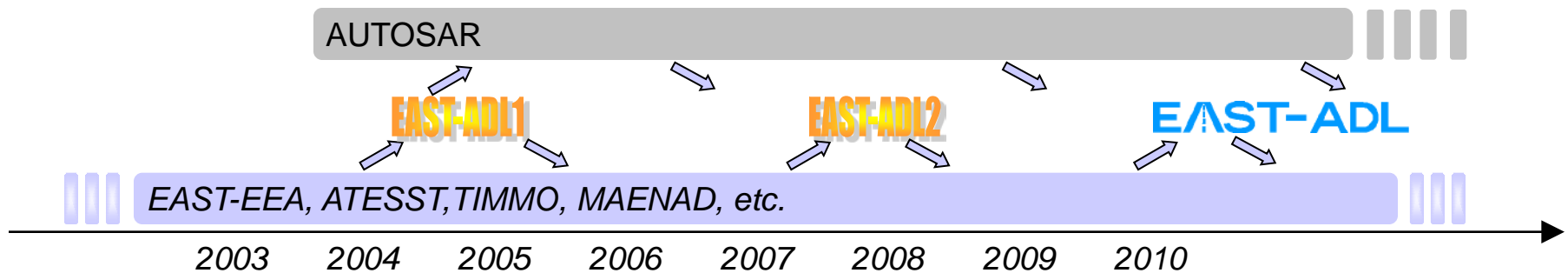# EAST-ADL Introduction

## EAST-ADL Overview

Background

- **Increasing Complexity and Criticality of Vehicle Electronics**
  - Errors due to engineering flaws are a major threat to Safety
- **Improved Engineering Methods are Necessary**
  - Standardization of ontology and specifications

Approach: System Modelling based on EAST-ADL

AUTOSAR

EAST-ADL1   EAST-ADL2   EAST-ADL

EAST-EEA, ATESST,TIMMO, MAENAD, etc.

2003   2004   2005   2006   2007   2008   2009   2010

EAST-ADL Introduction: Overview

Background

Capture Specifications of Automotive Electronic Systems
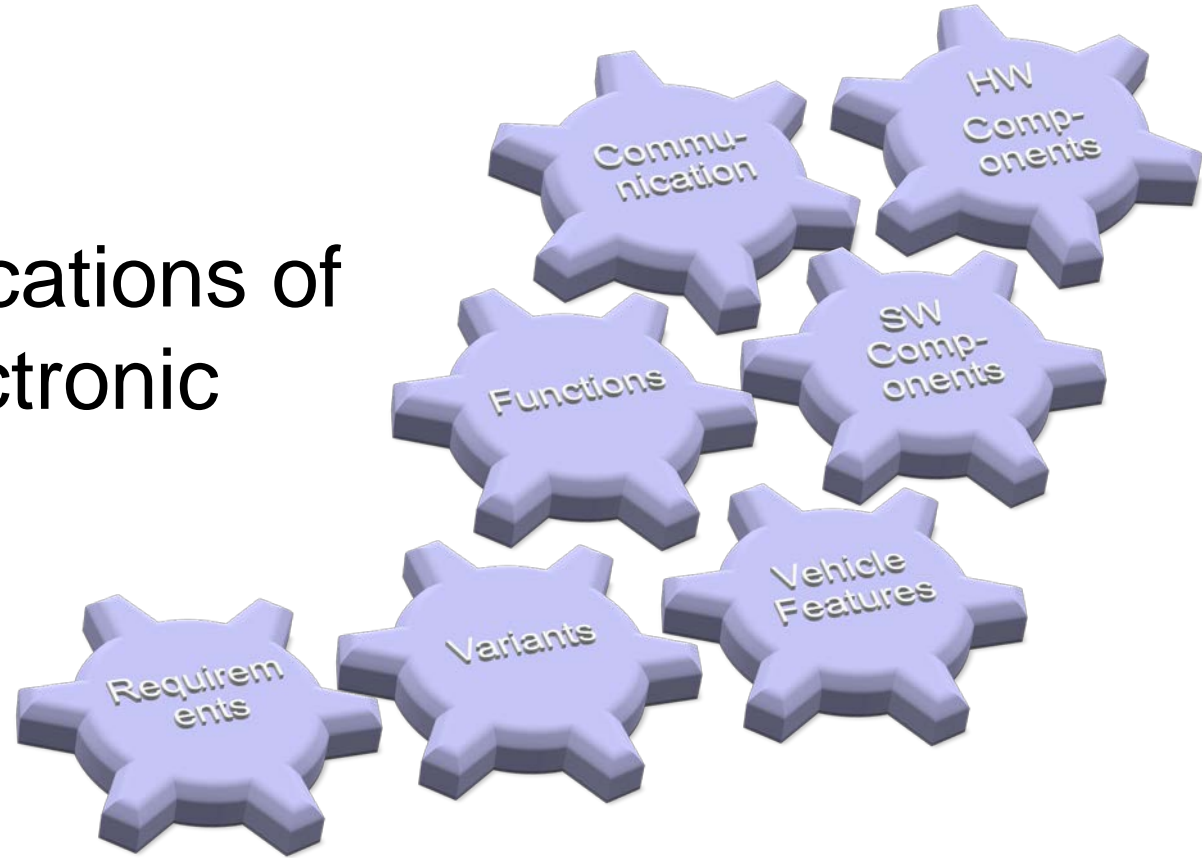
Architecture Description Language
An information model that captures engineering information in a standardized way

Why Collaborative Research?

- Enable long-term, pro-active work
- Leverage of company effort through collaborative work
- Reaching common approach in the automotive industry
- Influence Research Community to address automotive needs
- Influence other Research Projects to address automotive needs
- Exchange of experience - suppliers, OEMs and institiutes

Why EAST-ADL?

