



PIDMIC 3.0

Process Industry Data Model Integration Congress

11 - 12 June 2024



DEXPI Data Exchange in
the Process Industry



ISO 15926-11:2023 Semantic Modelling OF LIFE CYCLE DATA FOR PROCESS PLANTS

ISO 15926-11:2023 Semantic Modelling



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- *> 25 years experience in LCF Projects in infrastructure and industry from specification up until maintenance.*
- *> 20 years member of the Dutch NEN standardization committee 'Information integration and interoperability'.*
- *> 20 years member of Executive Committee USPI.*
- *Member ISO TC 184/SC4; Industrial Data, initiator and editor of ISO 15926-11*
- *PhD: A unified framework improving interoperability and symbiosis in the field of Systems Engineering.*

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Agenda

- **Status ISO 15926-11**
- **Challenge of plant life cycle data integration in large capital facility projects**
- **Fundamentals of ISO 15926-11 semantic modelling methodology**
- **Harmonizing views on plant life cycle data with ISO 15926-11**
 - **DEXPI, CFIHOS and Systems Engineering**
- **Characteristics ISO 15926-11**

ISO 15926-11:2015 Methodology for simplified industrial usage of reference data

Enables a flexible creation of product knowledge and Systems Engineering models

- that can be exchanged in the plant engineering supply chain
 - by combining:
 - RDF triples captured in Named Graphs,
 - a standardized set of relationships,
 - a project RDL with reference data from any other reference data library (RDL).

Edition 2:

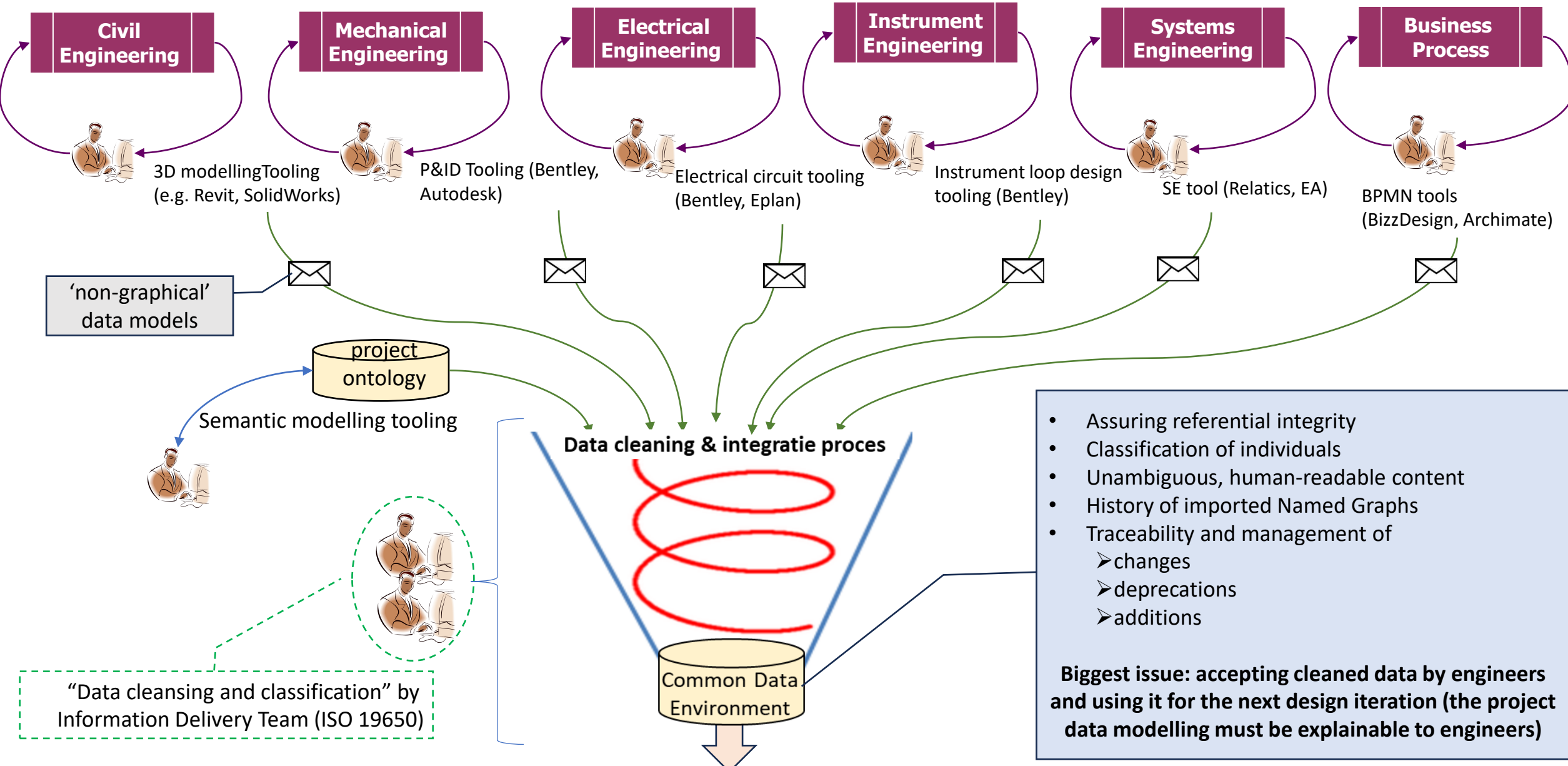
ISO 15926-11:2023 Simplified industrial usage of reference data based on RDFS methodology

Improvements:

- RDF triples reified as `rdf:Statement`
- Changed the role of Named Graph's in supporting configuration and change management
- Defined a lifecycle model for physical objects aligned with EN 17632 "Semantic modelling and linking"
- Based on Systems Engineering use cases derived from process industry best practices
- Explicit connection made to ISO 15926-2
- Supporting both data exchange and a data driven Common Data Environment as per ISO 19650 BIM standard

