Achieving the digital thread through PLM and ALM integration using OSLC

Purdue PLM Meeting Spring 2018

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Koneksys

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Axel Reichwein

- Developer of multiple data integration solutions based on Open Services for Lifecycle Collaboration (OSLC)
- Background in aerospace engineering
- Since PhD, focus on data integration
- Since Koneksys, focus on OSLC
- Previously involved in standardization efforts related to SysML (Systems Modeling Language)
- Presented OSLC at multiple conferences: INCOSE, OMG, SAE International Automotive, North American Modelica Users Group, IBM InterConnect, IBM Innovate, NoMagic World Conference, CIMdata Systems Engineering Workshop

Status Quo of Collaboration

According to David Meza, Head of Knowledge Management at NASA

"**Most engineers have to look at 13 different sources** to find the information they are looking for"

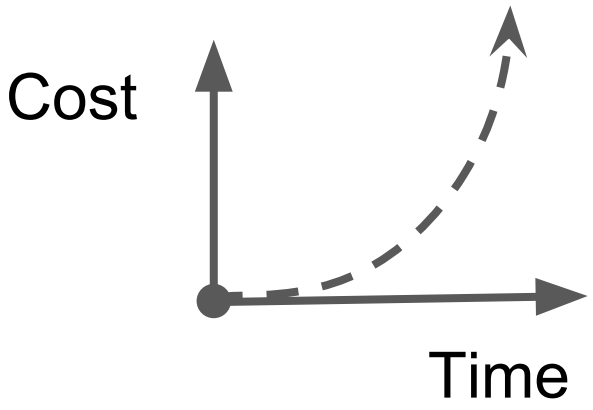
"**46% of workers can't find the information** about half the time"

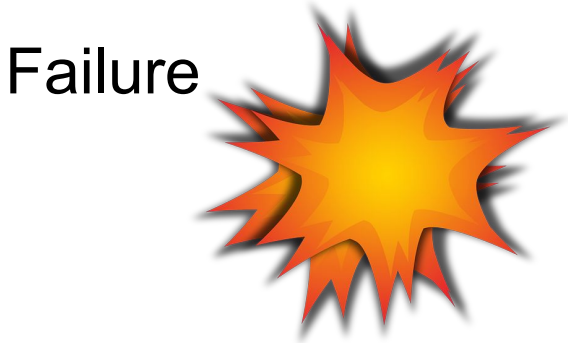
"**30% of total R&D funds are spent to redo** what we've already done once before"

"**54% of our decisions are made with inconsistent, or incomplete, or inadequate information**"

https://www.youtube.com/watch?v=QEBVoultYJg

Consequences of Bad Collaboration



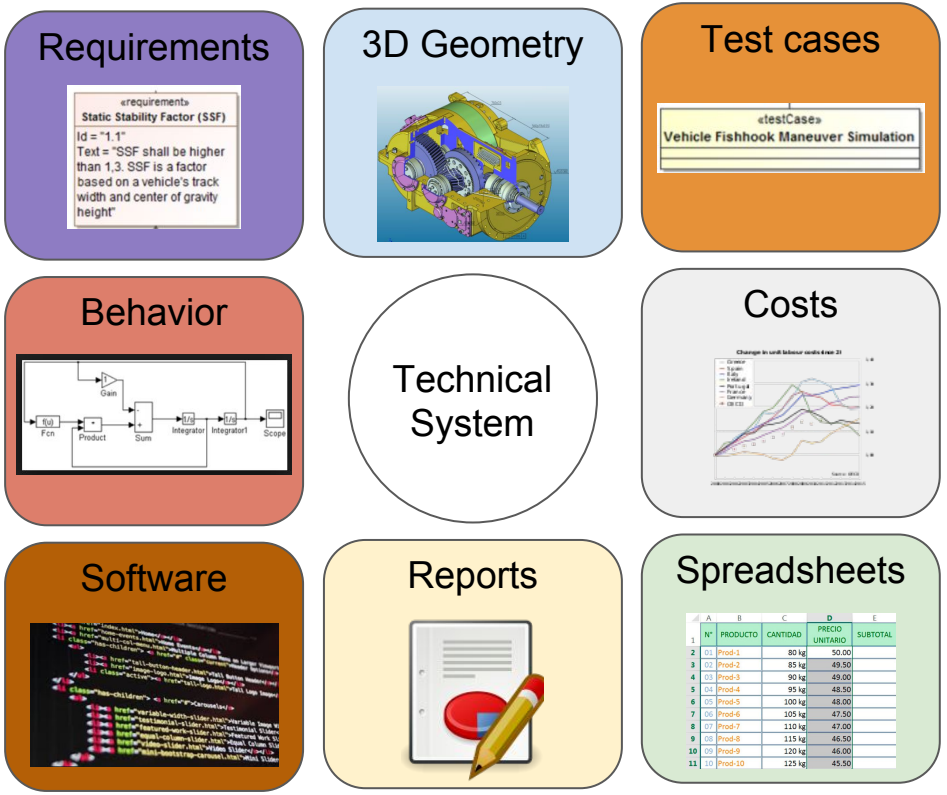


Distributed Engineering Information

One technical system described from different perspectives

One technical system, but a lot of distributed information

Distributed information is challenging for collaboration

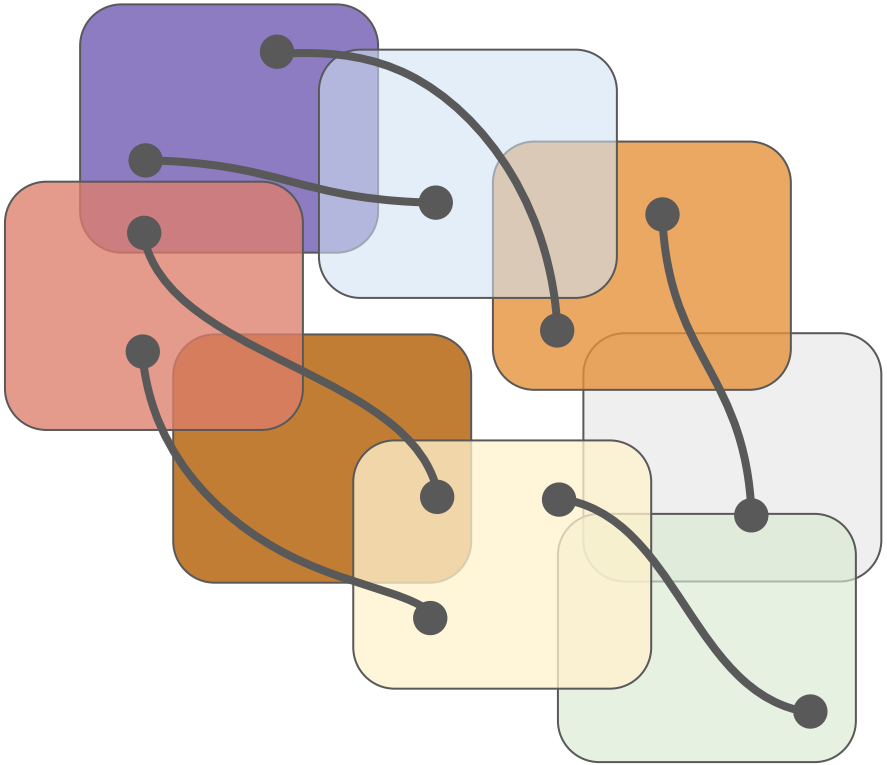


Overlaps and Relationships in Engineering Information

Overlaps due to data duplication (e.g. same parameter used in different models or reports)

Logical relationships such as a requirement verified by a test case

The more complex a system is, the more relationships exist between engineering information



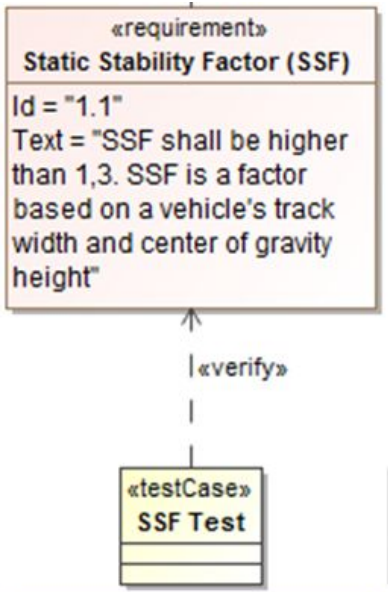
Problem: Rollover Risk of SUVs

Higher center of gravity -> higher risk of rollover

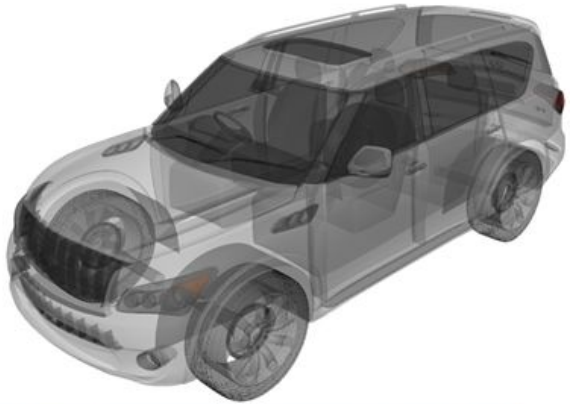
More than a third of all fatal crashes in the US are rollovers!

http://www.cars.com/go/crp/buyingGuides/Story.jsp?section=SUV&story=suvSafe2012&subject=stories&referer=&year=New

