Fundamental OSLC Concepts for Distributed Link Creation

OSLCFest 2021

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Overview

Distributed Link Creation Strategy

Key Ideas of OSLC APIs to enable distributed link creation

Impact of distributed linking on achieving interoperability faster and cheaper

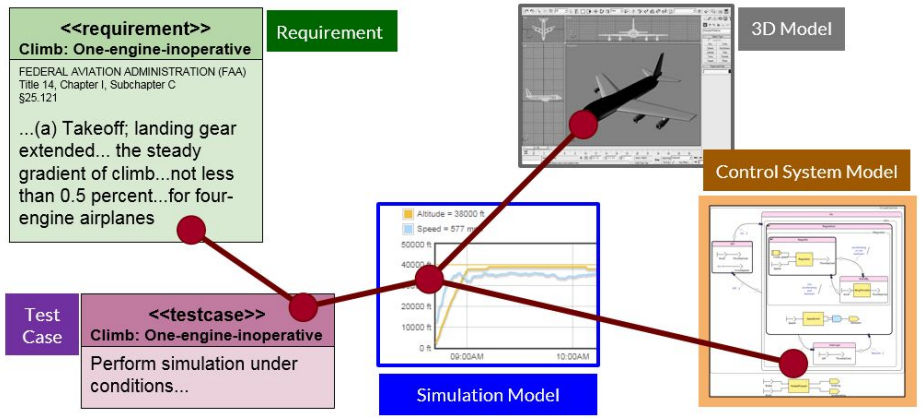
Benefits of Linking Engineering Data

Knowing exactly how a requirement has been tested (vs believing what is written in a document)

Knowing what is impacted if something changes

Knowing when having to run again simulation models

Knowing how to run simulation models in the right sequence with the right parameters



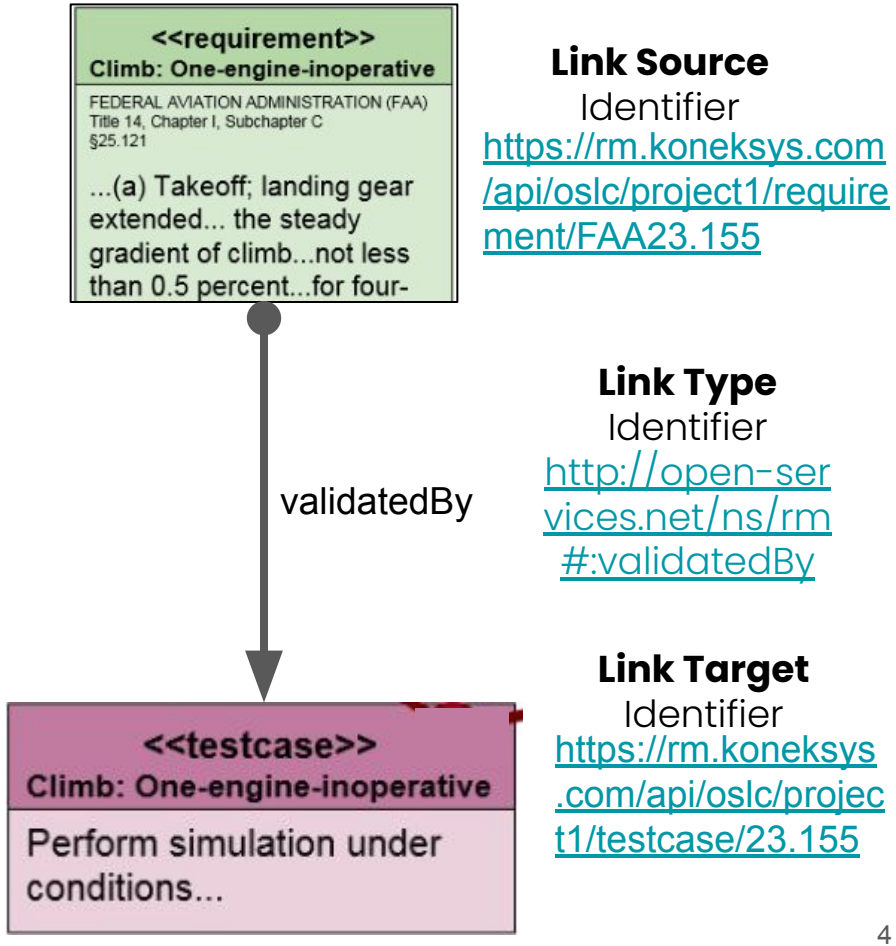
Linked Engineering Data is more meaningful than siloed Engineering Data

What is a Link?

