

# Overview of Open Services for Lifecycle Collaboration (OSLC)

INCOSE IW MBSE Workshop

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Koneksys

# 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



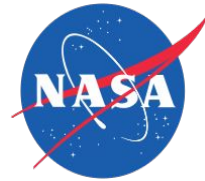
# Koneksys

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



# 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”**

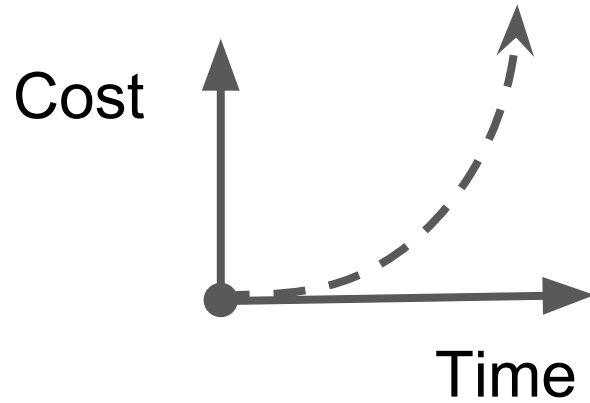
**“46% of workers can’t find the information about half the time”**

**“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



Failure



# Distributed Engineering Information

One technical system described from different perspectives

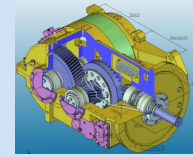
One technical system, but a lot of distributed information

Distributed information is challenging for collaboration

## Requirements

```
«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"
```

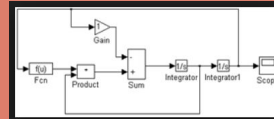
## 3D Geometry



## Test cases

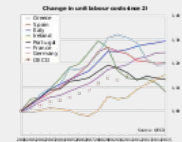
```
«testCase»
Vehicle Fishhook Maneuver Simulation
```

## Behavior



## Technical System

## Costs



## Software



## Reports



## Spreadsheets

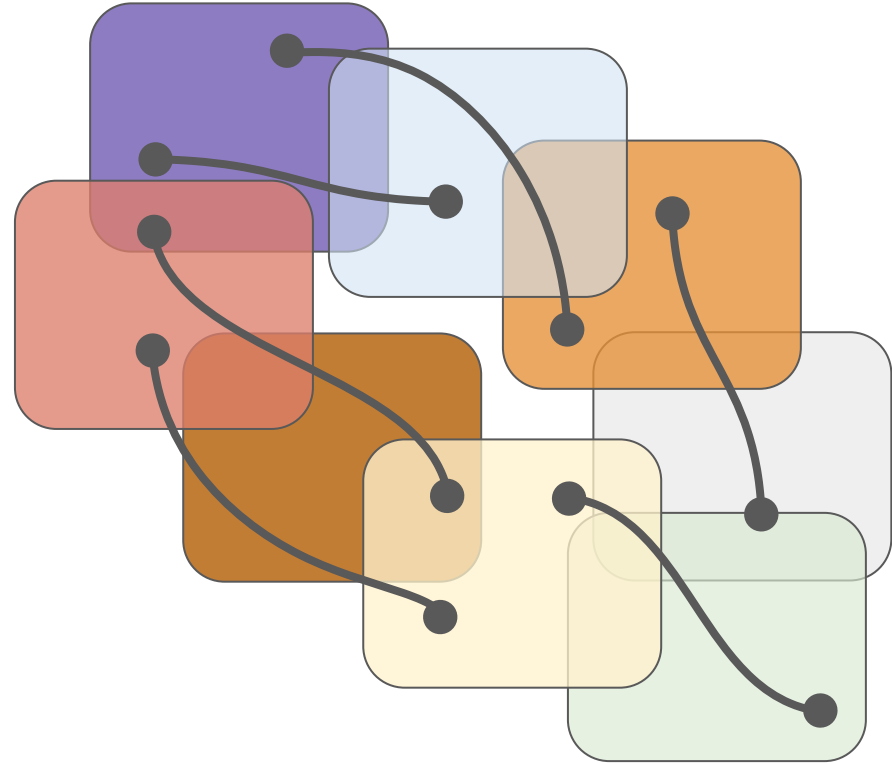
	A	B	C	D	E
1	N°	PRODUCTO	CANTIDAD	PRECIO UNITARIO	SUBTOTAL
2	01	Prod-1	80 kg	50,00	
3	02	Prod-2	85 kg	49,50	
4	03	Prod-3	90 kg	49,00	
5	04	Prod-4	95 kg	48,50	
6	05	Prod-5	100 kg	48,00	
7	06	Prod-6	105 kg	47,50	
8	07	Prod-7	110 kg	47,00	
9	08	Prod-8	115 kg	46,50	
10	09	Prod-9	120 kg	46,00	
11	10	Prod-10	125 kg	45,50	

# 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

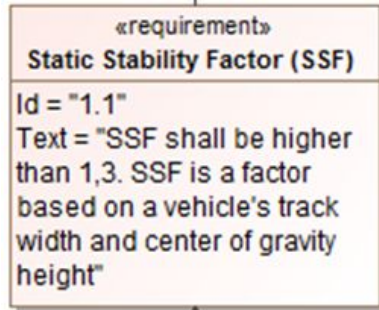
More than a third of all fatal crashes in the US are rollovers!



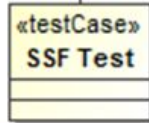
<http://www.cars.com/go/crp/buyingGuides/Story.jsp?section=SUV&story=suvSafe2012&subject=stories&referer=&year=New>



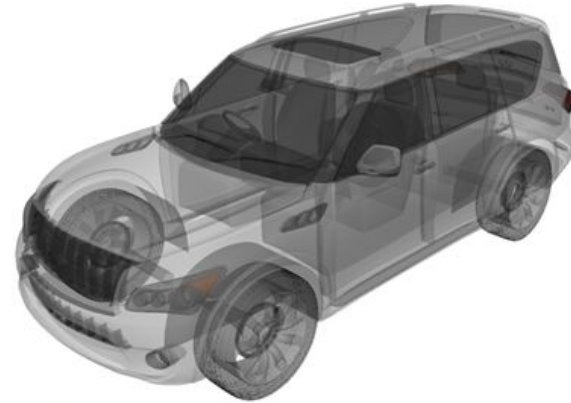
# Static Stability Factor Test



«verify»

