

The Open-Source path to Interoperability and Digital Transformation

Project Results: Arrowhead fPVN

fPVN = flexible Product Value Network

Jan van Deventer | October 2, 2024



**ARROWHEAD
fPVN**

An Ecosystem

Integration through open source

- By leveraging an open **ecosystem** that overcomes protocol and semantic challenges, you can **seamlessly** embrace **digital transformation** without costly infrastructure changes—unlocking significant savings and new revenue opportunities.
- The ecosystem combines the **Industrial Data Ontology (IDO)** with the **Arrowhead framework**, working together to provide seamless interoperability and digital transformation capabilities.



Some results

Presentation time is limited

- Semantic model of a plant (a simple pump station)
- Semantic model of a cyber physical local cloud during operations
- Request for information between stakeholders and semantically correct DPPs



What is an Ontology?

How do you use it?

- An **ontology** is a structured classification of 'things' and the relationships between them. It defines categories and how these categories connect.
- A **semantic model**, on the other hand, relies on ontologies to organize specific instances of these 'things' and their relationships in real-world contexts.
- For example:
 - A vehicle has a motor and a person steers it.
 - A boat, outboard motor and a captain.
 - A car, a V6 engine and a driver.



Pump station

Simplified version of one of the use cases

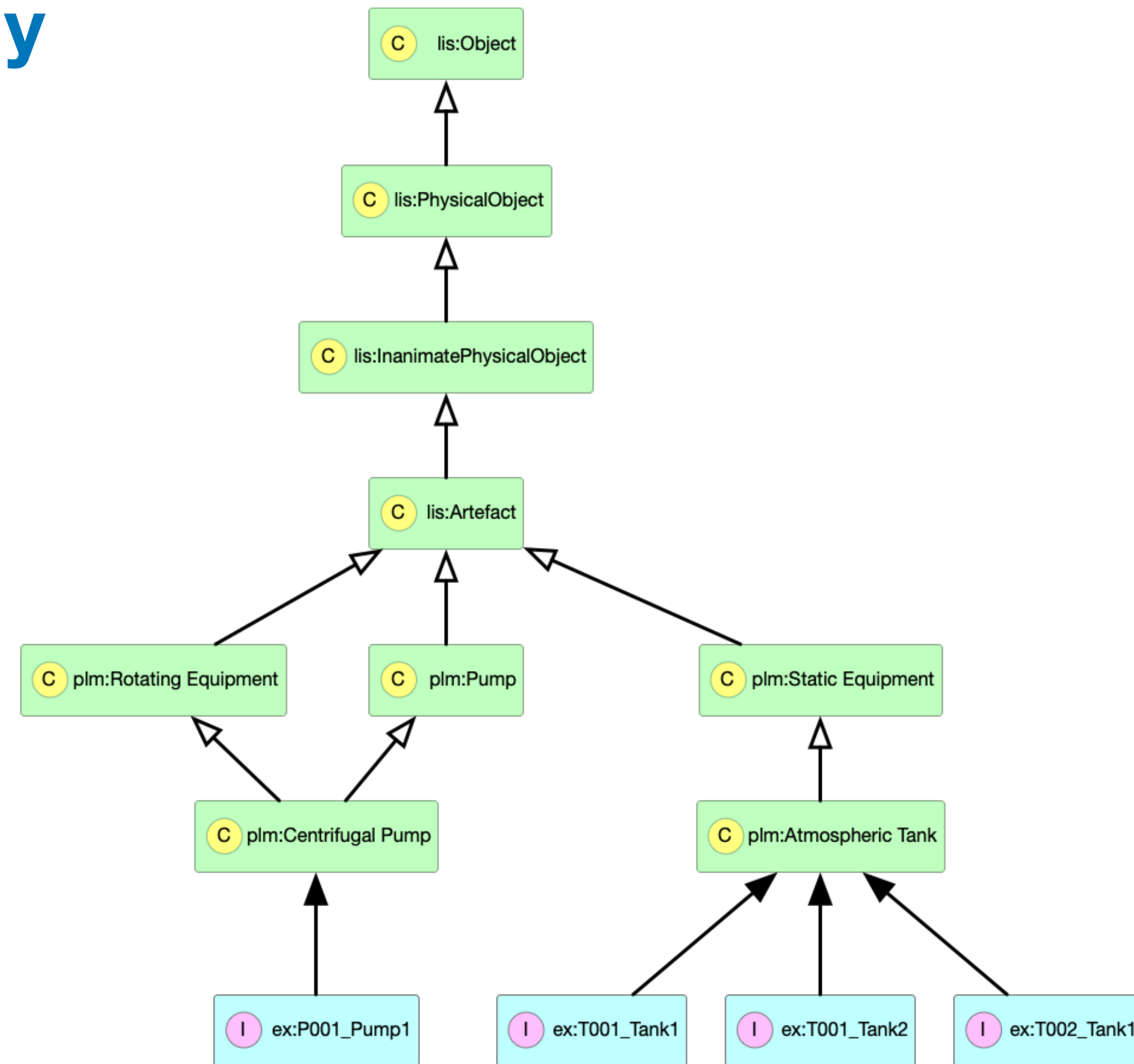
- Semantic model
 - Pump
 - Tanks
 - Pipes
- Model with IDO & PLM



