OSLC4MBSE Working Group

Axel Reichwein, Koneksys
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OSLC4MBSE WG Members

Parham Vasaiely, Airbus Group, UK
Axel Reichwein, Koneksys, USA
Allison Barnard Feeney, National Institute of Standards and Technology, USA
Yves Bernard, Airbus, France
Markus Brandstaetter, PROSTEP, Germany
Roger Burkhart, Deere, USA
Jim Conallen, IBM Rational, USA
Amit Fisher, IBM, USA
Sandy Friedenthal, SAF Consulting, USA
Sylvere Krima, Engisis, USA
Mike Loeffler, General Motors, USA
Eldad Palachi, IBM, Israel
Chris Paredis, Georgia Institute of Technology, USA
Rick Steiner, Raytheon, USA
John Watson, Lockheed Martin, USA
Ron Williamson, Raytheon, USA
Outline

• Integration scenario

• Presentation of OSLC

• What is missing in OSLC?

• What is the OSLC4MBSE working group doing?
Models for Architectural Design

Many Relationships between Models

System Architecture

Dynamic system models

Computer-Aided Design (CAD) (e.g. 3D models, 2D drawings)

Meshed Analysis Models (e.g. FE, CFD, Thermo)

Requirements

And more...

ISO/IEC/IEEE 15288-Based SE Process V-Model

Stakeholder Requirements Definition

Validation

Requirements Analysis

Verification

Architectural Design

Verification

Implementation

Integration

Only the core SE Technical Processes are shown. Shown are the Transition, Operations, Maintenance, and Disposal Processes.
Problem: Rollover Risk of SUVs

- Higher center of gravity -> higher risk of rollover
- More than a third of all \textit{fatal} crashes in the US are rollovers!

Static Stability Factor Test

System Engineer defines SSF Test Case

Mechanical Engineer computes center of gravity height of new vehicle with payload through geometric model

Center of Gravity
Fishhook Maneuver Simulation

System Engineer defines simulation test case

Mechanical Engineer performs simulation with dynamic system model

http://www.mathworks.com/tagteam/49380_2008-01-0579_Cherian_Final_1.10.08.pdf
Link between COG Parameter of Geometric Model and Simulation Model

Center of gravity in geometric model

Center of gravity in simulation model

Center of Gravity + Moment of Inertia
Relationships between Engineering Data

Requirements

- **Static Stability Factor (SSF)**
  - Id = "1.1"
  - Text = "SSF shall be higher than 1.3. SSF is a factor based on a vehicle's track width and center of gravity height."

- **Vehicle in motion rollover test**
  - Id = "1.2"
  - Text = "The vehicle shall not "tip-up" during fishhook maneuver. If the vehicle lifts two wheels off the ground during a quick left-right turn at 50 mph, it's considered a "tip-up" and the test failed."

Test Cases

- **SSF Test**
- **Vehicle Fishhook Maneuver Simulation**

Simulation Model

Geometric Model
In Reality: Many more Relationships!

- Requirements
- Test Cases
- System Architecture
- Software
- Simulation Model
- Geometric Model
Relationships on the Web

Linked Web Pages
(Unstructured Data)

Linked Data
(Structured Data)
Example query: Capitals in Europe?

Rendering DBpedia data with Google Map.
Open Services for Lifecycle Management (OSLC)

- OSLC = Reusing the Web for tool integration

- Based on Web standards (Linked Data and RESTful Web Services)

- Initiated by IBM

- Adopted by many tool vendors

- Managed by OASIS
Linked Data Principle 1

Use URIs to denote things

URI of Requirement

http://myDomain/myTool/myProject/requirements/S5.4.1

Requirement in Systems Engineering Tool

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Use **HTTP URIs** so that these things can be referred to and looked up.

**URI of Requirement**

http://myDomain/myTool/myProject/requirements/S5.4.1

**Requirement in Systems Engineering Tool**
Provide useful information about the thing when its URI is dereferenced, leveraging standards such as RDF, SPARQL.
### Resource Description Framework (RDF)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Predicate</th>
<th>Object</th>
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<tbody>
<tr>
<td>Requirement „Master Cylinder Efficacy“</td>
<td>name</td>
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<tr>
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Resource Description Framework (RDF)

Requirement „Master Cylinder Efficacy“

http://.../requirements/S5.4.1

http://.../myvocabulary/type

http://.../myvocabulary/text

String literal

„A master cylinder shall...“

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Include links to other related things (using their URIs) when publishing data on the Web.
Interoperability Through OSLC

OSLC Requirement Resource in RDF

Requirement in Tool A

Tool A

OSLC Adapter for Tool A

HTTP

OSLC Adapter for Tool B

Requirement in Tool B

Tool B
## Interoperability Through Standardized URIs

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# Interoperability Through Standardized URIs

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## URIs from OSLC
### Requirements Management Vocabulary

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<td><strong>Requirement „Master Cylinder Efficacy“</strong></td>
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## Extensible Resources

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<td>Use Case „Decelerate Car“</td>
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Standardized RDF Vocabularies for Interoperability

OSLC Requirement Management Vocabulary in RDFS

OSLC Requirement Resource in RDF

Standardized URIs for resource properties and resource types

Requirement in Tool A

Tool A

OSLC Adapter for Tool A

HTTP

OSLC Adapter for Tool B

Requirement in Tool B

Tool B
OSLC Resource Shapes for Defining Additional Constraints on RDF data

OSLC Requirement Management Vocabulary in RDFS

OSLC Requirement Resource Shape defined with OSLC Core Vocabulary

refers_to

conforms_to

OSLC Requirement Resource in RDF

Requirement in Tool A

Tool A

requirement

OSLC Adapter for Tool A

HTTP

OSLC Adapter for Tool B

Requirement in Tool B

Tool B

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<table>
<thead>
<tr>
<th>Domain</th>
<th>Status</th>
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<td>Draft</td>
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<td>Configuration Management</td>
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Missing OSLC Specifications

System Architecture

Dynamic Simulation

3D Geometry (CAD)
Defining OSLC Spec for System Architectures

• Reuse existing SysML standard

• Convert SysML standard into OSLC specification (RDF Vocabulary + OSLC Resource Shapes)

• Align RDF vocabulary for SysML with existing RDF vocabularies

• Standardize the RDF vocabulary for SysML
Model-driven Generation of OSLC Specification

SysML Metamodel

OSLC Specification

- OSLC Requirement Management Vocabulary in RDFS
- OSLC Requirement Resource Shape defined with OSLC Core Vocabulary
OSLC4MBSE Tasks

• Define OSLC Specification for describing system architectures

• Collect use case scenarios from the systems engineering community

• Share use case scenarios with OSLC community

• Get technical feedback from OSLC community
Summary

• **OSLC** = Reusing the Web infrastructure for tool integration

• **Interoperability** through standardized RDF vocabularies

• **OSLC4MBSE Working Group**
  – Definition of new RDF vocabularies for engineering data
  – Bridge between systems engineering and OSLC communities