Each linked artifact needs to have a unique global/universal identifier (e.g. URL)

Each link has a type so that we understand the meaning of the relationship

Each link has a direction from source to target

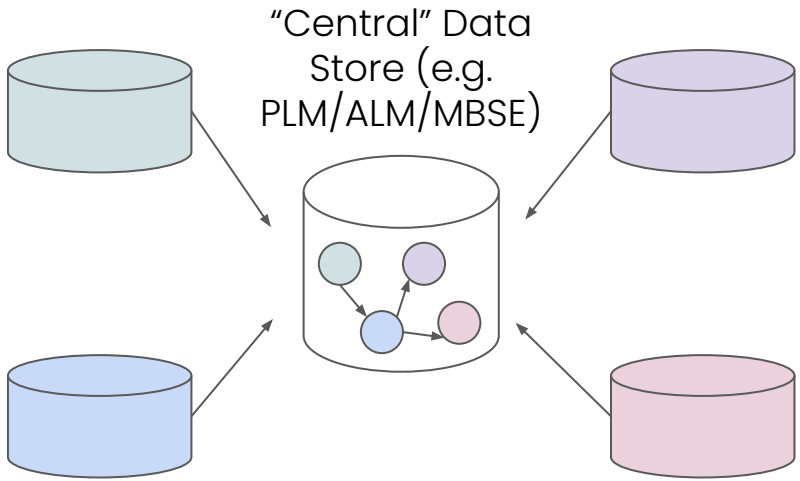


Traditional Centralized Link Creation Strategy

Certain applications describe many different aspects of a system, so they provide support for data integration (PLM, ALM, MBSE)

Many useful capabilities provided by integration apps: visualization, analysis, etc.

Should ALL the links be created in such a central application?

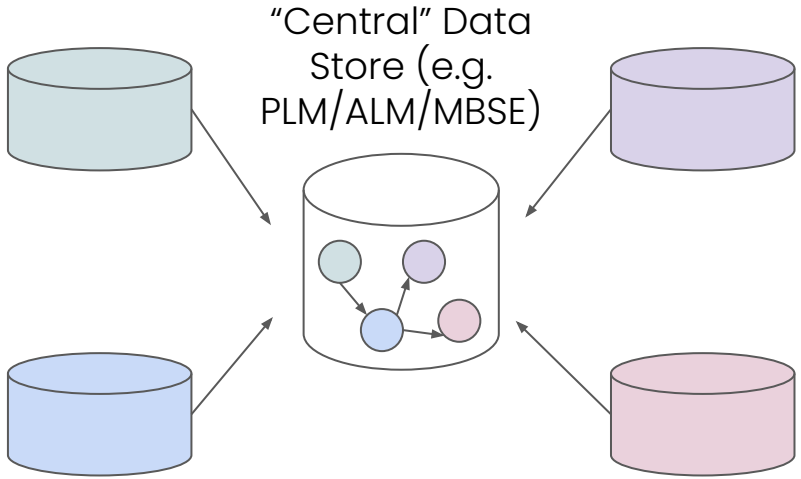


Until now, links are created within a "central" application

Traditional Centralized Link Creation Strategy

Problems:

- **Not user-friendly** for engineers to have to switch to a different application
- **Importing data not always possible** due to vendor lock-in (lack of integrations)
- **Schema often not flexible enough** to describe new link types
- **No single database suitable for all purposes!** No one size fits all! Example: data lake for IoT data vs data warehouse for "traditional" PLM data

