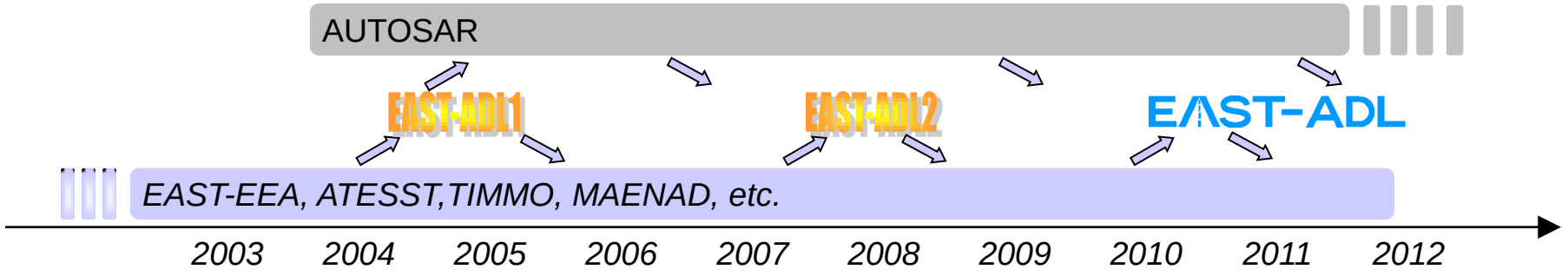
EAST-ADL Introduction

EAST-ADL Overview

Background

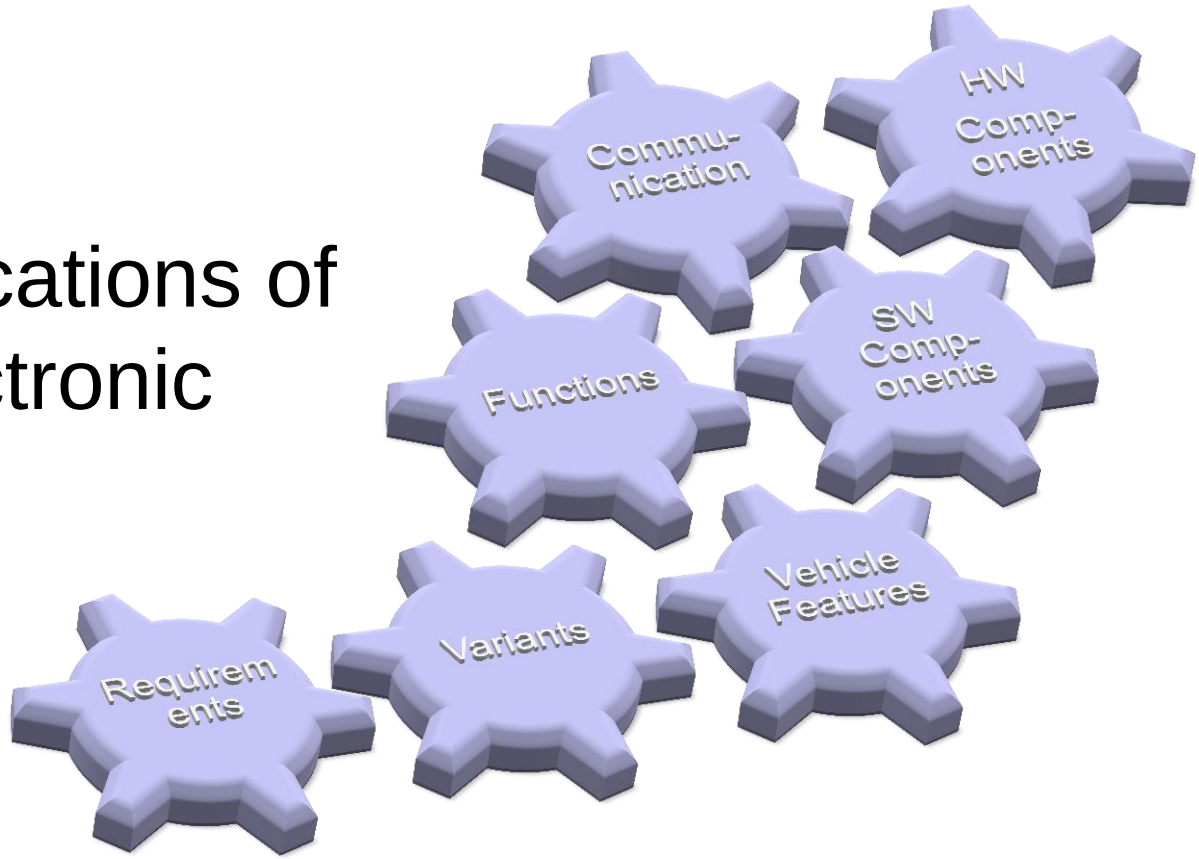
- Increasing Complexity and Criticality of Vehicle Electronics
  - Errors due to engineering flaws are a major threat to Safety
- Improved Engineering Methods are Necessary
  - Standardization of ontology and specifications

