



WHEN TRUST MATTERS

Industrial Data Ontology

Status update to IDO-OBI training community

Dirk Walther, Johan Wilhelm Klüwer, Pål Rylandsholm

30 April 2026

A global assurance and risk management company

15,000+

employees

100,000+

customers

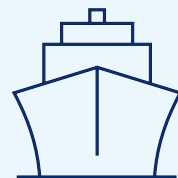
100+

countries

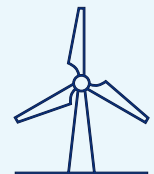
6%+

of revenue to R&D

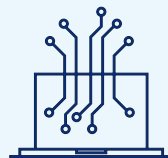
Ship and offshore
classification and advisory



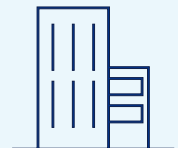
Energy advisory, certification,
verification, inspection and
monitoring



Software, cyber security, data
platforms and
digital assurance



Certification and assurance across
industry sectors, including
healthcare and ocean health



Industrial ontology and asset modelling services

Get value from your data



Key services

Ontology & model development

Data integration & model deployment

RDL development

Training & governance

Advisory services

How we help and key benefits

- Provide and support customers with a trusted data foundation, framework and semantic technology expertise
- Design, build, deploy and maintain standardized models that unify data across systems and supply chains
- Ensure compliance with industry standards and best practice
- Industrial Ontology Tool – enabling customers to scale, building Ontologies from data

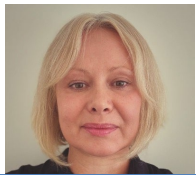


Development and standardization of IDO has been a true team effort

IDO Core Team



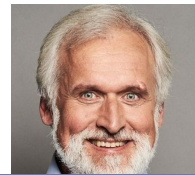
Inghild Kaarstad
Standards Norway



Kristina Tomicic
Aker Solutions



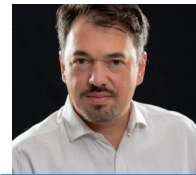
Jann Slettebakk
Aker Solutions



Andreas Neumann
Freelance catalyst



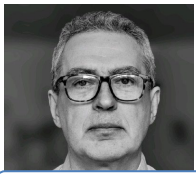
Dirk Walther
DNV



Michel Sauvage
Airbus



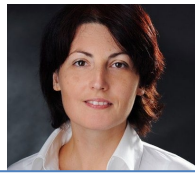
Mikkel H Brynildsen
Grundfos



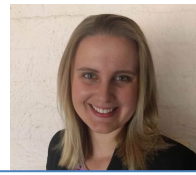
Mihaly Fekete
Equinor



Per-Olav Opdahl
Cognite



Maja Milicic-Brandt
Siemens



Caitlin Woods
UWA/Grundfos



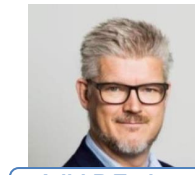
Pål Rylandsholm
DNV



Melinda Hodkiewicz
UWA



J.-C. Leclerc
Total Energies



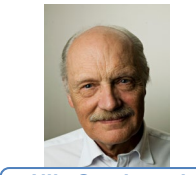
Arild B Torjusen
DNV



Johan W Klüwer
DNV



Anders Gjerver
Aibel



Nils Sandmark
POSC Caesar

Part of

- ISO/TC 184/SC 4/WG 26

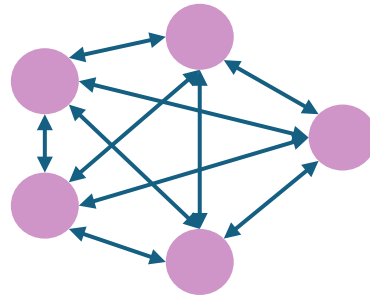
Supported by

- Arrowhead fPVN project
- DISC initiative

Content

- Industrial Data Ontology (IDO) — brief recap
- Status of the development and standardization of ISO 23726-3 IDO
- Main changes from IDO v4.1 (DIS) to v4.2 (FDIS)

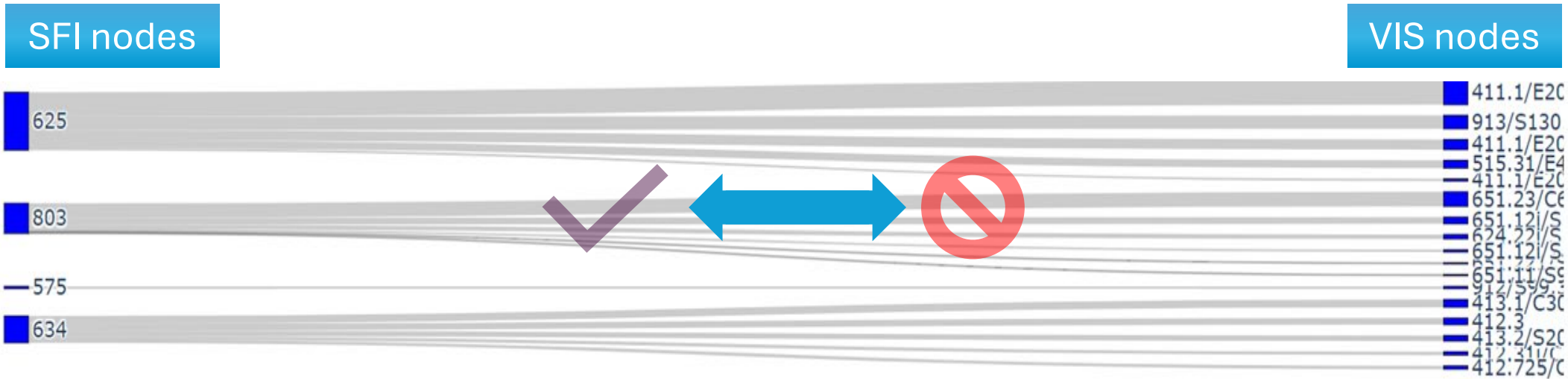
Interoperability and Integration Scenarios