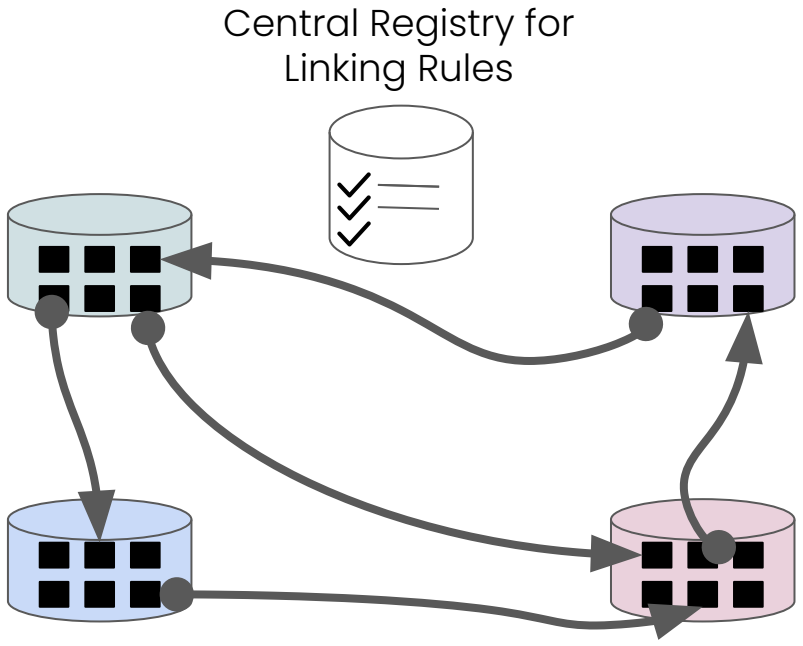


Centralized Link Creation does NOT SCALE

Distributed Link Creation Strategy

Links are created from **within ANY application.** Advantages:

- **User-friendly**: Links created only as needed by engineers within their familiar applications
- **Central registry for linking rules** to ensure that only meaningful links of a certain type are used between artifacts of a certain type
- **Multiple smaller and more manageable domain-specific schemas** instead of multidomain monolithic schemas

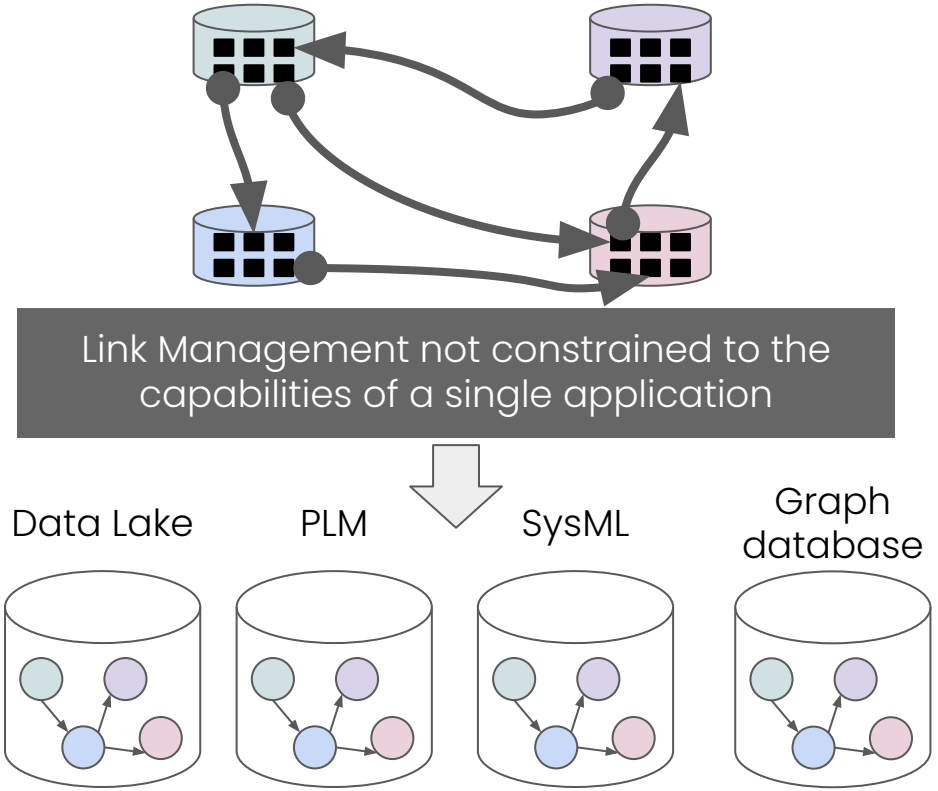


Link Creation Decoupled from Link Management

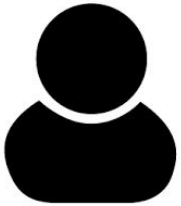
Links can be persisted in multiple storage solutions at time of creation

