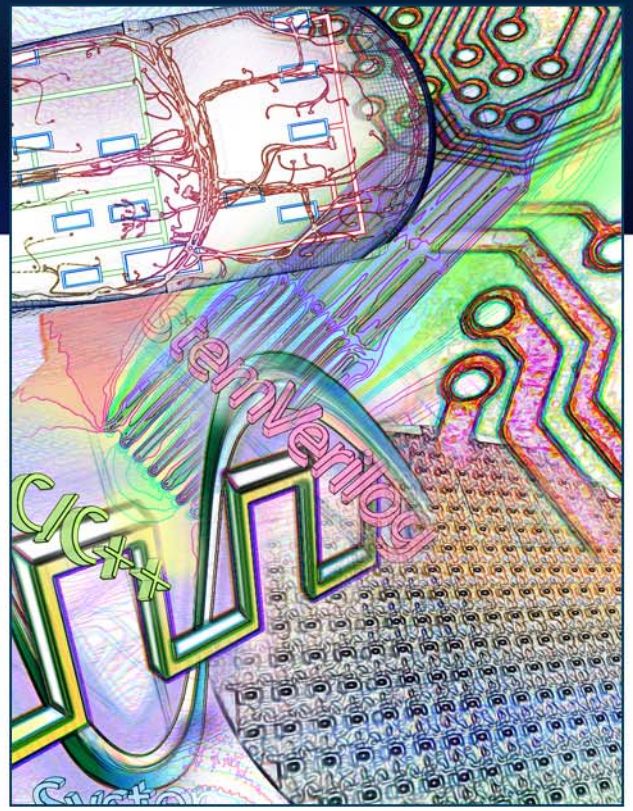

AUTOSAR and Mentor Graphics' Solution VSx

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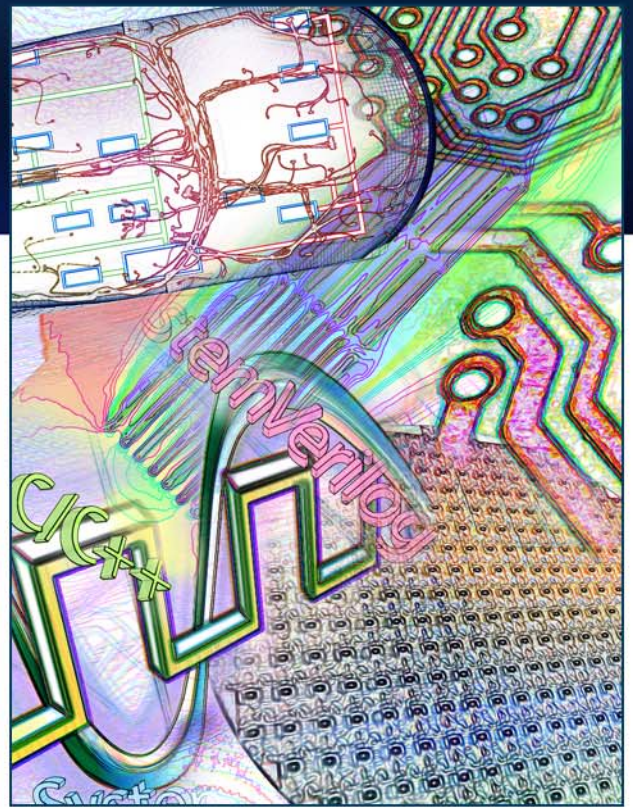
Outline

- Vehicle Development Trends
- AUTOSAR development methodology
- Mentor Graphics' AUTOSAR & Architecture Tool chain
- Summary



Vehicle Development Trends

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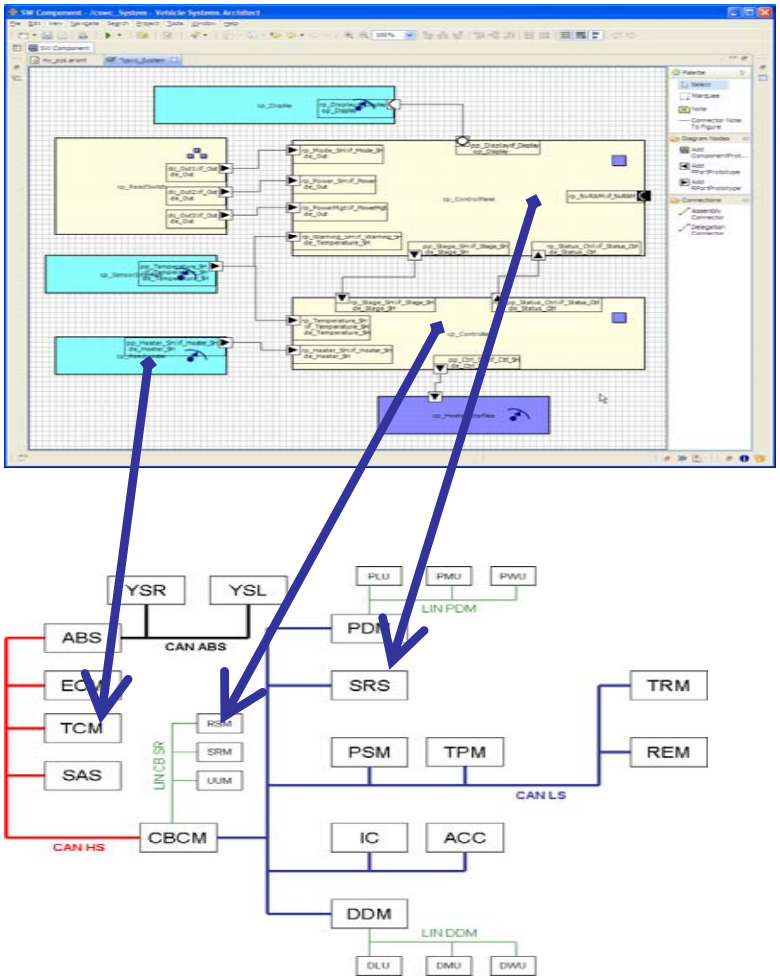
Automotive Software and Electronics Development

- Increase of functionality
- Increase of E/E Complexity
  - Real time requirements
  - Software complexity
- Increasing Communication
  - More networks, More signals

- ECU number not increasing much anymore
  - More functionality in each ECU
  - Functions distributed over several ECUs
  - Integration of standard functionality like ABS into other ECUs
  - Today's maximum is about 95 ECUs in High Class Vehicles

Automotive Software and Electronics Development

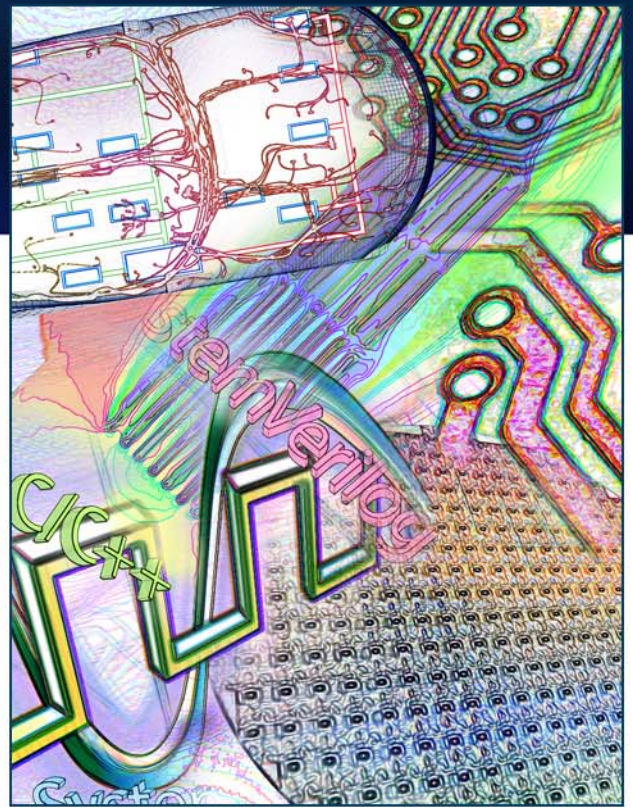
- New methods and standards
- Functionality described separately from implementation
- Enable reuse in multiple scenarios
- Separation between HW and SW in ECUs at System Design Level
- Enable to move SW components between ECUs
- Capture timing requirements



General E/E Architecture Trends

Trend	Description	Objective
Frontloading	▪ Increase effort in early design stages	▪ Reduce late changes ▪ Reduce warranty and recall costs
Standardization	▪ AUTOSAR ▪ EAST ADL	▪ Improve flexibility ▪ Enable professional tooling
Integrate architecture design and implementation	▪ Bi-directional flow of information	▪ Use architecture design results in implement ▪ Use feedback from implementation projects during architecture design
Attention to timing requirements	▪ Standardized timing models now part of AUTOSAR	▪ Reduce number of timing problems ▪ Improve network design