Static Stability Factor Test

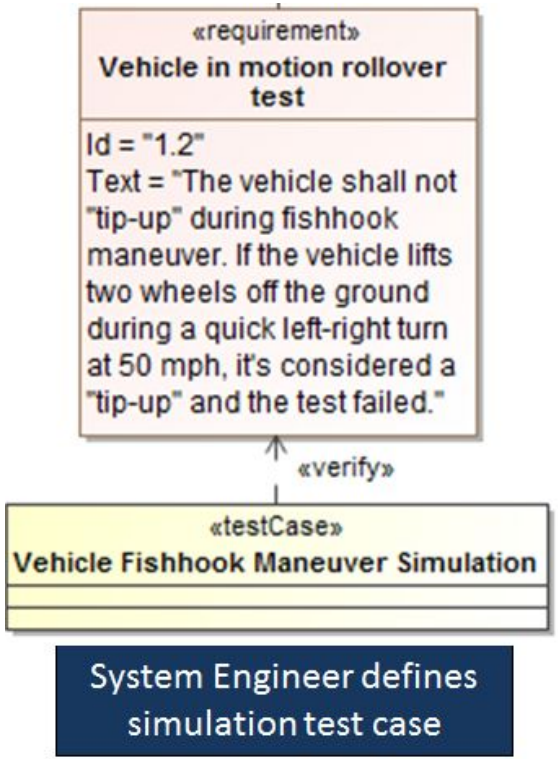


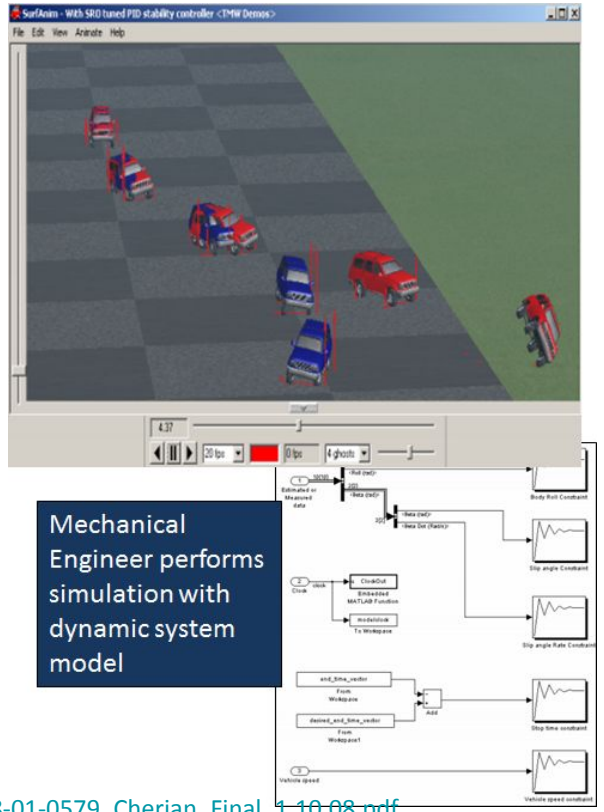
System Engineer defines SSF Test Case



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

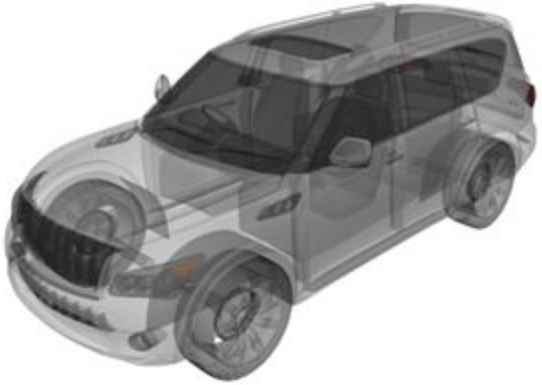
Fishhook Maneuver Simulation





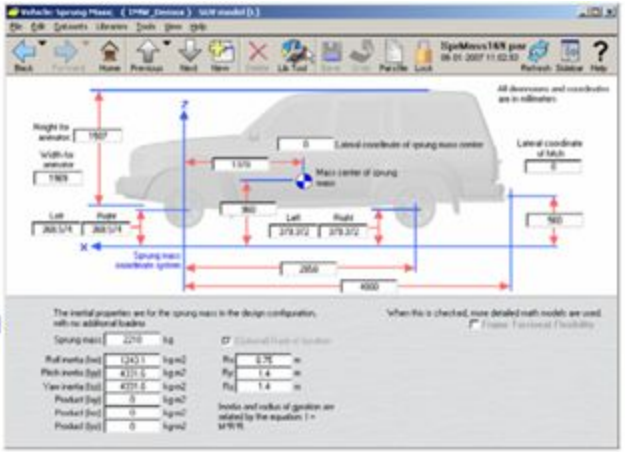
http://www.mathworks.com/tagteam/49380_2008-01-0579_Cherian_Final_1.10.08.pdf

