

Successfully
Integrating MBSE
Data Without
Replication Using
OSLC

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PROSTEP Inc

GLOBAL PRODUCT DATA
INTEROPERABILITY
S U M M I T
2017



Agenda

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Company Overview

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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

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PROSTEP - Strength in Partnership

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PROSTEP Technology Partners



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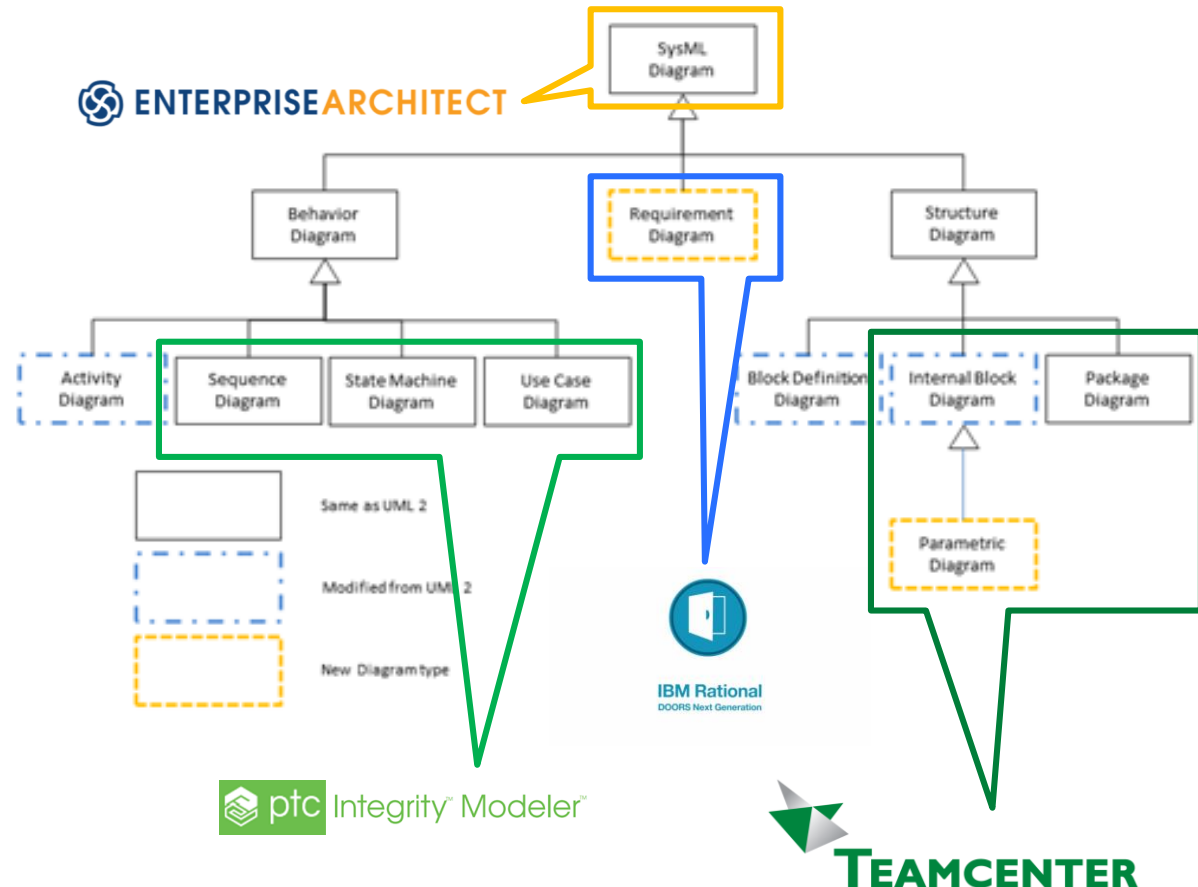
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Concept Meets Reality - Enabling MBSE

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- 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 Lots of Problems – A Business Case

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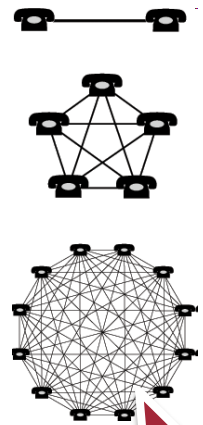
- **Efficiency from Modern Engineering Practices**
 - Traceability in Systems Engineering (MBSE)
 - Configuration Lifecycle Management
 - Digital Twin / Digital Thread / Digital Master
- **Manual integration of data can be quantified by the operation of synchronization**
 - Speed that the data is available
 - 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

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- **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!

Point-to-point Integrations don't scale



Creating new integrations is unpredictable

Monocultures lock you in



Past choices restrict present action and future vision

Maintenance, management, and change costs go up over time



Ongoing and unexpected costs drain resources

End-user productivity suffers: Either stuck with the wrong tool, stuck doing manual integration; often stuck doing both

Integrations consume more of the IT budget: integration failures are the top 2 causes of software project delays*

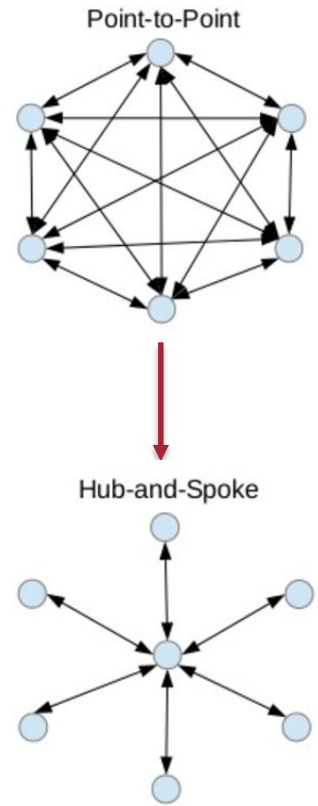
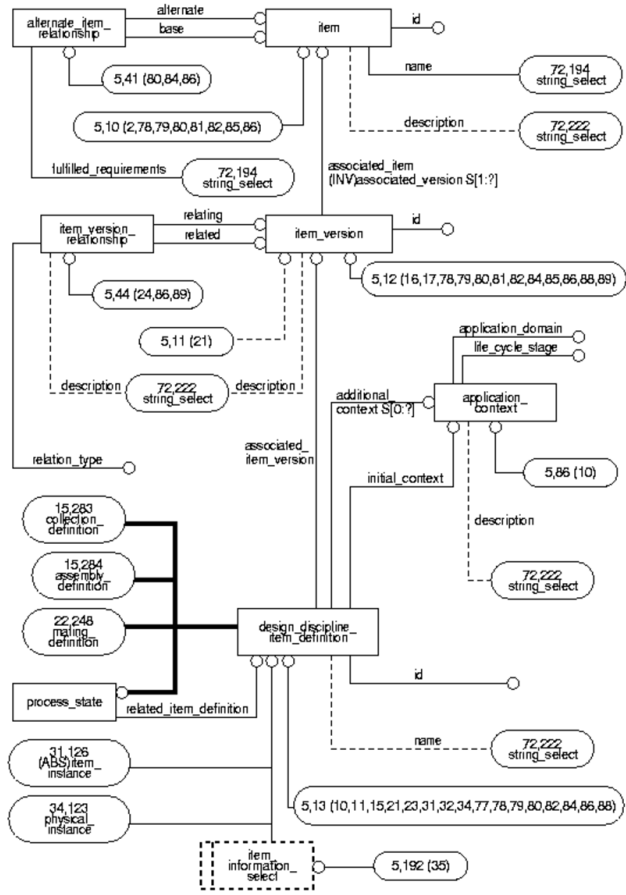
More limited ability to respond to change
Constrained by exhausted IT budget and lower productivity