Pump & Tanks

Reference to an upper ontology

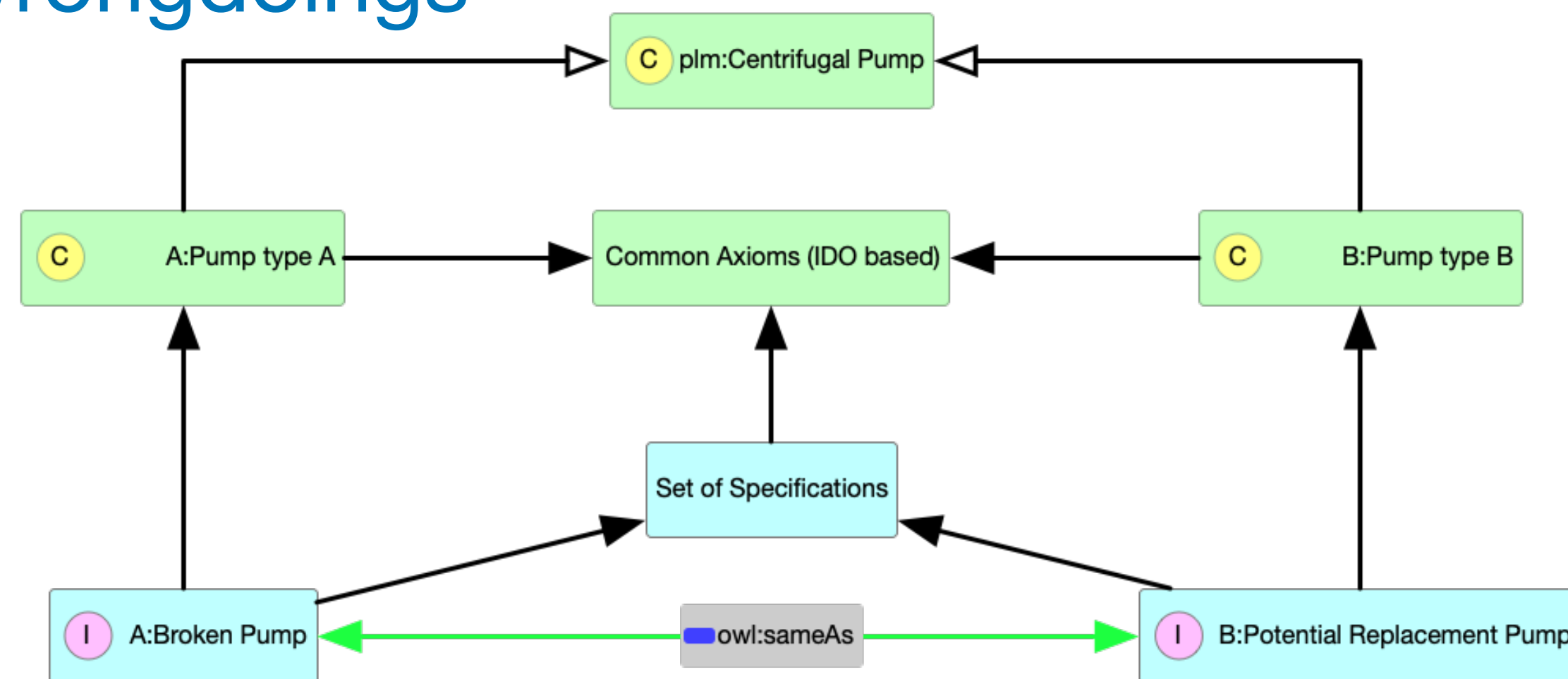
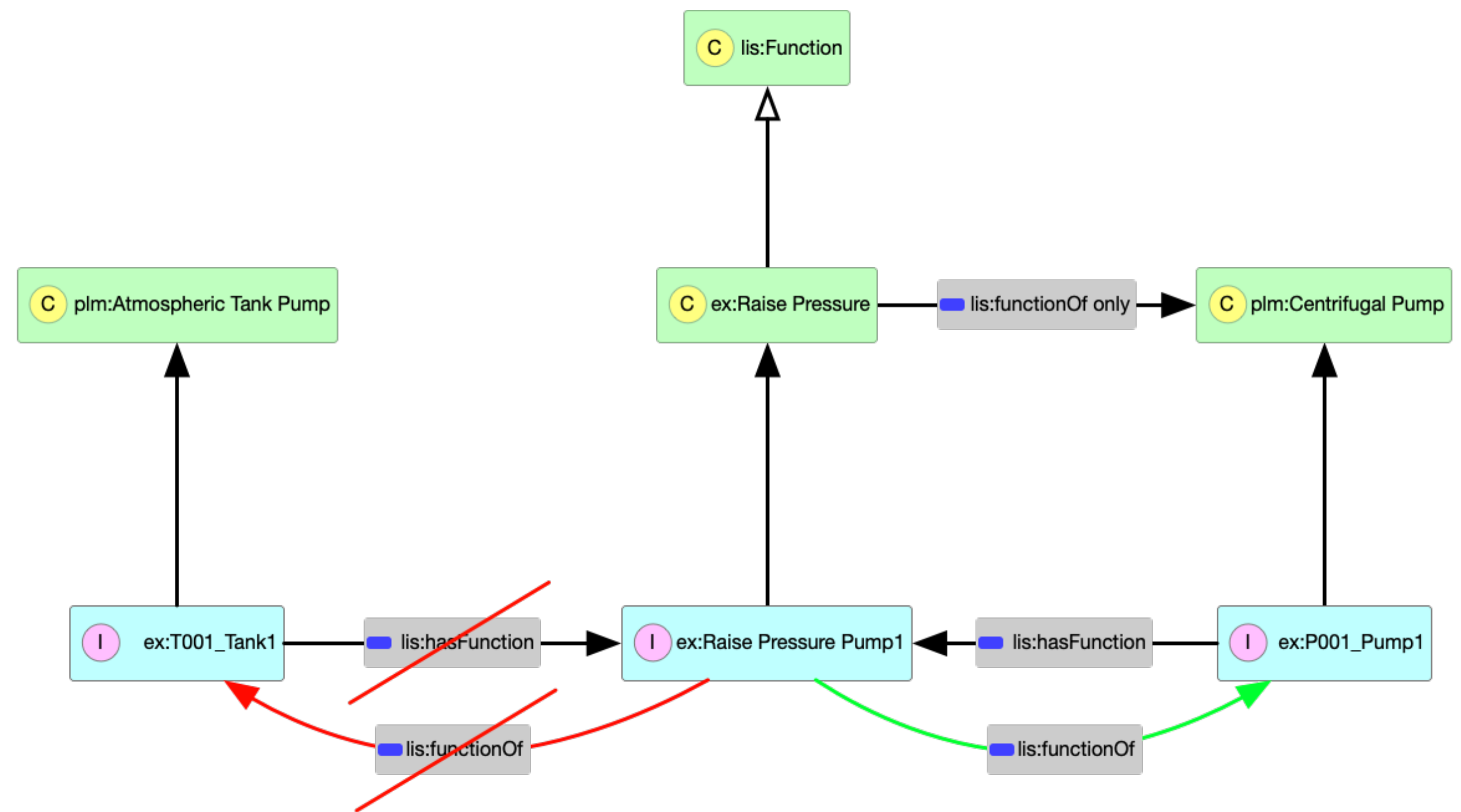
- Classes & Individuals
- Interoperability through alignment