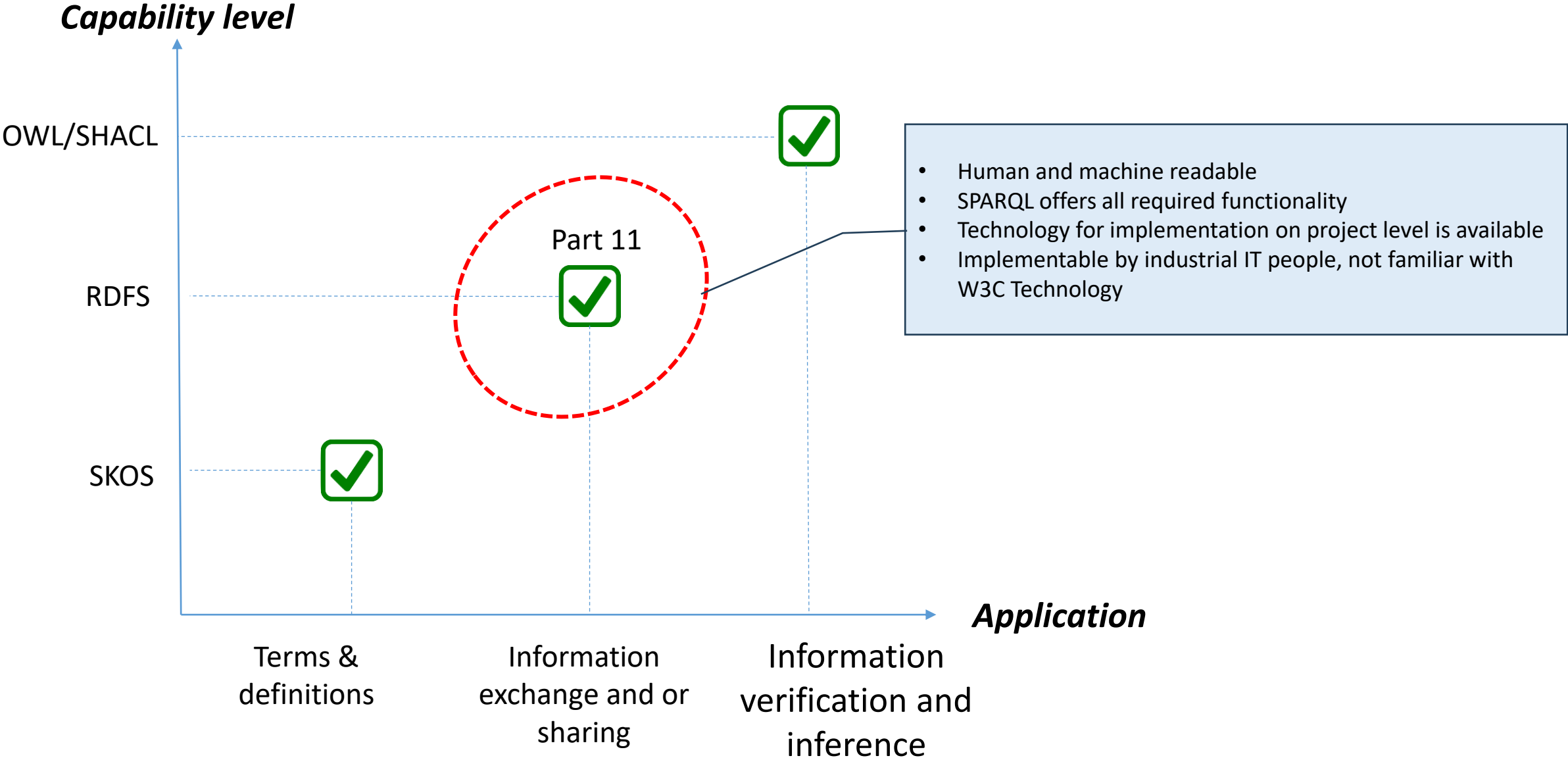
Full implementation of ISO 15926-11 within the PALLAS project (nuclear facility Netherlands)

Challenge: Integration of data obtained from legacy engineering tooling in a CDE (Single Point of Truth)



