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Heliple-2 PLM Federation

A Call for Action & Contributions

Erik Herzog, Ph.D., CSEP

Saab Technical Fellow – Systems Engineering

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Erik Herzog | Issue 1



The old game

- One customer
- One operations approach – national defence
- One project at a time
- Long development times
- Predictability: Sweden and Saab



1950



1970



1990



The new Game



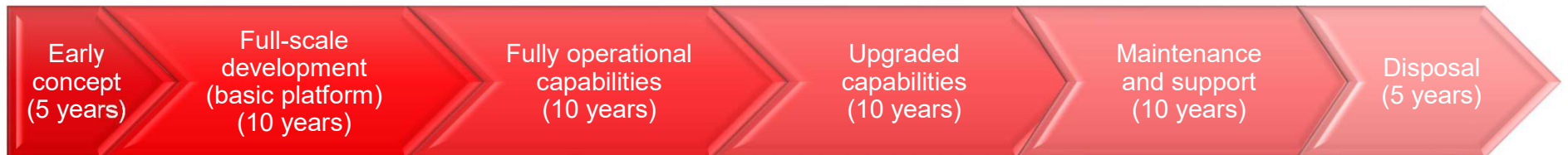
2000

2020

- Multiple parallel projects
- International operations and interoperability
- Exports
- International collaboration
 - Multi-site Development & Production
- More stringent international regulations
- Speed!
 - Product development
 - Enabling systems
- Unpredictable future

System characteristics

- Long lifecycles Safety critical systems
- Continuous development
- Development system life is substantially **shorter** than System life
- Historical observation
 - Need to replace development system **trice** over the life of the system



Consequences

New strategic directions for thriving in the new **unpredictable** world:

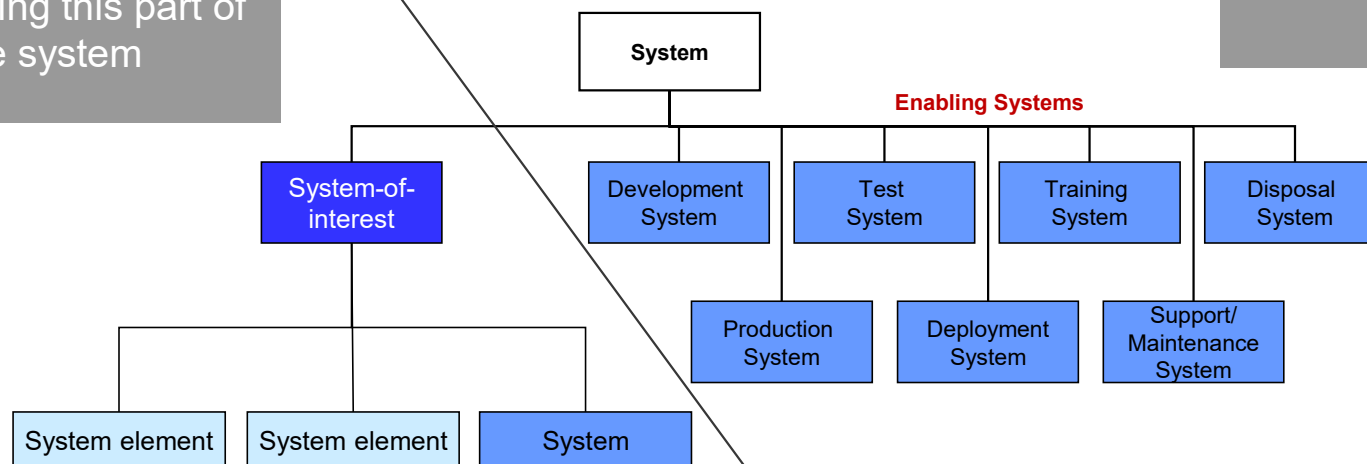
- Alignment with best **international practise**
- Need to architect organisation and development environment for **Flexibility**
 - Optimise **overall capability**
 - Ability to adapt the latest **processes, methodology and tools**
- Quick adaptation to **new collaboration scenarios**
 - At **low cost**



