An Approach of Combining Model-based Testing with Product Family Management

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Agenda

• Overview of the MBAT project
• Current state of practice
• Combining test models with variability models
• Introduction to the use case
• Demonstrator
• Evaluation results
• Way ahead
Overview of the MBAT Project

MBAT: combined model-based analysis and testing of embedded systems

Objectives

• Reduce validation and verification (V&V) cost and time-to-market by advanced model-based V&V technology

• Provide a Reference Technology Platform (RTP) for effective V&V of embedded systems

• Ensure in several use cases that the MBAT RTP can be used in industry.

Key Data

• EU project (Artemis JU)

• 41 partners from automotive, aerospace and rail domain

• 8 countries

• Total budget: 34.5 Mio €

• 3 years (Nov 2011 – Oct 2014)

• Project coordinator: Daimler AG

• Further information: http://www.mbat-artemis.eu
Current State of Practice

- Test process is mainly driven by (quality of) requirements and low degree of test automation
- Similar products are tested independently with no re-use of test artefacts
Combining Test Models with Variability Models

- Test models describe what needs to be tested in the product family
- Variability models define variation points in the product family
- Product configuration enables automatic generation of test models
- Product test models allow generating product test suites
Introduction to the Sferion™ Use Case

Degraded visual environment ...

3D Sensor(s) → Terrain, Ground Details, Obstacles, Man Made Objects → Real-time Fusion → Databases... enhanced and synthetic vision systems for situational awareness provide pilot assistance for landing, take-off and flight.
Overview of the Demonstrator

Product Family Analysis
- Identify product family scope
- Develop variability model

Product Family Test Model
- Create usage model for product family
- Associate requirements with test model

Product Management
- Associate requirements and features
- Define products
- Generate product test models

Product Test Suite Generation and Execution
- Generate test suites for products
- Execute test suites with test automation solution

Tools:
- Vedit OVM Editor
- MaTeLo Usage Model Editor
- MaTeLo Product Line Manager
- MaTeLo Testor
Product Family Analysis (1/2)

- Analyze potential product variants and features during the scoping with the help of the product feature matrix
- Prioritize features and define the product family scope
• Document variation elements and constraints with the help of an Orthogonal Variability Model.
Product Family Test Model

- Develop a test model which covers all functions of the product family and is associated with product family requirements

**LS3D-SRD-36-1**
The LS3D function shall visualize virtual reference objects for landing at the marked landing position as specified in [REF-5] if the marked landing position is valid and the distance from H/C to landing position < 0.08 NM.
Product Management (1/3)

Variability Model (VM)

SUT Requirements

Product Family Test Model (TM)

Products configuration

Generator Test Model (GM)

Configured Product (CP)

Generated Test Model of Configured Product

Test Case Generation

- Mark landing position
- Check for obstructions
- Display reference objects in landing zone
- Display real reference objects
- Provide slope indication for LP
- SI sensor-based
- SI from DG
- FWS
  - FOP (F/S)
  - HELIAS (CAS)
- Databasics
  - D3 provided by customer
  - TM provided by customer
• Map requirements to be verified with their associated features
• Configure product variants
• Generate test models for product variants
• Generate product-specific test cases
Product Test Suite Generation

- Test cases and procedures are generated from product-specific test model and can be imported into test automation system.
Evaluation Results

• Clear potential that the combined approach of model-based testing and product family management leads to **better quality test design at less time and less cost**:  
  • Model-based testing allows to automate parts of the test design.
  • Test models are reviewed and applied in many products in different contexts and various scenarios which leads to higher quality.
  • Test artefacts are re-used for each new product, rather than starting from scratch.
  • Less test artefacts need to be maintained for the product family since re-use is managed at the model level.

• The MaTeLo PLM tool is available as a prototype, but **not fully industrialized** yet:  
  • Some usability and interoperability topics need to be improved in order to raise the acceptance by industrial end users.
Way Ahead: MBAT IOS and RTP

Integrate industrialized PLM in new MaTeLo V5.x platform version.

- IBM Rational DOORS
  - Requirements Management
  - Impact Analysis
- IBM Rational Rhapsody
  - Requirements Analysis
  - Functional Analysis
  - Architectural Design
- Vedit
  - Variability Modelling
- MATELO
  - Test Modelling
  - Product Management
  - Test Case Generation
- Test Automation
  - Test Reporting

OSLC & MBAT IOS

- Eclipse Process Framework
  - Process Modelling
  - Process Guidance
  - Project Governance
- IBM Rational DOORS
  - Requirements
  - Test Cases & Results
  - Traceability
- Model Repository
  - System Models
  - Test Models
  - Variability Models
- AIDASS
  - Cassidian Test Support System

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Thank you