Applications

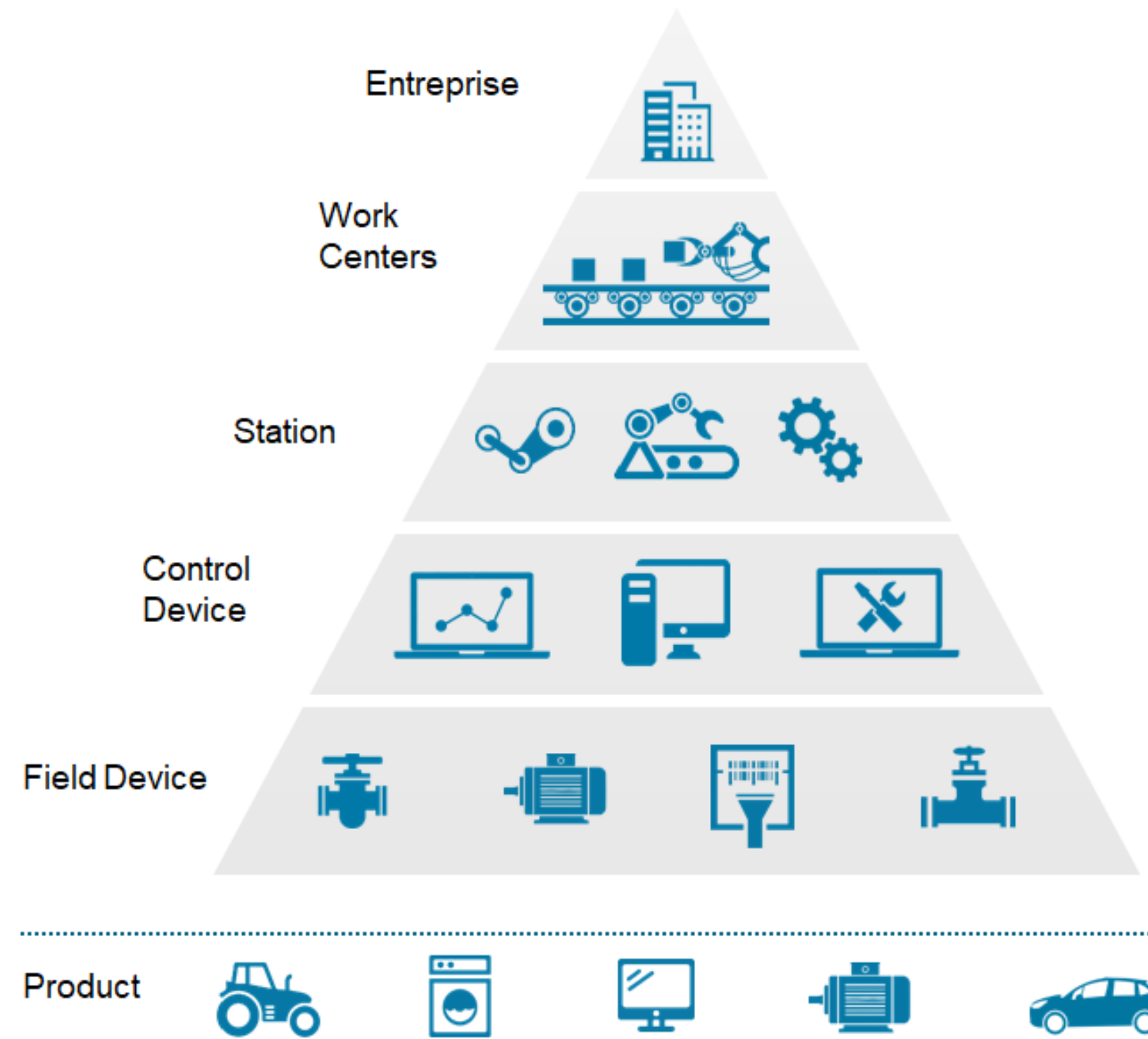
Modeling & replacements

- Axioms
 - Give shape to the model
- Reasoning engine
 - Infer knowledge and detect wrongdoings
 - Find a correct replacement