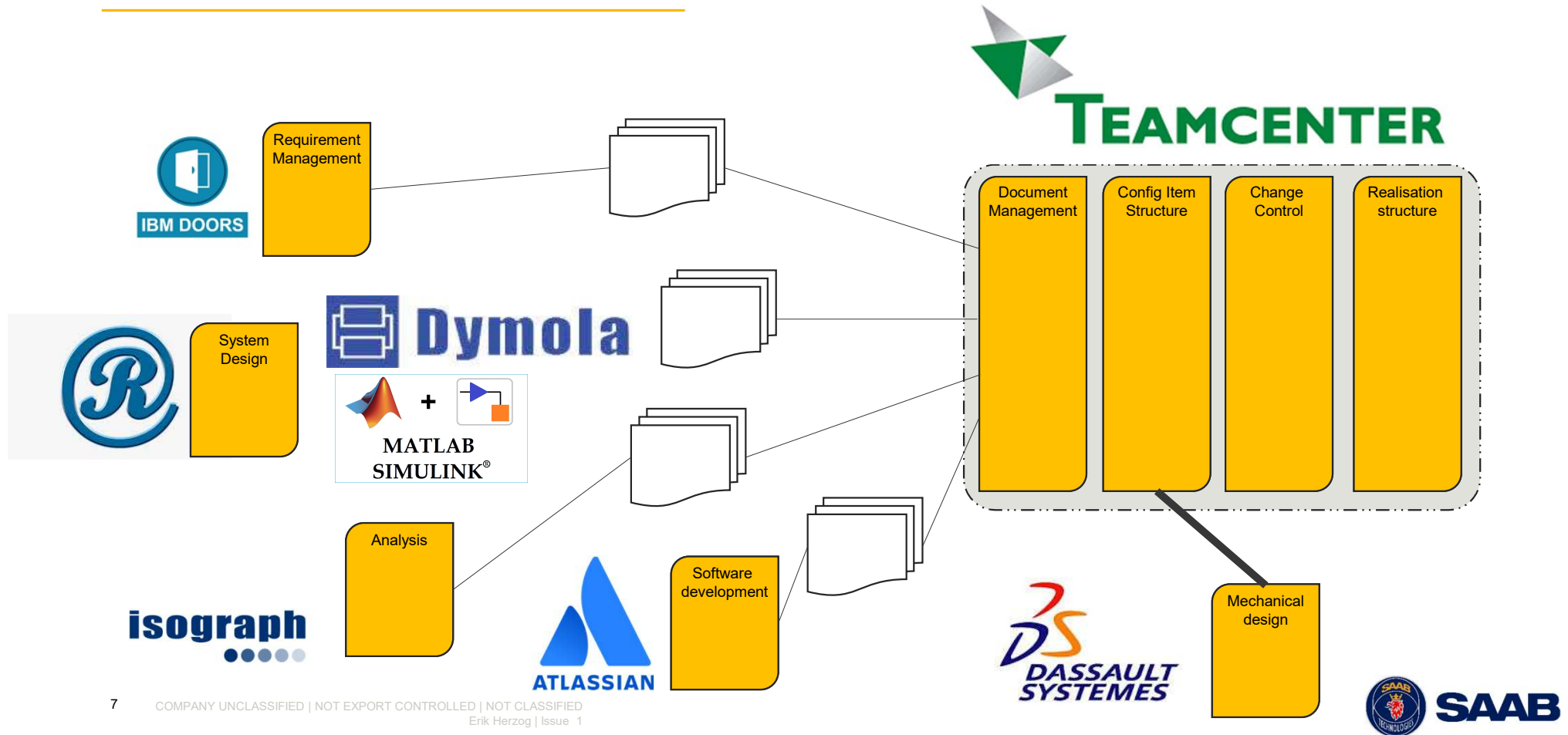
A look at the enabling systems

We are good at architecting this part of the system

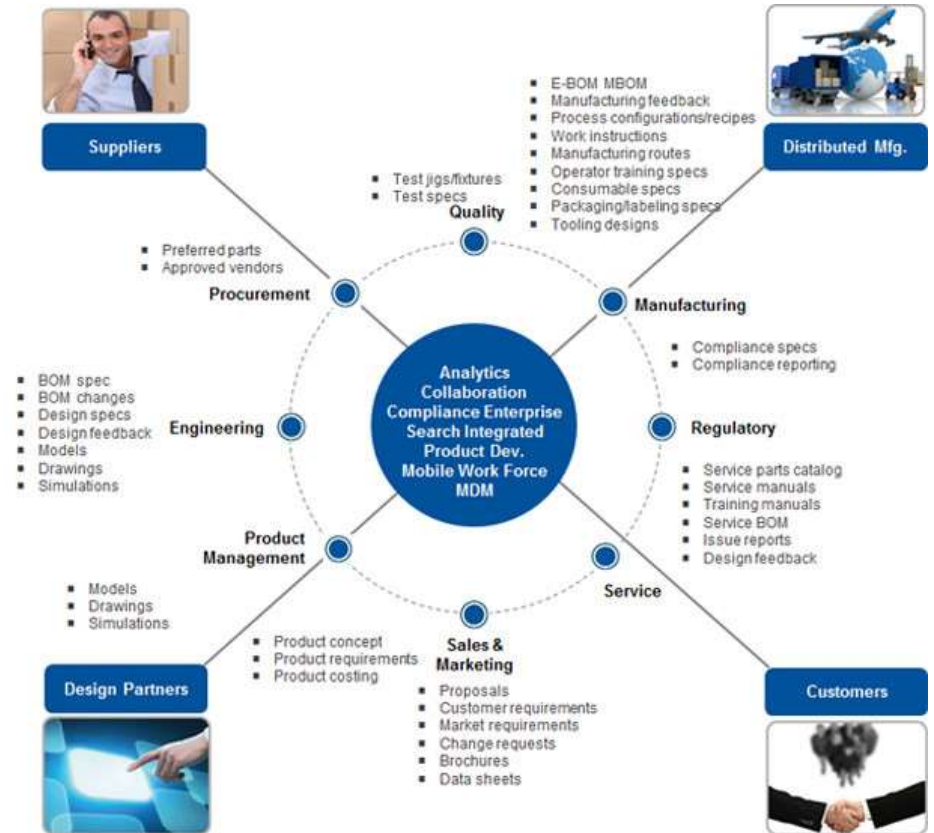
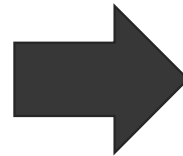
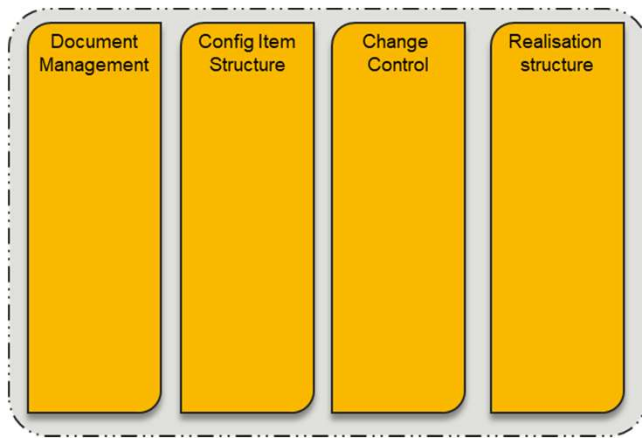
Less attention on Enabling systems – they tend to emerge