Link between COG Parameter of different models



Center of Gravity

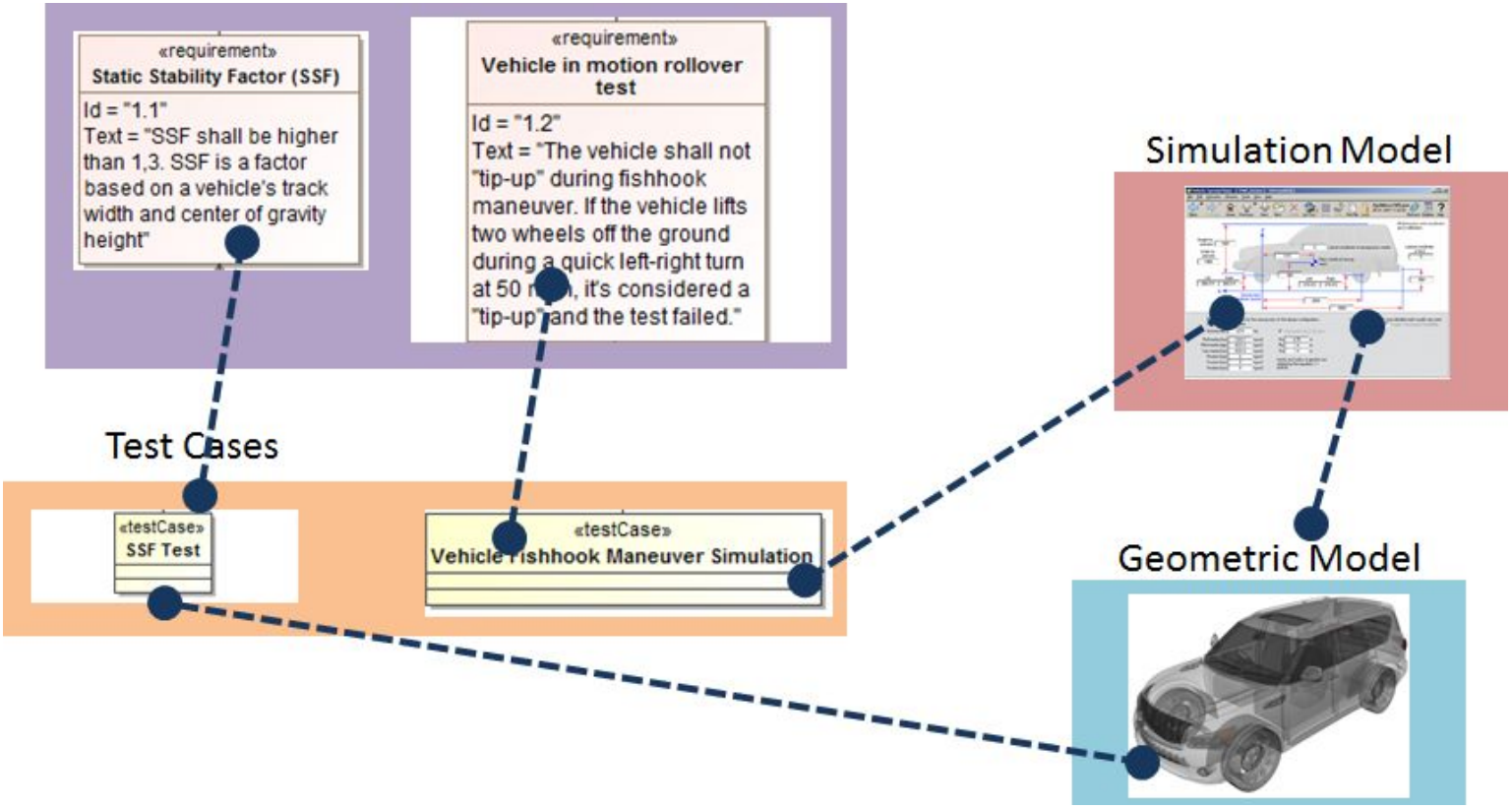
+ Moments of Inertia



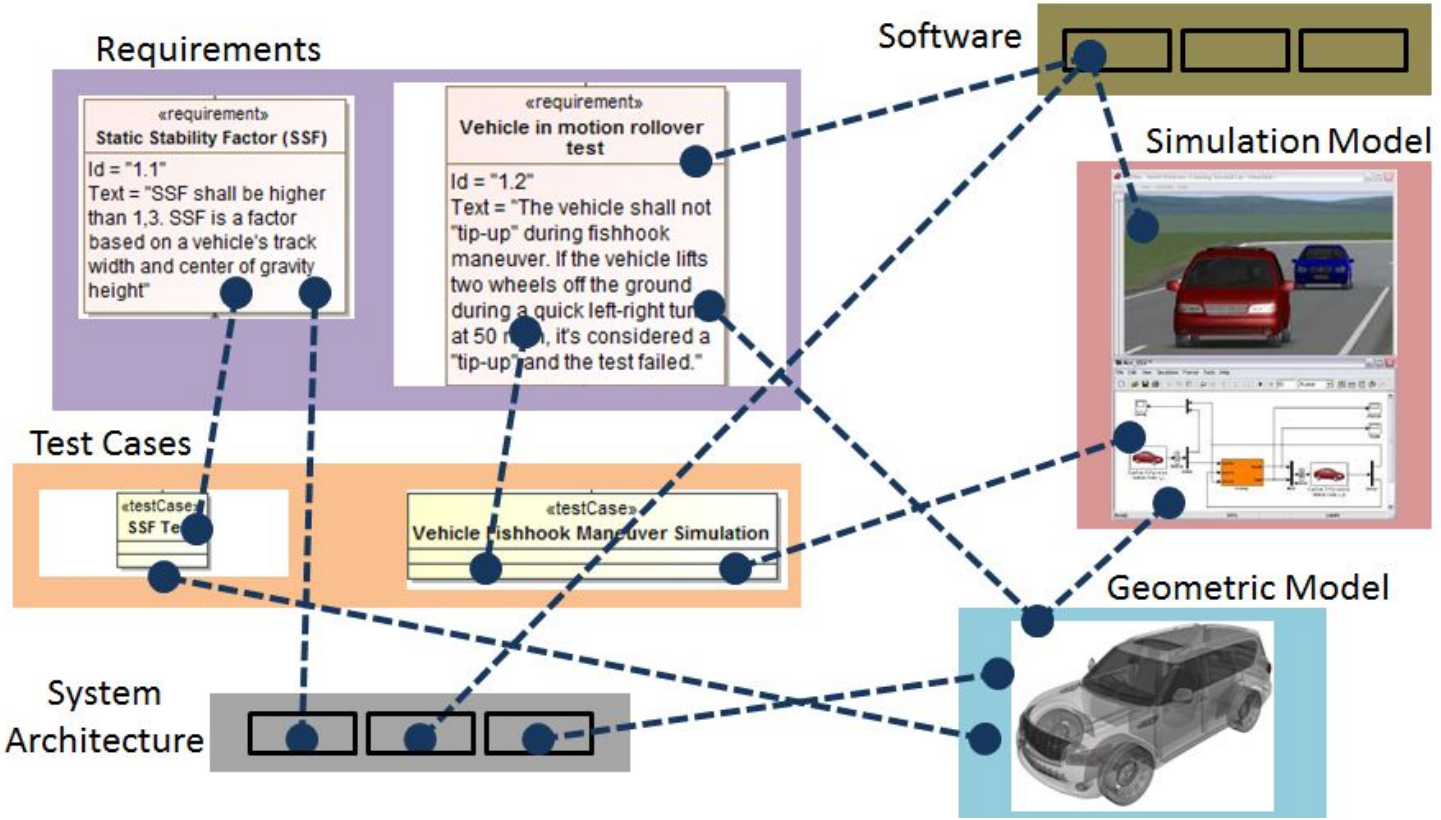
Center of gravity in geometric model

Center of gravity in simulation model

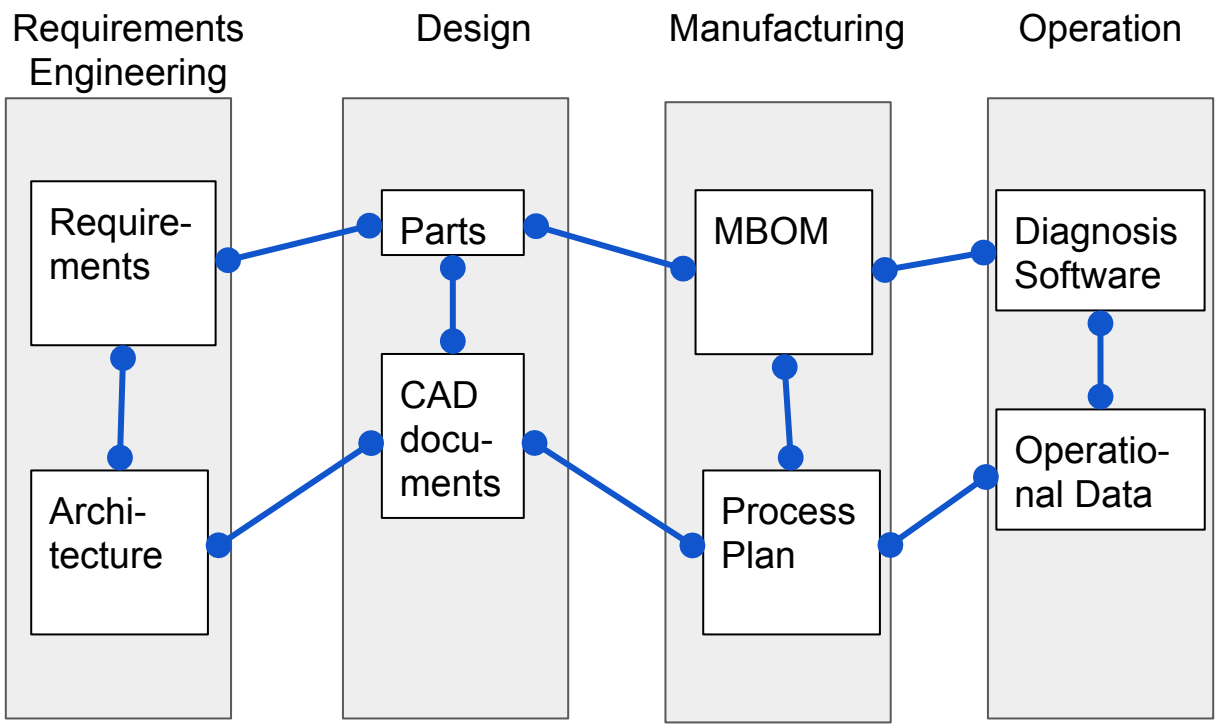
Relationships between Engineering Data



Reality: Many Relationships between Engineering Data



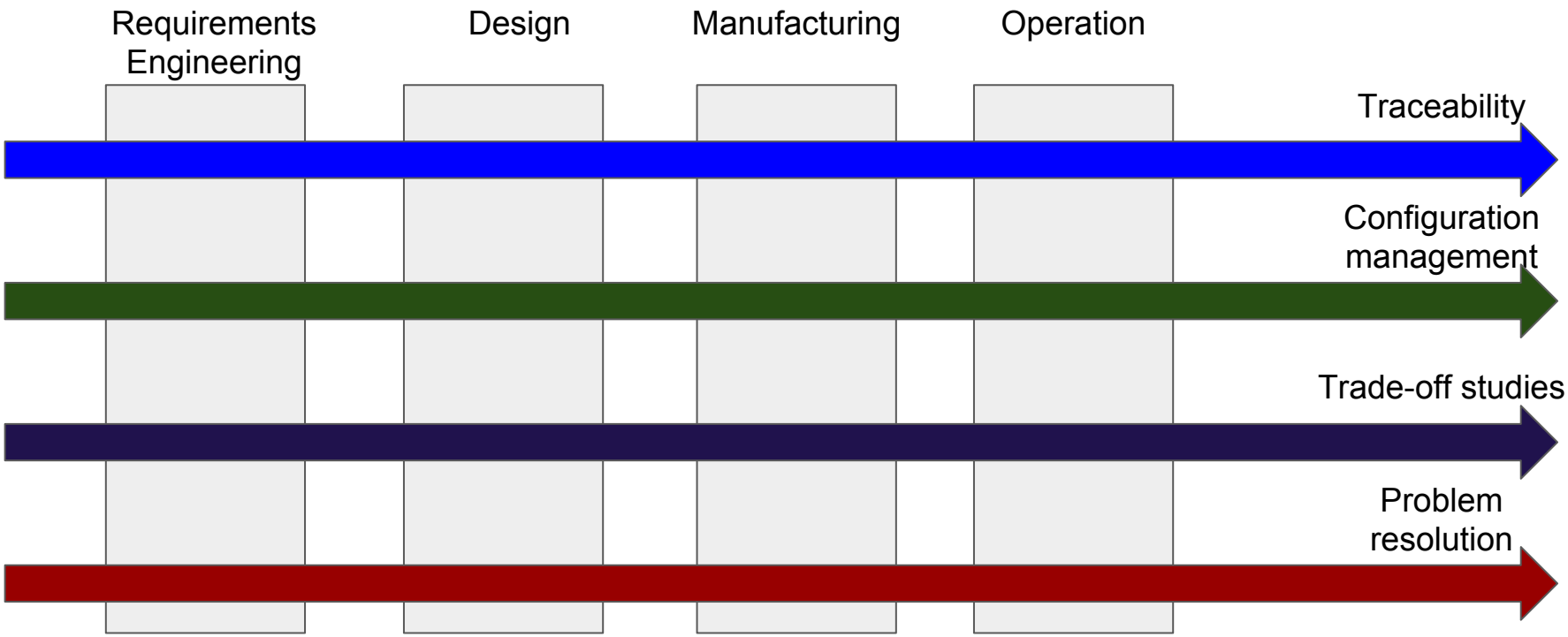
Example Digital Thread of PLM vendor



Problems

- **Limited integration** of specific disciplines and software applications
- **No mix-n-match** as needed by your organization (No ad-hoc integration)
- **Custom integration development is expensive**
- **Locked in by vendor**

Crosscutting Concerns Across Disciplines



Collaboration Challenges in Designing Systems

- Increasing system complexity
- Increasing number of partners
- Increasing number of versions of data