Point-to-point integration

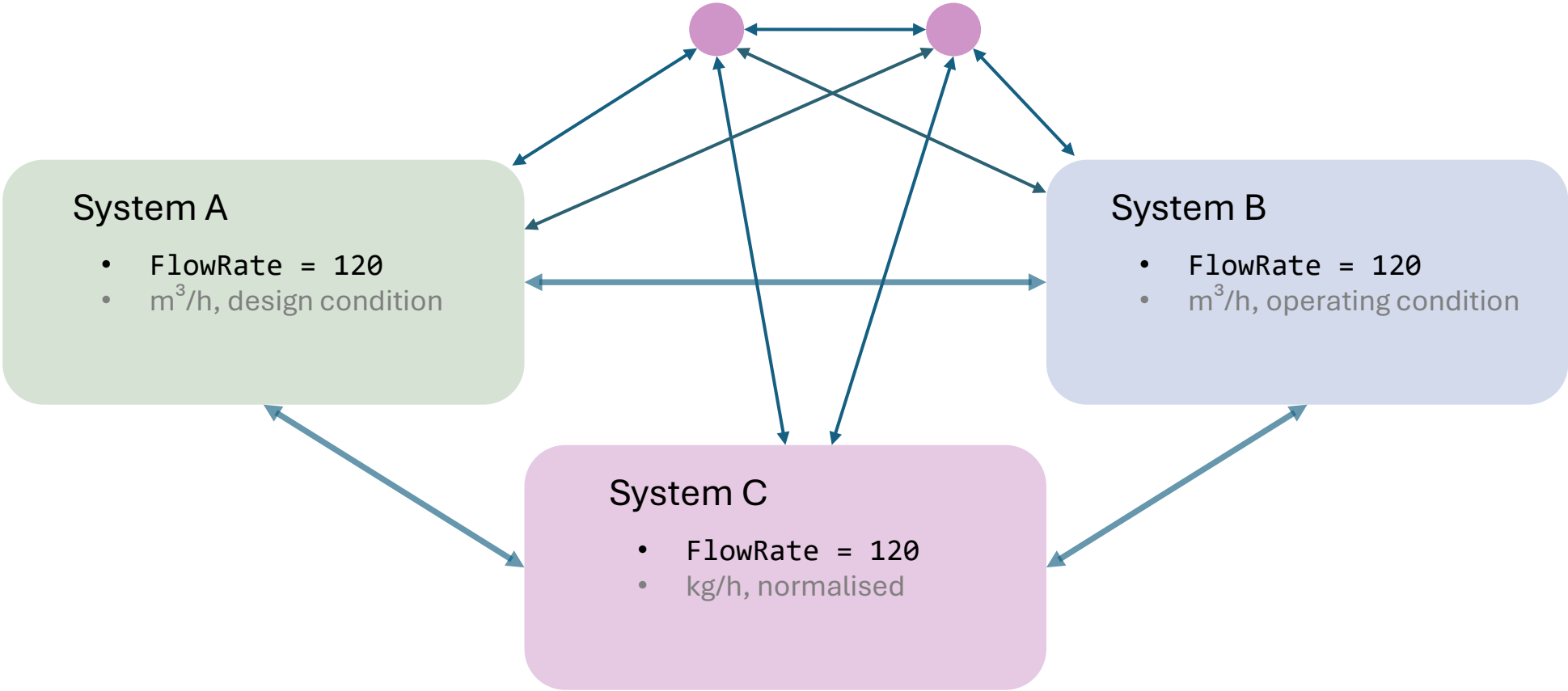
- As systems increase, integration effort explodes.

Mapping vs. Understanding



- Granularity mismatch
- Hidden assumptions
- Looks mapped—but isn't understood

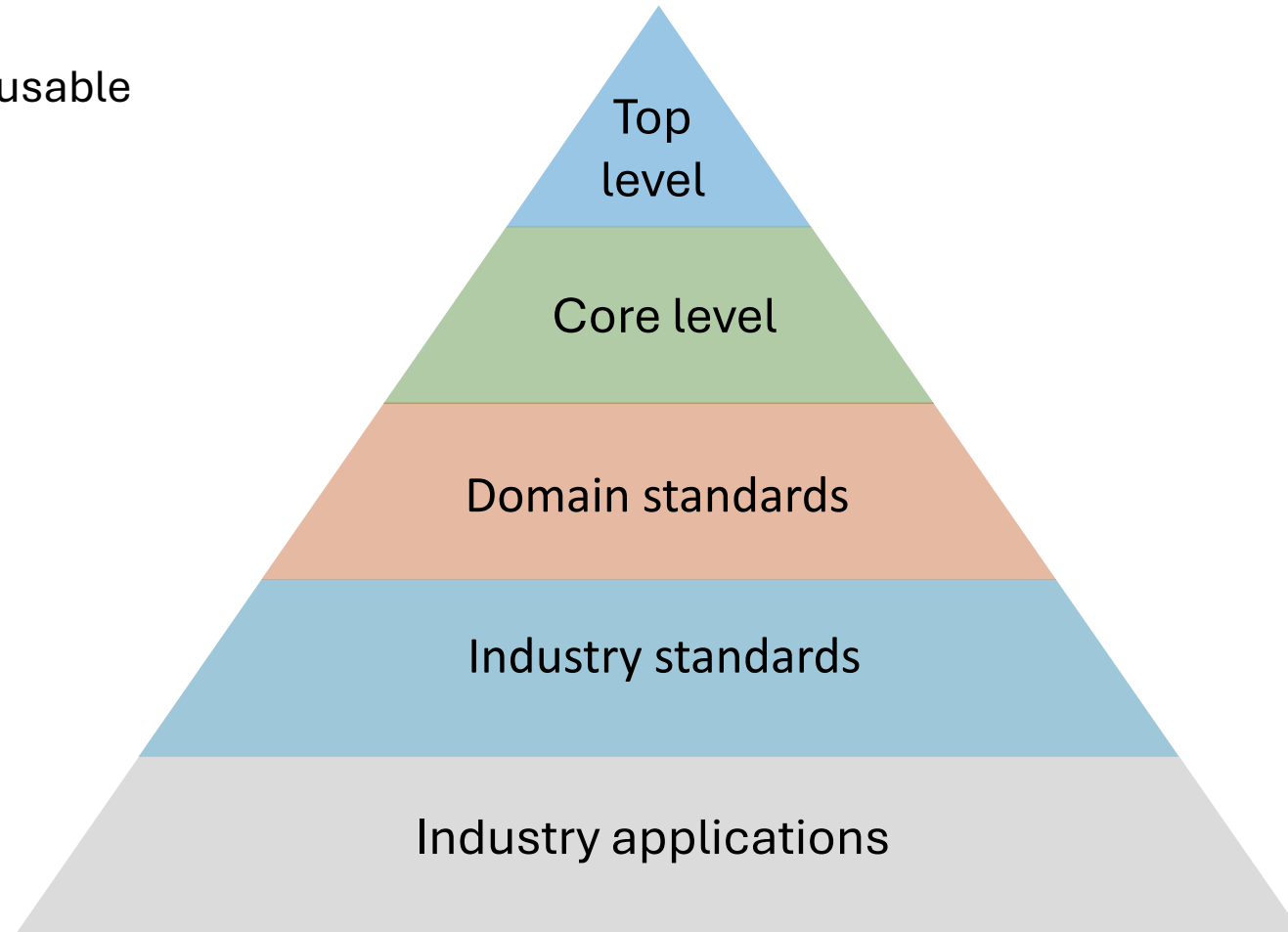
Meaning



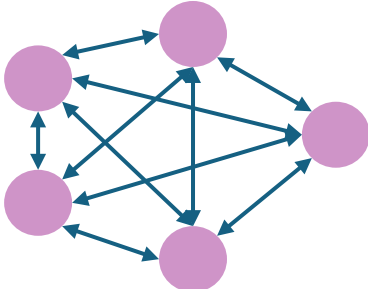
- Same data. Different meaning.

A Shared Semantic Foundation

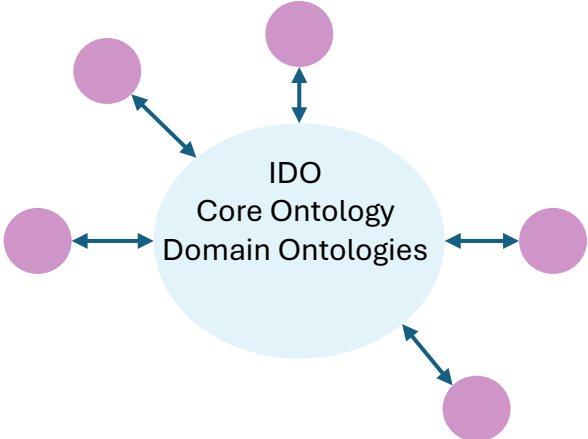
- Making meaning explicit and reusable



Interoperability Through Alignment




Point-to-point integration

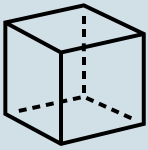


Ontology-based integration

- Each system aligns once

IDO Top-level Categories

 lis:Object




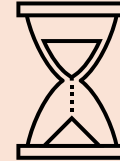
independent
entities that
persist
through time