- **Background**
  - System complexity is increasing
  - Lead times are reduced
  - Criticality is increasing
  - Quality is at stake
  - Safety is at stake
  - ISO26262
- **Standardization of specification means = EAST-ADL**
  - Collaborate on tools
  - Collaborate on methods
  - Exchange models, not documents

EAST-ADL Introduction: Overview

EAST-ADL Related Projects

EAST-ADL Introduction: Overview
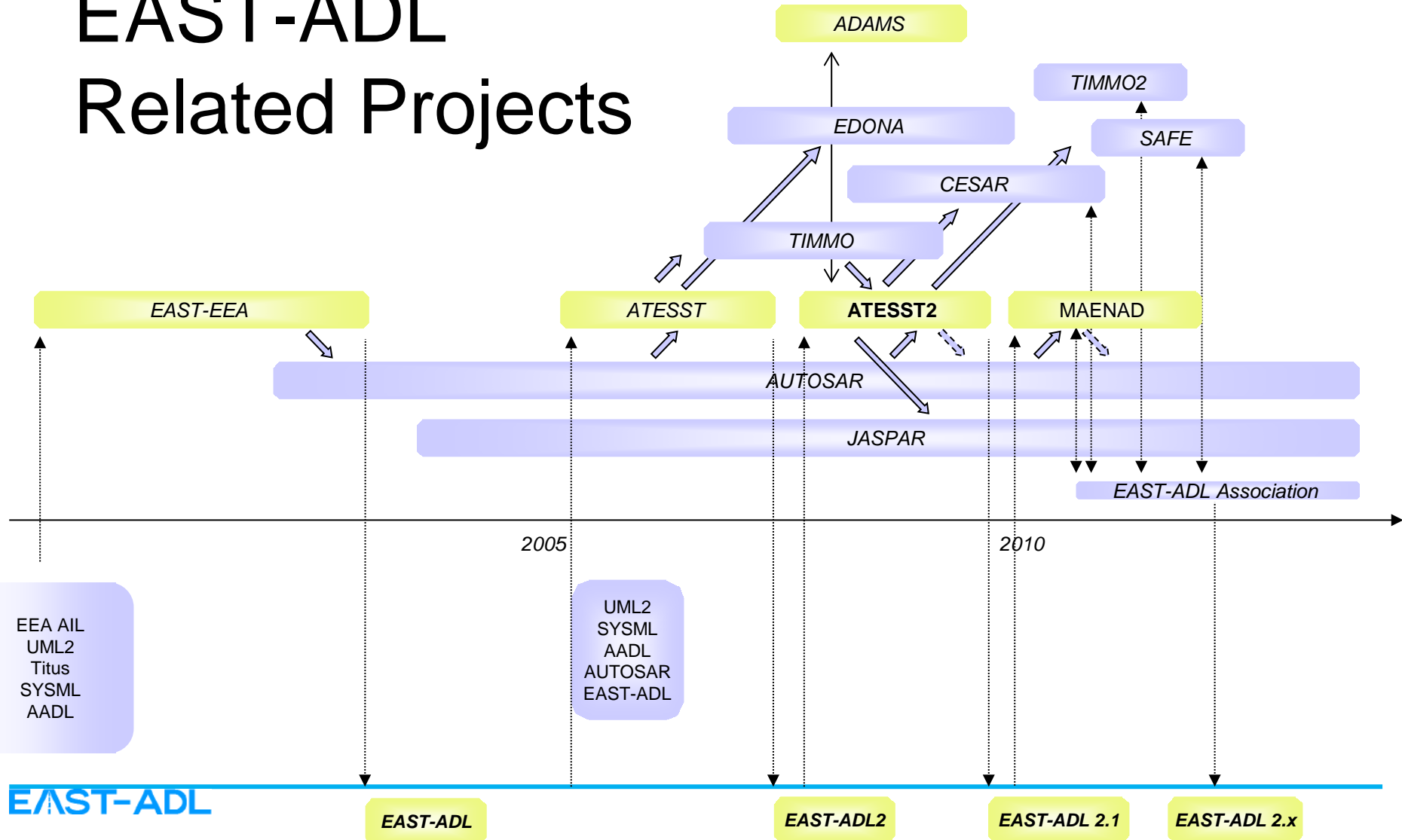
EAST-ADL Related Projects

- ATESST: Refining EAST-ADL language, profile, methodology, tools
- ADAMS: Promoting MARTE UML2 profile and EAST-ADL as UML solution
- CESAR: EAST-ADL is input to Reference Technology Platform
- TIMMO: Timing model for AUTOSAR and EAST-ADL
- EDONA: Deployment of AUTOSAR and EAST-ADL
- MeMVaTex: Requirements modelling for EAST-ADL
- MAENAD: Refining EAST-ADL language, profile, methodology, tools
- TIMMO2: Timing model for AUTOSAR and EAST-ADL, focus on deployment
- SAFE: Safe Automotive soFtware architEcture, ISO26262 Support
- MBAT: Model-based analysis and test
- …

EAST-ADL Contributors 2000-2010

- AUDI AG
- BMW AG
- Carmeq GmbH
- CRF
- Daimler AG
- ETAS GmbH
- Mecel AB
- Mentor Graphics
- OPEL GmbH
- PSA
- Renault
- Robert Bosch GmbH
- Siemens, Continental
- Valeo

- Vector
- Volvo Car Corporation
- Volvo Technology AB
- ZF
- CEA-LIST
- INRIA
- LORIA
- Paderborn Univerisity-C-LAB
- TU of Darmstadt
- Technische Universität Berlin
- The Royal Institute of Technology
- The University of Hull
- …

