Bernd Jäger, 28th September 2016
9th AUTOSAR Open Conference, Gothenburg

AUTOSAR METHODOLOGY @BMW.

BMW GROUP

Rolls-Royce Motor Cars Limited

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

Delivery as series production code

AUTOSAR 1.0/2.0

AUTOSAR 2.1/3.0

AUTOSAR 4.0

AUTOSAR 4.2

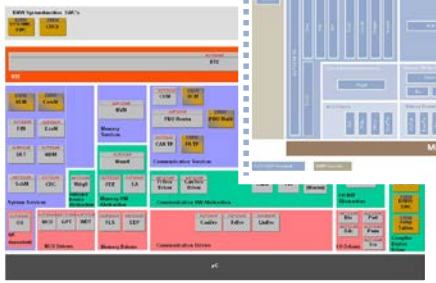
Adaptive AUTOSAR 1.0

Introduction of AIDA-Symphony

SC6
Generation 2008

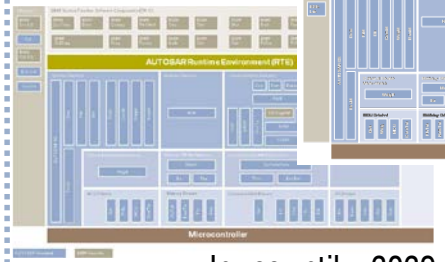
In use until ~ 2022

BAC2/3
Generation 2011