ISA 95 & Industry 4.0

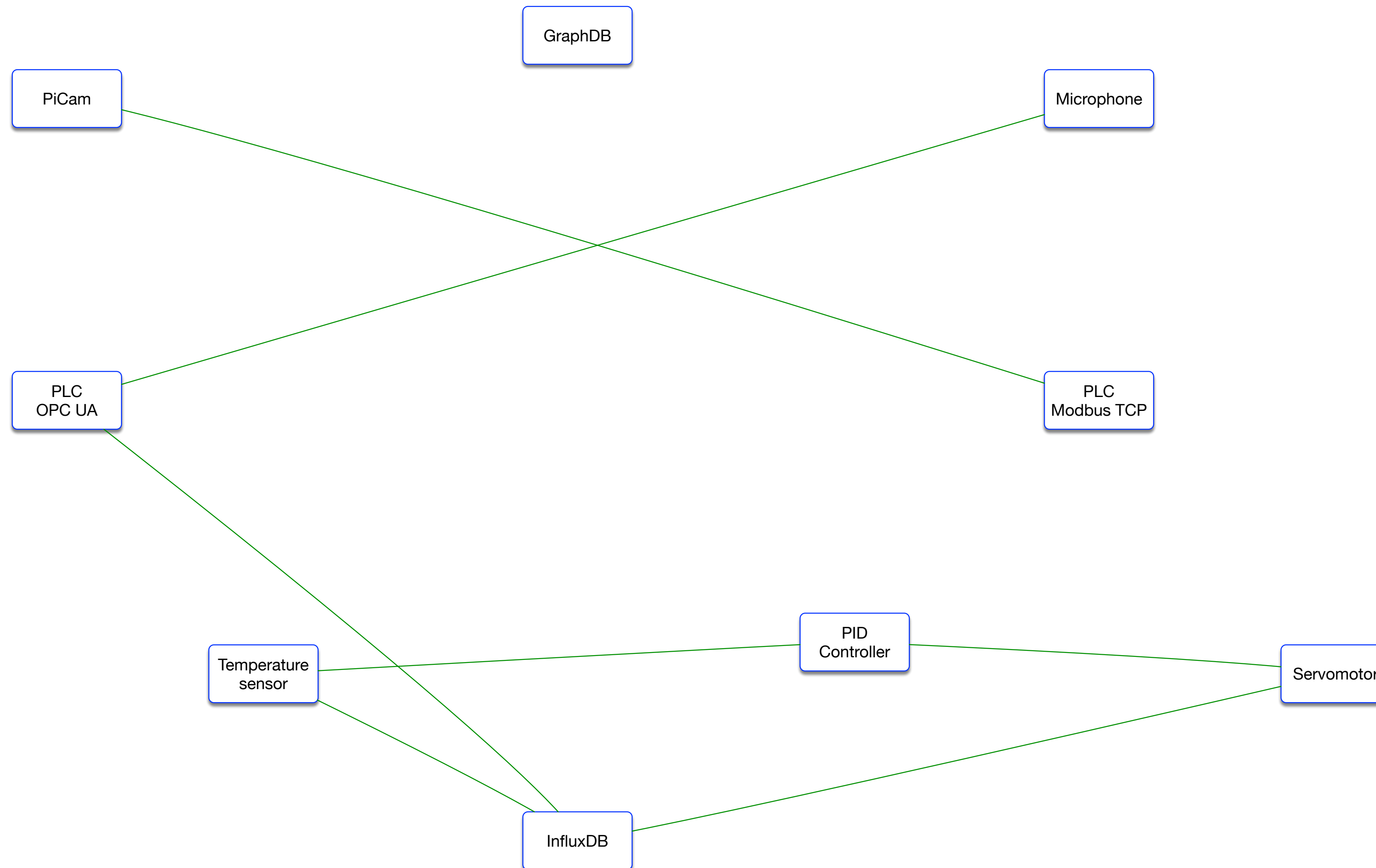
The promises of interconnections



Grafik © Anna Salari, designed by freepik

