Classic & Adaptive AUTOSAR Modeling with PREEvision

Vector TechNight – October 2019
<table>
<thead>
<tr>
<th></th>
<th>Brief Overview of PREEvision</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>AUTOSAR Modeling Workflow – Classic &amp; Adaptive</td>
</tr>
<tr>
<td>3.</td>
<td>PREEvision Modeling Examples</td>
</tr>
<tr>
<td>4.</td>
<td>Additional Q&amp;A</td>
</tr>
</tbody>
</table>
## Application Areas and Product Examples

<table>
<thead>
<tr>
<th>Development of Distributed Systems</th>
<th>PREEvision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Embedded Software and Systems</strong></td>
<td></td>
</tr>
<tr>
<td>MICROSAR, CANbedded, VC ECU, Customer Projects</td>
<td></td>
</tr>
<tr>
<td><strong>Testing</strong></td>
<td></td>
</tr>
<tr>
<td>CANoe, CANalyzer, vTESTstudio, VT System, Logger, VectorCAST</td>
<td></td>
</tr>
<tr>
<td><strong>Diagnostics</strong></td>
<td></td>
</tr>
<tr>
<td>CANdelaStudio, Indigo, vFlash, DiVa</td>
<td></td>
</tr>
<tr>
<td><strong>ECU Calibration</strong></td>
<td></td>
</tr>
<tr>
<td>CANape, VX1000, vCDM, vADASdeveloper, ASAP2 Tool-Set</td>
<td></td>
</tr>
<tr>
<td><strong>Measurement Technology</strong></td>
<td></td>
</tr>
<tr>
<td>vMeasure exp, vSignalizer, vMDM, MDF4 Lib, Analog Measurement Devices</td>
<td></td>
</tr>
<tr>
<td><strong>Consulting</strong></td>
<td></td>
</tr>
<tr>
<td>Consulting Services, Engineering Services</td>
<td></td>
</tr>
</tbody>
</table>
The complete Vector AUTOSAR Tool Chain

System Design
- Architecture and Communication Design: PREEvision
- Diagnostics Design: CANdelaStudio

Application Software Development
- SWC Design: PREEvision
  - DaVinci Developer
- SWC Execution and Test: vVIRTUALtarget pro

ECU SW Integration
- BSW/RTE Configuration: DaVinci Configurator Pro
- Virtual Integration: vVIRTUALtarget basic

System Verification
- ECU Calibration: CANape
- Verification of Network Communication and Diagnostic Behavior: CANoe & CANoe.DiVa

Application Software Verification
- SWC Verification within Real ECU: CANoe & VT System
- SWC Verification in Virtual Environment: vVIRTUALtarget pro

ECU SW Verification
- ECU Monitoring and Debugging: CANoe.AMD/XCP
From a Fragmented Tool Landscape to an Integrated Solution

Approach to meet the challenges in the E/E Development

Tool Landscape Situation:
Multiple Tools and Interfaces

Integrated Tool Approach:
PREEvision E/E Engineering Environment
Overview

PREEvision: Model-Based Systems Engineering

- Requirements
- Logical Function Architecture
- Software/Service Architecture
- Hardware Architecture
- Wiring Harness
- Communication
- Tests
- Changes, Defects & Releases
- Functional Safety

Simple GUI – Single Client

Automation, Reports, Imports/Exports
Supported Use Cases

- Architecture Design
- Function Driven Design System Design
- Requirements Engineering and Requirements Management
- AUTOSAR System, Service and Software Design
- Communication Design (AUTOSAR and Legacy Formats)
- Network & Hardware Component Development
- Wiring Harness Design
- Test Engineering and Test Management
- Change and Release Management
- Design of Safety Relevant Systems
- E/E Backbone, Collaboration Platform, File Management
- Variant Management and Product Line Engineering

Integrated E/E Development with PREEvision
AUTOSAR System and Software Design

- AUTOSAR Classic Support
- AUTOSAR Adaptive Support
- System Design
- Service Design
- Software Design
- Hardware Network Design
- Software/Hardware Mapping
- Software Library Layer and Software Architecture Layer available
- UML/SysML Diagrams
- AUTOSAR Classic Import and Export
- AUTOSAR Adaptive Import and Export
AUTOSAR System, Service and Software Design

**Task:**
- Specification of software components, ports and interfaces, as well as their connections to each other
- Creation of a service oriented architecture, modeling of services, e.g. for Ethernet

**Corresponding layers of the PREEvision data model:**
Major Automotive Topics

Connectivity

Electrification

Automated Driving

Required Enablers

Connectivity

Offboard Eco Systems

Supercomputers On Board
Automotive Trends

Cloud / Backend
- support of high performance processors
- high bandwidth
- service based architectures
- open source, agile development
- dynamic and updatable
- internet

Embedded Systems
- safe
- secure
- embedded integration and debugging
- automotive supply chain
- automotive communication protocols
- automotive diagnostics

AUTOSAR Classic
Adaptive – best of two worlds

**Cloud / Backend**
- system and mobility strategies
- deep learning

**On board Supercomputers**
- multipurpose computing servers
- connectivity, gateways, HMI
- automated driving

**Responsibility of the OEM**

**AUTOSAR Adaptive**
- safe
- secure
- embedded integration and debugging
- automotive supply chain
- automotive communication protocols
- automotive diagnostics