Approach: System Modelling based on EAST-ADL



Background

Capture Specifications of Automotive Electronic Systems



Architecture Description Language

An information model that captures engineering information in a standardized way

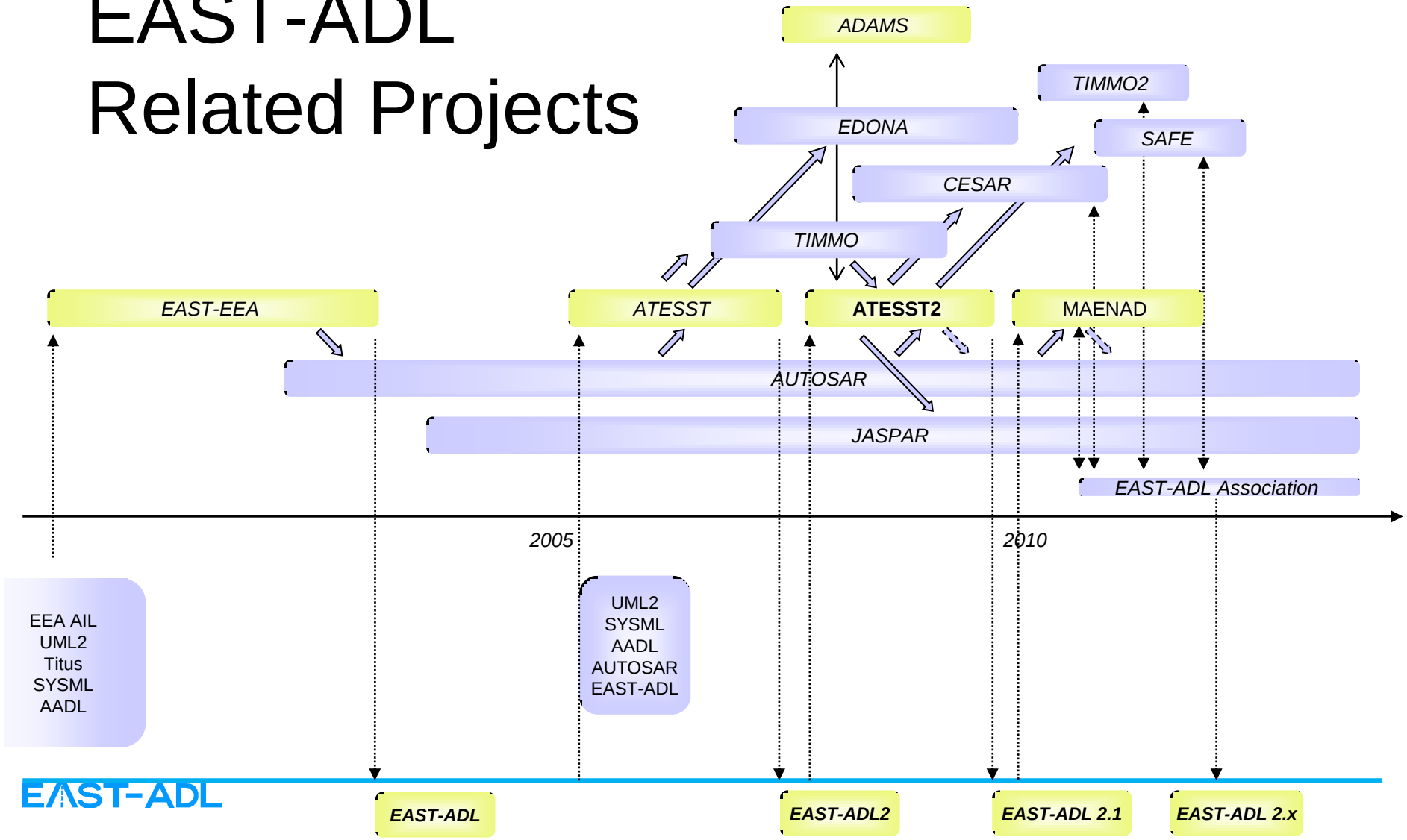
Why Collaborative Research?

- 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 Related Projects



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

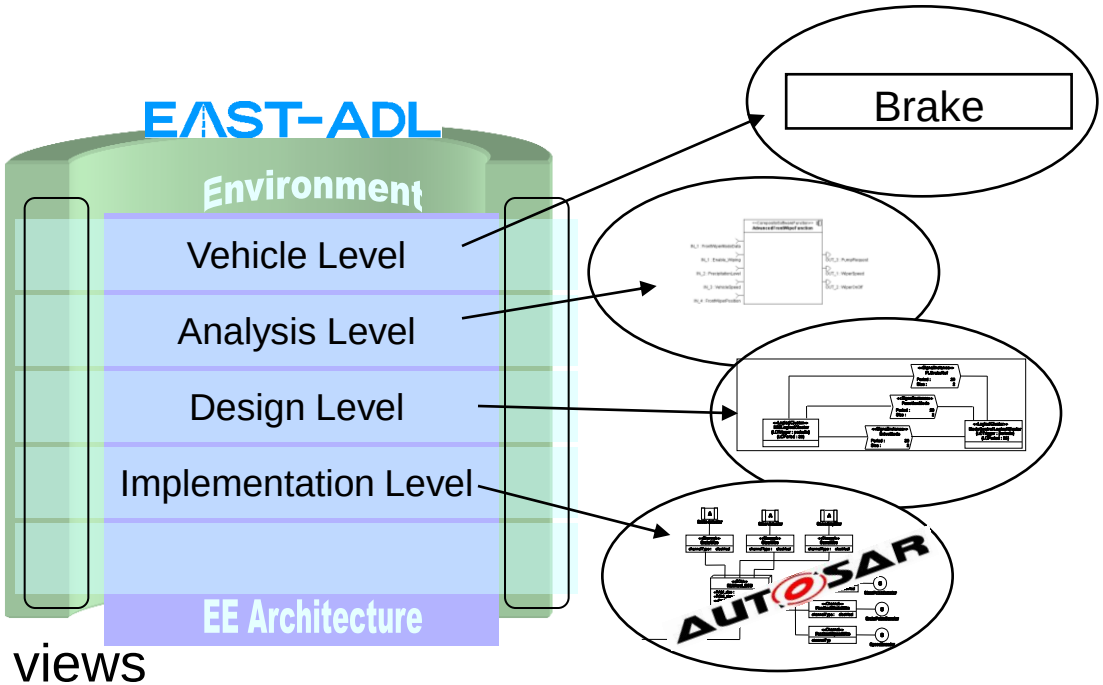
- AUDI AG
- BMW AG
- Carmeq GmbH
- CRF
- Daimler AG
- ETAS GmbH
- Mecel AB
- Mentor Graphics
- OPEL GmbH
- PSA
- Renault
- Robert Bosch GmbH
- Siemens, Continental
- Valeo
- Vector
- Volvo Car Corporation
- Volvo Technology AB
- ZF
- CEA-LIST
- INRIA
- LORIA
- Paderborn Univerisity-C-LAB
- TU of Darmstadt
- 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