AUTOSAR Development Methodology



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General Overview

AUTomotive **O**pen **S**ystem **Ar**chitecture

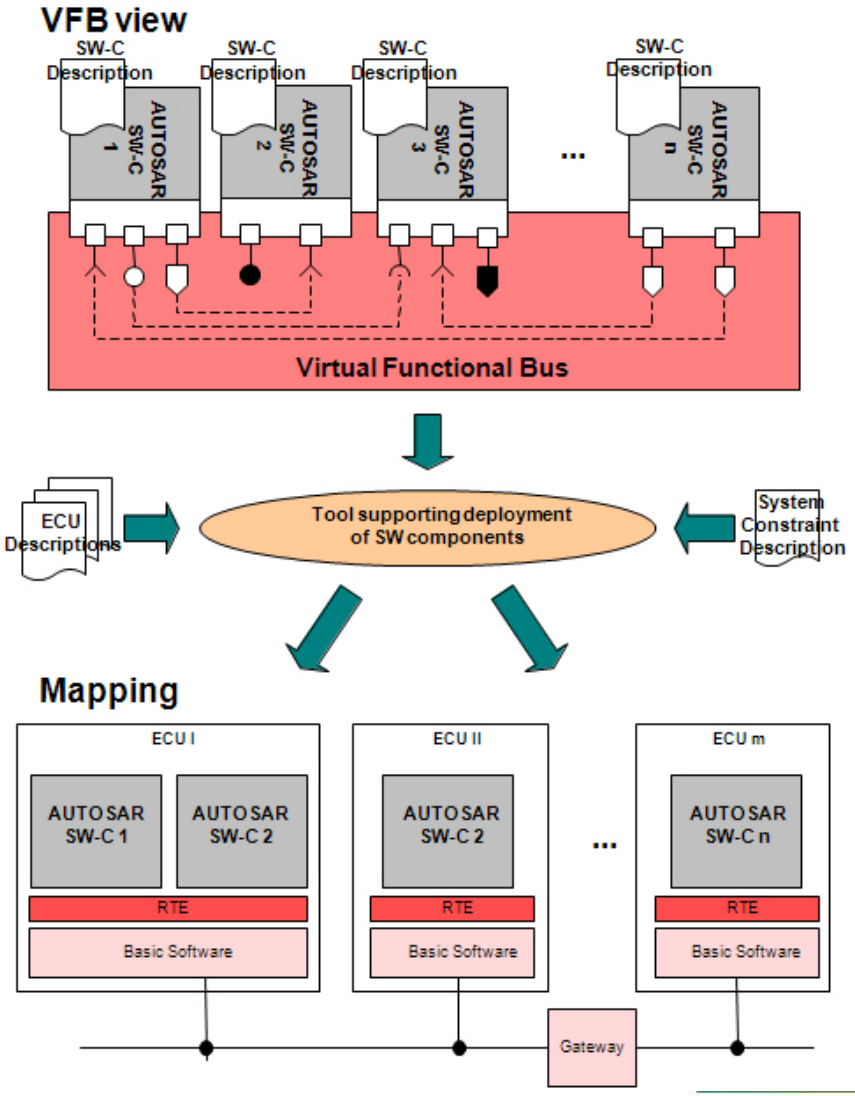
- AUTOSAR as a standard is providing specifications on 3 main areas
  - software architecture
  - application interfaces
  - methodology.

- AUTOSAR as a development project is following a stepwise approach to meet
  - quality
  - time schedule requirements.