**AUTOSAR Classic**
- high bandwidth
- service based architectures
- open source, agile development
- dynamic and updatable
- internet

**Adaptive AUTOSAR**

**Cloud / Backend**
- system and mobility strategies
- deep learning

**On board Supercomputers**
- multipurpose computing servers
- connectivity, gateways, HMI
- automated driving

**Responsibility of the OEM**

**AUTOSAR Adaptive**
- safe
- secure
- embedded integration and debugging
- automotive supply chain
- automotive communication protocols
- automotive diagnostics

**AUTOSAR Classic**
- high bandwidth
- service based architectures
- open source, agile development
- dynamic and updatable
- internet
3 types of ECUs:

1. **Sensor and Actuator ECUs**
   - commodity ECUs
   - basic functionality

2. **Integration ECUs**
   - per domain or per zone
   - lean or rich functionality

3. **Vehicle Brain**
   - high performance computers based on SoCs
   - secure IT-like software acc. ISO 26262
   - focus of functional innovation
   - linked to the cloud
Future ECU Types and Usage of AUTOSAR

3 types of ECUs:

1. Sensor and Actuator ECUs
   - commodity ECUs
   - basic functionality
   ➔ Classic AUTOSAR

2. Integration ECUs
   - zone oriented
   - lean or rich functionality
   ➔ Classic & Adaptive AUTOSAR

3. Vehicle Brain
   - high performance computers based on SoCs
   - secure IT-like software acc. ISO 26262
   - focus of functional innovation
   - linked to the cloud
   ➔ Adaptive AUTOSAR
   (supported by Classic for fail-operational)

- C
- static
- monolithic / top-down
- model-based
- configuration at compile time

➔ maximal efficiency

- C++
- dynamic
- modular / parallel
- model-based and software-based
- configuration at runtime

➔ maximal flexibility

interoperability!
Design Workflow for Signal-oriented Architectures in AUTOSAR Classic

- Software Architecture
- Hardware Architecture

*CAN, CAN FD, J1939
Design Workflow for Service-oriented Architectures in AUTOSAR Classic

- **Software Architecture**

- **Hardware Architecture**
Support of AUTOSAR Classic 4.3.0

<table>
<thead>
<tr>
<th>Format</th>
<th>Use Case</th>
<th>AUTOSAR version supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Description</td>
<td>Import Export Update</td>
<td>3.2.2 (only import), 4.0.3, 4.1.1, 4.2.1, 4.2.2, 4.3.0</td>
</tr>
<tr>
<td>ECU Extract</td>
<td>Export</td>
<td>4.0.3, 4.1.1, 4.2.1, 4.2.2, 4.3.0</td>
</tr>
<tr>
<td>ECU System Extract</td>
<td>Export</td>
<td>4.0.3, 4.1.1, 4.2.1, 4.2.2, 4.3.0</td>
</tr>
<tr>
<td>Software Component Description</td>
<td>Update</td>
<td>4.0.3, 4.1.1, 4.2.1, 4.2.2, 4.3.0</td>
</tr>
</tbody>
</table>

Support of new and updated Concepts of AUTOSAR Classic 4.3.0:
- Update Global Time Synchronization
- Update Ethernet
- Update End To End Protection
- Update SOMEIP Transformation
- Update Security
- Update Coupling Port
- Introduction of SOME IP Transport Protocol
- Introduction PDU Replication
Design Workflow for Service-oriented Architectures in AUTOSAR Adaptive
# Supported AUTOSAR Adaptive Formats and Versions

<table>
<thead>
<tr>
<th>Format</th>
<th>Use Case</th>
<th>AUTOSAR version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Interface Description</td>
<td>Import/Export</td>
<td>17-10</td>
</tr>
<tr>
<td>Application Manifest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine Manifest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Instance Manifest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Custom</td>
<td>Export</td>
<td></td>
</tr>
</tbody>
</table>
**Supported Concepts**

<table>
<thead>
<tr>
<th>Supported Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Interface</td>
</tr>
<tr>
<td>Adaptive data types (Vector, AssMap, String)</td>
</tr>
<tr>
<td>SOME/IP deployment</td>
</tr>
<tr>
<td>SOME/IP serialization</td>
</tr>
<tr>
<td>Adaptive Application SW Component Type</td>
</tr>
<tr>
<td>Adaptive Application</td>
</tr>
<tr>
<td>Executable</td>
</tr>
<tr>
<td>Process</td>
</tr>
<tr>
<td>Startup configuration</td>
</tr>
<tr>
<td>Machine</td>
</tr>
<tr>
<td>Service Instance</td>
</tr>
<tr>
<td>Service discovery</td>
</tr>
<tr>
<td>System Design*</td>
</tr>
</tbody>
</table>

* partially supported
AUTOSAR Adaptive

- Support for AR 19-03 (Schema)
- Modeling of mixed Systems (AUTOSAR Classic and Adaptive)
  - Software, hardware and communication
- Modeling of High Performance Computers
- Modeling and Export of internal communication over SPI/IPC
For more information about Vector and our products please visit

www.vector.com

Authors:
Scott Stevens, Raymon Abdelmassih
Vector North America