EAST-ADL Association

- Non-profit, non-governmental organization
- Assist and promote the development and application of the EAST-ADL.
- The EAST-ADL Association will stipulate the content of new versions of the EAST-ADL language.
- The EAST-ADL Association has no fees or funds, and each member carry any costs for contributing.
- Membership is open to individuals and organizations
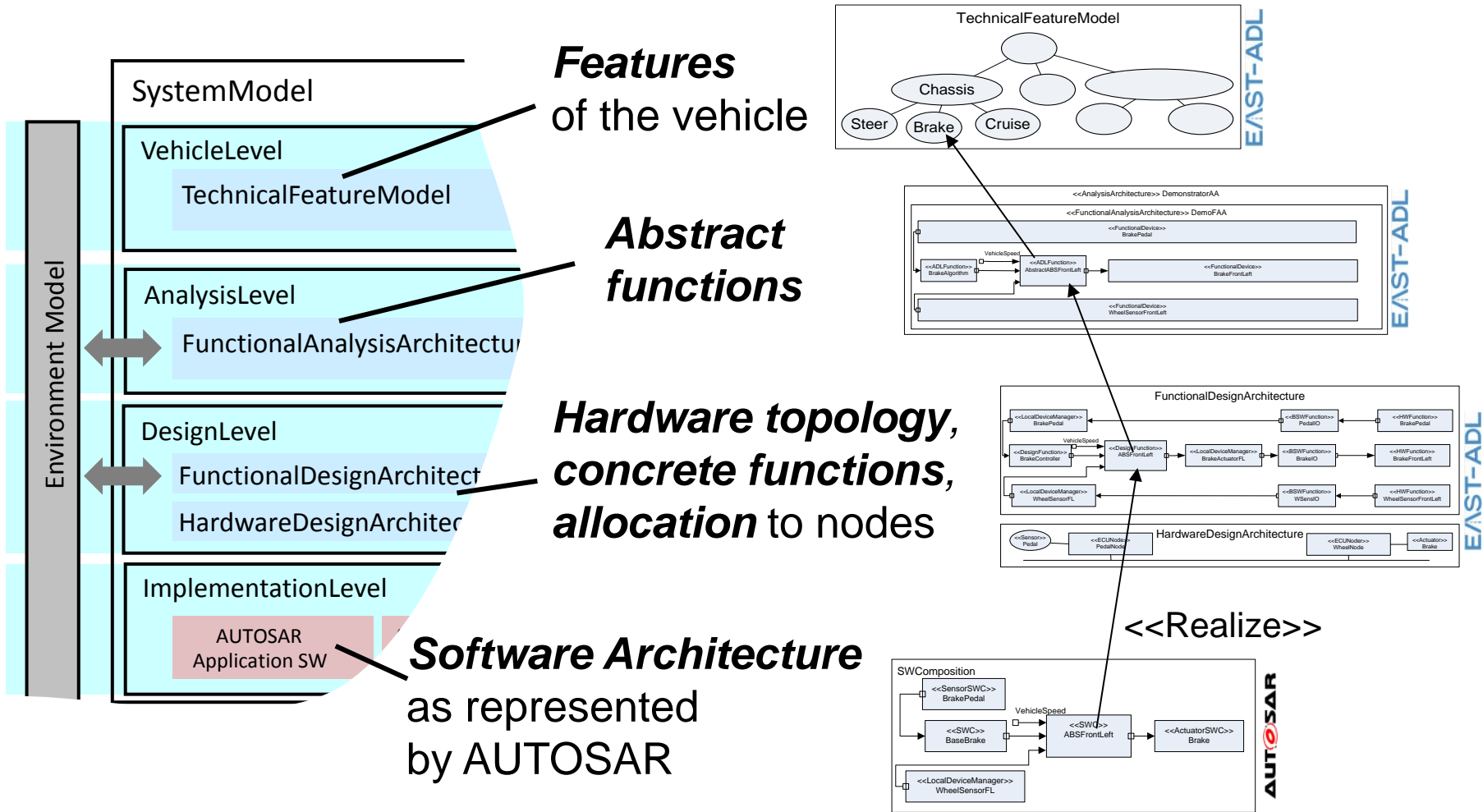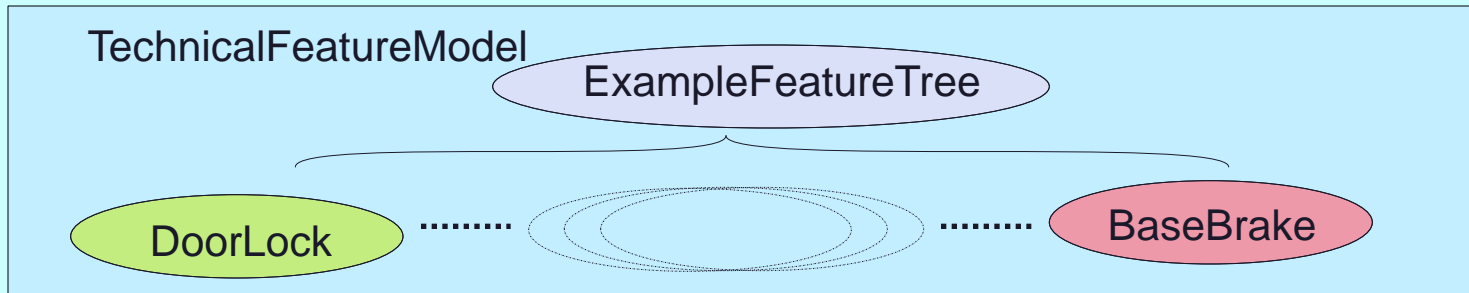- 50 members: OEMs, Suppliers, Tool Vendors, Institutes, Academia

Re-Inventing the Wheel?

- Why not UML?
  - ○ The EAST-ADL profile allows usage of UML
- Why not SysML?
  - ○ EAST-ADL is based on applicable SysML concepts
- Why not Autosar?
  - ○ EAST-ADL Complements Autosar
- Why not proven proprietary tools?
  - ○ EAST-ADL integrates external tools and provides an information structure for the engineering data regardless of tool
- Why not proven open scientific/academic approaches?
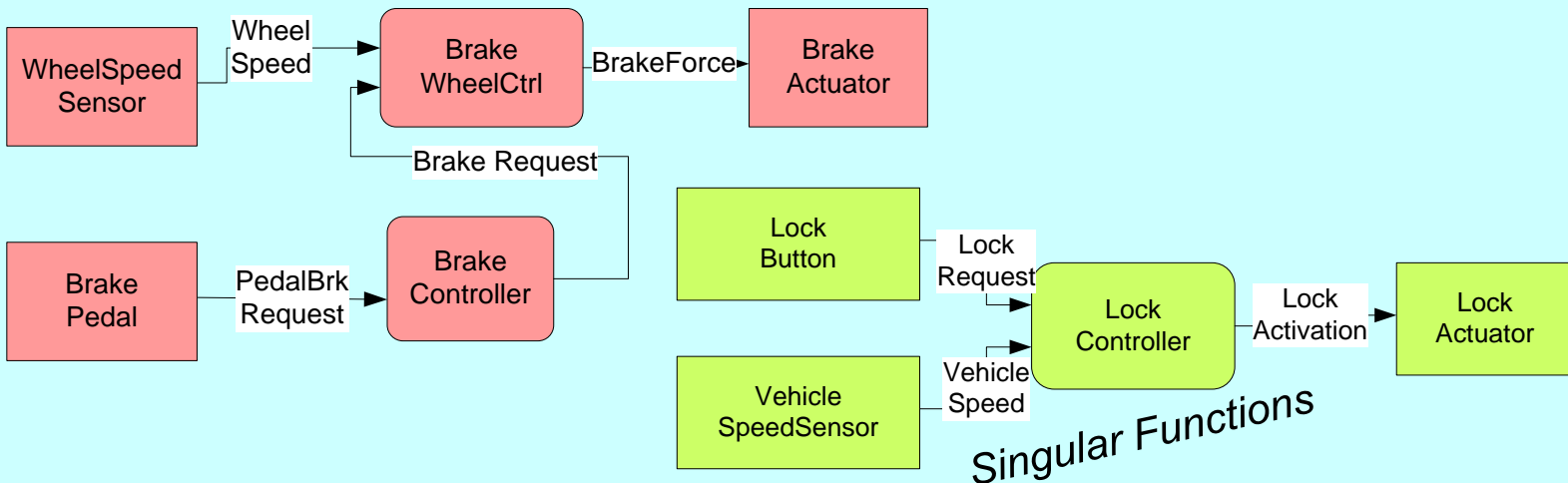 - ○ EAST-ADL integrates relevant approaches

