



TC 184/SC 4 Industrial Data

Winner
2007 & 2021
Lawrence D. Eicher Leadership Award



Semantics and Semantic Interoperability

- what is semantics?
- what is interoperability?
- ontologies
- how technologies enable semantic interpretation?
- how to achieve interoperability?
- lessons learnt, challenges and best practices
- benefits of using a semantic process

Online Webinar

27th June 2023
12:00 - 15:00 CET

The Pallas Project - A Practical Experience of Semantic Interoperability
Complexity and capabilities of SKOS, RDF and OWL/Shacl.

dr. ing. L.C. (Leo) van Ruijven MSc
Principal Systems Engineer

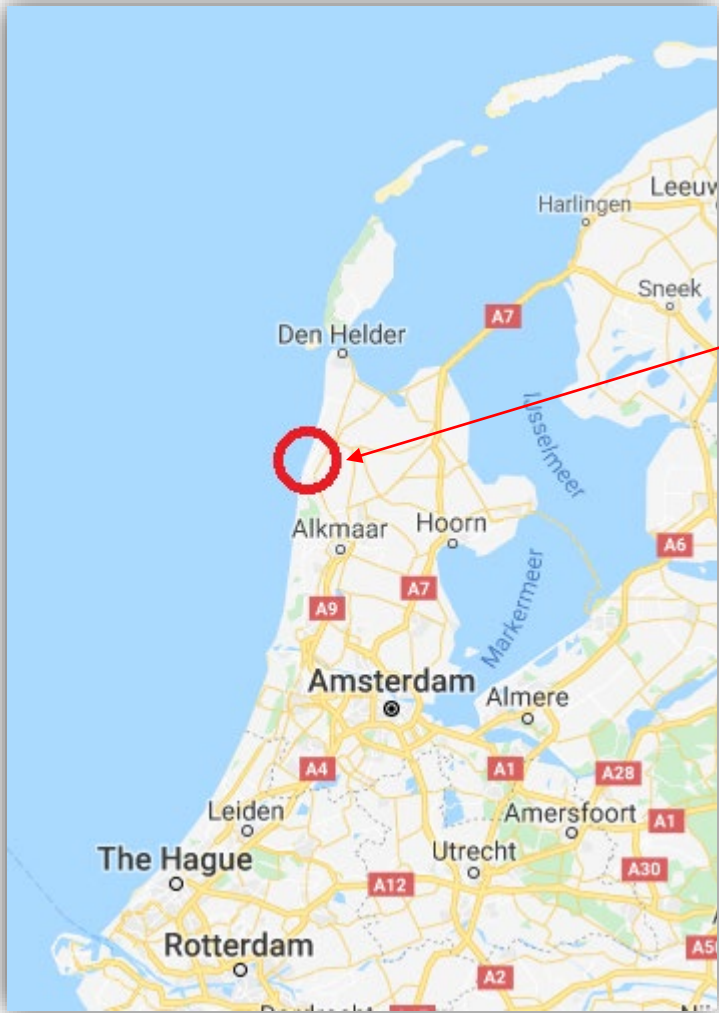
- 25 years employee of TBI Netherlands, EPC contractor in building and construction.
- > 20 years Chairman Dutch standards committee NC 181184 'Information integration and Interoperability'
- Member ISO TC 184/SC4; Industrial Data, initiator and editor of ISO 15926-11
- Member Executive Committee USPI
- PhD on Collaboration, Systems Engineering, and Information Management in construction and industry (2018).
- Initiator and architect of the CDE in the Pallas Project.



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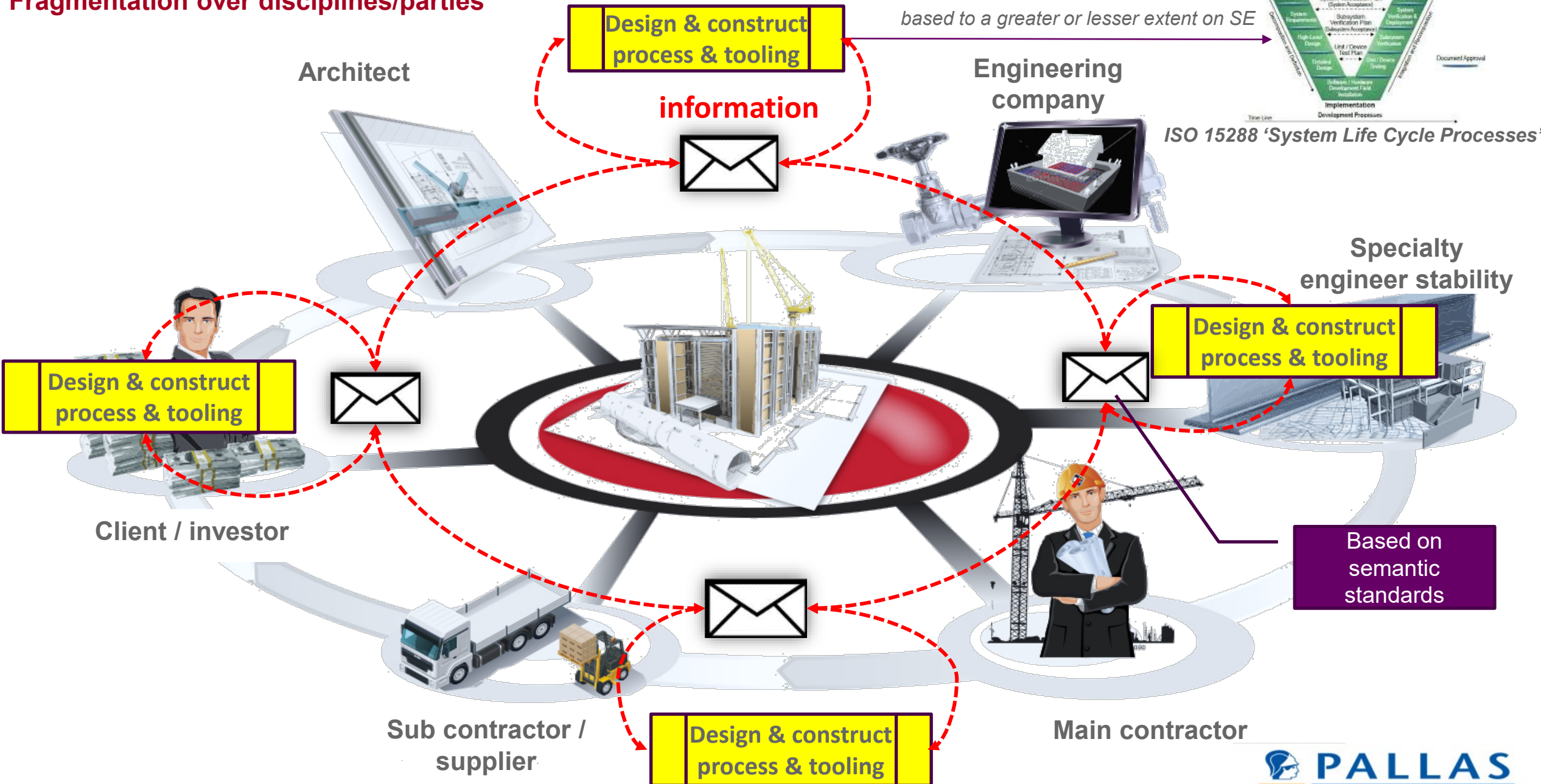