 lis:Dependent



inherent
qualities or
potentials of
an object

 lis:Temporal



entities relating
to or occurring
in time

Second-level Categories

`lis:Object`

`lis:PhysicalObject`



tangible entities with mass and spatial occupancy

`lis:Location`



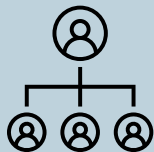
spatial regions

`lis:InformationObject`



data and information

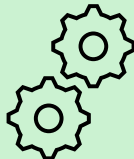
`lis:Organization`



groups with common objectives

`lis:Dependent`

`lis:Potential`



attributes realizable through activities

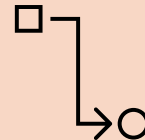
`lis:Quality`



inherent attributes

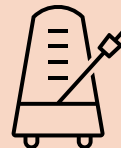
`lis:Temporal`

`lis:Activity`



temporal phenomena involving physical objects

`lis:TemporalRegion`



instances and intervals

`lis:SpatiotemporalRegion`



regions occupied by objects during specific time periods

Properties – Bridging Categories

C lis:Object

C lis:Dependent

C lis:Temporal

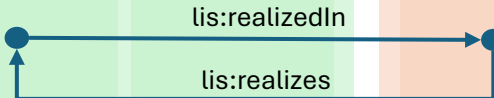
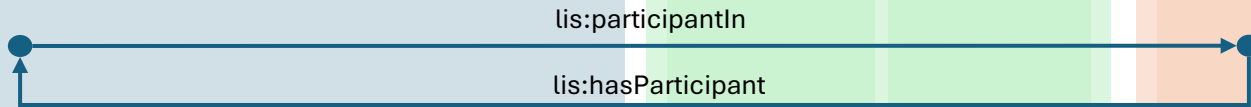
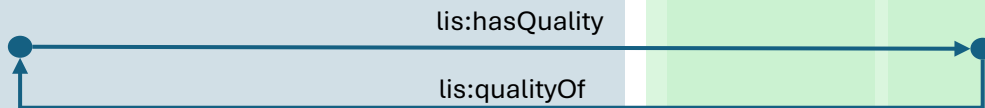
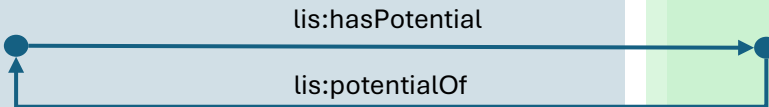
C lis:Potential