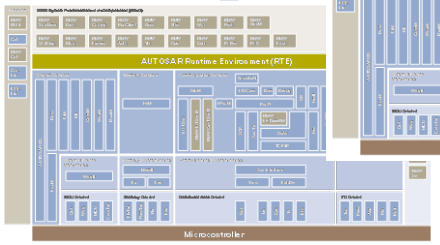
In use until ~ 2025

BAC4 Rel. 1
Generation 2015



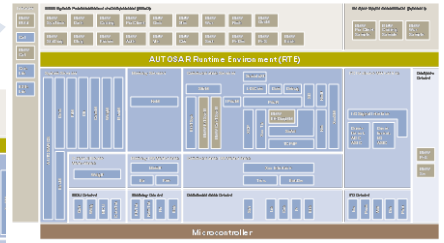
In use until ~ 2029

BAC4 Rel. 2
Generation 2018

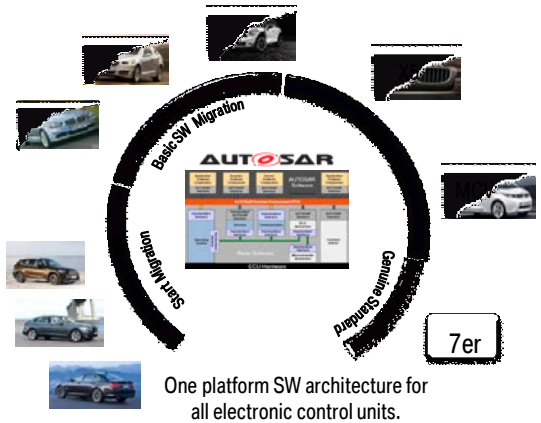


In use until ~ 2032

BAC4 Rel. 3
Generation 2021

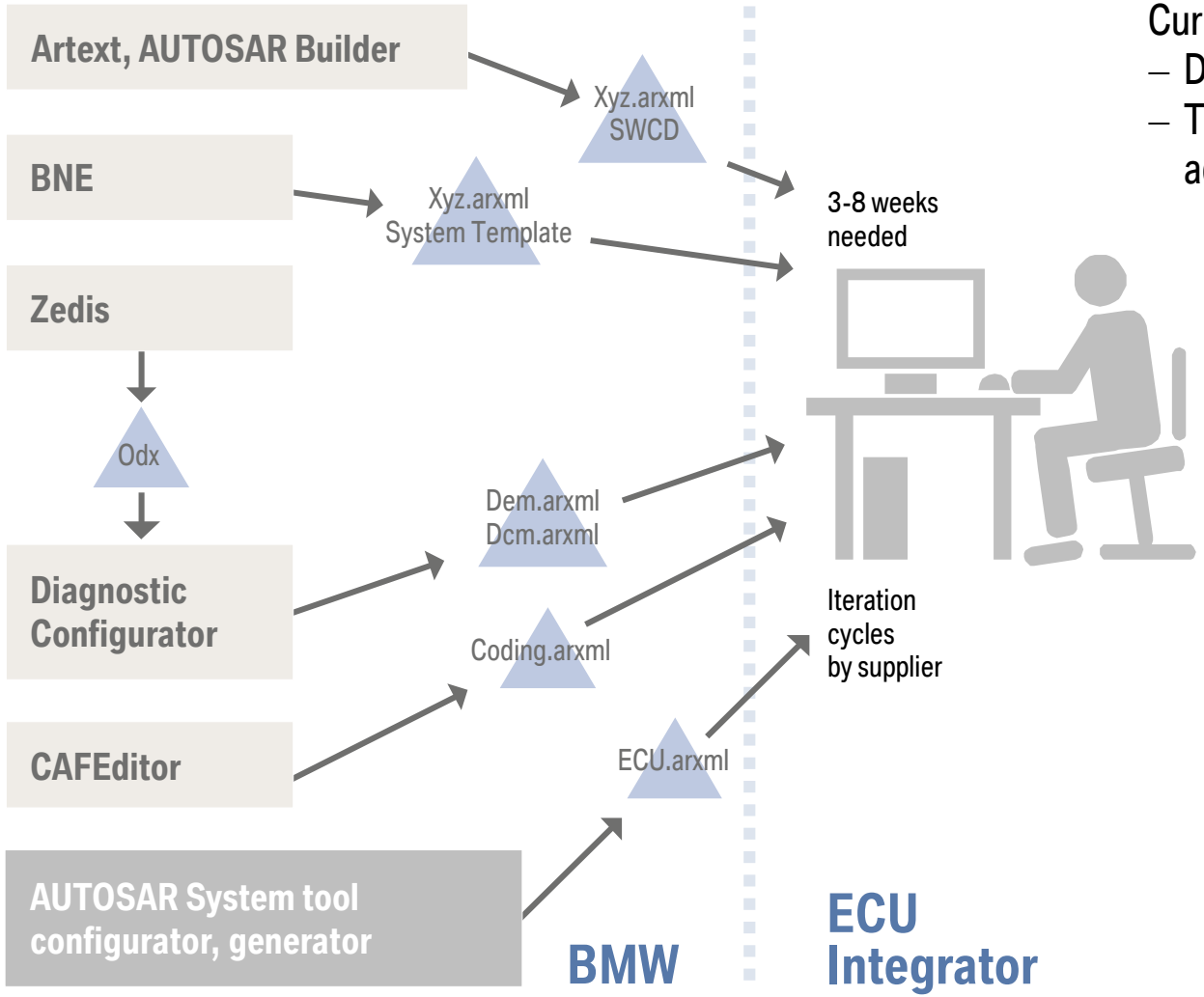


In use until ~ 2035



One platform SW architecture for all electronic control units.

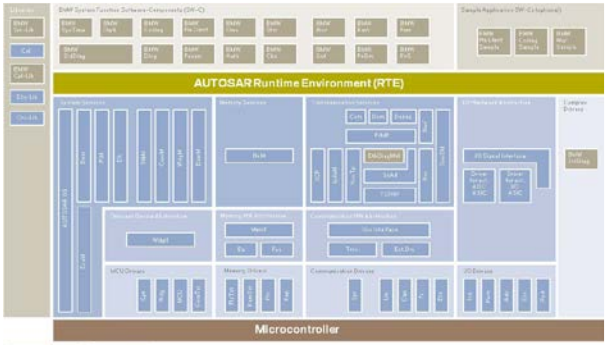
AIDA SYMPHONY ROADMAP.
ECU CONFIGURATION PROCESS GENERATION 2015.



Current Status:

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

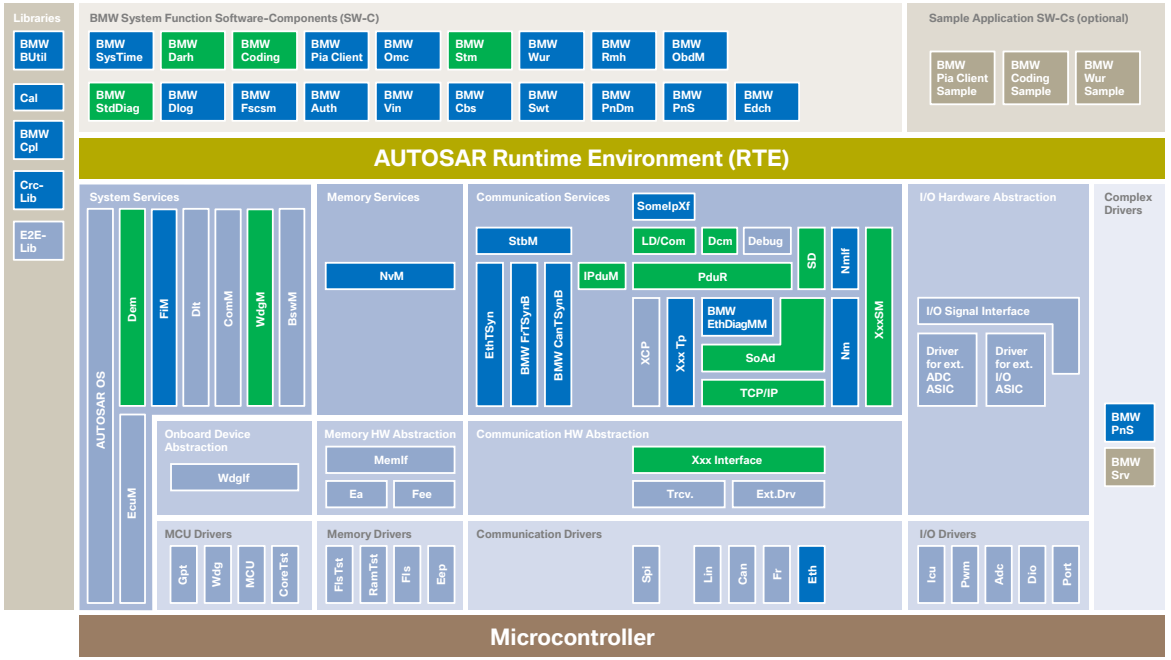
Generation 2015



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.



Sys. Function Components with the number of configuration parameters:

Diagnose		Programmierung		Automotive Security		Sonstige	
DCM	297	Blu	36	Auth	36	Dlog	102
DEM	174	Bm	11	Swt	47	EthDiagMM	45
ObdM	32	Cpl	107	StbMB	12	Fnm	11
Edch	28	Fscsm	45	StbP	16	PiaClient	20
Darh	12	Nrv	6			Coding	32
StdDiag	12	Prog	28			PnDm	34
						PnS	16
						PnDm	34
						Additional	70

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.**

AIDA SYMPHONY ROADMAP. VISION 2021.