EAST-ADL Introduction: Overview

Various Technologies are integrated

EAST-ADL+AUTOSAR Representation

Features
of the vehicle

Abstract functions

Hardware topology, *concrete functions*, *allocation* to nodes

Software Architecture
as represented
by AUTOSAR

<<Realize>>

EAST-ADL Introduction: Overview

EAST-ADL Abstraction Levels

EAST-ADL Introduction: Overview

EAST-ADL Abstraction Levels

EAST-ADL Introduction: Overview
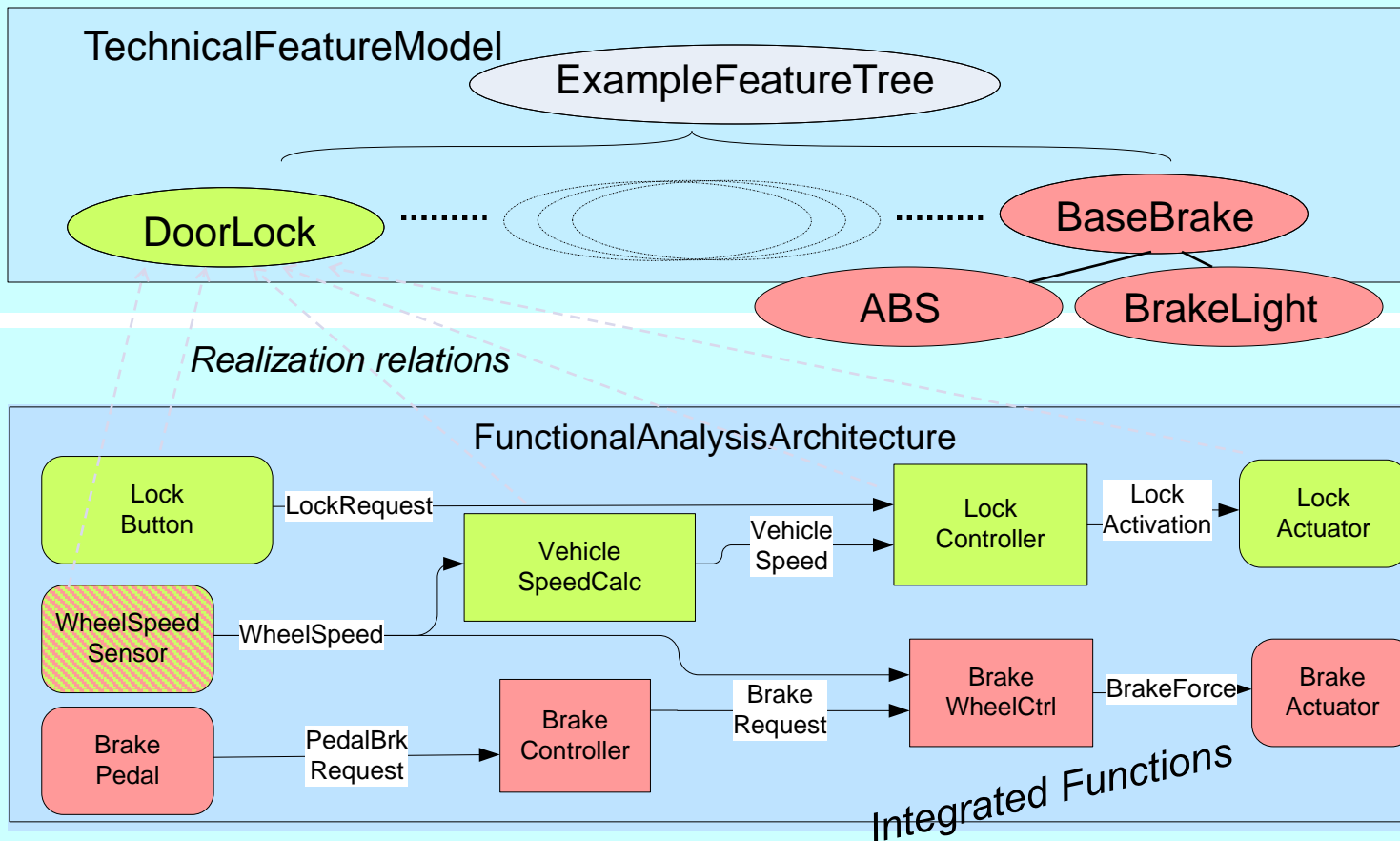
Vehicle Level

Characterization of Vehicle by a means of Features

- *Stakeholder* requested functional or non-functional characteristics
- Describes "what", but shall not fix the "how"
- Specified by requirements and use cases
- Configuration points to create a vehicle variant
- ProductFeatureModels for Configuration of TechnicalFeatureModel