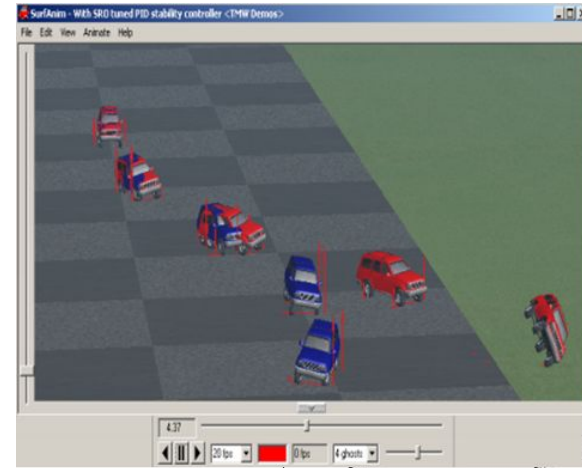
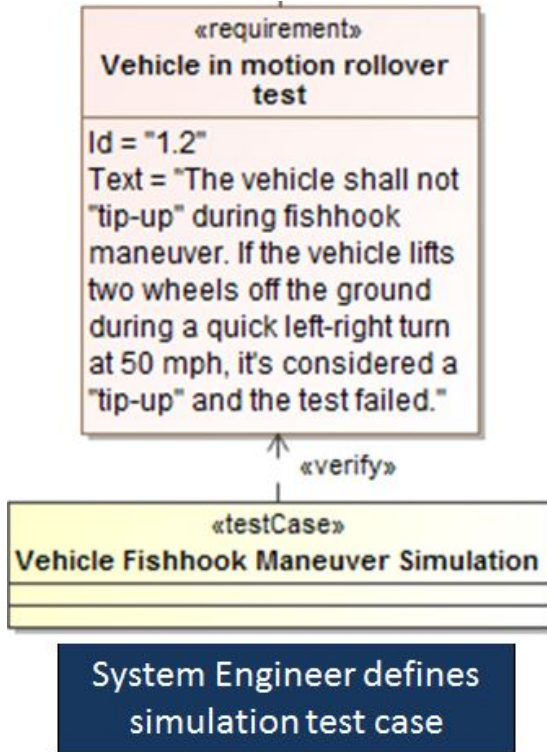


System Engineer  
defines SSF Test Case

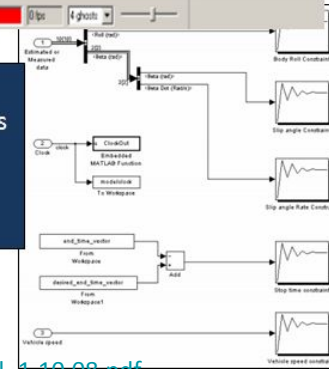


Mechanical Engineer computes center of gravity height of new vehicle through geometric model

# Fishhook Maneuver Simulation

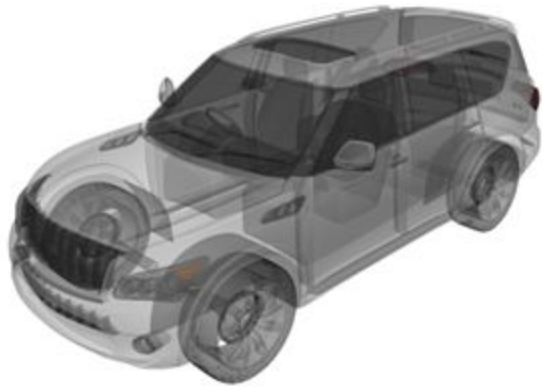


Mechanical Engineer performs simulation with dynamic system model



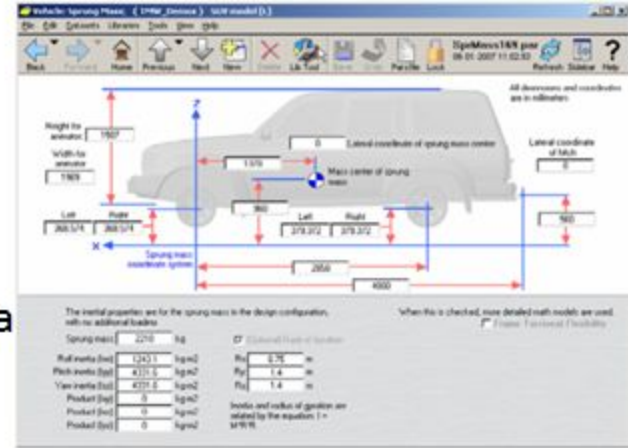
[http://www.mathworks.com/tagteam/49380\\_2008-01-0579\\_Cherian\\_Final\\_1.10.08.pdf](http://www.mathworks.com/tagteam/49380_2008-01-0579_Cherian_Final_1.10.08.pdf)