Current development tool landscape



Evolution of PLM capabilities



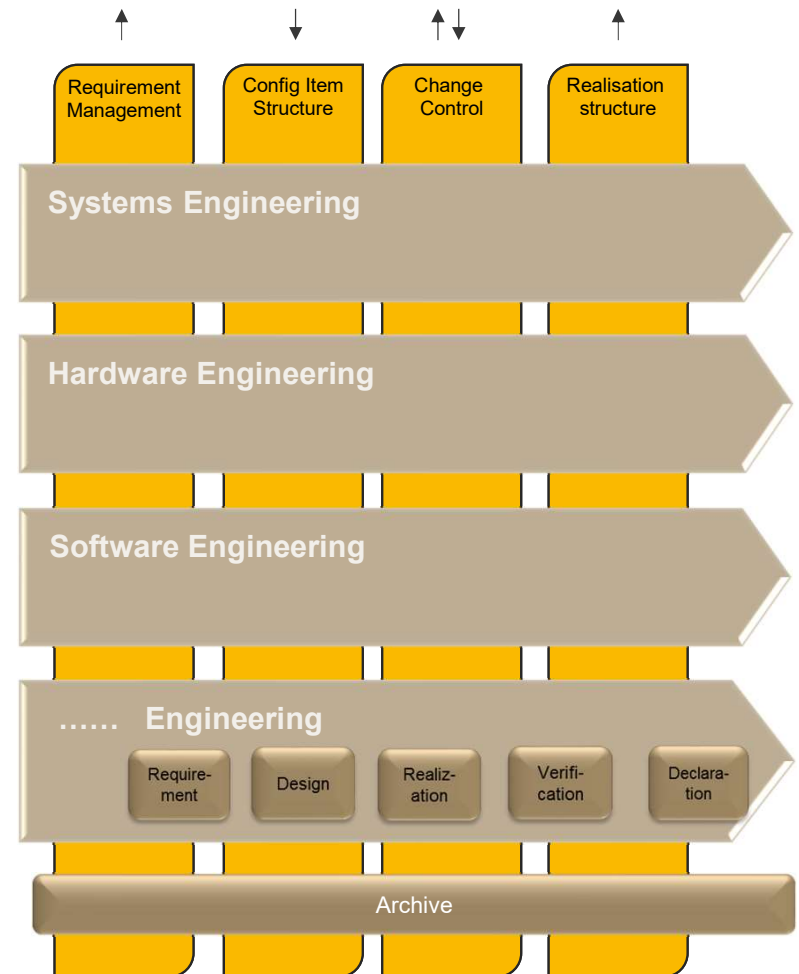
The desired solution

Genesis PLM Model

- Engineering Disciplines
- Fine granularity product data

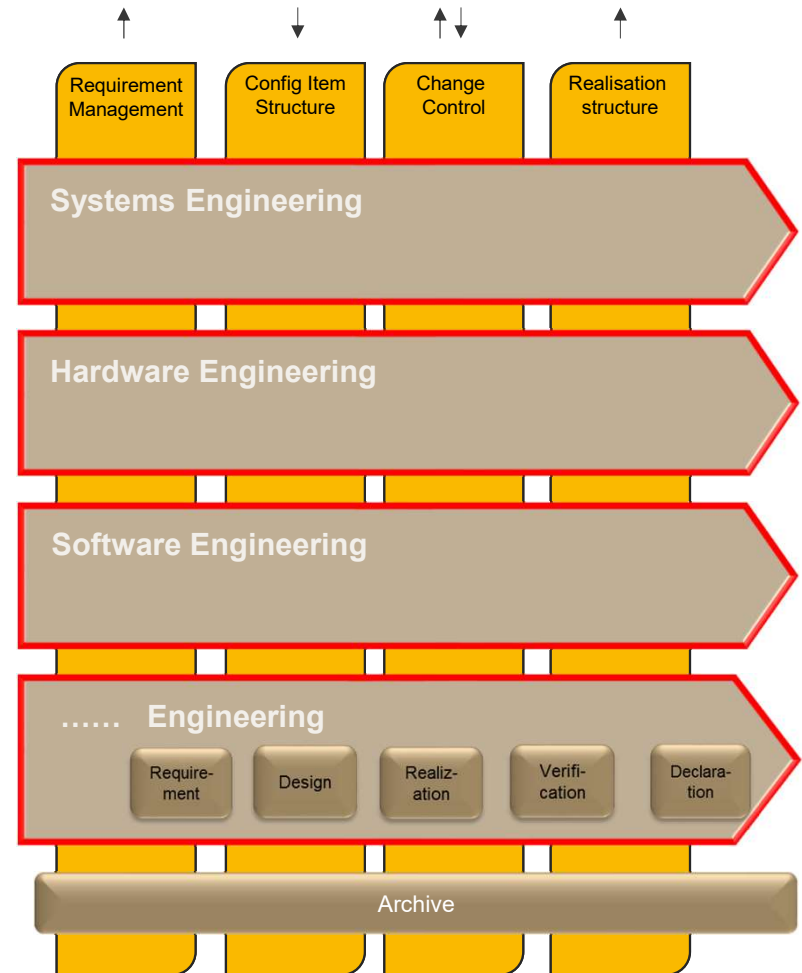


- Design Traceability Dimensions
 - We believe there are four of them only
- Archiving