PALLAS IS PREPARING THE REPLACEMENT OF THE AGEING HIGH FLUX REACTOR (HFR) PRODUCING MEDICAL ISOTOPES AT LOCATION PETTEN, THE NETHERLANDS



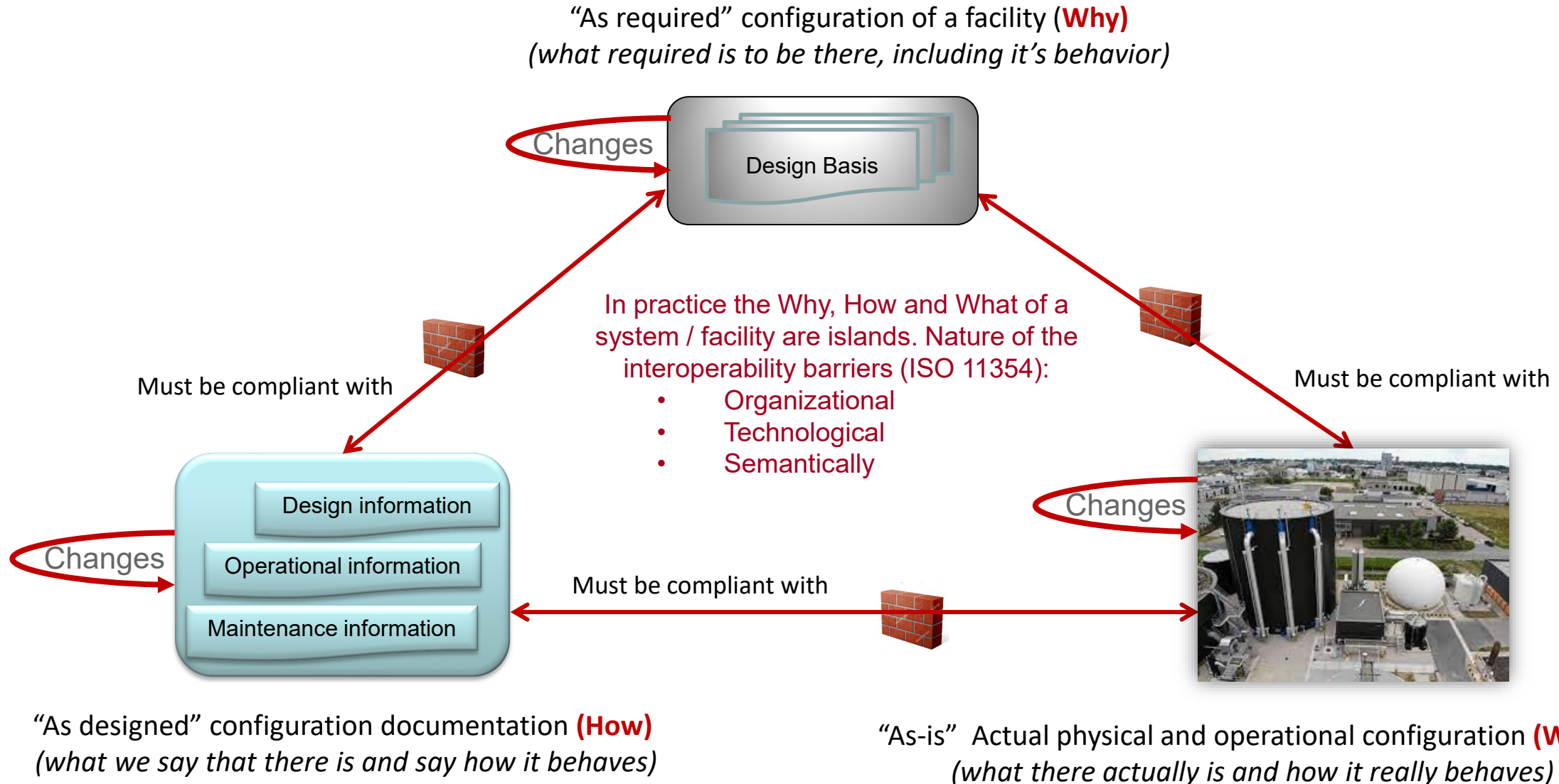
The challenge of Information Management in complex projects

