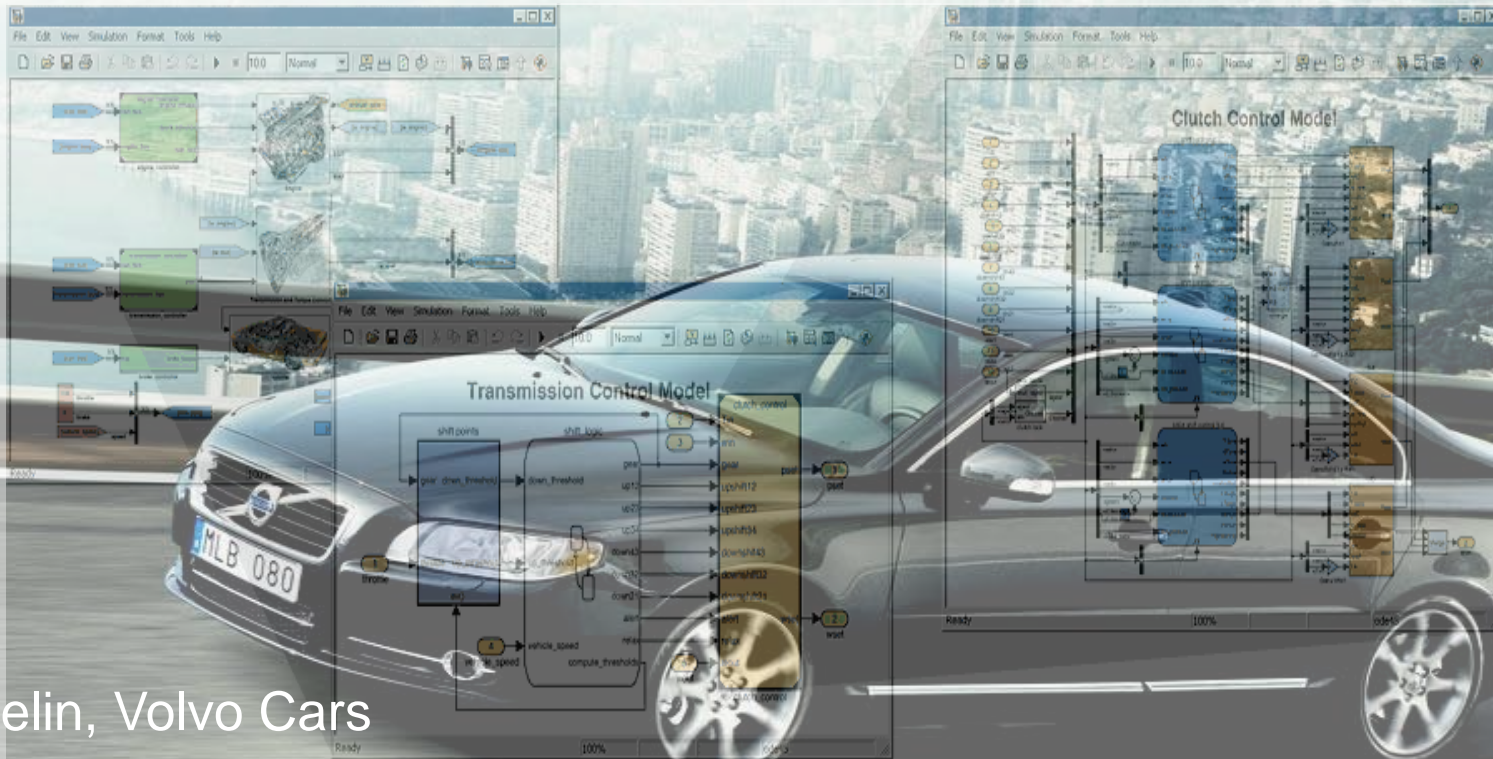


Model-Based Design based on AUTOSAR in an Electrical Systems Engineering Environment at Volvo Cars



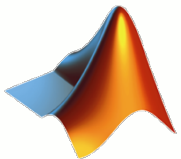
Dennis Selin, Volvo Cars
Guido Sandmann, MathWorks