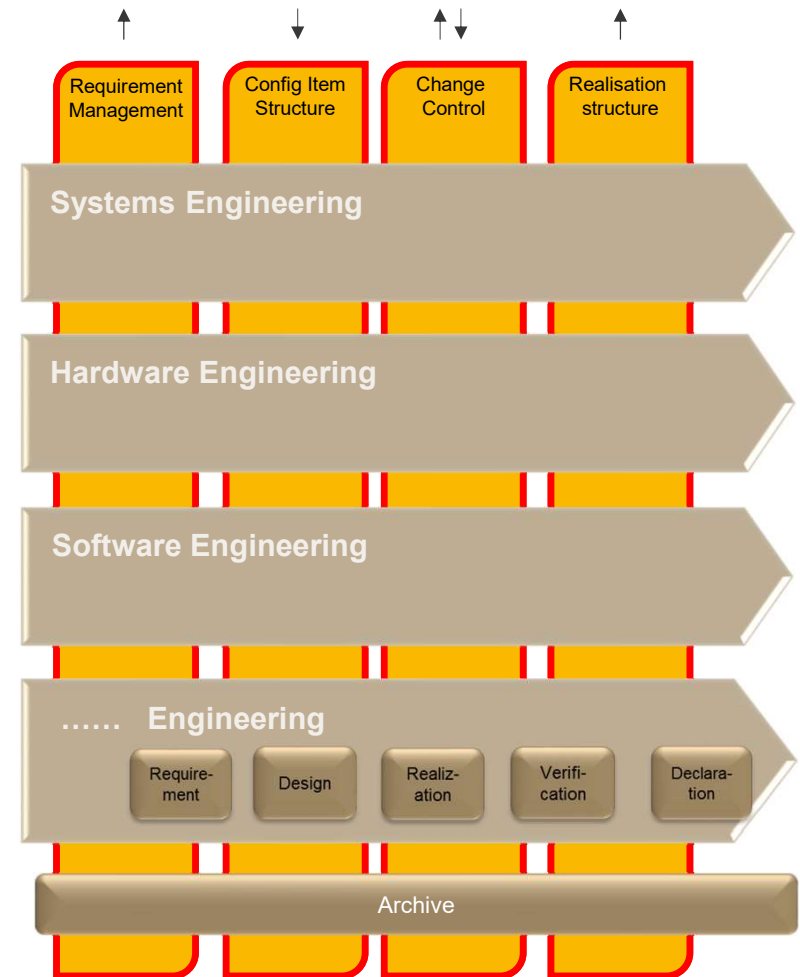
Modularity

- Optimise support for each **engineering discipline**
 - **Maximise automation**, as provided by the supplier
 - Minimise application family **switching**
- Bring together **management and engineers** in a single environment
 - E.g., Change management and Status reporting
- **Redundant** capabilities accepted
- Ability to **upgrade or replace** environments without upsetting the complete PLM landscape



Traceability

- Need capability to ensure **traceability** and **integrity** of product data
- Traceability dimensions between engineering discipline environments
 - **Requirements**
 - **Configuration item structure**
 - **Change management**
 - **Realization**
- Configuration Management capability required for Requirements Traceability, Configuration item structure and Realization structure
 - **Versions and baseline** capabilities
- The **OSLC standard** offers the desired capabilities
 - Exploit for **low** cost and **high quality** integrations



OSLC overview

The architectural solution: linked data based on OSLC

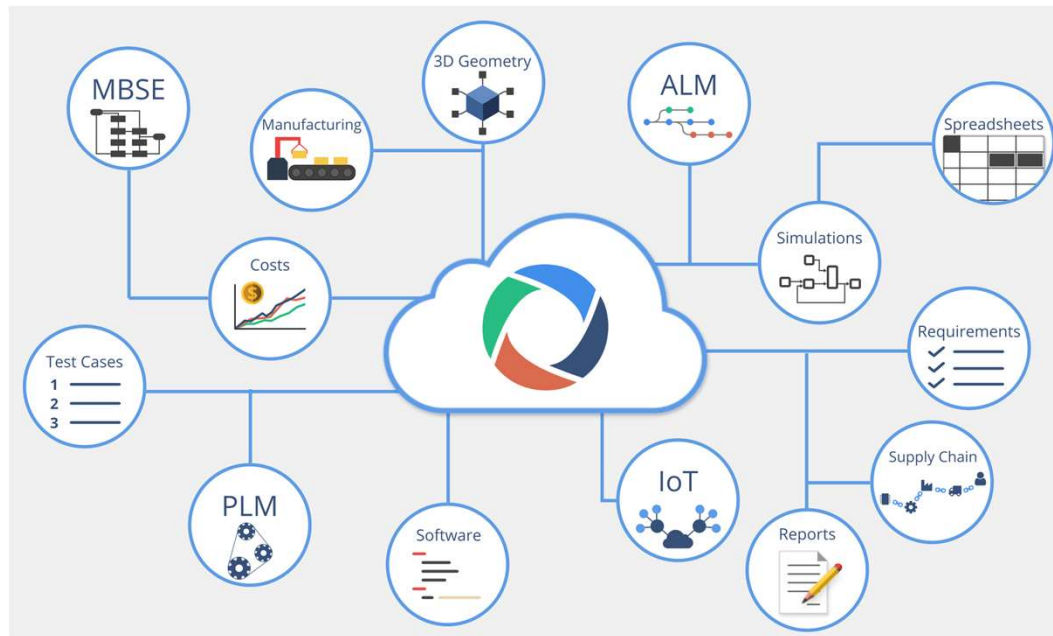
Work seamlessly across tools avoiding complex data synchronization