# Link between COG Parameter of different models



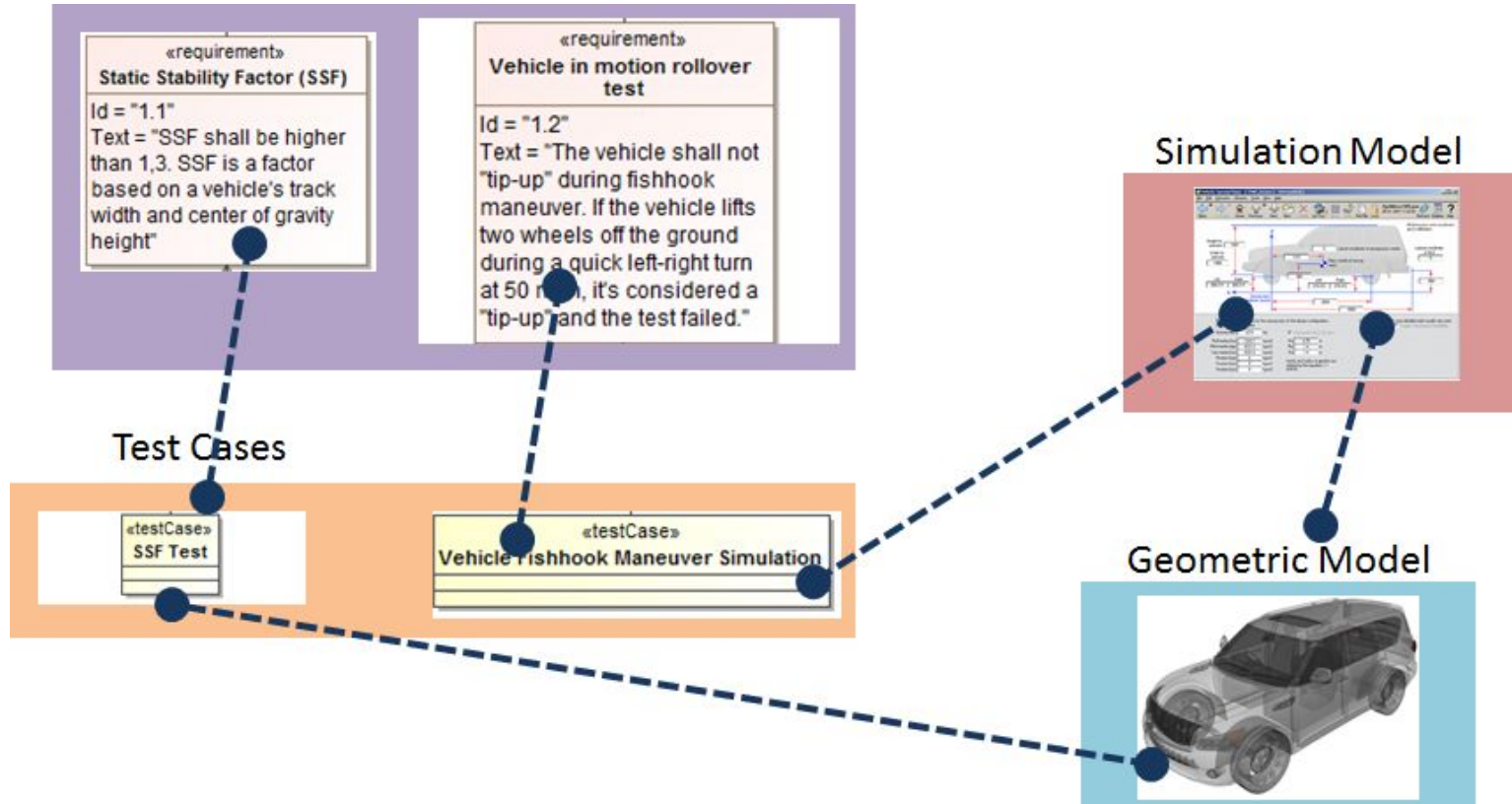
Center of Gravity  
→  
+ Moments of Inertia

Center of gravity in geometric model

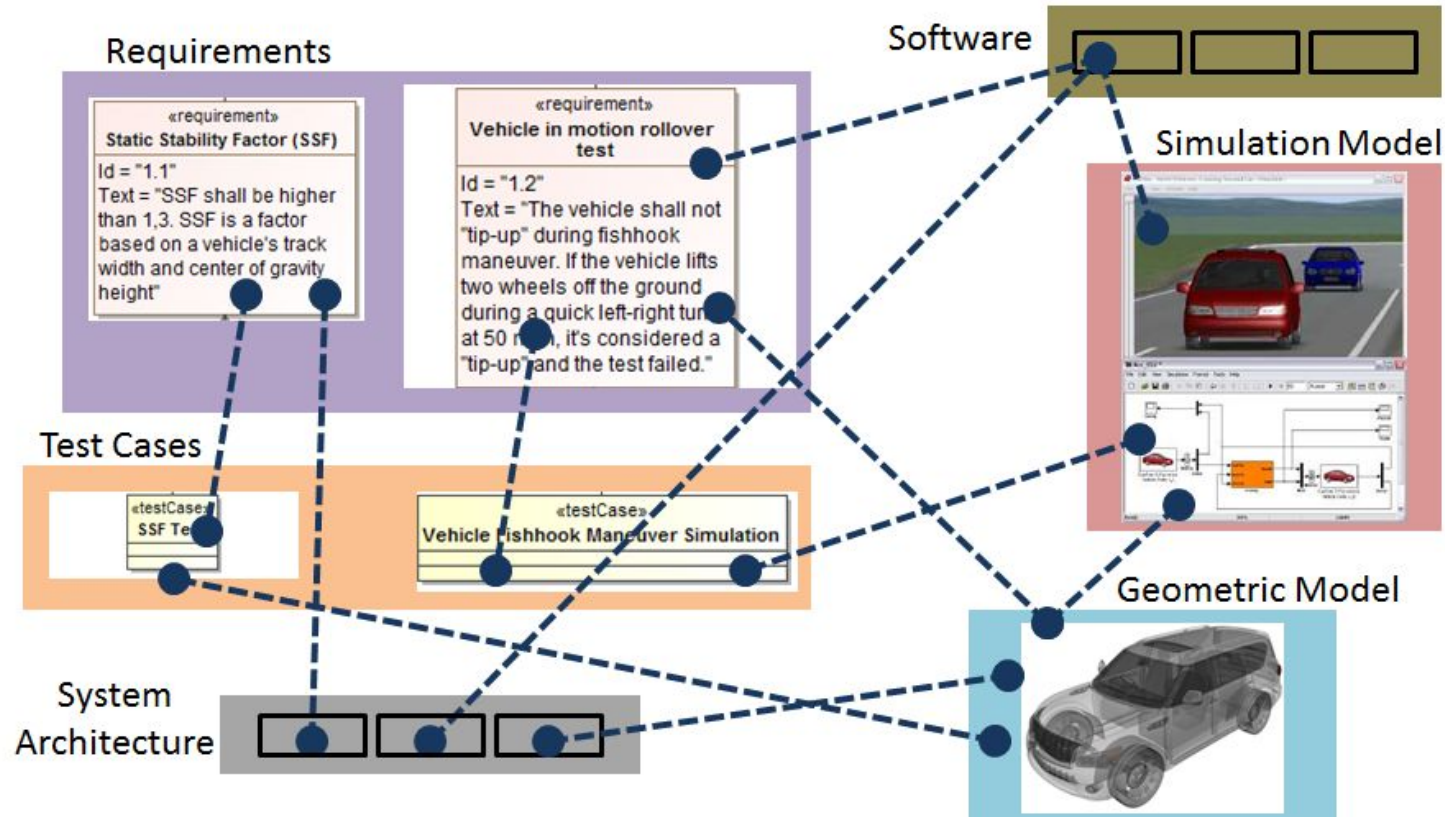


Center of gravity in simulation model

# Relationships between Engineering Data



# Reality: Many Relationships between Engineering Data



# Collaboration Challenges in Designing Systems



Increasing system complexity



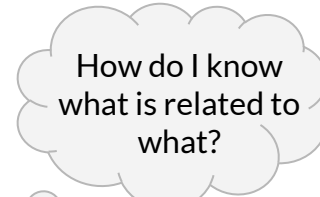
Increasing number of partners



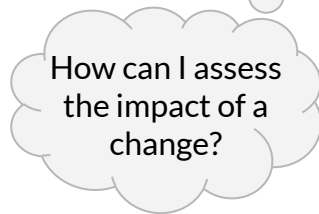
Increasing number of versions of data



How can I establish traceability



How do I know what is related to what?