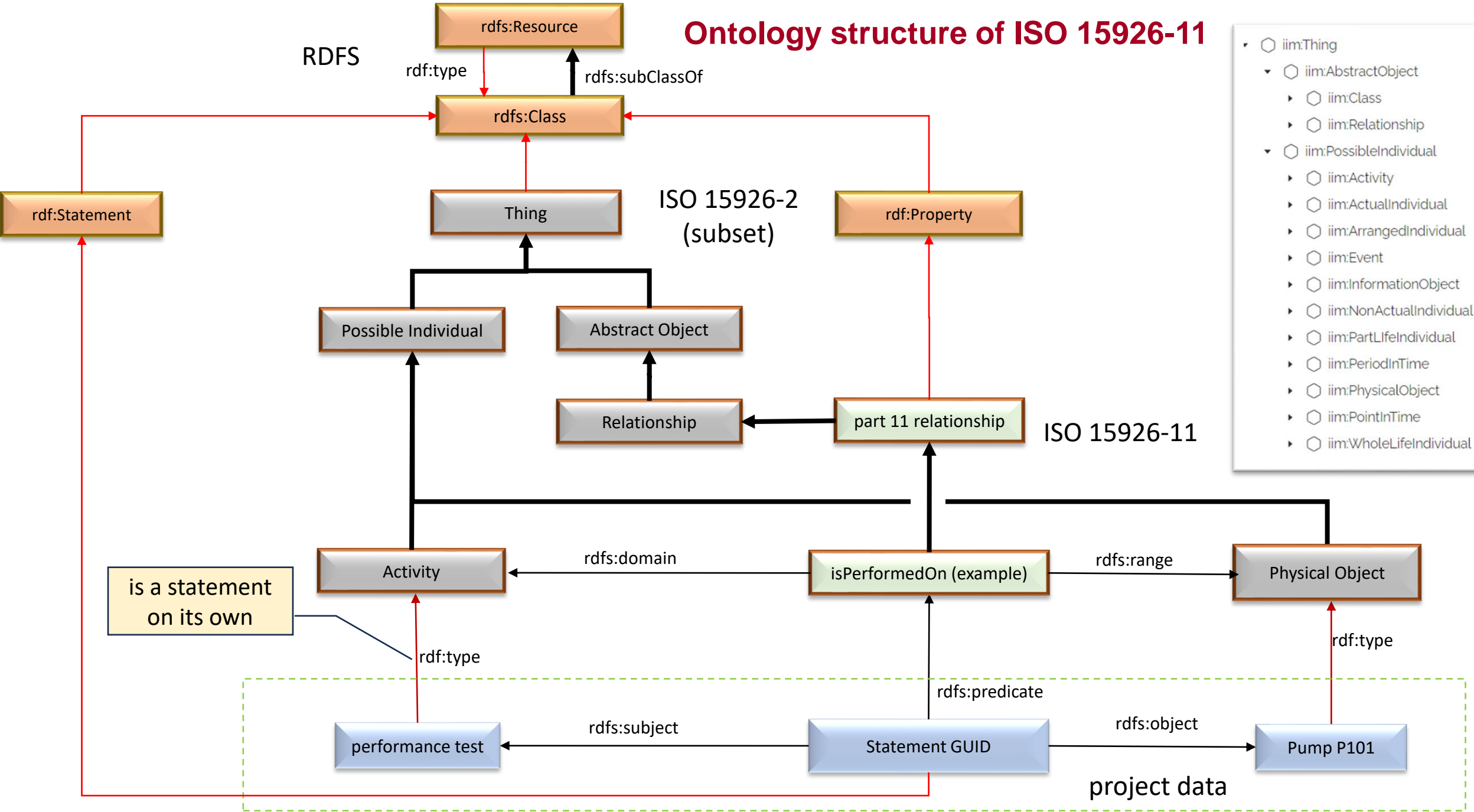
Stakeholders: Configuration management, V&V, authorities, asset management etc.

Conscious choice for W3C standard RDFS in the context of ISO 15926-11



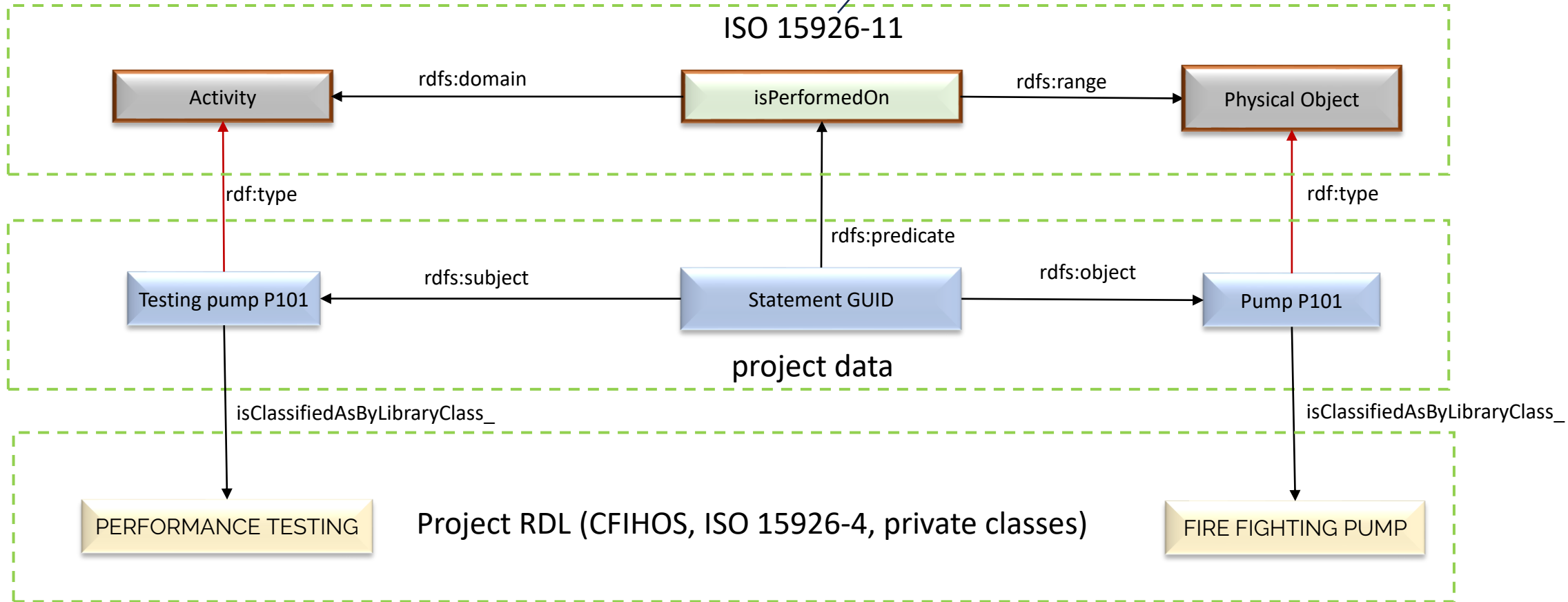
Ontology structure of ISO 15926-11

- iim:Thing
 - iim:AbstractObject
 - iim:Class
 - iim:Relationship
 - iim:PossibleIndividual
 - iim:Activity
 - iim:ActualIndividual
 - iim:ArrangedIndividual
 - iim:Event
 - iim:InformationObject
 - iim:NonActualIndividual
 - iim:PartLifeIndividual
 - iim:PeriodInTime
 - iim:PhysicalObject
 - iim:PointInTime
 - iim:WholeLifeIndividual