Modern HTTP/REST
integration architecture

W3C Linked data
architecture

Data and UI/workflow
integration

Standard Domain
vocabularies



No vendor lock

Complete lifecycle
traceability

Open Standard and Open
Source community

Better visibility

Increased reuse

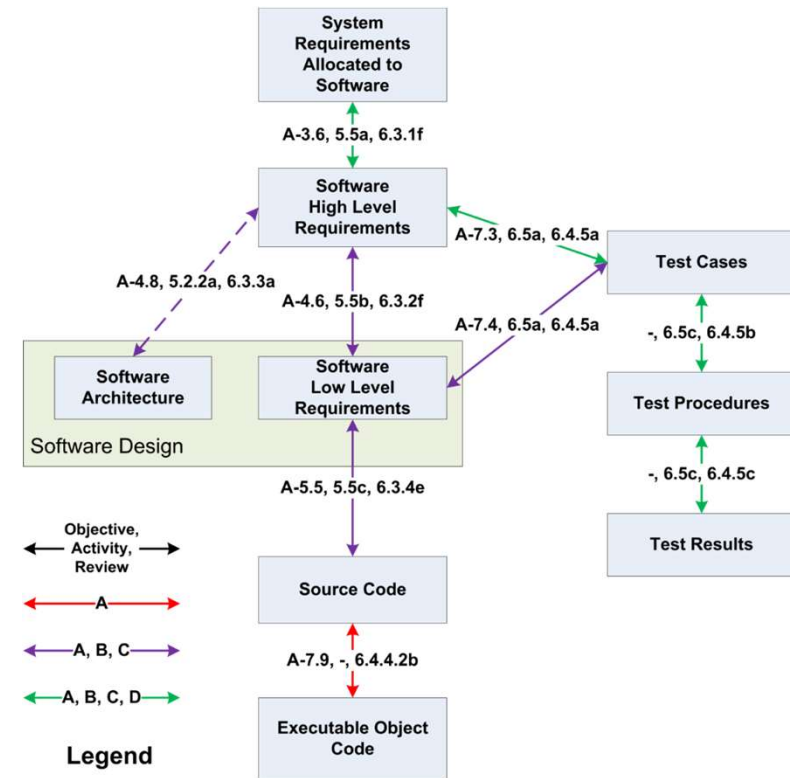
***OSLC is an open and scalable approach to lifecycle integration.
It simplifies key integration scenarios across heterogeneous tools.
Does not replace other data interchange standards.***

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The 5 foundational necessary capabilities

Ensuring cross lifecycle data integrity and stakeholder insights

- **Digital continuity:** establish digital relationships across all engineering data artifacts across all tools and domains
- **Enable cross domain data exchange:** through standard domains vocabularies (ontologies)
- **Global configuration management:** manage consistency across all engineering data sources using cross tools configuration management
- **Cross lifecycle analytics and reporting:** produce the necessary insights and evidence based on concrete engineering data
- **Integrated change and process management:** across all engineering data and tools



Example: cross-domain information model required by DO178 DALs

Federated PLM and the Heliple-2 project

Heliple-2

- Heliple-2 - Heterogeneous Linked Product Lifecycle Environment – Iteration 2
 - Vinnova funded project for exploring Federated PLM



SAAB

•eurostep



KTH
Royal Institute of Technology



Evaluation criteria

Federated PLM – feasibility dimensions

- Technical feasibility
 - Does OSLC offer industrial strength solutions for integrating stand-alone PLM systems?
- Development efficiency
 - Does a federated PLM environment offer improved productivity potential in the short and long term compared to a monolithic, single supplier solution?
- Operational feasibility
 - Can a federated PLM environment be maintained over time?
- Realisation effectivity
 - Can OSLC interfaces be implemented and maintained at a reasonable cost?