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

Standards Enable hub-and-spoke Integration at a Cost

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- **Point-to-Point Integration** at MBSE scale is **unmaintainable**
- 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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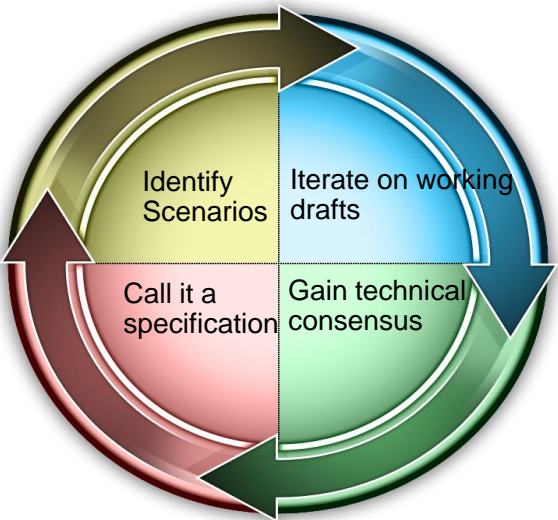
Model the Internet for “Just Enough” Integration (OSLC)

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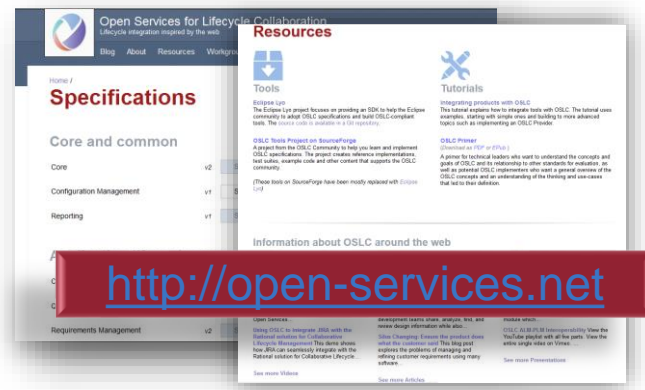
- Open Services for Lifecycle Collaboration
- Open Standard, Open Community
- Proposed by IBM et. al. in 2008
- Motivated by Rational Team Concert (RTC)
- Data is stored at single location and simply linked. No replication!
- Emerging standard for Tool integrations in ALM domain
- Loosely Coupled
- Semantic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