EAST-ADL Introduction: Overview
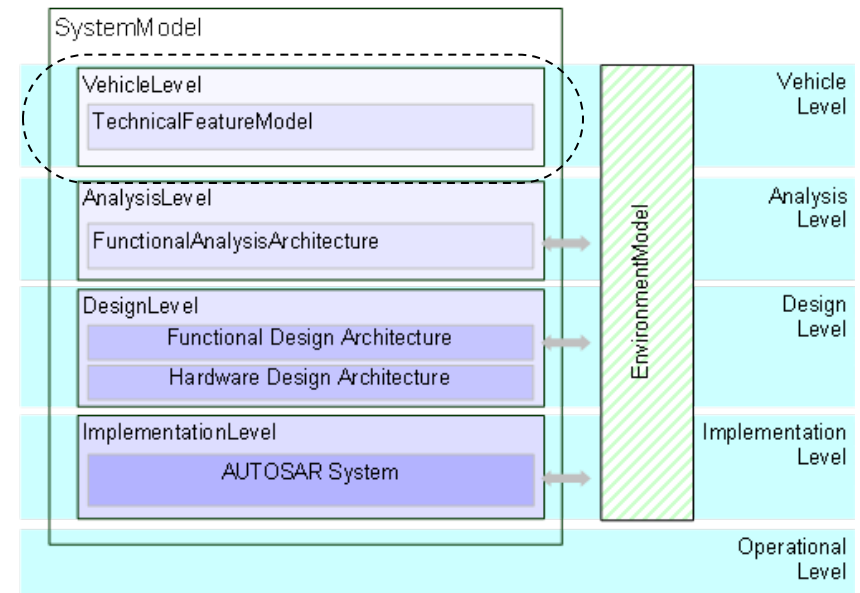
Analysis Level

Abstract Functional description of the EE system

○ Realizes functionality based on the features and requirements

○ Abstract functional definition avoiding implementation details

○ Defines the system boundary

○ Environment model defines context
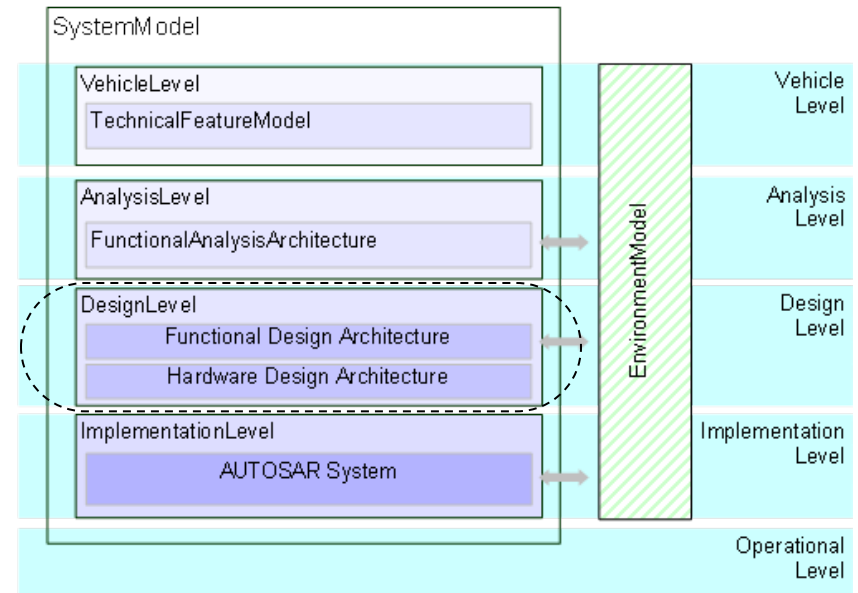
○ Basis for abstract safety analysis
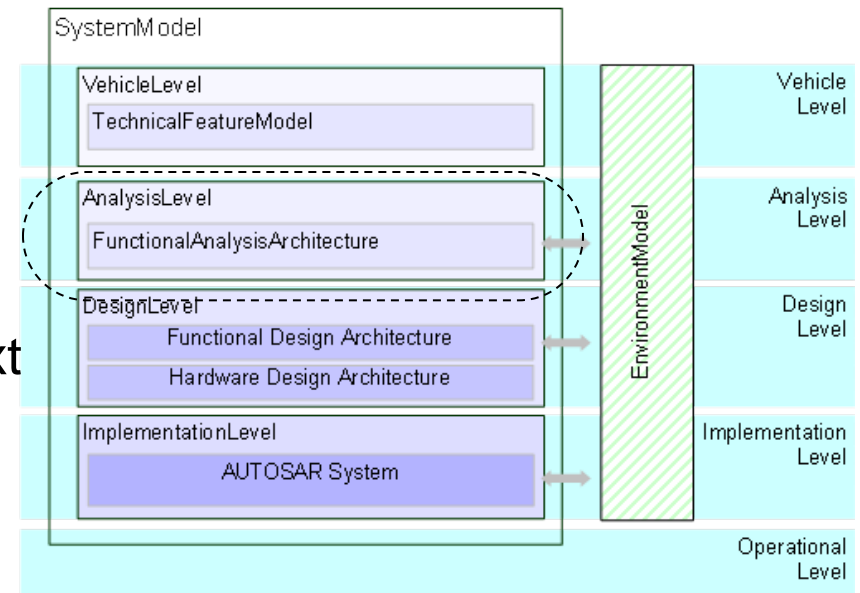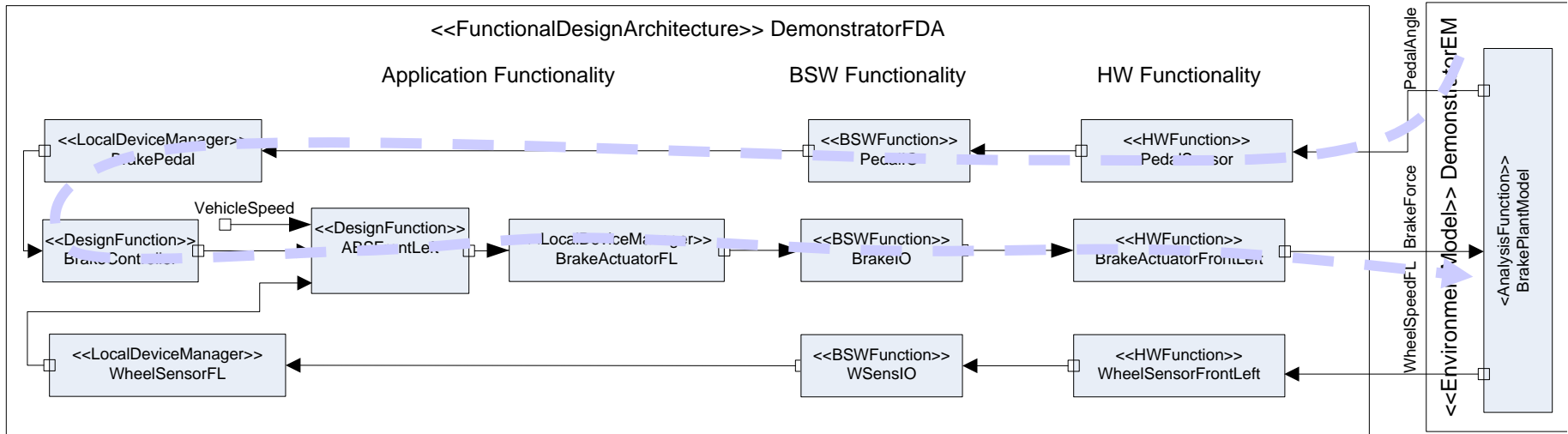
Design Level