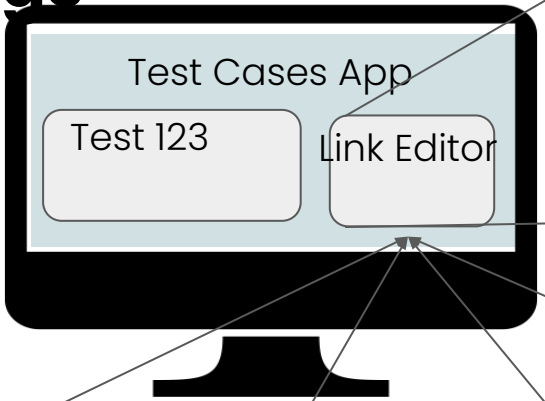
Data and Links are accessible to API clients and can be collected and saved in another storage solution for

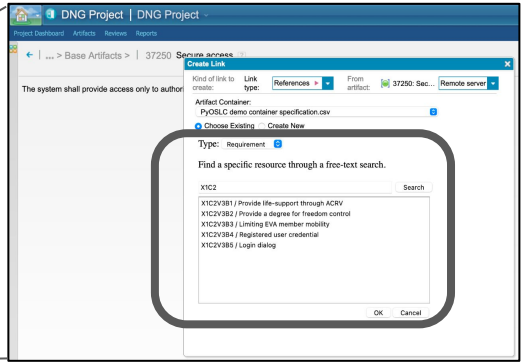
- Query purposes
- Visualization
- Analysis
- Triggering automated workflows



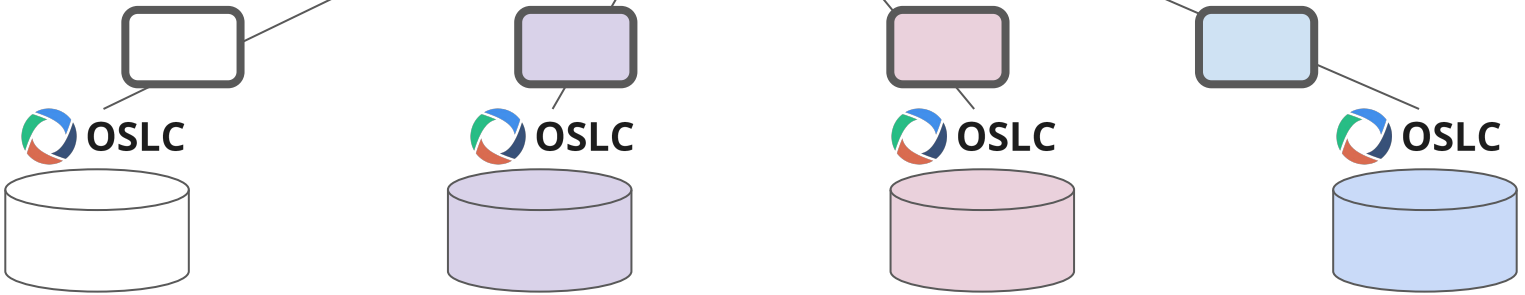
Finding Link Targets Requires Application-specific Search Dialogs