Fragmentation over disciplines/parties



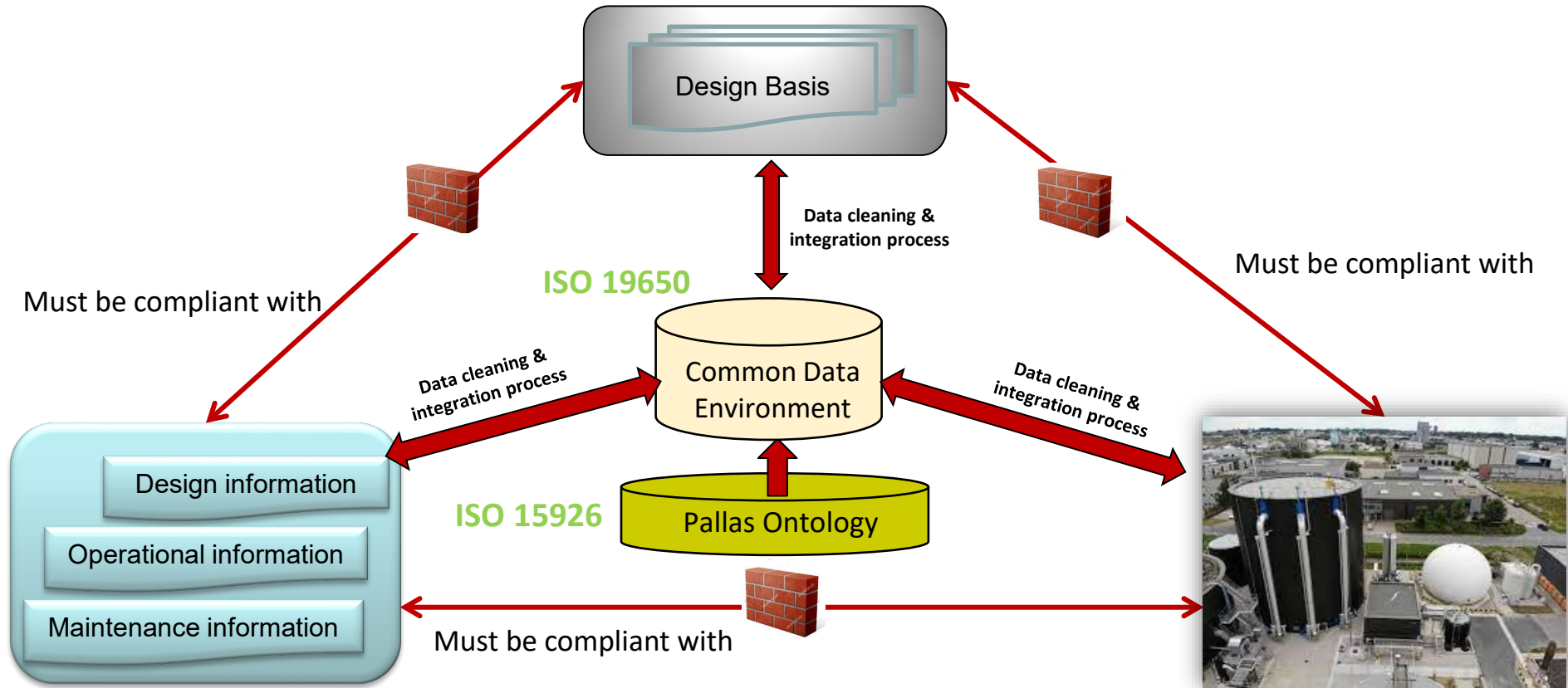
The challenge of Configuration Management over the total life cycle (Equilibrium triangle IAEA)

Fragmentation over time



Solution direction PALLAS, based on ISO and W3C data integration and semantic standards

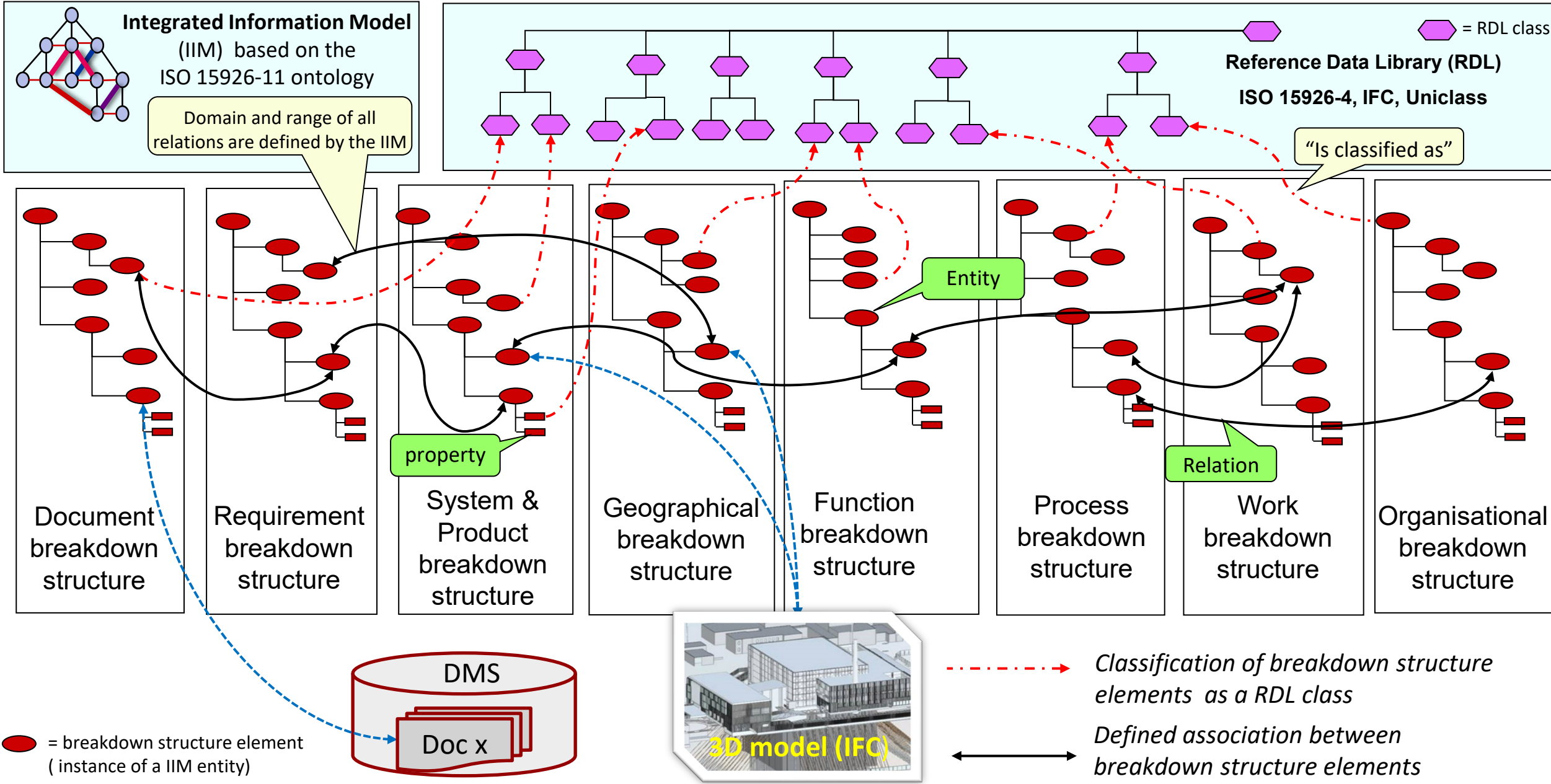
“As required” configuration a facility (**Why**)
(what required is to be there, including it’s behavior)



