

AUTOSAR - A worldwide standard Current developments, roll-out and outlook

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Frank Kirschke-Biller (Ford Motor Company)

BMW Group



BOSCH

Continental



DAIMLER



PSA PEUGEOT CITROËN



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Overview

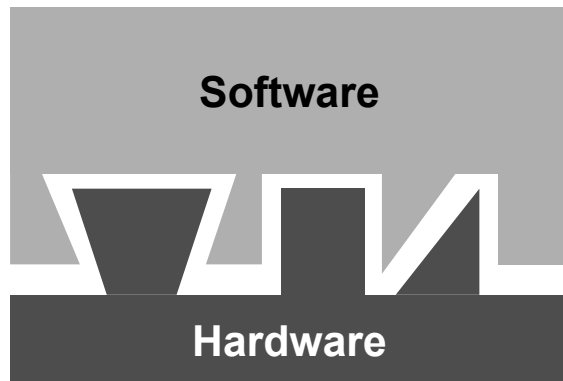
AUTOSAR Overview

- ☐ Current Releases of AUTOSAR
- ☐ AUTOSAR Phase III
- ☐ AUTOSAR Test Standardization
- ☐ Emerging Markets / AUTOSAR's co-operation with other organizations
- ☐ Conclusion

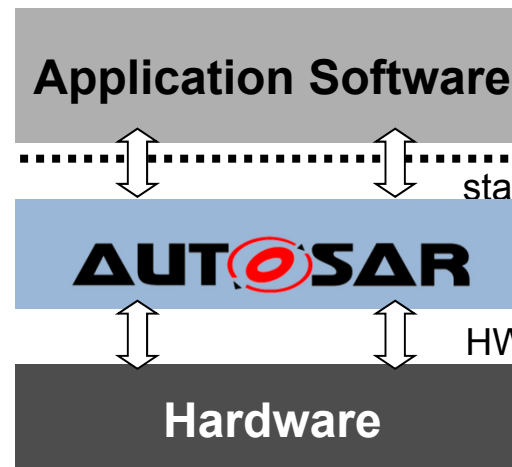
AUTOSAR Vision

- AUTOSAR aims to standardize the software architecture of ECUs.
- AUTOSAR paves the way for innovative electronic systems that further improve performance, safety and environmental friendliness.

Yesterday



AUTOSAR



Customer needs

- Adaptive Cruise Control
- Lane Departure Warning
- Advanced Front Lighting System
- ..

Using standards

- Communication Stack
- OSEK
- Diagnostics
- CAN, FlexRay

- Hardware and software will be widely independent of each other.
- The reuse of software increases at OEM as well as at suppliers.
 - This reduces development time and costs.
 - This enhances quality and efficiency.

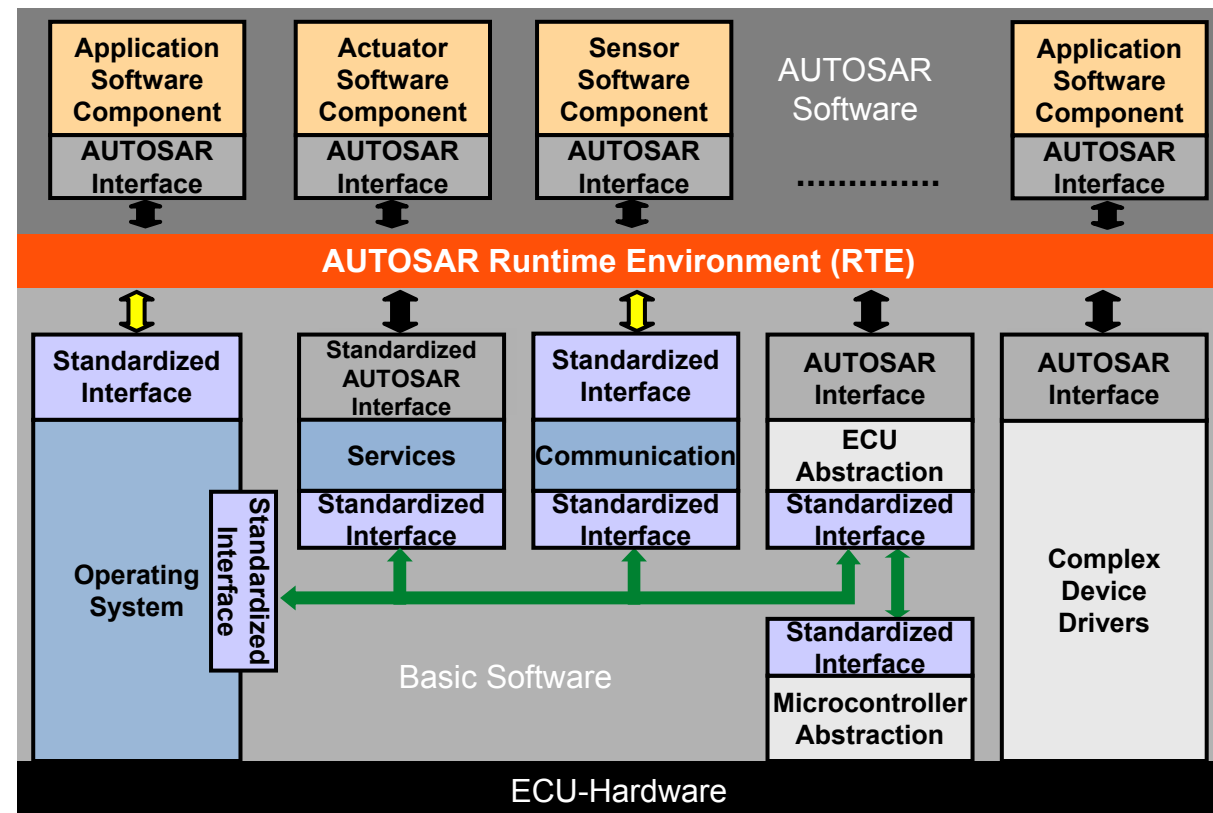
Software Architecture – Functional view

Automotive Open System Architecture (AUTOSAR):