Application-specific search dialogs exposed by OSLC APIs



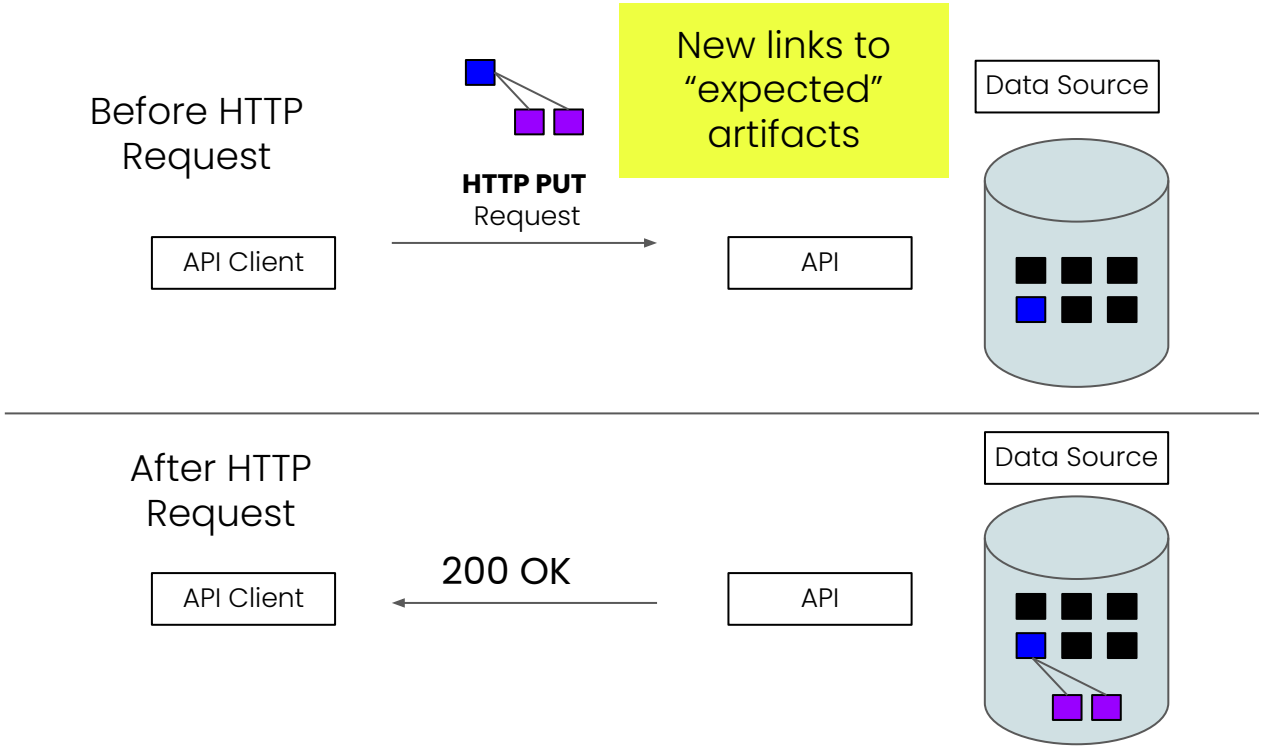
Requirements

Simulation Models

3D Models/PLM

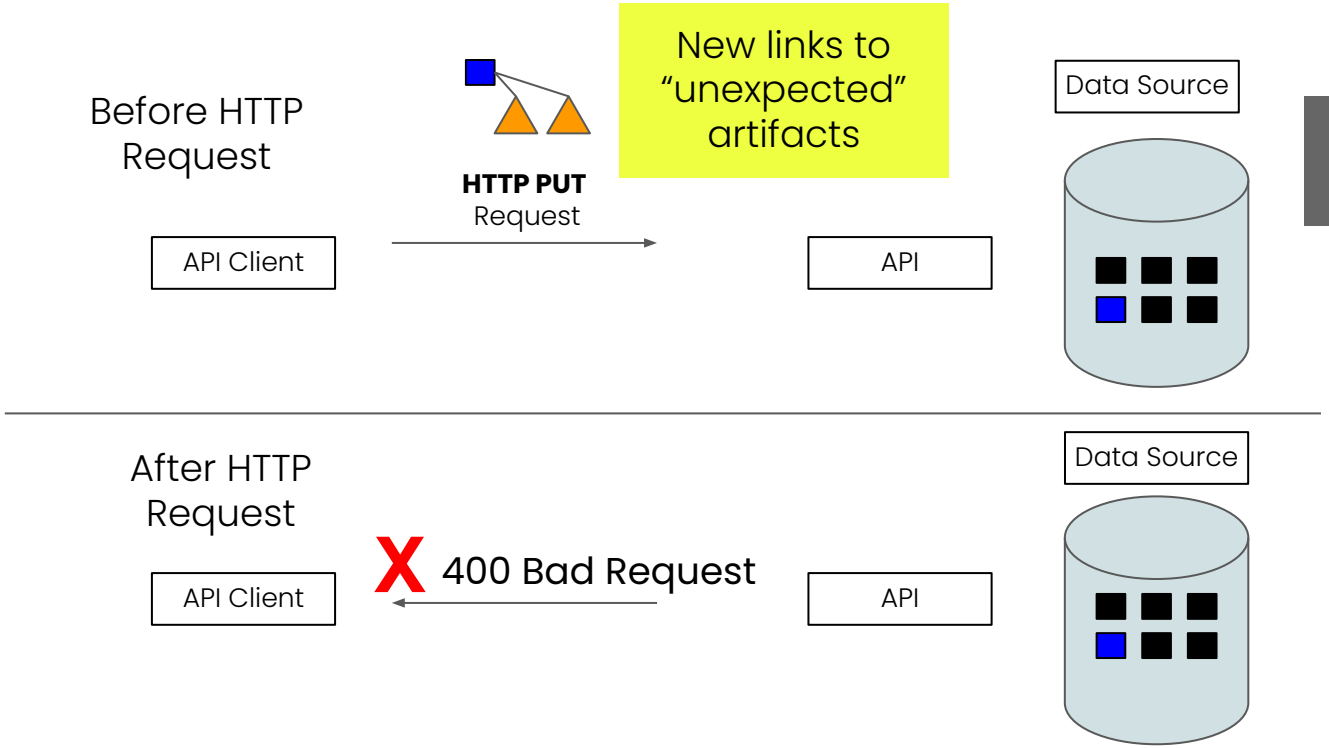
SysML Models

Traditional API Adopting Closed World Assumption