” Model-based development often fall short due to the **lack of integration** at both conceptual and tooling level ” ¹⁾

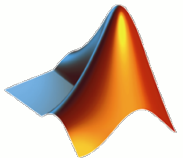
One of the major fundamentals of the Volvo Cars Model-Based Design initiative is to provide integration on conceptual as well as on tooling level by use of **AUTOSAR methodology**

¹⁾ *Seamless Model-based Development, from Isolated Tools to Integrated Model Engineering Environments, Manfred Broy, TUM*



Outline

1. Introduction
2. VCC objectives
3. Pilot project execution & experiences
4. Conclusion

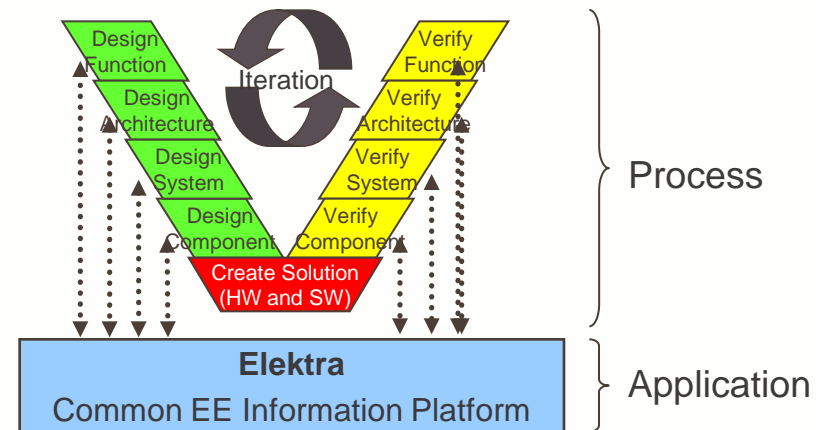


Introduction

- A major VCC EESE Operational Development program has been assigned the responsibility for the new **Process & Method & Tool** setup for future AUTOSAR based platforms
- One major strategy is to have a central "**Data backbone**" of EE development data. This Common EE information Platform is called **Elektra** and is built on Vectors eASEE tool (VCC – Vector partnership)

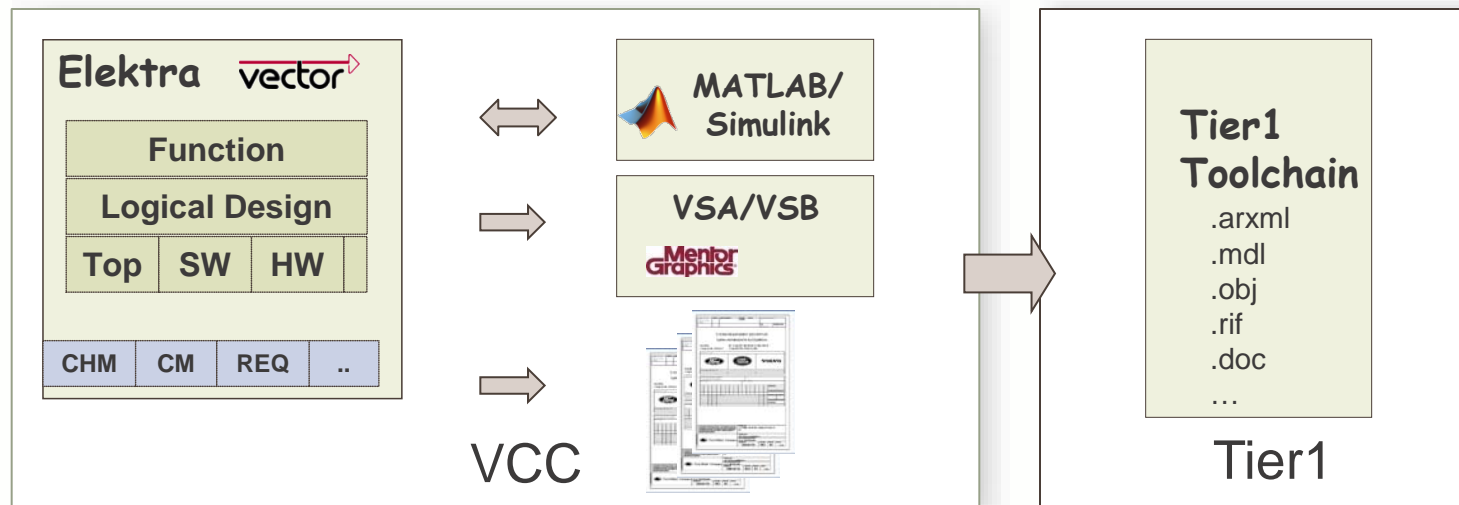
The common EE Information Platform shall provide:

1. Information management of EE engineering data from Function to ECU S/W & H/W.
2. Interoperability with external tools (e.g. Matlab/Simulink)
3. AUTOSAR concepts as System Configuration, ARXML import & export etc



VCC Process & Methods & Tool Objectives

- Reduced leadtime & increased development efficiency
- **AUTOSAR** methodology support
- Significant increased use of Model-Based Design
- ISO 26262 support
- Support for a new generation EE Architecture



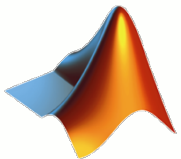
VCC Model Based Design

Objectives:

- Reduce the amount of textual specifications and raise their abstraction level
- Support **early integration**
- **Reuse** of design artefacts
- Possibility for Code Generation

But some important aspects must be considered:

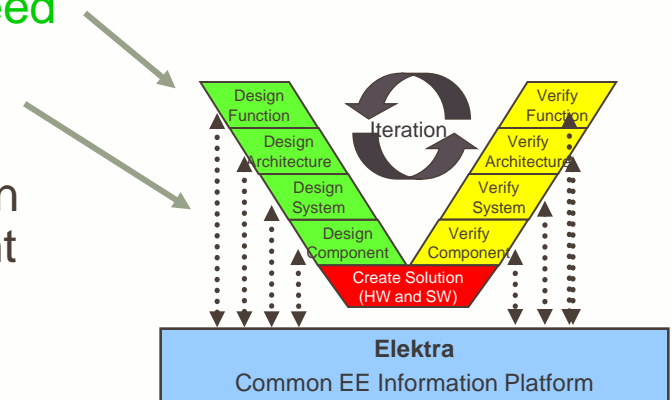
- Value chain aspects
- Integration aspects
- ...