- Standardized, openly disclosed interfaces
- HW independent SW layer
- Transferability of functions

AUTOSAR RTE:

by specifying interfaces and their communication mechanisms, the applications are decoupled from the underlying HW and Basic SW by the RTE. This enables the realization of re-usable application software components.

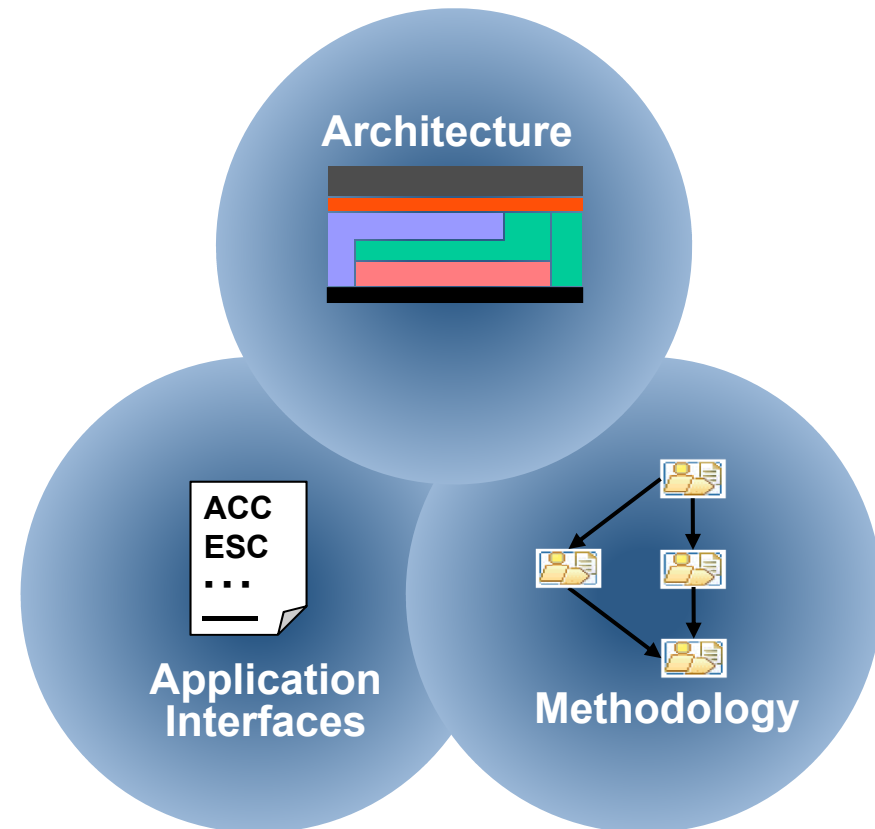


AUTOSAR Project Objectives Summary and Main Working Topics

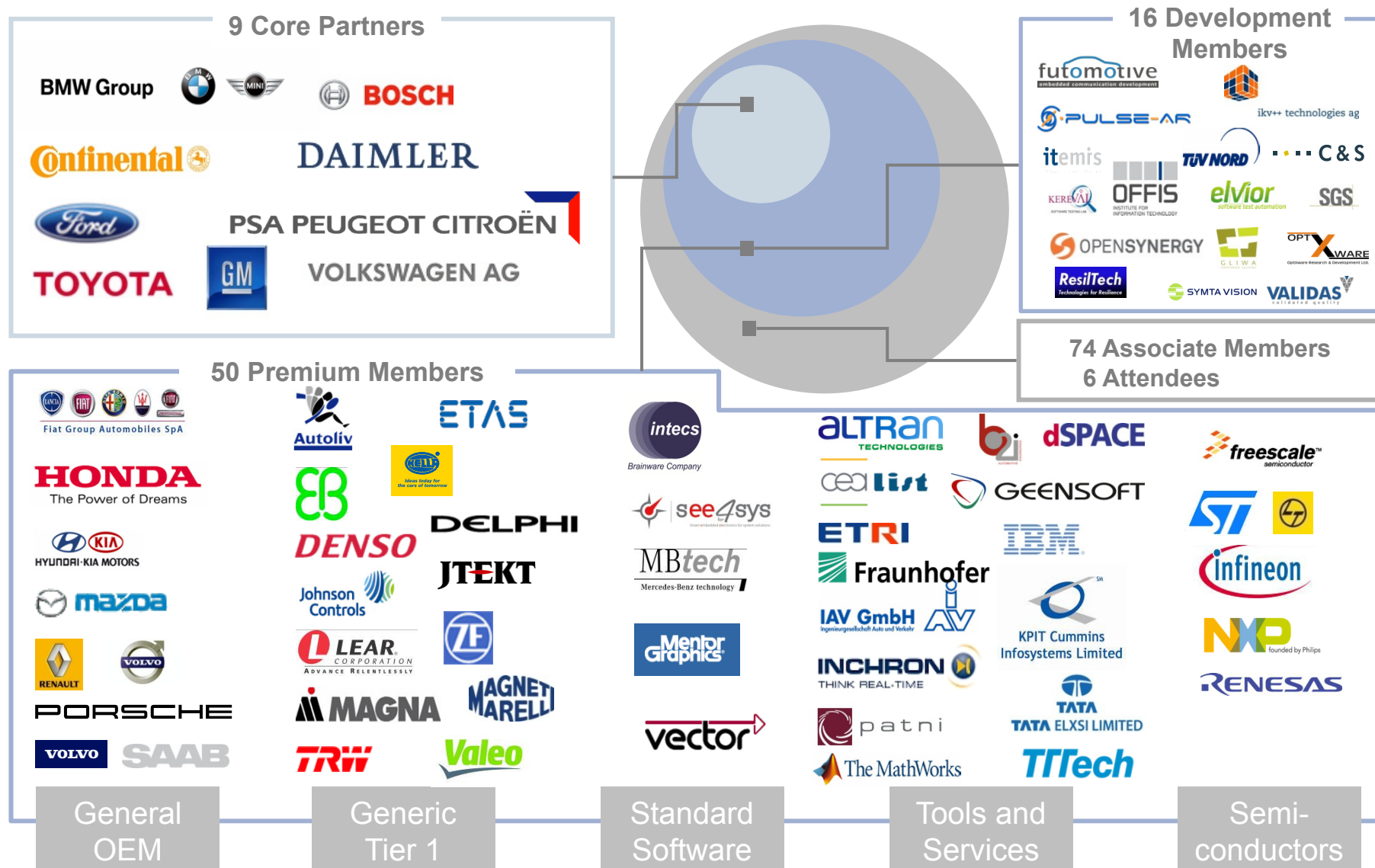


Automotive Open System Architecture Project Objectives