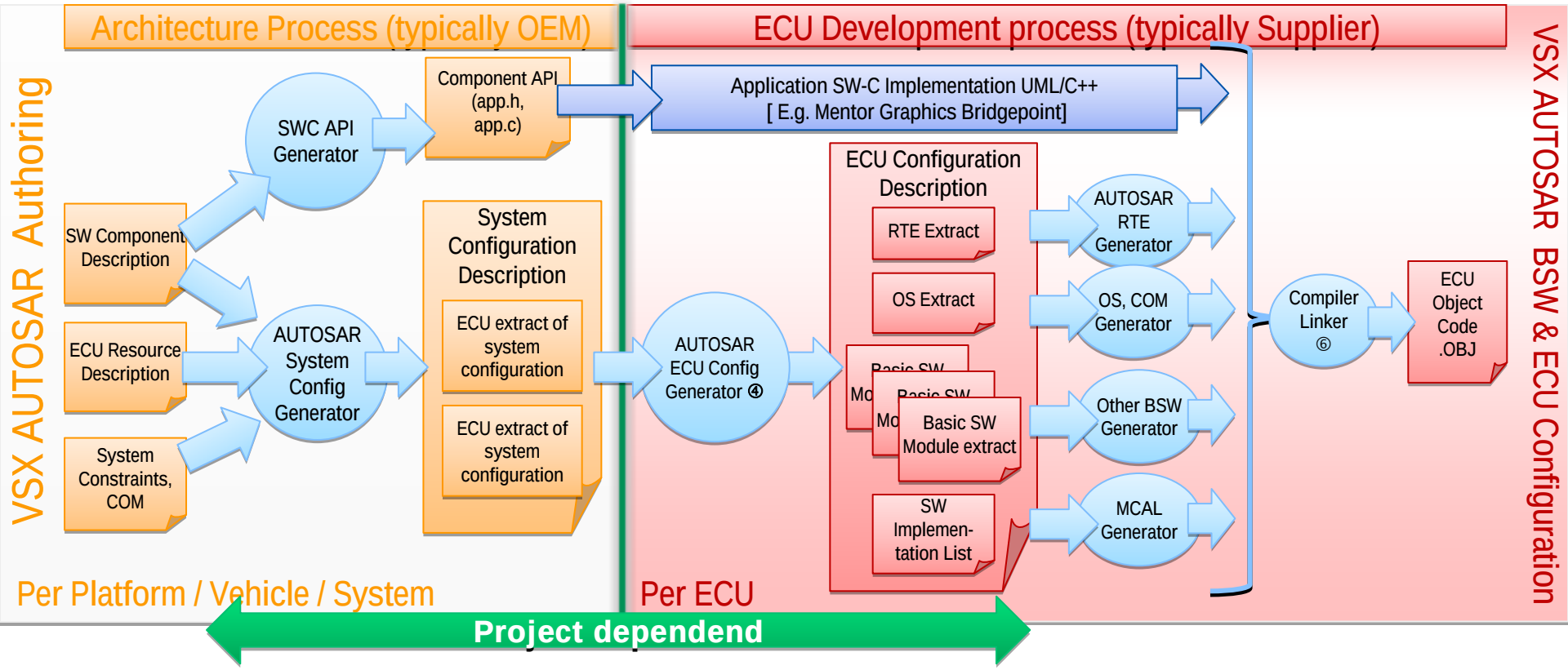
AUTOSAR

http://www.autosar.org

AUTOSAR Basic Approach



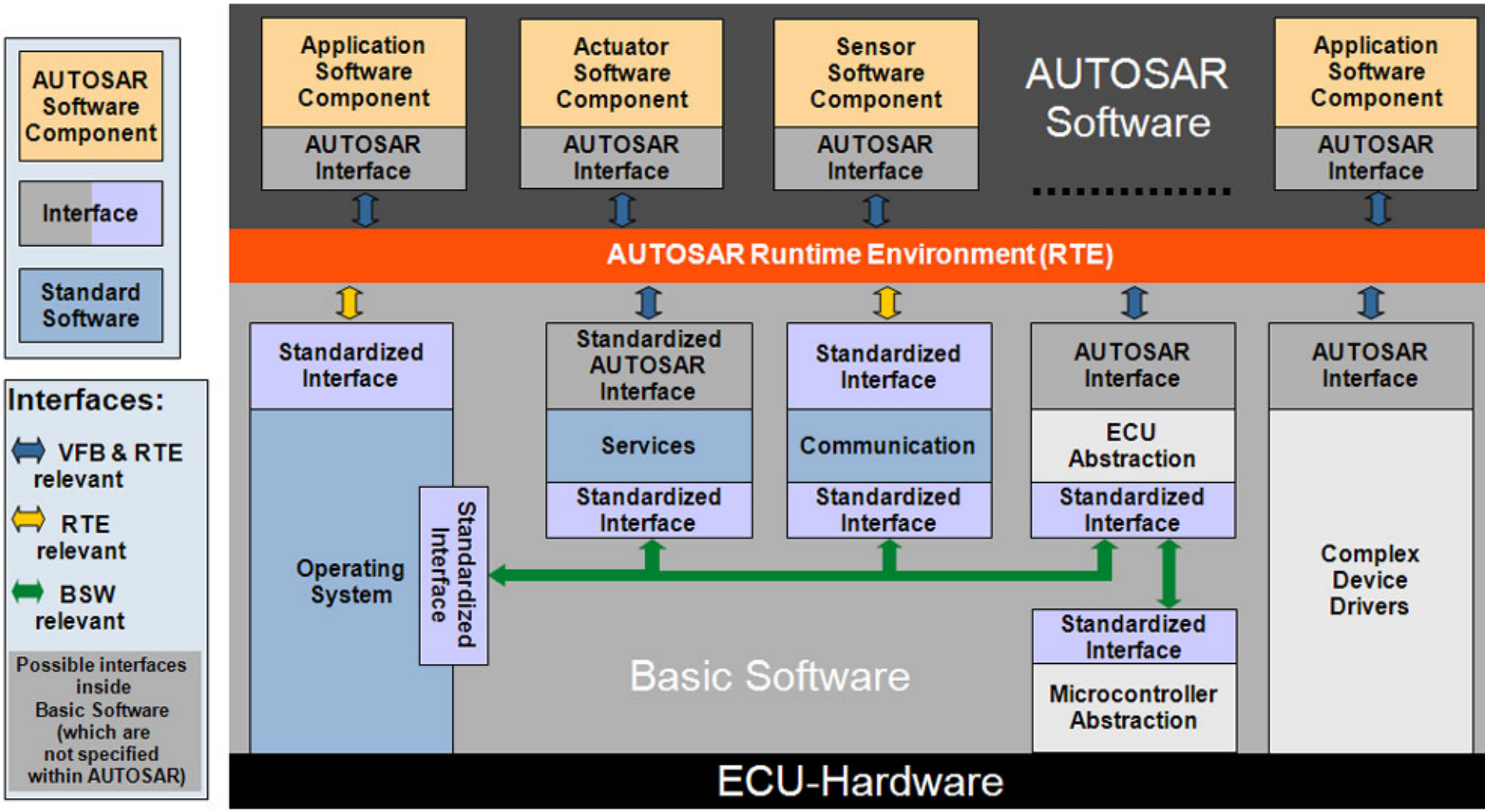
AUTOSAR Methodology



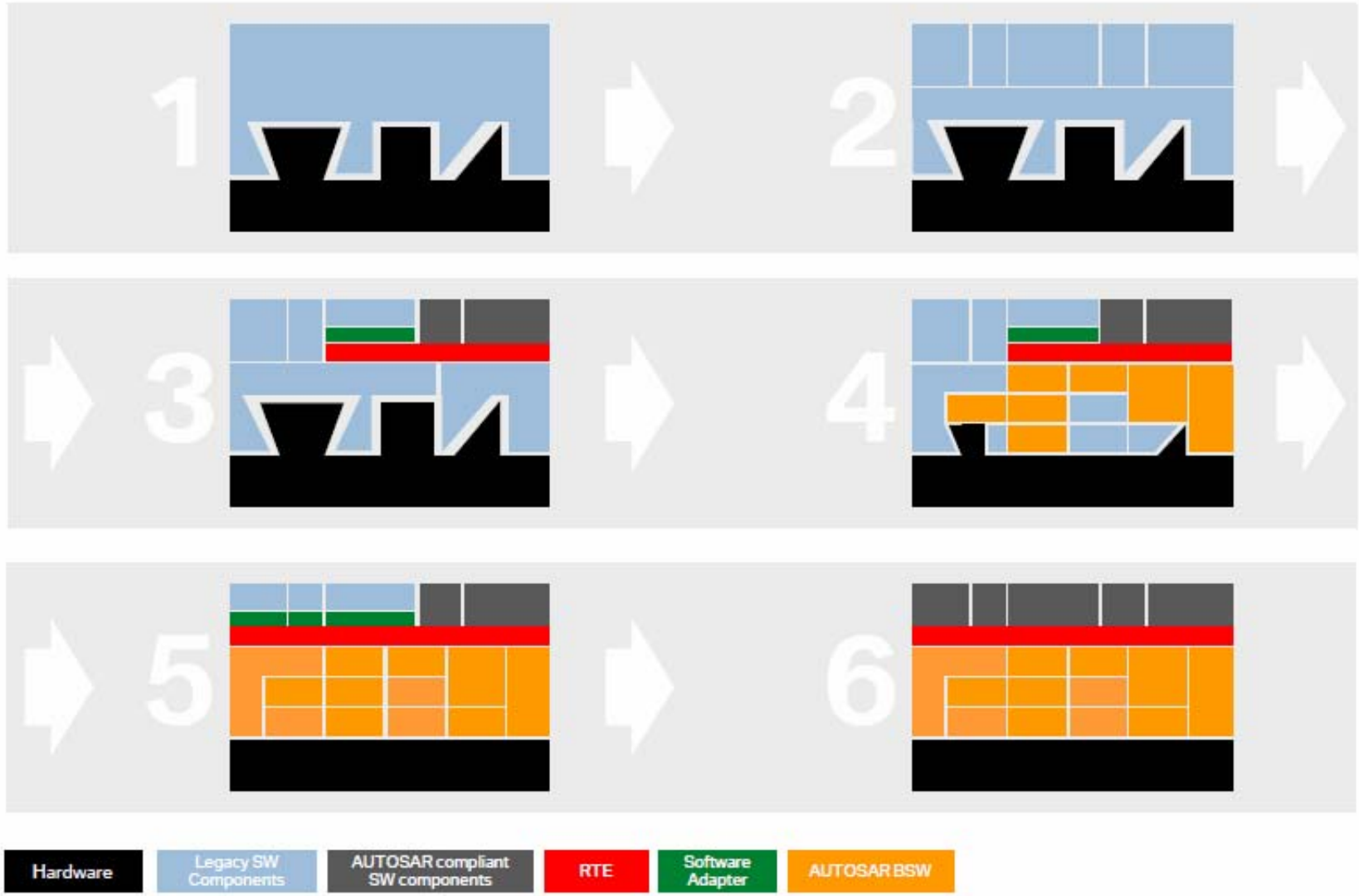
Information, Data, Files

Process step, tool feature

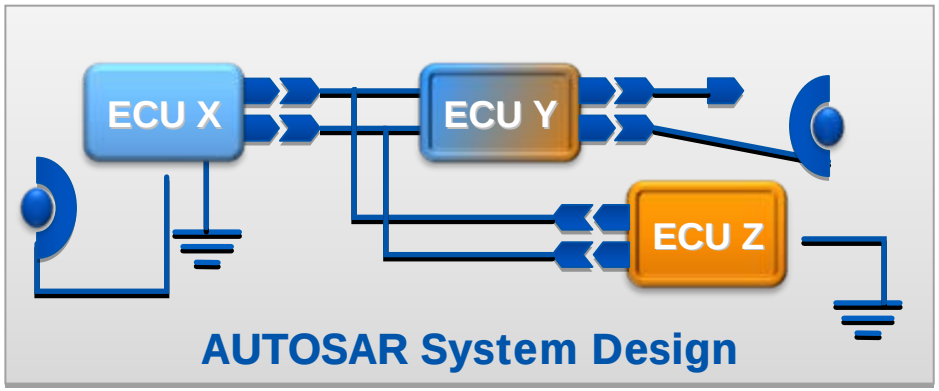
AUTOSAR
Applications and Interfaces

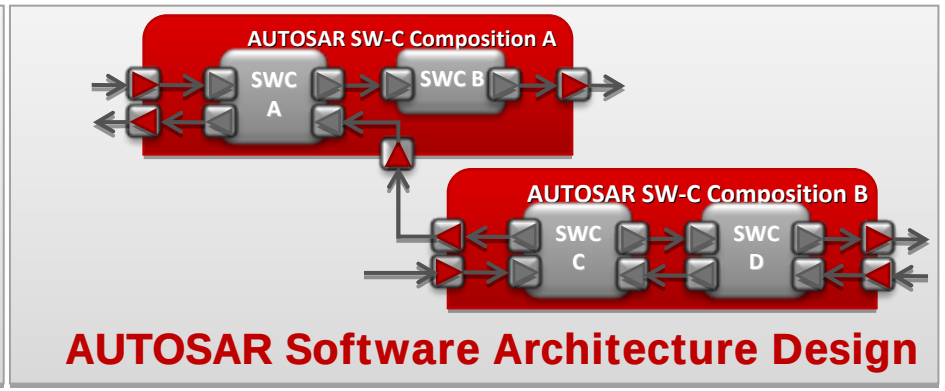


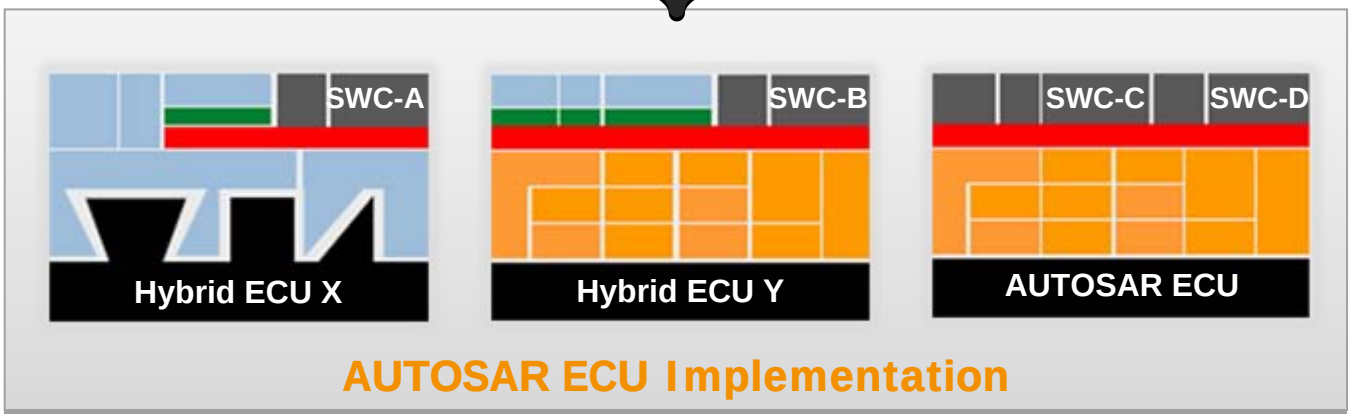
AUTOSAR in Series Production. Possible Migration Path – BSW