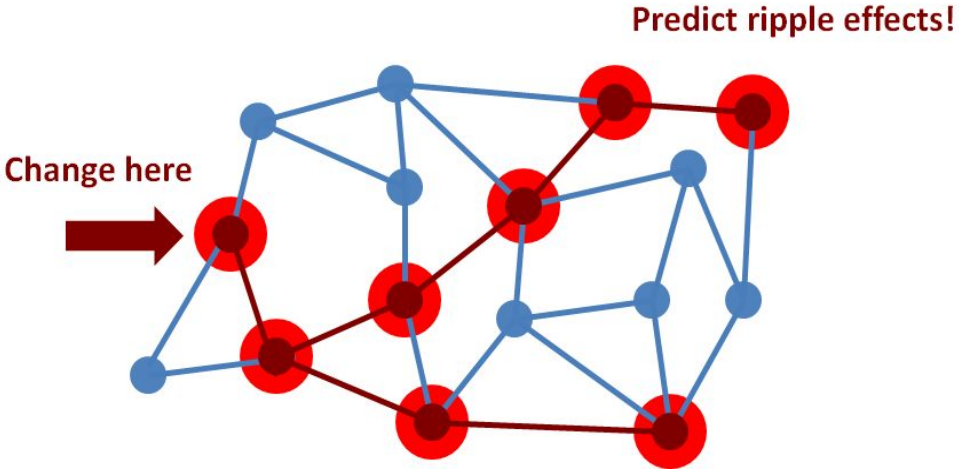
- Increasing number of meetings
- Increasing costs
- Increasing frustration

Data Integration Benefits

Understanding the context of information

Understanding the ripple effects of changes

Understanding the origin of product failures



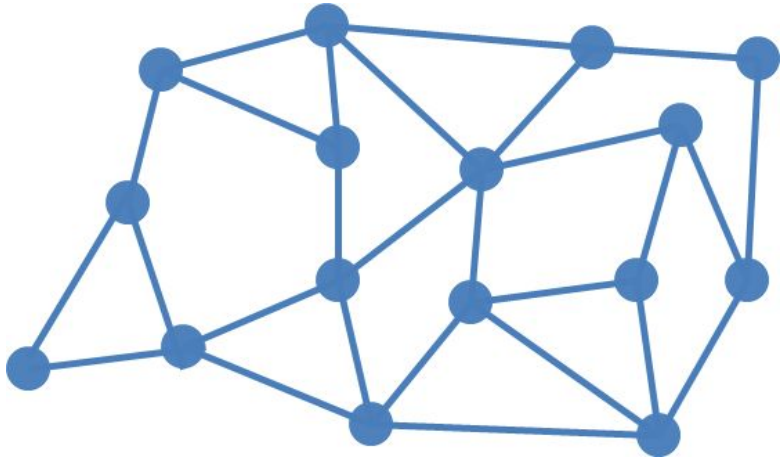
Performing consolidated reporting

Performing data analysis

Performing better decisions

Key Data Integration Concepts and Standards

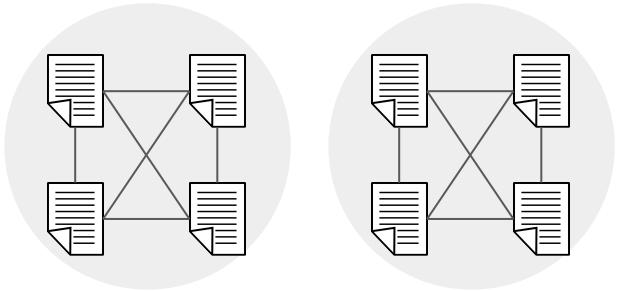
1. Standard machine-readable data format = RDF
2. Standard to identify data = URL
3. Standard to access data = HTTP



- No license costs
- No vendor lock-in
- Mature and widely adopted infrastructure
- Abundance of Web specialists/developers

Hypertext + Internet = Web

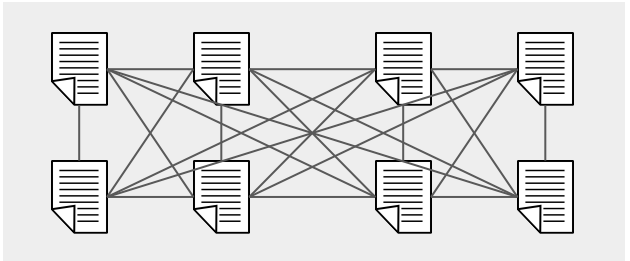
BEFORE THE WEB



Hypertext System 1 Hypertext System 2

Problem: No Compatibility between hypertext systems + different protocols to access and connect documents on the internet (Gopher, WAIS, etc...)

WITH THE WEB



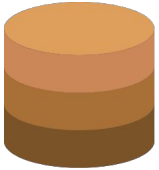
One global hypertext system = Web
One protocol to access and connect documents

Extending Web of documents to a Web of Data

Web of Documents

Documents spread across multiple machines

Facebook Server



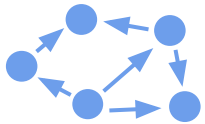
Wikipedia Server

Gmail Server

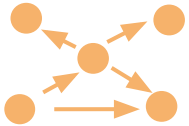
Note: a lot of information accessible through the Web is private!