Approach

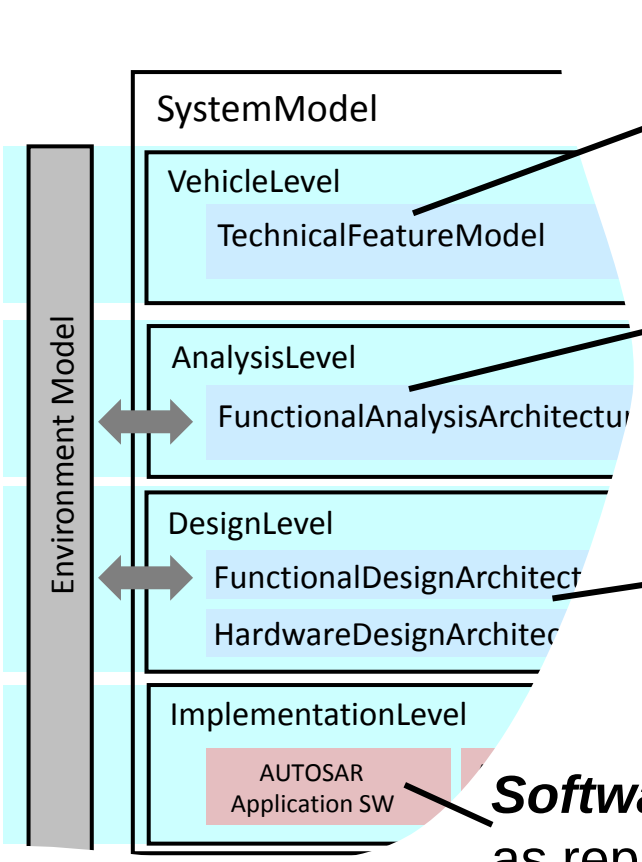
- EAST-ADL provides means to represent the embedded system in several abstraction levels
- Different kinds of engineering information
  - Feature content
  - Functional content
  - Software architecture (AUTOSAR)
  - Requirements
  - Variability
  - Safety information
  - V&V Information
  - Behavior
- Traceability is supported
- Analysis and synthesis
- Document generation and views



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+AUTOSAR Representation

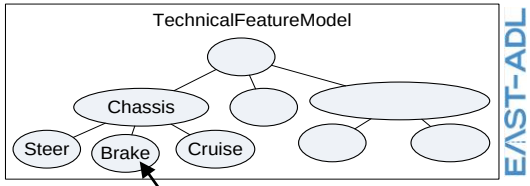


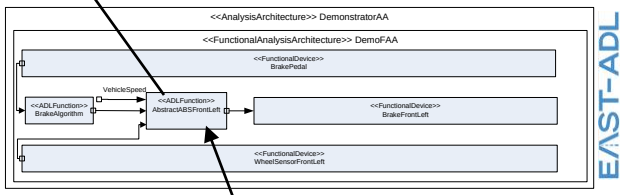
Features of the vehicle

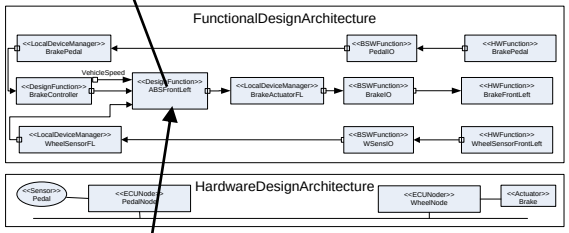
Abstract functions

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

Software Architecture as represented by AUTOSAR







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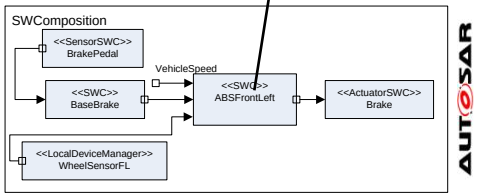
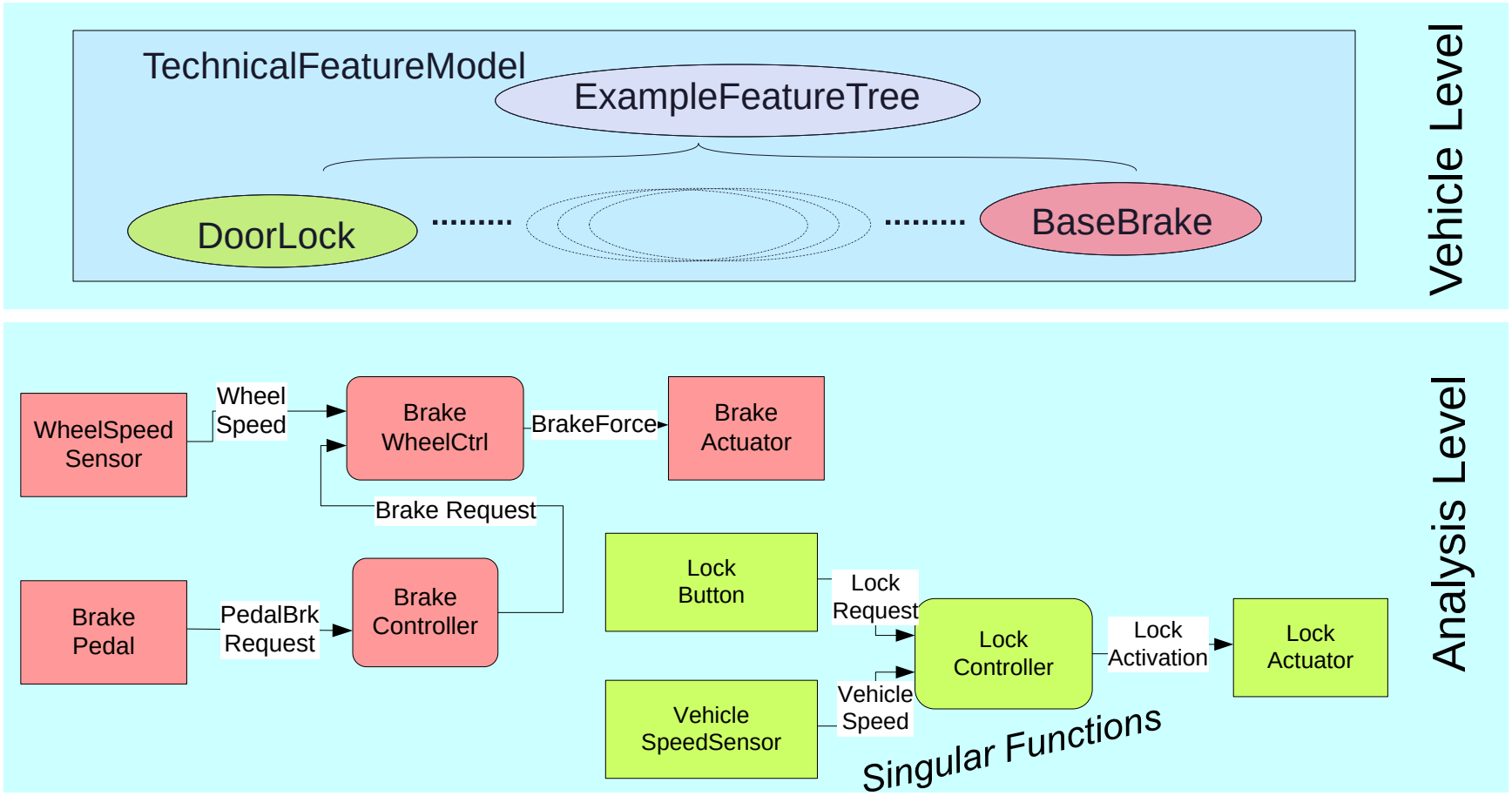