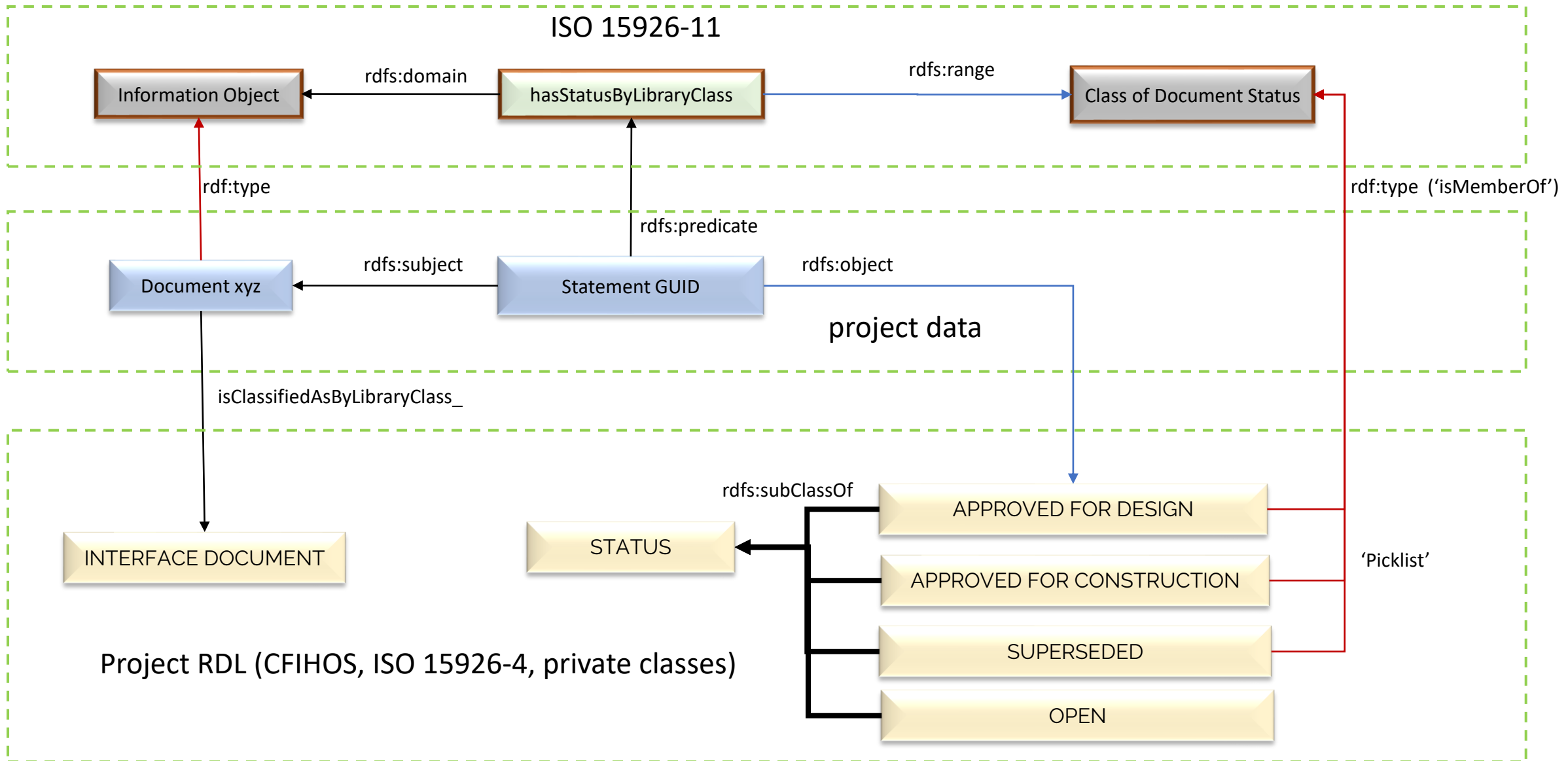


Creating project data base on ISO 15926-11 and usage of an RDL

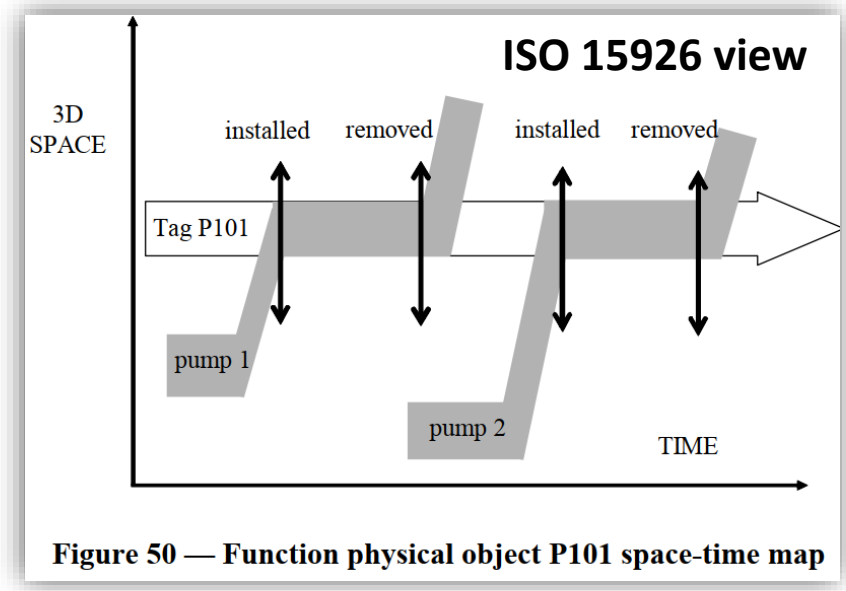
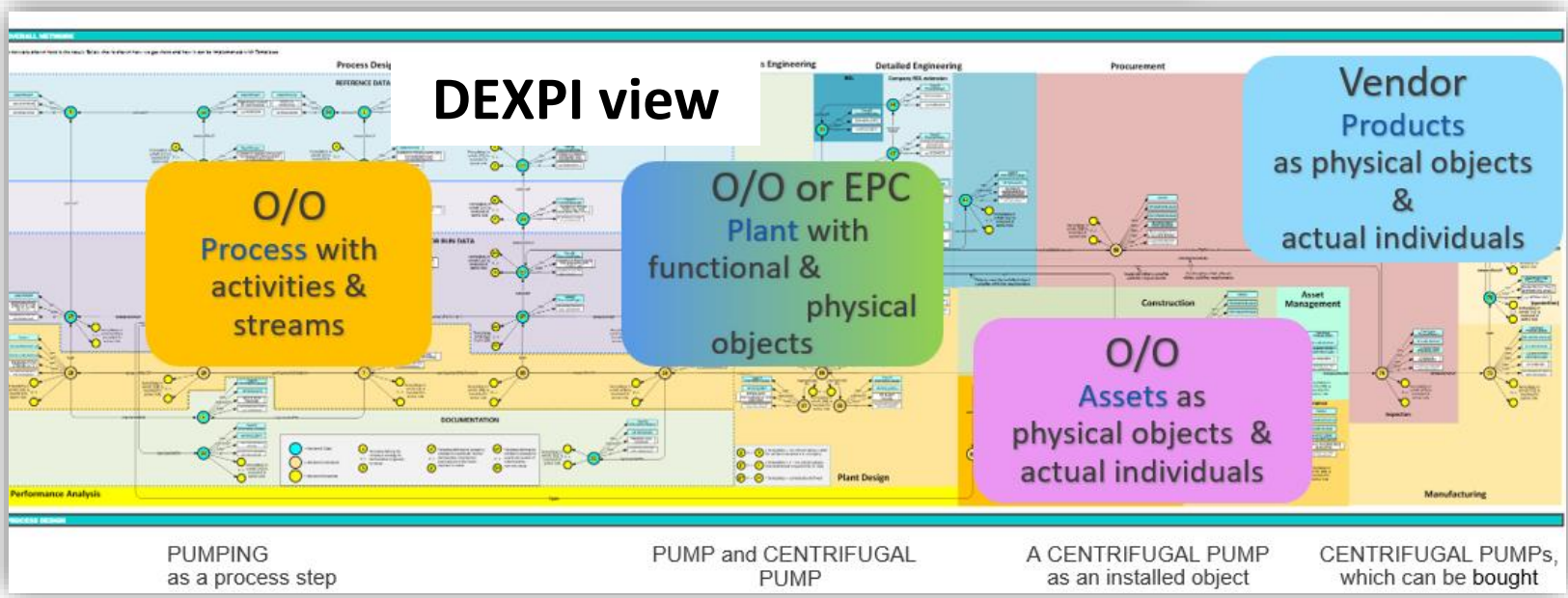
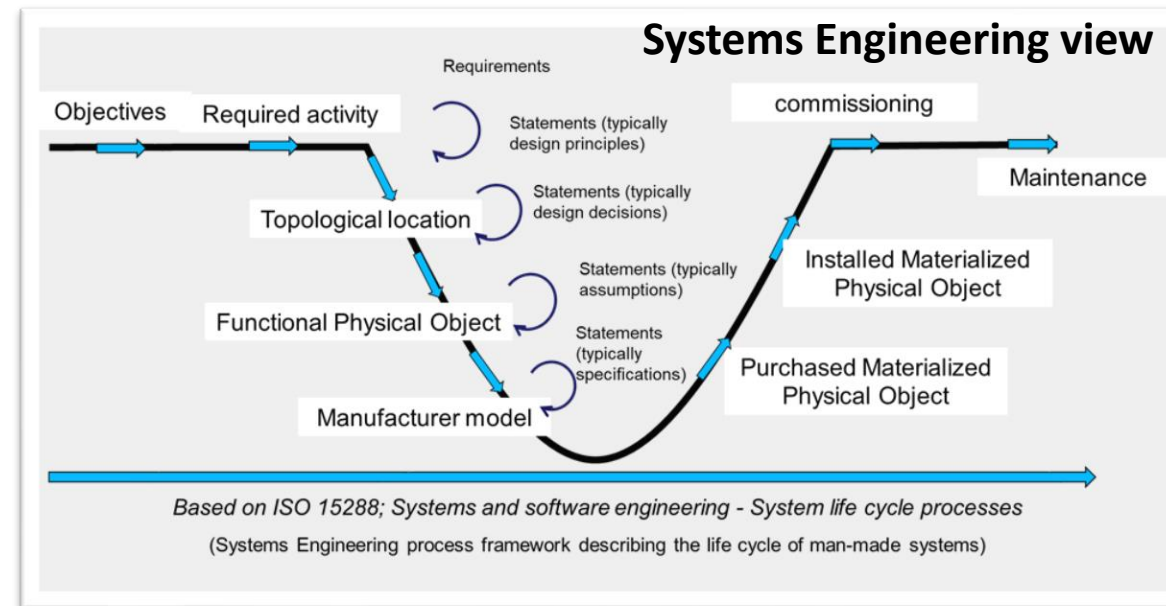