2022 Results presented

- **Federated PLM – feasibility dimensions**
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Demonstrating federated PLM

Experiments by the Heliple-2 project

The tools selection presented in the example represents the experiments performed in the Heliple-2 project. It does not represent a Saab selected setup

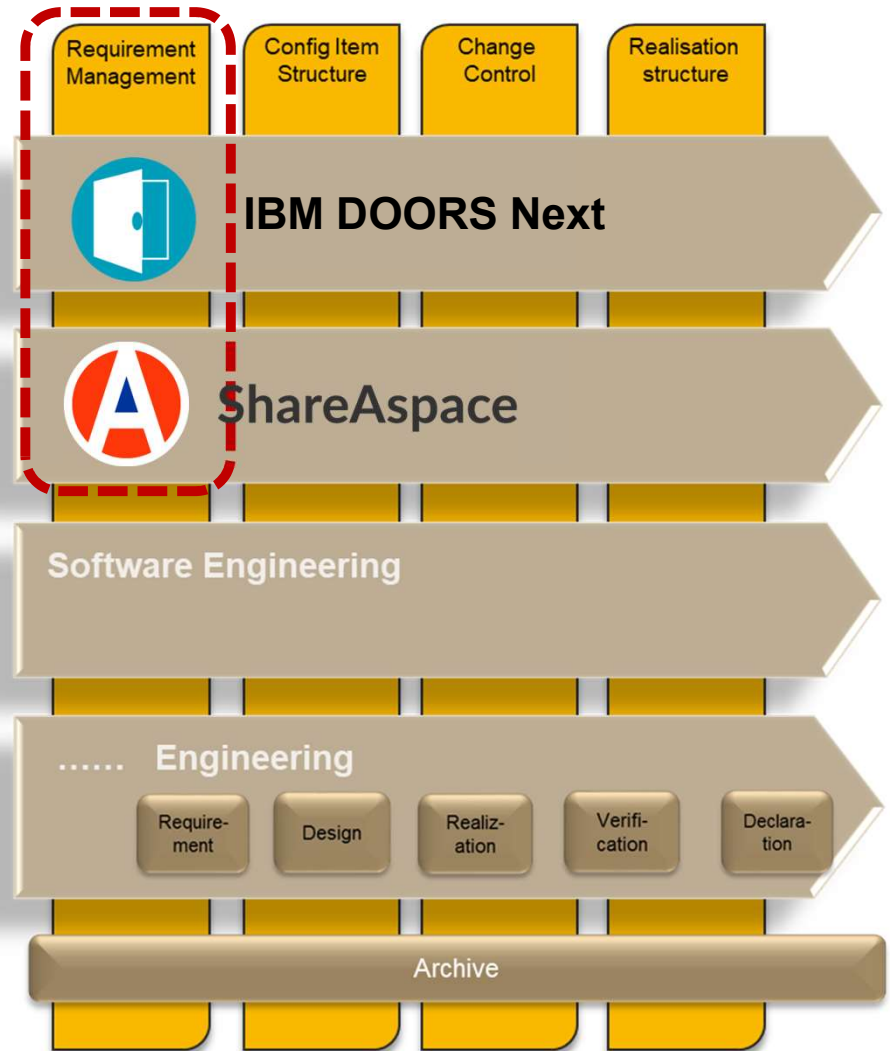
UAS
Unmanned Aircraft System



ADC
Air Data Computer



PLM Federation – Demonstration

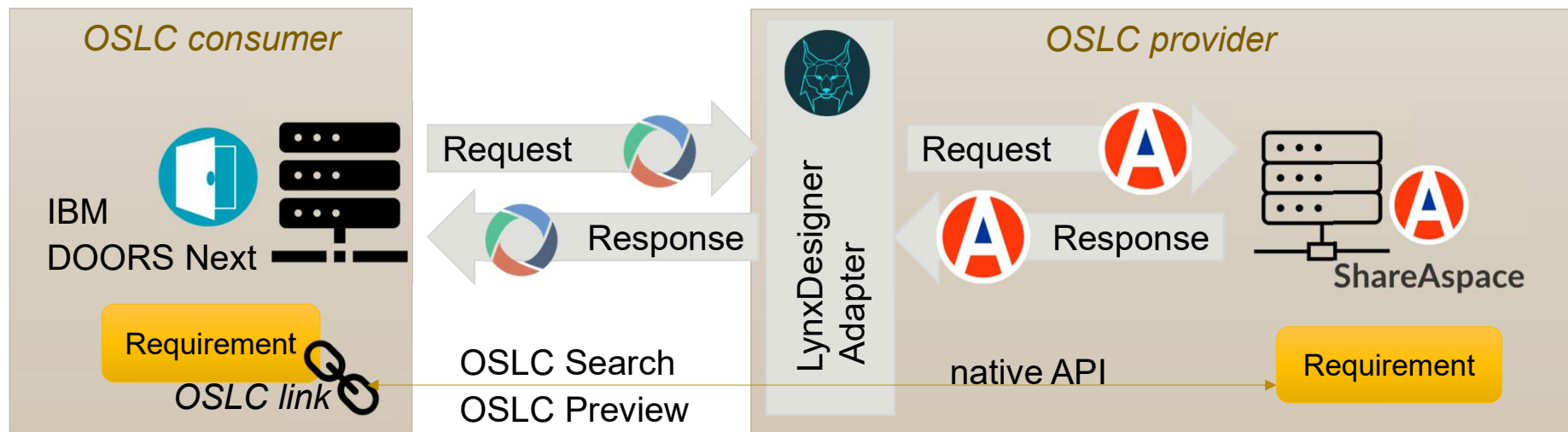


Traceability Use Case

Use Case: Create link from DOORS NG Requirement to ShareAspace Requirement

Technology: OSLC mechanisms allow a user to search, select and link

Solution: An adapter (LynxDesigner) to convert OSLC calls to native API



Developing an OSLC Adapter



LynxDesigner
Adapter



Representing configurations

STEP and OSLC

Configuration Management

OSLC approach

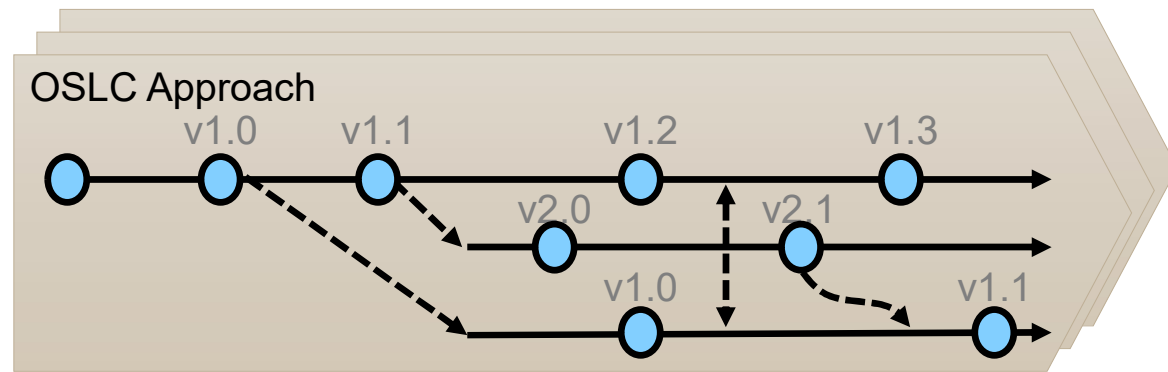
Stream →