How can I assess the impact of a change?



How can I manage changes/updates?



Increasing number of meetings



Increasing costs



Increasing frustration

# Data Integration Benefits



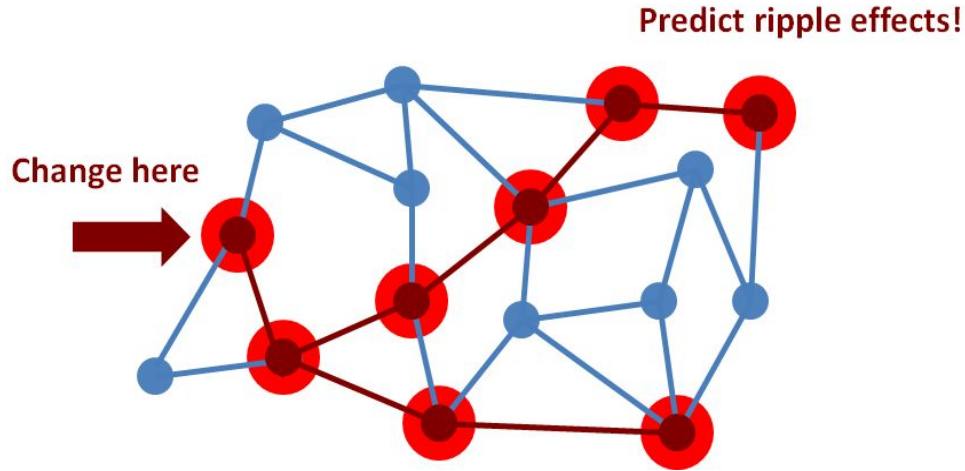
Understanding the context of information



Understanding the ripple effects of changes



Understanding the origin of product failures



Performing consolidated reporting



Performing data analysis



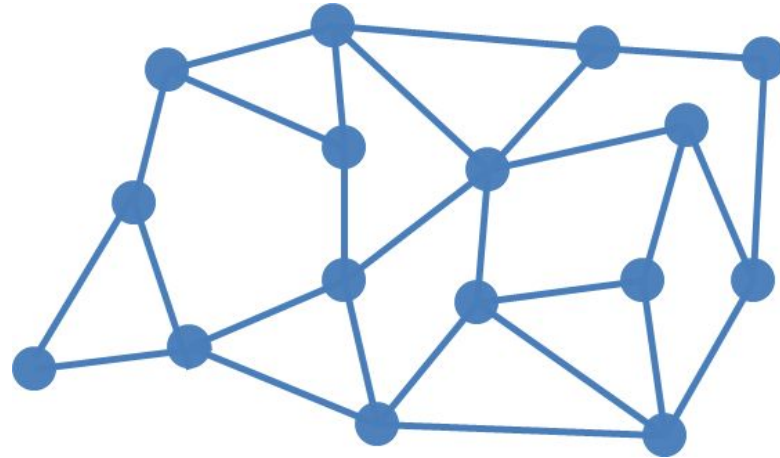
Performing better decisions

# 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**



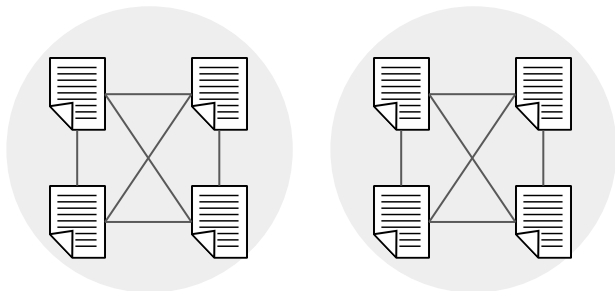
- No license costs
- No vendor lock-in
- Mature and widely adopted infrastructure
- Abundance of Web specialists/developers





# Hypertext + Internet = Web

BEFORE THE WEB

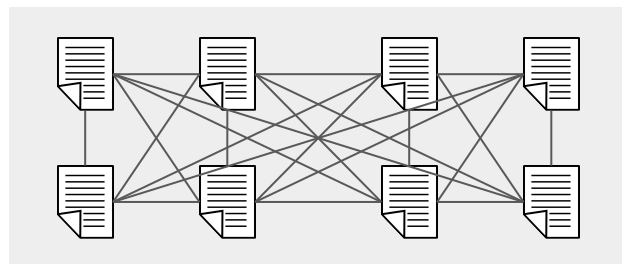


Hypertext System 1

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

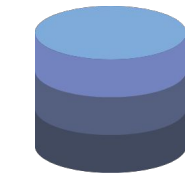
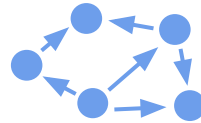


Gmail Server

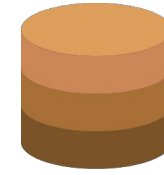
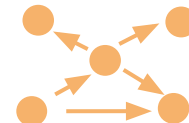
Note: a lot of information accessible through the Web is private!

## Web of Data

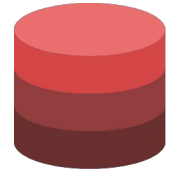
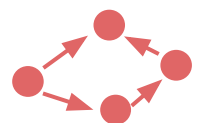
Data spread across multiple databases



Requirements



PLM



ERP

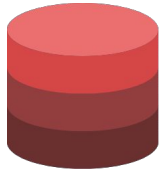
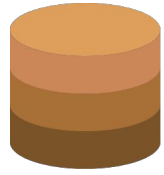
# URLs = Common Global Information Identifiers

## Web of Documents

wikipedia.org

facebook.com

myblog.com



Data Repository 1

Data Repository 2

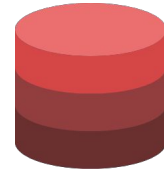
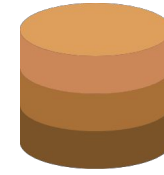
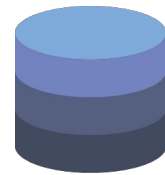
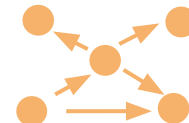
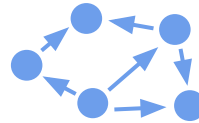
Data Repository 3