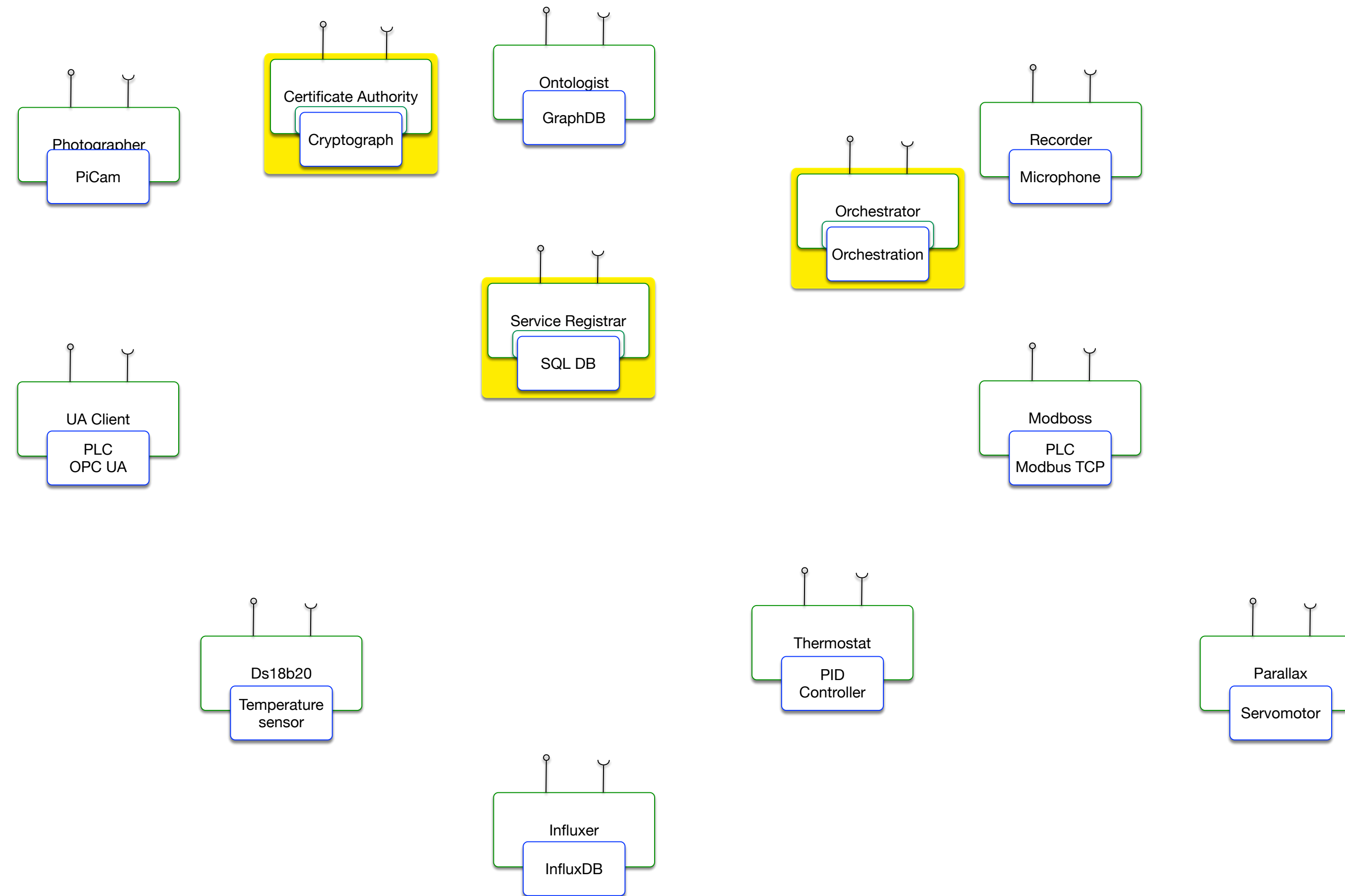
Connecting assets

No prior knowledge => Binding @ run time



The Open Source Arrowhead framework

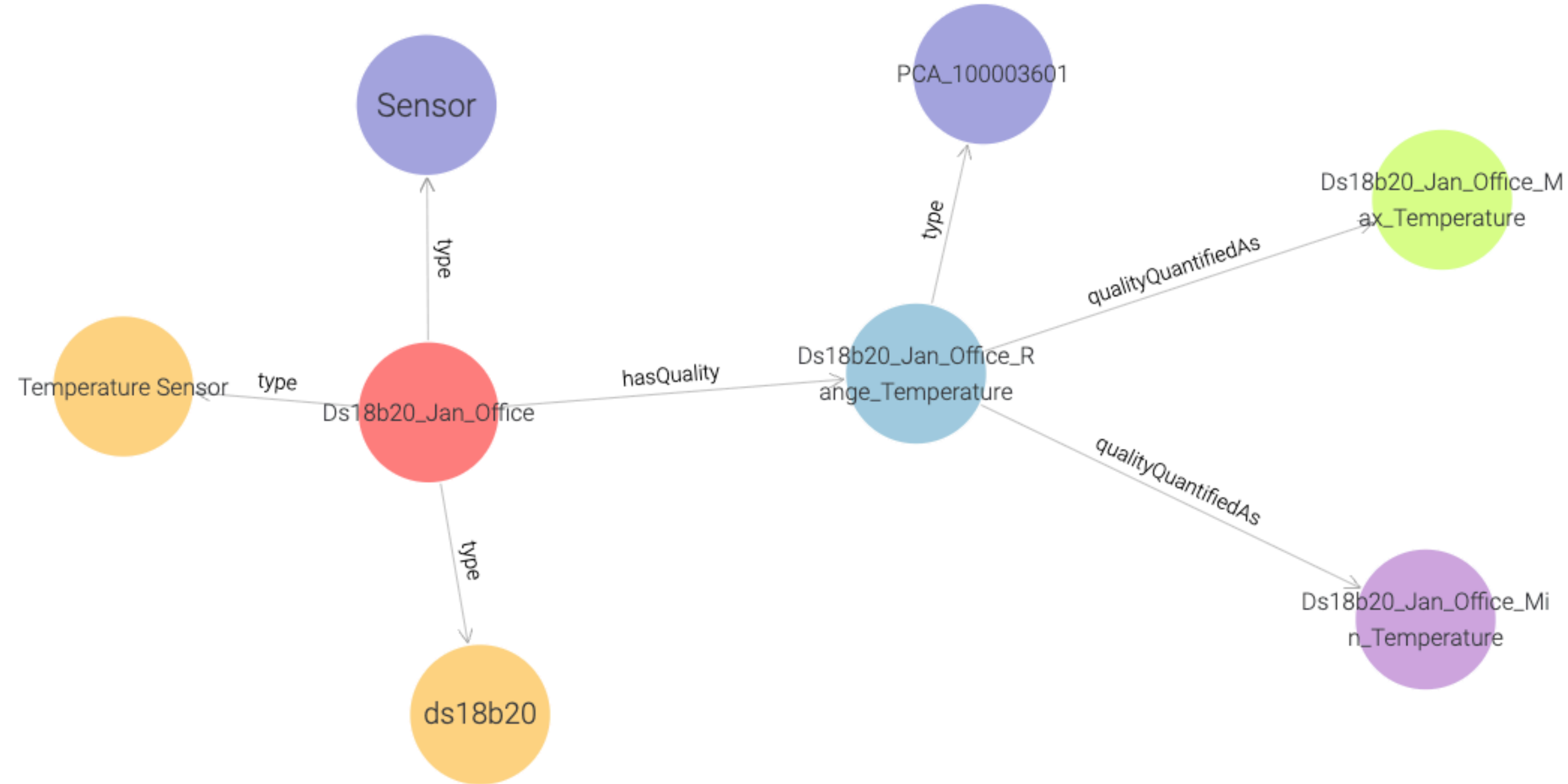
