OSLC MBSE INTEGRATION
Successfully Integrating MBSE Data Using OSLC
Agenda

- About PROSTEP
- MBSE Integration Needs and Challenges
- What is OSLC and What Can it Do?
- Connecting PLM, ALM, SDM with OSLC
- Implemented Customer Solutions
Company Overview

A vendor neutral / independent engineering services and software company since 1993

Over 24 years experience with engineering interoperability, migration, intelligent documents, benchmarking, more

Approximately 250 employees and consultants based from international locations throughout Europe and in North America

More than 500 Customers that are leading companies across most industries

Shareholders
# PROSTEP - 100% PLM

Consulting and Solution Portfolio

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Concepts &amp; Solution Architecture</th>
<th>Implementation of IT &amp; Process</th>
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</thead>
<tbody>
<tr>
<td><strong>PLM Implementation Strategy</strong></td>
<td><strong>PLM Architecture &amp; Processes</strong>&lt;br&gt;Benachmark &amp; ROI-Analysis&lt;br&gt;PLM Landscape &amp; Complexity Management&lt;br&gt;Product Structure and Variant Management</td>
<td><strong>PLM Migration &amp; Integration</strong>&lt;br&gt;OPENPDM&lt;br&gt;OPENDXM&lt;br&gt;<strong>PLM Realization and Roll-out</strong>&lt;br&gt;Bill of Material &amp; Change Management&lt;br&gt;Variant &amp; Configuration Management&lt;br&gt;Digital Master / Digital Twin</td>
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<tr>
<td><strong>PLM for Digital Transformation</strong></td>
<td><strong>PLM for IoT/I 4.0 Solutions</strong>&lt;br&gt;Digital Master / Digital Twin</td>
<td><strong>Technical Data Package</strong>&lt;br&gt;Paper-less Processes</td>
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<td><strong>Model Based Enterprise</strong></td>
<td><strong>Model Based Enterprise</strong>&lt;br&gt;3D Master / Systems-Engineering</td>
<td><strong>PLM Collaboration</strong>&lt;br&gt;Automated PLM Data Supply&lt;br&gt;PDM &amp; CAx Data Exchange</td>
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<td><strong>PLM for Collaboration</strong></td>
<td><strong>Cross-company PLM</strong>&lt;br&gt;PLM for Merger &amp; Acquisitions&lt;br&gt;PLM for Joint Ventures&lt;br&gt;Partner &amp; Supply Chain Integration</td>
<td><strong>PLM Collaboration</strong>&lt;br&gt;Automated PLM Data Supply&lt;br&gt;PDM &amp; CAx Data Exchange</td>
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- PLM System Selection
- PLM Implementation
- PLM Process Optimization

- Digitalization
- Industry 4.0
- IoT

- Merger & Acquisitions
- Joint Venture
- Project Consortia
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Concept Meets Reality

Enabling MBSE

- Data is mastered in multiple sources
- One solution is not desired or preferable
- MBSE needs the impact of system changes across multiple sources
- The manual maintenance of traceability is a huge time investment in the process.
- Integration is the solution to providing complete and comprehensive information
Integration Solves a Lot of Challenges

A Business Case

- Efficiency from Modern Engineering Practices
  - Traceability in Systems Engineering (MBSE)
  - Configuration Lifecycle Management
  - Digital Twin / Digital Thread / Digital Master

- Manual integration of data can be quantified by the operation of synchronization
  - Speed that the data is available
  - Time the manual process takes for the data to be synchronized
  - Accuracy of the duplicated data and costs of failures (wrong production revision?)

- Elimination of software licenses for integrated systems
  - Data is available in the primary system of that user and additional license not needed
  - Duplicate functionality only needs to be utilized in one system
  - Integration can enable migration and eliminate other system entirely

- Consolidation, Quality, Training, Maintenance, Support and Knowledge
  - Less utilization of different systems means less overhead
Integration Comes With Challenges

- **Point-to-point solutions** do not scale and typically become unmanageable.
- **Full centralization** is neither feasible nor desirable.
- **Data Duplication** comes with data model compatibility issues, data mastery issues and synchronization processing time.
- **Remastering** data means duplication.
- **MBSE only requires reference** not data mastery!

*Commissioned study conducted by Forrester Consulting on behalf of IBM.

Slide Contents from OSLC Working Group Presentation:
"An Introduction to OSLC and Linked Data"
Standards Enable Integration at a Cost

Hub-and-Spoke vs Point-to-Point

- **Point-to-Point Integration** at MBSE scale is un-maintainable
- Standards are introduced to have a “neutral format” to read from and write to
- Many need to pre-define all semantics beforehand in a closed world approach (like STEP 10303 AP 214)
- Traditional standards everything is known ahead of time.
- **OSLC** allows for a standard simplified interface (mix of both)
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Model the Internet for “Just Enough” Integration

OSLC

- Open Services for Livecycle Collaboration
- Open Standard, Open Community
- Proposed by IBM et. al. in 2008
- Motivated by Rational Team Concert (RTC)
- Data is stored at single location and simply linked. No replication!
- Emerging standard for Tool integrations in ALM domain
- Loosely Coupled
- Semantic Web Linked Data
- Based on Architecture of Web – HTTP, RDF

- RDF (Resource Description Framework)
- JSON / XML for transfer
- REST Service for requests
- OAuth for authorisation
- UI Integration

- Slim Data model
  - Granular to one attribute at a time
- Enhanced Data models available for Change- and Document Management
- Easy to define your own data types

http://open-services.net
OSLC is an open and scalable approach to lifecycle integration. It simplifies key integration scenarios across heterogeneous tools.