## Web of Data



<https://private.myorg.com/req123>

<https://private.supplier.com/part123>



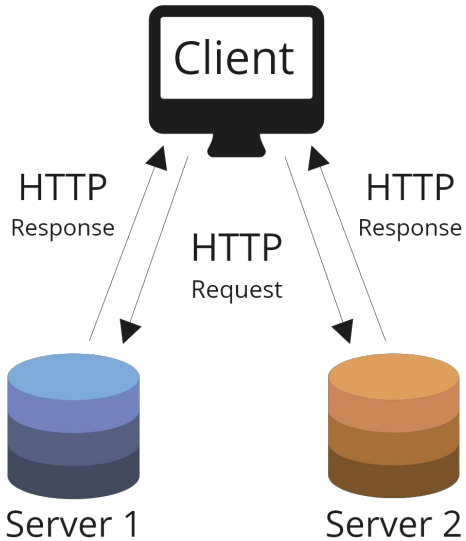
Data Repository 1

Data Repository 2

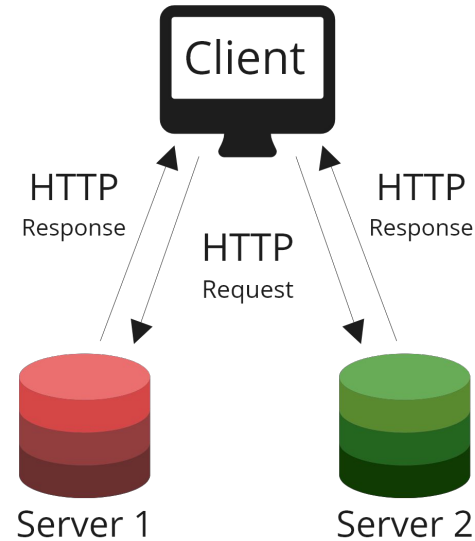
Data Repository 3

# HTTP = Common Protocol to Access Information

## Web of Documents



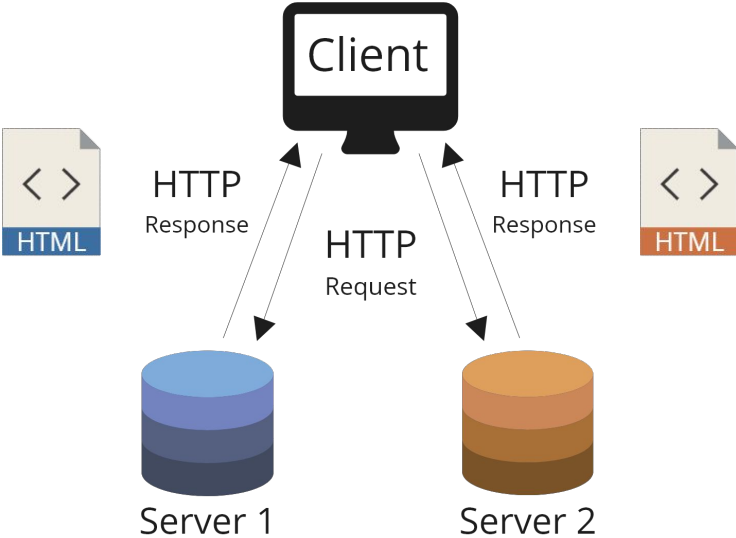
## Web of Data



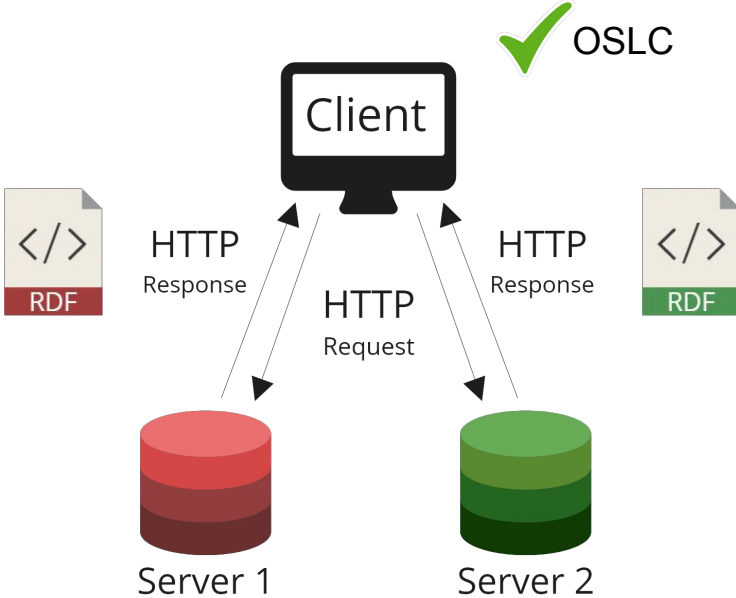
OSLC specifies how to perform CRUD operations on data using HTTP

# HTML + RDF = Common Web Data Formats

## Web of Documents



## Web of Data



# Schemas for Data Interoperability

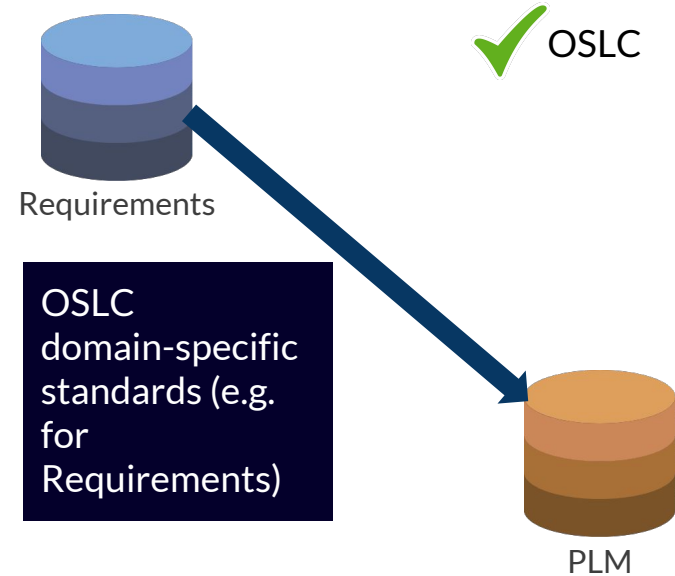
## Web of Documents

The image shows two screenshots related to the movie "Pirates of the Caribbean: The Curse of the Black Pearl (2003)".