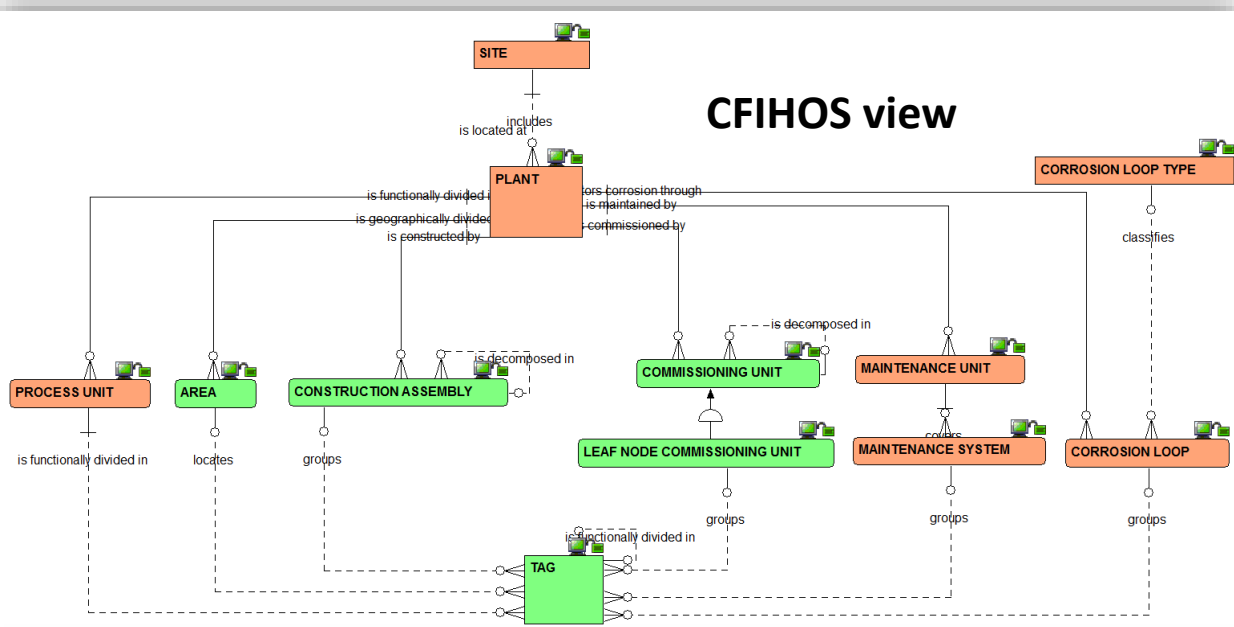
ISO 15926-11 ontology is free downloadable from <https://standards.iso.org/iso/ts/15926/-11/ed-2/en/> (>300 semantic relationships defined by domain and range)