AUTOSAR in Series Production. Possible Migration Path - System



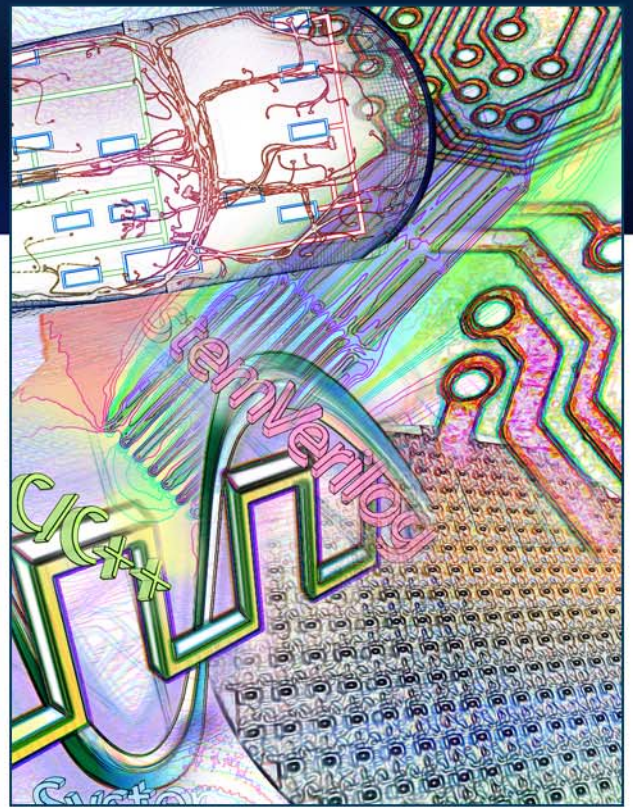




Hardware | Legacy SW Components | AUTOSAR compliant SW components | RTE | Software Adapter | AUTOSAR BSW

Benefits of AUTOSAR

- Project and supplier independent, reusable application SW
- Standardized method to describe full E/E platform from requirements to implementation for HW and SW
- Standardized basic software enables common reusable HW platforms
- Enable independent choice of the best supplier for the job regarding (tool/SW vendor, T1 supplier, T2 supplier)



Mentor Graphics AUTOSAR Solution VSx

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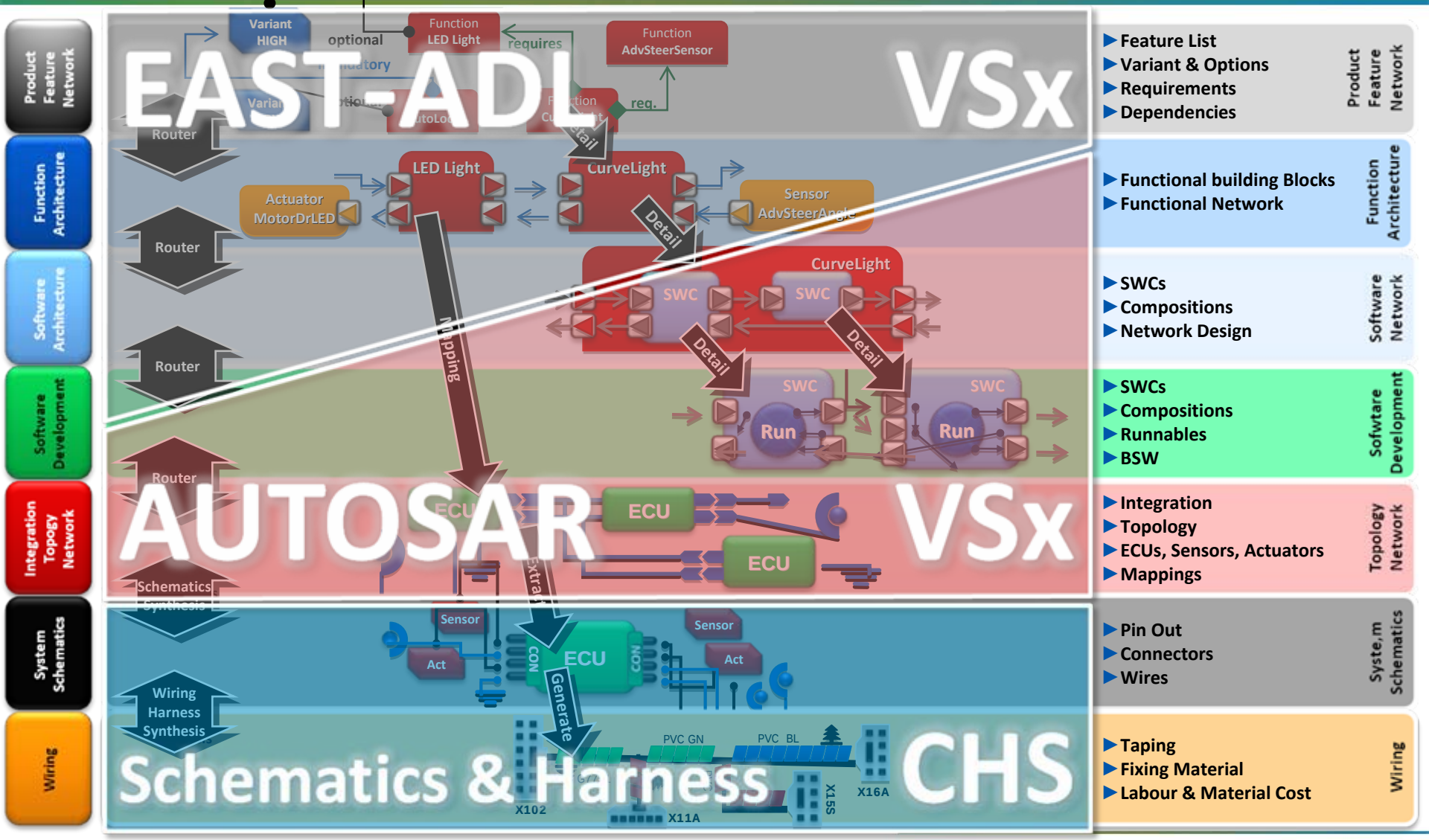
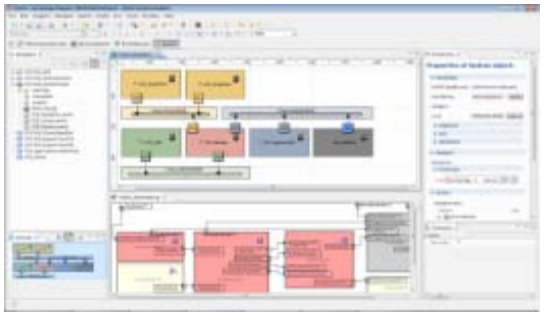
E/E Architecture Design
Meta-model layers



E/E Architecture Design
Meta-model layers – tool mapping

Product Feature Network
Function Architecture
Software Architecture
Software Development
Integration Topogy Network
System Schematics
Wiring