A system = Asset + Software interface



Exposing assets' functionality as services

Semantic model @ run time

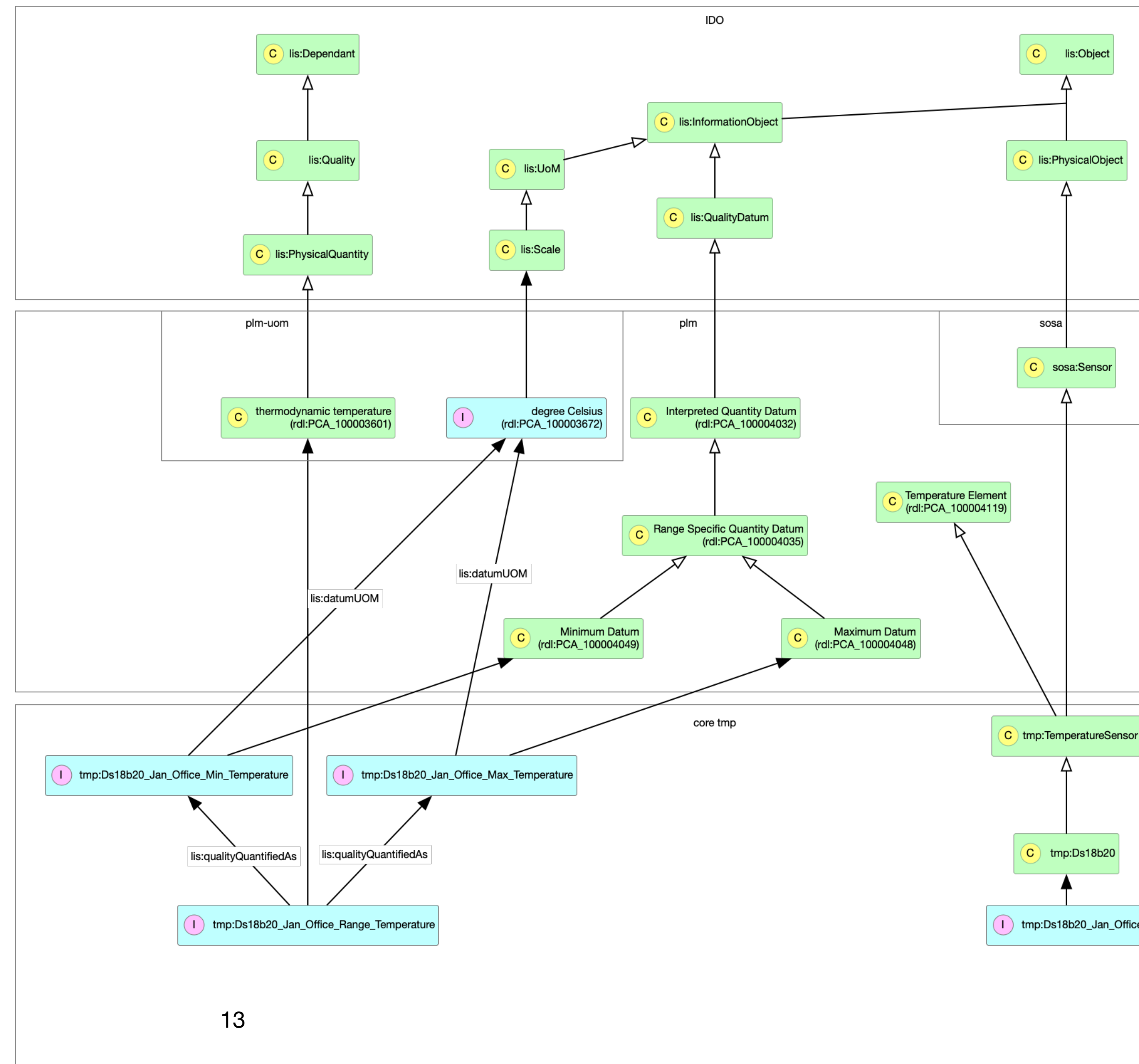