- The top screenshot is from IMDb, showing the movie title, a star rating of 8.0 (with 872,980 votes), and the IMDb logo. A blue circle highlights the 8.0 rating.
- The bottom screenshot is a Google search result for the same movie, showing the title, a "PG-13" rating, and a "Play trailer on YouTube" button. A blue circle highlights the IMDb logo.

A blue arrow points from the IMDb logo in the top screenshot to the IMDb logo in the bottom screenshot. A dark blue box labeled "schema.org" is positioned between the two screenshots.

## Web of Data

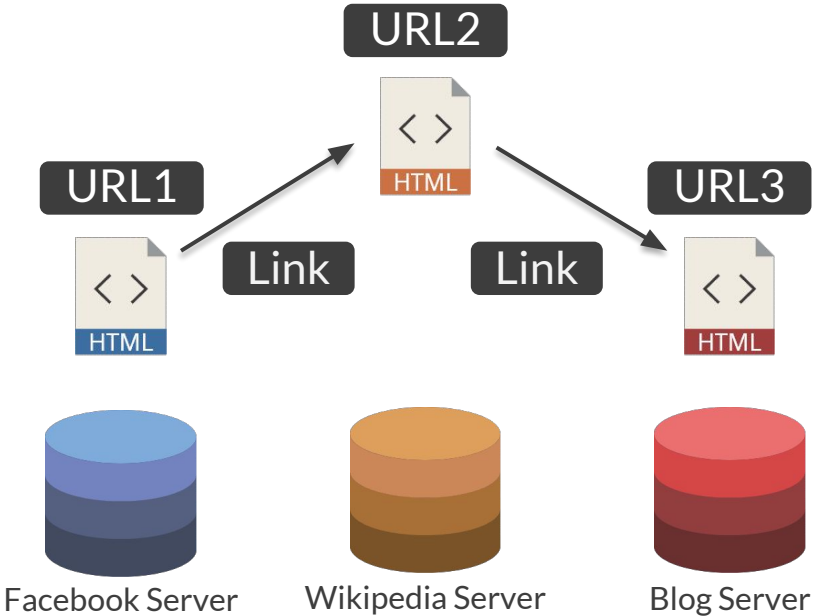


# OSLC Domain-specific Standards

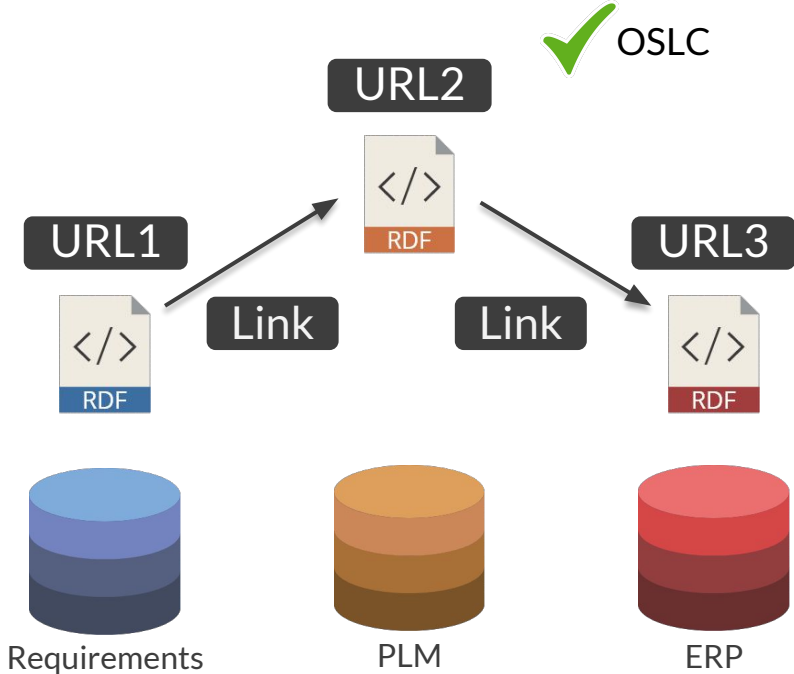


# Links for Data Integration

## Web of Documents



## Web of Data





# Mashup Applications

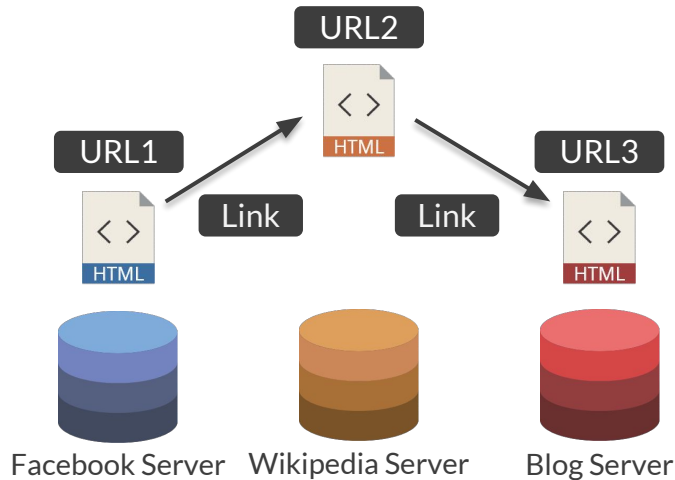
## Web of Documents

Search

(e.g Google, Bing)

Visualize

(e.g Chrome, Firefox)



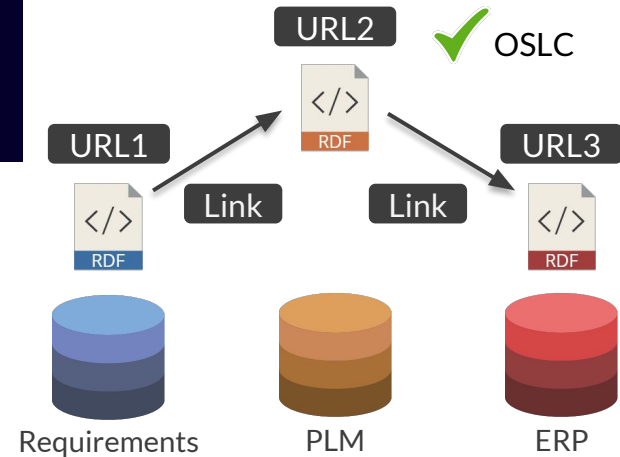
Equal access to information - more competition amongst data management solutions