EAST-ADL Abstraction Levels



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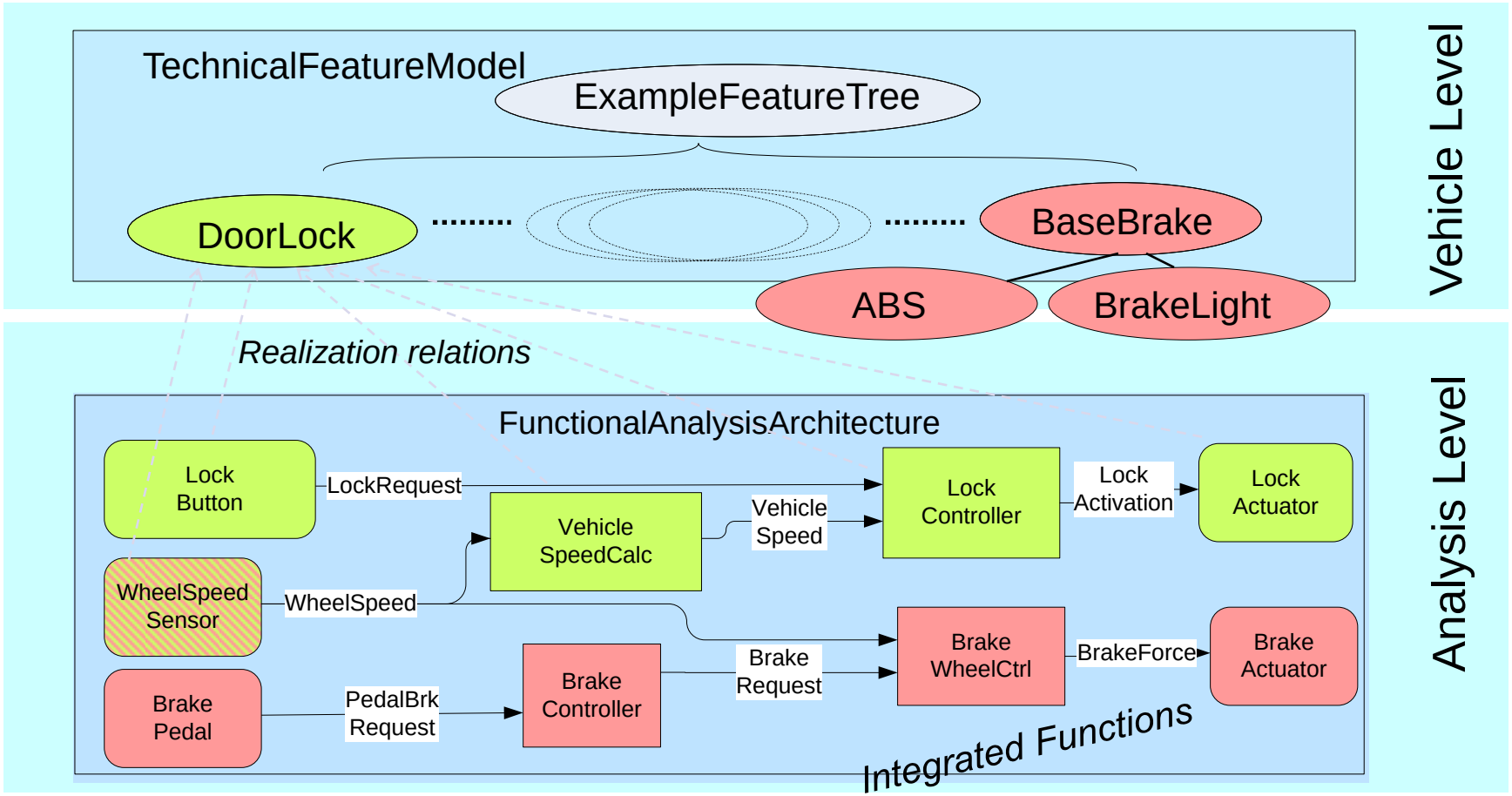
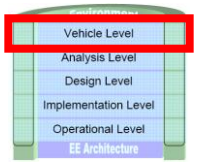
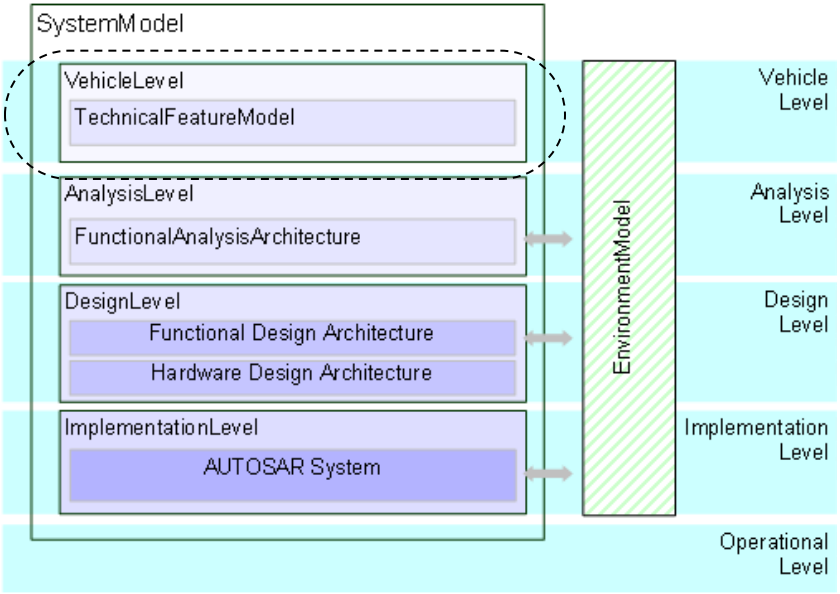