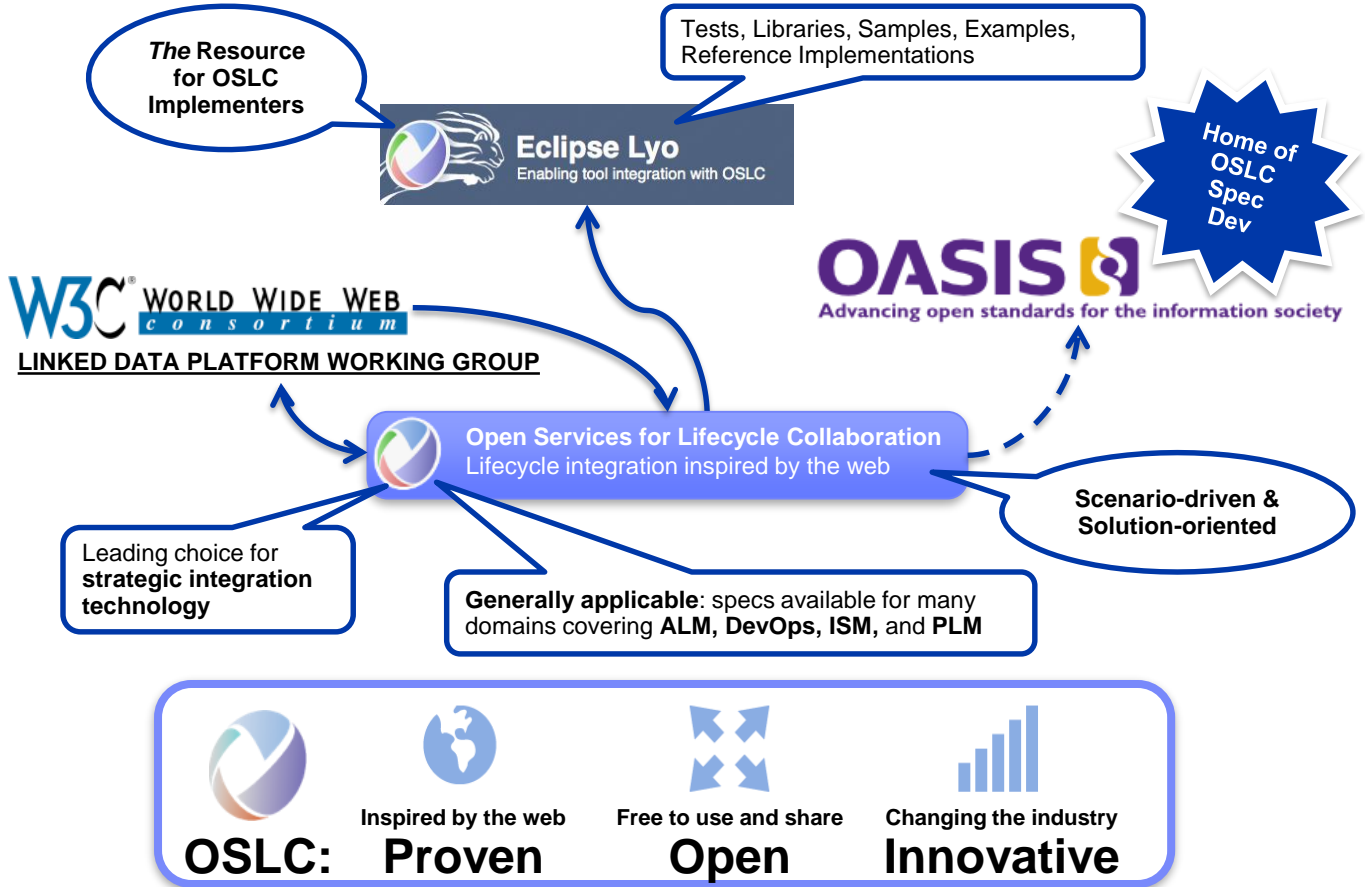


“Just Enough” integration



Open Standards & Open Resources

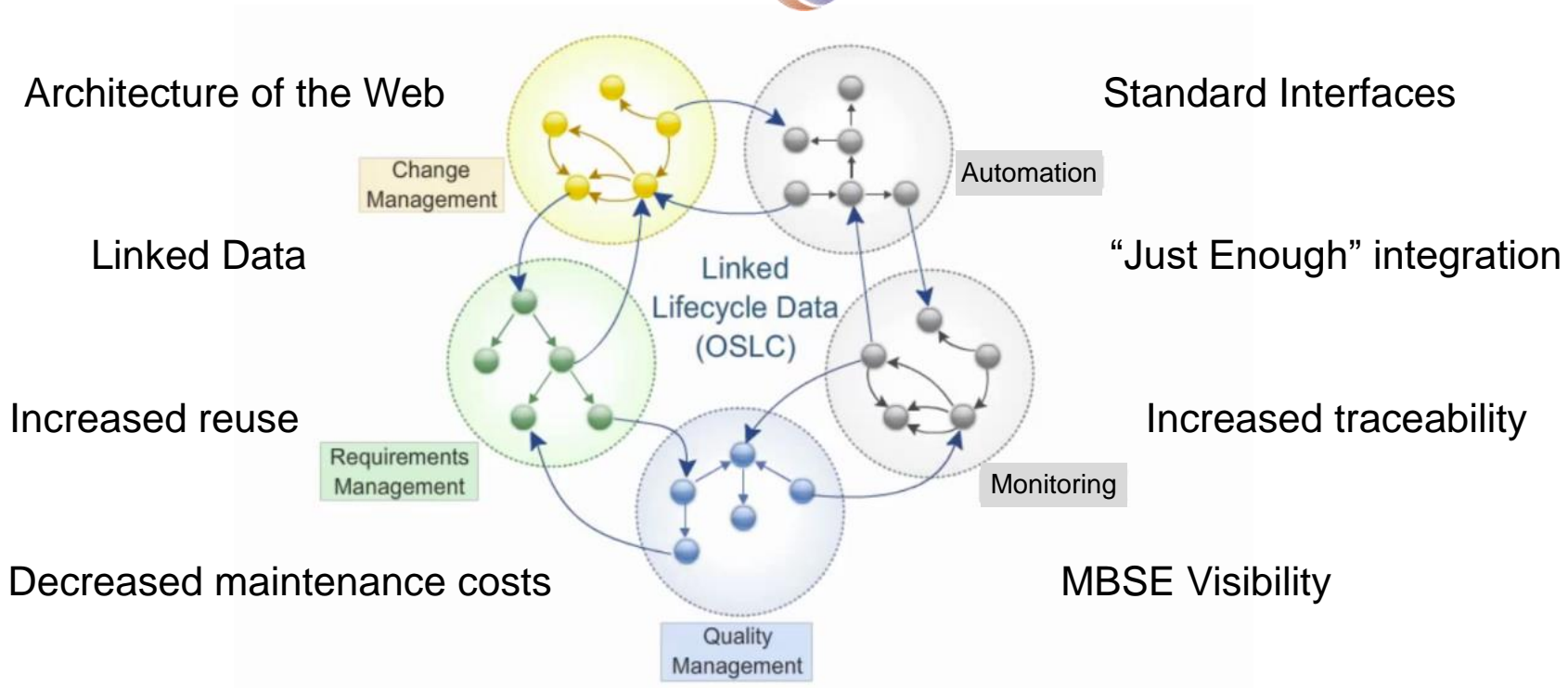
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OSLC Linked Data Solution

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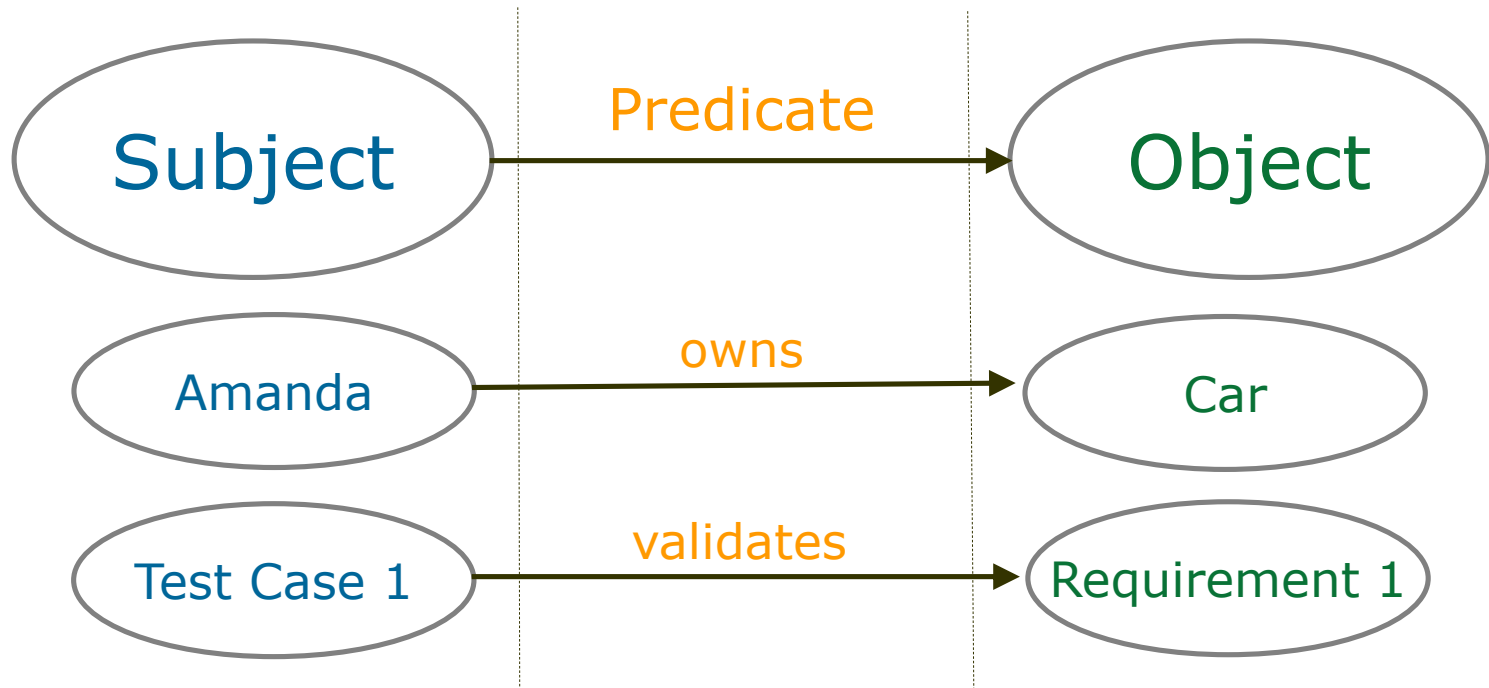
OSLC's Simple Solution



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

OSLC Uses an RDF Graph Data Model

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Adapted from:

<http://www.w3.org/TR/2004/REC-rdf-concepts-20040210/#section-data-model>

Everything is an RDF triple (subject-predicate-object)

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Triple

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)