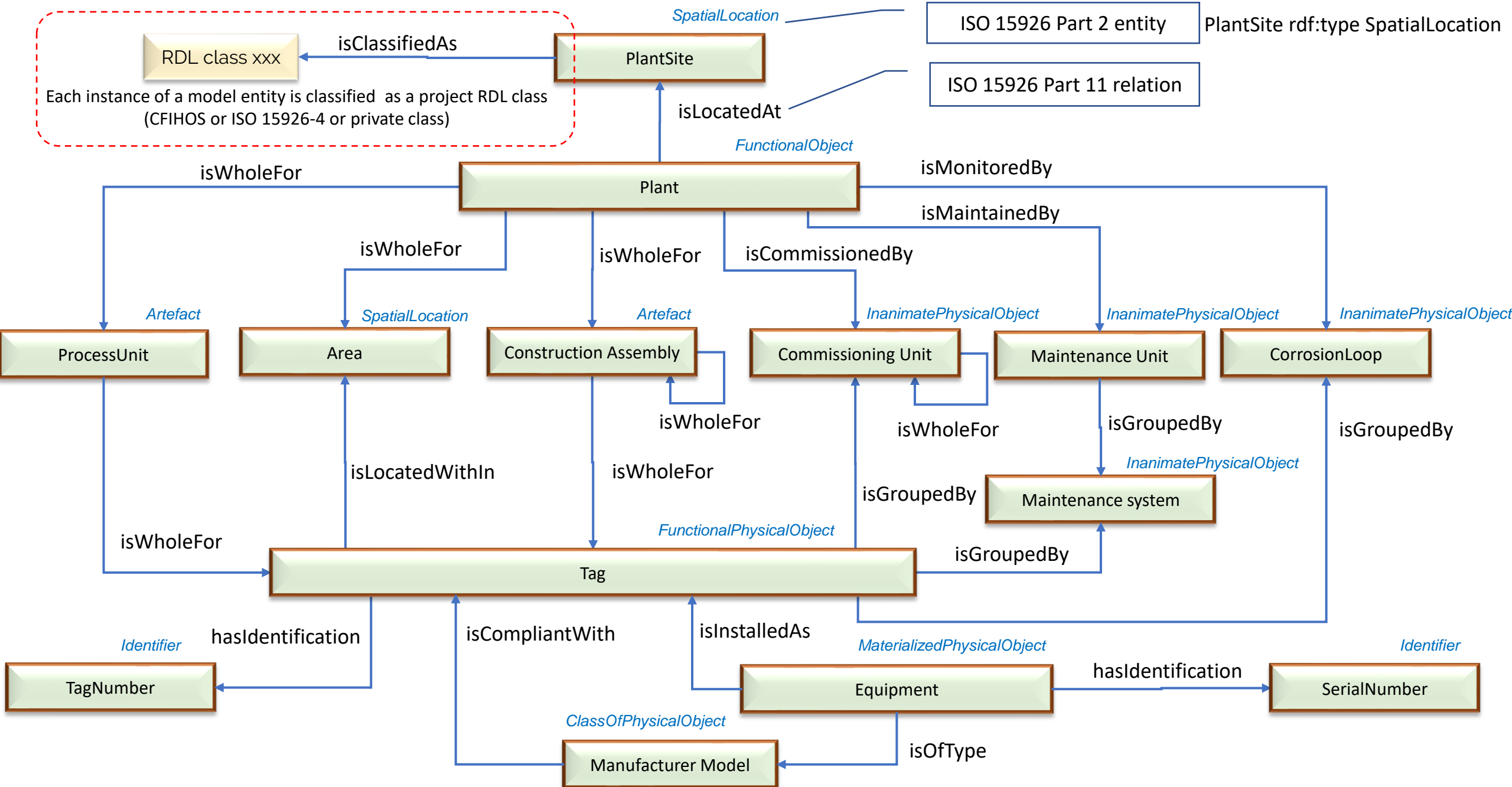
Creating project data base on ISO 15926-11 and usage of the 'class of class' mechanism



