

“CAR WASH FOR DATA”: BEST PRACTICE FOR INFORMATION & CONFIGURATION MANAGEMENT FOR A NUCLEAR FACILITY.

Data integration and life cycle support in industry based on ISO 15926-11ed2

*Dr. ing. L.C. (Leo) van Ruijven MSc, Principal Systems Engineer
Croonwolterendros (EPC contractor)*

➤ *>20 years member of the Dutch NEN standardization committee ‘Information integration and interoperability’*



➤ *Member ISO TC 184/SC4; Industrial Data, initiator and editor of ISO 15926-11*



➤ *>20 years EC member USPI*



➤ *Initiator of and architect of the Pallas alphanumeric part of the CDE, Pallas ontology and project RDL*

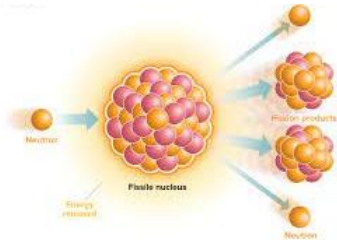
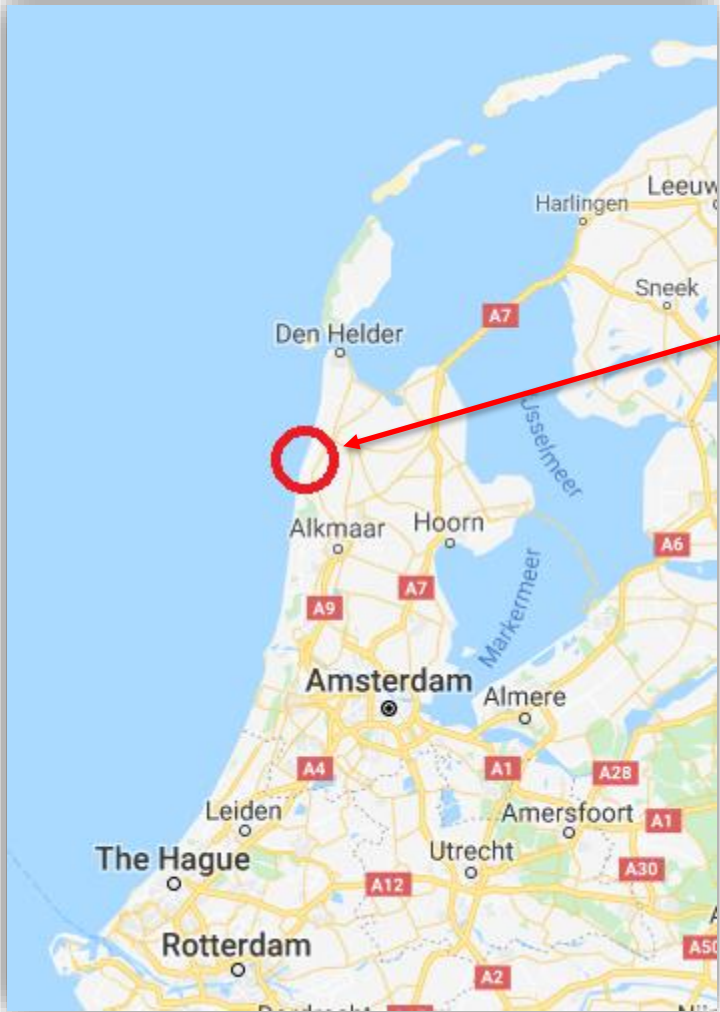
leo.vanruijven@croonwolterendros.nl



Content:

- **Context Pallas Project**
- **Challenges of information management (IM) and configuration management (CM)**
- **Introduction and structure of the Common Data Environment (CDE)**
- **Positioning of the CDE in the project**
- **Recap approach Pallas concept**
- **Adoption of the Pallas concept**

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



Context

Mission of PALLAS:

- **“A data driven isotope production and data driven Asset Management”.**

Foundation: Information Management (IM) and Configuration Management (CM) at the start of the design:

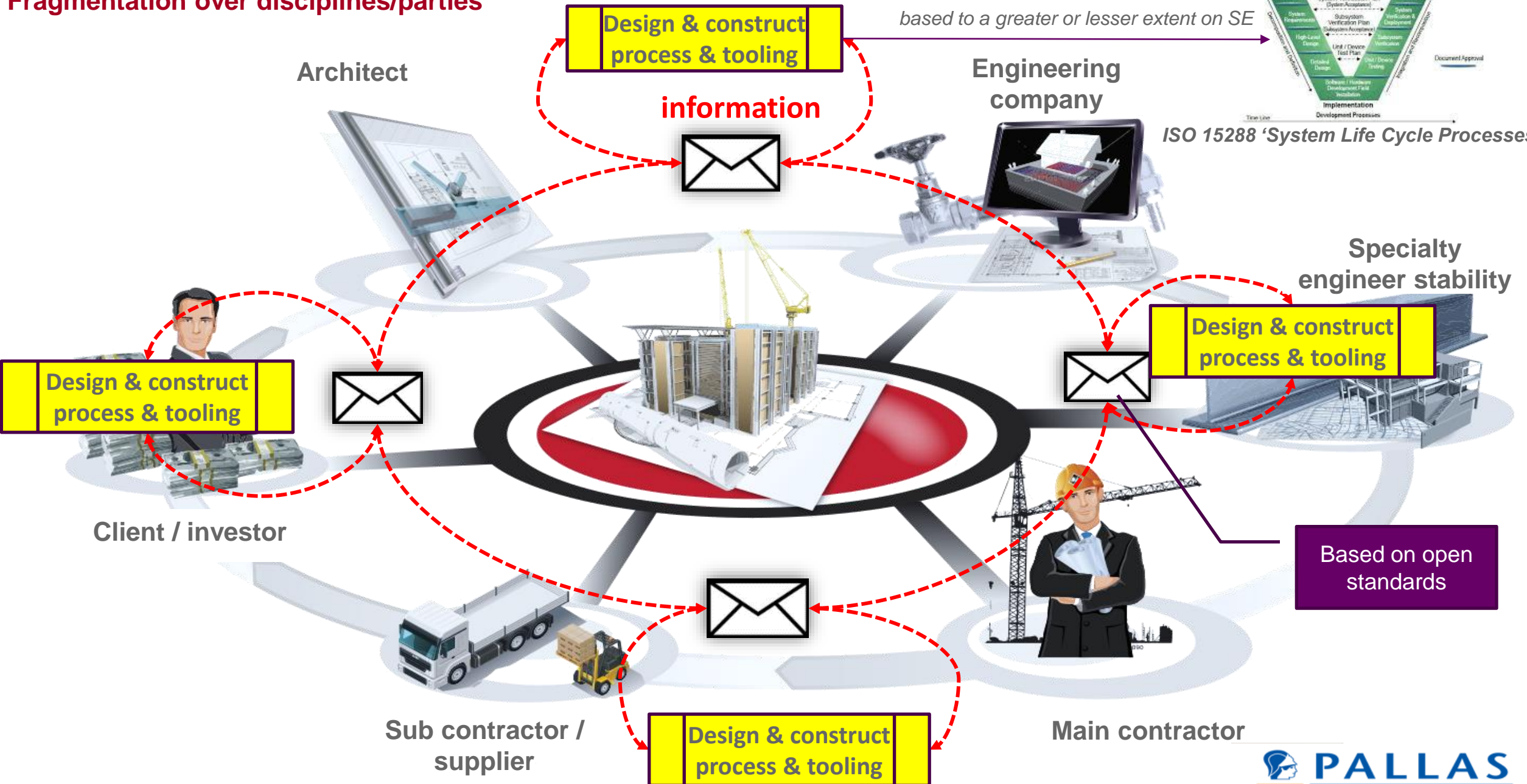
- Assurance of **reliability, safety**, performance and ‘**license to operate**’,
- Support **sustainability** ambitions and regulations,
- Controlling **changes**, (data)quality, project schedule and costs,
- Optimization **CAPEX and OPEX**,
- **Reuse** of knowledge, creation of learning capability.

Challenge: companies in general have problems implementing IM and CM for two main reasons:

- The design is **fragmented across time and disciplines** and based on tools from different vendors, lacking interoperability.
- **Lack of integration** of domain knowledge, information modeling knowledge and IT knowledge.

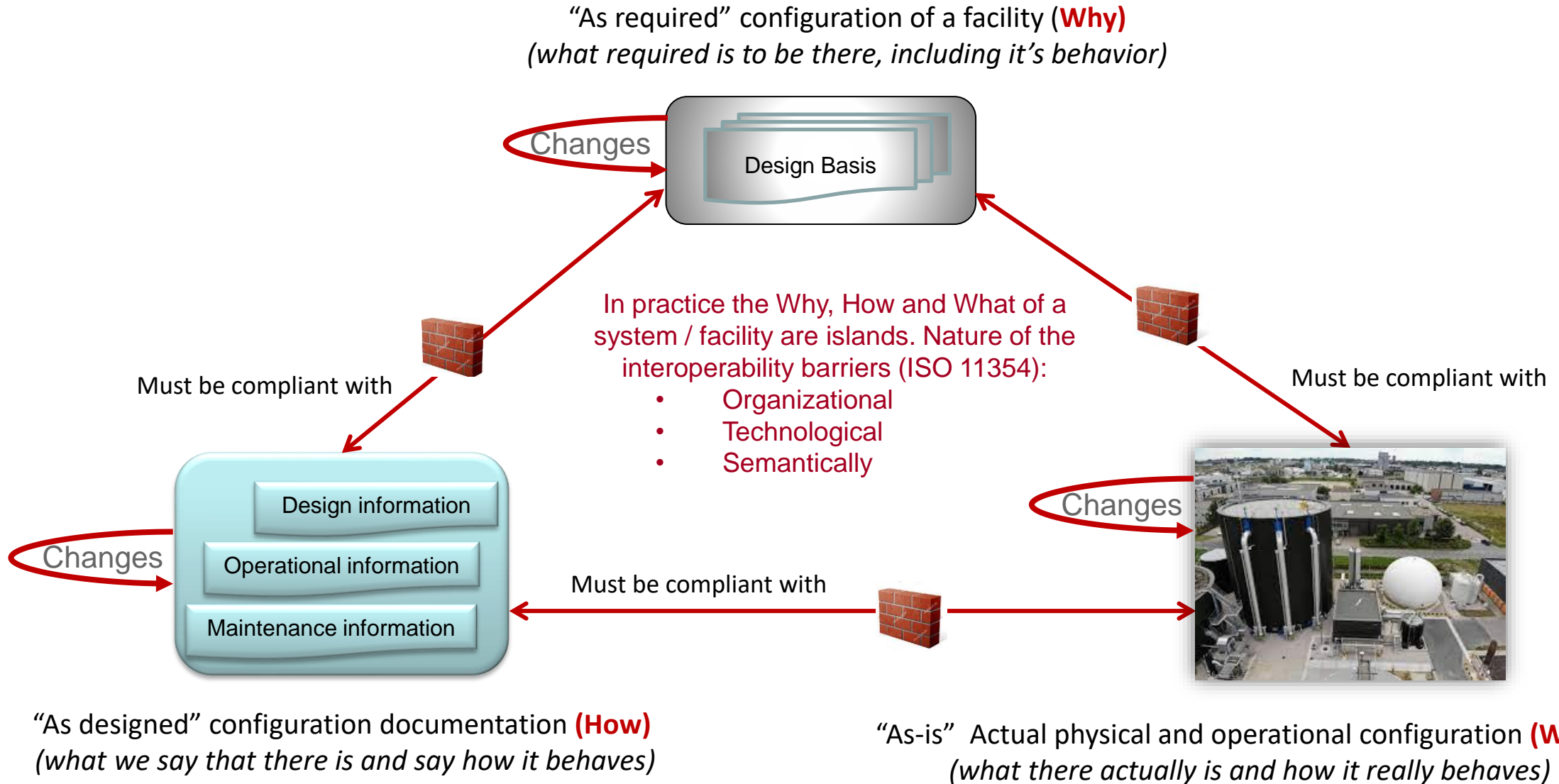
The challenge of Information Management in complex projects in general