C lis:Quality

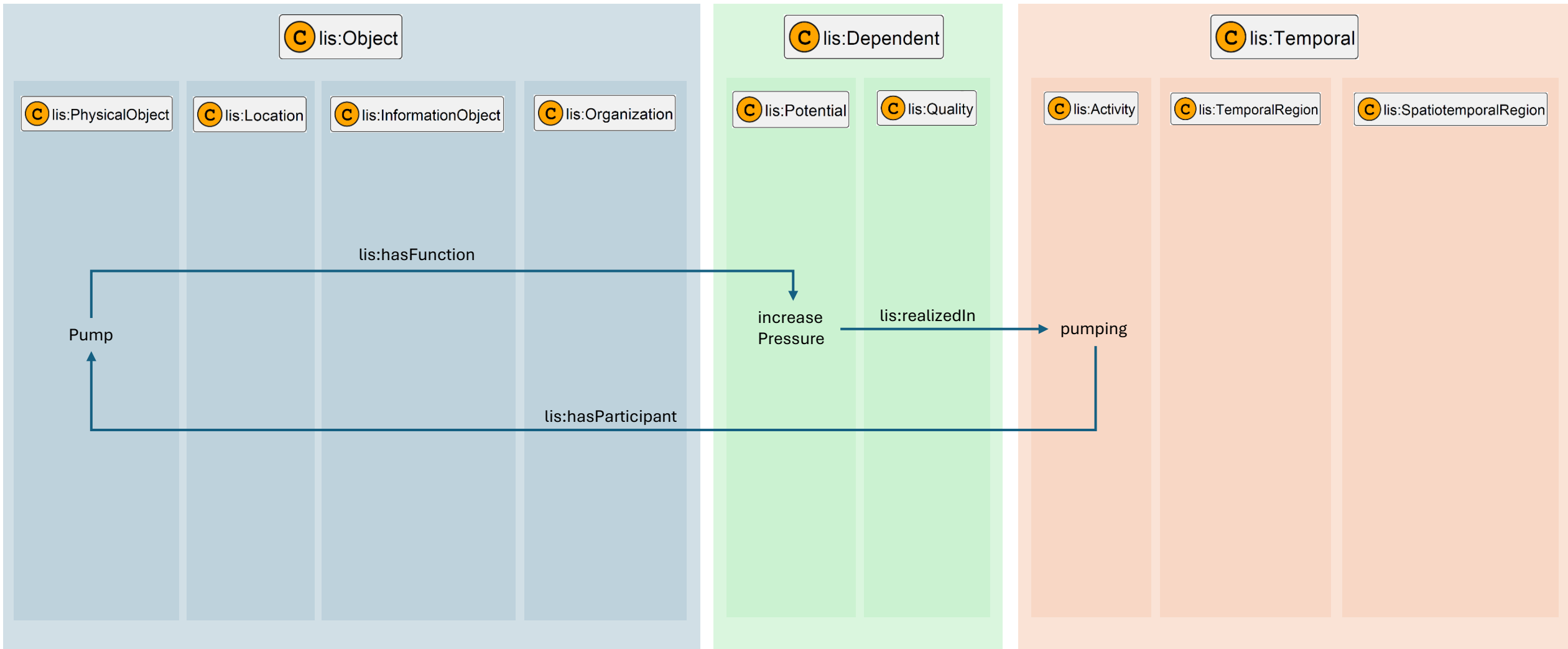
C lis:Activity

C lis:TemporalRegion

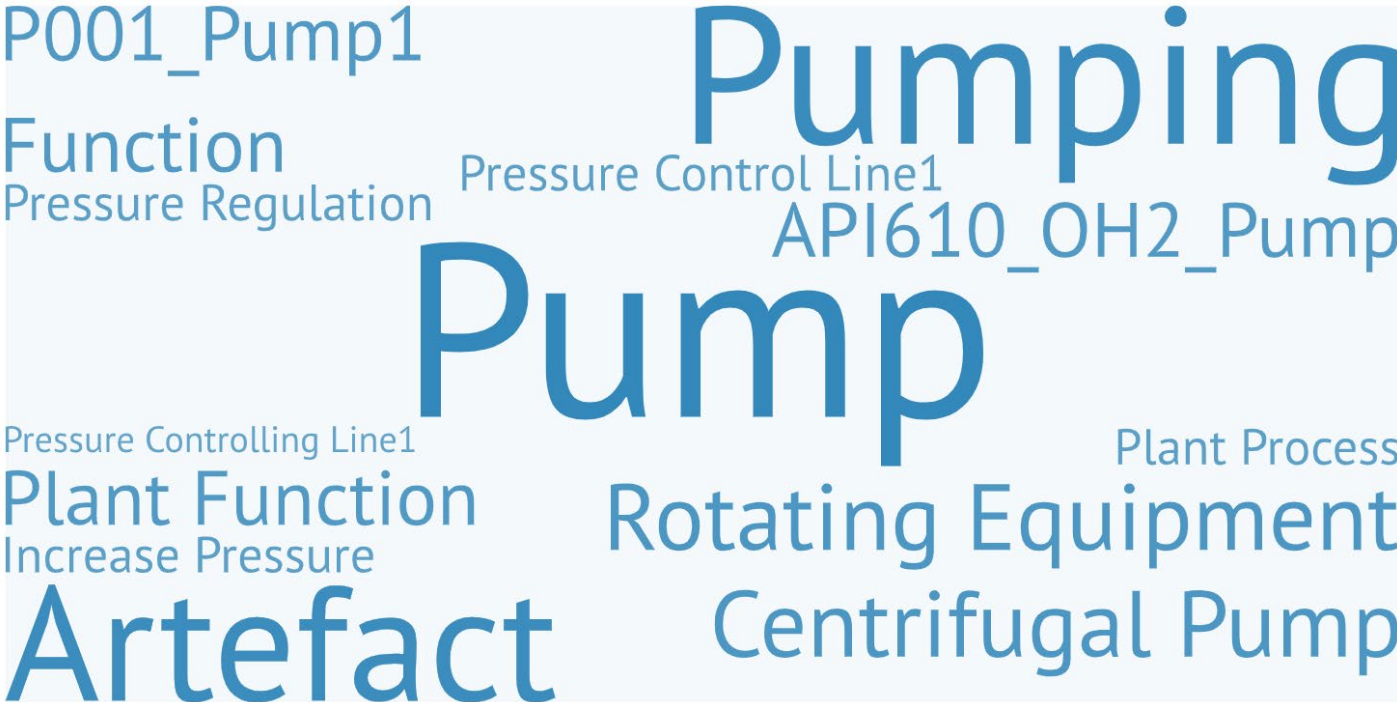
C lis:SpatiotemporalRegion



Pattern – Objects having Functions that are realized in Activities that have Participants





