AUTOSAR Overview
Agenda

> AUTOSAR Overview

AUTOSAR Solution

AUTOSAR on the way
Overview and Objectives

AUTOSAR Partnership

9 Core Partners

- BMW Group
- BOSCH
- Continental
- DAIMLER
- PSA PEUGEOT CITROEN
- TOYOTA
- GM
- VOLKSWAGEN AG

21 Development Members

50 Premium Members

- Autoliv
- Brembo
- DELPHI
- Autokon
- DELPHI
- ETRI
- Mentor Graphics
- NXP
- Magna
- TRW
- TTECH
- Vector
- Freescale
- Dassault Systemes
- Dassault Systemes
- Elatec
- EDA
- EDA
- EDA
- EDA
- EDA

83 Associate Members
10 Attendees

General OEM

Generic Tier 1

Standard Software

Tools and Services

Semiconductors
Development of Functionality

>80% of automotive innovations are based on software

- Adaptive headlights
- Active steering
- Curve warning
- Stop and Go
- Lane keeping assistance
- Automated parking
- Collision mitigation
- Hybrid powertrain
- Road trains
- Electronic Brake Control
- Telediagnostics
- Car-2-car communication
- Software updates
- Airbags
- Electronic stability control
- Active body control
- Adaptive gearbox control
- Adaptive cruise control
- Emergency call
- Gearbox control
- Traction control
- Anti-lock brakes
- Electronic fuel injection
- Cruise control


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Why AUTOSAR?

The challenge:

- **E/E complexity** is growing fast
- Quantity of **software** is exploding
- Many different **hardware platforms** are used
- Development **processes** and **data formats** are not harmonized

The main objective of **AUTOSAR**:

- **Improve software quality and reduce costs by re-use**
  - Re-use of functions across carlines and across OEM boundaries
  - Re-use of basic software
  - Re-use of development methods and tools
Why AUTOSAR???

Source: Explore AUTOSAR Conference in Pune 2012
10 Years

Source: 6th AUTOSAR Open Conference
10 Years

Source: 6th AUTOSAR Open Conference
AUTOSAR is a broadly used standard in Europe

**AUTOSAR 3.x:**
- First specification: 2007
- Mature solution used for series production 2010ff
- Adaptations necessary → OEM-specific extensions

**AUTOSAR 4.x:**
- First specification: 2009
- First mature specification: 2012 (4.0.3)
- 4.0.3 is the right version for development start in 2012
- New functions: safety, Ethernet/IP, multicore, ...
Two different AUTOSAR statements:

“Cooperate on standards – compete on implementation”
AUTOSAR Specification – “In the beginning was the word”

- **AUTOSAR 3**
  - 8,624 pages
  - 0.86 m

- **AUTOSAR 4.0**
  - 12,030 pages
  - 1.2 m

- **AUTOSAR 4.1**
  - 16,538 pages
  - 1.65 m

- **AUTOSAR 4.2**

**Standardization** of methods and data exchange formats

**Standardization** of application software interfaces

**Standardization** of basic software and network behavior

- Network Management
- Partial Networking
- ECU State Management
- Transport Protocols
- Non-Volatile Memory
- …
AUTOSAR RTE Architecture

- Task
  - Components independent of ECU mapping
- Functionality
  - Middleware providing communication services (intra / inter ECU)
AUTOSAR BSW Layered View: Simplified

- 80 BSW modules abstracted by 3 layers
AUTOSAR BSW

Service Layer

- Task
  - Services for application
- Functionality
  - Diagnostics, NVRAM Management, OS, Communication
  - Memory and ECU management
AUTOSAR BSW
ECU Abstraction Layer

- Task
  - Make higher levels independent of ECU hardware
- Functionality
  - Driver for external devices
  - Interface for internal and external periphery (IO)
AUTOSAR BSW
Microcontroller Abstraction Layer

- Task
  - Make higher layers independent of microcontroller
- Functionality
  - Drivers with direct access to internal periphery of µC
  - Memory-mapped devices external to µC
AUTOSAR BSW

Complex Device Drivers

- **Task**
  - Offer functionality for complex sensors and actuators

- **Functionality**
  - Direct access to resources for critical applications
  - Examples: Injection control, tire pressure monitoring

![Layer Diagram](image)
Agenda

- AUTOSAR Overview

> AUTOSAR Solution

- AUTOSAR on the way
Designing AUTOSAR SWCs

DaVinci Developer: SWC Design

- Define application architecture of AUTOSAR ECUs
- Integrate the SWC with the ECU basic SW
- Configure the AUTOSAR RTE
Designing AUTOSAR SWCs
DaVinci Developer: Interaction with model-based development tools

- Simulink/EmbedderCoder or TargetLink
  - Develop the behavior model
  - Generate SWC implementation code

SWC description (e.g. ports, runnables) is exchanged via AUTOSAR XML

- DaVinci Developer
  - Define SWC structure
  - Integrate the SWC into the ECU application architecture
  - Configure the RTE
DaVinci Configurator Pro

Configuring Basic Software

- One tool for configuration of complete BSW and RTE
- Comfort Editors and Assistants to support specific use cases
- Basic Editors (GCE) for native ECU-C view
- Easy navigation between editors
## Vector Embedded AUTOSAR Software

### MICROSAR

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<tr>
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<th>SYS</th>
<th>DIAG</th>
<th>MEM</th>
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</table>

### Microcontroller

#### Vector Standard Software

- ADCDRV
- DIDDRV
- FLSDRV
- GPTDRV
- LINDRV
- PORTDRV
- SHEDRV¹

#### 3rd Party Software

- CANDRV
- EEPDRV
- FLSTST
- ICUDRV
- MCUDRV
- PWMDRV
- SPIDRV

1 Available extensions for AUTOSAR

² Includes EXTAEC, EEPACT, FLSEX, and WDGEXT
Workflow AUTOSAR 4.x

**PREEvision**
- Input files provided by OEM
  - Contains communication information, needed for the ECU
- Software Component Description files