Fragmentation over disciplines/parties



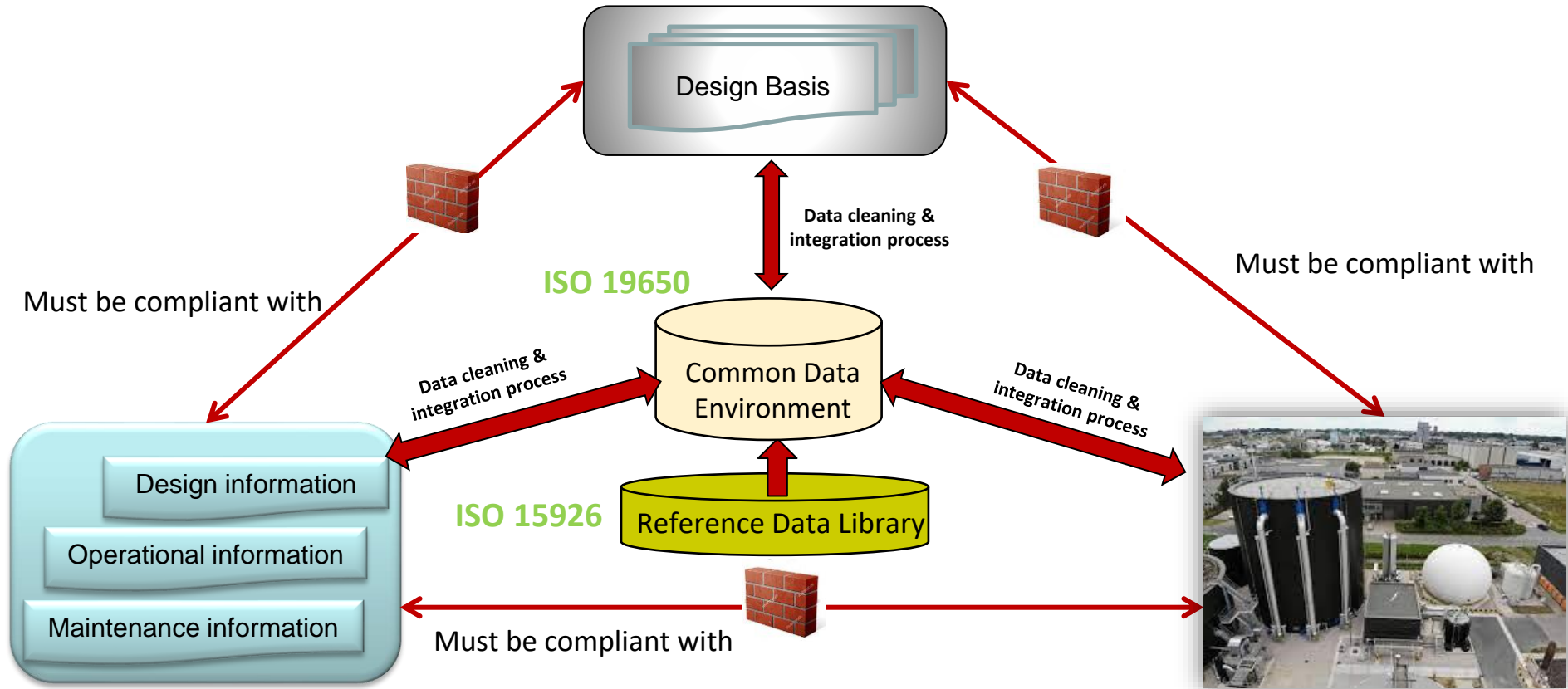
The challenge of Configuration Management over the total life cycle (Equilibrium triangle IAEA)