## Concrete functional definition

- Functional definition of application software

- Functional abstraction of hardware and middleware

- Hardware architecture

- Function-to-hardware allocation

- *No SW Architecture*

EAST-ADL Introduction: Overview

Function interaction – end-to-end

Model structure supports interaction with the environment and end-to-end functional definitions
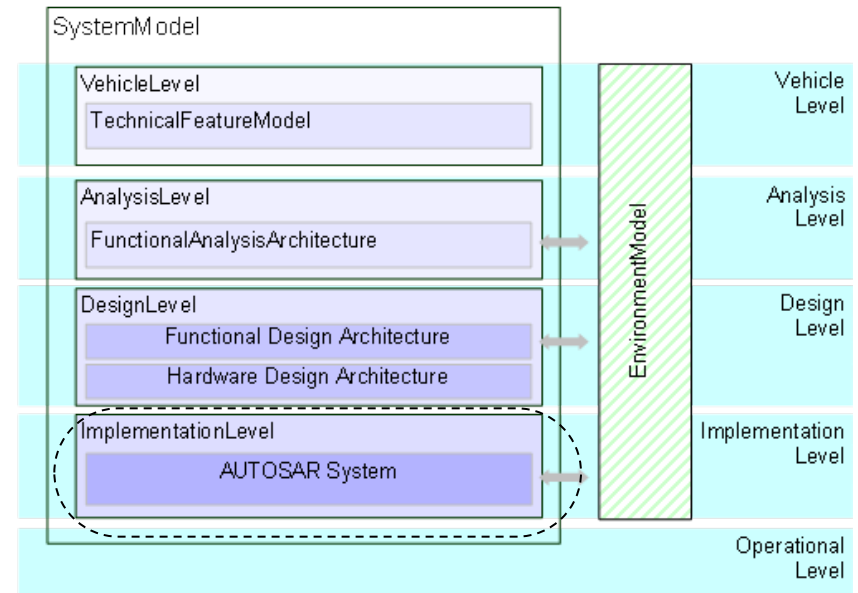
EAST-ADL Introduction: Overview
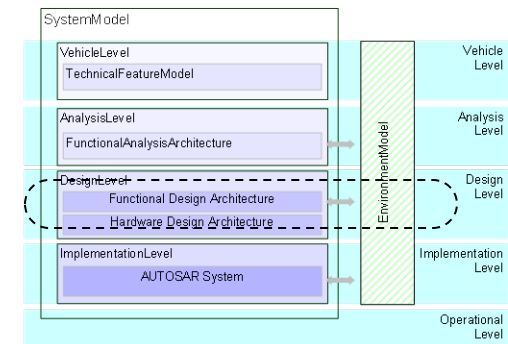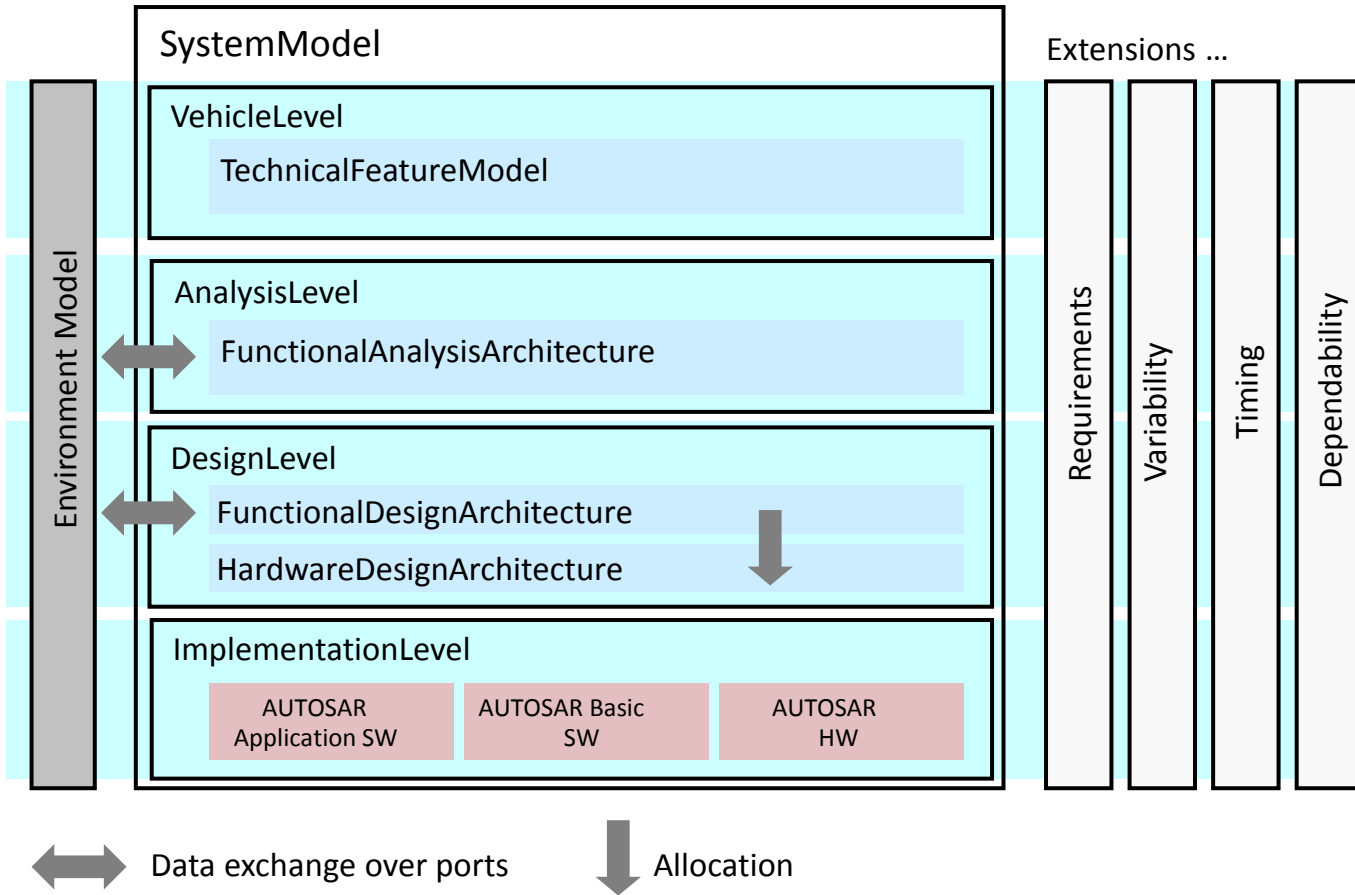
Implementation Level