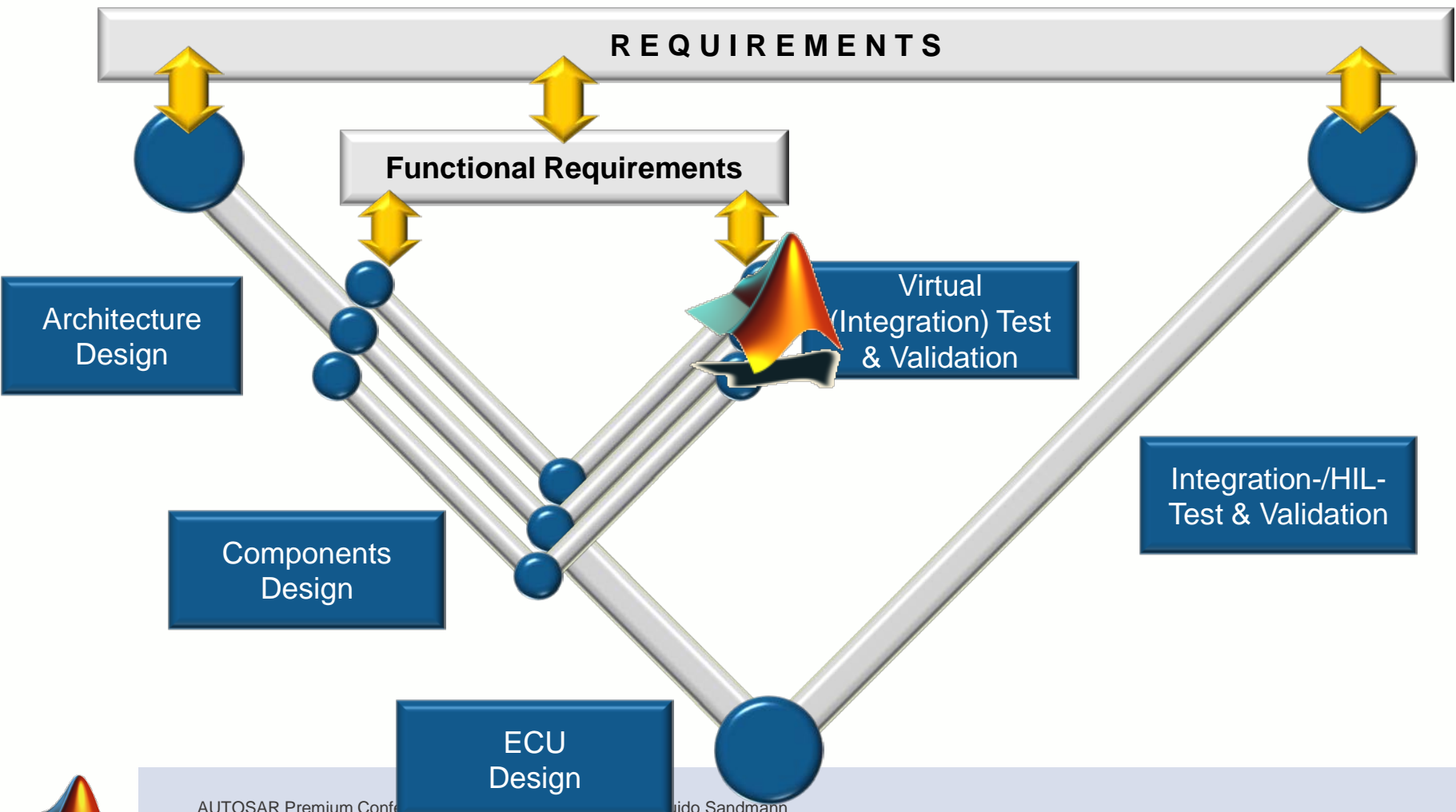
VCC Model Based Design

Three types of models exists – differentiated with its purpose

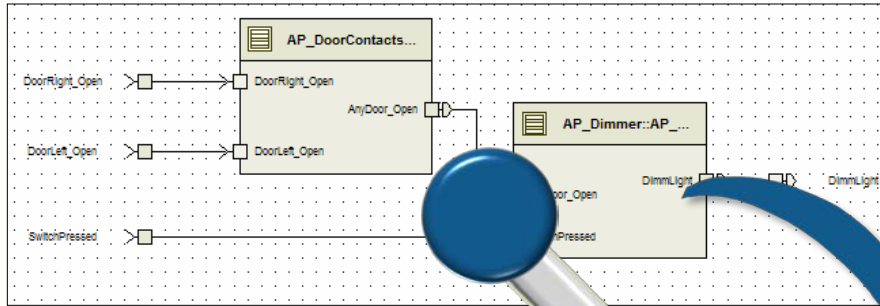
1. Models intended for analysing/verifying the **product need**
2. Models intended to define **software applications** of the EE system
 - All models are compliant to one structural definition in Elektra and are all formally AUTOSAR compliant SWCs and thus specified by AUTOSAR XML
 - The model can be a simplified interaction model for integration purposes
 - or are complete model with ability for code generation
3. **Plant** Models intended to support simulation and verification of System Models



AUTOSAR Workflows: Interoperability with ELEKTRA



AUTOSAR Workflows: Interoperability with ELEKTRA



Architecture Design

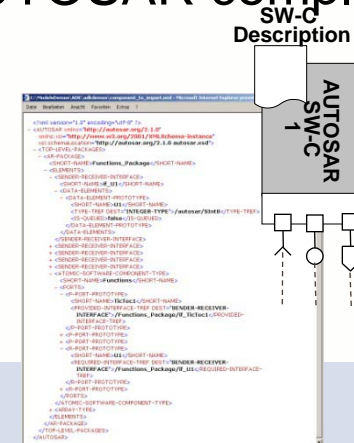
Components Design

ECU Design

Tool Interfacing:

– Connection with ELEKTRA via AUTOSAR Formats:

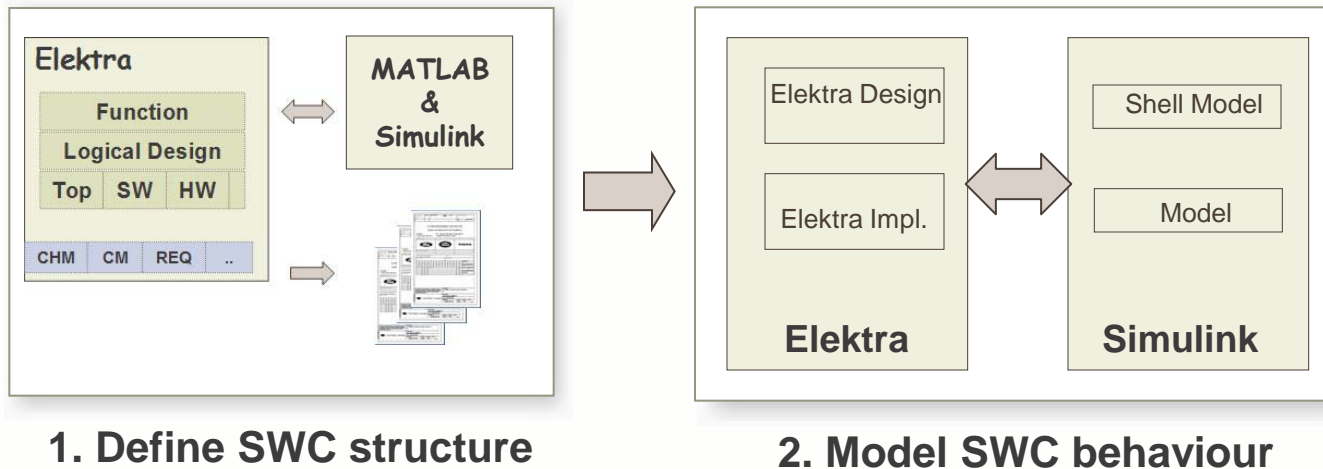
- SWC-Description files
- AUTOSAR compliant Code