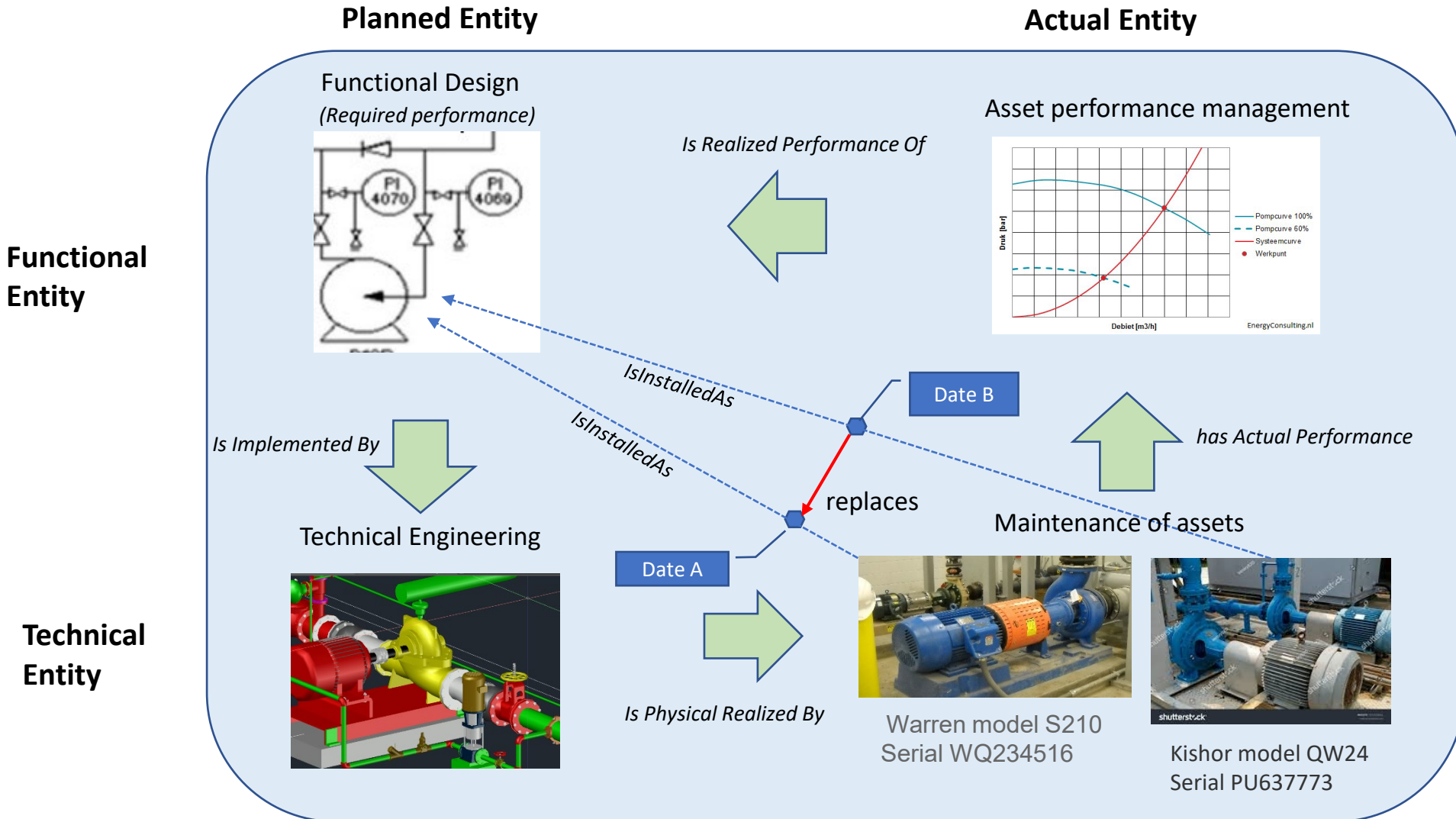
“As designed” configuration documentation (**How**)
(what we say that there is and say how it behaves)

“As-is” Actual physical and operational configuration (**What**)
(what there actually is and how it really behaves)