Pump Example – Terminology




<https://wordart.com>


Pump Example – Aligned Terminology

 **lis:Object**

 **lis:PhysicalObject**

 **lis:Location**

 **lis:InformationObject**

 **lis:Organization**

Artefact


Rotating Equipment

Pump


Centrifugal Pump

API610_OH2_Pump

P001_Pump1

 **lis:Dependent**

 **lis:Potential**

 **lis:Quality**

Function


Plant Function


Pressure
Regulation


Pressure
Control Line1

increase
Pressure

 **lis:Temporal**

 **lis:Activity**

 **lis:TemporalRegion**

 **lis:SpatiotemporalRegion**

PlantProcess

Pumping

Pressure
Controlling
Line1

pumping

Pump Example – Relate Terms

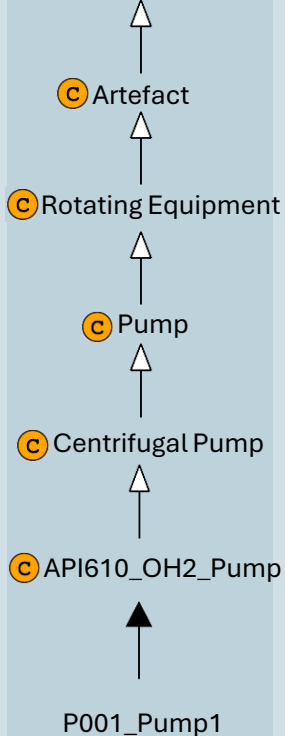
C lis:Object

C lis:PhysicalObject

C lis:Location

C lis:InformationObject

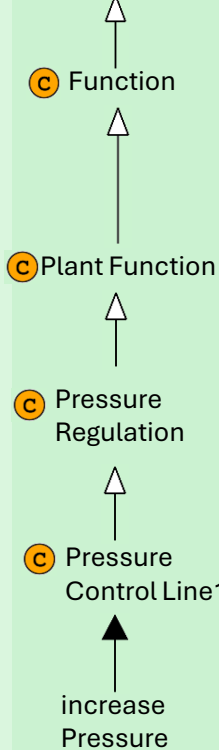
C lis:Organization



C lis:Dependent

C lis:Potential

C lis:Quality

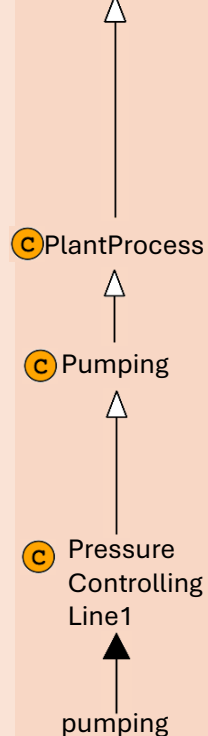


C lis:Temporal

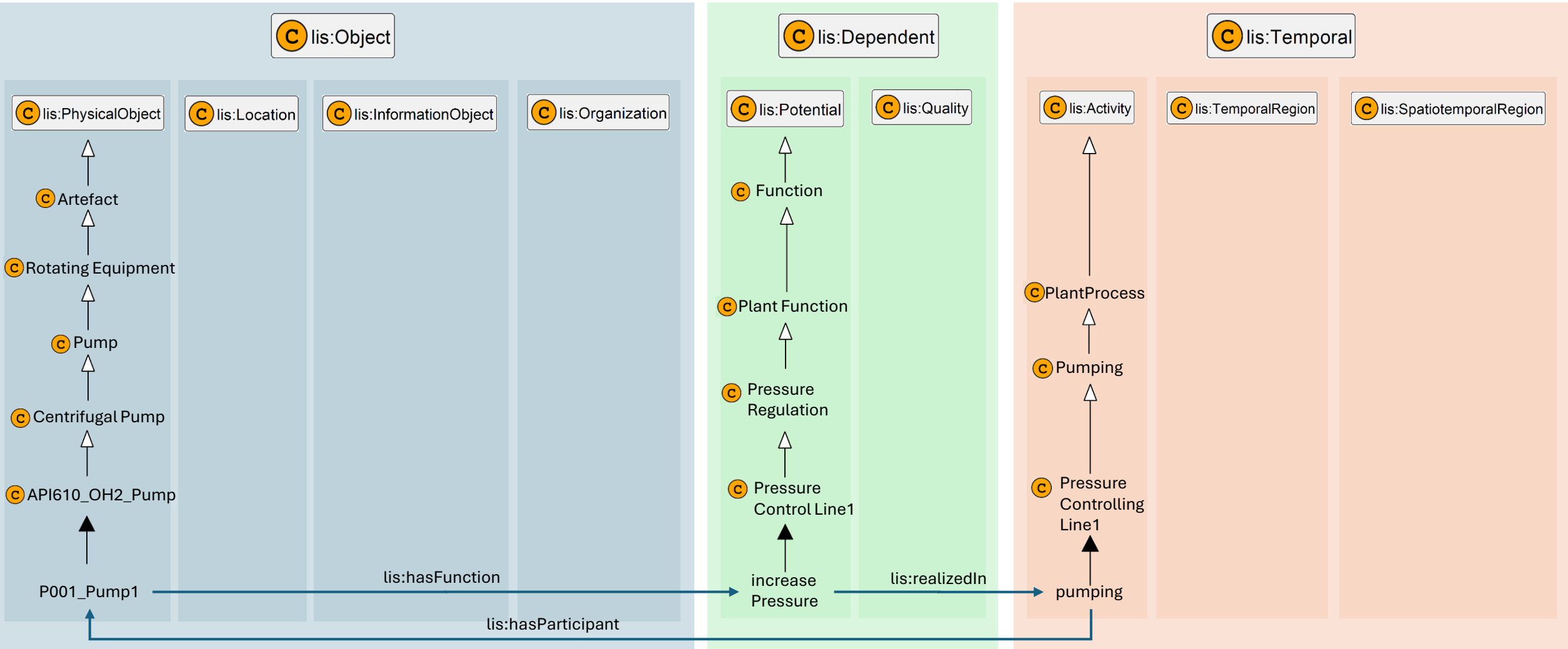
C lis:Activity

C lis:TemporalRegion

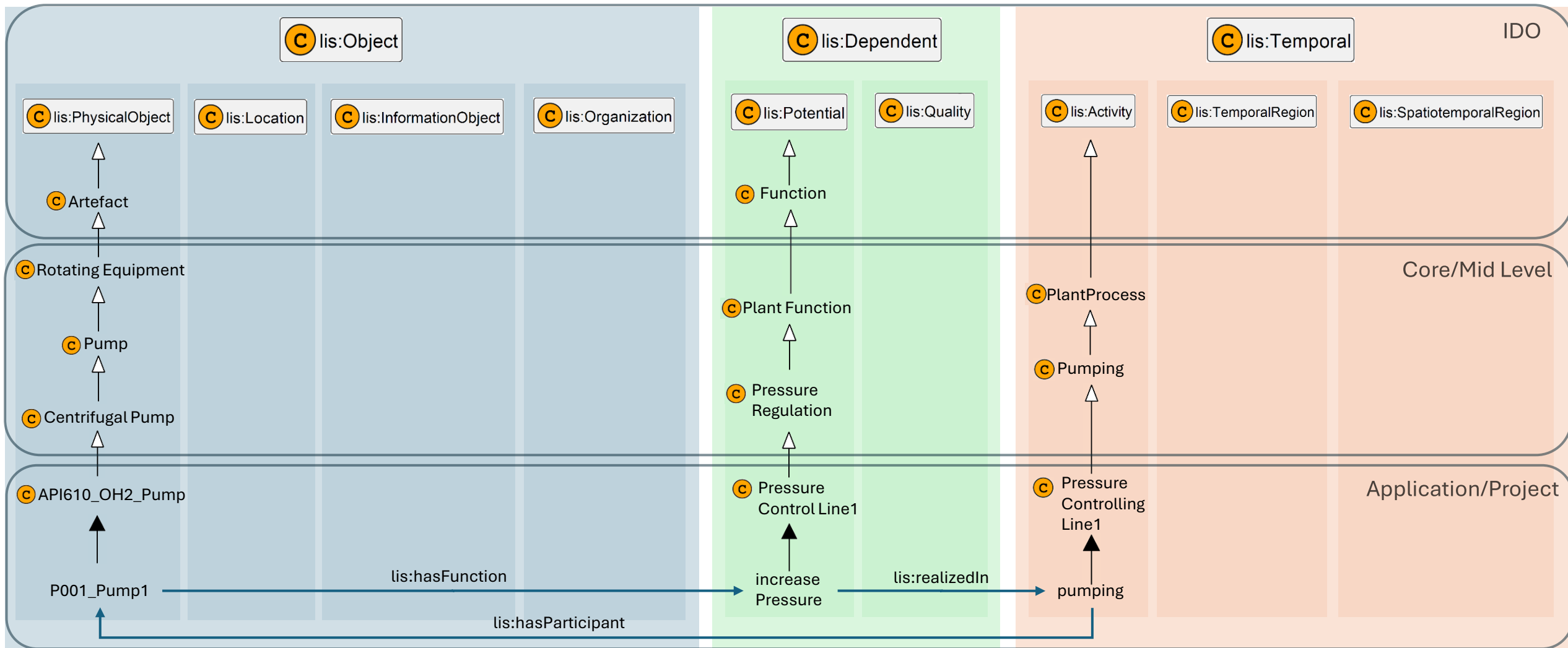
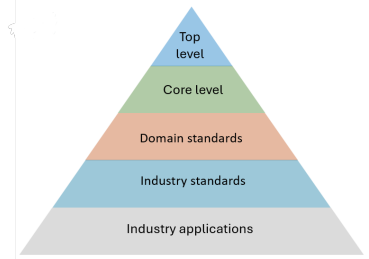
C lis:SpatiotemporalRegion



Pump Example – Relate Terms cont.



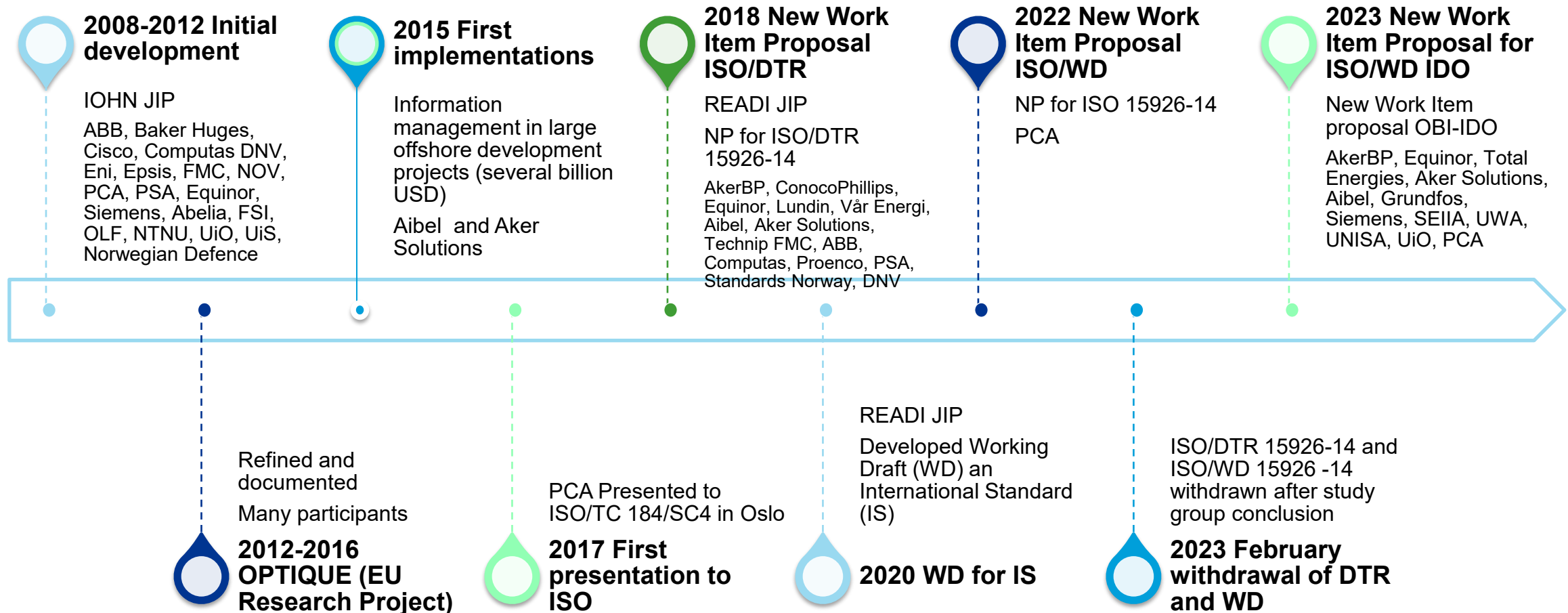
Pump Example – Layered Modular Ontology Architecture



What this enables

- **Shared understanding**
A common language with precise definitions
- **Scalability & reuse**
Models grow without re-integration
- **Consistency & quality**
Reduced ambiguity and duplication
- **Automation & assurance**
Reasoning makes implicit knowledge explicit

IDO has been developed since 2008, and the first successfully implementations was in 2015



The standardization journey has been supported by a consortium of key players since 2022