`<http://...require
ment28465_
improve_remote
steering>`

`<http://...validatedby>`

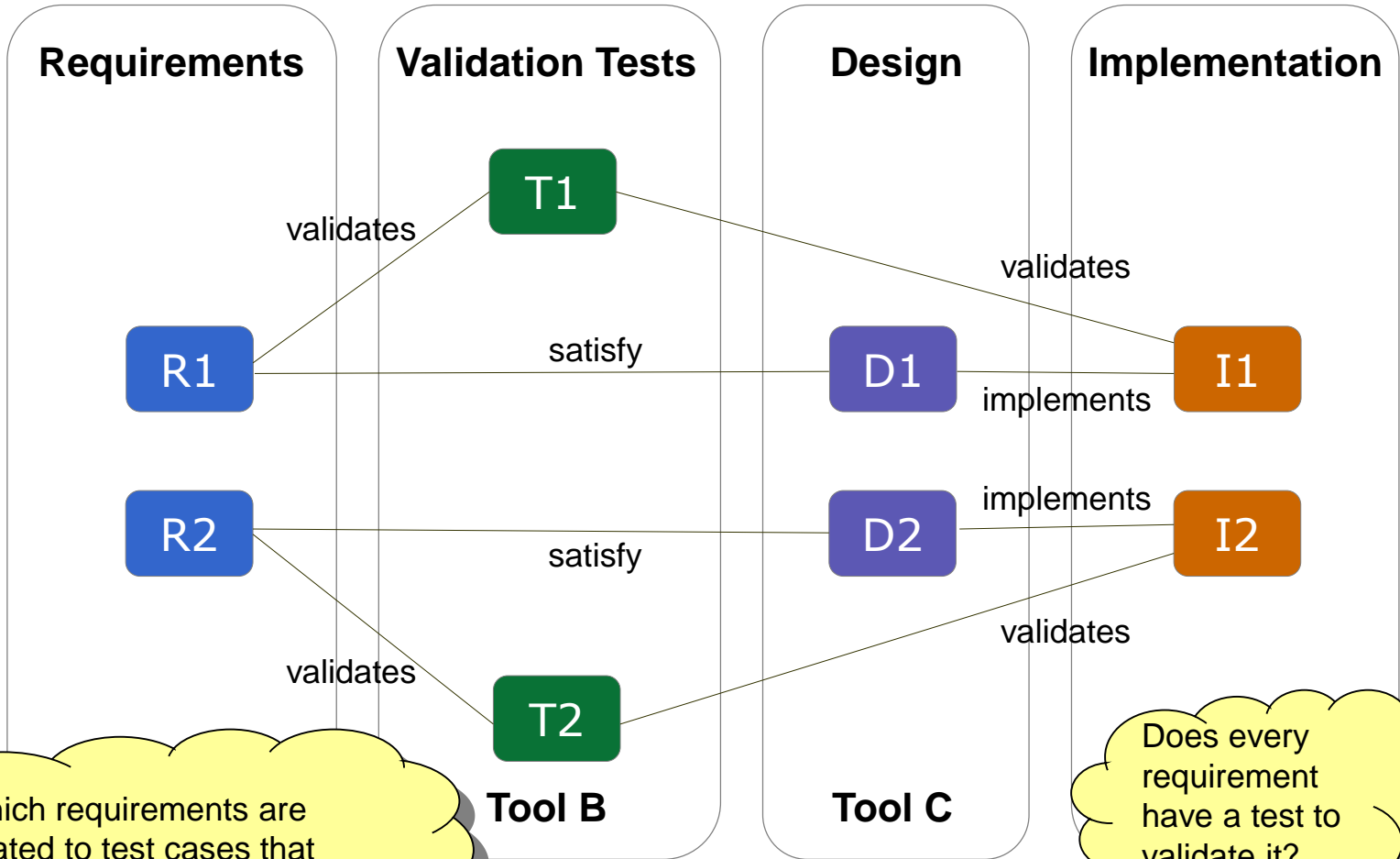
`<http://...testcas
e35645_test_ste
ering>`

`<http://...priority>`

"High"

MBSE – Integrating Data in Different Silos

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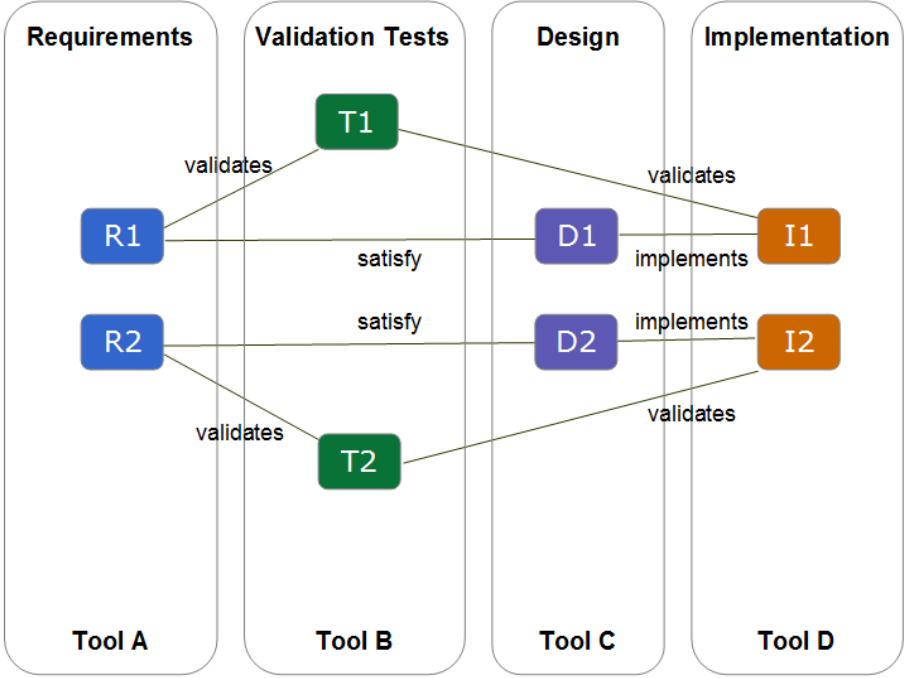
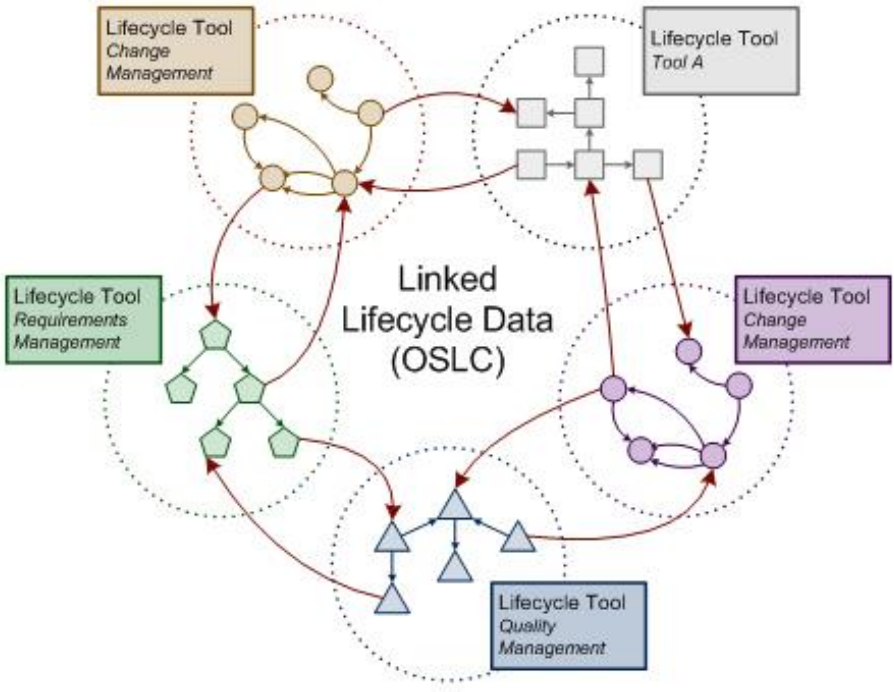


Which requirements are related to test cases that failed?