Example of a **valid** API update request

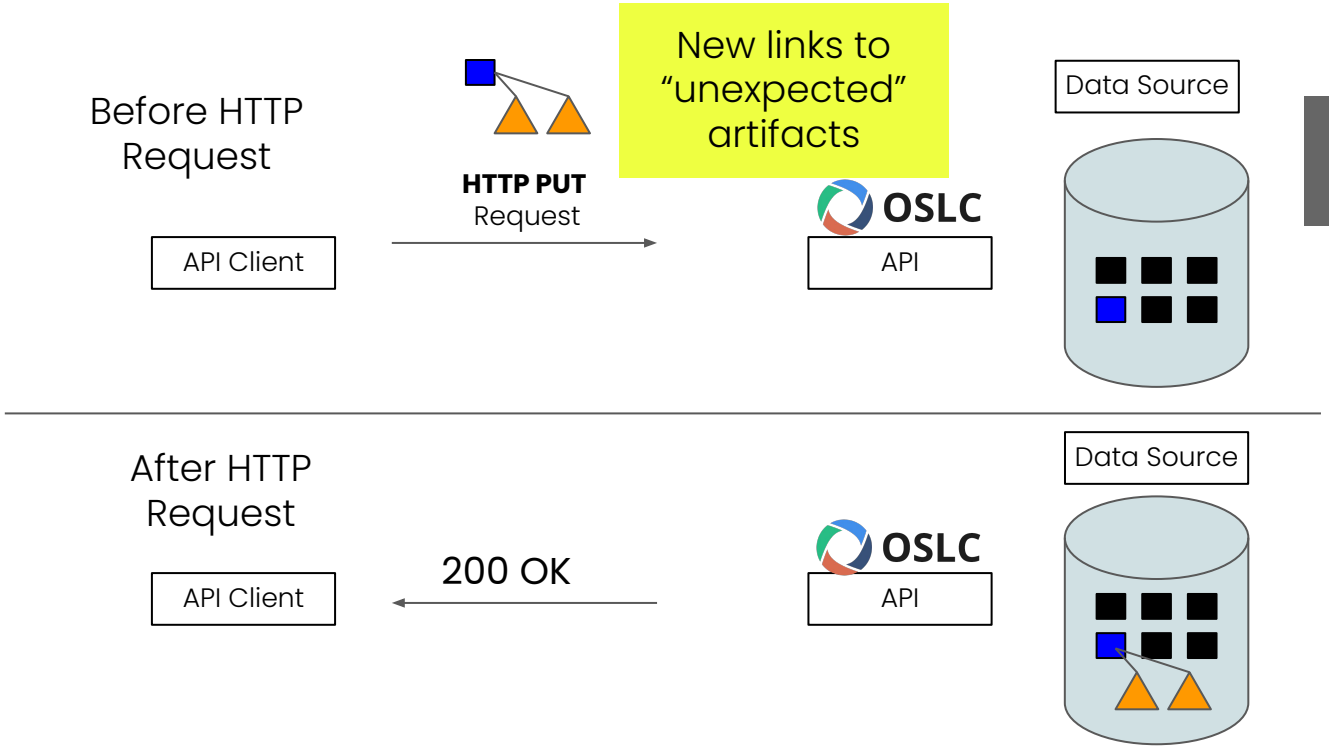
Traditional API Adopting Closed World Assumption



Example of an **invalid** API update request

CWA: what is not currently known to be true, **is false** (or only what is known to be true, is true)