MathWorks & Volvo Collaboration on Tool Interoperability

1. Model Based Design methodology

- Establishing Model-Based Design environment for production projects



2. Full AUTOSAR modelling support & code generation

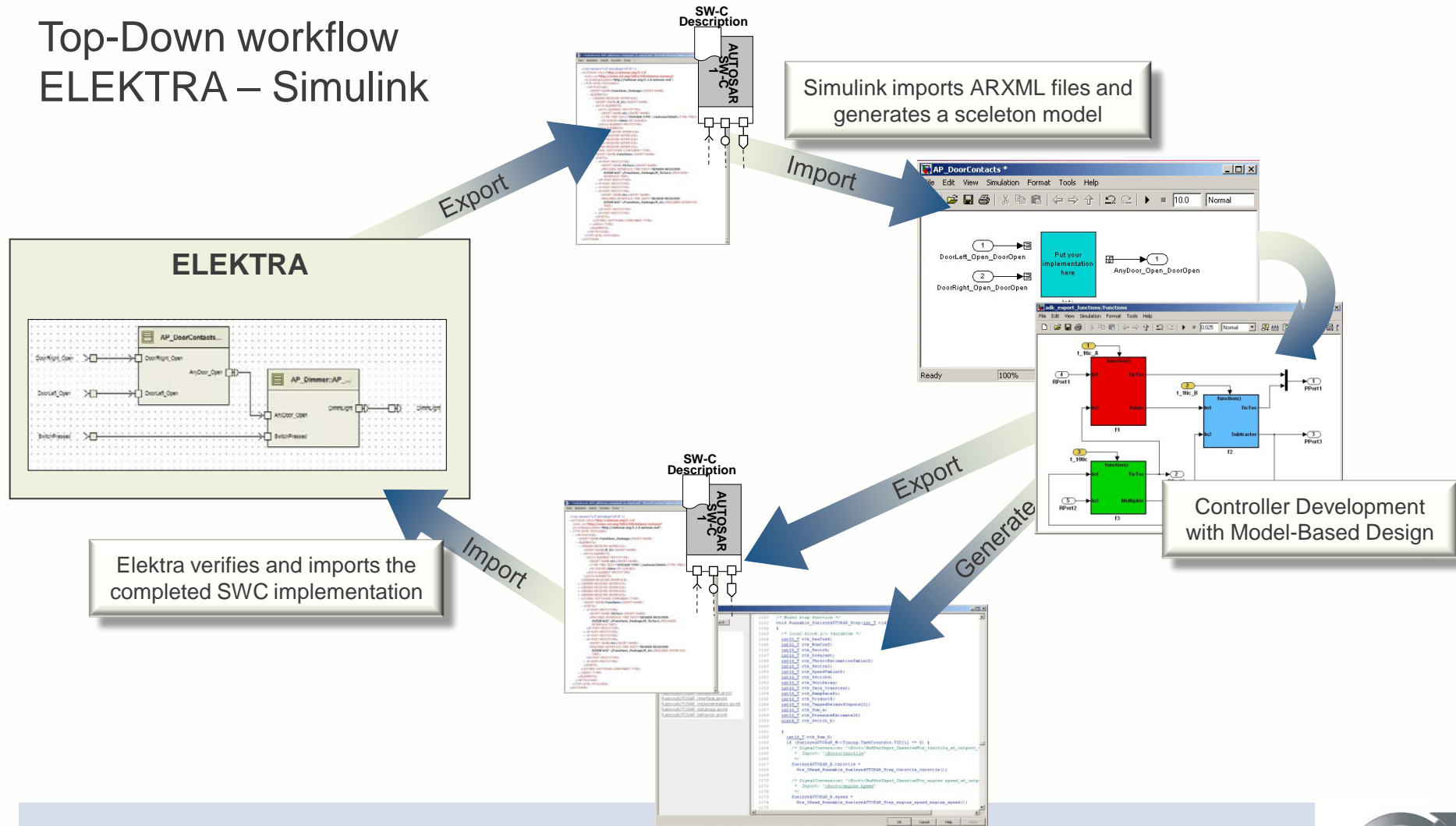
- Use AUTOSAR standardized formats for tool interoperability

3. Project kick-off in May 2009

- Weekly conference calls and regular onsite meetings

MathWorks & Volvo Collaboration on Tool Interoperability

- Top-Down workflow
ELEKTRA – Simulink



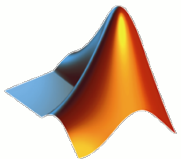
MathWorks & Volvo Collaboration on Tool Interoperability

Standardization like AUTOSAR facilitates Interoperability

- Technically:
 - Standardized Interfaces,
 - Standardized exchange formats
- Conceptually:
 - Defines a methodology that supports implementing process improvements

Challenge: Interoperability for Production Projects is a question of details:

- Tool Chain
- Standard support of involved tools:
 - Set of features
 - Interpretation of features



MathWorks & Volvo Collaboration on Tool Interoperability

- Workflow & AUTOSAR feature topics:

Usability Improvements

NVRAM support

ARXML Packaging

Client Server Communication

Preservation of UUIDs

Roundtrip Engineering

Per Instance Memory

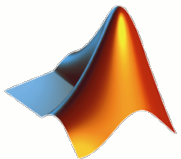
Multi-Runnables Software Components

Support for multiple Event Types

AUTOSAR 3.1

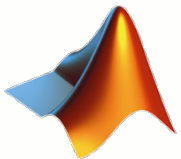
- Deliverables:

- Pilot Support Packages: product enhancements on top of the regular product releases



Conclusion

- The next generation EE platform is **fully AUTOSAR** and VCC application SWCs are modelled in MATLAB & Simulink
- VCC believes that **Model-Based Design** will be a significant contributor to reach the VCC objectives
- AUTOSAR methodology provides the conceptual foundation for tool integration
- The Pilot project is **successful** and still ongoing
 - MathWorks has provided competence and dedication of high value to the project and to VCC
- Collaboration between Volvo Cars & MathWorks formed a good relationship between the companies and across the organizations
- Outlook: topics and requirements with high priority
 - AUTOSAR Composition modelling
 - Support for iterative workflow



Thank you very much for your attention!