Does every requirement have a test to validate it?

OSLC Allows for Different Vendor Data to be Linked Together

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How does OSLC Work?

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1. Discovery of capabilities

2. HTTP C.R.U.D. for resources

6. UI Previews for Resource Links

3. Standard resource representations

5. Delegated UI for Create and Select

4. Querying for resources



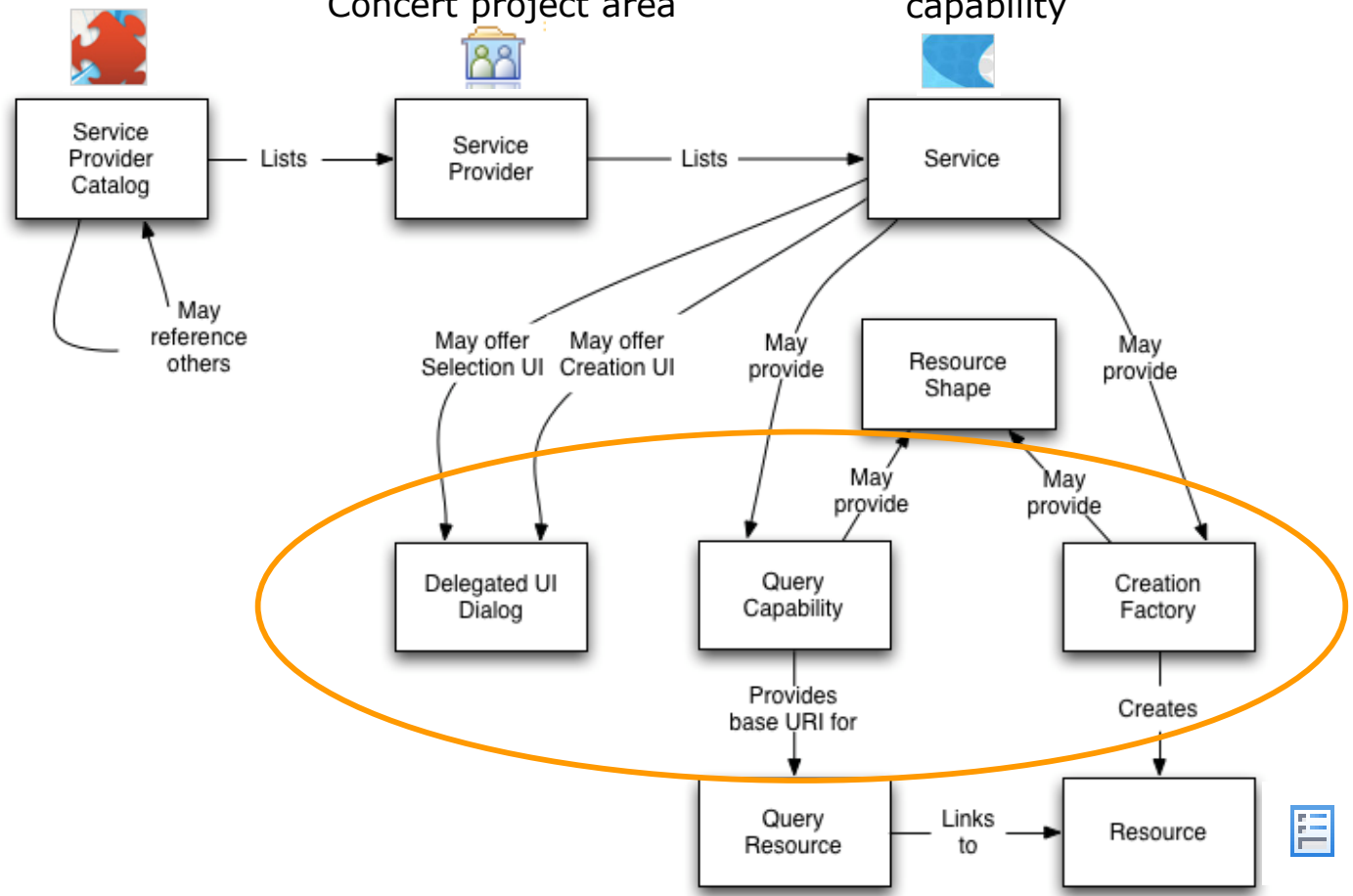
1. Discovery of Capabilities

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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

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

	<u>HTTP</u>	<u>SQL</u>
Create	= POST	= INSERT
Request	= GET	= SELECT
Update	= PUT	= UPDATE
Delete	= DELETE	= DELETE

3. Standard Resource Representations

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```
<http://example.com/TestCases/1> a oscs_qm:TestCase ;  
    oscs_qm:validatesRequirement <http://example.com/Requirements/1>
```

Turtle

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

JSON

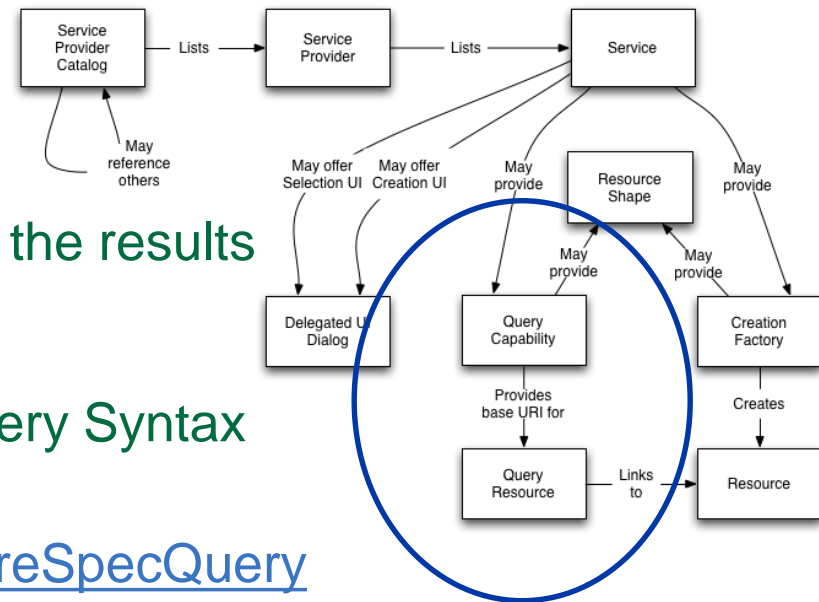
```
<oscs_qm:TestCase rdf:about="http://example.com/TestCases/1">  
  <oscs_qm:validatesRequirement rdf:resource="http://example.com/Requirements/1"/>  
</oscs_qm:TestCase>
```

RDF/XML

4. Query For Representations

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- 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>



- **Example: Find high severity bugs created after April fools day**