OSLC API Adopting Open World Assumption



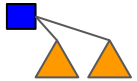
Example of an **valid** API update request

OWA: what is not currently known to be true **may be true** (or only what is known to be false, is false)

OSLC API Adopting OWA decoupled from Linking Rules adopting CWA

Before HTTP Request

API Client

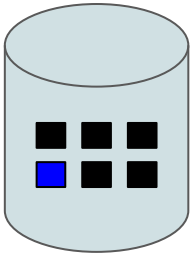


HTTP PUT Request

New links to "unexpected" artifacts

OSLC API

Data Source



Central Registry for **Linking Rules**

New links valid?

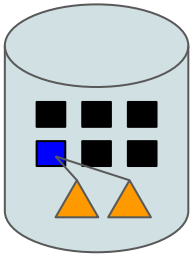
After HTTP Request

API Client

200 OK

OSLC API

Data Source



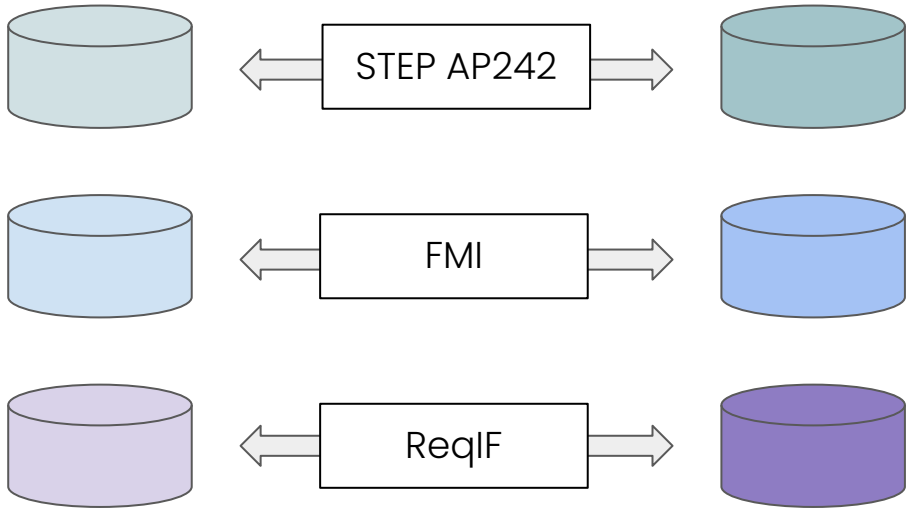
OSLC API and Linking rules are decoupled to support the reuse of an OSLC API

Link Lifecycle Phases & Key OSLC Concepts

To find link targets	Embeddable **OSLC application-specific search dialogs**
To find OSLC search dialog	OSLC API resources and services self-discoverable by API clients through **hypermedia**
To create the link	**OSLC API adopts Open World Assumption** and complies with linking rules
To persist the link	**OSLC agnostic**: New link is created and persisted at specific location(s)
To access the link	Links exposed as **properties of OSLC resources** to be consumed by other applications
To review the status of a link	**no OSLC standard**
To expose changes to links (and associated artifacts)	Change events (deltas) exposed using **OSLC TRS**

Successful Schemas for Data Exchange/Interoperability

Suitable for exchanging data between applications within the same domain with a clearly defined scope