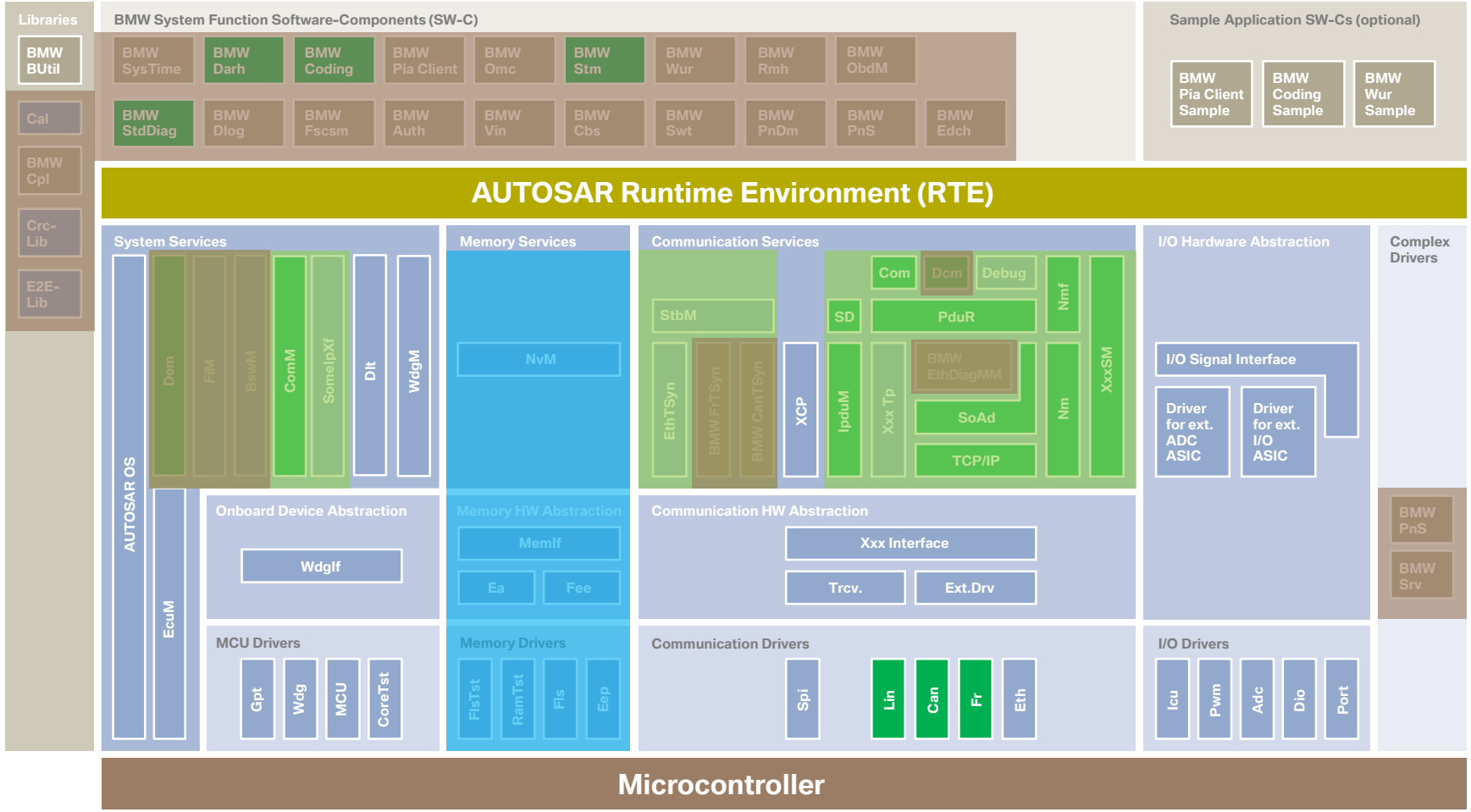
Vision for 2021

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



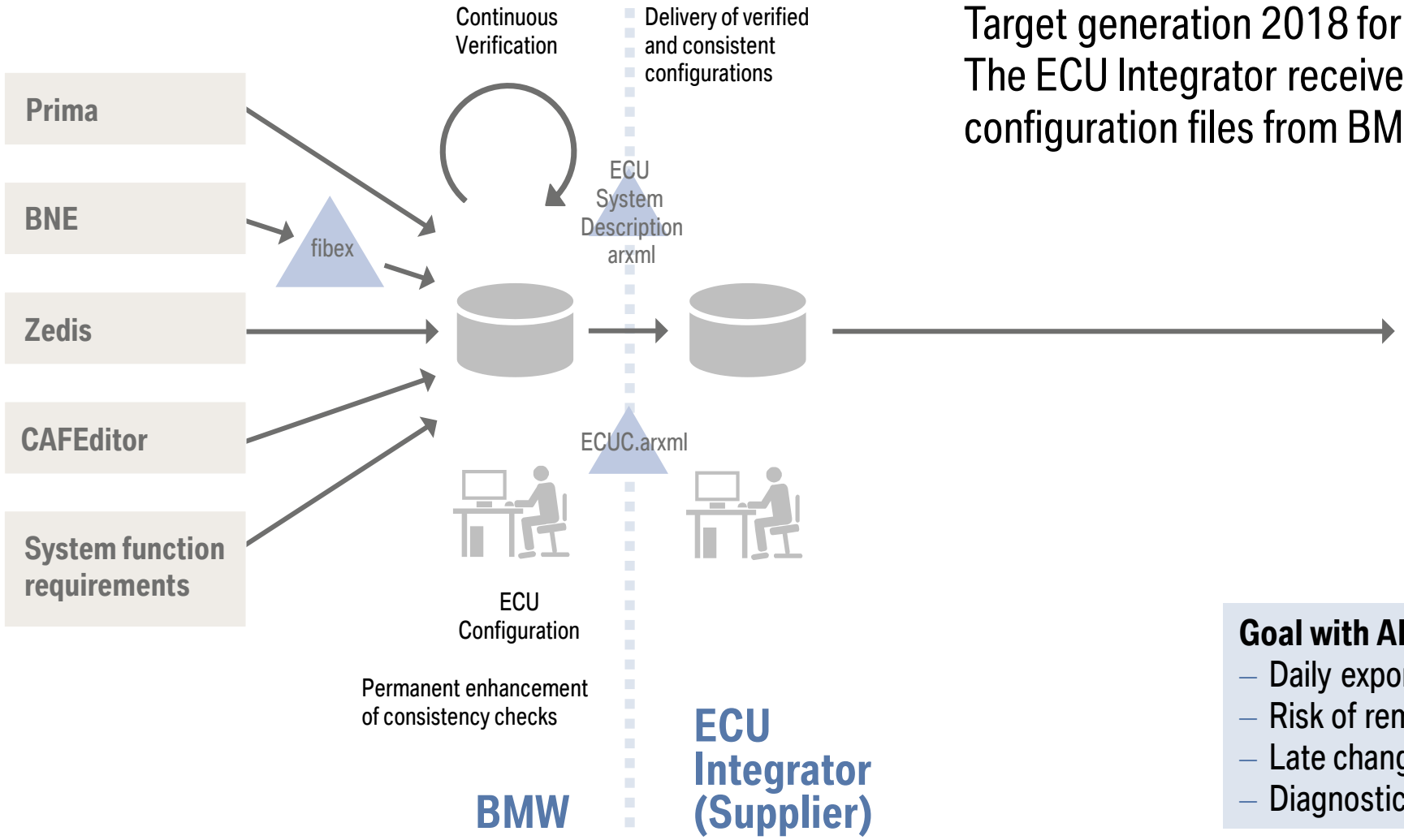
AUTOSAR Standard | BMW Specific | Configured in SP2018

Configured by ECU System Description

Configured by ECU Configuration (ECUC)