- **Standardization of basic system infrastructure** functions as an industry wide solution
- **Scalability** of embedded automotive software to different vehicle and platform variants
- **Transferability** of functions throughout the vehicle network
- **Integration** of functional modules from multiple suppliers
- ...



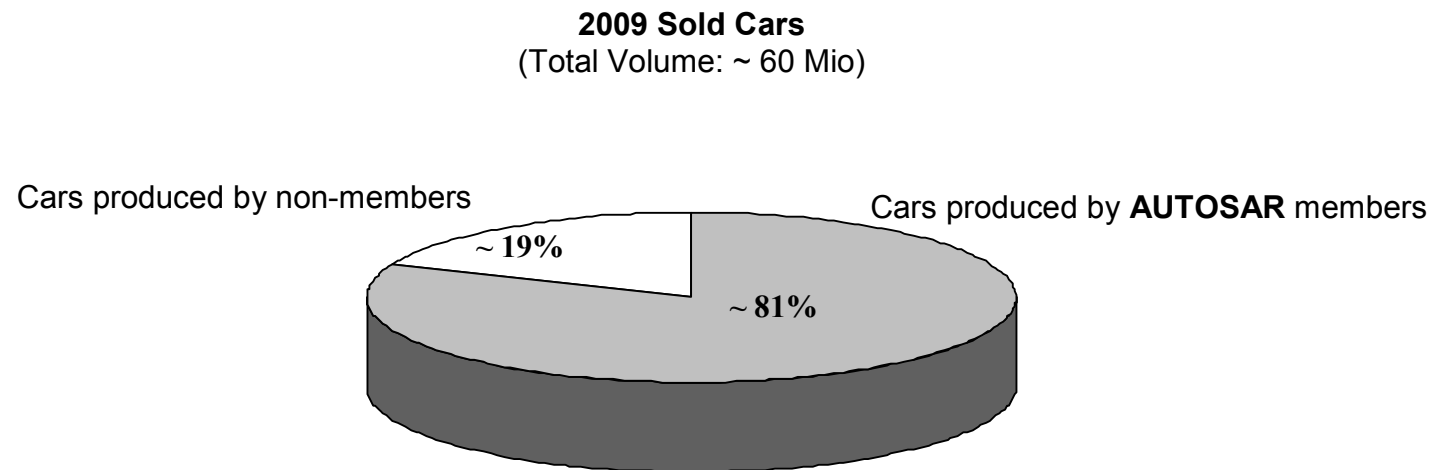
AUTOSAR – Core Partners and Members



Up-to-date status see: <http://www.autosar.org>

AUTOSAR – The Global Automotive Software Standard

- The car production of AUTOSAR members: 80% of the total cars produced worldwide



