AUTOSAR
Automotive Open System ARchitecture
Challenges and Achievements 2005

Dr. Thomas Scharnhorst, AUTOSAR Spokesperson
Management summary
AUTOSAR aims to improve complexity management of integrated E/E architectures through increased reuse and exchangeability of SW modules.
AUTOSAR integrates existing and emerging industry electronics standards.
Worldwide, OEMs and suppliers participate in AUTOSAR.
Status: June 9th, 2005
The AUTOSAR core partners manage the project and maintain organizational control.
To achieve the objectives, AUTOSAR has to address the main topics: software integration, basic software, and functional APIs.

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<th>Project Objectives</th>
<th>Topics</th>
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<tr>
<td>Consideration of availability and safety requirements</td>
<td>Methods of Software Integration</td>
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<td>Redundancy activation</td>
<td>Basic Software</td>
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<td>Scalability to different vehicle and platform variants</td>
<td>Functional APIs</td>
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<td>Implementation and standardization of basic system functions as an OEM wide “Standard Core“ solution</td>
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<td>Transferability of functions throughout network</td>
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<td>Integration of functional modules from multiple suppliers</td>
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<td>Maintainability throughout the whole “Product Life Cycle“</td>
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<td>Increased use of “Commercial off the shelf hardware“</td>
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<td>Software updates and upgrades over vehicle lifetime</td>
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The AUTOSAR ECU software architecture comprises the layers Application, AUTOSAR Run Time Environment (RTE), and Basic Software.
Basic Software Architecture: The layered architecture is finalized

AUTOSAR Software Component

Different Kinds of Interfaces

ECU Firmware

Standard Software

API 2 VFB & RTE relevant

API 1 RTE relevant

API 0

API 3 Private Interfaces inside Basic Software possible

AUTOSAR Runtime Environment (RTE)

Services Layer

ECU Abstraction Layer

Microcontroller Abstraction Layer

Complex Drivers

ECU-Hardware
Basic Software Architecture: The layered architecture is split up in more than 80 different modules

- **AUTOSAR Software Component**
- **Application Software Component**
- **Actuator Software Component**
- **AUTOSAR Interface**
- **Application Software Component**
- **Actuator Software Component**
- **AUTOSAR Interface**
- **Application Software Component**
- **AUTOSAR Interface**

**Basic Software Architecture:**

- **Services Layer**
- **ECU Abstraction Layer**
- **Microcontroller Abstraction Layer**
- **ECU-Hardware**

**APIs:**
- **API 2 VFB & RTE relevant**
- **API 1 RTE relevant**
- **API 0**

**Interfaces:**
- **Sensor Software Component**
- **Application Software Component**
- **Basic Software Architecture: The layered architecture is split up in more than 80 different modules**

**AUTOSAR Runtime Environment (RTE):**

- **System Services**
- **Memory Services**
- **Communication Services**
- **IO Hardware Abstraction**
- **Complex Drivers**

**Weitere Detaillierung der Layered Architecture:**

**Konzeptfolie**
Service Layer – Flow through the layer

- Memory Services
  - NVRAM Manager

- Memory Hardware Abstraction
  - EEPROM Interface
    - External EEPROM Driver
      - Spi_Read()
      - Spi_Write()
    - SPI Handler
  - SPI Driver
  - Memory Drivers
    - Internal EEPROM Driver

- COM Drivers

- External EEPROM

- µC I/O driver

- ECU
  - device #1
  - device #2
  - µC
  - driver #1
  - driver #2

IF
Following the AUTOSAR Method, the E/E architecture is derived from the formal description of software and hardware components.

Using „Software Component Descriptions“ as input, the „Virtual Functional Bus“ validates the interaction of all components and interfaces before actual software implementation.

The AUTOSAR Method supports the generation of an E/E architecture.
Description of Topology

Net of ECUs

Net of Software Components

System-Constraint Description
Description of Mapping

SW-C to ECUs

Interface Connections to Bus Signals
Unified functional interfaces are been standardized to ensure the interoperability of functional Software-Components (applications) from different sources

- Body/Comfort domain
- Powertrain domain
- Chassis domain
- Safety domain
- Multimedia and HMI domain

**Body Comfort**
- Exterior Light: ready for approval
- Interior Light: ready for approval
- Central Locking: 60%
- Anti Theft: 60%
- Wiper Washer: ready for approval

**Powertrain**
- Driver Request: 95%
- Functional Architecture: 50%
- System Functionalities: 50%

**Chassis**
- ACC: 91%
- External ESP Interfaces: just started
The AUTOSAR standard will be completed and available to OEM product development in 2006.

**Milestones**

**Phases**

**Status**

**Specification of Templates, BSW and RTE**

- Concept - Autosar concept finalized
- Spec R1.0 - Autosar BSW specifications for Release 1 are finalized
- Spec R2.0 - Autosar BSW and RTE specifications for Release 2 are finalized
- Implementation and Integration - methodology and templates finalized
- Integration - BSW and RTE prototype implementations and integrations completed, test specification completed
- Validation - All documents formally released, specifications verified on an application demonstrator, proof of concept demonstrated

**Update BSW and RTE Specifications via CCB**

**Update BSW and RTE Specifications via CCB**

**Test & Validation**

- All documents formally released, specifications verified on an application demonstrator, proof of concept demonstrated

**Actual Timeline**
Migration scenarios allow concurrent deployment of AUTOSAR modules and existing proprietary components to one ECU.

Today

Transition period

Future – AUTOSAR Life

Time

AUTOSAR-development

MS 1

MS 2

MS 2'

OEM infrastructure

Incorporation of all available AUTOSAR specifications

Partly proprietary solutions

Implantation of components not available from AUTOSAR

Proprietary Basic SW Core
Conclusion

1. Fast growth of the complexity of automotive E/E architectures is a major challenge with respect to product quality.

2. Through interconnection of subsystems, new system properties emerge which have to be understood and controlled.

3. Systems Engineering is an integrated approach which covers the development process and the complete product life cycle.

4. AUTOSAR enables management of the growing E/E complexity with respect to technology and economics.

5. AUTOSAR pushes the paradigm shift from an ECU based to a function based approach in automotive software development.
How to get in contact with AUTOSAR …

http://www.autosar.org

request@autosar.org
Thank you for your attention!

http://www.autosar.org

request@autosar.org
Backup
Heading
Sub-Heading

Level 1

➤ Level 2

  ▪ Level 3

    – Level 4

    – Level 5
### Document information and change history

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<tr>
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<th>Dr. Thomas Scharnhorst</th>
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<td>Document Title</td>
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<td>Document Version</td>
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#### Document Change History

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<th>Changed by</th>
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<td>07.06.2005</td>
<td>0.1</td>
<td>Gabriel Schwab</td>
<td>Document creation</td>
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The AUTOSAR standard will be completed and available to OEM product development in 2006.

**Initiation of Partnership**
- 05/03

**Structure & Basis Specification**
- 12/03

**Implementation of the SW-Components**
- 09/04
- 06/05

**Test- & Integration-process**
- 11/05
- 02/06
- 08/06

**Phases**
- 

**Milestones**
- 

**WP10 / WP20**

- Project plan created and agreed
- AUTOSAR Concept and first specification are created and executability is approved
- AUTOSAR compatibility of selected SW modules is approved. First tools and generators are available
- AUTOSAR specifications are tested and verified on an application

AUTOSAR concept (specification and preparation of a de-facto standard) is feasible and in plan

Realization of Run Time Environment feasible and on track

Evaluated test and integration process (product oriented)
Colors