Vehicle Level



Characterization of Vehicle by a means of Features

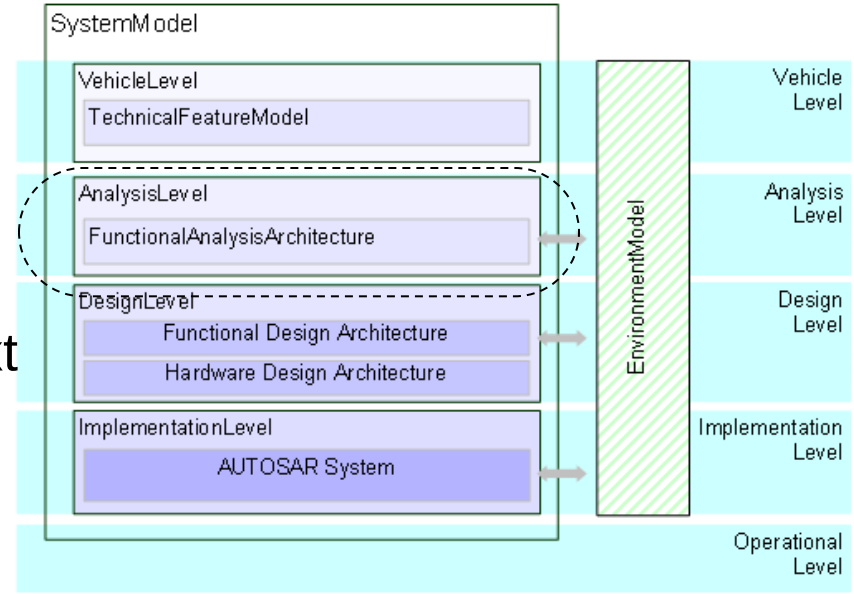
- *Stakeholder* requested functional or non-functional characteristics
- Describes "what",
  but shall not fix the "how"
- Specified by requirements and use cases
- Configuration points to create a vehicle variant
- ProductFeatureModels for Configuration of TechnicalFeatureModel