## Web of Data

Search

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

Visualize



# Mashup Application Example

Google-like Search

Search Assembly [Search]

Filters

Type:

- Assembly
- ItemPart
- DesignPart
- TraceLink

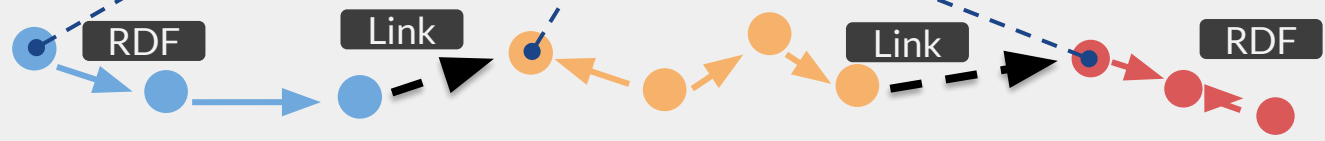
Origin:

- Supplier1-PLM1
- Supplier2-PLM2
- OEM-PLM1
- OEM-PLM2

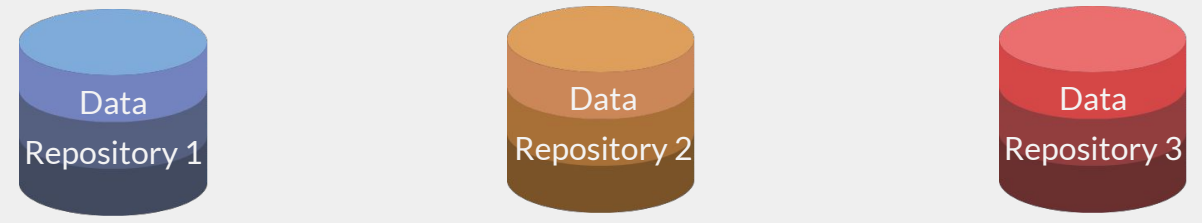
Results 5 of 5

RESOURCES ▲	TYPE ▲	ORIGIN ▲
Assembly_1	Assembly	Supplier1-PLM1
Assembly_2	Assembly	Supplier1-PLM1
Assembly_3	Assembly	Supplier1-PLM1
Assembly_B1	Assembly	OEM-PLM1
Assembly_B2	Assembly	OEM-PLM2

Private/public Data Web

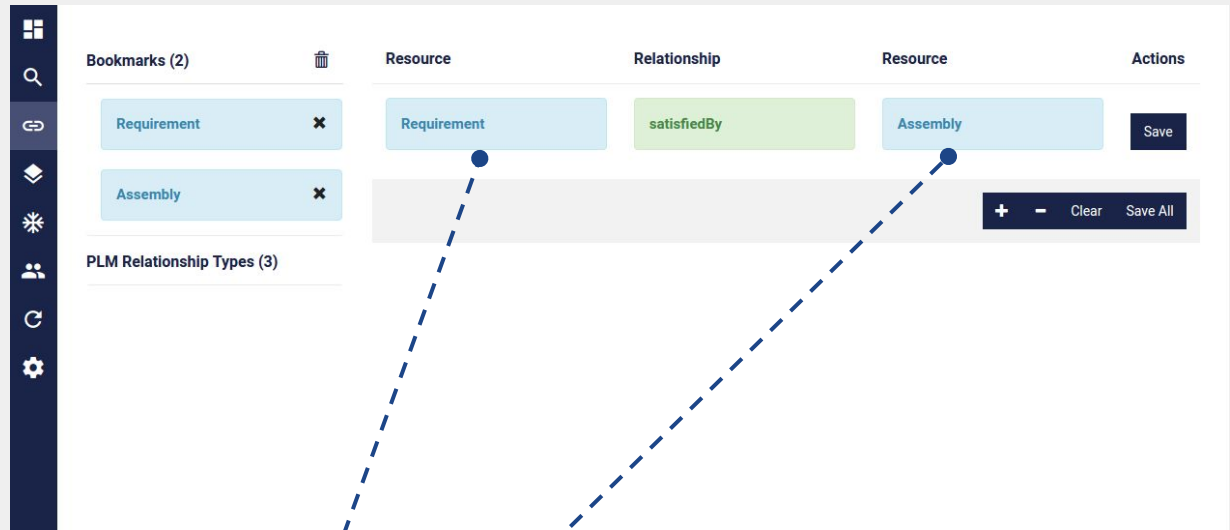


Distributed Data Silos



# Mashup Application Example

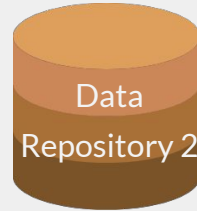
## Link Editor



Private/public Data Web



Distributed Data Silos



# Mashup Application Example

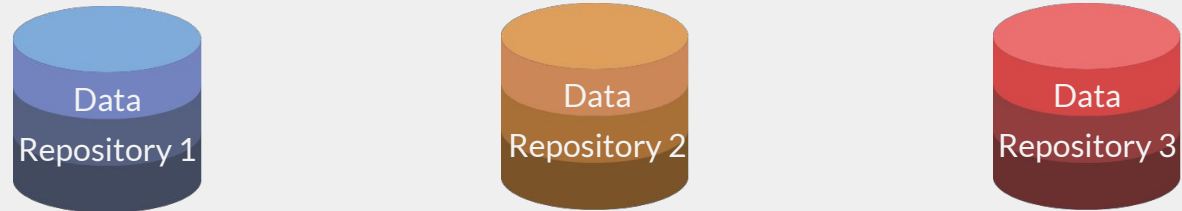
## Tree (BOM-like) Viewers

	Revision	Type	Origin	
Assembly1-DB1	A	Job	Supplier1 [Aras]	<input type="checkbox"/>
Part1-DB1	A	Location	Supplier1 [Aras]	<input type="checkbox"/>
Assembly2-DB1	A	Job	Supplier1 [Aras]	<input type="checkbox"/>
Part2-DB1	A	Location	Supplier1 [Aras]	<input type="checkbox"/>
Assembly3-DB2	A	Job	Supplier2 [Teamcenter]	<input type="checkbox"/>
Part3-DB2	A	Location	Supplier2[Teamcenter]	<input type="checkbox"/>
Assembly4-DB3	A	Job	Supplier3	<input type="checkbox"/>
Part4-DB3	A	Location	Supplier3	<input type="checkbox"/>
Part5-DB3	A	Location	Supplier3	<input type="checkbox"/>