Router
Router
Router
Router
Schematics Synthesis
Wiring Harness Synthesis

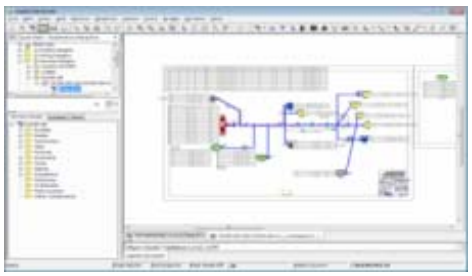


Vehicle System Architect

Virtual Systems Integration

VSA COM Designer

VSB BSW Configurator



Capital Architect

- Feature List
- Variant & Options
- Requirements
- Dependencies

Product Feature Network

- Functional building Blocks
- Functional Network

Function Architecture

- SWCs
- Compositions
- Network Design

Software Network

- SWCs
- Compositions
- Runables
- BSW

Sofwtare Development

- Integration
- Topology
- ECUs, Sensors, Actuators
- Mappings

Topology Network

- Pin Out
- Connectors
- Wires

Syste,m Schematics

- Taping
- Fixing Material
- Labour & Material Cost

Wiring

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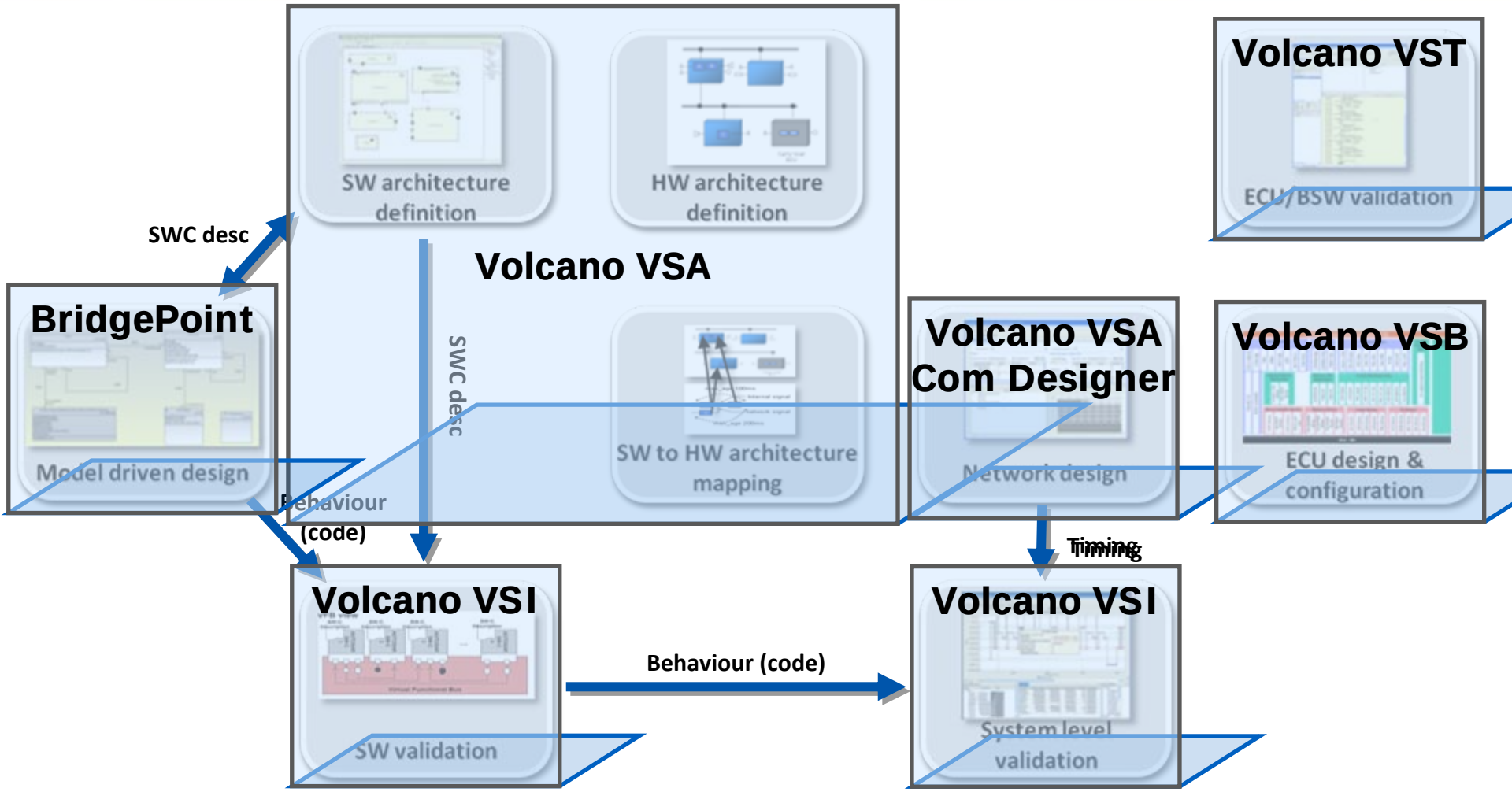
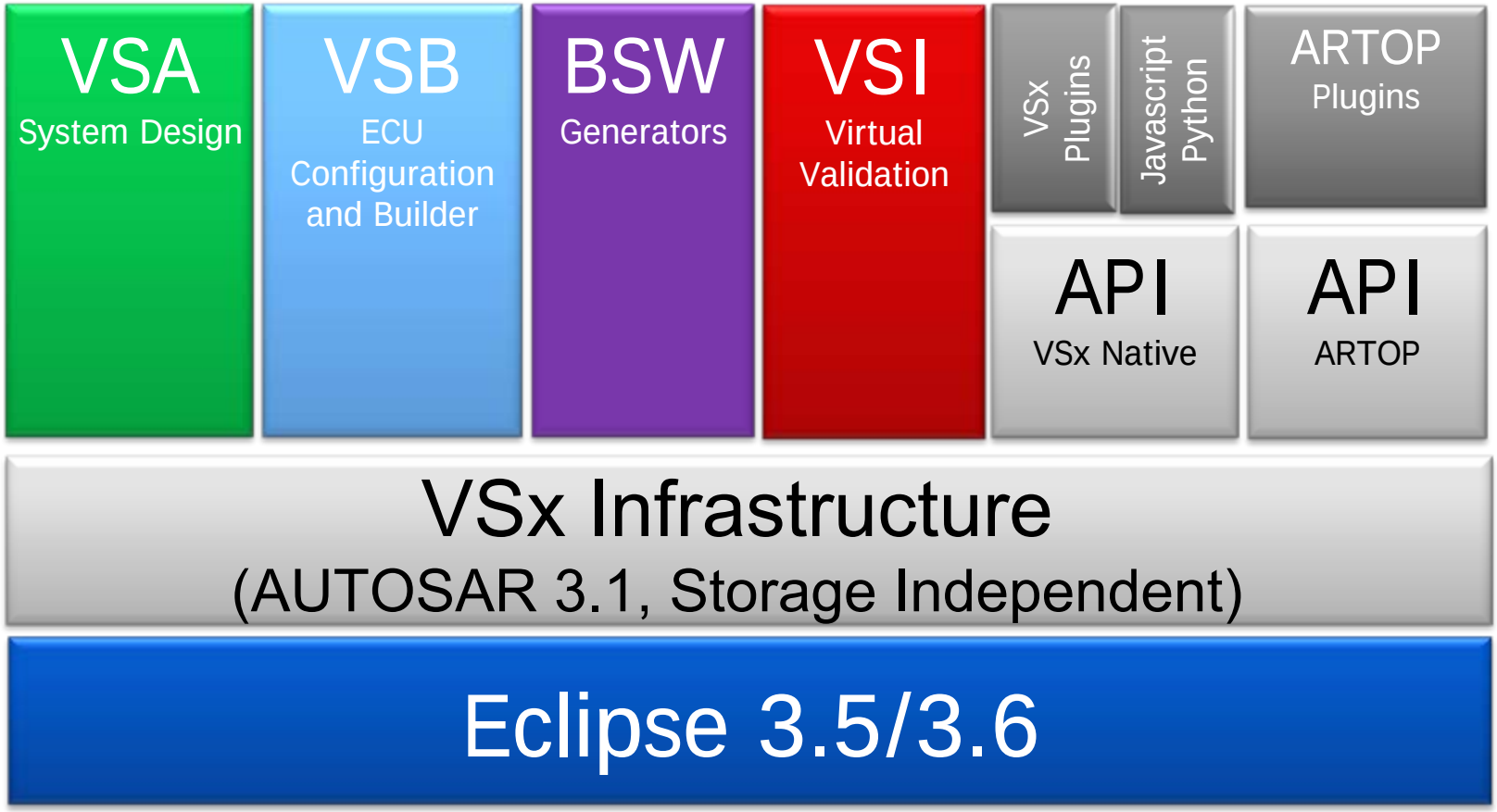
VSx Architecture Development
SW development process & tools