Fragmentation over time



Solution direction PALLAS, based on ISO, IEC and W3C standards

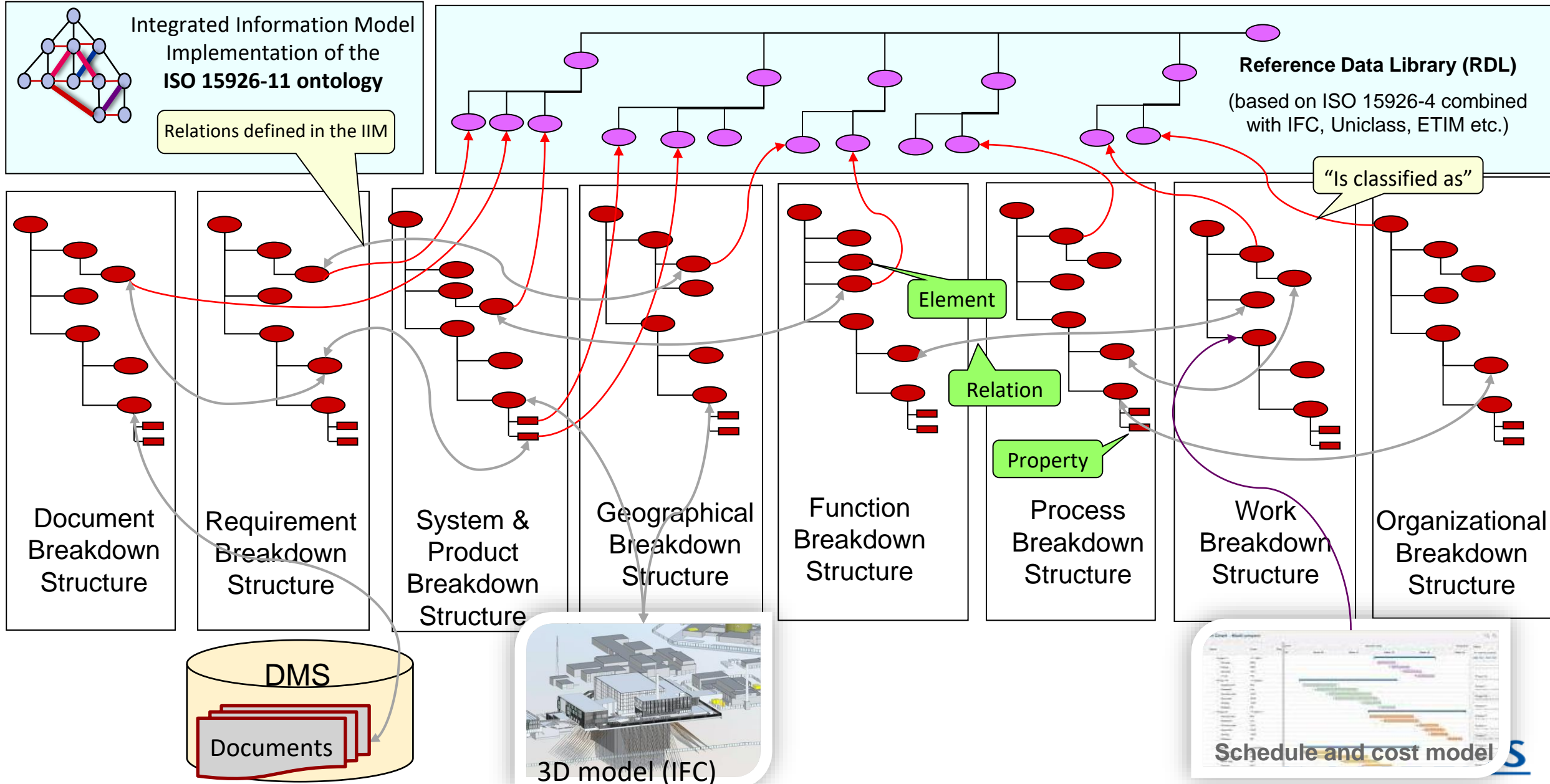
“As required” configuration a facility (**Why**)
(what required is to be there, including it’s behavior)