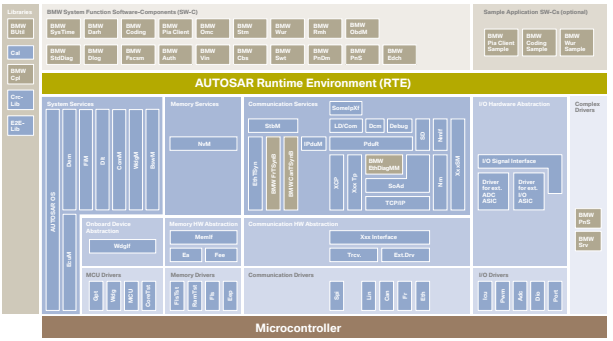
Configured with Service Needs

AIDA SYMPHONY ROADMAP.
ECU CONFIGURATION PROCESS FOR GENERATION 2018



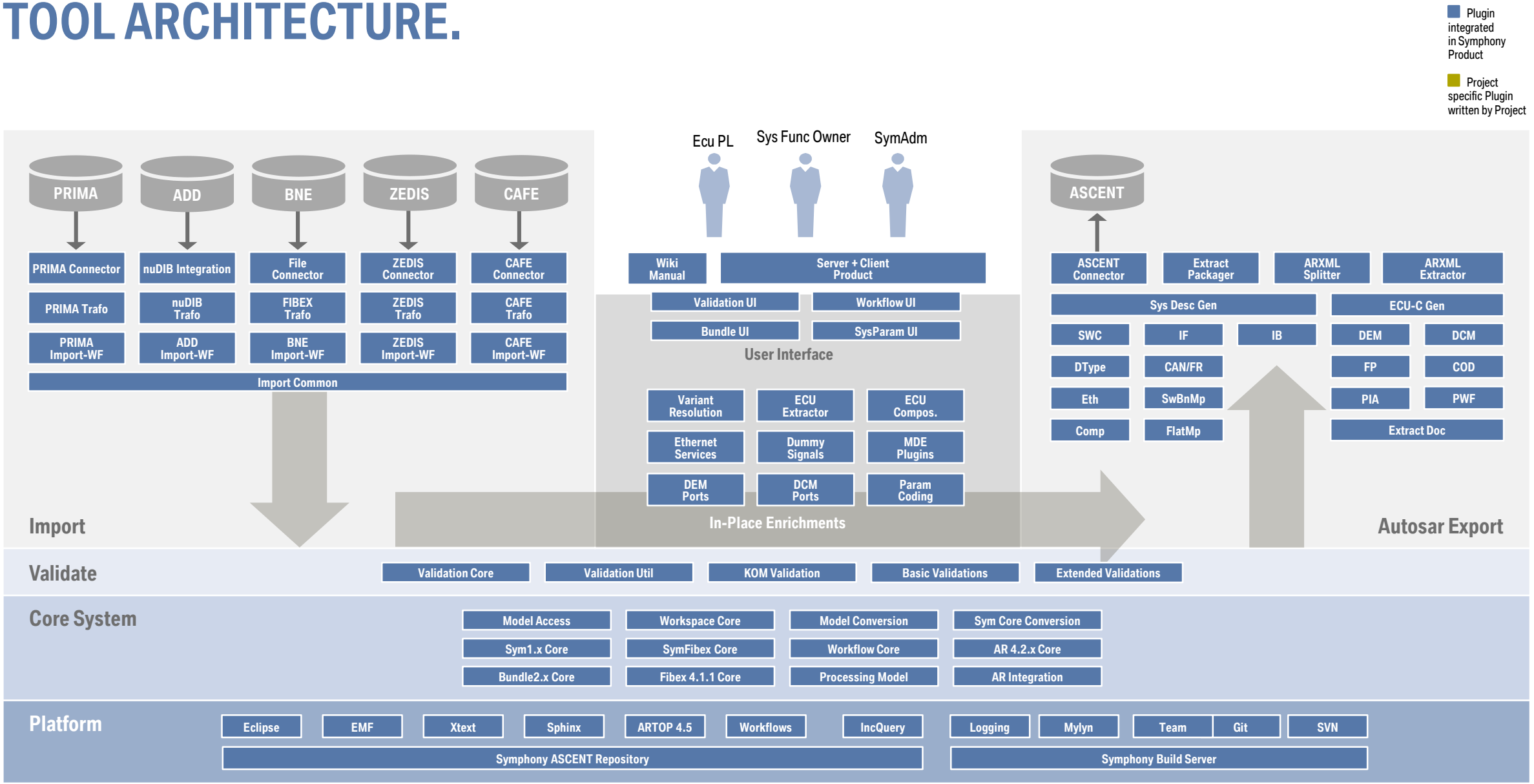
Target generation 2018 for newly developed ECUs
The ECU Integrator receives **two** ECU specific configuration files from BMW.