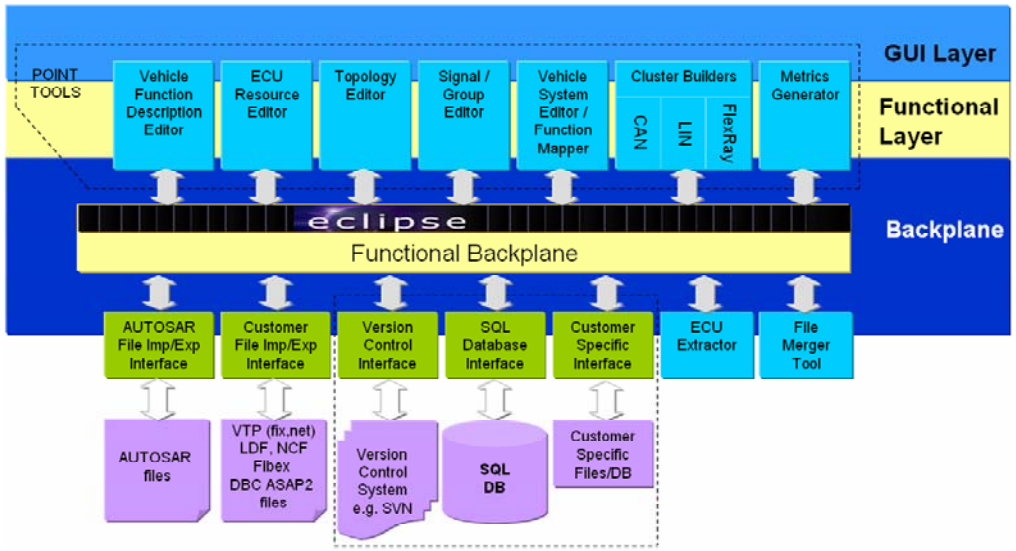


VSx Tool Platform



VSA
Architecture & Features

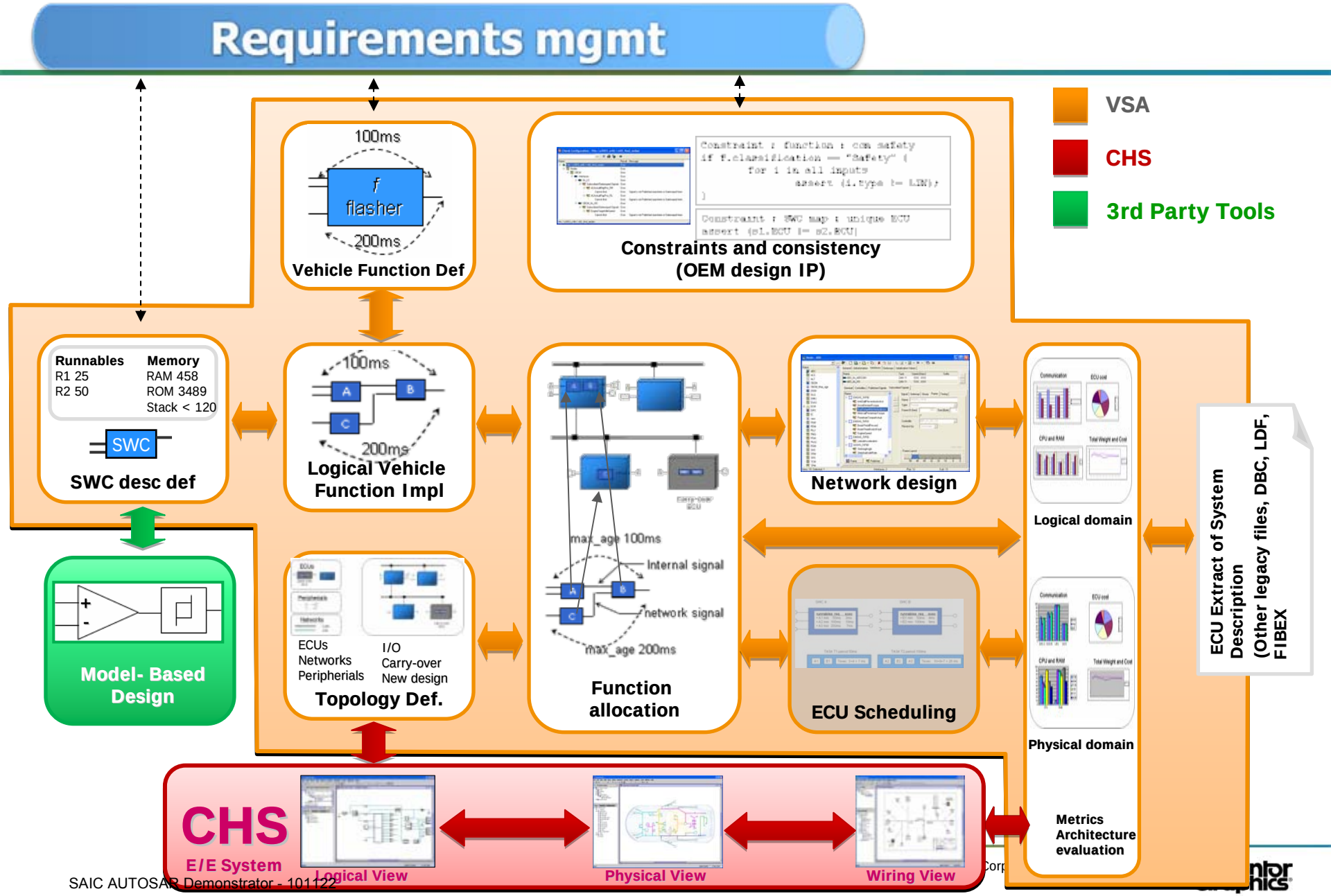
- **SWC Domain**
  - SWC/C-SWC Editor
  - Behavior/Runnable Editor
  - ODX Importer and Mapper
  - NVRAM Editor
  - CompuMethod Editor
- **System Domain**
  - ECU Resource Generator
  - Topology Editor
  - SWC-to-ECU Mapper
  - DE/OP-to-Signal Mapper
- **Communication Domain**
  - Signal-to-PDU Packing
  - PDU-to-FramePacking
  - Frame Scheduling
  - Gateway-Compilation



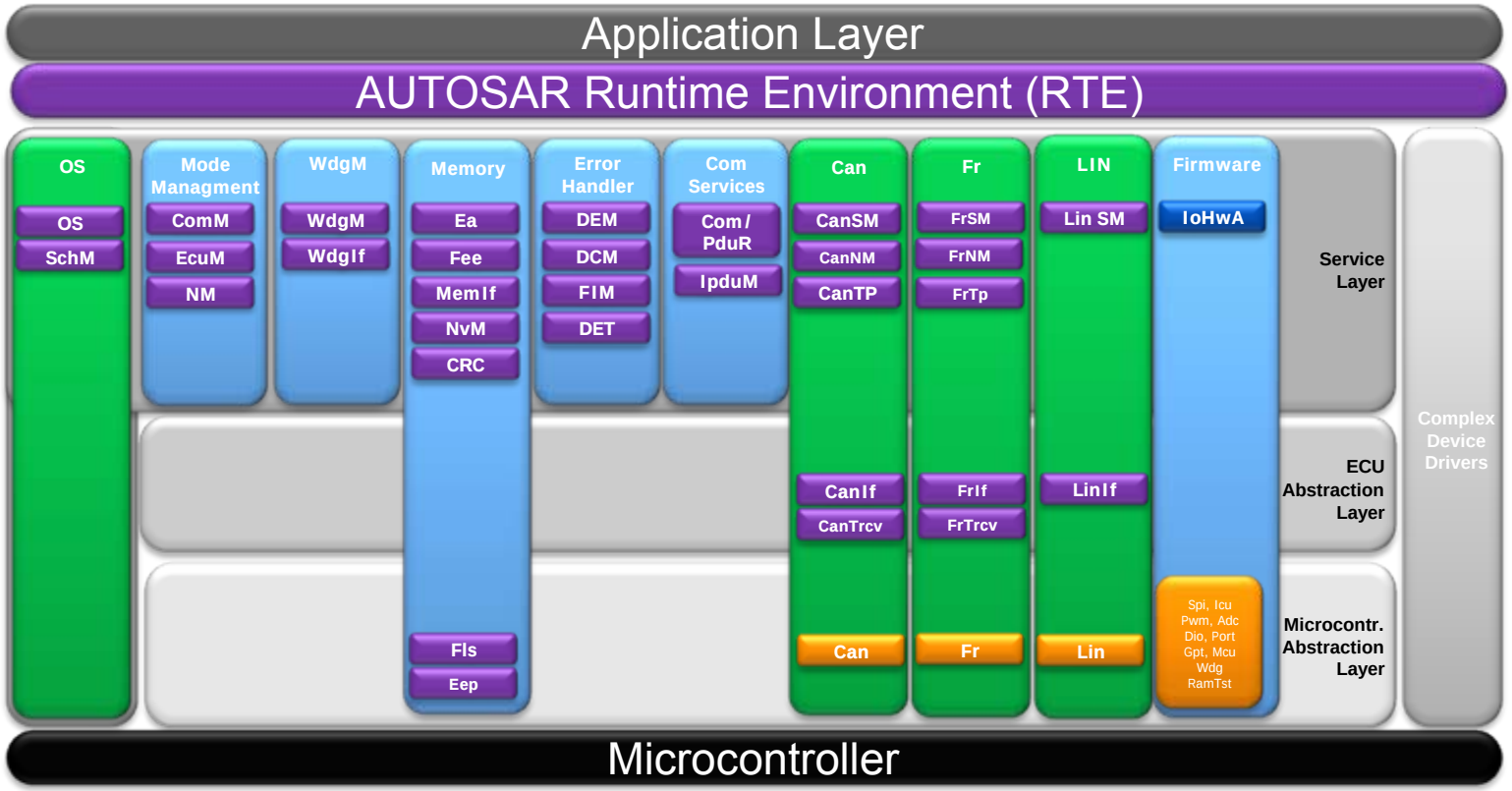
- **Import/Export**
  - AUTOSAR
  - FIBEX (2.0.1, 3.x)
  - ODX
  - Simulink
  - AscetSD
  - Microsoft Office

  (- DBC
  - LDF)
- **Interfaces**
  - VTP (Volcano Target Package)
  - LTP (LIN Target Package)
  - CHS (Capital Harness Systems)
  - VSB (Vehicle Software Builder)
  - VSI (Virtual Systems Integrator)
- **Analysis/Metrics**
  - Resource Analysis
  - Bus load
  - Latencies
  - ECU Costing
- **META-Model**
  - AUTOSAR
  - TIMMO
  - Easily extendable
  - Model Validation
  - Model Merge/Compare