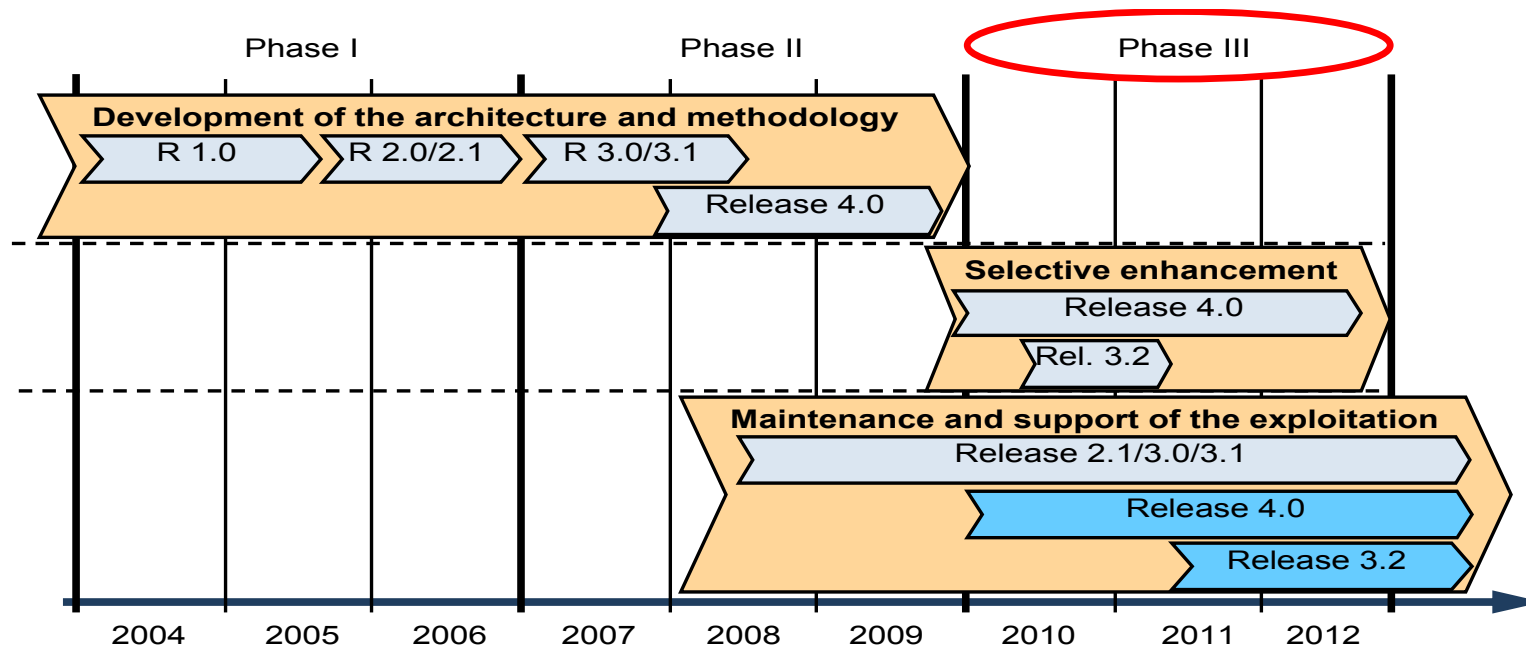
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A Brief Reflection on AUTOSAR Phase II



Release 3.0/3.1

- ☐ Closing remaining gaps in the basic software
- ☐ Harmonization of the basic software modules and templates.

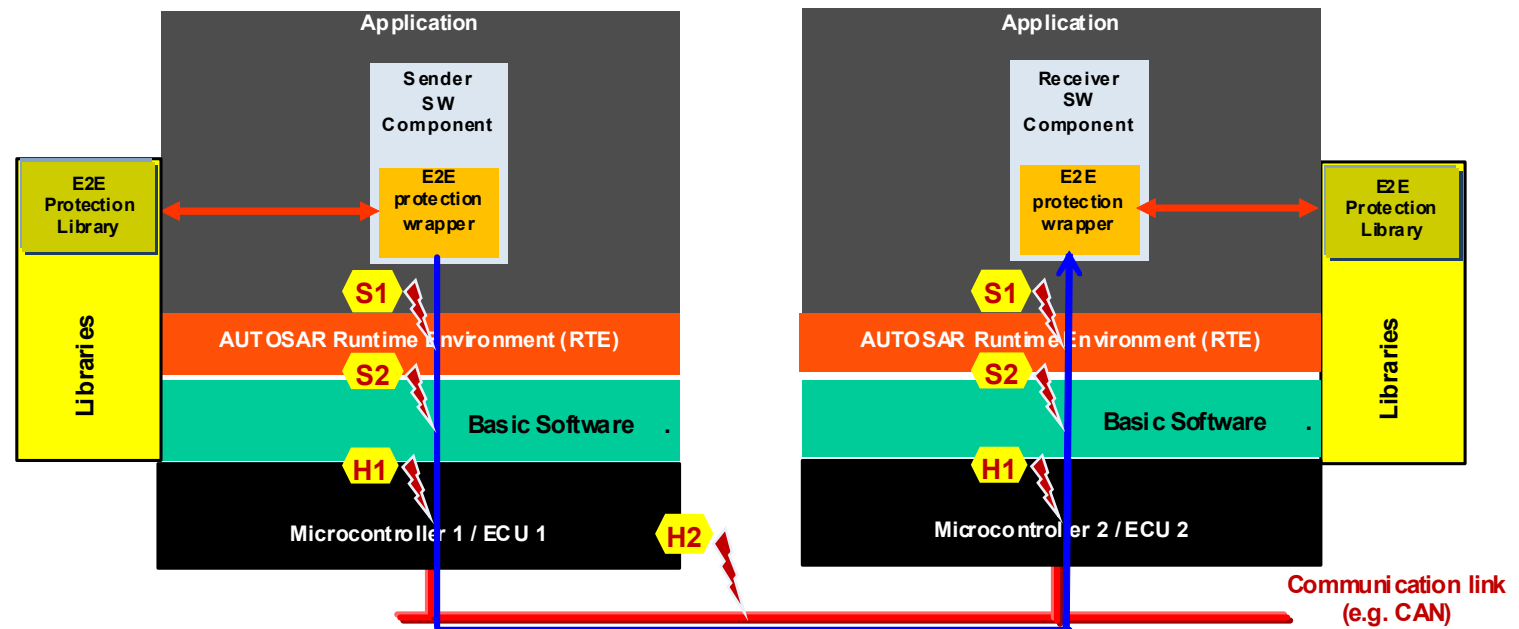
Release 4.0

- ☐ Support for functional safety (e.g. memory partitioning, program flow control, end-to-end library)
- ☐ Multi-core support
- ☐ Application / vehicle mode management
- ☐ Variant handling
- ☐ Standardized application interfaces

Functional Safety - ISO 26262 Compliance

Example: E2E Library

- The end-to-end (E2E) communication protection library is one of AUTOSARs safety features.
 - The E2E protection provides mechanisms, adequate for safety-related communication up to ASIL D.