Generation 2018

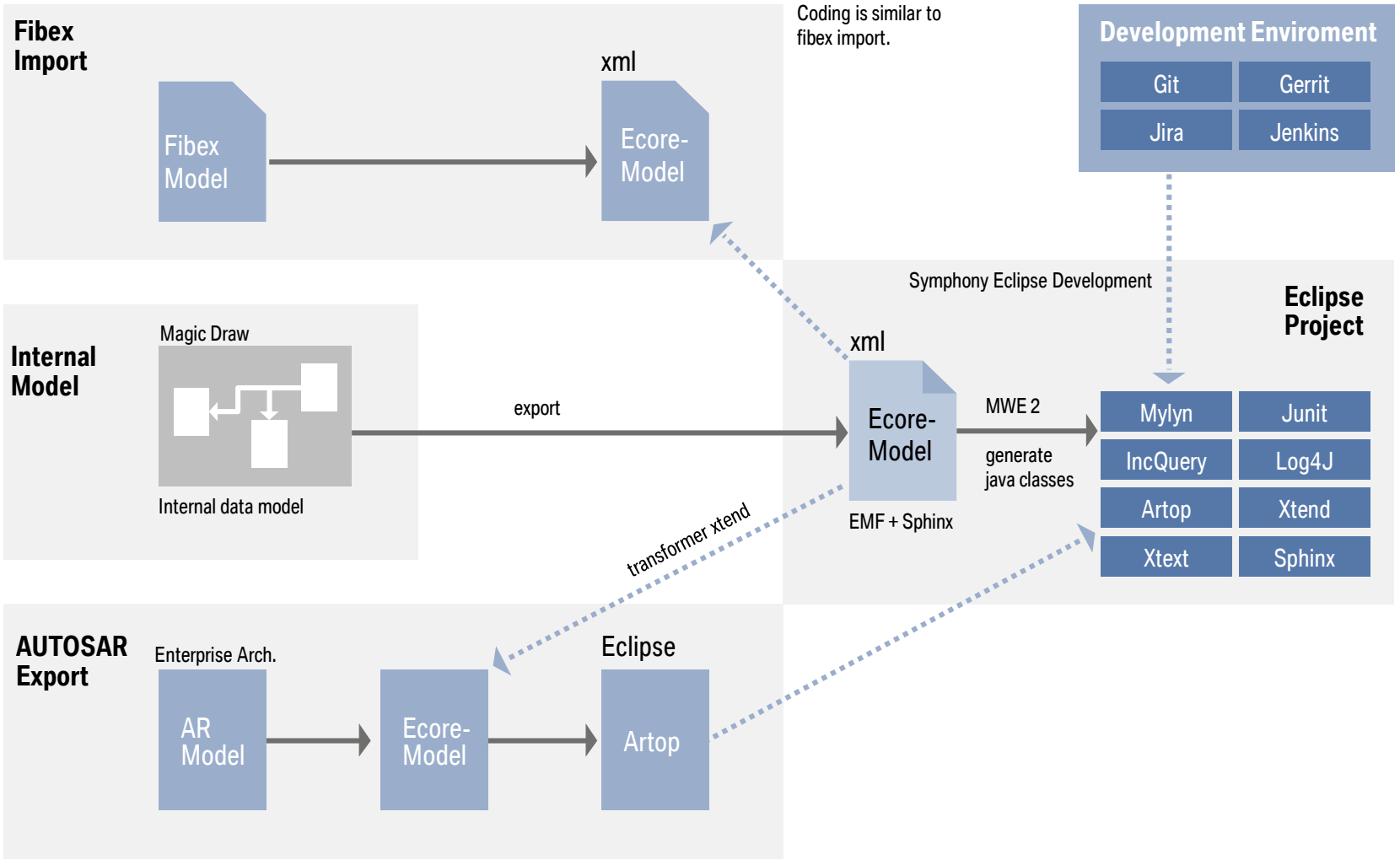


Goal with AIDA Symphony
- Daily export with consistency checked possible.
- Risk of remaining consistency errors low
- Late changes in on-board network are possible
- Diagnostic configuration 1st time right

AIDA SYMPHONY ROADMAP. TOOL ARCHITECTURE.



AIDA SYMPHONY WORKFLOW.
ECLIPSE DEVELOPMENT ENVIRONMENT AND TOOLS.



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

Junit: Test Framework for Java Units.

IncQuery: Framework to decscribe complex queries to EMF models.

Log4J: Standard Logging Framework in Java Environment.

ARTOP: Sphinx based framework to use AUTOSAR models.