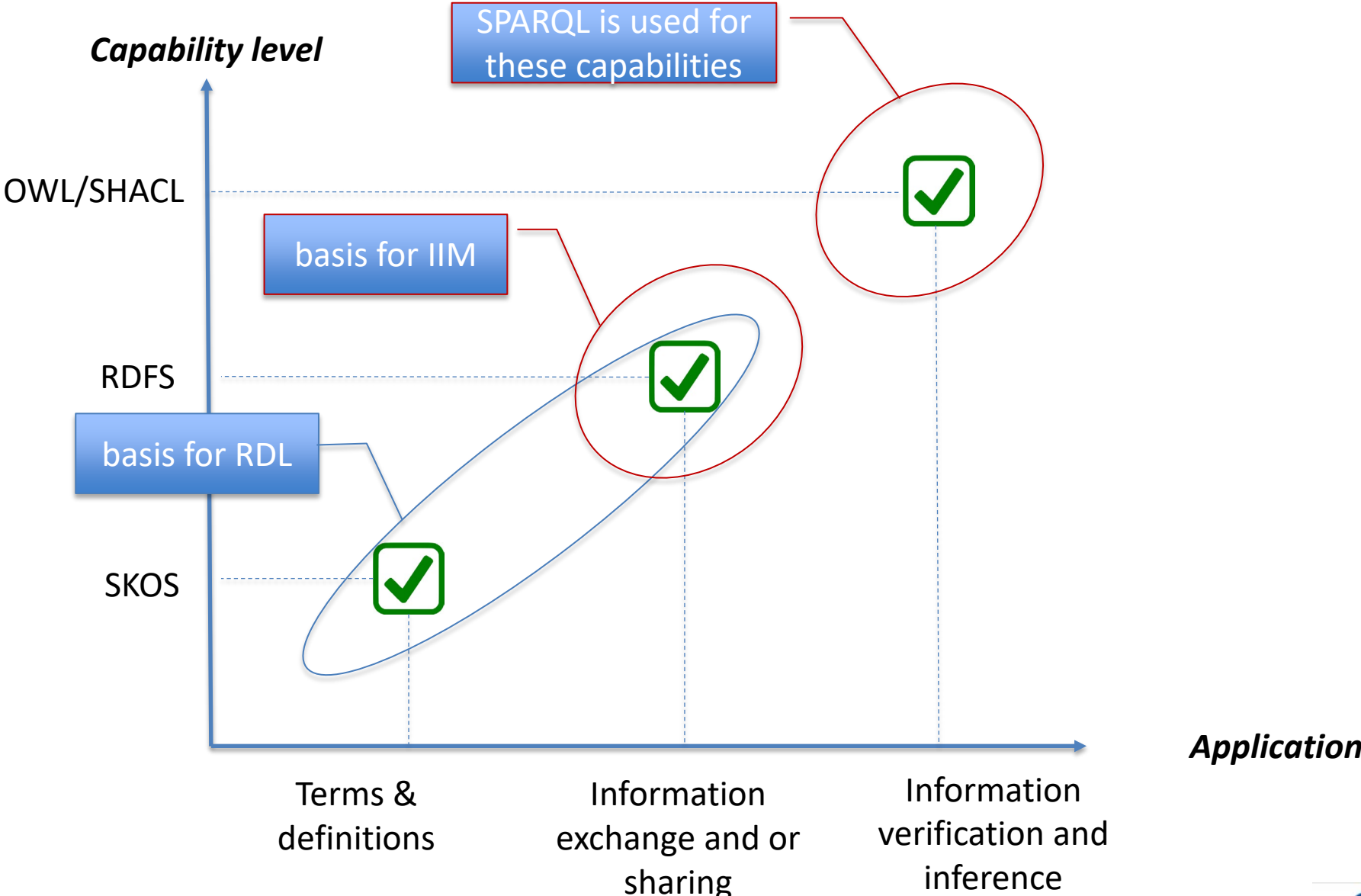
Breakdown structures (IEC 81346) forming the backbone of the CDE (ISO 19650) realized by data integration standards (ISO 15926 / RDFS)



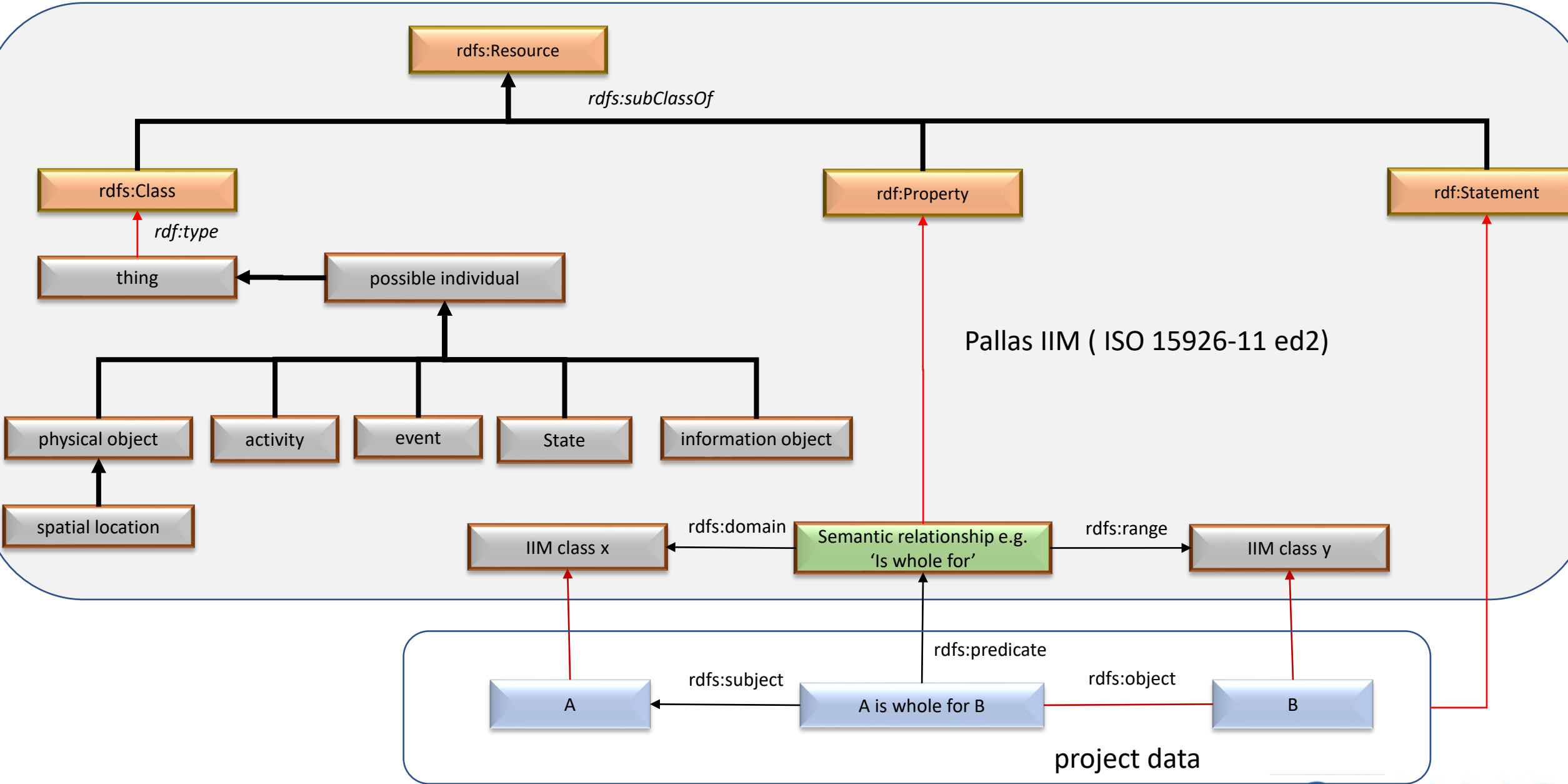
Extending Product Breakdown with asset life cycle data management: The asset life cycle model (ISO 15926-11, EN 17632)