Live demo if desired



Connecting to an upper ontology

IDO:

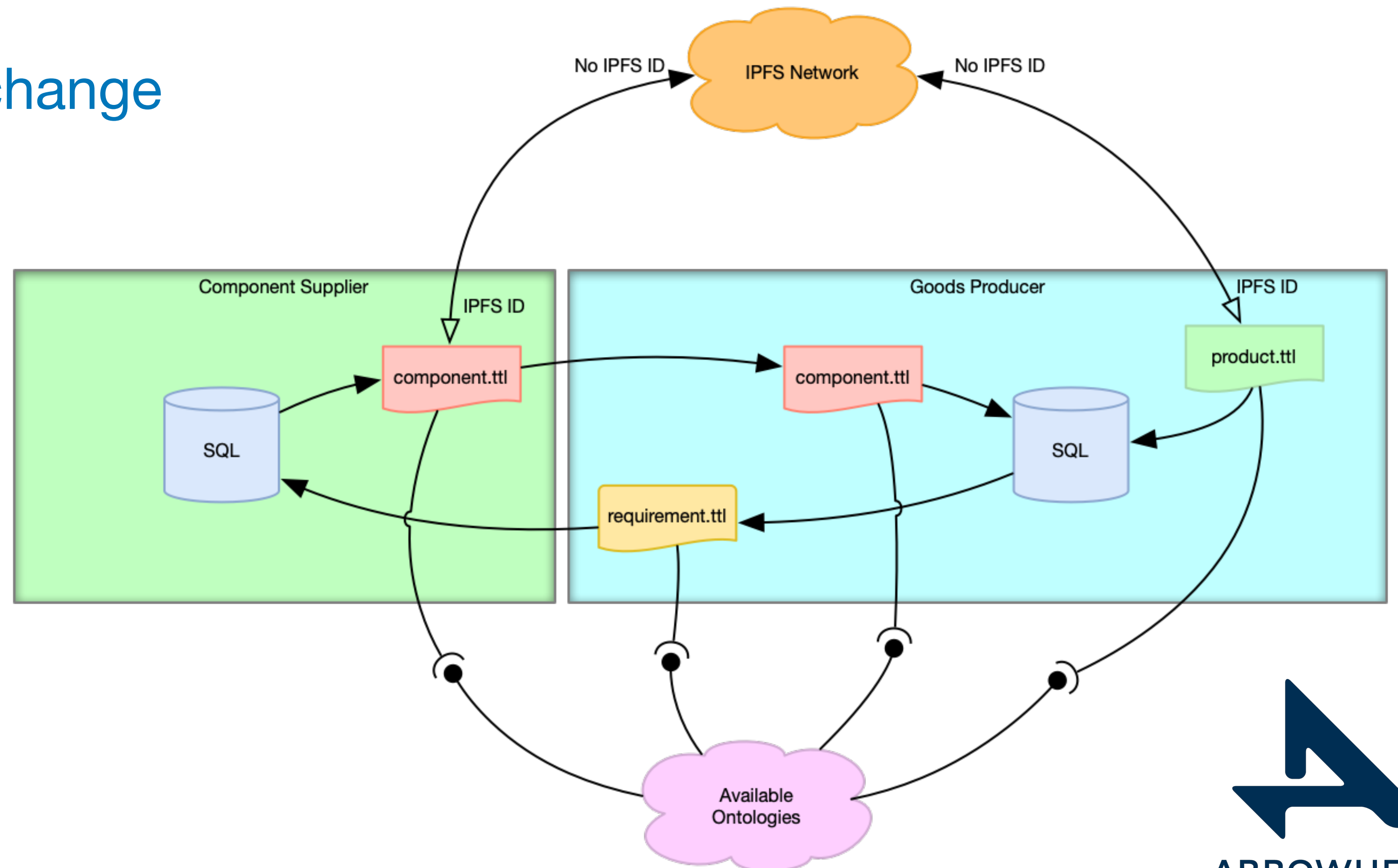
- No duplication of work
- Semantic interoperability