**DaVinci Configurator Pro**
- Configuration of RTE + BSW
  - SystemDesc Conversion
    - ECU Extract of System Description
    - Base ECUC Generation
    - ECU Configuration Description
  - Editing and Generation
    - .xml

**DaVinci Developer**
- Embedded Coder
- TargetLink

**Other AUTOSAR tools**
- BSW module configuration header and code files
- RTE header and code files
- SWC header files
Large variety of platforms supported

- Vector cooperates with microcontroller manufacturers to integrate the MCAL (Microcontroller Abstraction Layer) which are provided by them.
- An individual solution for your favored microcontroller is possible at any time.
Agenda

AUTOSAR Overview

AUTOSAR Solution

> AUTOSAR on the way
AUTOSAR is stabilizing with R3.2 and 4.x

AUTOSAR is worldwide in massive series roll-out

High acceptance in the market is achieved

Existing releases will be used over long period of time in many applications

Source: 6th AUTOSAR Open Conference
AUTOSAR - Exploitations

- **SOP of a complete AUTOSAR solution** (BSW + RTE)

|       | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | ...
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</tbody>
</table>

- **AUTOSAR 3.x** is used in serial production projects by:
  - Audi / Volkswagen / Porsche
  - Daimler
  - Fiat / Chrysler
  - Volvo Trucks (incl. Construction Machines)

- **AUTOSAR 4.x** is used in serial production projects by:
  - BMW
  - GM
  - Toyota
  - Volvo Cars

- **AUTOSAR 4.x** is generally announced by
  - Ford
  - PSA
  - ...

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AUTOSAR in VW

Start version MQB

Extensions of MQB

EE - Decision:
New ECU Developments with AUTOSAR only

Source: Explore AUTOSAR Conference in Pune 2012
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)

Source: Explore AUTOSAR Conference in Pune 2012
**MICROSAR 3 for VW Group**

**MQB (technical identical to MLBevo)**

<table>
<thead>
<tr>
<th>E2E Protection</th>
<th>Wrapper</th>
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<tbody>
<tr>
<td>Application</td>
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<tr>
<td>RTE</td>
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### OS
- BSWM
- COMM
- DET
- ECUM
- LIBS
- SCHIM
- WDGIF
- WDGM

### DIAG
- Wrapper
- DEH
- FIM

### MEM
- EA
- FEE
- MEMIF
- NVM

### COM
- COM
- IPDUM
- NM
- PDUR

### CAN
- J1939TP
- CANXCP
- CANTP
- CANNM
- CANSM
- CANIF

### LIN
- LINXCP
- LINTP
- LINSM
- LINIF

### FR
- FRXCP
- FRTP
- FRISOTP
- FRNM
- FRSM
- FRIF

### ETH
- ETHXCP
- SOAD/DOIP
- TCP/IP
- ETHSM
- ETHIF

### V2G
- DNS
- EXI
- HTTP
- JSUS
- SCC
- TLS
- XML Engine
- XML Security

### Complex Driver
- IOHWAB
- KS
- BAP

### MCAL
- ADCDRV
- EEPDRV
- FRDRV
- IIDRV
- PORTDRV
- SPIDRV
- CANTRCV
- FRTRCV
- DRVEXT
- LINTRCV
- ETHTRCV

### Microcontroller

<table>
<thead>
<tr>
<th>Vector Standard Software</th>
<th>3rd Party Software</th>
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<tr>
<td>3rd Party distributed by OEM</td>
<td>Not Used by OEM</td>
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</table>

1 Available extensions for AUTOSAR
2 Includes EXTA, EEPEXT, FLSEX, and WDGEXT
3 Includes E2E, CRC, CAL (CPL)
# BAC 4.0 MICRO SAR Basic-Software for BMW

**Overview**

<table>
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<tr>
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<th>SYSTIME</th>
<th>DARH</th>
<th>Coding</th>
<th>PI A</th>
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**Complex Driver**

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**MCAL**

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**Software**

- **Vector Standard Software**
- **3rd Party Software**
- **BMW BAC 4.x Modules**
- **Not Used by OEM**

1. Available extensions for AUTOSAR
2. Includes EXTADC, EEPEXT, FLSEXT, and WDGEEXT
## MICRO SAR 3 for Daimler SLP10

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</table>
### MCAL
| ADC DRV | EEP DRV | FR DRV | IIC DRV | PORT DRV | SPI DRV | |
| CAN DRV | ETH DRV | GPT DRV | LIN DRV | PWM DRV | WDG DRV | |
| DIODRV | FLSDRV | ICUDRV | MCUDRV | RAM1ST | | |

### EXT
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<th>CAN TRC</th>
<th>FAT TRC</th>
<th>DRV EXT</th>
<th>LIN TRC</th>
<th>ETH TRC</th>
</tr>
</thead>
</table>

### Microcontroller

- **Vector Standard Software**
  - Vector SLP 10
  - 3rd Party Software
  - Daimler SLP 10
  - Not Used

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3 Available extensions for AUTOSAR
2 Includes EXTADC, EEPEXT, FLSXT, and WDGEXT
3 Includes E2E, CRC, CAL (CPL)
Why Vector

History Embedded Software at Vector

- Vector was the first independent vendor of Basic Software
AUTOSAR in China

- Cooperation with Chinese customers from 2009
- FAW, ChangAn, Foton, PATAC, DFM...

Case Study
Developing a driver library for engine controllers with AUTOSAR Complex Device Drivers (CDD)
Thank you for your attention.

For detailed information about Vector and our products please have a look at:

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