ECUs</td>
</tr>
<tr>
<td><strong>PO 3</strong></td>
<td><strong>PO 6</strong></td>
<td><strong>PO 9</strong></td>
</tr>
<tr>
<td>Broad variety of functional domains</td>
<td>Sustainable utilization of natural resources</td>
<td>Support of applicable international automotive standards and technologies</td>
</tr>
</tbody>
</table>
Main working topics

- Architecture
- Acceptance Tests
- Methodology
- Application Interfaces
Software architectures including a complete basic software stack for ECUs – the so called AUTOSAR Basic Software – as an integration platform for hardware independent software applications.
Main working topics

Methodology

Architecture

Acceptance Tests

Application Interfaces

Defines exchange formats and description templates to enable a seamless configuration process of the basic software stack and the integration of application software in ECUs. It includes even the methodology how to use this framework.
Specification of interfaces of typical automotive applications from all domains in terms of syntax and semantics, which should serve as a standard for application software.
Main working topics

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

Acceptance Tests

Architecture

Methodology

Application Interfaces
Topics

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AUTOSAR standardizes two software platforms – Classic and Adaptive

Common Bus Interface Specification
AUTOSAR Classic Platform is worldwide on the road

First choice for deeply embedded ECU with high demands regarding safety and deterministic execution.

Targets small and medium sized microcontrollers.

Common Bus Interface Specification

© AUTOSAR
Software architecture of AUTOSAR Classic Platform

- Application Software Component
- Actuator Software Component
- Sensor Software Component
- AUTOSAR Software Component
- Operating System
- Services
- Communication
- ECU Abstraction
- Complex Device Drivers
- Microcontroller Abstraction
- ECU-Hardware

AUTOSAR Interface
Standardized AUTOSAR Interface
Standardized Interface
Basic approach

Virtual Integration

Introduction of HW Attributes

ECU Configuration
Basic approach

Virtual Integration

Independent of hardware

SW-C Descriptions

Application Layer

Virtual Functional Bus

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Introduction of HW Attributes

Holistic view of the entire system, both software and hardware

Tools supporting development of software components

ECU Descriptions

System Constraint Description

ECU Descriptions
Basic approach

**ECU Configuration**

- Run-Time Environment
- Separation of system into its ECU plus common infrastructure

---

**System Descriptions**

- **ECU I**
  - SW-C 1
  - SW-C 2
  - RTE
  - BSW

- **ECU II**
  - SW-C 3
  - RTE
  - BSW

- **ECU n**
  - SW-C n
  - RTE
  - BSW

Connections:
- Flex Ray
- Gateway
- CAN
HW and SW applications are decoupled from each other.
AUTOSAR Classic Platform
Acceptance Test Architecture

Acceptance Tests at Application Level, RTE and Services

Acceptance Tests at Bus Level

Software under Test
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
Main drivers for new automotive software systems have been determined.

- New processor technologies
AUTOSAR Adaptive Platform for realizing future drivers

- Supports the simple distribution of adaptive applications within Adaptive Platform instances.
- Interacts with Classic Platform and non-AUTOSAR systems.

Common Bus Interface Specification

e.g. SOME / IP
AUTOSAR Adaptive Platform
Logical view

User Applications

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

Legend

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

Legend

- IPC (local)
- DDS
- POSIX PSE51 / C++ STL Operating System
- AUTOSAR Runtime for Adaptive Applications (ARA)

Legend

- ara::com Communication Mgmt.
- ara::rest RESTful
- ara::time Time Synchronization
- ara::per Persistency
- ara::phm Platform Health Mgmt.
- ara::exec Execution Mgmt.
- ara::iam Identity Access Mgmt.
- ara::log Logging & Tracing
- 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

(Virtual) Machine / Container / Hardware

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## 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</td>
</tr>
<tr>
<td>Execution of code directly from ROM</td>
<td>App. is loaded from persistent memory into RAM</td>
</tr>
<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>
</tr>
<tr>
<td>Optimized for signal-based communication (CAN, FlexRay)</td>
<td>Service-oriented communication</td>
</tr>
<tr>
<td>Fixed task configuration</td>
<td>Support of multiple (dynamic) scheduling strategies</td>
</tr>
<tr>
<td>Specification</td>
<td>Specification and code</td>
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</tbody>
</table>
The platforms are organized by 5 AUTOSAR standards.
Topics