- It provides mechanisms to detect
 - (systematic) software faults,
 - (random) hardware faults,
 - as well as transient faults due to external influences (e.g. EMI).

Functional Safety - ISO 26262 Compliance

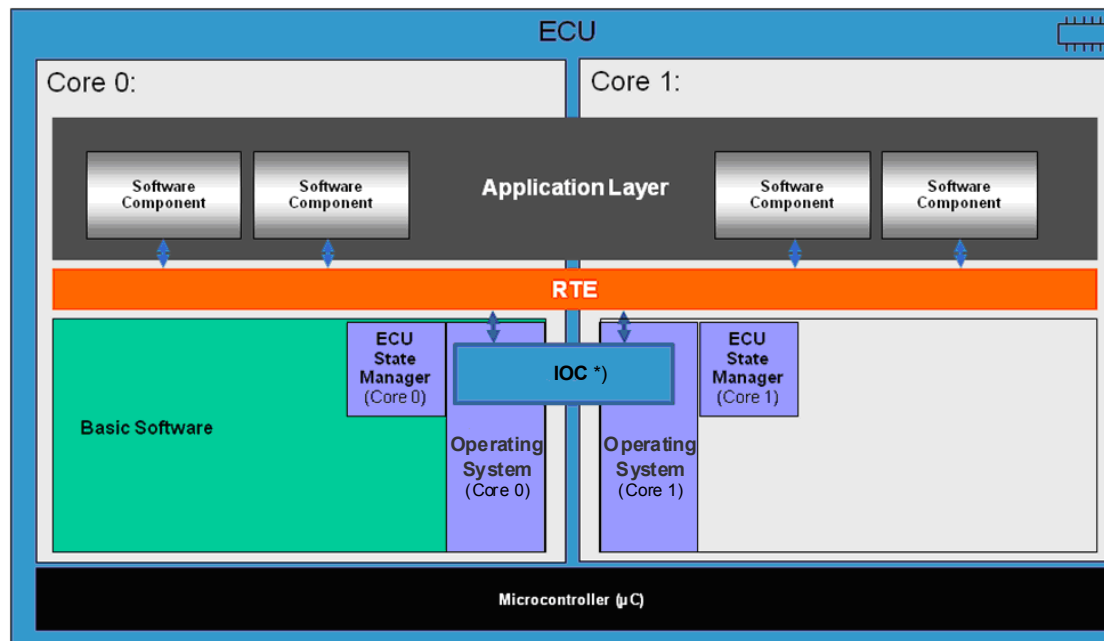
Example: E2E Library

- More specifically the E2E communication protection mechanisms detect the following faults as defined in the ISO 26262
 - Repetition
 - Deletion
 - Insertion of unintended data
 - Incorrect sequence
 - Data Corruption
 - Timing faults (delay)
 - Addressing faults
 - Masquerading

- The E2E library achieves this by
 - Protecting safety-related data elements to be sent over the runtime environment (RTE) by attaching control data (e.g. data id, sequence counter, checksum)
 - Verifying the safety-related data elements received from the RTE using this control data and by timeout monitoring
 - Notifying the receiver SW-C, if received safety-related data elements are faulty. Fault reaction is in the responsibility of the receiver SW-C.

Support for Multi-core Architectures

- AUTOSAR defines a software platform, that provides support for the diverse multi-core hardware architectures.



*) Inter OS-Application communicator

- AUTOSAR extends the specification of the runtime environment (RTE) and OSEK-based operating system (OS) by multi-core specific functions
- The distribution of application software among cores is supported by the AUTOSAR methodology and hence by the tool chain.
- Adding further flexibility w.r.t. load balancing and basic software distribution is planned for the future.