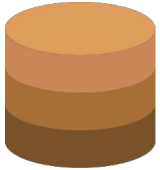
Web of Data

Data spread across multiple databases

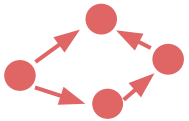


Requirements





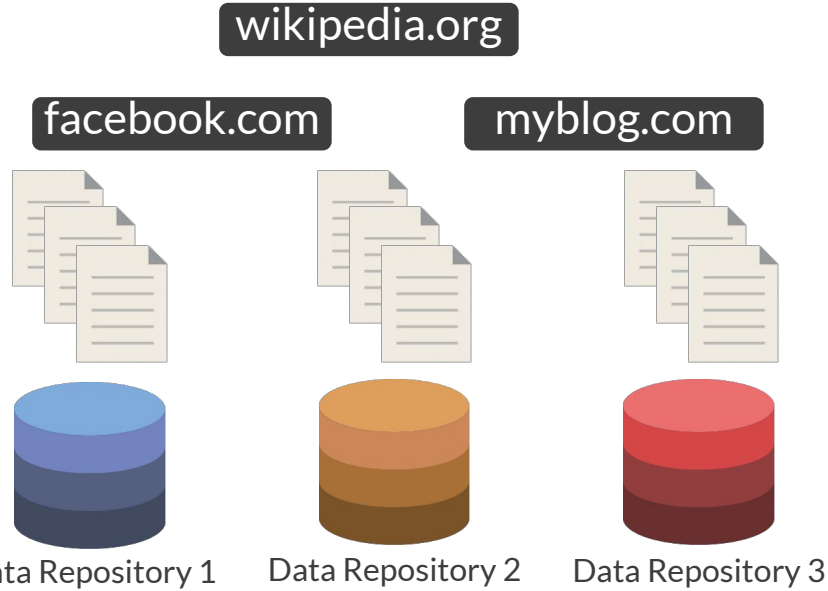
PLM



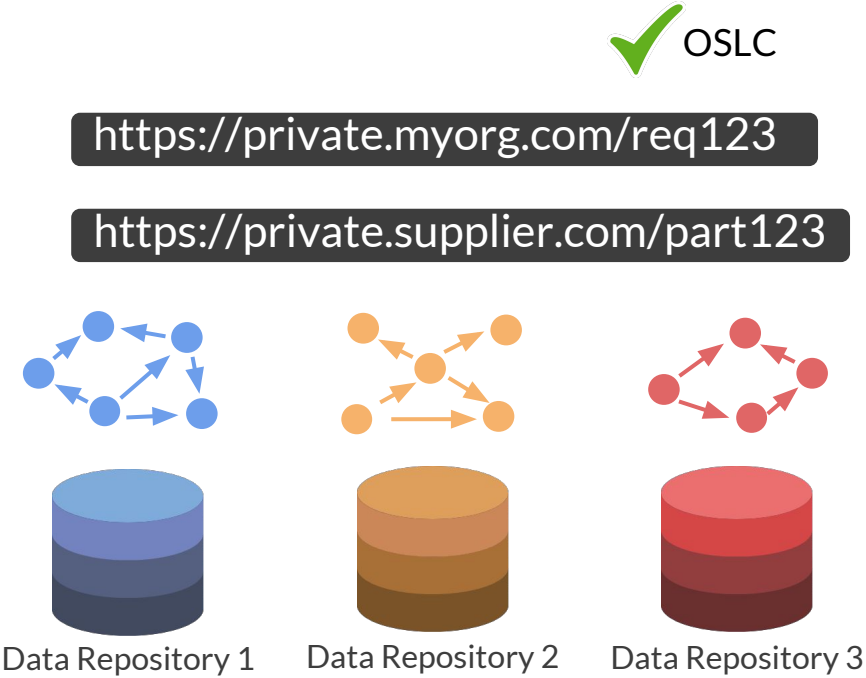
ERP

URLs = Common Global Information Identifiers

Web of Documents

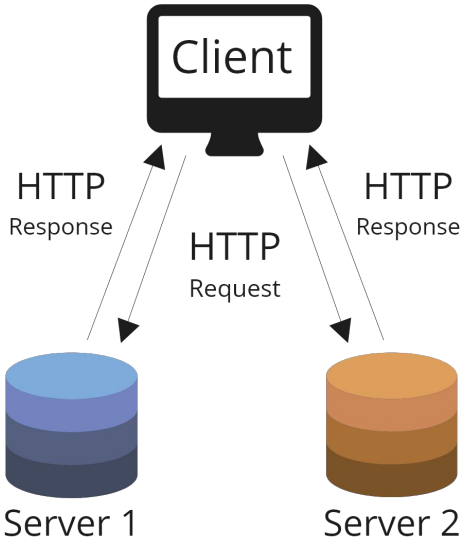


Web of Data

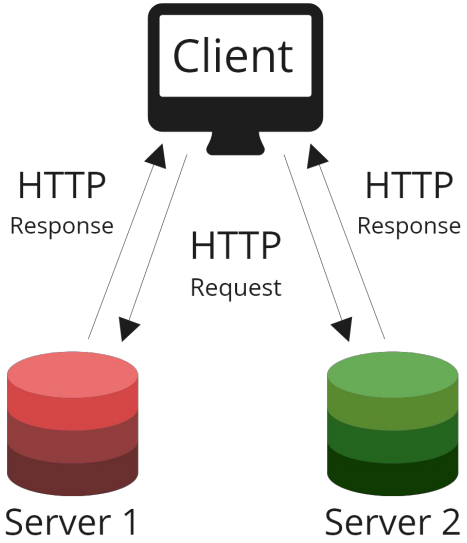


HTTP = Common Protocol to Access Information

Web of Documents



Web of Data

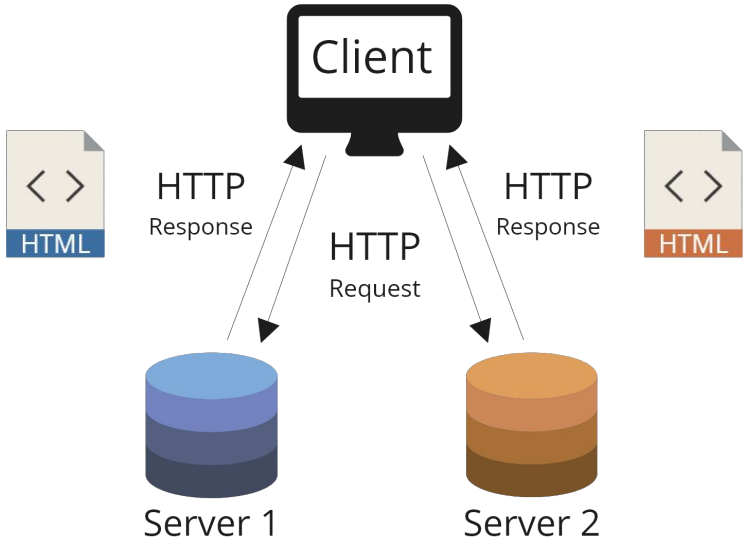


✓ OSLC

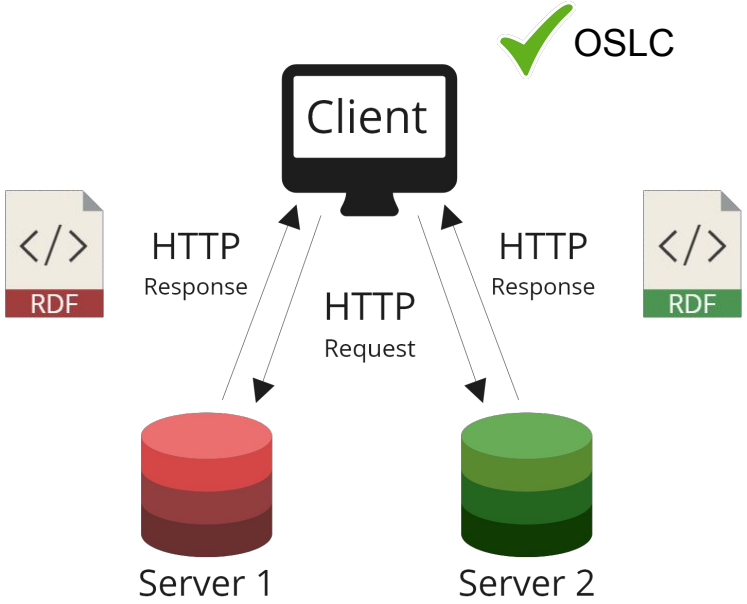
OSLC specifies how to perform CRUD operations on data using HTTP