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AUTOSAR Adaptive Platform: Success factors

- Market driven feature development
- Frontloading of validation
- Precision and quality of the standard
- Early availability of exemplary implementation
- Short development cycles
- Interoperability and increased quality
Key factors to make AUTOSAR Adaptive Platform a success

- Collaboration between other standardization bodies
- Joint development of specifications and exemplary software implementations
Joint development of AUTOSAR specifications and exemplary software implementations for the AUTOSAR Adaptive Platform

Development in AUTOSAR Work Packages

AUTOSAR Specifications

validate

AUTOSAR Software Implementations

improve

Licensing for exploitation

Providing for product development

› Usage by AUTOSAR partners
Cooperation with other standards

Open to connect with others
Identifying / monitoring open source projects
Topics

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AUTOSAR Achievements and Outlook (1/2)

Milestones, just to name a few

- First release
- Basic SW complete
- Feature enrichment
  - Multicore support
  - Functional safety
  - Ethernet
  - ...
- Derived applications
- New development methods
  - Timing analysis
  - Diagnostics
  - Acceptance testing
  - ...

AUTOSAR founded

- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
AUTOSAR Achievements and Outlook (2/2)

Milestones, just to name a few

Release 4.2.1
- Large data communication via Ethernet and CAN FD
- Integration of non-AUTOSAR systems
- ...

10 years of AUTOSAR
6th OC Nov 13

2013

2014

2015

2016

2017

2018

Release 4.3.0
- Hardware Test Management on Startup and Shutdown
- Crypto Interface
- V2X Support
- Extended Buffer Access for Rapid Prototyping
- SOME/IP Transport Protocol Decentralized Configuration

Release 4.3.1
- Quality
- Interface Module for Ethernet and IP testing
- Macro Encapsulation Of Library Calls
- Error Detection and Correction for Communication

Release 4.4.
- Remote Event Communication Manager
- Harmonization of Physical Units for ASW and BSW Based on ASAM
- Security Policy Manager Module
- AUTOSAR Real Time Interface
- RTE Implementation Plug-Ins
- LIN-Support for LIN slave
- Ethernet Wake on data line
- Formal Model Query and Blueprint Derivation Mechanisms
- Bus-Mirroring
- Extended Serialization for Data Structures in SOME/IP with tag/length/value encoding
# AUTOSAR Platform Roadmap

## Acceptance Tests
- R1.2.0
- Review of open RFCs

## Adaptive Platform
- R17-03
- R17-10
- R18-03
- R18-10

## Classic Platform
- R4.3.0
- R4.3.1

## Foundation
- R1.1.0
- R1.2.0

<table>
<thead>
<tr>
<th>Q1/17</th>
<th>Q2/17</th>
<th>Q3/17</th>
<th>Q4/17</th>
<th>Q1/18</th>
<th>Q2/18</th>
<th>Q3/18</th>
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- **new contracts**
- **Life Cycle**: released, planned, on demand
- **Autosar**: development, evolution, maintenance
AUTOSAR Adaptive Platform Roadmap

**METHODOLOGY**
- Diagnostic Extract
- Manifests
- Methodology Extensions for Adaptive

**EXECUTION MANAGEMENT**
- Integration of Applications onto Platform
- Start and Stop of Applications
- Resource Management
- Recovery action framework
- Machine State handling
- Resource Management
- Parallel Processing by HWA
- Recovery action framework

**POSIX OPERATING SYSTEM**
- OS Application Interface (PSE51 & C++STL)
- Maintenance and Improvements
- Common System Model

**Release Timeline**
- Q1/17: R17-03 Released
- Q3/17: R17-10 Released
- Q1/18: R18-03 Released
- Q4/18: R18-10 Released

**Life Cycle**
- Development
- Evolution
- Maintenance
AUTOSAR Adaptive Platform Roadmap

DIAGNOSTICS
- DTC Management
- ISO 14229 / ISO 13400

COMMUNICATION
- Service-Discovery and Service-based Communication
- Events, Fields and Methods
- Language-Binding: C++
- Inter-Process Communication
- Bus-Binding: SOME/IP
- ISO 13400 / ISO 14229 completion
- Handling of SW Clusters
- Time Synchronization
- Support of RESTful
- Network Management Ethernet
- Signal-based Communication
- Support of RESTful
- Network Management Ethernet
- Vehicle API
- Further Language Bindings
- LIN Support
- Support of CAN and CAN-FD

