AUTOSAR METHODOLOGY @BMW.
OVERVIEW.

1. AUTOSAR Versions and Roadmap
2. Configuration Process until Generation 2015
3. Vision Generation 2021 and Current Status Generation 2018
4. Tool Architecture
5. Tool Development
6. ECU Configuration Flow
7. AUTOSAR Tool Requirements for the Future
PLATFORM SOFTWARE ROADMAP GENERATIONS 2008 UNTIL 2021. VERSION OVERVIEW.

DELIVERY AS EXAMPLE

AUTOSAR 1.0/2.0

BAC2/3 Generation 2011

SC6 Generation 2008

AUTOSAR 2.1/3.0

AUTOSAR 4.0

Introduction of AIDA-Symphony

BAC4 Rel. 1 Generation 2018

BAC4 Rel. 2 Generation 2015

BAC4 Rel. 3 Generation 2021

Adaptive AUTOSAR 1.0

AUTOSAR 4.2

Delivery as series production code

In use until ~ 2022

In use until ~ 2025

In use until ~ 2029

In use until ~ 2032

In use until ~ 2035

One platform SW architecture for all electronic control units.

AUTOSAR Methodology at BMW
AIDA SYMPHONY ROADMAP. ECU CONFIGURATION PROCESS GENERATION 2015.

Current Status:
- Different Tools generate AUTOSAR configuration files.
- The ECU Integrator has to merge and add missing parameters.

Experiences
- 3-8 Weeks per export needed, until mapping correct and tested (empirical determined).
- Risk of remaining consistency errors high
- Late changes in on board network are not feasible due to manual D2SMapping
- Diagnostic Configuration errors found 2 weeks after first integration
AIDA SYMPHONY ROADMAP. EXAMPLE SYSTEM FUNCTION PARAMETERS.

32 system function components with 1200 parameters can lead up to 30000 configurations per ECU.

Example DSC: 320 Parameter (static configuration) can lead to approx. 400 different configurations.

480 Parameter (dynamic configuration) can lead to approx. 29.400 different configurations.

Manual work at supplier site led to a lot of different errors.

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<th>Automotive Security</th>
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Sys. Function Components with the number of configuration parameters:

- Manual work at supplier site led to a lot of different errors.
Vision for 2021
BMW provides the BMW System Software (BMW specific parts of the BAC architecture) and for integration ECUs domain specific customer function Software Components. In addition BMW delivers an ECU-specific configuration, which is based on all information BMW knows, and will partially fill the final configuration of the ECU. The partial configuration will be verified, continuously exported and support best the continuous integration approach.

Goal 2015 for Symphony in Generation 2018
BMW provides for diagnostic at least 60% of the configuration parameters and for the remaining system functions 20% in an AUTOSAR tool readable xml file. The communication stack will be configured up to 70%. Integration ECUs will get the Software Component Descriptions for the application components delivered by BMW and partly the configuration of the RTE.
AIDA SYMPHONY ROADMAP.
WHICH FILE CONFIGURES WHICH MODULE IN AUTOSAR 4.2.2
AIDA SYMPHONY ROADMAP.
ECU CONFIGURATION PROCESS FOR GENERATION 2018

Target generation 2018 for newly developed ECUs
The ECU Integrator receives two ECU specific configuration files from BMW.

Goal with AIDA Symphony
- Daily export with consistency checked possible.
- Risk of remaining consistency errors low
- Late changes in on-board network are possible
- Diagnostic configuration 1st time right
AIDA SYMPHONY WORKFLOW. ECLIPSE DEVELOPMENT ENVIRONMENT AND TOOLS.

Fibex Import

Fibex Import

Fibex Model → Ecore-Model

Coding is similar to fibex import.

Internal Model

Internal data model

Magic Draw

Internal data model output

Ecore-Model

Development Environment

Git

Gerrit

Jira

Jenkins

Symphony Eclipse Development

EMF + Sphinx

MWE 2

generate java classes

Junit

IncQuery

Log4J

Artop

Xtend

Eclipse Project

Sphinx

Mylyn: Eclipse Feature to interconnect to tickets systems like JIRA.

JUnit: Test Framework for Java Units.

IncQuery: Framework to describe complex queries to EMF models.


Artop: Sphinx based framework to use AUTOSAR models.

Xtend: Extension of JAVA programming language especially to develop model transformations.

Xtext: Framework to develop applications based on own text based languages.

Sphinx: Extension of EMF (Eclipse Modeling Framework) to use models in own applications.

MWE2: Framework to program Workflows.
AIDA SYMPHONY WORKFLOW.
TOOL DEVELOPMENT WORKFLOW.

Jenkins
Gerrit (Commit branch)
Gerrit (master)

Developer
fetch
developer partial unit tests
Code change
Tests passed

Development
Commit
Check out
Status o.k.

Tests passed
Code reviews
Tests passed
Code reviews passed
Merge

Production

Tests
Tests passed
Final Testing passed

Tests
Tests passed
Integration tests (Golden Reference)

Tests passed

Automatic Test Execution

Slave Development Trunk

Master Development Trunk
AIDA SYMPHONY WORKFLOW. 
EXAMPLE ECU CONFIGURATION WORKFLOW.

1. Fill input data bases
2. Choose corresponding input versions of input data bases
3. Generate export
4. Check warnings or errors and change input database until valid export possible
5. Import artefacts with your AUTOSAR Tooling
6. Complete configuration
7. Start AUTOSAR and BMW generators
AIDA SYMPHONY WORKFLOW.
HOW IS THE ECU CONFIGURATION AND SW BUILT MANAGED IN THE PROJECT?

1. AIDA Symphony delivers ECU System Description and ECUCs for an ECU Project
2. The integrator imports the partially filled ECUCs provided by AIDA Symphony to the AUTOSAR Tool
3. Integrator completes the ECUC configuration
4. Integrator generates the BSW and BMW System Function modules (BAC4).
5. ECU System Description Files are imported to the RTE Generator
6. RTE is generated
7. Software is compiled and linked

Description on next page.
AUTOSAR Tooling related issues:

1. Removed ECUC values may not be removed in the AUTOSAR Tooling.
2. Changed ECUC values may not be correctly updated in AUTOSAR Tooling.
3. Some parameters are reset to default when the ECU System Description is imported.
4. Top-level shall be processed correctly (SystemTemplate Chapter 10, the standard approach)

Integrator related task (Can not be automated except by specific project rule sets):

1. BMW provides a partially filled ECU configuration
   - Sometimes the integrator has to extend the provided configuration with the project/ HW specific content.
   - Examples are: Runnable to OS Task mapping, diagnostic debouncing information, BSW main cycle times, etc.
AIDA SYMPHONY ROADMAP.
FUTURE REQUIREMENTS ON AUTOSAR TOOLING AND SPECIFICATION.

AUTOSAR Tooling

- AUTOSAR Tool Chain shall be run-able on Linux.
- Full tool functionality shall be controllable by command line.
- 1st and 2nd Tier Suppliers to support completely integrated tool flow to enable real continuous integration.

AUTOSAR Specification

- Usage of Diagnostic Extract Template, released in AUTOSAR 4.2.2 would reduce the pre-configuration of diagnostic modules by 40% compared to today’s approach of BMW.
  - Upstream Mapping rules between the BSW Parameters and the M2 Parameters need to be completed in the next Release of the AUTOSAR Standard.