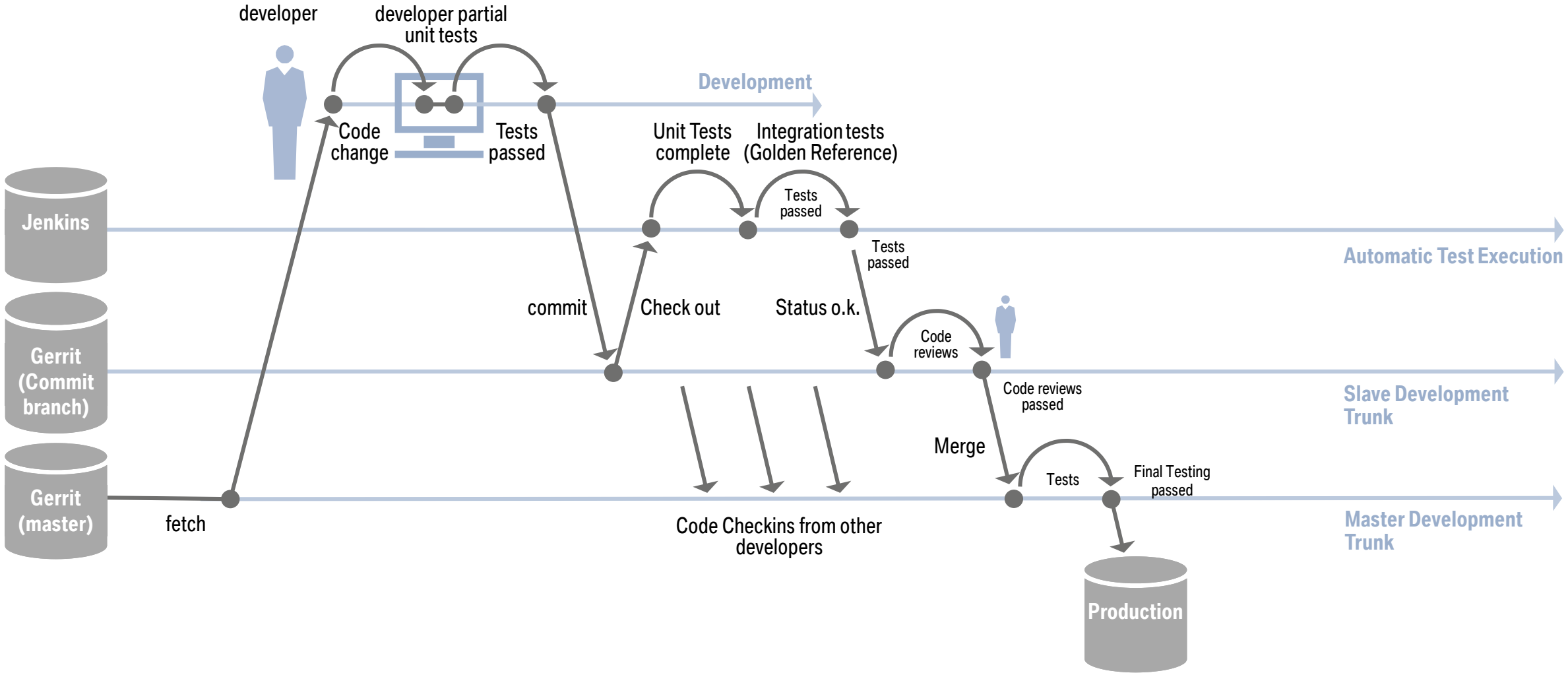
Xtend: Extension of JAVA programming language especially to develop model transformations.

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

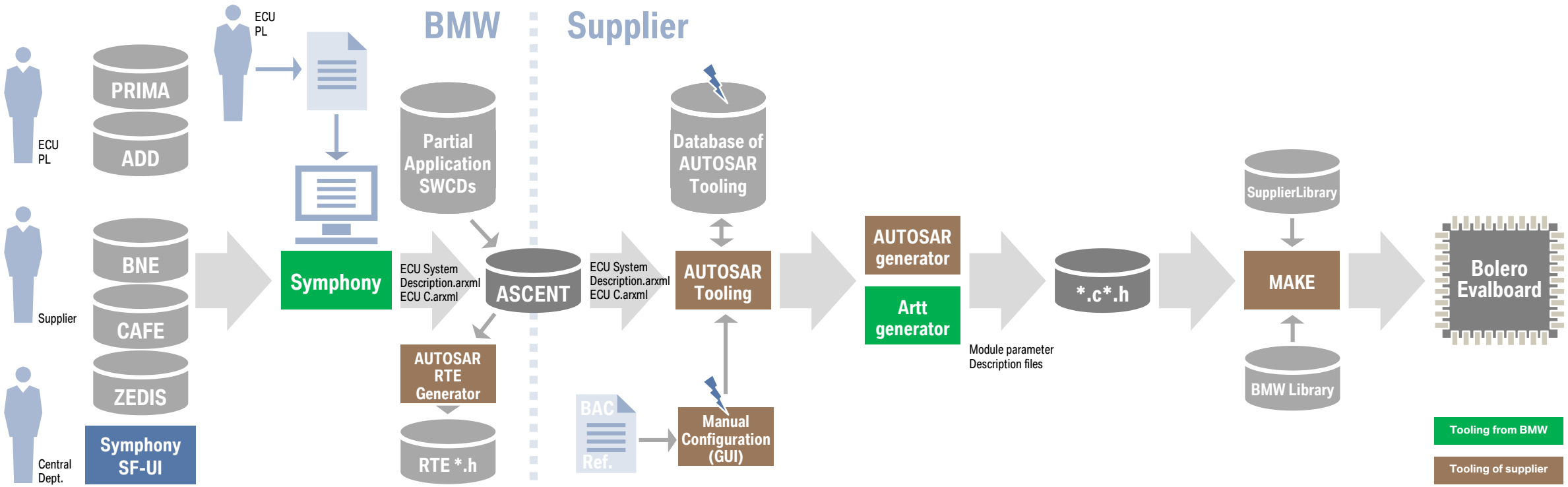
Sphinx: Extension of EMF (Eclipse Modeling Framework) to use models in own applications.