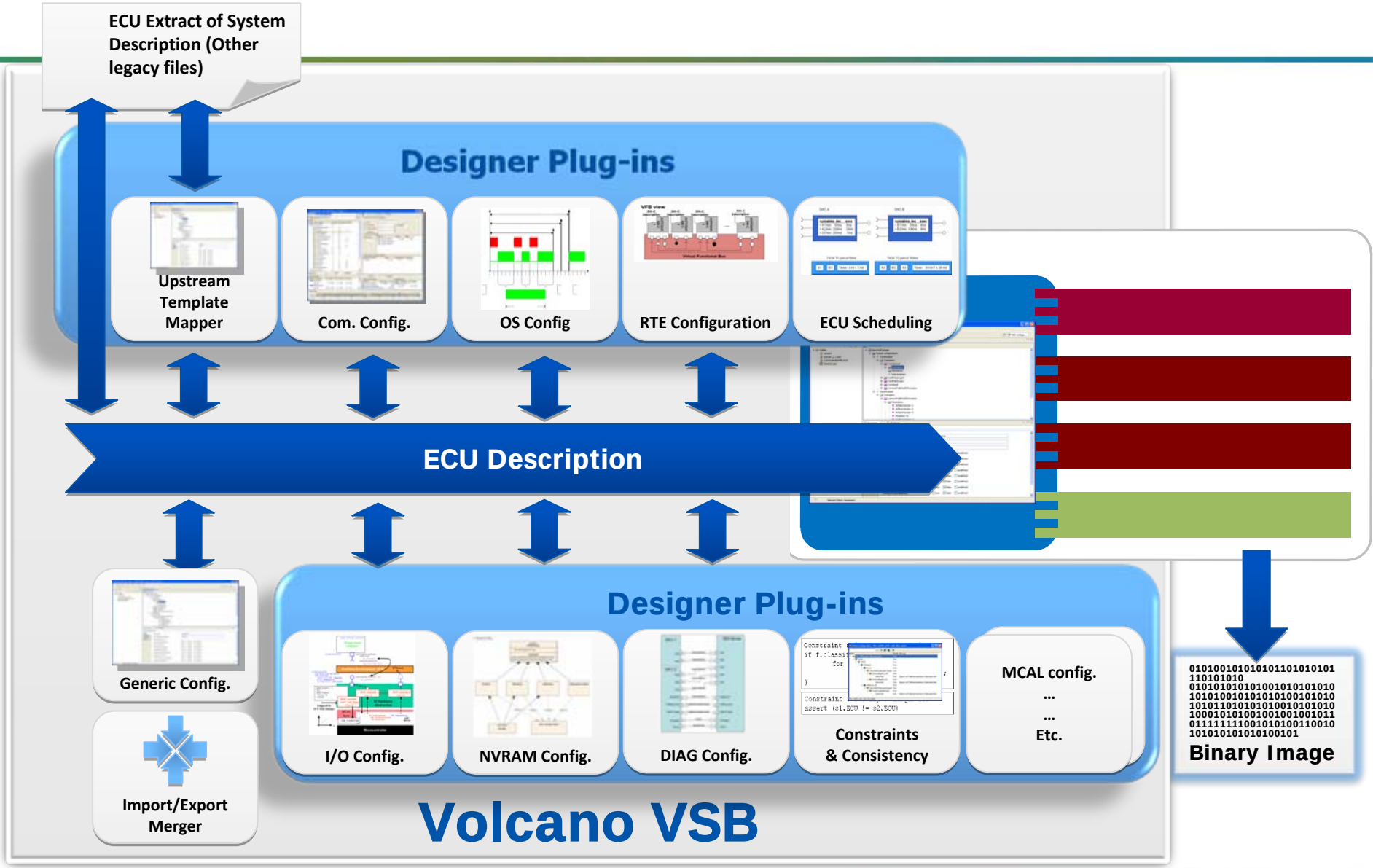
VSA Activities



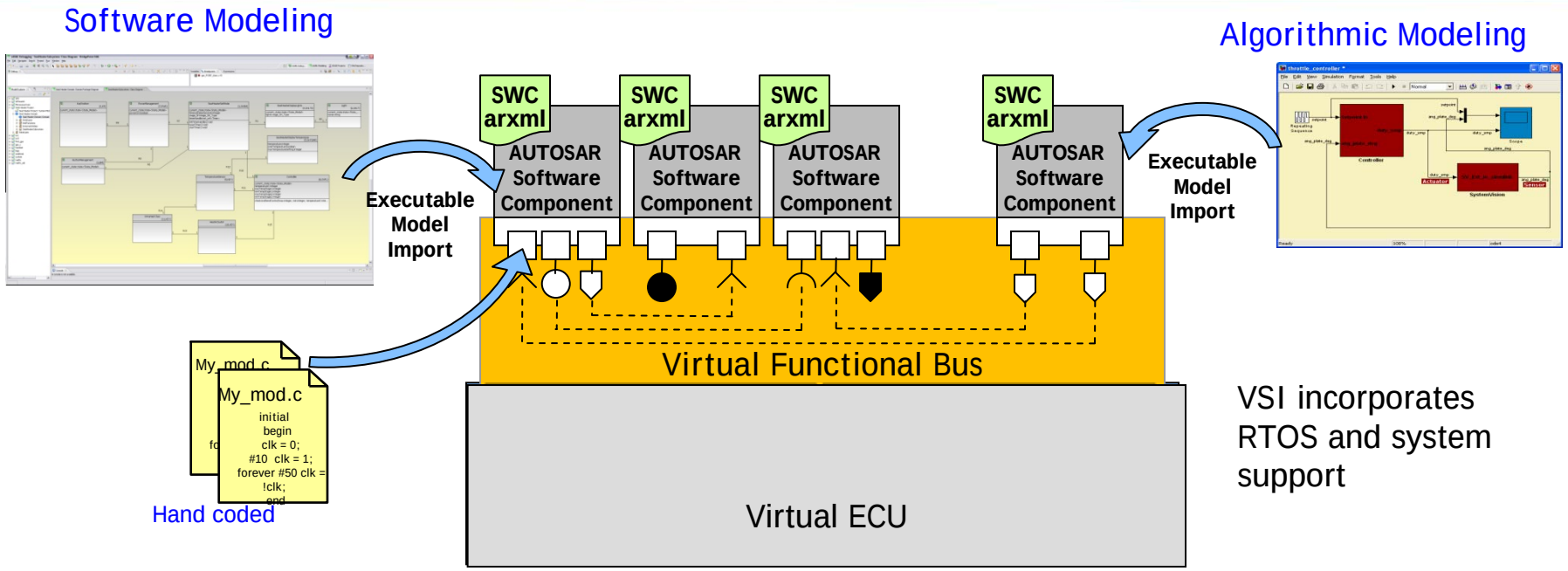
Standard BSW Stack (3.x)