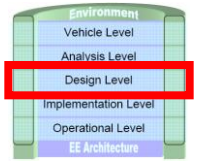
Analysis Level

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

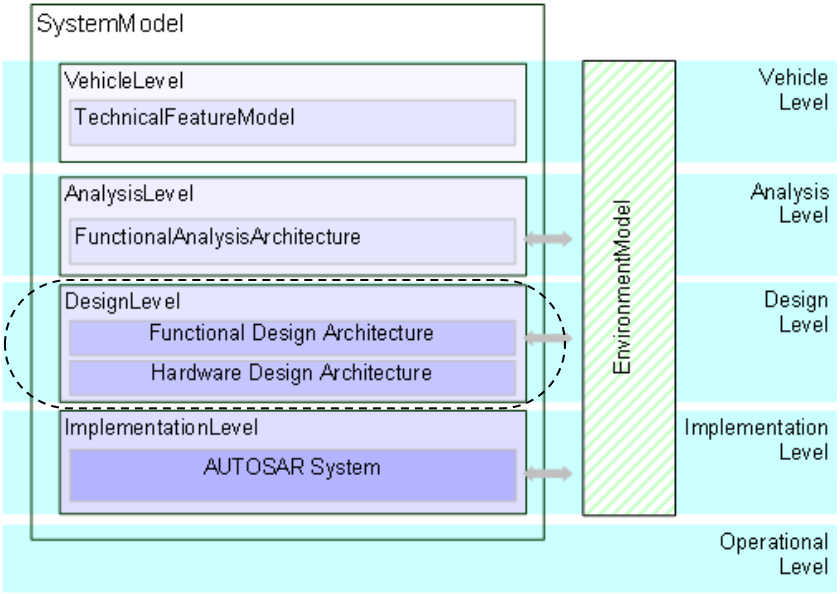


Design Level

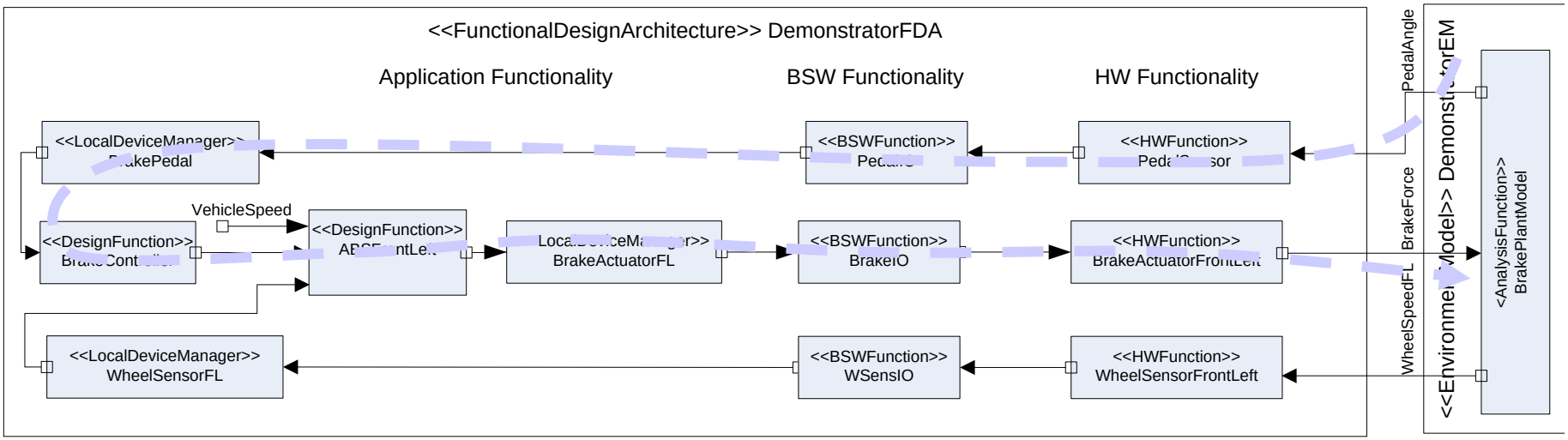


Concrete functional definition

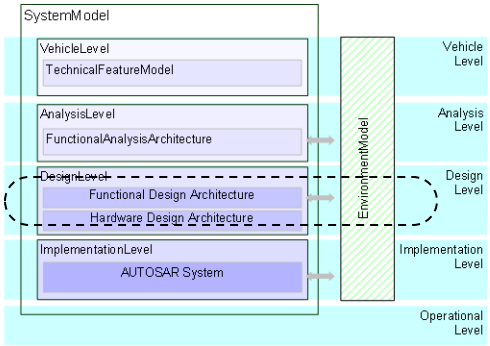
- Functional definition of application software
- Functional abstraction of hardware and middleware
- Hardware architecture
- Function-to-hardware allocation
- *No SW Architecture*



Function interaction – end-to-end



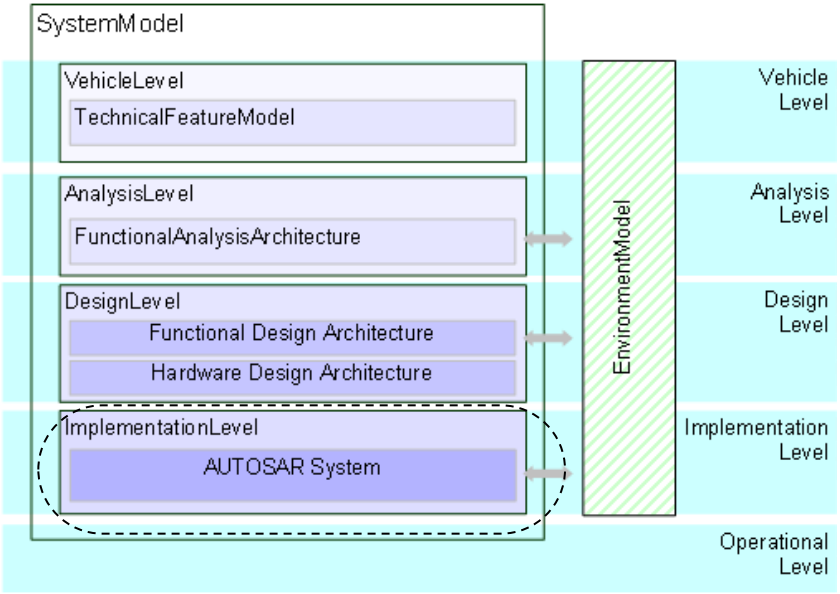
- Model structure supports interaction with the environment and end-to-end functional definitions