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

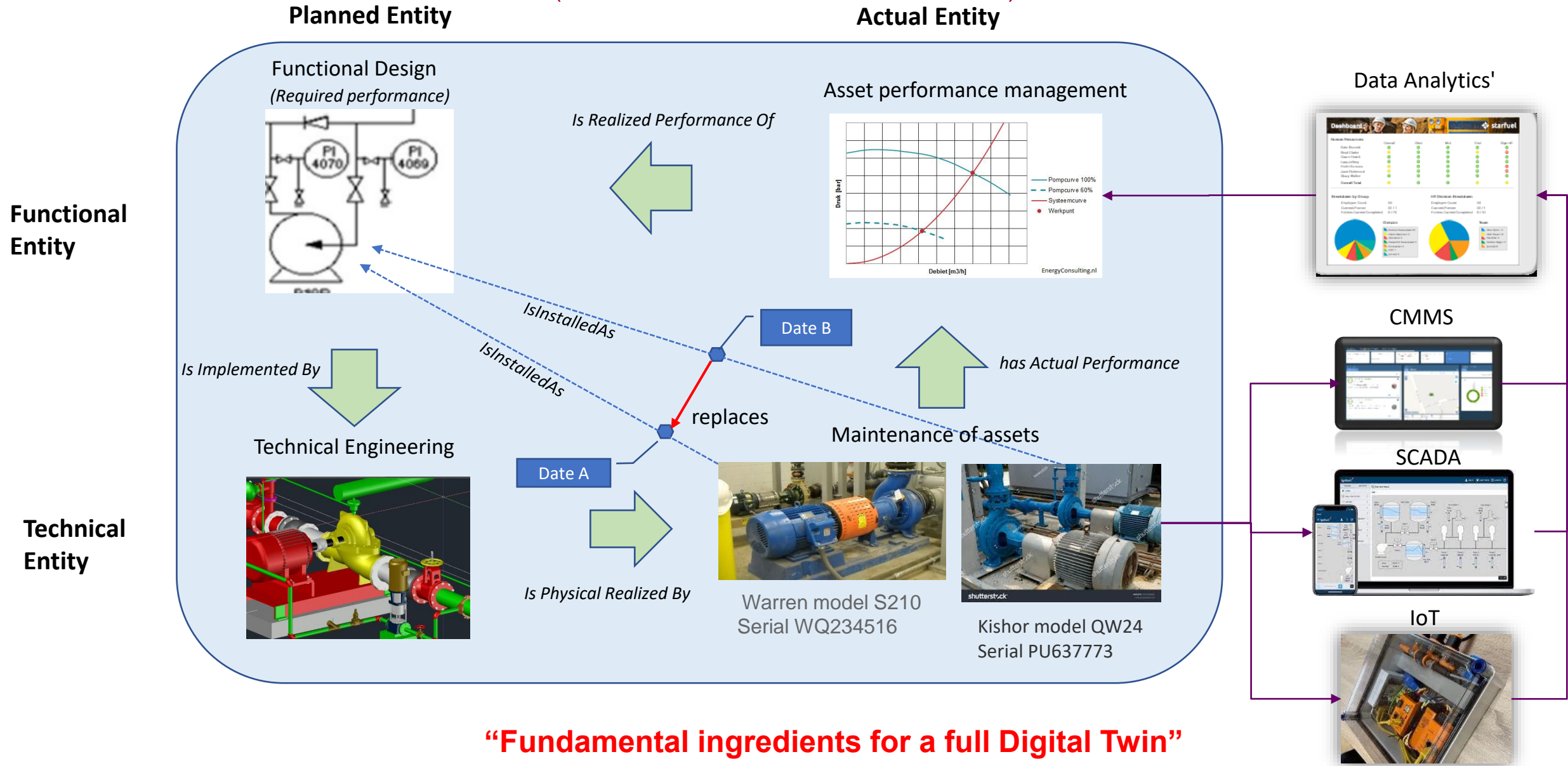
“As-is” Actual physical and operational configuration (**What**)
(what there actually is and how it really behaves)

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



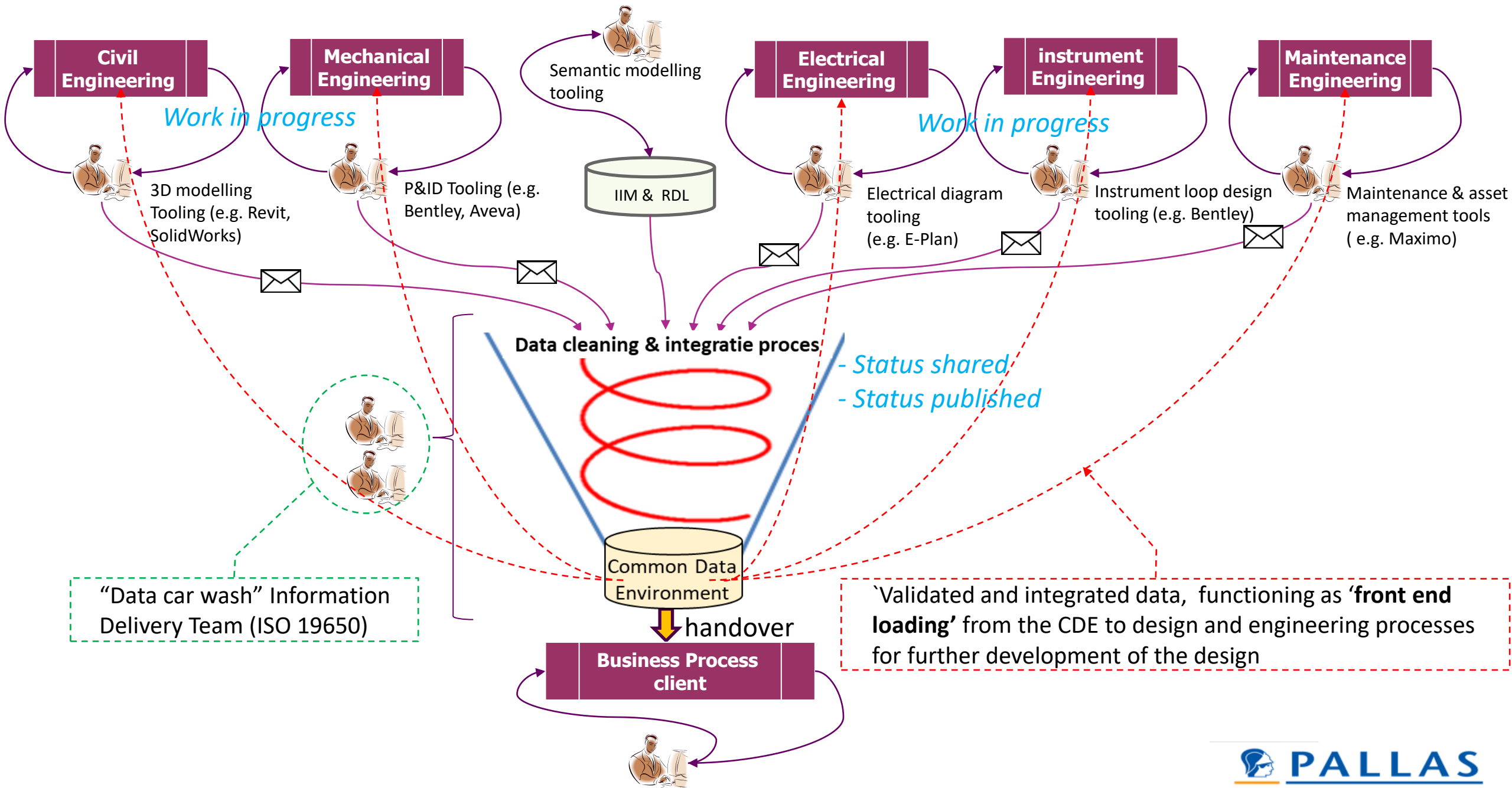
Extending Product Breakdown with asset life cycle data management: The life cycle model