Supported and applied in several industries

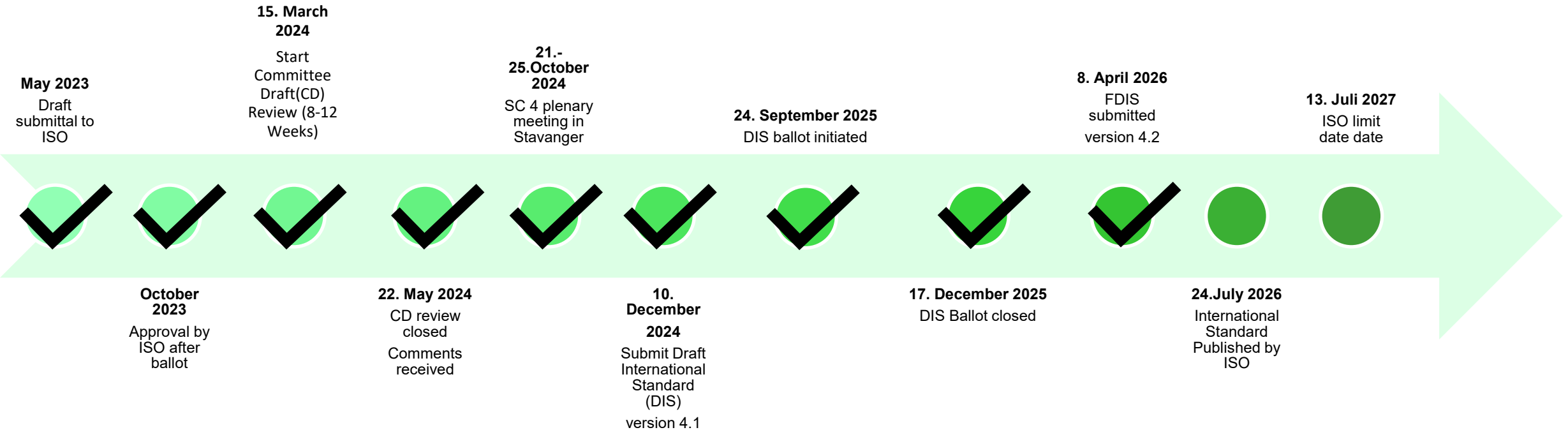


Motivation and industry requirements

- **Stable reference**
 - Secure investments done
- **Common language to integrate standards and information across industries**
- **Support automated verification, validation and quality assurance**
 - Reasoning (Artificial Intelligence)
- **Simplicity and usability**
 - Re-use when possible
 - Keep it as minimalistic as possible

IDO is scheduled to be published at the earliest July 2026

- three ballots and reviews has passed with a total of 278 comments(DIS 182)



Comments resolution ISO/DIS 23726-3 IDO → ISO/FDIS 23726-3 IDO

| Accepted or partly accepted | | | | |
|-----------------------------|-----------|----------|------------|------------|
| From | te | ge | ed | Total |
| Australia | 1 | 1 | 21 | 23 |
| Denmark | 0 | 0 | 0 | 0 |
| France | 9 | 1 | 0 | 10 |
| Germany | 1 | 0 | 0 | 1 |
| Norway | 2 | 3 | 1 | 6 |
| China | 0 | 0 | 1 | 1 |
| ISO | 0 | 1 | 100 | 101 |
| Total | 13 | 6 | 123 | 142 |

| Noted | | | | |
|--------------|-----------|----------|----------|-----------|
| From | te | ge | ed | Total |
| Australia | 0 | 0 | 1 | 1 |
| Denmark | 1 | 0 | 0 | 1 |
| France | 7 | 3 | 0 | 10 |
| Germany | 1 | 0 | 0 | 1 |
| Norway | 6 | 1 | 0 | 7 |
| China | 0 | 0 | 0 | 0 |
| ISO | 0 | 0 | 0 | 0 |
| Total | 15 | 4 | 1 | 20 |

| Disapproved | | | | |
|--------------|----------|----------|-----------|-----------|
| From | te | ge | ed | Total |
| Australia | 0 | 0 | 3 | 3 |
| Denmark | 0 | 0 | 0 | 0 |
| France | 4 | 0 | 0 | 4 |
| Germany | 0 | 0 | 0 | 0 |
| Norway | 0 | 3 | 0 | 3 |
| China | 0 | 0 | 0 | 0 |
| ISO | 0 | 0 | 10 | 10 |
| Total | 4 | 3 | 13 | 20 |

Main changes to document

- **Foreword**

- No changes

- **Introduction**

- No changes

- 1. Scope**

- One editorial change (Scope remains the same)

- 2. Normative references**

- No changes

- 3. Terms and definitions**

- Some changes

- 4. Abbreviated terms**

- No changes

- 5. IDO entities**

- Some changes (separate slides)

- 6. Annexes**

- Annex C Alignment of IDO with other ontologies” has been removed
 - Sync issue.
 - To be provided as ISO TR (Technical Report) or/and online resources

- **Bibliography**

- Some editorial changes

IDO 4.2 FDIS ontology update

- Draft IS: Ontology revision 4.1
- Final Draft IS: Ontology revision 4.2
 - *last update 2026-04-10*

FDIS *conceptual deltas*

| Topic | Trigger | Resolution |
|--|------------------------|--|
| Specified vs Actual / implements | FR-071, FR-103, NO-104 | Removed "same individual" wording; recast implements as a weak traceability link between disjoint Specified/Actual individuals; conformance checking specified as a controlled ABox transformation (implements → owl:sameAs, classes collapsed to a neutral superclass) under OWL DL. |
| 3D vs 4D architecture | FR-073, FR-137 | Articulated IDO as a spanning ontology: lis:Object (3D/endurant) and lis:Temporal (4D/perdurant) declared disjoint, mirroring BFO/DOLCE. No structural change. |
| Feature redefinition | FR-114, FR-113, FR-092 | Replaced inherited ISO 15926-2 "non-separable, contiguous arranged part" with disposition-grounded definition: a feature is an arranged part that bears a material quality on which a disposition of the object depends. Dropped "contiguous"; added flange/thread/lens/sponge examples. |
| PhysicalObject mass constraint | FR-083, FR-086 | Definition weakened from "occupies space and possesses mass" to "...mass or energy", admitting energy streams (light, electricity) without category error. |
| Time as quantity | NO-117 | Time removed from PhysicalQuantity of objects. New pattern: Activity hasTemporalRegion TemporalRegion temporalRegionQuantifiedAs TemporalDatum, with datatype temporalValue; hasTemporalExtent made a subproperty of hasTemporalRegion. |
| Continuity across system boundaries | NO-121 (impl. #494) | Added lis:consumes as dual of lis:creates (both ⊆ hasPassiveParticipant); inverse consumedBy. Enables upstream/downstream flow continuity without rules or SHACL. |
| Site of an activity | FR-107, FR-106, DE-081 | Separated site from the general spatial surrounding of an activity. Suggested new containsActivity (with occursIn as inverse, siteOf as subproperty); added siteDeterminedBy / determinesSite linking sites to demarcating physical objects; hasSpatialExtent no longer functional. |
| Event vs Activity | FR-102 | Retained Event ⊆ Activity with hasTemporalExtent only InstantRegion; design rationale and BFO contrast documented in annotations. Queries on duration to constrain on Interval vs InstantRegion. |
| ActivityProfile | FR-099, NO-094 | Kept under Activity as pragmatic compromise; clarifying annotation referencing the physics notion of projection of processes added; deeper rework deferred. |
| InformationObject vs BFO GDC | FR-078 | Confirmed deliberate placement under lis:Object (independent), not as a generically dependent continuant; usage note added that subclasses (Agreement, Identifier, ...) may represent content independently of any physical bearer; concretizes available but optional. |
| concretizes ambiguity | FR-110 | Domain/range retained; explanatory note clarifying intended direction (object ↔ informational pattern shared with copies/realizations) added. |
| Tag poly-hierarchy (Functional Object × Physical Artefact) | FR-074 | No structural change; pattern defended via Annex A.14 and A.4; identifier/classification modelling deferred to ISO 23726-1 and future editions (cf. NO-076, DK-077). |