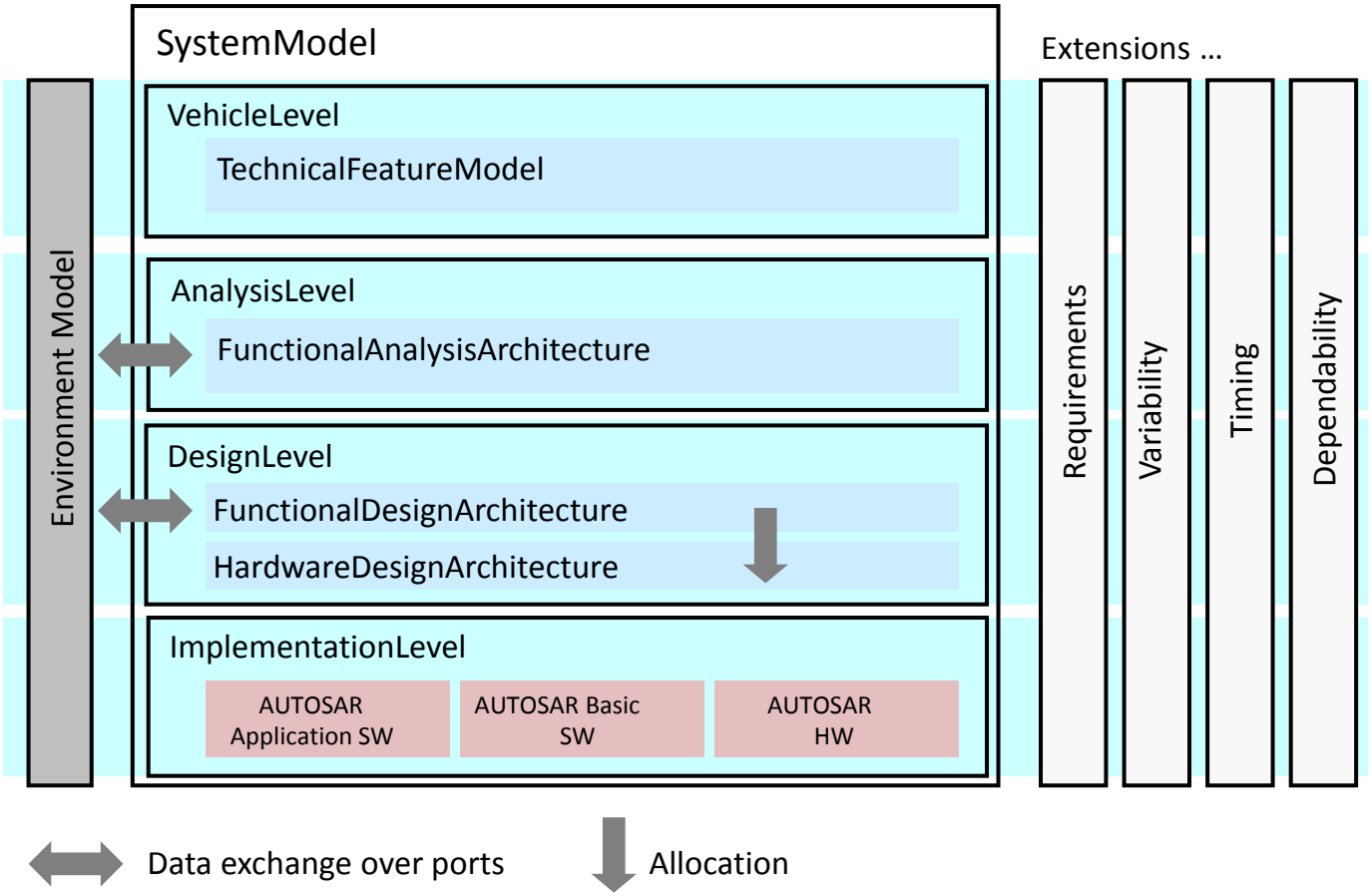
Implementation Level

Software-based implementation of the system

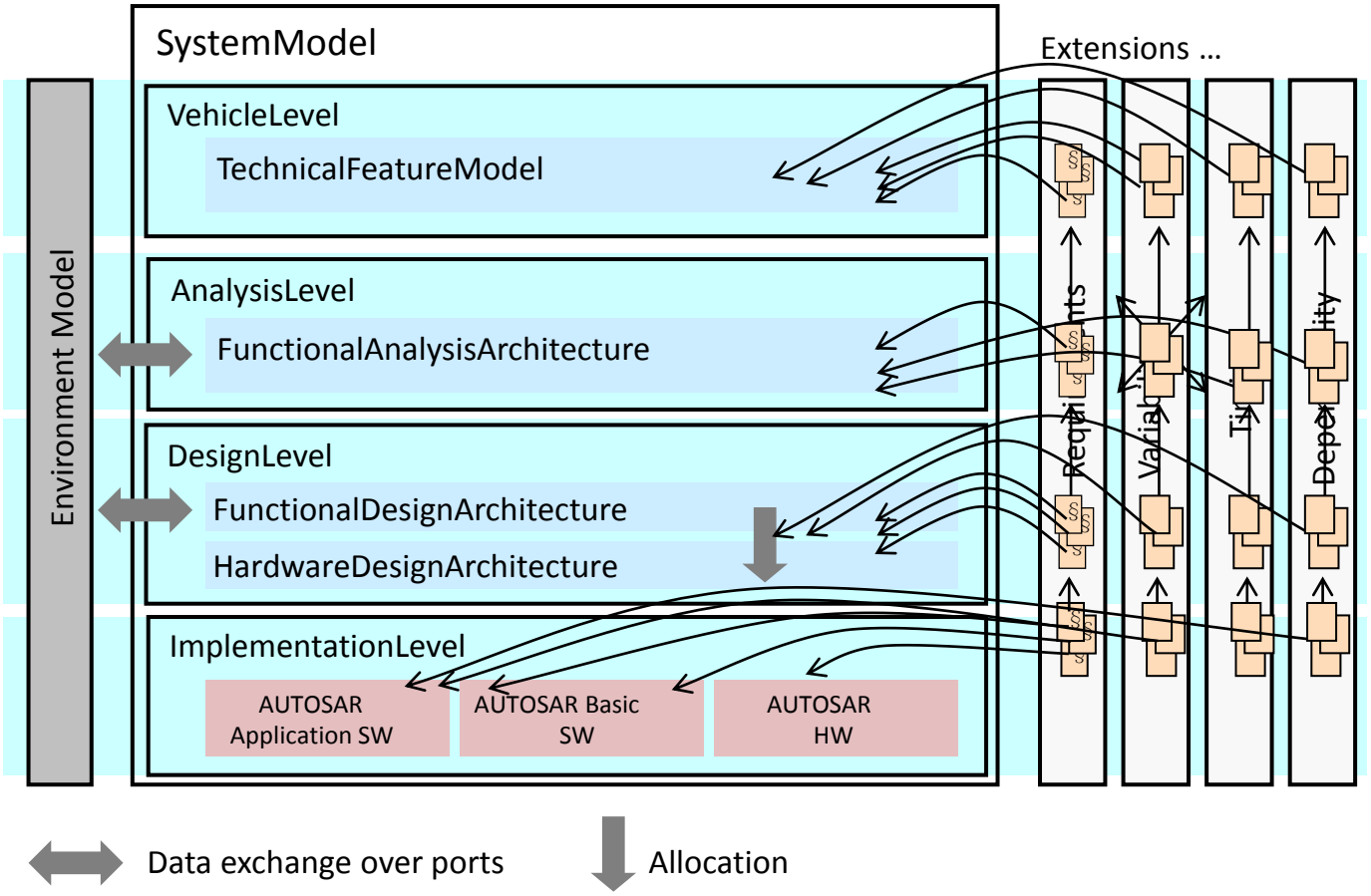
- AUTOSAR Software components represent application functionality
- AUTOSAR Basic software represents platform
- ECU specifications and topology represent hardware
- Model is captured in AUTOSAR
  - Software component template
  - ECU resource template
  - System Template