(ISO 55001, ISO 15926-11, EN 17632)



“Fundamental ingredients for a full Digital Twin”

Information Management: controlling information input and output of 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)

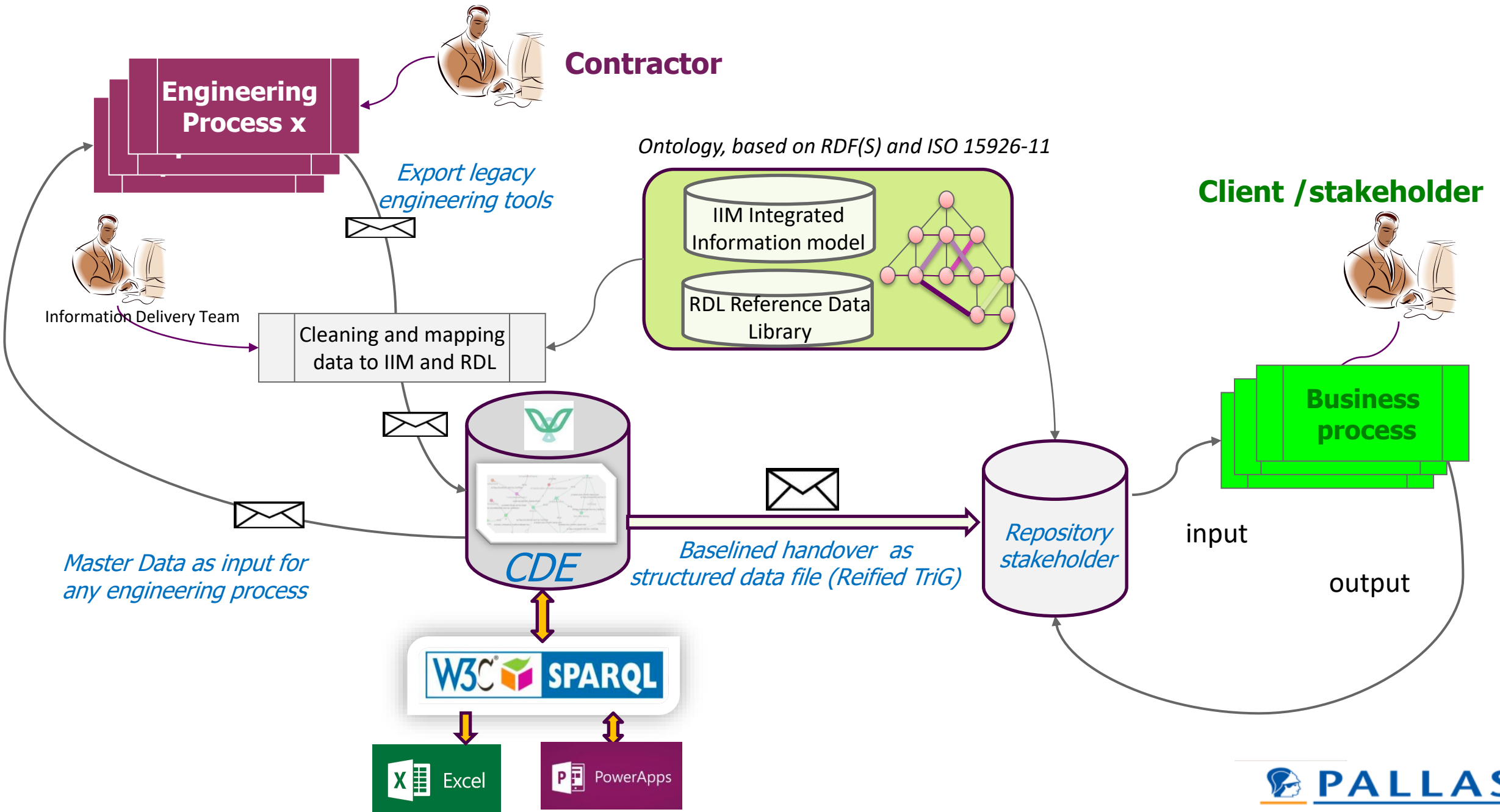
Raw data sets from engineering tooling