Overview

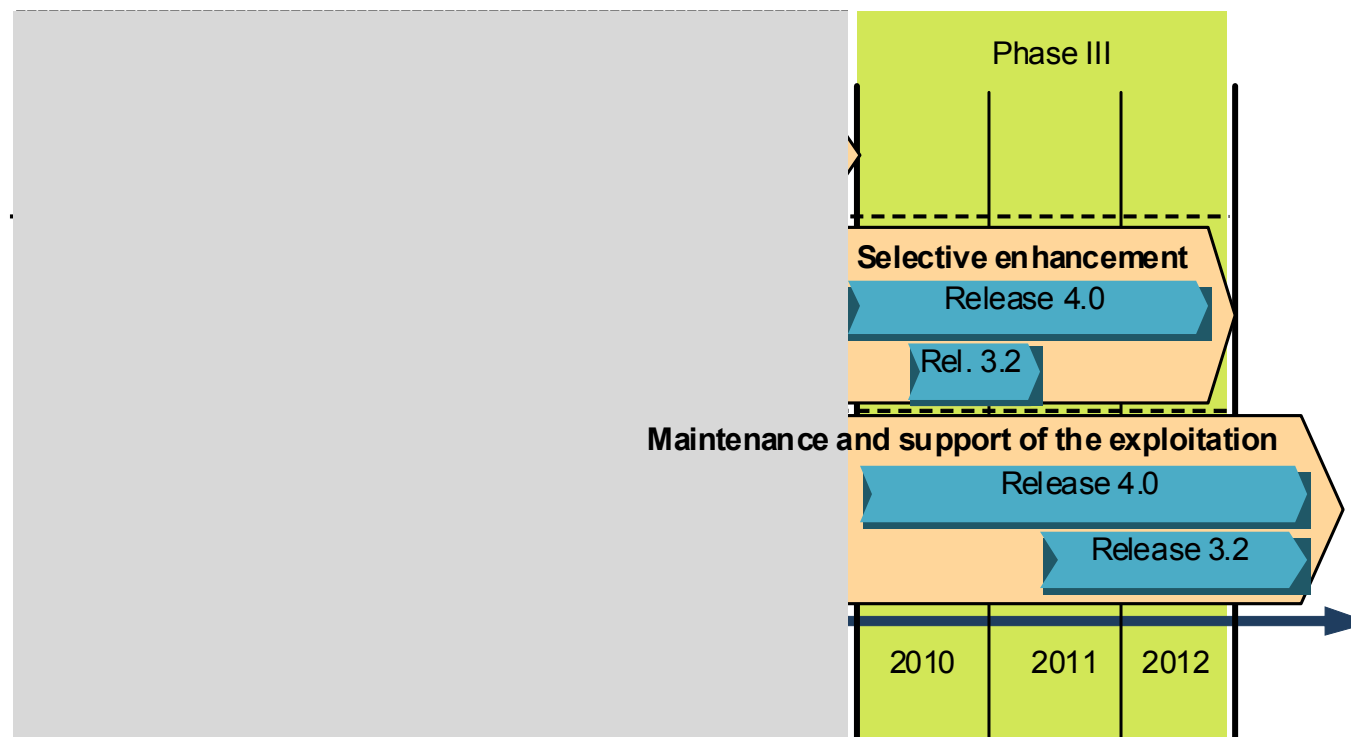
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AUTOSAR Phase III – An evolutionary release approach

- Main objectives of Phase III
 - Maintenance of existing releases
 - Selective enhancement of the standard driven by market needs
 - Improve maintainability of the standard



AUTOSAR core partners' exploitation plan

- A survey among AUTOSAR Core Partners shows
 - The main stream of AUTOSAR releases are R3.x and 4.0.
 - Different migration strategies and license models for the BSW and the RTE co-exist and will continue to co-exist, even within an OEM.
 - Core Partner Tier1s prefer own development of AUTOSAR BSW, instead of purchasing it from Tier2s.
 - The majority of the Core Partners will finish their migration to fully compliant AUTOSAR BSW in 2015.

	already in use	planned SOP in 2011	planned SOP in 2012	planned SOP in 2013	planned SOP in 2014	planned SOP in 2015	planned SOP in 2016	planned SOP later than 2016
Mandated in new platforms	  1)							
Optional for new platforms	   							