IDO 4.2 FDIS count of resources

- Classes C: 50 (+ 1)
- Object Properties OP: 102 (+ 10)
- Data Properties DP: 3 (+ 1)
- Annotation Properties AP: 42 (+ 1; includes built-ins)

IDO 4.2 FDIS resource updates

12 entities added

- C TemporalDatum
- OP hasTemporalRegion -- temporalRegionOf
- OP temporalRegionQuantifiedAs -- quantifiesTemporalRegion
- DP temporalValue
- OP consumes -- consumedBy
- OP siteDeterminedBy -- determinesSite
- OP siteInsideOf -- hasSiteInside

186 entities modified

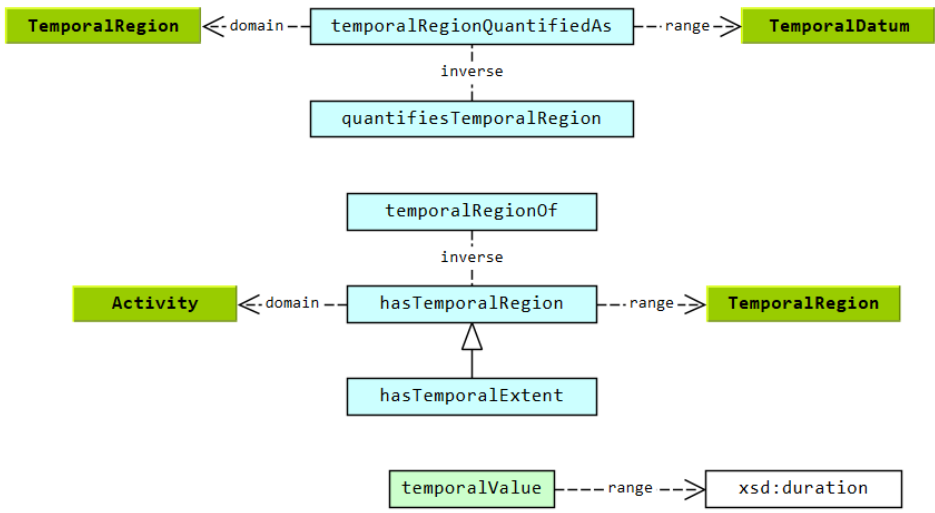
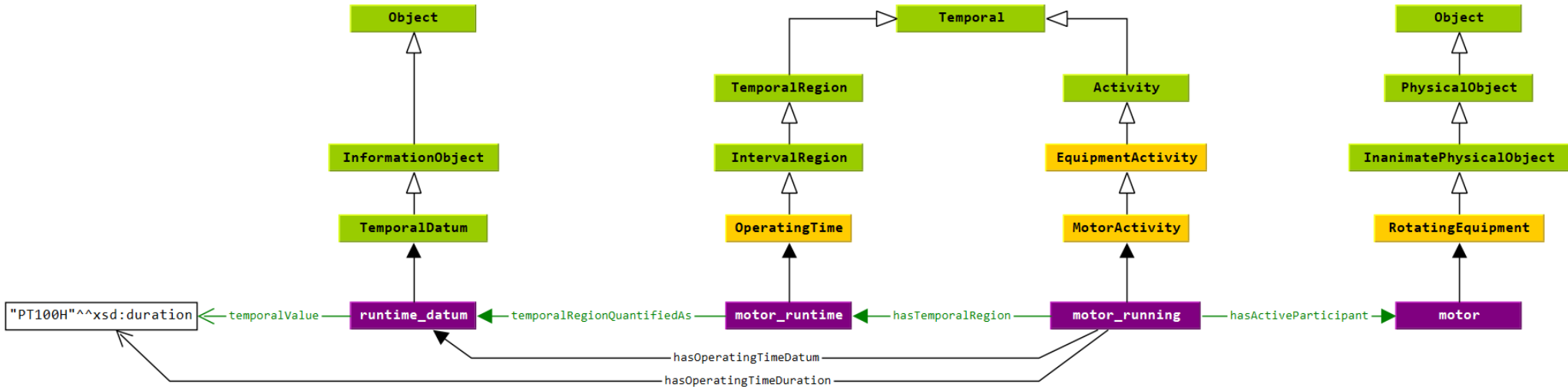
- systematic change means all resources are touched

Temporal data support

- C TemporalDatum
- OP hasTemporalRegion – temporalRegionOf
- OP temporalRegionQuantifiedAs – quantifiesTemporalRegion
- DP temporalValue

Durations are not quantities.

Temporal data support cont.



Creates – consumes

- OP consumes – consumedBy

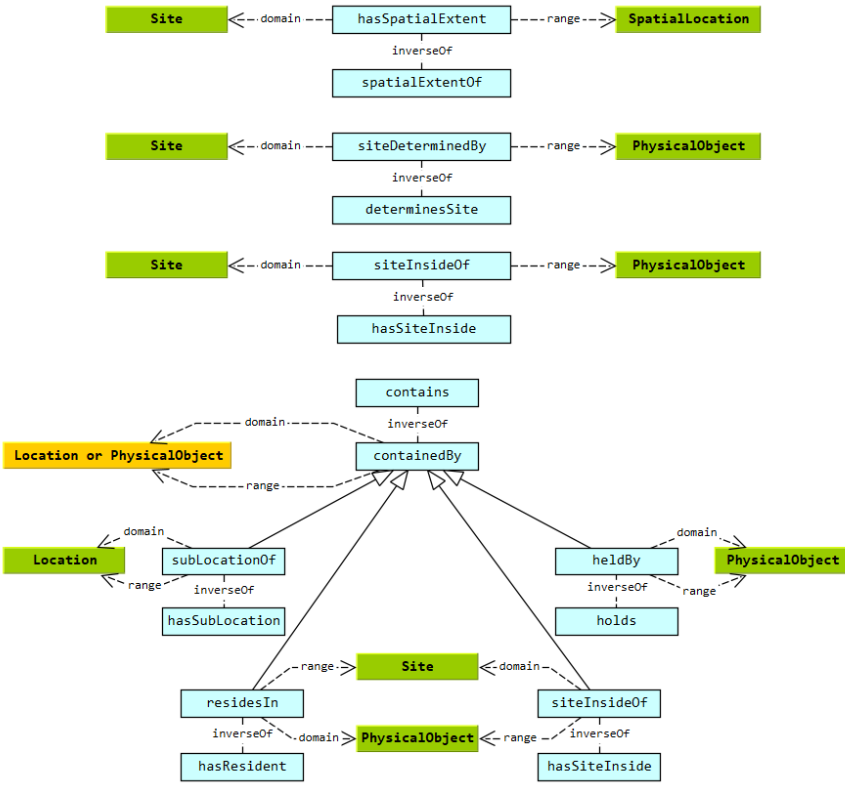
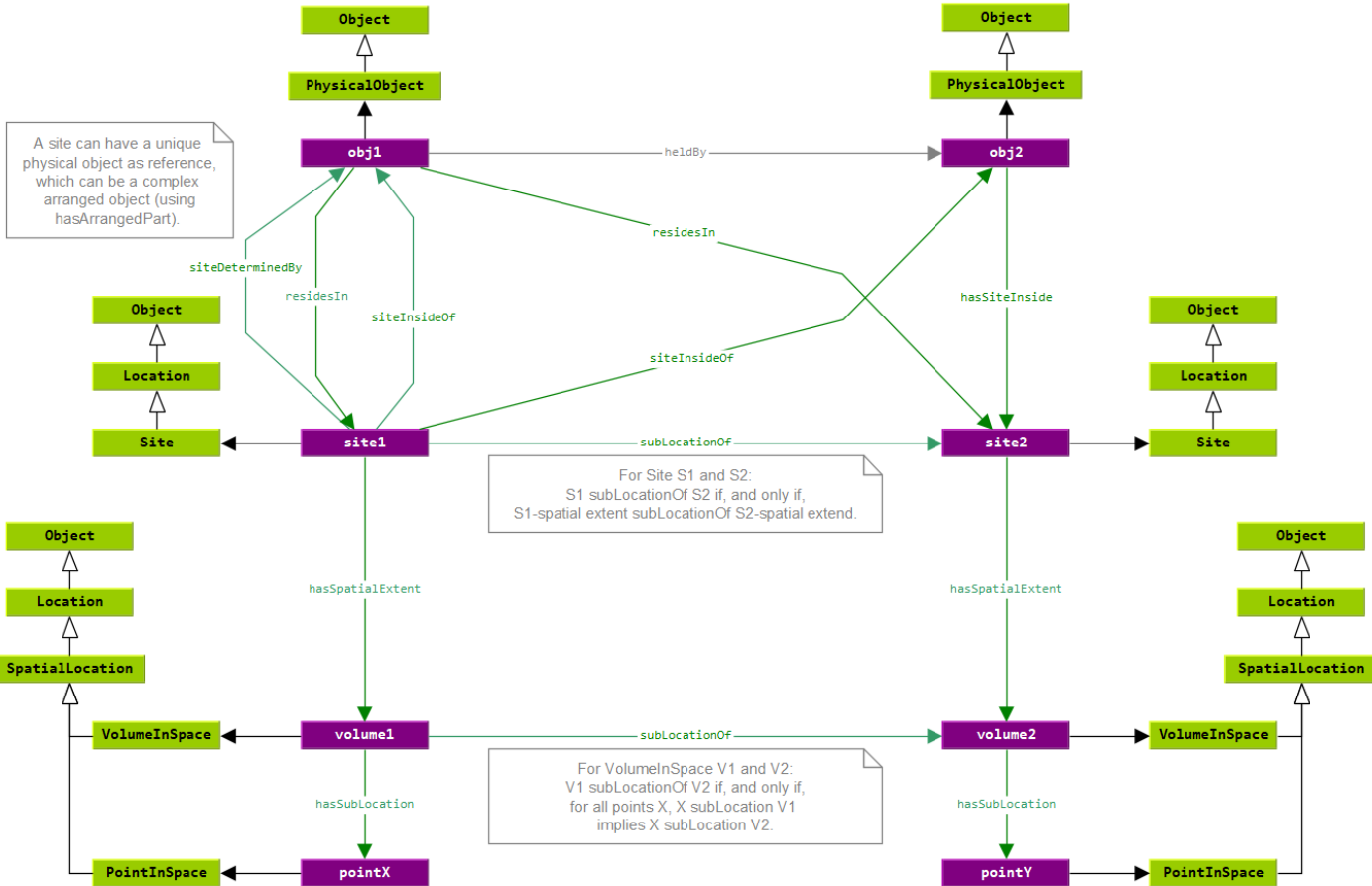
Added to complement OP creates – createdBy