HTML + RDF = Common Web Data Formats

Web of Documents



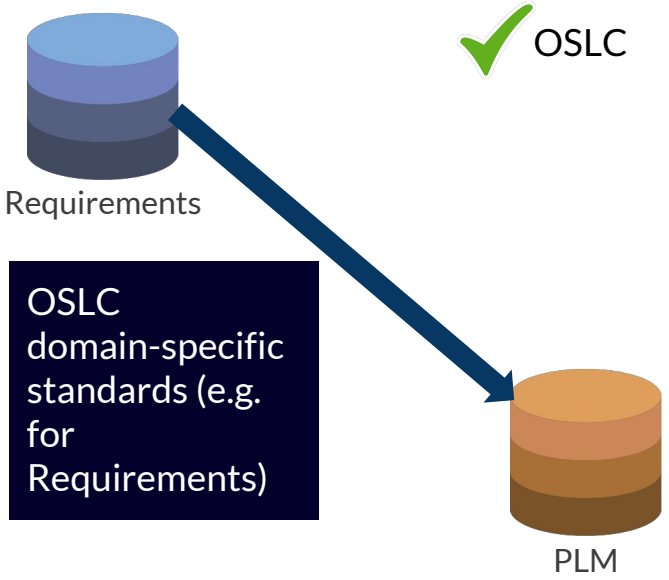
Web of Data



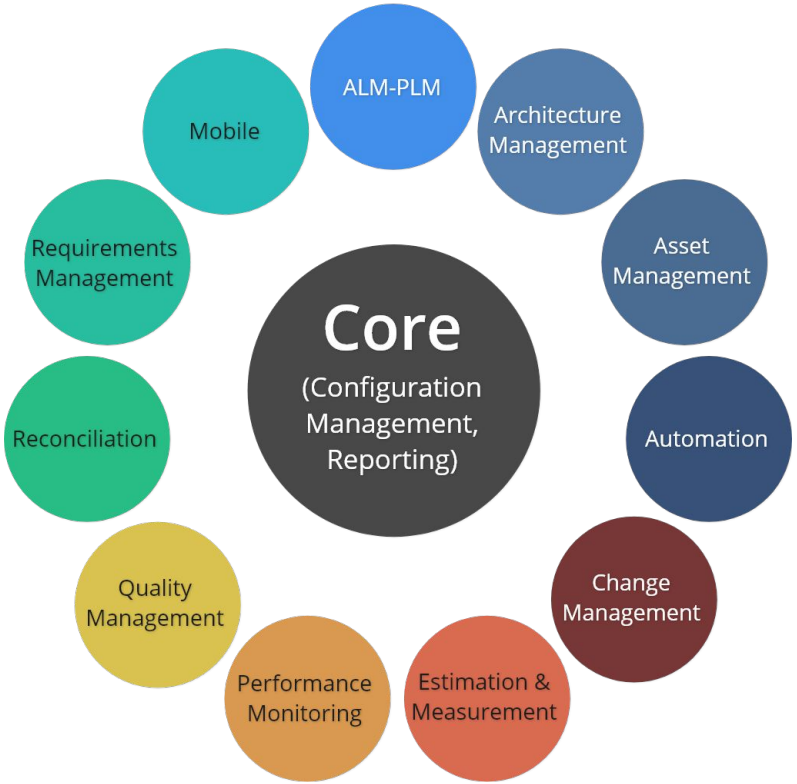
Schemas for Data Interoperability

Web of Documents

Web of Data

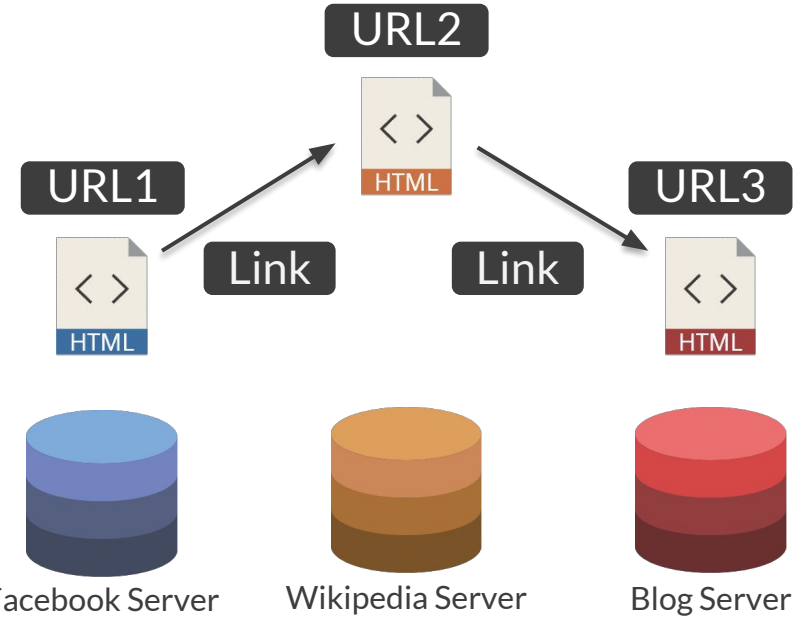


OSLC Domain-specific Standards

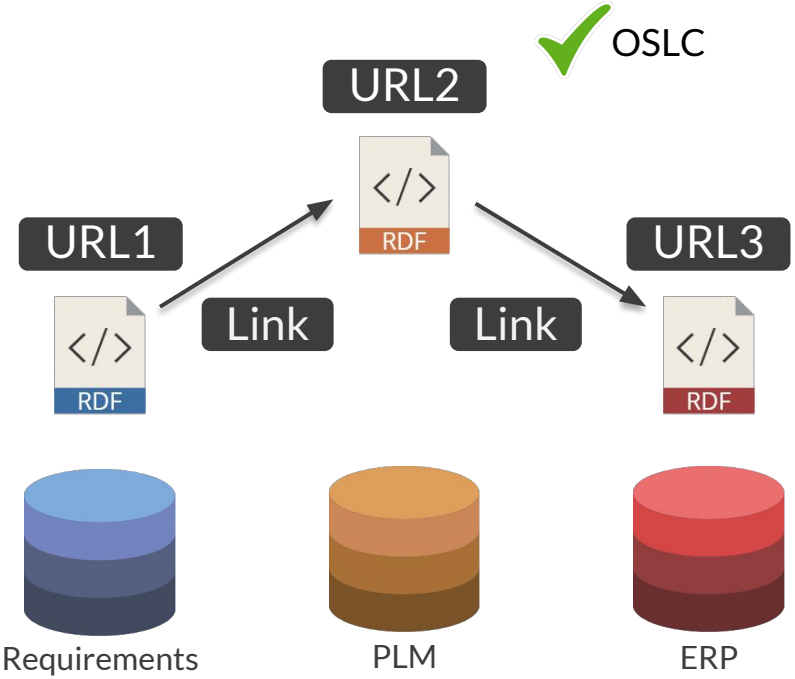


Links for Data Integration

Web of Documents



Web of Data



Mashup Applications

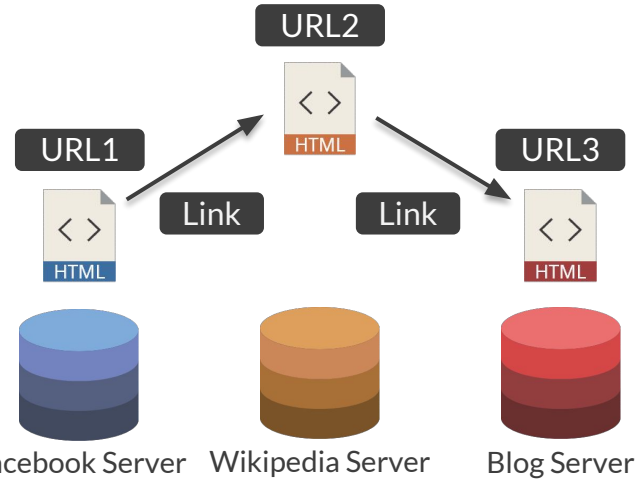
Web of Documents

Search

(e.g Google, Bing)

Visualize

(e.g Chrome, Firefox)



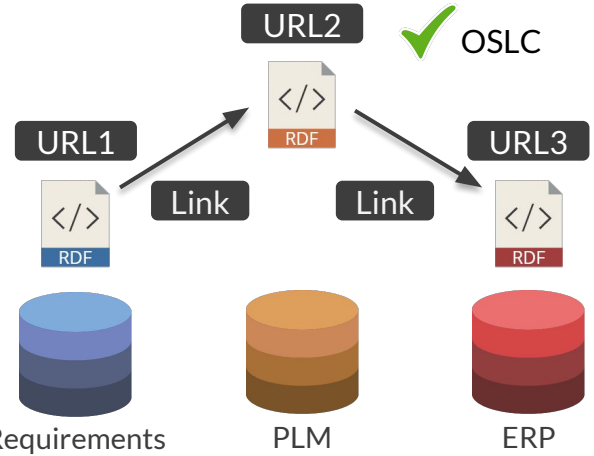
Equal access to information - more competition amongst data management solutions

Web of Data

Search

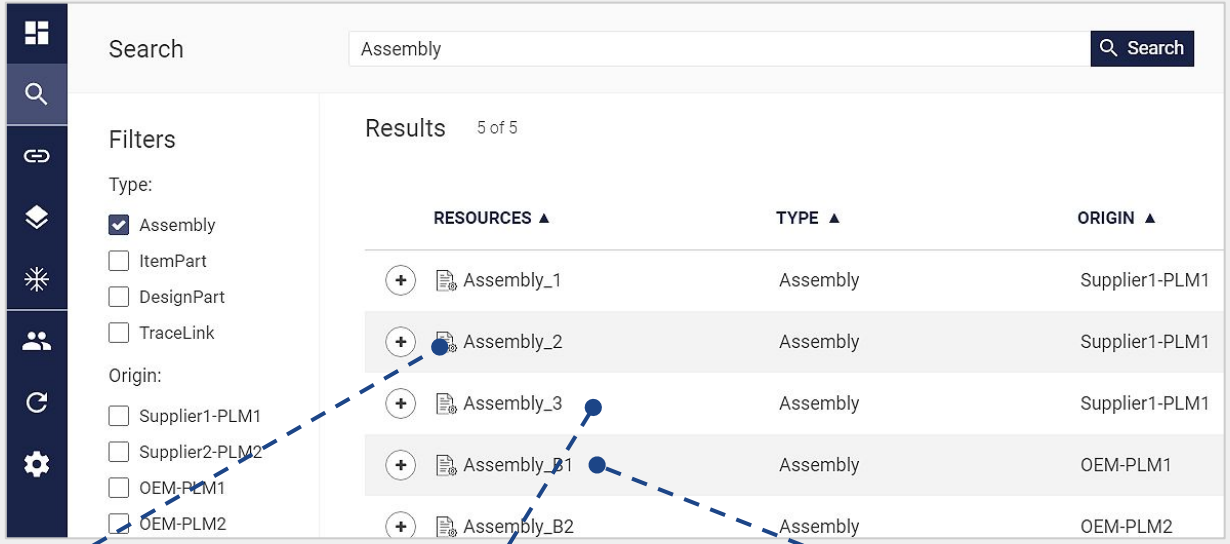
Visualize

(e.g. IBM Lifecycle Query Engine and Mentor Graphics Context)