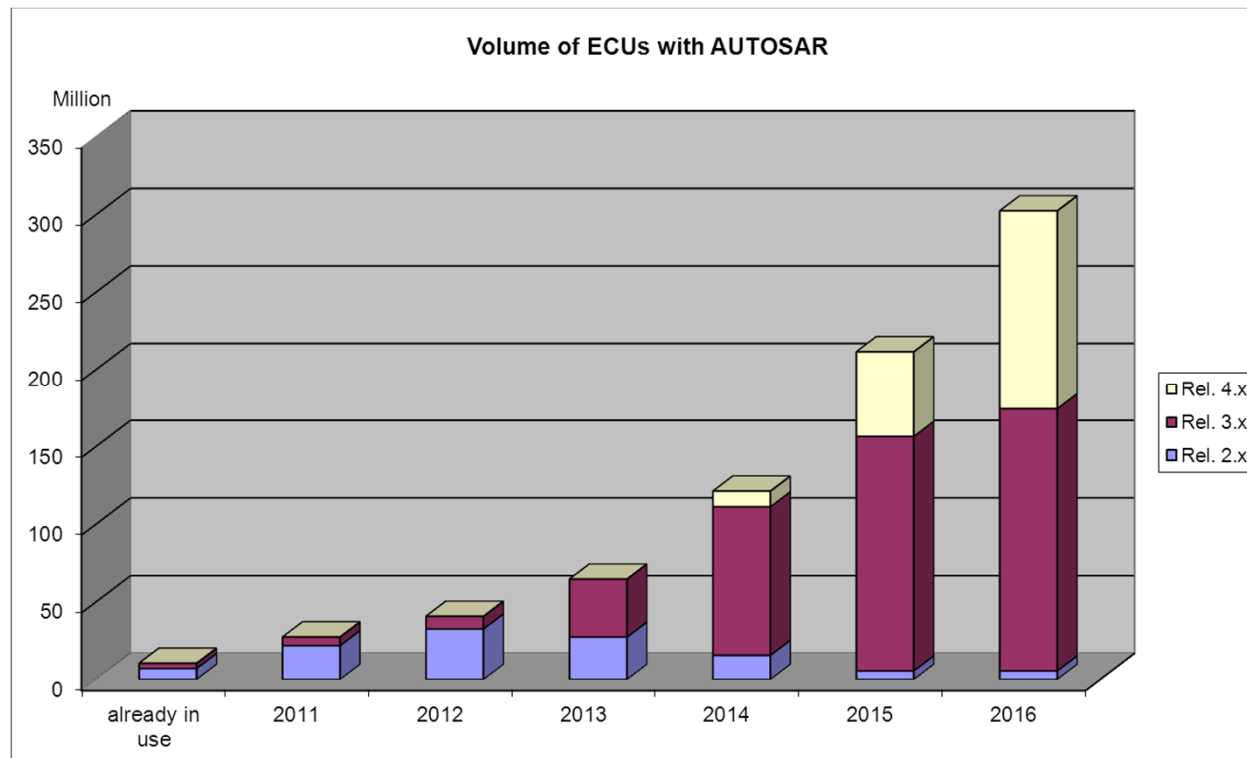


"Each domain is about to establish a migration path to AUTOSAR"

1) FlexRay ECUs only

AUTOSAR core partners' exploitation plan

- A rapid growth of AUTOSAR's market penetration between now and 2016 is predicted.
 - At least 25% of the total number of ECUs produced in 2016 will have AUTOSAR inside (based on planning of AUTOSAR OEM Core Partner only)



Maintenance of Existing Releases

- AUTOSAR members require protection of investments into existing releases (e.g. in tooling and software implementations)
 - further maintenance and improvements of releases 3.x covered by release 3.2

- **Additional new features in release 3.2**
 - Partial Networking (pull-ahead from release 4.0.3)
 - Robustness features (especially in state manager modules)
 - Improvement of error handling (e.g. production vs. development errors).

- **Back-ported from release 4.0 to release 3.2**
 - End-to-end communication protection
 - Extended Complex Device Driver (CDD) concept
 - Basic Software Mode Manager
 - FlexRay ISO Transport Protocol

Efficient Energy Management - Partial Networking

- Motivation for efficient energy management
 - increasing power consumption by new, complex electronic concepts
 - CO₂-based vehicle tax + penalty for car manufacturer that miss the CO₂-target
 - increasing fuel costs
 - increasing number of electric cars + increased battery life time

- The power consumption can be reduced by temporarily shutting down functions, which are currently not needed, e.g.
 - seat control functions
 - park assistant functions

- AUTOSAR is the first initiative to standardize the Partial Networking technology.
 - Extension of AUTOSAR methodology w.r.t. to system modeling
 - Extension of mode and network management
 - Standardization of interface to HW
(e.g. ISO 11891-6 CAN transceiver w/ selective wake-up)

Backward Compatibility

- Protection of the investments into existing releases requires
 - strict control of the backward compatibility (BWC) through process enhancements to impede incompatible developments in the standard.
 - to have an AUTOSAR BWC Statement to support AUTOSAR users in the migration analysis between releases or revisions.
 - The scope of BWC is bus and application level, including templates.
- Backward Compatibility requirement of Phase III brought to practice.
- Only backward compatible concepts will be introduced in revisions of release 4.0 instead of introducing a new minor or even major release by end 2012.

Overview

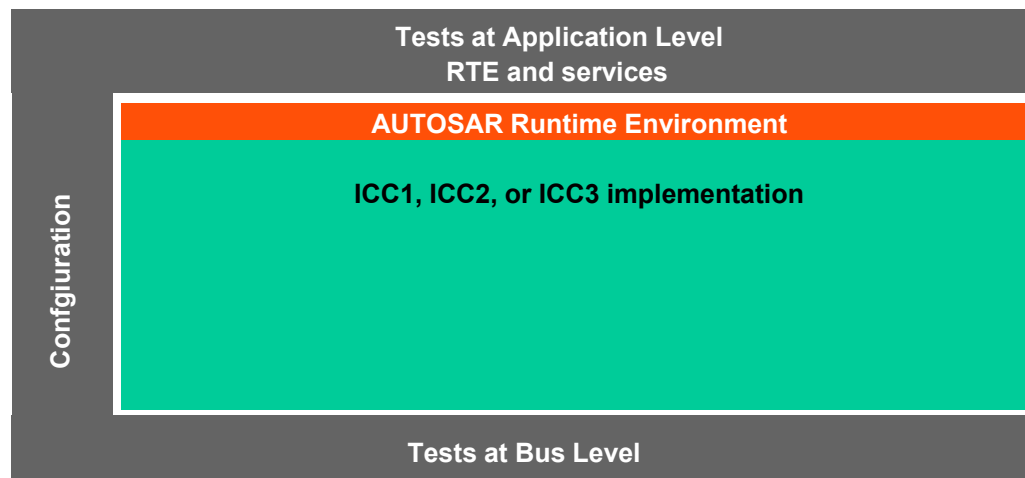
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AUTOSAR Test Standardization

- The **Conformance Test** specification has helped to improve the quality of each of the BSW module specifications and the overall standard. It is part of release 4.0.2.
- The fine granularity of the tested modules and strict test processes on such a detailed level do not exactly fit the business needs of the AUTOSAR users



- The new **Acceptance Test** specification will include tests for
 - Bus compatibility (e.g. compatibility of protocols such as TP, NM)
 - Application compatibility (Compatibility of interfaces to ensure integration of SWCs)
 - Configuration compatibility (Compatibility of templates to ensure that a “typical” ECU extract can be used for configuration)

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AUTOSAR's co-operation with other organizations