Business interactions

Semantically modeled Digital Product Passport (DPP)

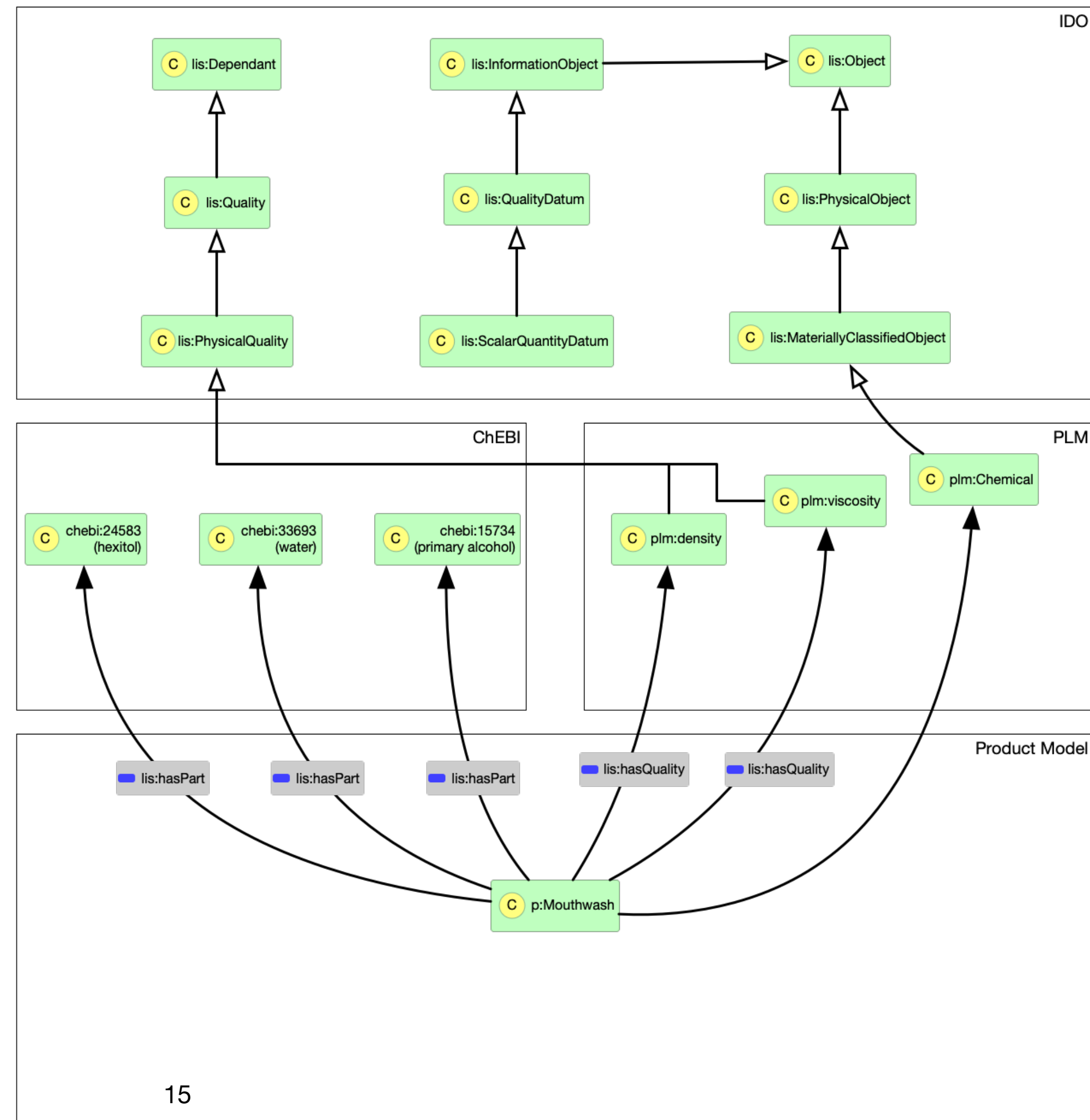
- Complete information exchange
- Traceability
- Transformation of existing technology
- Process optimization



Chemical composition semantic model

Mouthwash example

- Composed of
 - Alcohol
 - Sorbitol
 - Water



Conclusion

Transforming what you have rather than changing it

- Whatever communication protocol your devices and information systems use, they can communicate seamlessly and understand what they mean. This is made possible by using:
 - The open source Arrowhead framework
 - ISO 23726-Part 3 (Industrial Data Ontology, IDO)



Contact

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