Objects and sites

- OP siteDeterminedBy – determinesSite
- OP siteInsideOf – hasSiteInside

Extended vocabulary for enclosures, buildings, etc.

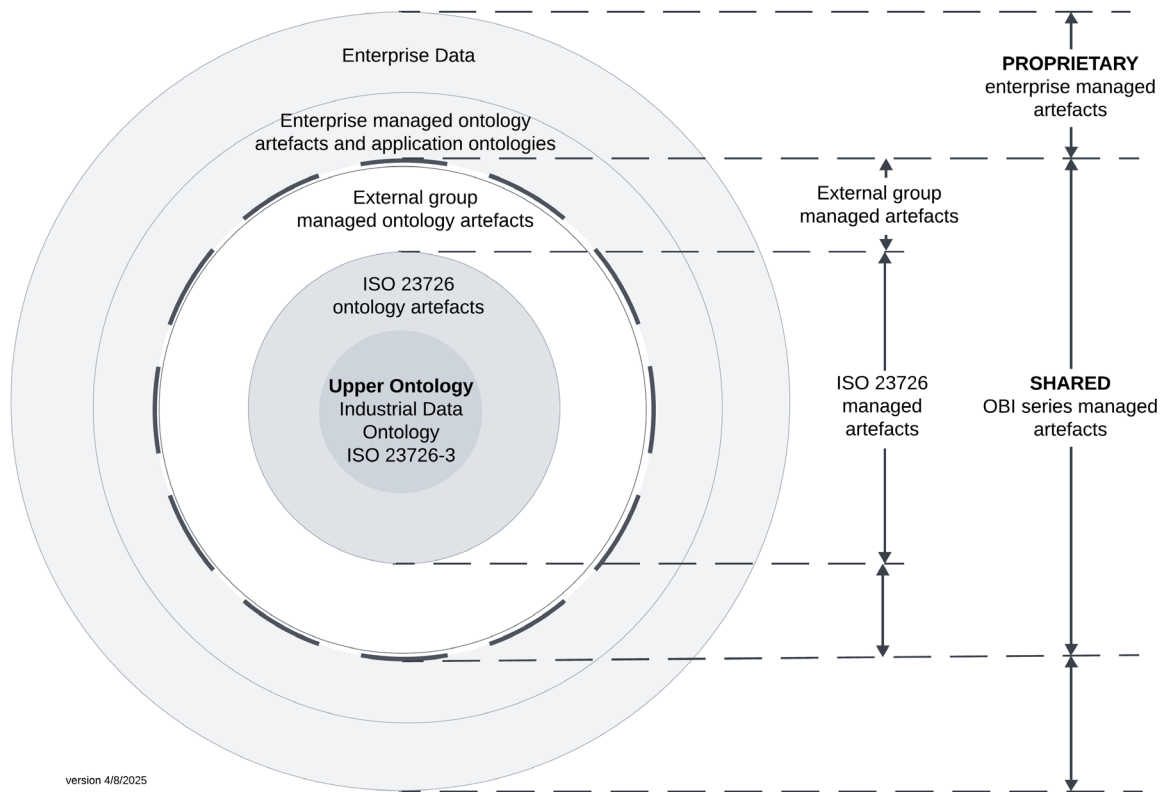
Objects and sites cont.



Annotation changes that affect all resources

- For traceability
 - `rdfs:isDefinedBy` `lis-ont:core` – *all IDO resources*
- Removed as not needed
 - `isPrimitive`, `primitiveRationale`, `semiFormalNaturalLanguageAxiom`
- Replaced for better precision
 - `rdfs:comment` annotations -> `explanatoryNote`, etc.
- Syntactic corrections: URIs instead of strings

A standards-based ontology ecosystem for interoperability and meaningful data



Parts to ISO 23726 Ontology based interoperability

| Part | Name | Publication (Planned) |
|------|-------------------------------------|-----------------------|
| 1 | Overview and fundamental principles | 30 January 2028 |
| 2 | Vocabulary | 20 June 2027 |
| 3 | Industrial data ontology | 23 July 2026 |
| 100 | Schedule data ontology | 31 May 2027 |

Industrial semantic interoperability summit 2026

Turning semantic interoperability into industrial competitiveness in an AI-driven world



Join this three-day event, hosted by DNV in association with POSC Caesar association and Standards Norway, at DNV Høvik, just outside **Oslo, 9-11 June 2026.**

Experience presentations, hands-on workshops, and networking opportunities to explore where industries are headed and how to maximize the value of semantic interoperability.

More info and registration at [Industrial semantic interoperability summit 2026](#). **NB: Early bird rates available until May 1st**

Thank you!

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www.dnv.com