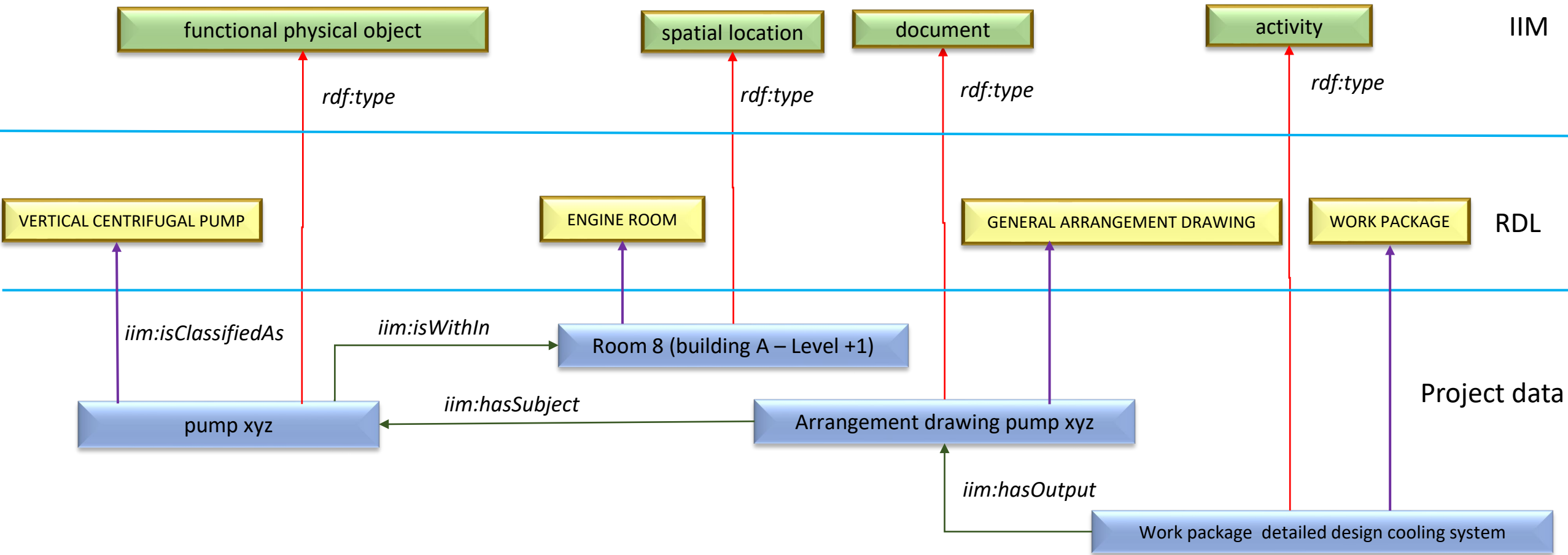
Positioning W3C standards as applied in the Pallas ontology