VSB – Volcano system Builder

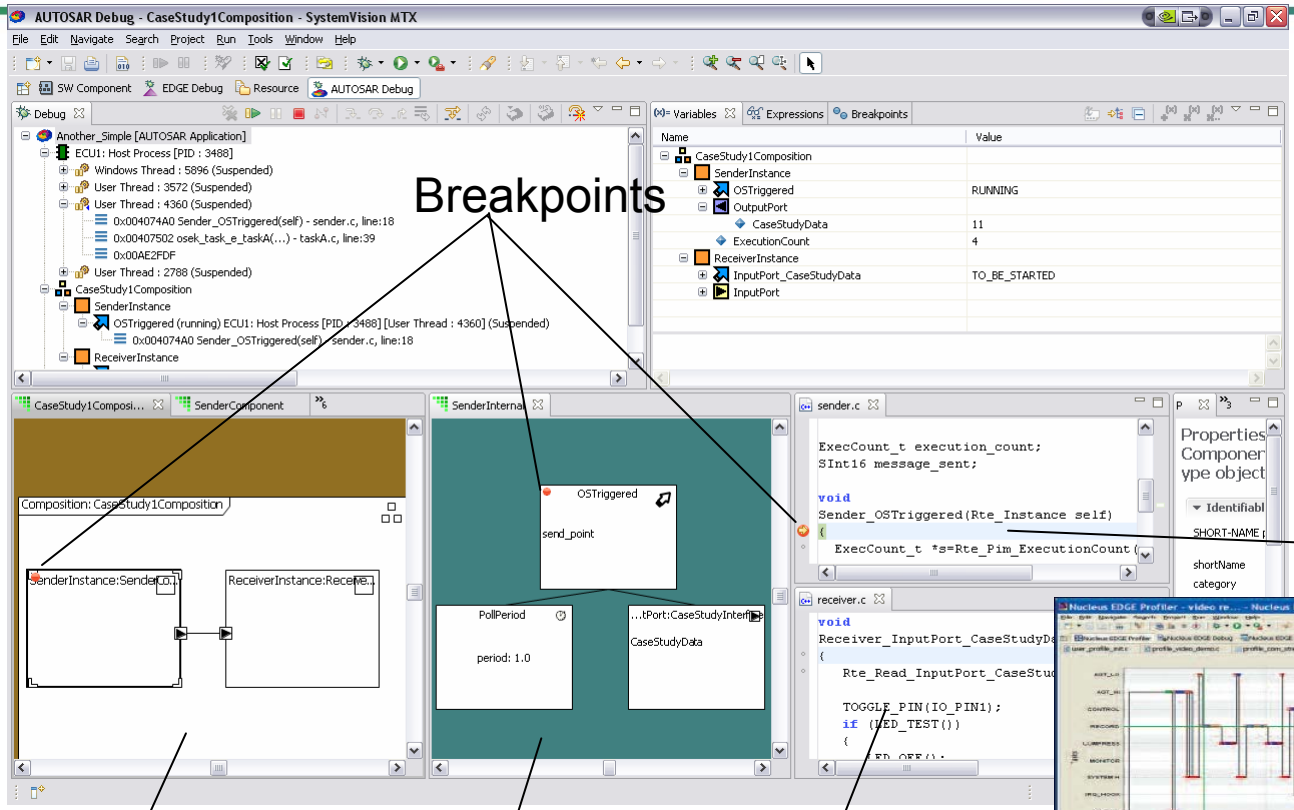


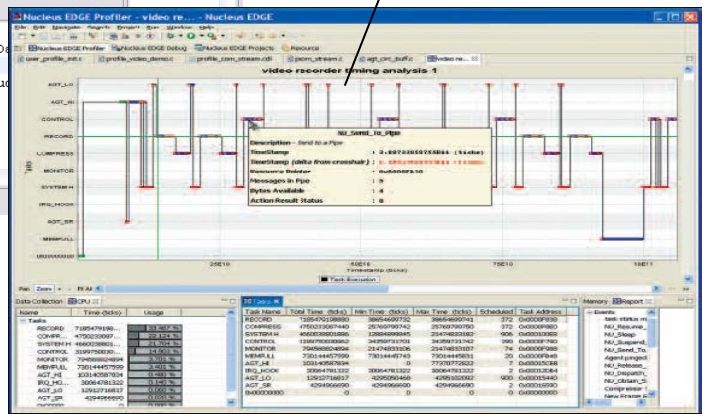
VSI - Volcano System Integrator



- Execution environment for AUTOSAR Systems
- Early validation of SW functionality on virtual ECU and BSW
- Full debug and interactive validation at all relevant levels of software system, OS task or executing code

VSI Tool Suite





Profiler, Code and Data Trace

Software Component View
SWC and Composition

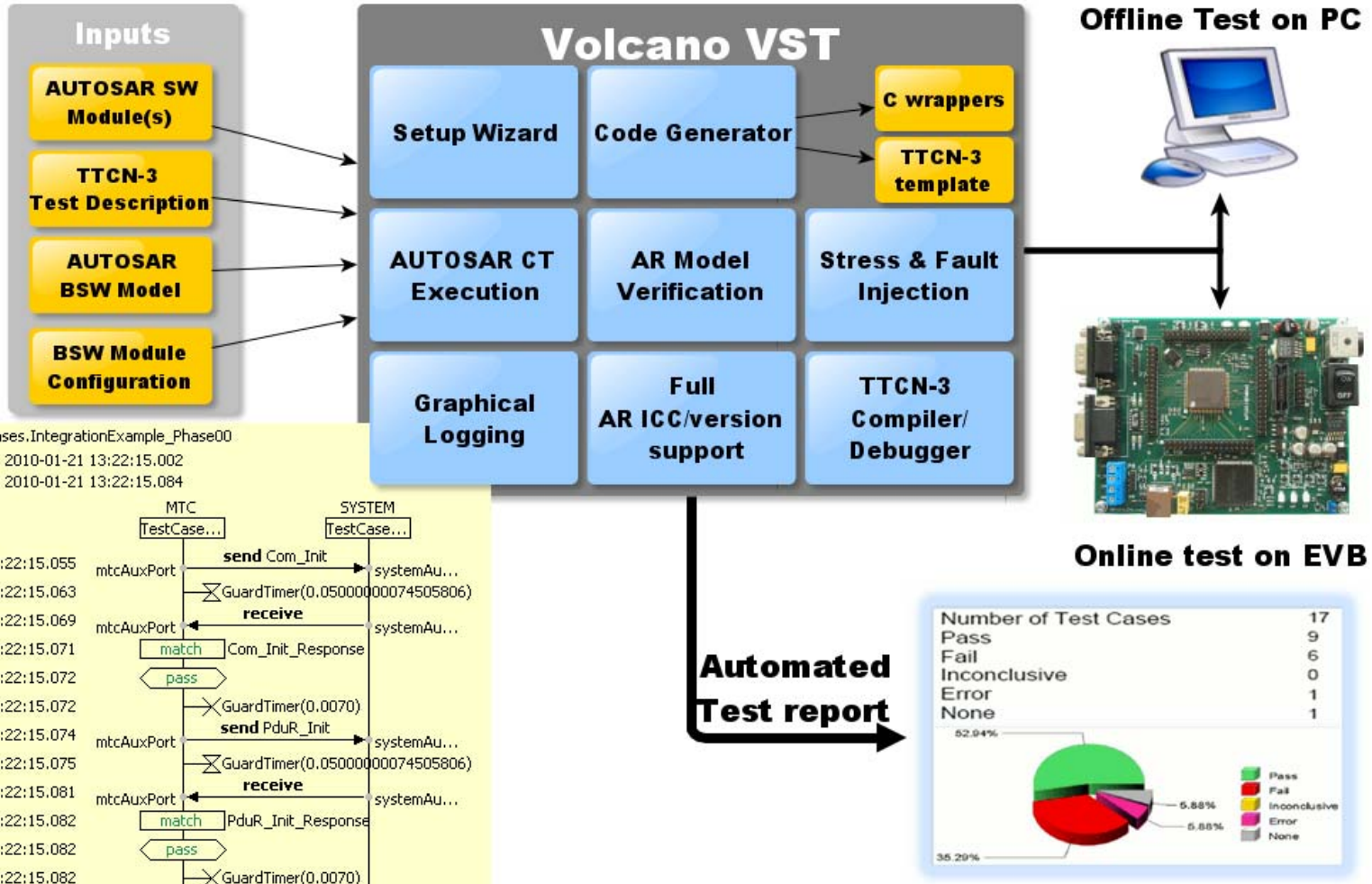
Runnable and Task

IDE, Debugger

VST – Volcano Systems Tester

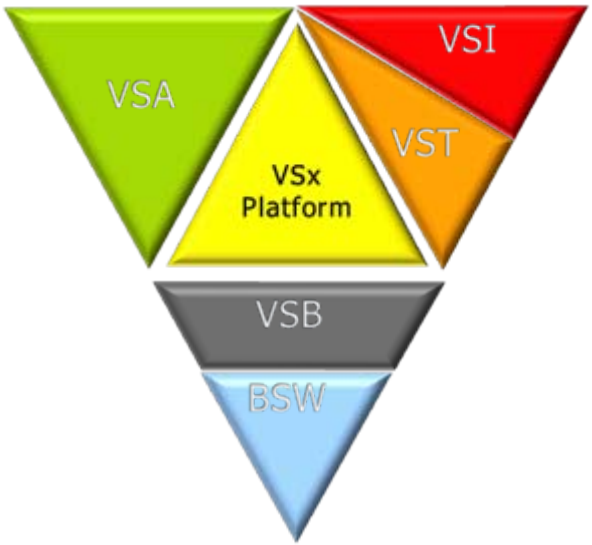
- One single environment for Test Development, Execution and Reporting.
- A generic test tool, not limited to AUTOSAR SW testing
- Test Execution either on Target or on PC
- Based on well known and open Standard Language (TTCN-3)
- Automatic report generation

VST – Volcano Systems Tester

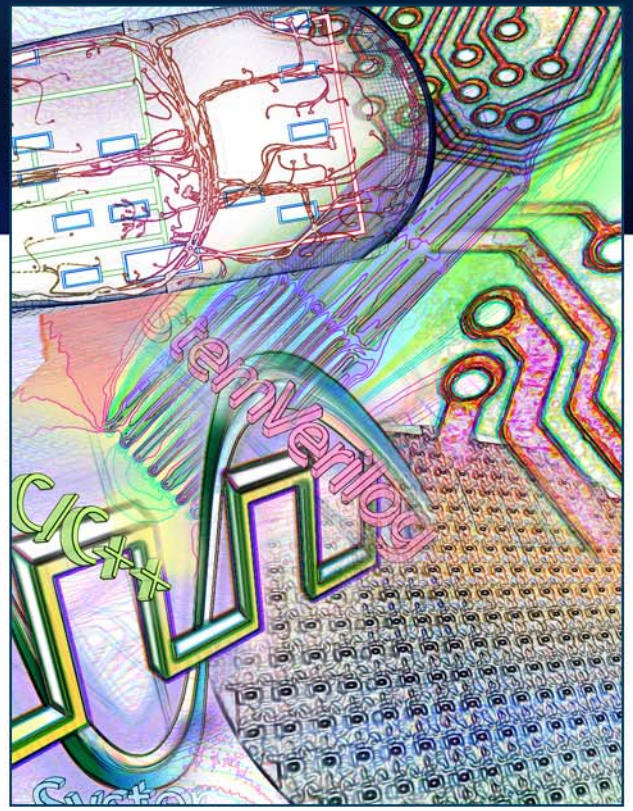


Summary

- VSx Covers
  - Architecture design
  - Network Design
  - ECU configuration, design and test
  - VFB level simulation
  - Implementation in ECUs



- VSx Goals
  - Optimisation of the E/E architecture
  - Early verification of the system
  - ”Correctness by design”
  - Consistence guarantee from requirements to realisation



Thank You!

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