System Lifecycle Management

Syndeia™ for MBSE
(formerly SLIM)

No Magic World Symposium
Allen TX, Jun 9, 2015

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Chief Systems Officer
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www.intercax.com
• Commercial spin-off from Georgia Tech in 2008
• Located in Atlanta, GA
• SysML-Centric Model-Based Systems Engineering
• InterCAX business model
  – Standard software products for systems engineering
    • Parametric Solvers (e.g. ParaMagic for MagicDraw)
    • Syndeia (formerly SLIM) – PLM/CAD/CAE Integration
  – Training, consulting and custom development
• Government customers: NASA, DoD, DoE
• Corporate customers: primarily defense, aerospace, automotive, transportation, consumer goods, energy
A week in the life of a system engineer
Challenge

Point-to-Point Ad-Hoc Information Flows

Use of models in systems engineering IS NOT model-based systems engineering (MBSE)
Wait, wait, don’t tell me...
It is a rope, It is a wall, It is a pillar....
System Lifecycle Management (SLIM)

Enabling Model-Based Systems Engineering

Primavera, MS Project, Windchill ProjectLink and PPMLink, Teamcenter Portfolio, Program and Project Management...

Project Management

CAD

MCAD (Creo, NX, CATIA, ...) & ECAD (Mentor Expedition, OrCAD, ...)

Requirements

DOORS, Integrity, Cradle, RequisitePro, ...

Simulation/CAE

Mathcad, Mechanica, MATLAB, Simulink, ABAQUS, ANSYS, Mathematica, ...

Libraries / Databases

CAD models, cost models, analysis modules, parts and material databases, supplier database, ...

PLM & SCM Systems (Windchill, Teamcenter, Git, ...)

Optimization

Mathcad, ModelCenter, Isight, OpenMDAO, ...

Manufacturing, Supply Chain

Creo View, Windchill MPMLink, Tecnomatix, SAP, ...

SysML


Total System Model

Bill-of-Systems (BOS)

Connections based on Reference, Data Map, Function Wrap, Model Transform, and Composite patterns

Rev 7

B.20

2012-07-12, 1000h US ET

Documents & Spreadsheets

CAD model
(Creo, NX, CATIA,...)

MATLAB / Simulink & Mathematica models

SysML

CAE (FEA/CFD) models

Requirement models

Optimization models

Other Artifacts and Databases

latest
Total System Model History

Timeline

Technical Data Packages auto-generated from TSM graph
### Basic Syndeia Functions

<table>
<thead>
<tr>
<th>SysML</th>
<th>PLM/CAD/Simulation/Db...</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect</td>
<td></td>
<td>Syndeia creates a connection between existing elements in the SysML element and repository. This may be a simple traceable link or a detailed data mapping between element attributes. These connections are stored and managed by Syndeia.</td>
</tr>
<tr>
<td>Generate</td>
<td></td>
<td>Syndeia generates an element on one side from an element on the other. SLIM manages a persistent connection between them.</td>
</tr>
<tr>
<td>Check</td>
<td></td>
<td>Syndeia checks for changes at the repository end of a connection. This may include generation of a difference report.</td>
</tr>
<tr>
<td>Update</td>
<td></td>
<td>Syndeia updates the element at one end of the connection based on the element at the other end. This may include changes in the element structure or attribute values.</td>
</tr>
<tr>
<td>Execute</td>
<td></td>
<td>Syndeia triggers execution of an element (e.g. a MATLAB function) managed in the repository as part of a SysML model execution.</td>
</tr>
</tbody>
</table>
Hello Syndeia!

Demonstrate as a plugin for MagicDraw
Hello Syndeia! – Demo Part 1

• Launch SLIM
• Connect and view
  – Windchill
  – Teamcenter
  – MySQL
  – Local File System
• Search
• Open
Hello Syndeia! – Demo Part 2

• Story of Sam Video
  – Generate TC requirements from SysML
  – Generate SysML block structure from WC
  – Generate SysML blocks from MySQL
  – Compare and sync with WC
  – Simulink use cases and demo
  – CAD (NX and Creo) use cases and demo
  – Visualization of Total System Model
SysML-Simulink Model Transform

1. Generate Simulink models from SysML internal block structure or activities.

2. Generate SysML internal block structure or activity structure from Simulink model.

3. Comparison and bi-directional sync of SysML and Simulink models
4. Use SysML blocks representing Simulink library blocks to generate fully executable Simulink model (see next slide)
Execution of Simulink model generated from SysML
CAD (NX) models managed in Teamcenter
Use Case 1 – If a SysML element is connected to a CAD model, SEs can visualize the CAD model in SysML
Use Case 2 – Key geometric characteristics of a sub-system can be read in the system (SysML) model to facilitate system-level analyses, roll-ups, and requirement verification. Examples of these characteristics include mass/volume, bounding box, feature sizes, center-of-gravity, and moment-of-inertias.
Use Case 3 – (A) System-level representation of hardware sub-systems can be derived from CAD models and used in the SE (SysML) model, such as for roll-ups and requirement verification, (B) System-level requirements/constraints on a hardware sub-system can be used to seed a CAD model for designers.
Syndeia 2.0 arriving Jun 29, 2015

Build the Total System Model with bi-directional generate, compare, sync

<table>
<thead>
<tr>
<th>Syndeia / SLIM 1.0</th>
<th>Syndeia 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windchill (PTC)</td>
<td>Windchill** (PTC)</td>
</tr>
<tr>
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</tr>
<tr>
<td>MySQL (Oracle)</td>
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<tr>
<td>Excel (Microsoft)</td>
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<td></td>
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<td>Creo (PTC)</td>
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<td></td>
<td>Simulink (Mathworks)</td>
</tr>
<tr>
<td></td>
<td>Search / Open / ...</td>
</tr>
</tbody>
</table>
Try out Syndeia

• Download Syndeia plugin for MagicDraw
  – Go to www.intercax.com/slim
  – Follow instructions to download
  – Step-by-step tutorials to get started

• Demonstration
  – Story of Sam (INCOSE IW, Jan 2015)
    http://goo.gl/B91MYP
Summary

• Collaborative development of Total System Model
• Concurrent in multiple repos - SysML, PLM, Databases
• Multiple version mgt. and config. control systems
• Drag-n-drop approach to connect models (usability)
• Algorithms to compare models and bi-directional sync
• Visualization of Total System Model
• Parametric analyses & trades from the TSM
• Seed simulation models (Simulink) from architecture
• Seed CAD models (NX/Creo) from system architecture
  • Communicate requirements as geometry
We would love to hear from you...

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SLIM and OSLC are Complementary

- SLIM = Software for integrated MBSE (UI + API)
- OSLC = Specs + REST API in various PLM/ALM areas
- InterCAX is a member of the OSLC working group

Interoperability Challenge

Connect, access, and identify information

Do useful things - query, compare, generate, sync – requires semantics

SLIM provides specialized connection patterns and services

These models mean different things (semantic heterogeneity)

OSLC adapter (under development)

Native SOA API

Teamcenter, Windchill, MySQL, ….

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