About the Presenter

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Local Product Line Manager
Vector GB – Embedded Software Product Line
Vector provides OEMs and suppliers of automotive and related industries a professional and open development platform of tools, software components and services for creating embedded systems.
Vector Application Areas and Product Examples

- **Development of Distributed Systems**
  - PREEvision, Network Designer

- **ECU Software**
  - MICROsAR, CANbedded

- **ECU Testing**
  - CANoe, VT System, Logger

- **Diagnostics**
  - CANdela

- **ECU Calibration**
  - CANape, VX1000, vCDM

- **Process Management and Development**
  - Consulting Services

Vector offers solutions for ... >
## Vector Application Areas and Product Examples

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Vector offers solutions for ... >
PES - we focus on basic software as supplement to the application software of our customers.
AUTOSAR Overview
Development of Functionality

>80% of automotive innovations are based on software


Electronic fuel injection
Cruise control

Airbags
Electronic stability control
Active body control
Adaptive gearbox control
Adaptive cruise control
Emergency call

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

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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 development methods and tools
- Re-use of basic software
AUTOSAR (AUTomotive Open System ARchitecture) is a worldwide development partnership of car manufacturers, suppliers and other companies from the electronics, semiconductor and software industry.

AUTOSAR has the working principle:

“Cooperate on standards, compete on implementation”
AUTOSAR Basic Software
Layered Architecture

Application

RTE

System Services

Memory Services

Communication Services

I/O Services

Onboard Device Abstraction

Memory Hardware Abstraction

Communication Hardware Abstraction

I/O Hardware Abstraction

Microcontroller Drivers

Memory Drivers

Communication Drivers

I/O Drivers

Complex Drivers

Source: www.autosar.org
AUTOSAR: Specifications Then and Now

- Multicore
- Safety Extensions for Watchdog
- Extension for Diagnostics
- Standardized Interface for NVRAM
- Extension ECU State Management
- Introduction Ethernet and TCP/IP (DoIP)
- Debugging Support (AMD)
- Partial Networking
- J1939 Support
- Variant Handling
- ...

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AUTOSAR: Specifications Then and Now

- Usage BSW on different processor cores
- Extension of IP in vehicle communication
- Pretended Networking
- Introducing Variant Points for ECUC
- J1939 dynamic addressing
- ...
AUTOSAR: In an Ideal World

Developing a new car...

- Seat movement
- Window handling
- Light control
- Door locking

...with AUTOSAR
AUTOSAR: In an Ideal World

Functions of the car
- Light control LC
- Seat movement SM
- Window handling WH
- Door locking DL
- ...

Mapping of SWC to ECU
Network communication of the vehicle is specified.

The ECU is configured based on the DBC, FIBEX, LDF file.

ECU 1

Applications

Basic Software (BSW)

ECU n

Applications

Basic Software (BSW)
Future Workflow
With AUTOSAR

SW functionality of the vehicle is defined as a system of SWCs ...

Software Component Description*

An extract is created for each ECU...

Extract of System Description*

... and mapped to ECUs

System Description*

The ECU is configured in detail

ECU Configuration Description (ECUC)*
AUTOSAR Market - Vector’s Evaluation

1. The number of OEMs using AUTOSAR is growing
2. The number of Tier1s using AUTOSAR is growing
3. The AUTOSAR functionality is growing
4. The invest of tool providers to support AUTOSAR is growing
5. Alternative solutions are losing ground

➤ The market is certainly growing – approx. 25% per year
MICROSAR – OEM Solutions
Exploitation of AUTOSAR – Vector’s Evaluation

Degree of AUTOSAR usage is different for different aspects:

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<td>Distribution of application software (SWC) by OEM</td>
<td>Full function oriented development by OEM (~ 2020)</td>
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**Push**: Introduction of new functionalities (Safety, FlexRay, ...)