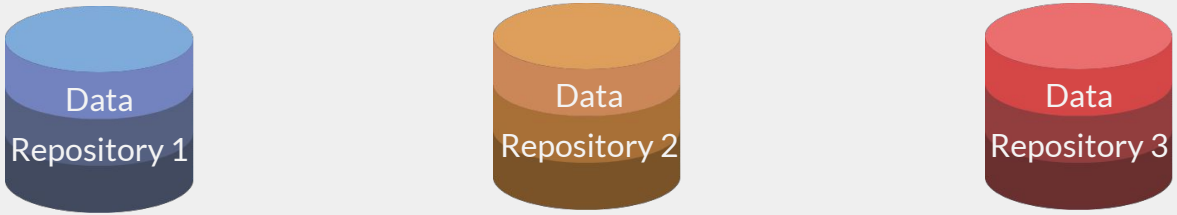
Mashup Application Example

Google-like Search



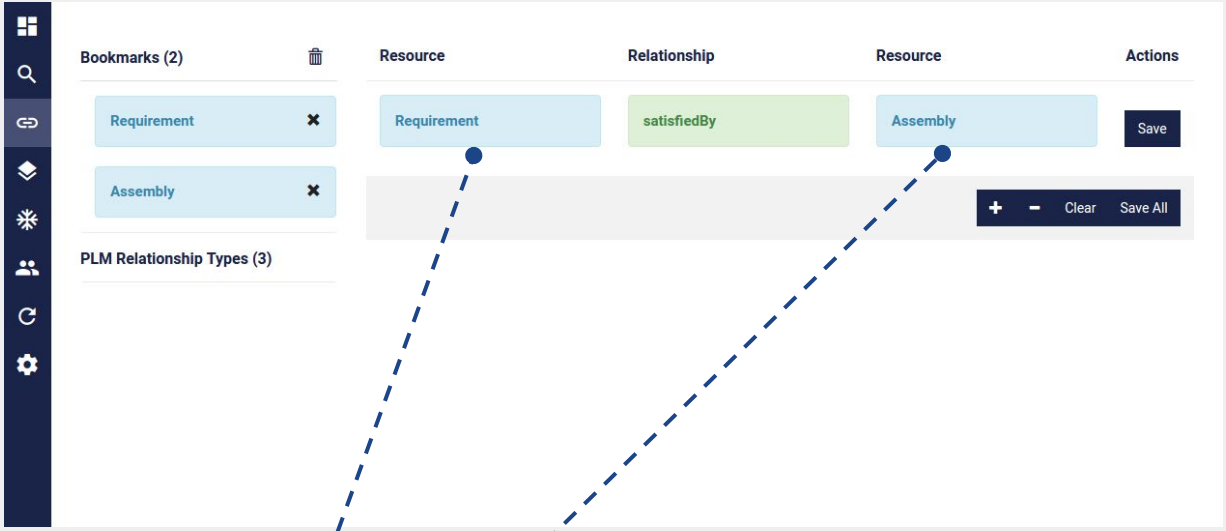
Private/public Data Web

Distributed Data Silos



Mashup Application Example

Link Editor



Private/public Data Web

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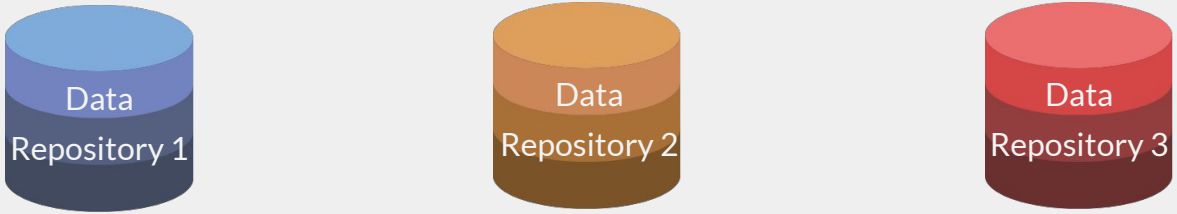
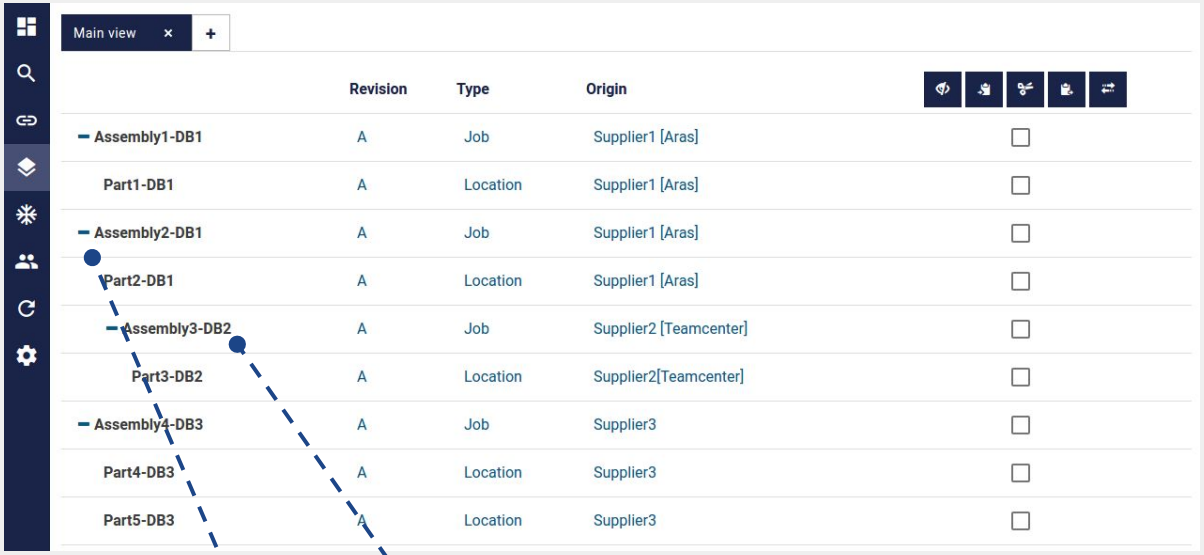


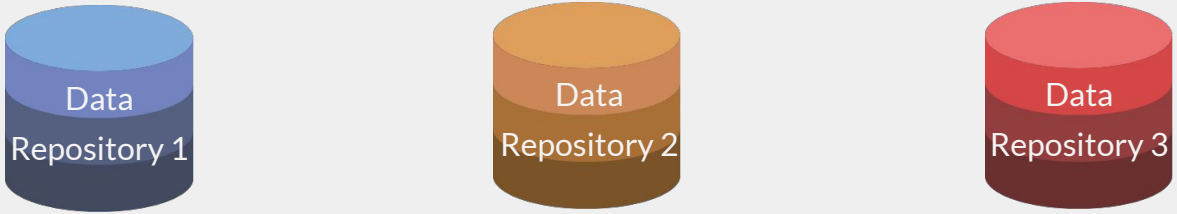
Mashup Application Example

Tree (BOM-like) Viewers



Private/public Data Web

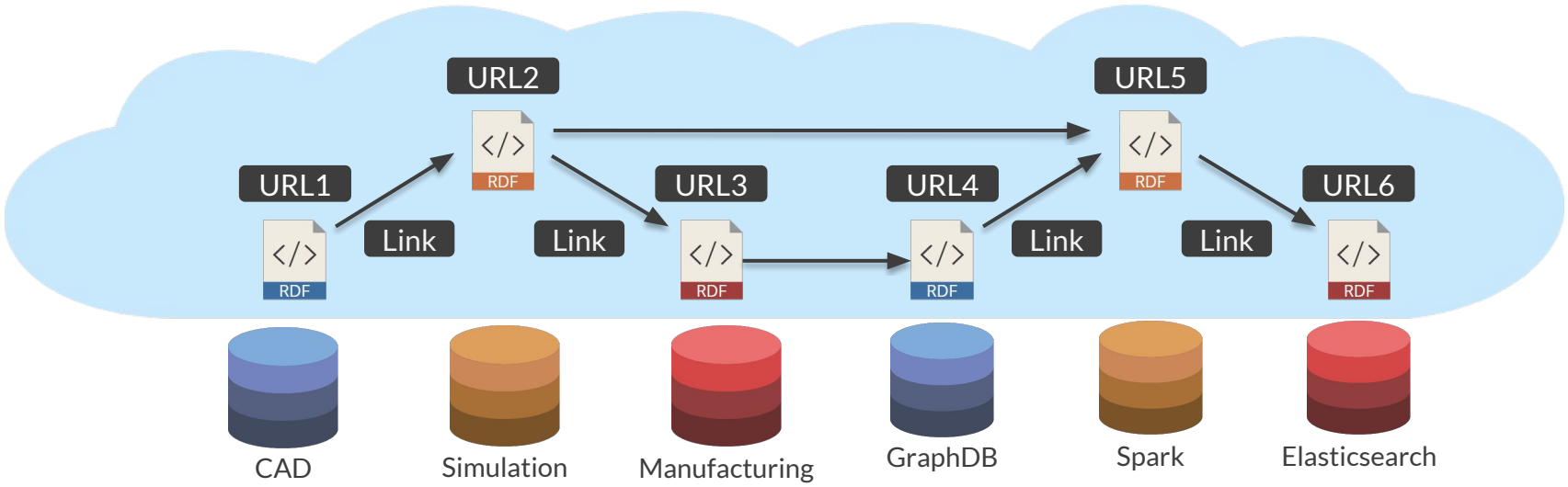
Distributed Data Silos



Mashup Applications for AI

AI for Generative Design

Equal access to information -> more data available to AI algorithms -> more interesting AI results



Mashup Application Challenge

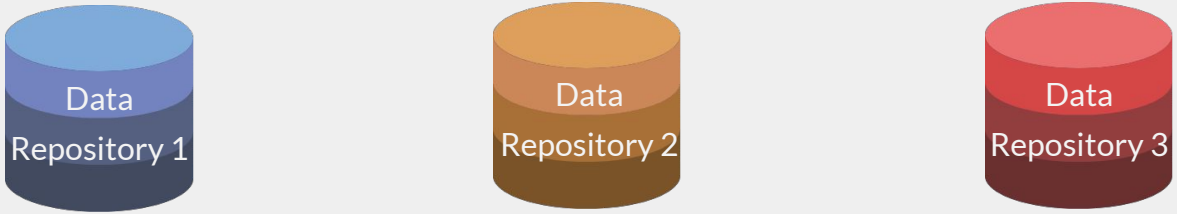
Scalability

What happens if the private data Web consists of 10 billion resources? Can you still query it?

Solution: use scalable big data solutions used for example by Google and Amazon (e.g. Elasticsearch, Amazon Neptune)

Private/public Data Web

Distributed Data Silos



Mashup Application Challenge

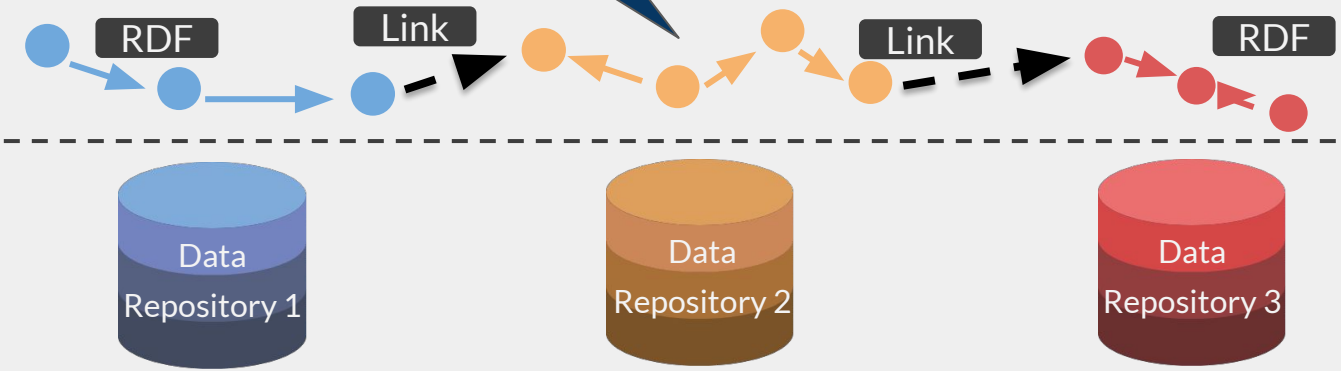
Global Configuration Management

Private/public Data Web

Distributed Data Silos

Which version of a resource is linked with which version of the linked resource? Can you do version management at a global level?

Solution: use OSLC Config management standard for global version management



Mashup Application Challenge

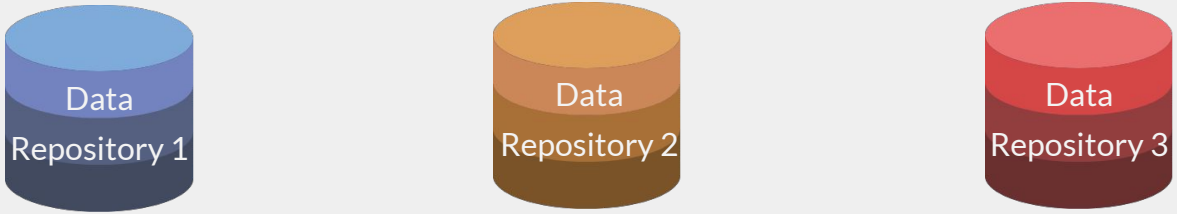
Security

How can I make sure that certain resources can only be accessed by certain users? How can the access management be more secure?

