Automated Requirements Verification using SysML

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About Me

Saulius Pavalkis

- **Chief MBSE Solutions Architect**, training and consulting companies as: Ford, Orbital ATK, Boeing, Google, Abbott, Raytheon, UTAS, NYTA, SMEE, NASA, BAH.
- **PLM Product Integrations Manager**, working with all major PLM vendors.
- Former **Analyst** on the MagicDraw R&D team for over 10 years.
- **Major expertise area** is MBSE, Requirements engineering, PLM, Traceability.
- **Ph.D.** from Kaunas University of Technology (KTU) in model traceability area. Former **researcher** at Kaunas University of Technology on multimillion projects.
- **Research and technical articles** in model-based solutions presented at INCOSE IS, NDIA. Check modeling community blog (blog.nomagic.com) for more.
- **Representative at INCOSE CAB.**
Agenda

- Introduction to V&V
- Requirements modeling concepts
- Cameo Systems Modeler demo
- Questions & Answers session
V-model

Concept of Operations
- Requirements and Architecture
- Detailed Design

Verification and Validation

Operation and Maintenance
- System Verification and Validation
- Integration, Test, and Verification

Project Definition

Project Test and Integration

Implementation

Time
Verification and Validation

- **Validation**
  - "Are you building the right thing?"
  - Always against the real world or user needs

- **Verification**
  - "Are you building it right?"
  - Always against the requirements
Requirements in SysML

1. Avert magnetic-stripe skimming and PIN stealing
   Prevent abuse of OS and reduce the attack surface of the ATM
   Prevent exploitation of public domain vulnerabilities in the Operating System
   Reduce attack surface from public and private networks.

2. Develop ATM Machine(s)

3. Cash Withdrawal
   - If a transaction... then
     - The ATM will... print
     - The card will... & yield

4. Communication Interface
   - A customer will... (PIN)
   - ATM card and... (PIN)
   - ATM Controller
   - Communication Interface
Requirements can be customized by adding properties such as verification method, verification status, criticality, risk, and requirements category.

The `verifyMethod` property includes:

- Inspection
- Analysis
- Demonstration
- Testing
Verification Methods

- The test case definition and execution depends on the method of verification.

- For example, the method of verification for a system requirement that “The vehicle shall weigh between 98 and 100 pounds” may be performed by testing or analysis.

- To verify the requirement by testing, a test case is defined to weigh the system on a scale and compare the measured weight against the required weight.

- To verify this requirement by analysis, the estimated weight of each component is summed to estimate the system weight. In the latter case, a parametric diagram may be used to verify the requirement by analysis.
Steps to Automate Requirements Verification

Steps

- Refine, formalize requirement by the Constraint Block
- Define analysis context
- Use constraint block in analysis context
- Bind system parameters to constraint parameters
- Evaluate default or alternative system configurations
- Verify requirements
- Capture verification results
Text-based Requirements verification

Vehicle

- **grossWeight**: lbs
- **stoppingDistance**: ft
- **speed**: mph

**Vehicle Weight**

- **Id**: 4
- **Text**: "The vehicle weight shall be equal to or less than 3200 pounds."

**Brake Heating**

- **Id**: 2
- **Text**: "Braking at 60 miles per hour shall generate less than 54kW of heat at each wheel."

Description

- **less than (Glossary)**: heat < 54.0

**Tires**

- **Id**: 5
- **Text**: "The tires shall have 22-inch rolling diameter"
Trade-off analysis

• Parametric alternatives
• Topological alternatives
• Finding the best design
• Help decision making
Automate Testing Execution

- Simulation can be executed through command line and show test results through Jenkins, as another alternative to run the project.
- You can create JUnit test cases and configuration files and set up Jenkins for automated testing.
Demo

Cameo Systems Modeler v19.0 (enterprise edition)
Questions
The Truth is in the Models

Thank You!

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