```
http://example.com/bugs?oslc.where=
cm:severity="high" and dcterms:created>"2017-04-01"
```

5. Delegated UI for Create or Select

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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

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- **Scenario supported: hover over link to get in context preview of resource**
- **Simple resource format defined and retrieved using HTTP**

The screenshot displays a web interface for managing plan items. At the top, a 'Plan Items' header includes a help icon and the text 'Change management items that are aligned with the testing'. Below this is a 'Show All' dropdown menu and 'Items per page' text. A navigation bar shows 'Previous | 1 - 1 of 1 | Next'. The main content area features a 'Summary' tab and a link for '16: Point of Sale System'. A yellow callout box labeled 'Hover over link' points to this link. A large, semi-transparent preview window is overlaid on the left, showing details for the '16: Point of Sale System' item. The preview includes a status indicator (New), a 'Details' section with fields like Type (Story), Filed Against (RRC Scorpio Project), Story Points (5 pts), Project Area (RTC Scorpio Project), and Creation Date (November 23, 2009 4:50 PM). It also has a 'Quick Information' section with 'Subscribers (1)' and 'Implements Requirement (1)', and a 'Description' section. An 'Open Item' button is at the bottom left of the preview.

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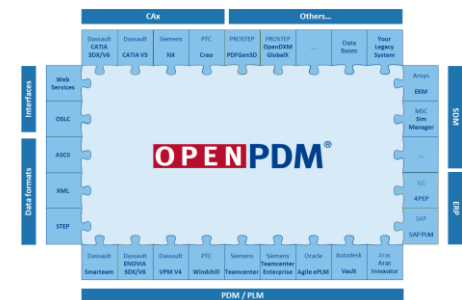