Views on plant life cycle data integration

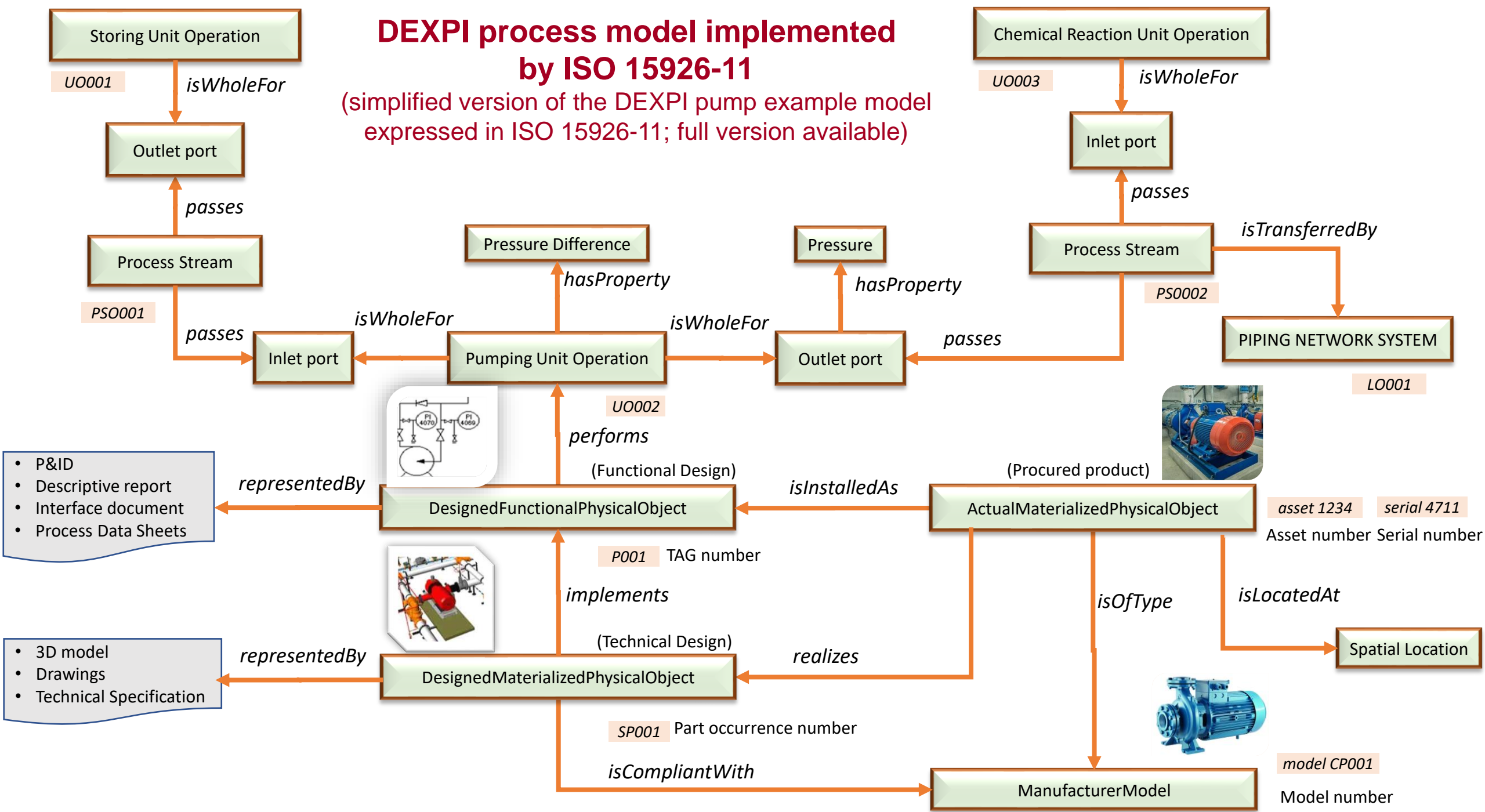


CFIHOS plant life cycle data breakdown structure: an ISO 15926-11 implementation



DEXPI process model implemented by ISO 15926-11

(simplified version of the DEXPI pump example model expressed in ISO 15926-11; full version available)