**Hurdle**: Compatibility to legacy solution (NM, data formats, ...)
AUTOSAR - Exploitations

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

|         | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | ...
|---------|------|------|------|------|------|------|------|------
| AUTOSAR 3.x |      |      |      |      |      |      |      |      
| AUTOSAR 4.x |      |      |      |      |      |      |      |      

- **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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OEMs adopting AUTOSAR

- We have accompanied some OEMs on their journey when introducing AUTOSAR
  - Volvo AB
  - Daimler (Automotive)
  - Audi

- We have published our experiences together with Daimler and Hella, here:

Vector AUTOSAR Solution
Vector AUTOSAR Tool Chain

Logical & Software Architecture Design
  - PREEvision

Development of Application Software
  - Virtual Integration Platform

Logical Software Design
  - DaVinci Developer

RTU Configuration
  - RTE Configuration
  - BSW Configuration

DaVinci Configurator Pro

Basic Software (BSW)
  - RTE
  - AUTOSAR ECU

Virtual Integration Platform

ECU Monitoring and Debugging
  - CANape

Calibration
  - CANape

ECU-/System-Test
  - CANoe

Virtual Integration Platform

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System design of vehicles or ECUs
- Software components
- Network communication
- Mapping
- Supports also various architecture levels beyond AUTOSAR
Vector AUTOSAR Solution
DaVinci Developer

- Creation of SWC descriptions with graphical or table-based editors
- Definition of SWC internal behavior (runnable entities)
- Consistency check of the SWCs
Vector AUTOSAR Solution

DaVinci Configurator Pro

- Creation of ECU configurations
  - MICROSOAR BSW and RTE
  - Third party BSW (MCALs)
- Specific editors for each BSW domain
- Validation of ECU configuration
- Generation of configurable part of BSW and RTE
AUTOSAR: In the Real World

Functions of the car
- Light control LC
- Seat movement SM
- Window handling WH
- Door locking DL
- ...

Mapping of SWC to ECU

SYSTEM
- PREEvision

ECU
- DaVinci Developer
- DaVinci Configurator Pro
- MICROSAR BSW
PES Services Overview
Scalable Services

- Training, Installation, Support, Reviews
  - CANbedded, MICROSAR

- Coaching
  - CANbedded, MICROSAR

- Workshops, Concepts
  - CANbedded, MICROSAR

- Extended Integration Package
  - CANbedded, MICROSAR

- System Functions and Software Integration
  - CANbedded, MICROSAR

- Complete ECU Software
  - CANbedded, MICROSAR

- Customer specific projects

- Embedded Standard Software
- Product Services
- Technical Consulting
- Engineering Services
Characteristics of MICROSAR

Quality

- **SPICE**
  - Development for PES products conforming to Automotive SPICE and ISO/IEC 15504

- **ISO 26262**
  - Development for selected PES products conforming to ISO26262

- **CMMI**
  - Development of customer-specific ECU software based on the Capability Maturity Model Integration (CMMI)

- **ISO 9001:2008**
  - Worldwide for all subsidiaries
AUTOSAR Market - Vector’s Evaluation

- The complexity will continue to rise in the coming years
- Focus is moving from the ECU to features/functions
- Each OEM has different strategy for AUTOSAR migration
  - Considering schedule, feature set and cost vs. benefit
- Each Tier-1 has its own migration strategy
  - Driven by the OEM, or their own strategy

AUTOSAR is not the problem, it is the solution!

The complexity is there already...
now the tools and Basic Software, have to manage it
Thank you for your attention

Any Questions Please?

For further information about Vector and our products please visit:

www.vector.com

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Further Reading...

**AUTOSAR Specifications:**
www.autosar.org
Information only, free-of-charge

**E-Learning:**
www.vector.com/vl_autosar_introduction_portal_en.html
3 hours, free-of-charge

**Webinars:**
www.vector.com/vi_webinars_en.html
Durations vary, free-of-charge

**Training:**
www.vector.com/vi_class_autosar_en.html?loc=GER
AUTOSAR Fundamentals – 1 day
AUTOSAR In Practice – 3 days
MICROSAR Safe – 1 day
*Please ask for a quote*