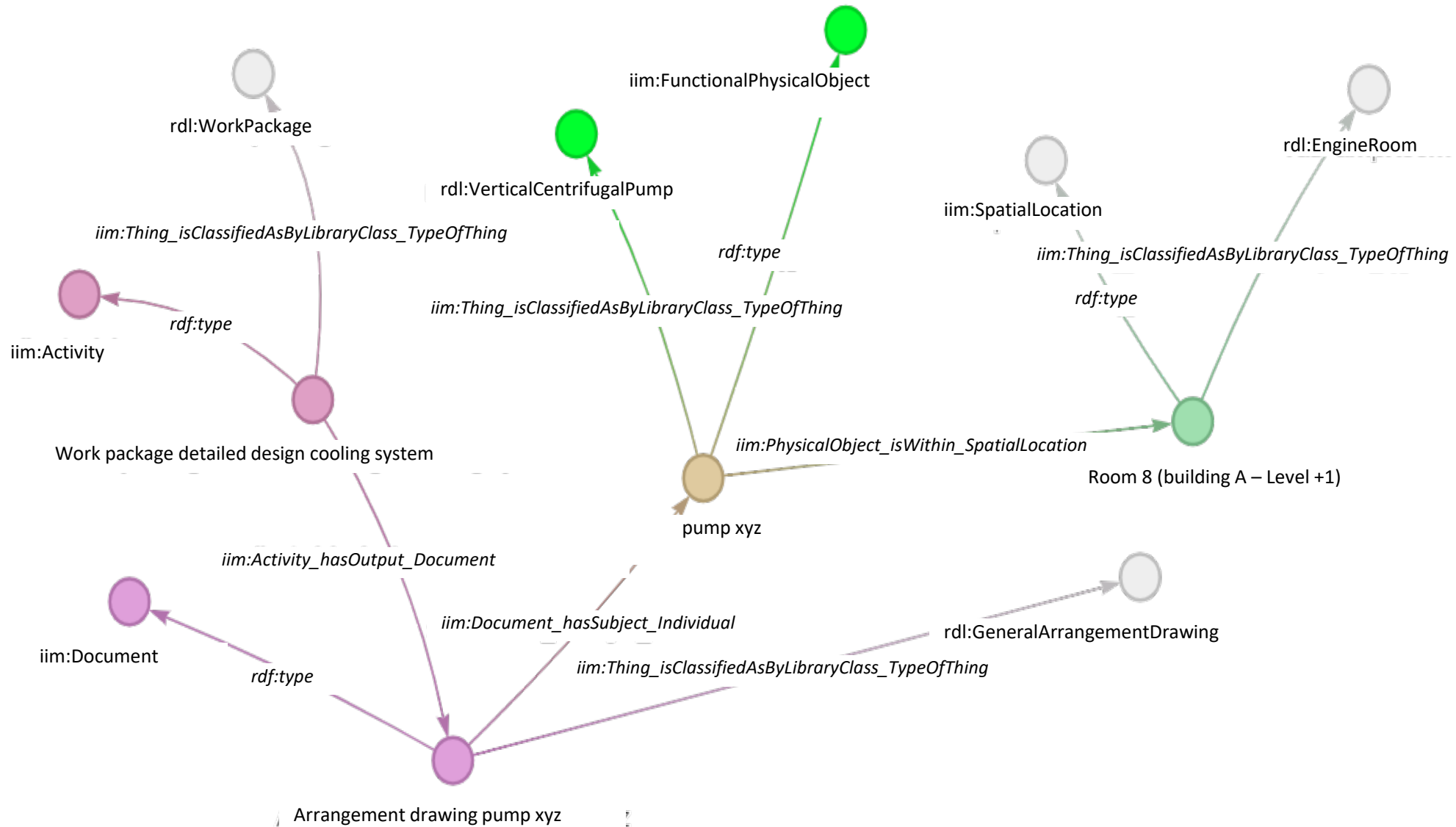
Structure of the Pallas ontology (compliant with ISO 15926-11ed2)



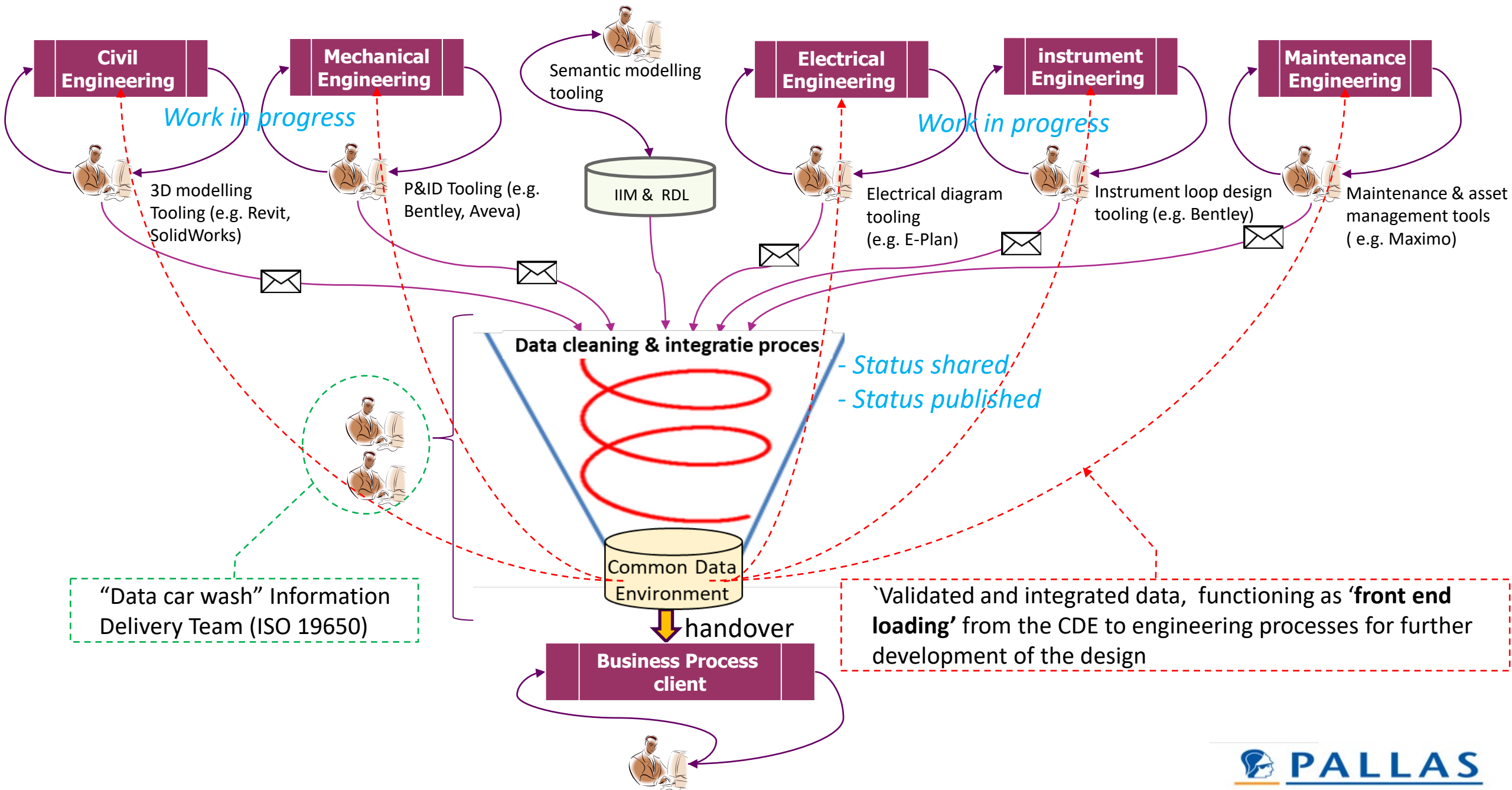
Example of the use of the Pallas ontology (based ISO 15926-11ed2)