MWE2: Framework to program Workflows.

AIDA SYMPHONY WORKFLOW.
TOOL DEVELOPMENT WORKFLOW.



AIDA SYMPHONY WORKFLOW.
EXAMPLE ECU CONFIGURATION WORKFLOW.



1. Fill Input data bases

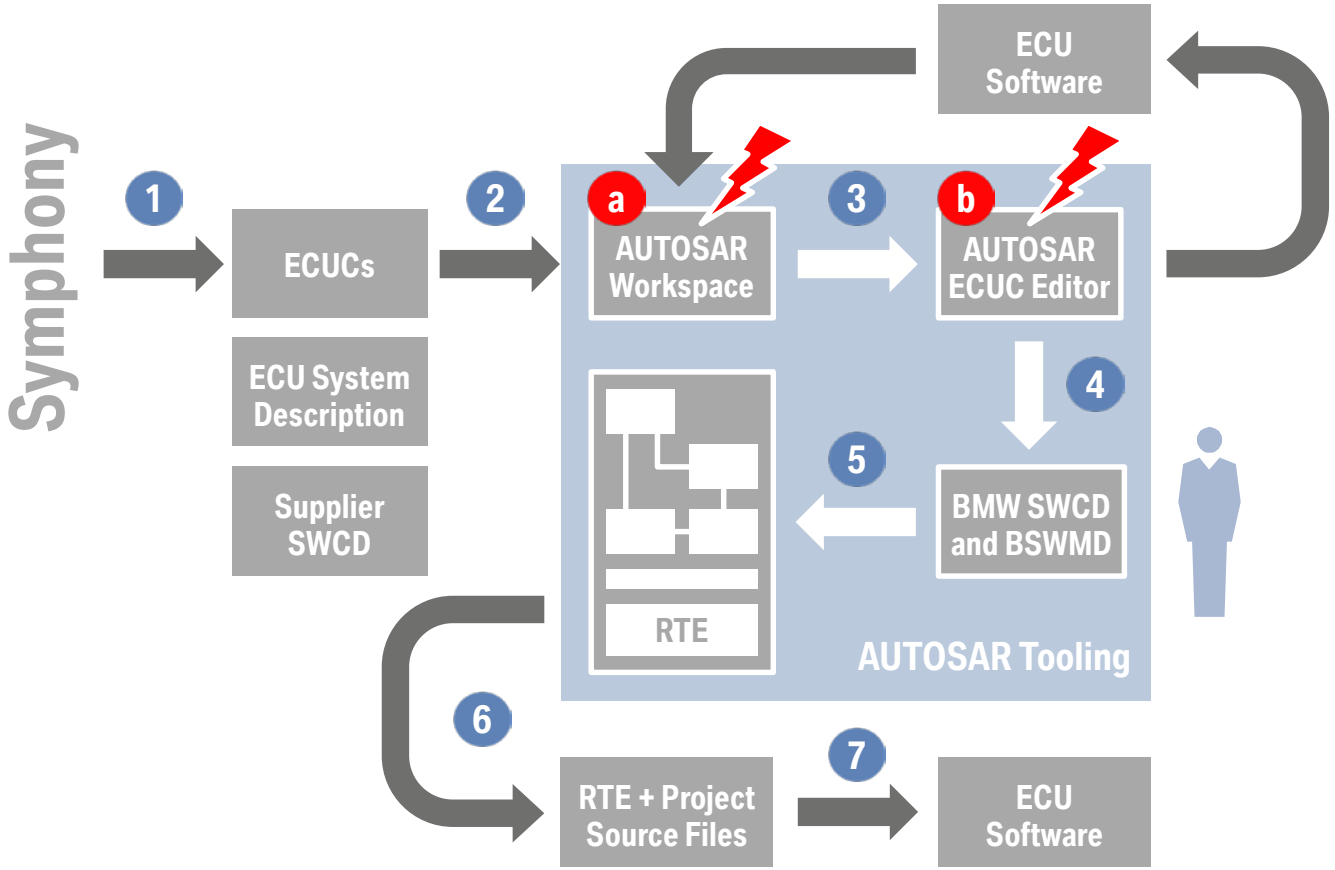
2. Choose corresponding input versions of Input data bases
3. Generate export
4. Check warnings or errors and change input database until valid export possible

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



x Description on next page.

AIDA SYMPHONY WORKFLOW.
CHALLENGES FOR PROJECTS TO AUTOMATE WORKFLOW

a 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)

b 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.

BACKUP.