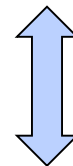
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How can I leverage OSLC for MBSE?

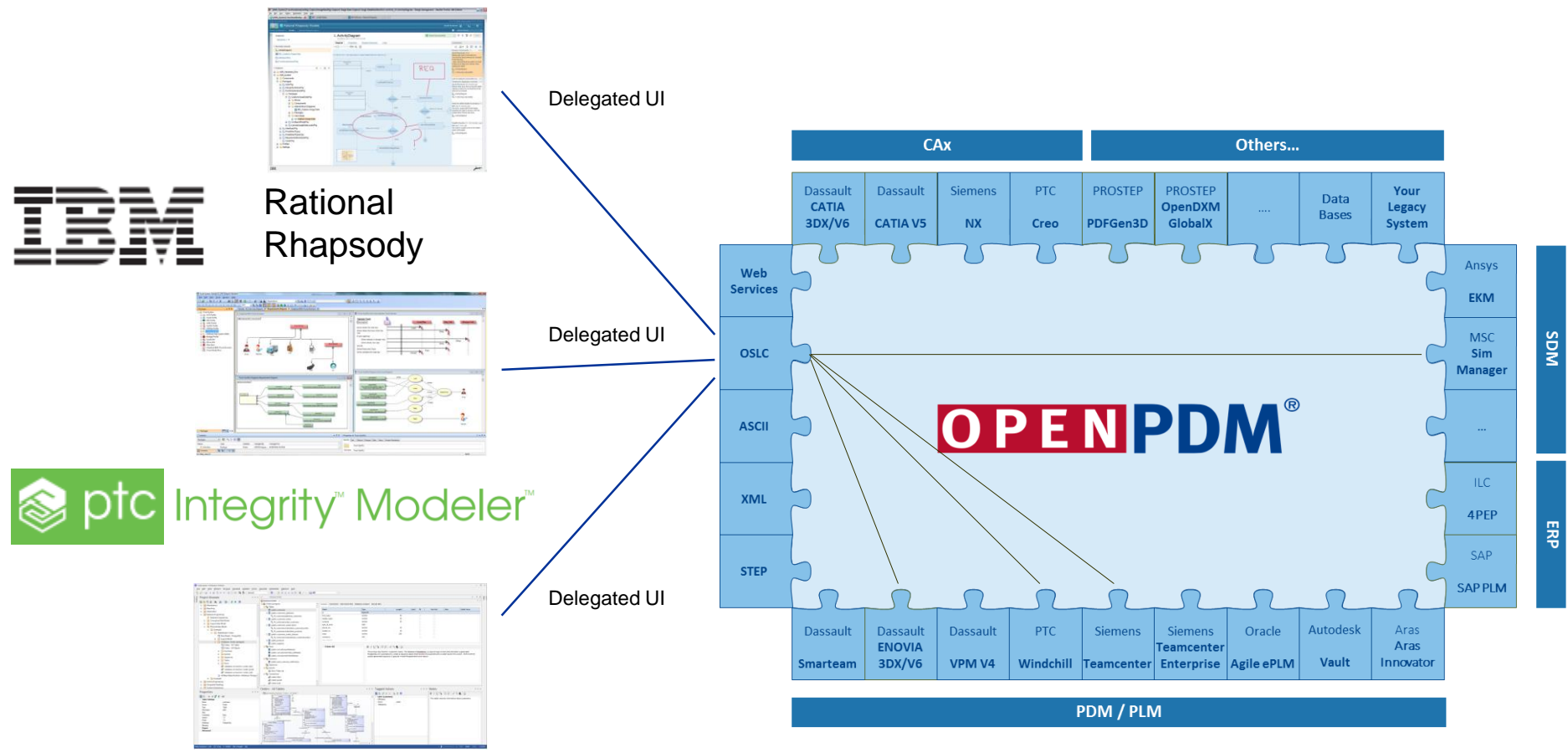
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- **OSLC UI integration is OOTB for many ALM and MBSE solutions**
 - Enterprise Architect Pro Cloud Server
 - IBM Rational Rhapsody (and all of RTC)
 - PTC Integrity Modeler
 - PROSTEP OpenCLM (Prototype)
- **OpenPDM offers OOTB Connectors for all types of systems**
- **Low complexity Standards Based COTS solution**
 - Install connectors
 - Generate the mappings
 - Data is federated to your MBSE system



MBSE Utilizing OSLC with OpenPDM

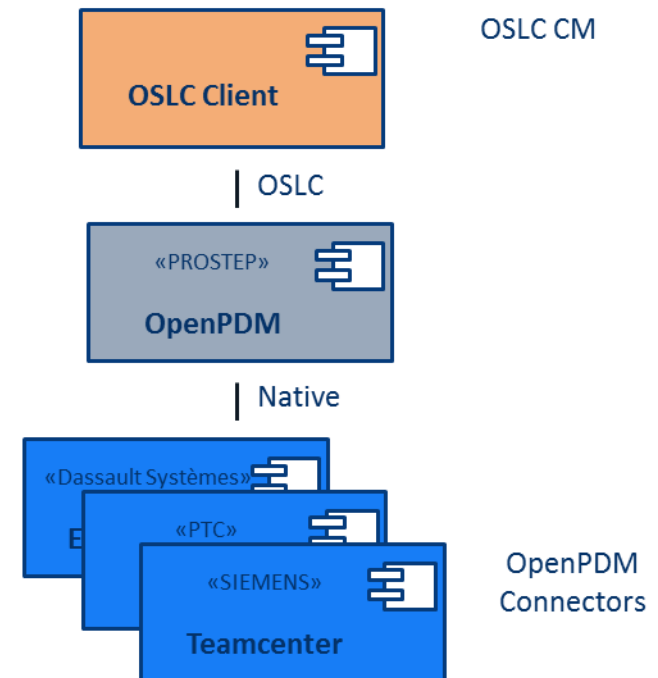
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OpenPDM OSLC Adapter

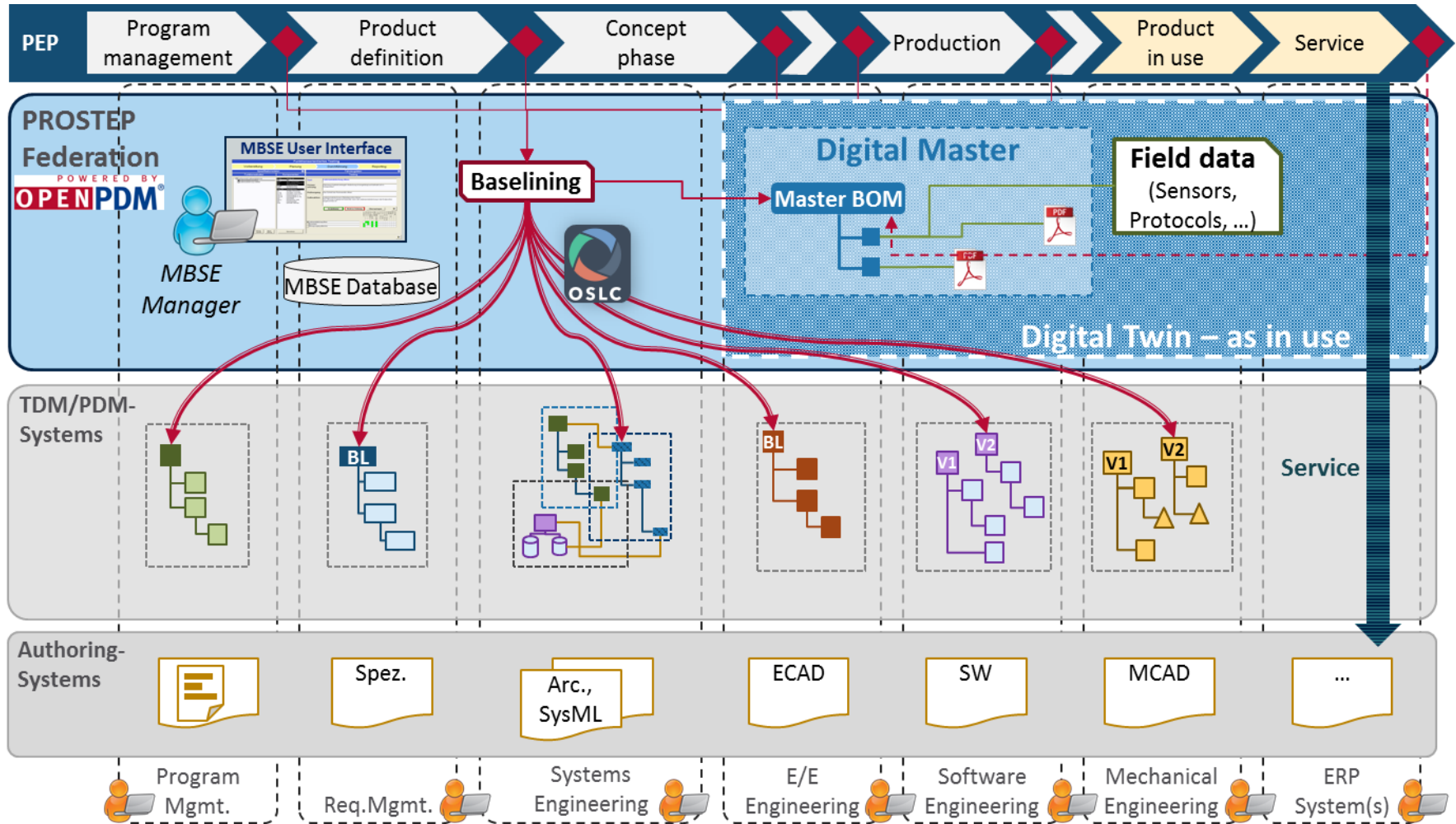
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- The OpenPDM OSLC Adapter enables OSLC access for non -OSLC systems
 - » Authentication against backend
 - » Query UI / Properties Display UI
 - » REST Resources and resource links
 - » Local Document Download from the backend system via OpenPDM
 - » Query Service maps OSLC queries onto backend
- Supports Change Management 2.0 + custom attributes
- Support for modern schema (new 2017)



More Than MBSE – CLM, Digital Master | Thread | Twin

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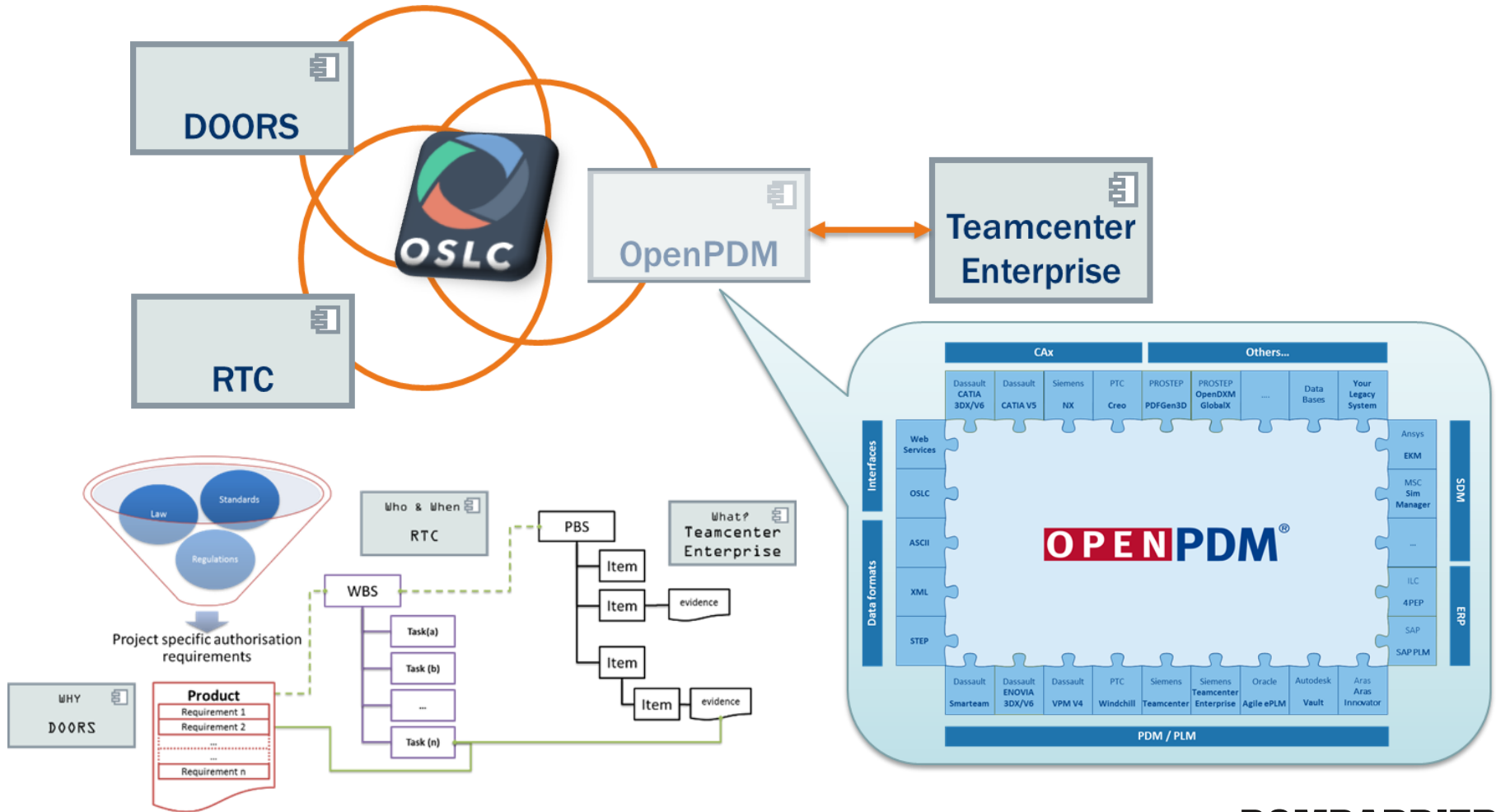
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Compliance (and CLM) Tracability at Bombardier Transport