Life Cycle
- Development
- Evolution
- Maintenance

Q1/17  Q2/17  Q3/17  Q4/17  Q1/18  Q2/18  Q3/18  Q4/18

R17-03  R17-10  R18-03  R18-10

✓ released  △ planned  ◈ on demand
AUTOSAR Adaptive Platform Roadmap

**LOGGING / TRACING**
- Logging and Tracing

**SAFETY**
- C++14 Coding Guideline
- E2E Communication Integrity
- Platform Health Management
- Safety concept for AP
- E2E Communication Integrity

**PERSISTENCY**
- Data Storage
- Data Storage
- Safe Data Storage
- Persistent Data Encryption
- Maintenance and Improvements
- Maintenance and Improvements
- Maintenance and Improvements
- Maintenance and Improvements

Life Cycle:
- Development
- Evolution
- Maintenance
AUTOSAR Adaptive Platform Roadmap

SECURITY
- Crypto API
- Authentication & Certificates
- Key Management
- Secure Communication

SOFTWARE CONFIG. MGNT
- Package Management
- Installation routine

Q1/17  Q2/17  Q3/17  Q4/17  Q1/18  Q2/18  Q3/18  Q4/18
R17-03  R17-10  R18-03  R18-10

Life Cycle:
- development
- evolution
- maintenance

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Field of Applications

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

Derived application
Use-cases that are neither an Automotive Application nor in a field of use of products or service 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
How do we do that?
Evolution of AUTOSAR’s Organizational Structure

Executive Board

Steering Committee

Legal Team

Project Leader Team

Communication Team

OSS-CB Open Source CB

CF-CCB Consensus Finding CCB

CCB Change Control Board

Work Packages

Feature Teams

User Groups

Legend

Core Partner

Core Partner, Premium and Development Partner

All partners including Associate Partners

Subcontractor

Project Management

Technical Management

Quality Management

Specification Management

Change Management

Release Management

Quality Assurance

Requirements Mgmt

Engineering

Technical Office

SW Dev. Engineering

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Work Group Structure

Legend:
- **Lead Work Package**
  - Work Package
  - Feature Team

- WP-A
  - Software architecture
- WP-A-LIB
  - Libraries
- WP-A-MCBD
  - Multicore BSW Distr.
- WP-A1
  - VFB and RTE
- WP-A2
  - COM Stack
- WP-A4
  - Diagnostics
- WP-A5
  - MCAL
- WP-M
  - Methodology and Templates
- WP-M-METH
  - Methodology
- WP-M-GST
  - Generic Structure Template
- WP-M-SWCT
  - Software Component Template
- WP-M-SYST
  - System Template ECU Configuration
- WP-M-TIMEX
  - Timing Extensions
- WP-M1
  - Timing Analysis
- WP-I
  - Application Interface
- WP-I-BODY
  - Body and Comfort
- WP-I-ENGINE
  - Powertrain Engine
- WP-I-TRSM
  - Powertrain Transmission
- WP-I-CHASSIS
  - Chassis Control
- WP-I-OCSAFE
  - Occupant and Pedestrian Safety
- FT-CM
  - Communication Mgmt.
- FT-EMO
  - Execution Mgmt.
- FT-DIAG
  - Adaptive Diagnostics
- FT-MM
  - Methodology & Manifests
- FT-PER
  - Persistency
- FT-UCM
  - Update & Conf Management
- FT-SAF
  - Safety
- FT-SEC
  - Security
- FT-X-SAFT
  - Functional Safety
- FT-X-VAL
  - Validation
- Cross-standard concerns
User Group Structure

- **UG-IN** India
  - Interoperability of exchange artifacts

- **UG-CN** China
  - Demonstrator development
  - System design with 3 AUTOSAR ECUs
  - BSW integration, documentation and project closure planned for E2016

- **UG-NA** North America
  - Common Training: OEM-Tier1 Workflows/ Security
  - Safety
  - Ethernet

- **UG-IE** Improved Exploitation
  - 6 thesis on optimizing the use of AUTOSAR
  - Establishment of Adaptive Platform
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.
11th AUTOSAR

Open Conference and Networking Reception

Networking Reception

Tuesday, November 6th, 2018
7:00 pm – 10:00 pm

Conference

Wednesday, November 7th, 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/
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