## Private/public Data Web



## Distributed Data Silos



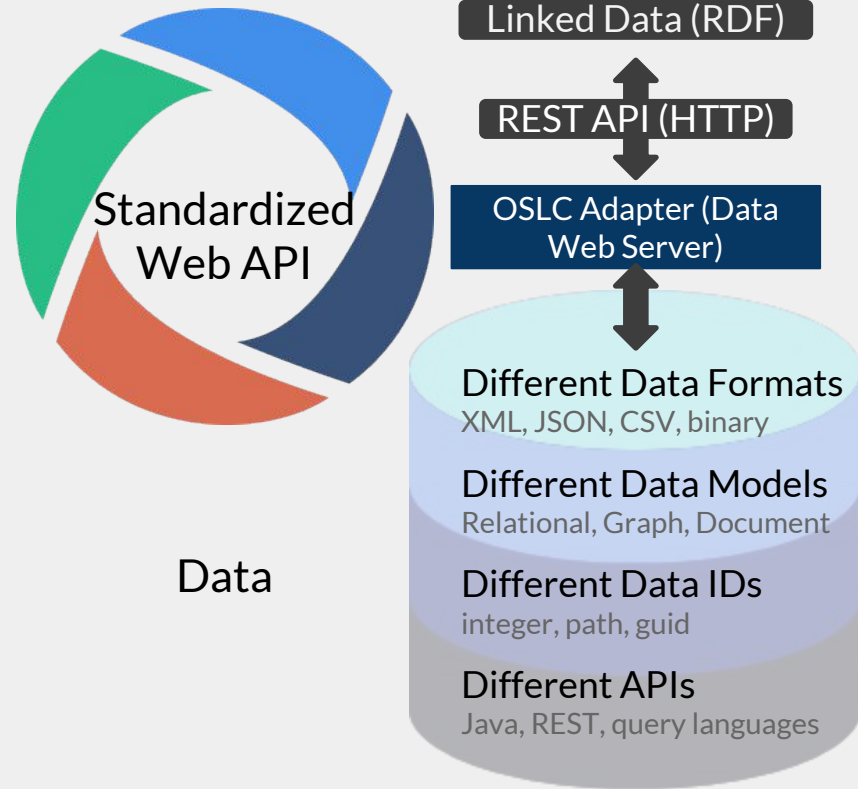
# Open Services for Lifecycle Collaboration (OSLC)

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

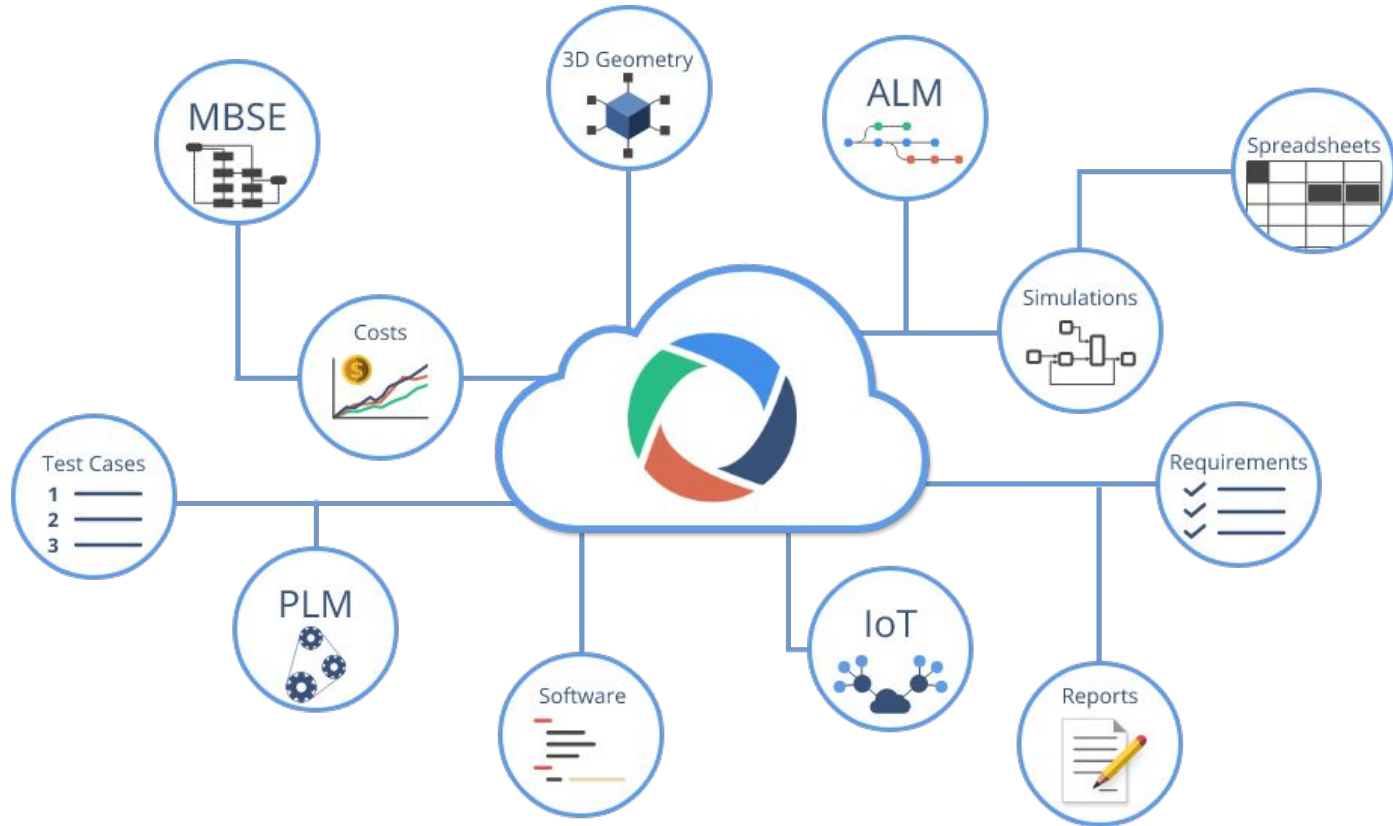
Standards for web-based data interoperability

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

## Open Services for Lifecycle Collaboration

Creating standard REST APIs to connect data



Thanks and get in touch!  
[axel.reichwein@koneksys.com](mailto:axel.reichwein@koneksys.com)