5. Identifying additions, changes and or deletions

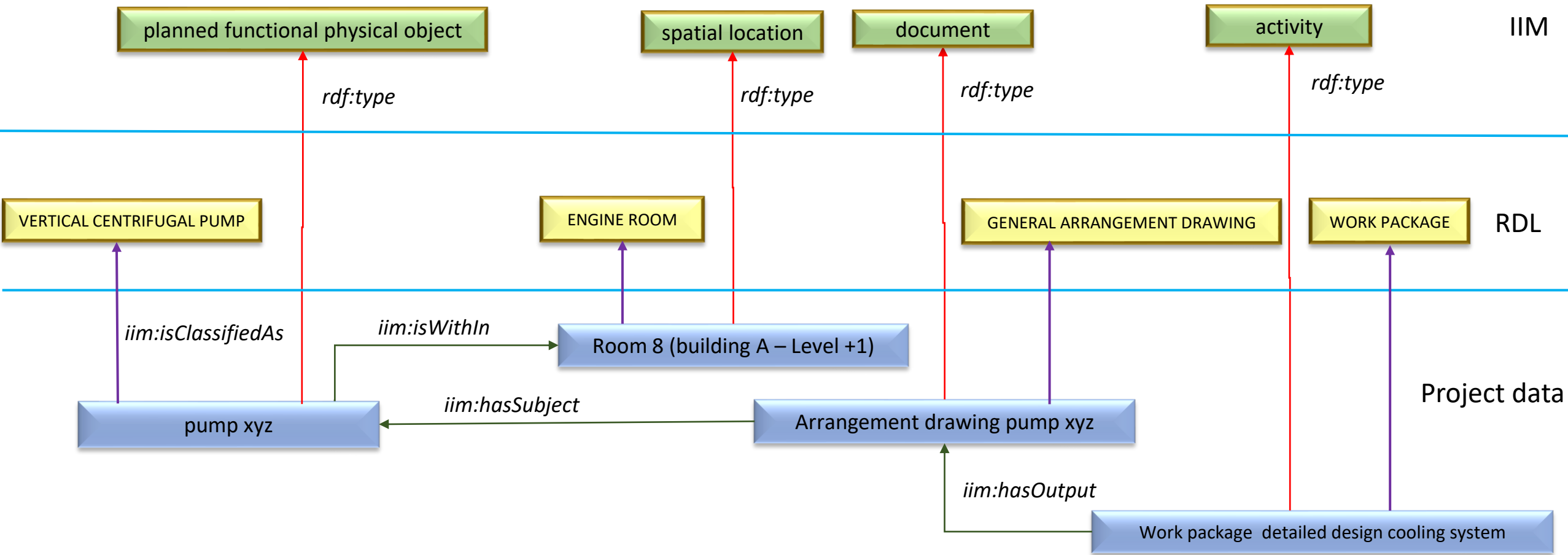
4. Classify all objects according the RDL

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

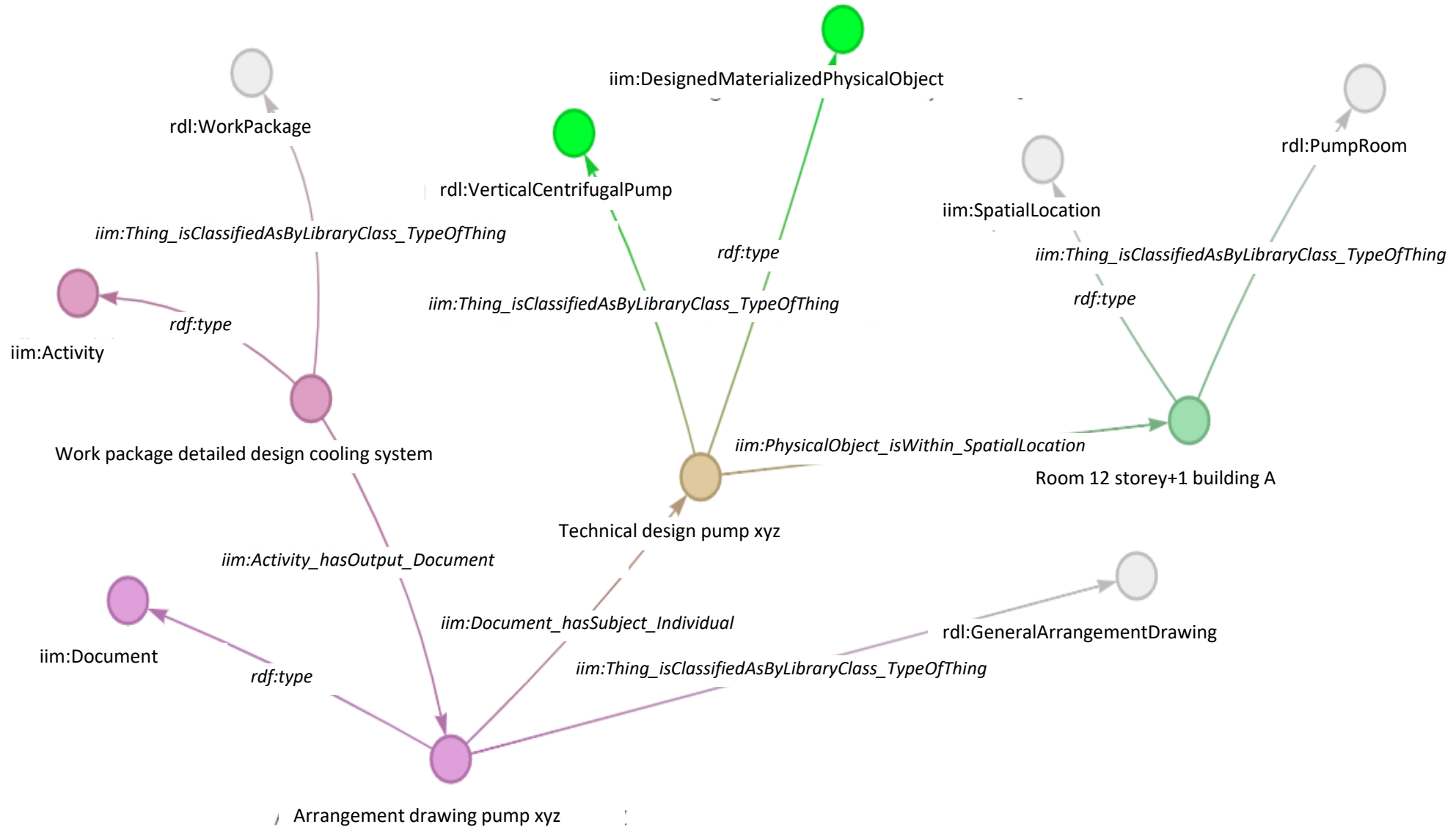
Digital eco system for managing and handover of engineering & facility data