- **Mutable** – for ongoing work
- Linking to latest artifacts
 - **implicit** - versions hidden
- **Merge** changes from other streams or baselines

Baseline ○

- A **frozen** record of a stream at a point in time
- Linking to artifacts at the time of freeze
- **Branch** into new streams

A stream (baseline) can be a contribution to other streams (baselines)




Configuration Management STEP approach

Links can be **implicit** (“latest”) or **explicit** (to versions)

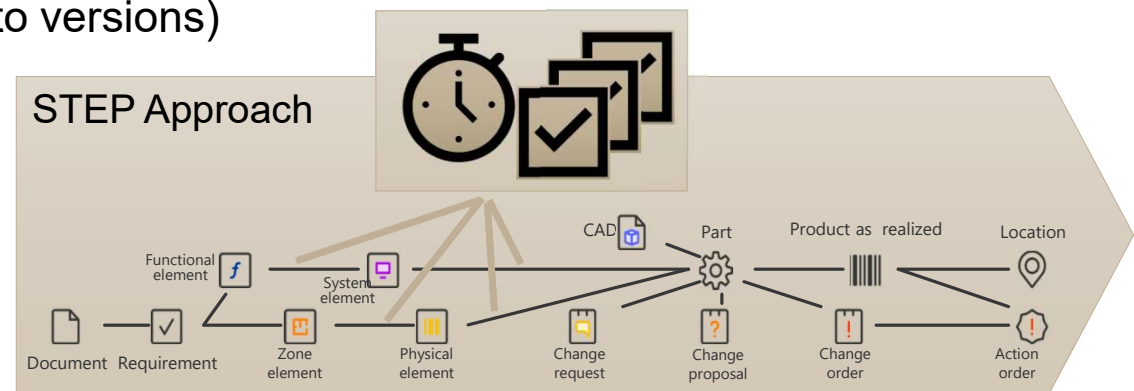
Date effectivity 

- Every **link**: start date, and optional end

Object effectivity (applicability) 






- Every **artifact and link** can have effectivity in relation to other artifacts, with conditions (no effectivity = always applicable)
- These can also have date effectivity

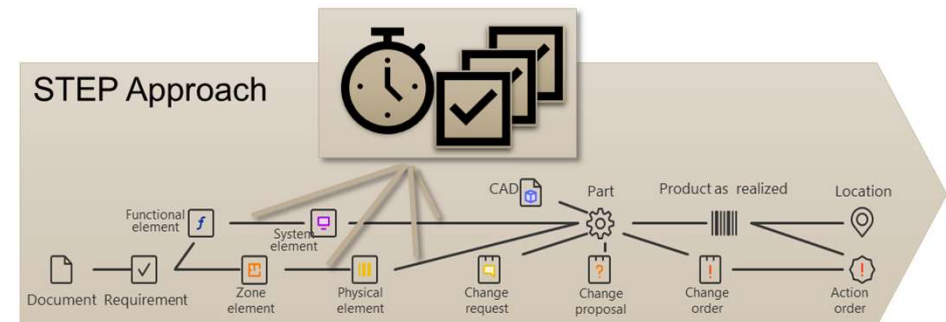
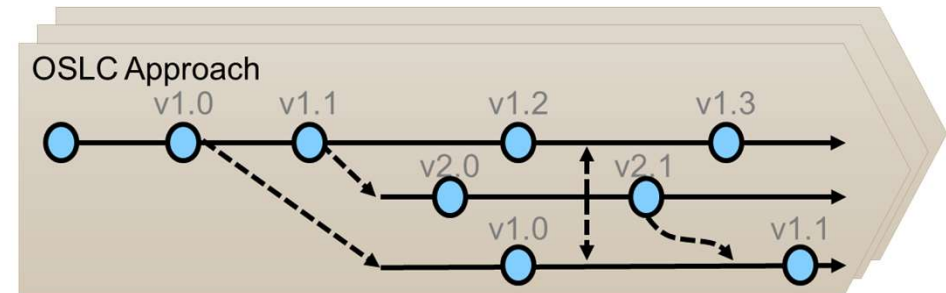
Now, or at any time in past, can **filter** to get the structured artifacts.