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BOMBARDIER
the evolution of mobility

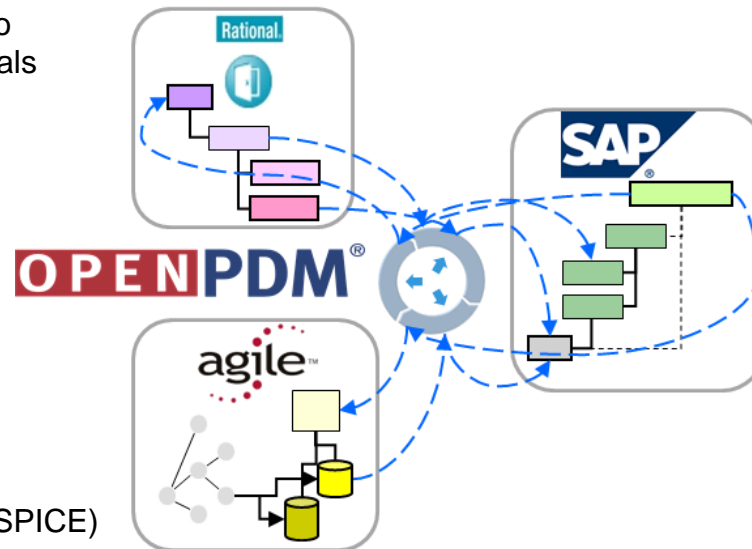
Systems Engineering Impact Analysis at ZF

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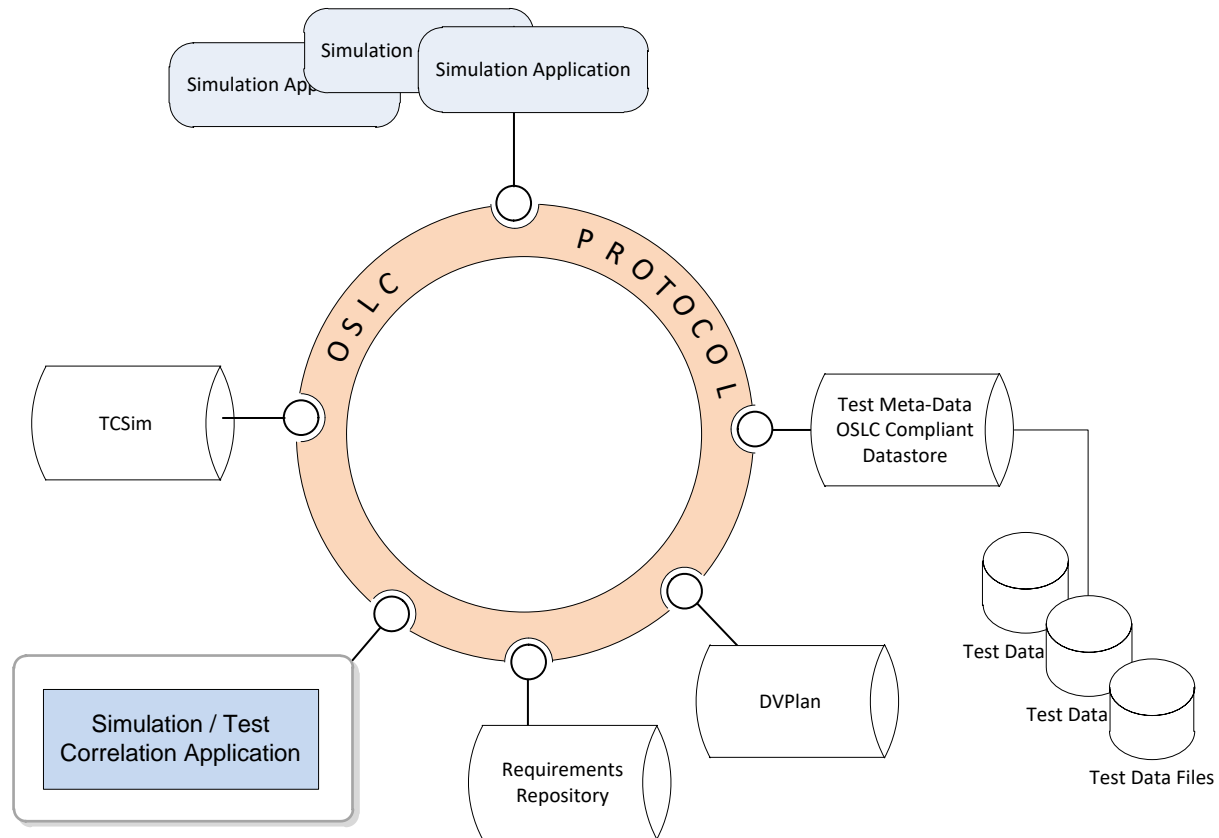
OpenPDM Use Cases

- 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

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OpenPDM – Linking with OSLC and More

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Challenges in the PLM Environment

One Solution for all Use Cases

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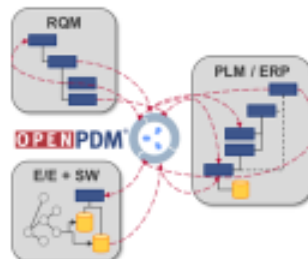
INTEGRATION

- Synchronization of data of various systems and domains
- Consistent and automated processes



LINKING

- Linking of product data of various disciplines
- Traceability of the whole product development process
- Creation of reports and realization of audits



MIGRATION

- Controlled migration of huge data volumes
- Minimized risk by parallel operation of old and new system
- Lower complexity by splitting into packages



COLLABORATION

- Integration of data from partners, customers and suppliers
- Reliable and transparent processes
- Check of data quality



OpenPDM Customers

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OpenPDM Customers

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Questions?

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THANK YOU!

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