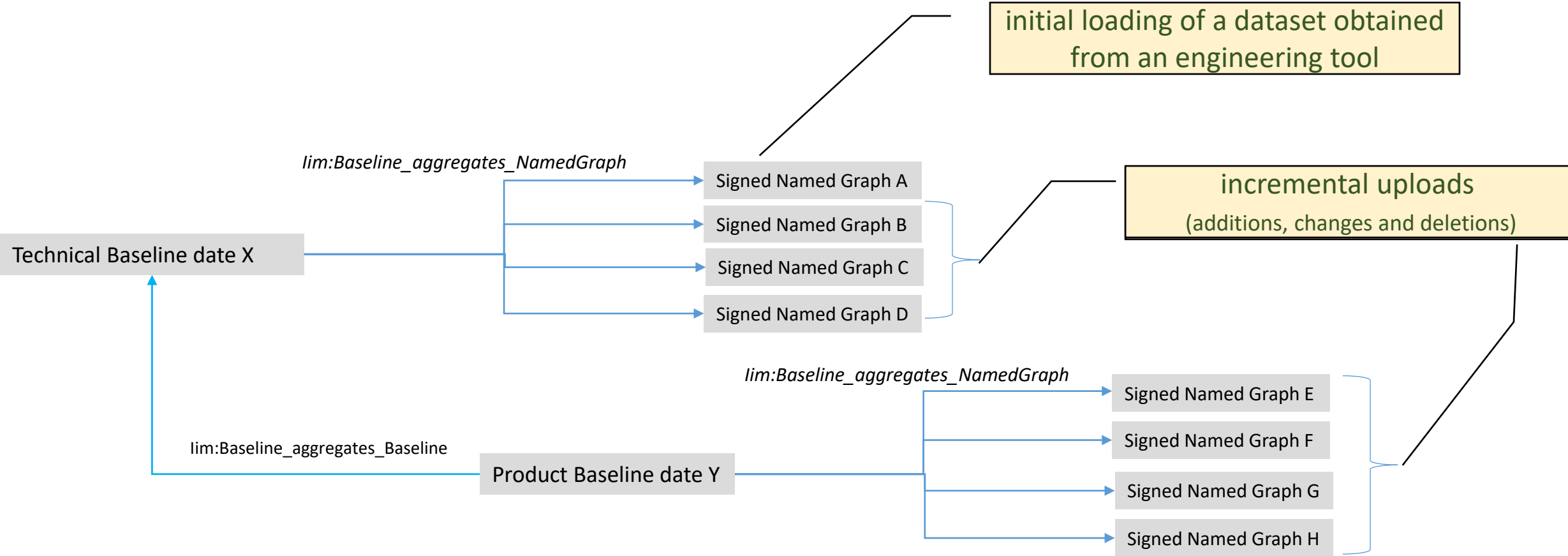
example of the use of the IIM and RDL (based ISO 15926-11ed2)



The example implemented in the Graph Database tool of the CDE (viewer direct on the data)



Managing baselines of project data inside the CDE by signed Named Graphs



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** (is gaining more and more legal significance)

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.

Statement with respect to adoption of the Pallas concept: It is not an “one fits all” solution

However, it can be tailored and scaled with respect to an appropriate ambition level and balance between documents and data

- Partners in a project consortium all have their own methods, standards and tools
- Partners has a different maturity in data quality and data modeling skills
- The contracts in many cases don't take explicit into count data quality and data exchange
- The vision and support of senior management is crucial for what can be achieved
- IT platforms and software supporting real data integration are still in development
- In general, within companies there is lack of knowledge of data integration standards
- The gap between ontologies and knowledge of it in regular industry companies is huge

Thanks for your attention

leo.vanruijven@croonwolterendros.nl