The example implemented in the Graph Database tool of the CDE



The challenge of processing input and output information of engineering processes



Data cleaning and mapping process (based on ISO 8000 Data Quality): Assuring reliability and integrity for acceptance of the CDE as a Single Source of Truth

“Similar carwash for cleaning IFC 3D models”

1 Checking correct syntax of references/Tags/codes/numbers

3 Harmonize semantics according to the Integrated Information Model IIM

6. Apply validation rules IIM and RDL before import in CDE

Cleaned, signed data sets in CDE
(signed Named Graphs)

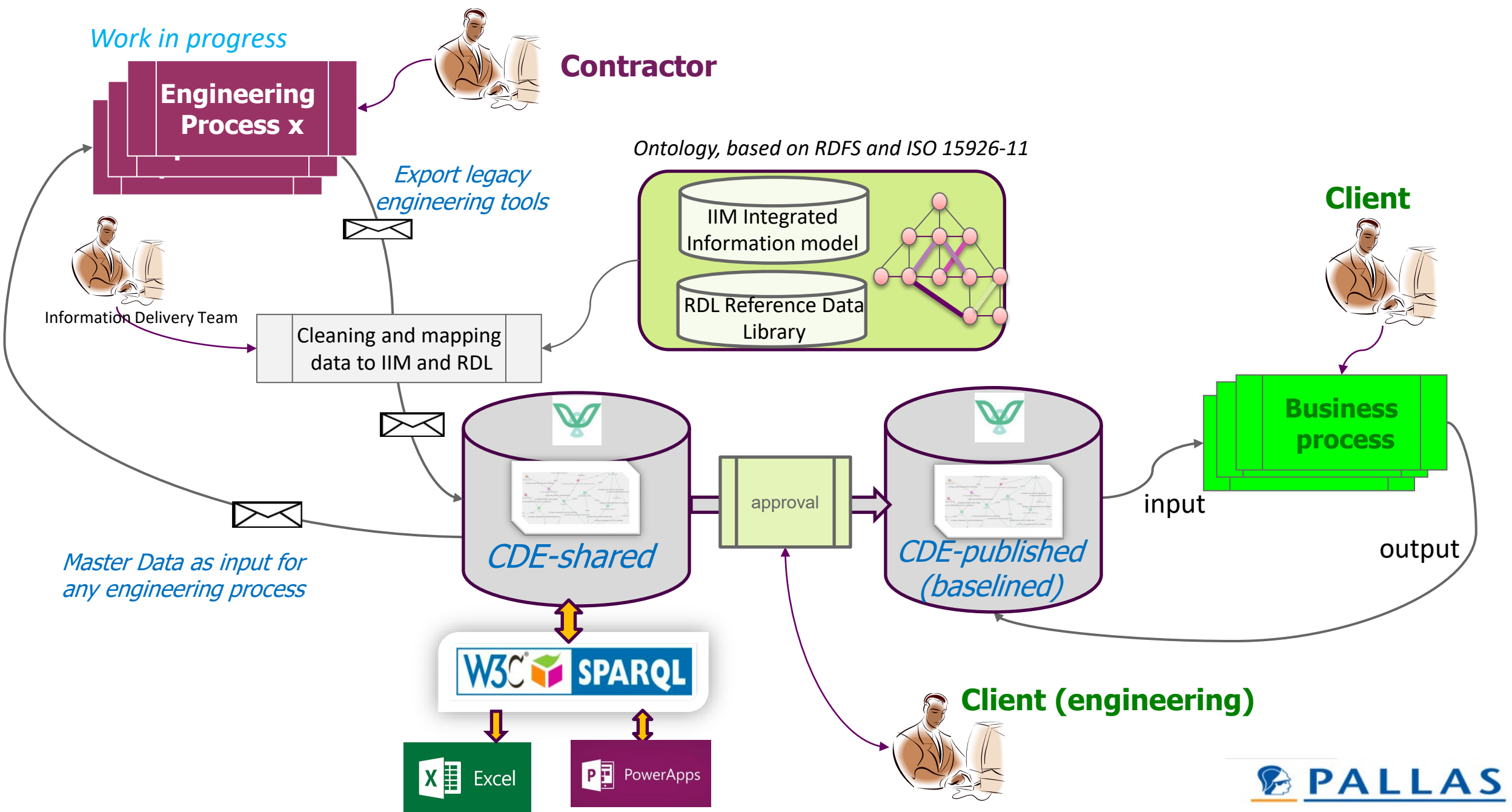
5. Identifying additions, changes and or deletions

4. Classify all objects according the RDL

2. Check if referenced codes exists in the CDE if they should.

Raw data sets from engineering tooling

Digital eco system for managing of engineering & facility life cycle data



Recap CDE approach PALLAS project (ontology driven rather than document driven)

Information:

- Select, tailor, and implement **data standards**, develop iterative an **IIM and RDL (“project ontology”)**
- Focus on **information streams**, the models behind them and their owners and stakeholders.
- Agree on data **exchange requirements** with the engineering environment (tool exports).
- Apply principles of ISO 8000: **syntactic, semantic and pragmatic Data Quality**.

Technology:

- Use **semantic modeling technology** to cope with the richness of **Systems Engineering** data
- Select a flexible '**linked data**' platform, capable of handling **Named Graph with reified triples**.
- Use **data standards** and **open-source technology** to ensure seamless migration for decades to come.
- The PALLAS project succeeded in its mission by limiting itself to using only **RDFS combined with SPARQL**.

Human and organization:

- Clear **vision** and support from **senior management**.
- Availability of required (new) **competences and new roles** acknowledged.
- Succeeded in **bridging the gap** between ontology, engineering environment and engineering tooling.
- Organized **integration** of domain knowledge, semantic modeling knowledge, and IT.



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Thanks for your attention

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