EAST-ADL Extensions



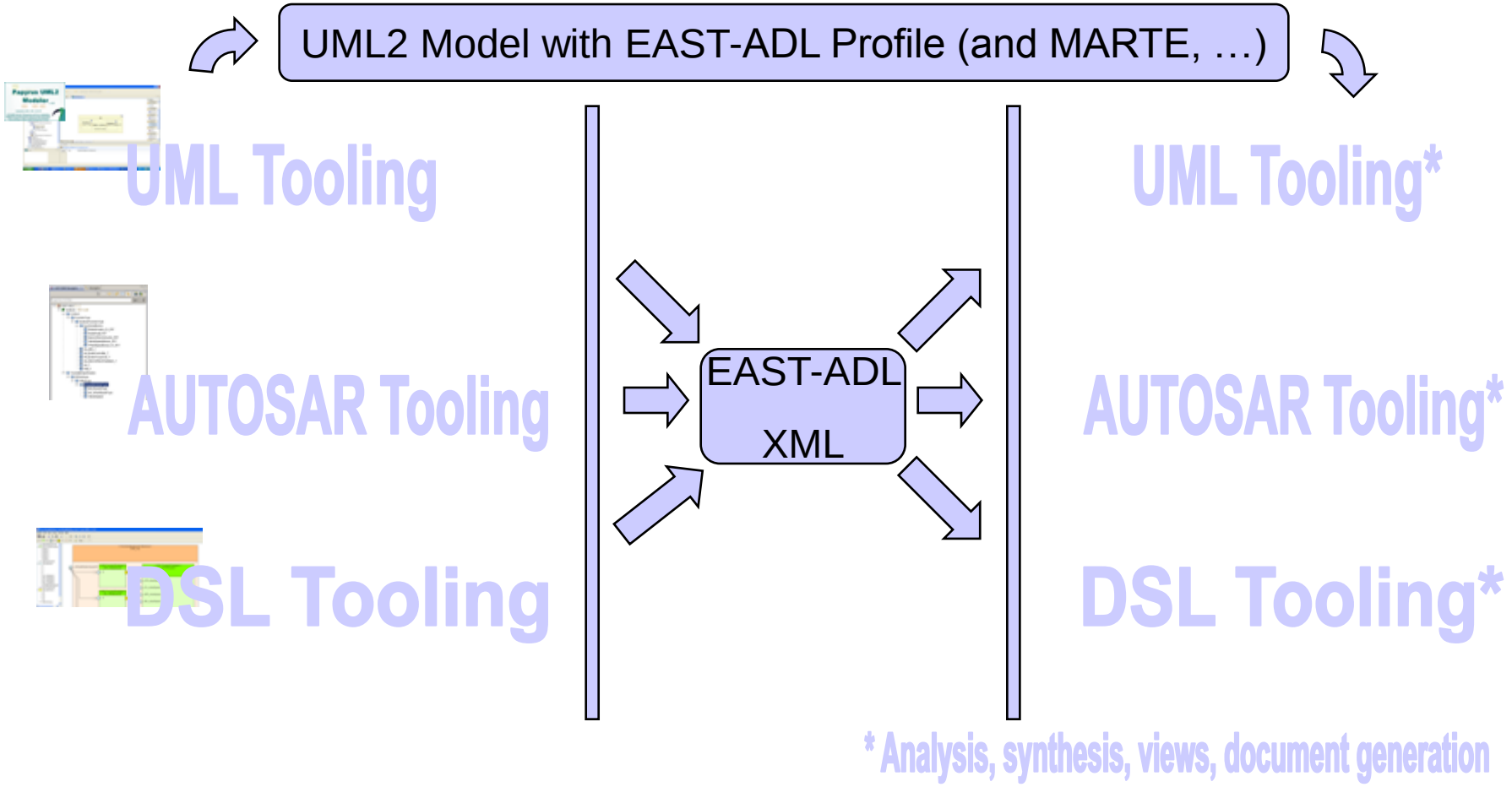
EAST-ADL Extensions



EAST-ADL Extensions: Summary

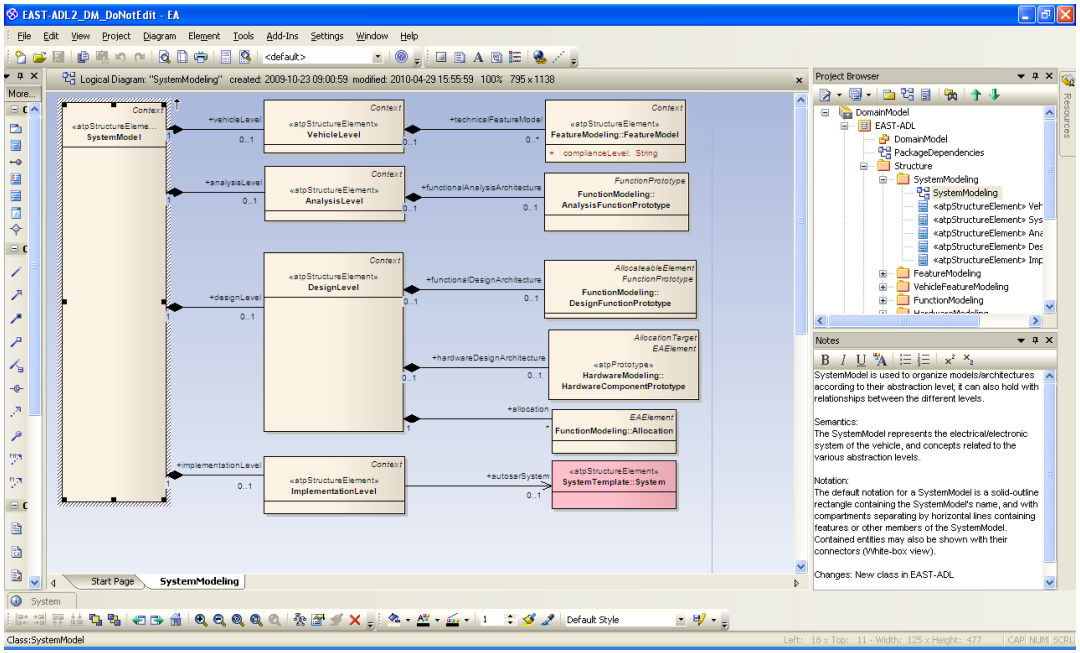
- Constructs for requirements, safety, variability, timing, environment, etc. represents extensions
- Extensions are organized according to abstraction level
- Extensions reference the structural core
- Language may be supported in steps
- UML Profile Application can be modular
- Language annexes can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

Model Definition and Exchange



Language Definition

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



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

Ongoing Activities

- MAENAD: Extends EAST-ADL for Fully Electrical Vehicle Needs
- TIMMO2-USE: Timing annotations, methodology and algorithms for AUTOSAR and EAST-ADL
- SAFE: Model Based support for ISO26262
- CESAR: Multi-domain, cost efficient and safe development of embedded systems
- MBAT: Model-based analysis and test