Software-based implementation of the system

- AUTOSAR Software components represent application functionality

- AUTOSAR Basic software represents platform

- ECU specifications and topology represent hardware

- Model is captured in AUTOSAR

  - Software component template
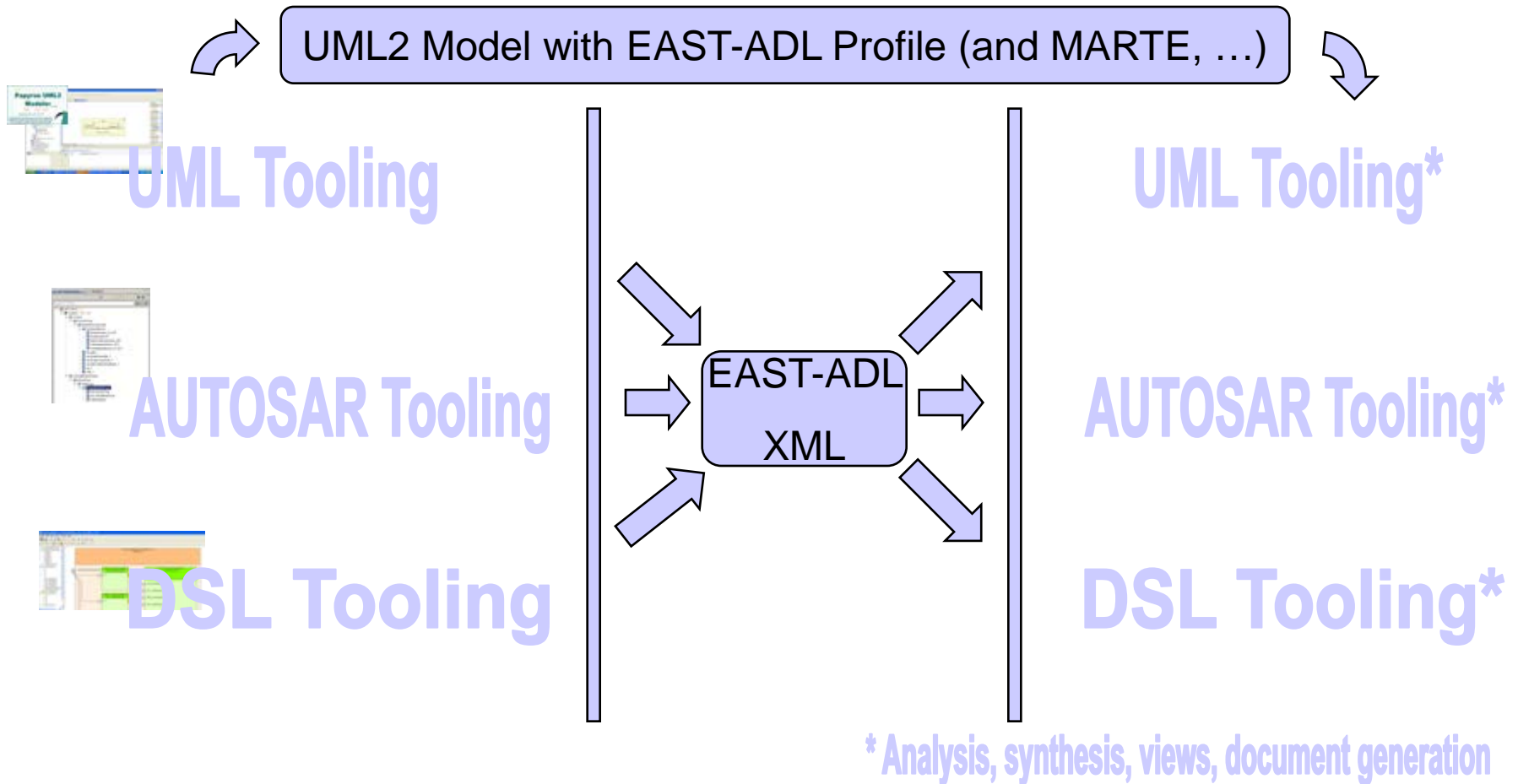 - ECU resource template
  - System Template