Solution: data access management at a global level + blockchain to record who gets access to what

Private/public Data Web

Distributed Data Silos



What does Koneksys do?

We offer **consulting services**:

- Create OSLC APIs for software applications and data stores not supporting OSLC natively
- Create integrations for OSLC-enabled applications (e.g. IBM DNG)
- Create mashup applications for OSLC data
- Offer OSLC training to developers and project managers

What does Koneksys do?

We perform internal **research** to address the challenges of future OSLC-based mashup applications:

- Running queries on OSLC data with Spark GraphFrames (https://github.com/koneksys/SPARQL_to_GraphFrames)
- Configuration management of OSLC data (https://github.com/koneksys/Git4RDF)
- Managing information in the blockchain using smart contracts (https://github.com/koneksys/Blockchain4LinkedData)

What does Koneksys do?

We **help grow the OSLC community**:

- Releasing open-source OSLC solutions (https://github.com/ld4mbse + https://github.com/oslc/)
- Creating new OSLC web site (http://oslc.co/)
- Promoting OSLC at conferences (https://koneksys.com/blog/)

Koneksys

Koneksys helps organizations create data integration solutions using

- Linked Data
- Open Services for Lifecycle Collaboration (OSLC)
- Big Data frameworks
- Graph Databases

Located in San Francisco. In business since 2012.

Koneksys Clients

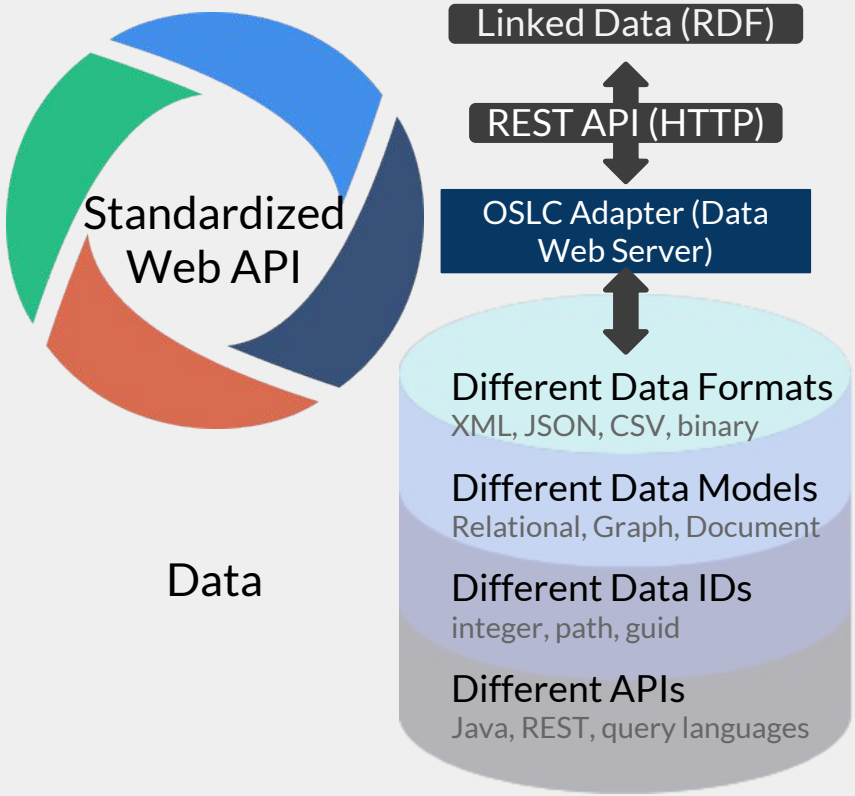
Open Services for Lifecycle Collaboration (OSLC)

Standards for servers hosting data (Hypermedia REST API + Linked Data REST API)

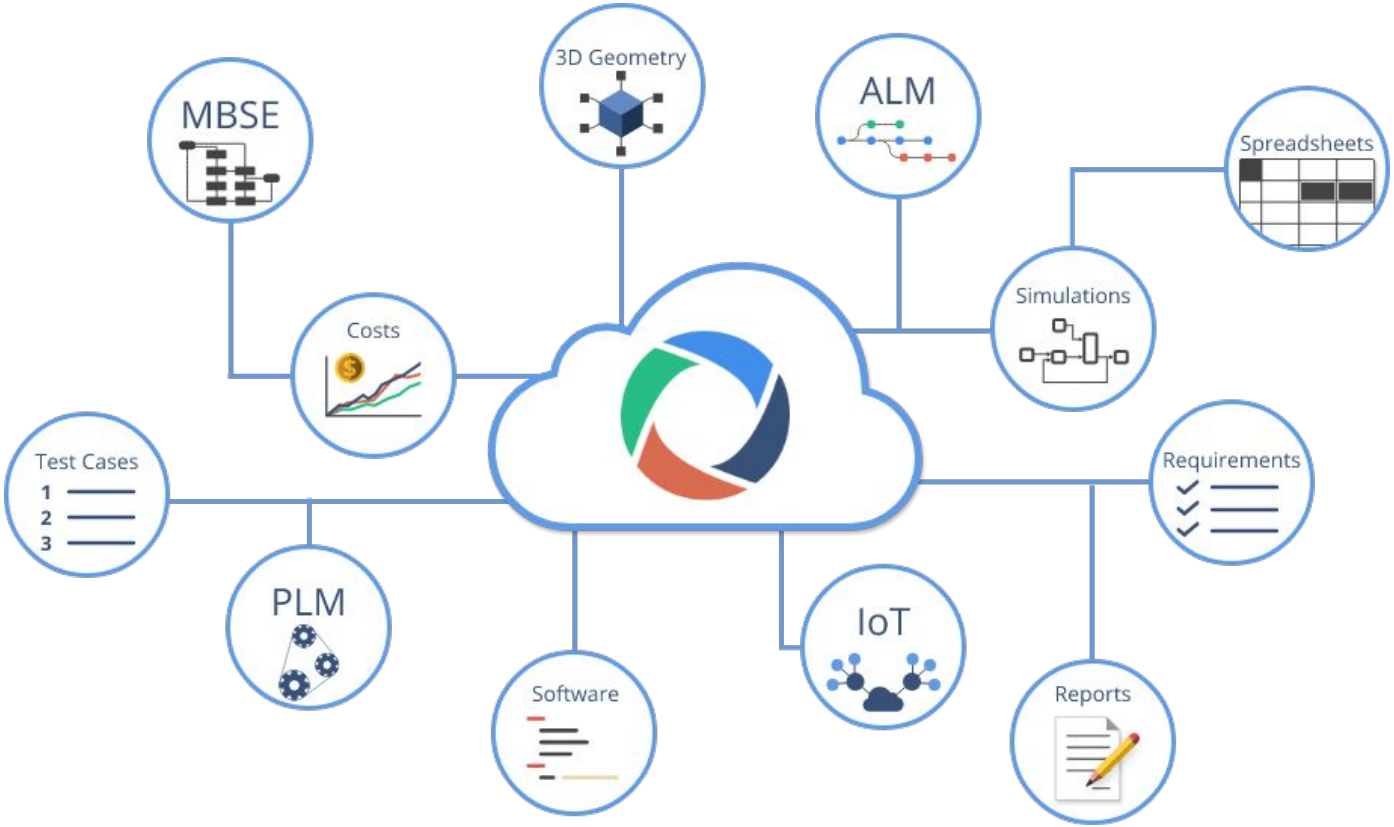
Standards for web-based data interoperability

Adopted so far mainly for Application Lifecycle Management (ALM), systems and requirements engineering

Open Community



OSLC to achieve the Digital Thread

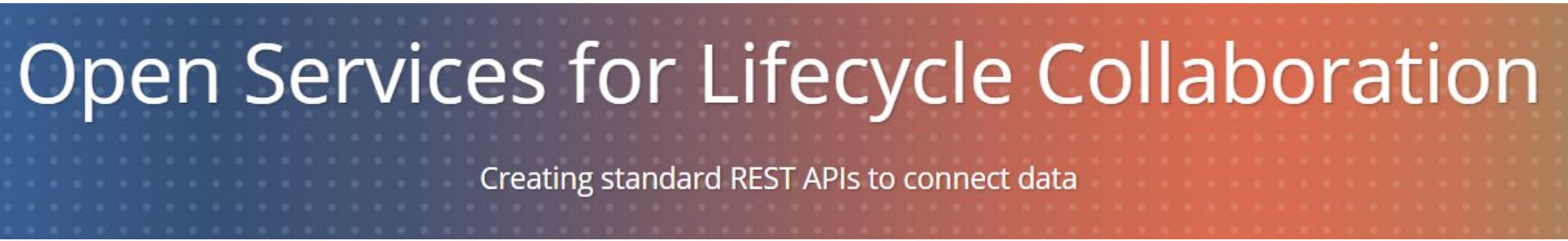


We need you to help promote OSLC!

New OSLC Web site: http://oslc.co/

Adding your company logo to the list of supporters on the web site helps the OSLC community grow

If end user organizations show support for OSLC, then vendors, consultants, and developers will offer more support for OSLC



Thanks and get in touch!

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