TIMMO WP2 TADL
Timing Augmented Description Language
Open Workshop
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WP2 TADL

• Timing Augmented Description Language

• WT 2.1 Syntax, this presentation
  – Modeling
  – TADL Events and Event Chains
  – TADL Constraints
  – TADL Editor: Organization of the user model

• WT 2.2 Semantics, next presentation

• WT 2.3 Editor, demonstration during break
What is the model?

Metalevels as defined by OMG and used by EAST-ADL2, AUTOSAR, and TIMMO

- **M3**: A metamodel for M2
- **M2**: The TIMMO metamodel following the rules set up at the M3 level
- **M1**: The user model
- **M0**: The real world system
TIMMO TADL

• The language definition is specified on the M2 level
  – Referring to EAST-ADL2 where the different model abstraction levels are defined
  – Referring to the AUTOSAR metamodel where different templates are defined
  – The definition of the TADL Constraints are supported by EAST-ADL2 tracing of requirements, verification, and realizations
XML as exchange format

Supporting Tools
- ASCET
- Intecrío
- SymTA/S
- TTTech
...

Mentor VSA Model Editor

XML

conforming to

XSD

generated from

AUTOSAR, TADL, EAST-ADL2 Metamodel

Syntax

Semantics

Supporting Tools
- ASCET
- Intecrío
- SymTA/S
- TTTech
...

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Development of TADL

Needs
Requirements
Concepts
Enterprise Architect
Tools, Req, Scenarios
AUTOSAR
EAST-ADL2
MARTE

TADL

Supporting tools
Validation
Analysis
VSA
Modeling
UML Tool
UML Profile

Exchange format
MARTE, EAST-ADL2 & AUTOSAR profiles

This is not the “TIMMO Methodology”
Steps in development of TADL

- TADL concept definitions based on TIMMO requirements, scenarios and existing approaches and tools
- TADL definition in Enterprise Architect class diagrams
- TADL Editor based on an AUTOSAR authoring tool updated with EAST-ADL2 and TADL
- User modeling in the TADL Editor
- Validation of TADL in supporting tools for schedulability analysis, communication configuration, allocation, etc. Using relevant parts of the EAST-ADL2 models and AUTOSAR models. Cf. TIMMO Methodology Workproducts
EAST-ADL Abstraction Levels

- **Vehicle Level**
  - Feature content in a Vehicle Feature Model

- **Analysis Level**
  - Functional Analysis Architecture capturing the abstract functional behavior

- **Design level**
  - Hardware entities/topology
  - Concrete Functional structure & behavior
  - Function-to-ECU allocation

- **Implementation Level**
  - AUTOSAR constructs
    - SWComponent
    - ECUResource
    - System

Data exchange over ports
Modeling framework

- TADL and the abstraction levels
  - EAST-ADL2
  - AUTOSAR

[Diagram showing abstraction levels: Vehicle Level, Analysis Level, Design Level, Implementation Level, EE Architecture, TADL Metamodel]
Basic Syntax in metamodel

- **Constraint**
  - Event Chain
  - Event
  - EAST-ADL2 Event
  - AUTOSAR Event
  - EAST-ADL2 structure
  - AUTOSAR structure

- **Timing**
  - stimulus
  - response

- **Structure**
Class-diagrams in Enterprise Architect, with documented classes, relationships and attributes
Example user model

<<functionalAnalysisArchitecture>>

fcn1:Function

inFlowPort

<<eventADLInFlowPort>>

stimulus

<<reactionConstraint>>

jitter = 2.0
nominal = 10.0
mode = startup

scope

<<eventChain>>

fcn2:Function

outFlowPort

<<eventADLOutFlowPort>>

response
For each change in (Sensor) Input:
Exactly one well-defined Reaction Time path
How long does it take to get an effect on (Actuator) Output
Tracing

• For requirements, from EAST-ADL2, compare SysML
  – ADLSatisfy
  – ADLDeriveReqt
  – ADLRefine
  – ADLVerify

• Tracing between EAST-ADL2 abstraction levels (also from AUTOSAR to EAST-ADL2)
  – ADLRealization
User model tracing as in EAST-ADL2
Mentor Graphics VSA

Editor tree view in Vehicle System Architect
Infrastructure

MM = Metamodel
XSD = XML Schema Definition

AUTOSAR “M3”

Enterprise Architect

instance of

EAST MM

import

import

AUTOSAR MM

TADL MM

specified by

TADL XSD

specified by

AUTOSAR XSD

EMF representation

generated from

Mentor VSA Model Editor

Mentor Eclipse Generator

EAST-ADL2 XSD

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Editor and Supporting tools

Eclipse

Mentor VSA Model Editor

TADL.XML

AUTOSAR.XML

EAST.XML

Supporting Tools
ASCET, Intecrio, SymTA/S, TTTech
References and dependencies

• References between exchanged information:
  – TADL
  – EAST-ADL2
  – AUTOSAR R3, templates

- SWComponent
- ECUResource
- System
Summary

- Events and Event Chains
- Constraints
- Metamodel specifying XSD, following AUTOSAR Metamodeling rules
- Modified AUTOSAR editor, to include:
  - EAST-ADL2
  - TADL
- XML as exchange format