EAST-ADL Introduction: Overview

EAST-ADL Extensions

EAST-ADL Introduction: Overview

EAST-ADL Extensions

EAST-ADL Introduction: Overview
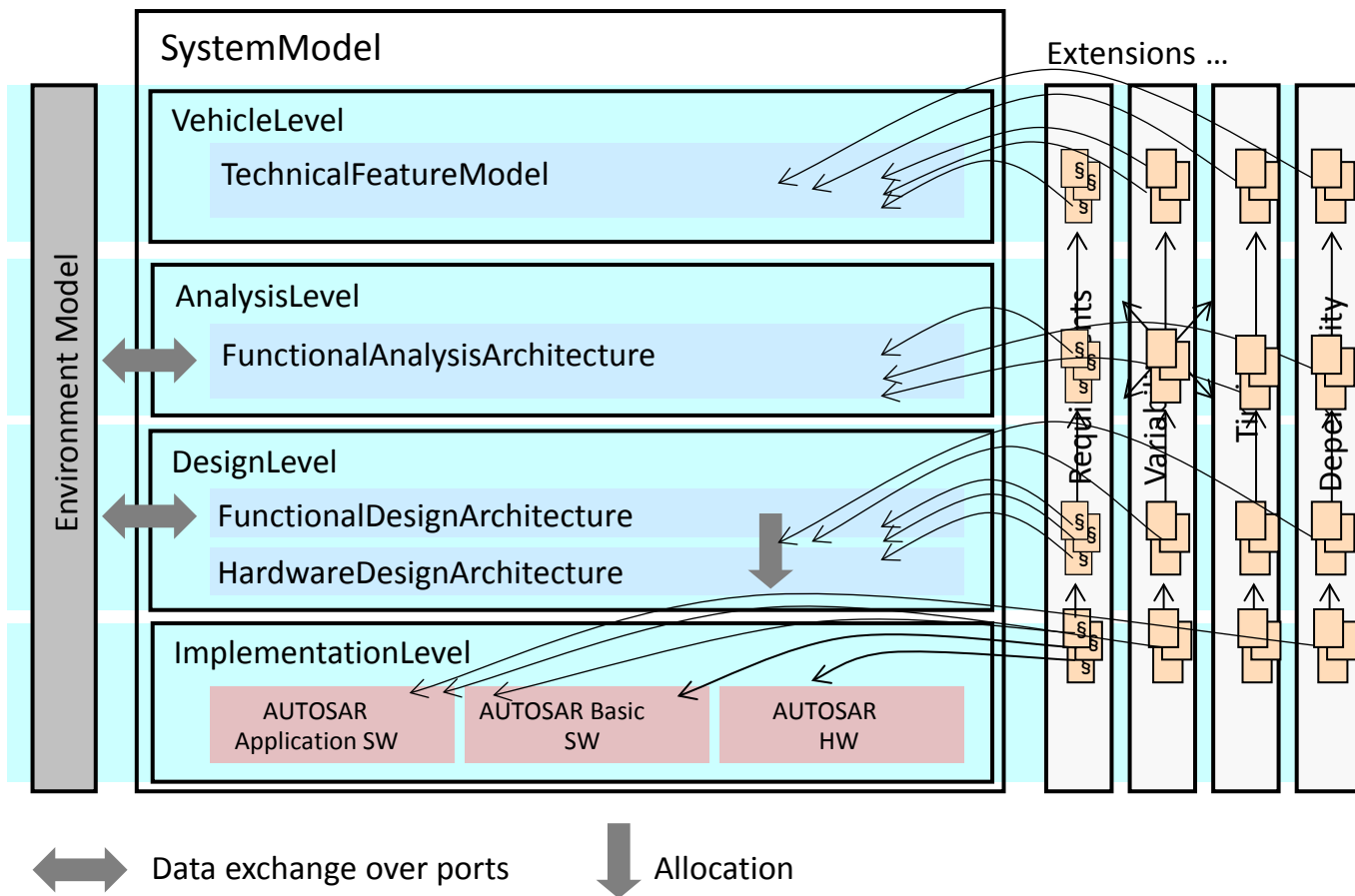
EAST-ADL Extensions: Summary

- Constructs for requirements, safety, variability, timing, environment, etc. represents extensions
- Extensions are organized according to abstraction level
- Extensions reference the structural core
- Language may be supported in steps
- UML Profile Application can be modular
- Language annexes can be added
- Changes in one annex does not affect rest
- Extensions can be applied to AUTOSAR

Model Definition and Exchange

UML2 Model with EAST-ADL Profile (and MARTE, …)

UML Tooling

AUTOSAR Tooling

DSL Tooling

EAST-ADL

XML

UML Tooling*

AUTOSAR Tooling*

DSL Tooling*

* Analysis, synthesis, views, document generation

EAST-ADL Introduction: Overview

Language Definition

- Metamodel defined in Enterprise Architect
- Documentation autogenerated from model
- Exchange format autogenerated using AUTOSAR rules
- AUTOSAR elements can be integrated

EAST-ADL Introduction: Overview
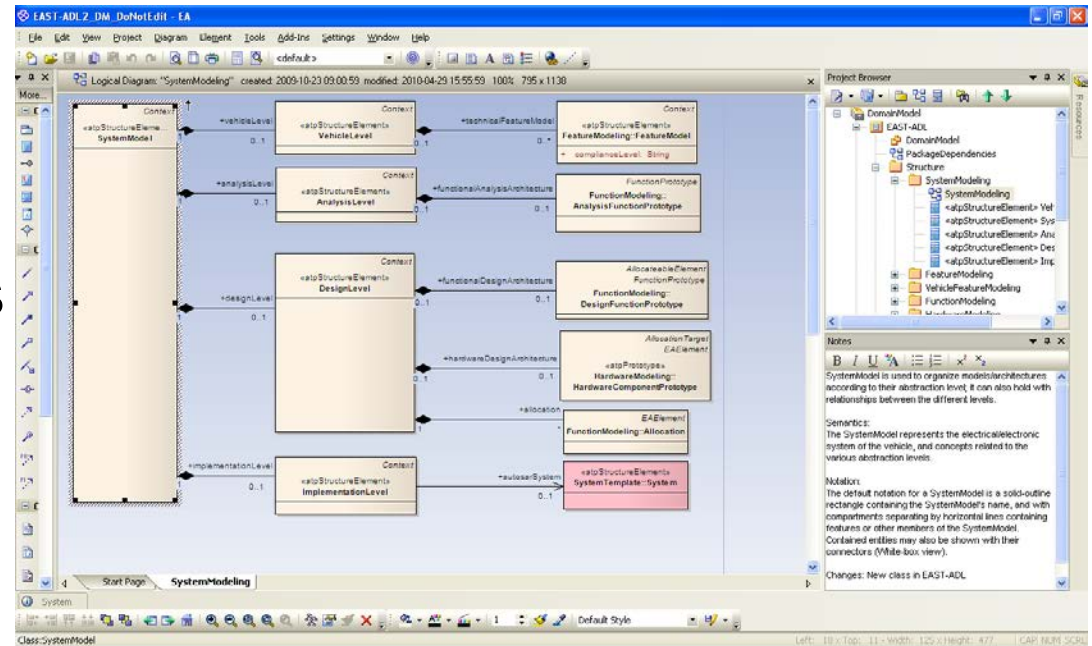
Conclusion

EAST-ADL supports automotive embedded systems modelling "starting" with needs and requirements and "ending" with an AUTOSAR SW architecture

- An agreed modelling language makes it possible
  - to understand engineering information from other departments/disciplines and companies
  - to exchange engineering models between different organizations
  - to progress jointly on tools and methodology for modelling, analysis and synthesis

EAST-ADL Introduction: Overview