Configuration Management

OSLC to STEP mapping

OSLC	Equivalent in STEP
Stream 	A set of object-effectivity, (with conditions if any).  Time = now Filter to get structure
Baseline 	A set of object effectivity, (with any conditions)  Time = freeze time of baseline  Filter to get structure



Configuration Management

STEP to OSLC mapping

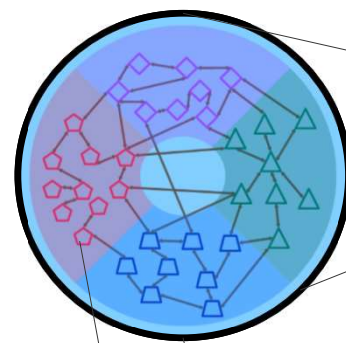
OSLC resource URI
+
OSLC Configuration

=

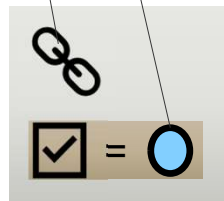
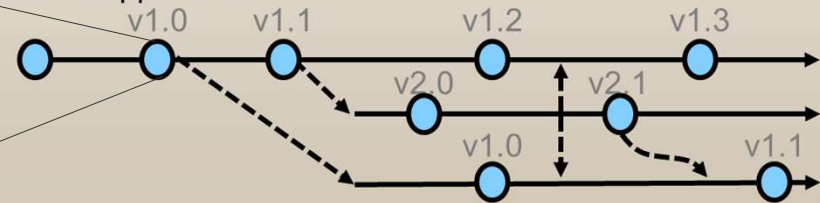
STEP PLM resource
with object effectivity

Response:

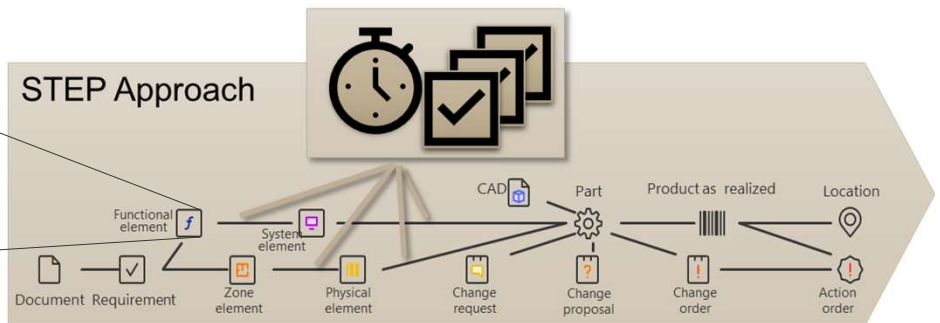
- Configuration = baseline → fixed version
- Configuration = stream → latest version



OSLC Approach



STEP Approach



Heliple-2: 2023 Contributions

- **Federated PLM – feasibility dimensions**
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Federated PLM – enabled by OSLC

From technical demonstration to commercial
acceptance

A call for action

- Heliple-2 results clearly show that OSLC has the capabilities to enable federated PLM
 - Implementation barriers are manageable
- Enabling standard technology, such as OSLC – necessary but not sufficient condition for standards based federated PLM
- Need to clearly show the demand from end-users
- Create OSLC end-user community to
 - Increase awareness among end-users and suppliers
 - Share end-user success stories and identified needs
 - Identify need for further standardisation, within OSLC and elsewhere
 - Continuation projects to Heliple-2 is being planned
 - Open to international partners

The Federated PLM interest group

- Forum for gathering stakeholders with an interest in establishing standards-based Federated PLM capabilities
 - Monthly webinars
 - With the aim to create the inertia for extending, maintaining and popularising OSLC and similar technologies for integrating stand-alone development environments
- Sign up with Erik Herzog (erik.herzog@saabgroup.com) for contributing to federated PLM

Heliple-2



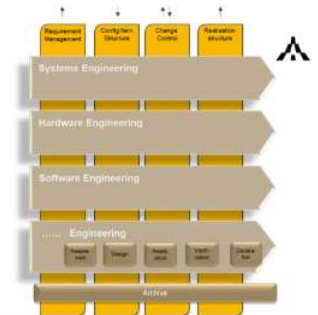
Heterogeneous Linked Product Lifecycle Environment

Part of: Advanced and innovative digitalization 2022
Time: January 2023 till September 2024

Product development data is often scattered and isolated per engineering discipline. This project shall Demonstrate that a PLM capability for development and maintenance of complex CyberPhysical Systems can be realized, cost-effectively, by creating a federation of integrated but independent development environments.

Demonstrate that the OSLC standard can be used for efficient integration of individual development environments.

The goal is to be able to demonstrate an integrated PLM environment based on federated standalone components.



Webinar 3, Heliple Federated PLM Interest Group

Event by Heliple Federated PLM

Tue, Feb 13, 2024, 4:00 PM - 5:00 PM (your local time)

Online

Event link • <https://kth-se.zoom.us/j/68636753071>



Tord Ringenhall and 5 other connections attending

Attend

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