Systems Engineering: ISO 15926-11 implementation of requirement management

ClassOfTypeOfStatement

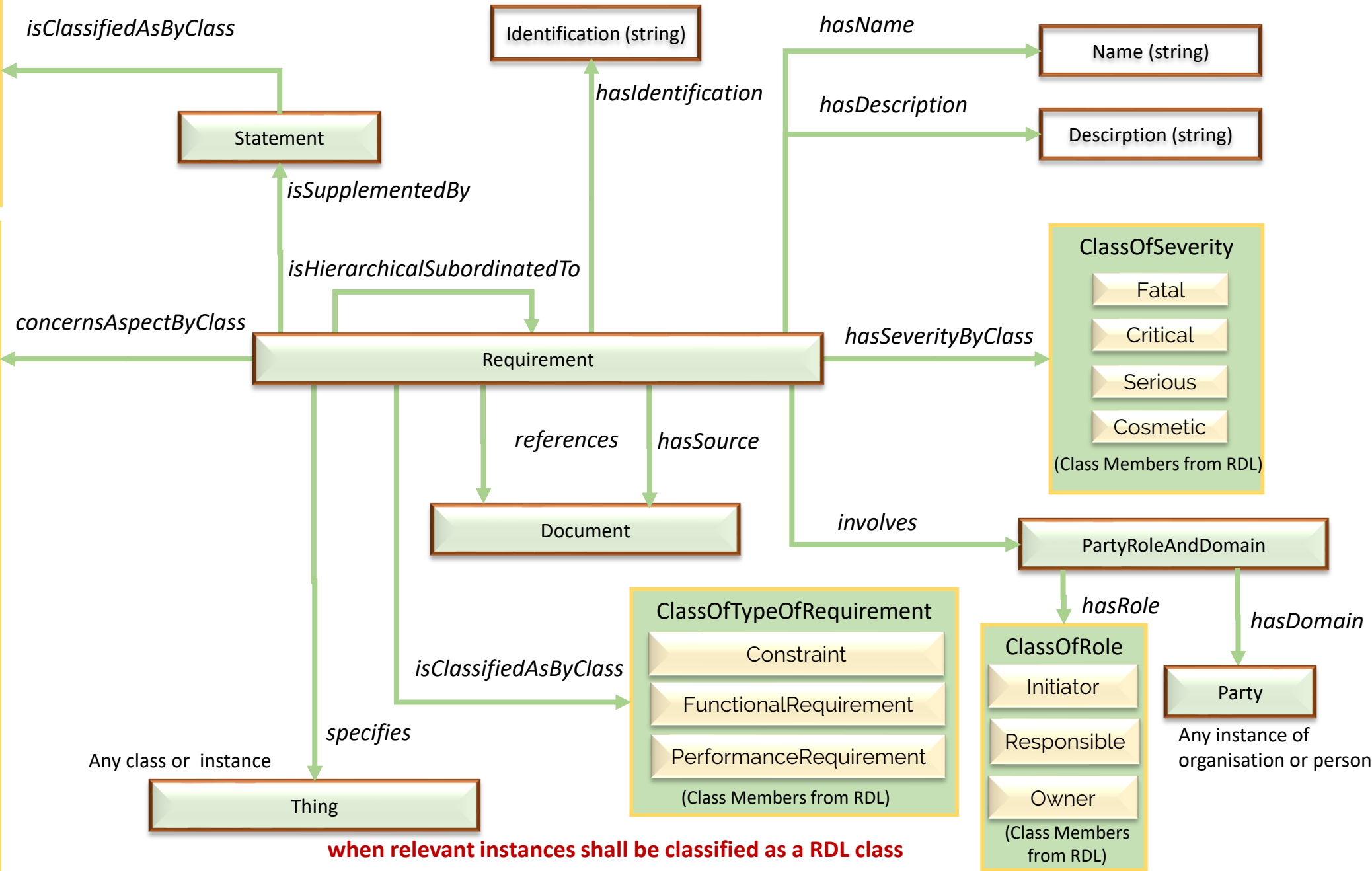
- Context
- Assumption
- Rationale
- Explanation

(Class Members from RDL)

ClassOfAspect

- reliability
- availability
- maintainability
- safety
- security
- health
- environment
- economics
- politics
- usability
- flexibility
- constructability
- testability
- sustainability

(Class Members from RDL)



The life cycle model (ISO 15926-11 and EN 17632)

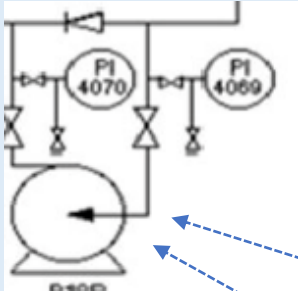
Planned Entity

Actual Entity

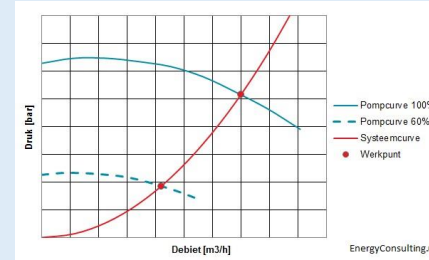
Functional Entity

Technical Entity

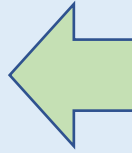
Functional Design
(Required performance)



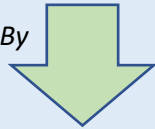
Asset performance management



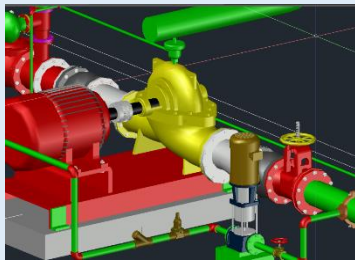
Is Realized Performance Of



Is Implemented By



Technical Engineering



Is Installed As

Date B

has Actual Performance



Maintenance of assets

replaces

Date A

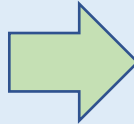


Warren model S210
Serial WQ234516



Kishor model QW24
Serial PU637773

Is Physical Realized By



Characteristics ISO 15926-11 semantic modeling methodology

- Allows to harmonize / integrate various 'plant life cycle data' approaches.
- Highly scalable.
- Machine AND Human readable (explainable to engineers => required for adoption).
- Adequate semantic precision (scalable).
- Supports change and configuration management (reified triples and Named Graphs).
- Works with any data reference library.
- Commercial databases / tools on project level available.
- With SPARQL combined with e.g. Python, any functionality can be realized.
- Supports Syntactic quality, Semantic quality AND Pragmatic quality according to ISO 8000.



USPI will organize a deep dive workshop Q3 2024:

‘ISO 15926-11 combined with a RDL (and other international standards) to create a Common Data Environment (CDE)’

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