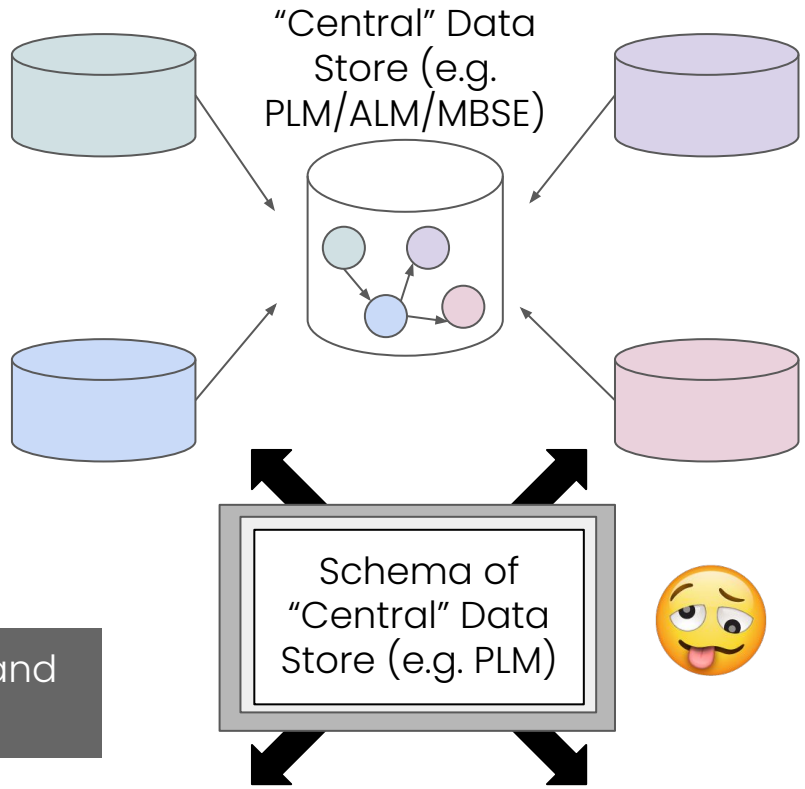


Individual Schemas covering multiple domains…

The larger the domain scope…

- the more likely the schema needs to be updated to stay relevant,
- the harder it is for implementations of the schema to support all its concepts and to stay up-to-date with schema changes
- the less likely the schema will be adopted,
- and the less likely the schema will provide value

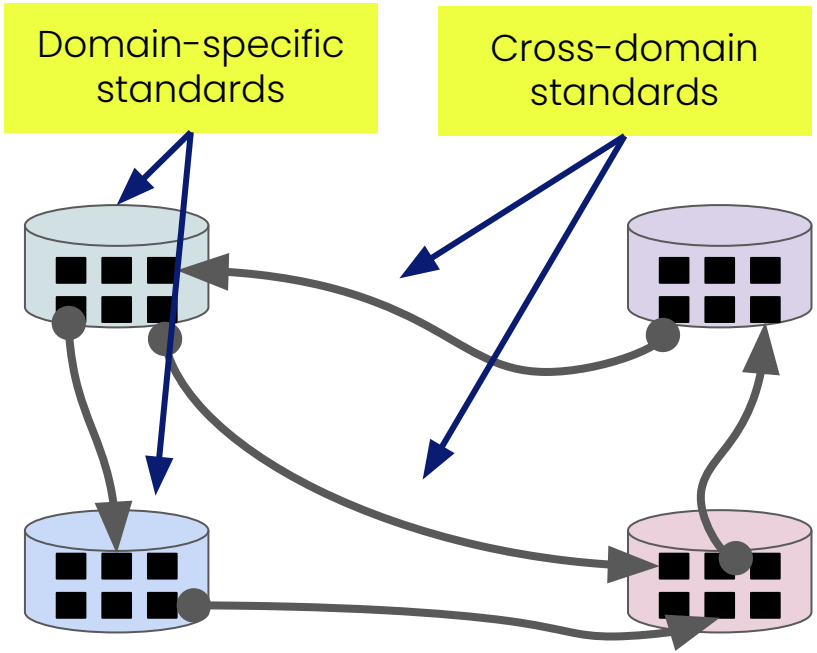
Multi-domain schemas getting bigger and bigger…



Domain-Specific & Cross-Domain Standards

In an ideal world from my perspective:

- Standards defined similarly as schema.org vocabularies (used for interoperability at Web scale)
- **Small domain-specific standards**
- **Cross-domain standards** defining link types for cross-domain relationships
- Domain-independent standards like for global configuration management etc.
- **No multidomain "monolithic" schemas**
- No semantic overlaps between different schemas
- Defining semantics using applied category theory?



We can achieve more interoperability by defining smaller more manageable standards

Data Integration: Old vs New (OSLC)

Old

- Single “central” application to define links
- Data accessible as files
- Data having to be transformed into a neutral “central” data format before being linked
- Links described in a vendor-specific format
- Links can only be accessed, managed, analysed, visualized within a single “central” application

New

- Any application can define links
- Data directly accessible as API resources (“objects”) at any level of granularity
- Data is linked by linking API resources (simple HTTP PUT operation to update an API resource representation)
- Links described in neutral open format
- Decoupling of concerns: Links can be accessed, managed, analysed, visualized in different applications

Thanks and get in touch!

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