OSLC Linked Data Solution
OSLC’s Simple Solution

- Architecture of the Web
- Linked Data
- Increased reuse
- Decreased maintenance costs
- Standard Interfaces
- “Just Enough” integration
- Increased traceability
- MBSE Visibility

OSLC is an open and scalable approach to lifecycle integration. It simplifies key integration scenarios across heterogeneous tools.

Slide Contents from OSLC Working Group Presentation: “An Introduction to OSLC and Linked Data”
Everything is Represented as an RDF Triple

Subject – Predicate - Object

**Subject** = Resource = always a URI

**Predicate** = Relationship or property = Always a URI

**Object** = Could be a URI (which could refer to a resource) or a literal value (value to work with and show users)

Triple

<http://...requirement28465_improve_remote_steering>

<http://...validatedby>

<http://...testcase35645_test_steering>

<http://...priority>

“High”
Use Actual Data for MBSE, Not Just Words

Integrating Data in Different Silos

Which requirements are related to test cases that failed?

Does every requirement have a test to validate it?

Requirements | Validation Tests | Design | Implementation
---|---|---|---
R1 | T1 | D1 | I1
validates | satisfies | implements | validates
R2 | T2 | D2 | I2
validates | satisfies | implements | validates

Tool A Tool B Tool D

Slide Contents from OSLC Working Group Presentation:
"An Introduction to OSLC and Linked Data"
How Does OSLC Work?

1. Discovery of capabilities
2. HTTP C.R.U.D. for resources
3. Standard resource representations
4. Querying for resources
5. Delegated UI for Create and Select
6. UI Previews for Resource Links
1. Discovery of Capabilities

example: IBM Rational Team Concert

example: IBM Rational Team Concert project area

example: Change Management capability

example: work item (bug, defect, enhancement request)
2. HTTP CRUD for Resources

- OSLC allows manipulation of resources using standard HTTP C.R.U.D

<table>
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<th>HTTP</th>
<th>SQL</th>
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<tbody>
<tr>
<td>Create</td>
<td>POST</td>
<td>INSERT</td>
</tr>
<tr>
<td>Request</td>
<td>GET</td>
<td>SELECT</td>
</tr>
<tr>
<td>Update</td>
<td>PUT</td>
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Slide Contents from OSLC Working Group Presentation:
"An Introduction to OSLC and Linked Data"
3. Standard Resource Representations

```
<http://example.com/TestCases/1> a oslc_qm:TestCase ;

{
    "rdf:about": "http://example.com/TestCases/1",
    "rdf:type": [
        {
            "rdf:resource": "http://open-services.net/ns/qm#TestPlan"
        }
    ],
    "oslc_qm:validatesRequirement": {
        "rdf:resource": "http://example.com/Requirements/1"
    }
}

<oslc_qm:TestCase rdf:about="http://example.com/TestCases/1">
    <oslc_qm:validatesRequirement rdf:resource="http://example.com/Requirements/1"/>
</oslc_qm:TestCase>
```
4. Query for Representations

- Query capability has base URI
- Clients form query URI and HTTP GET the results
- OSLC services MAY support OSLC Query Syntax
  - http://open-services.net/bin/view/Main/OSLCCoreSpecQuery

http://example.com/bugs?oslc.where=cm:severity="high" and dcterms:created>"2017-04-01"
5. Delegated UI for Create or Select

A delegated UI renders the source application UI in the target application. This example shows the contributed/delegated Rational Team Concert Work Item search dialog being rendered in an OSLC Quality Management application.

1. Click to launch delegated UI
2. iframe’s src set to delegated UI's URL
3. Selection made
4. Click OK. Sends message (link+label) to parent window
6. UI Previews for Resource Links

Hover over link
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MBSE Integration Needs and Challenges

What is OSLC and What Can it Do?

Connecting PLM, ALM, SDM with OSLC

Implemented Customer Solutions
How Can I Leverage OSLC for MBSE?

- OSLC UI integration is OOTB for many ALM and MBSE solutions
  - Enterprise Architect Pro Cloud Server
  - IBM Rational Rhapsody (and all of RTC)
  - PTC Integrity Modeler
  - PROSTEP OpenCLM (The Future!)

- OpenPDM offers OOTB Connectors for all types of systems

- Low complexity Standards Based COTS solution
  - Install connectors
  - Generate the mappings
  - Data is federated to your MBSE system
MBSE Integration Utilizing OSLC with OpenPDM
OpenPDM OSLC Adapter

- The OpenPDM OSLC Adapter enables OSLC access for non-OSLC systems
  - Authentication against backend
  - Query UI / Properties Display UI
  - REST Resources and resource links
  - Local Document Download from the backend system via OpenPDM
  - Query Service maps OSLC queries onto backend

- Supports Change Management 2.0 + custom attributes
- Support for modern schema (new 2017)
More Than MBSE – Digital Master | Thread | Twin

Digital Master
- Field data (Sensors, Protocols, ...)
- Master BOM

Digital Twin – as in use

Program management
Product definition
Concept phase
Production
Product in use
Service

PROSTEP Federation
OPEN PDM

MBSE Database
MBSE User Interface

TDM/PDM-Systems
Authoring-Systems

TDM/PDM-Systems
- TDM/PDM-Systems
- TDM/PDM-Systems

Authoring-Systems
- Authoring-Systems
- Authoring-Systems

Program Mgmt.
Req. Mgmt.
Systems Engineering
E/E Engineering
Software Engineering
Mechanical Engineering
ERP System(s)
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OpenPDM Use Cases

- DOORS – Agile e6 – SAP Integration
  - Linking requirements to documents and materials
- Process Improvement
  - Traceability
  - Impact Analysis (RFQ Assessment)
  - Integrated change management
  - Integrated release management
  - reuse
  - Improved auditability (SPICE)
  - quality management
SDM - Test & Requirements Integration at Auto OEM
Questions?
THANK YOU!

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