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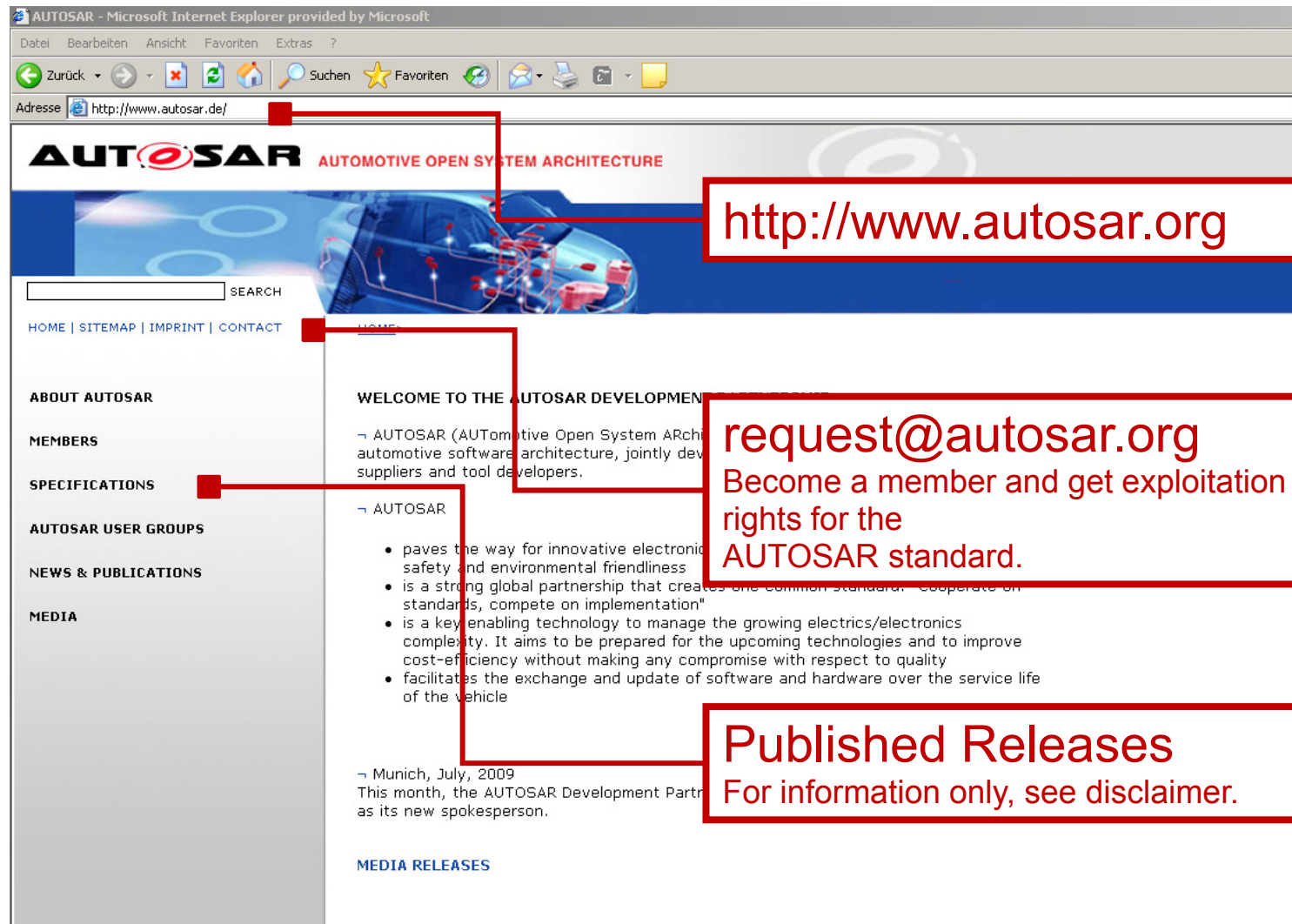
Conclusion

Summary and Conclusion

- Exploitation plans of the Core Partners show clear commitment towards AUTOSAR
- AUTOSAR is able to react to new market needs (e.g. Partial Networking)
- Only backward compatible concepts will be introduced in revisions of release 4.0
- Evolutionary release approach will strengthen the stability of AUTOSAR and stabilize the overall AUTOSAR ecosystem.
- AUTOSAR is globally recognized as the standard for automotive software architecture

Thank you for your attention!

Questions?



AUTOSAR - AUTOMOTIVE OPEN SYSTEM ARCHITECTURE

<http://www.autosar.org>

request@autosar.org
Become a member and get exploitation rights for the AUTOSAR standard.

Published Releases
For information only, see disclaimer.

ABOUT AUTOSAR

MEMBERS

SPECIFICATIONS

AUTOSAR USER GROUPS

NEWS & PUBLICATIONS

MEDIA

WELCOME TO THE AUTOSAR DEVELOPMENT PARTNERSHIP

→ AUTOSAR (AUTomotive Open System ARchitecture) is a worldwide automotive software architecture, jointly developed by automotive suppliers and tool developers.

→ AUTOSAR

- paves the way for innovative electronic safety and environmental friendliness
- is a strong global partnership that creates one common standard. "Cooperate on standards, compete on implementation"
- is a key enabling technology to manage the growing electrics/electronics complexity. It aims to be prepared for the upcoming technologies and to improve cost-efficiency without making any compromise with respect to quality
- facilitates the exchange and update of software and hardware over the service life of the vehicle

→ Munich, July, 2009
This month, the AUTOSAR Development Partnership has appointed Dr. ... as its new spokesperson.

MEDIA RELEASES