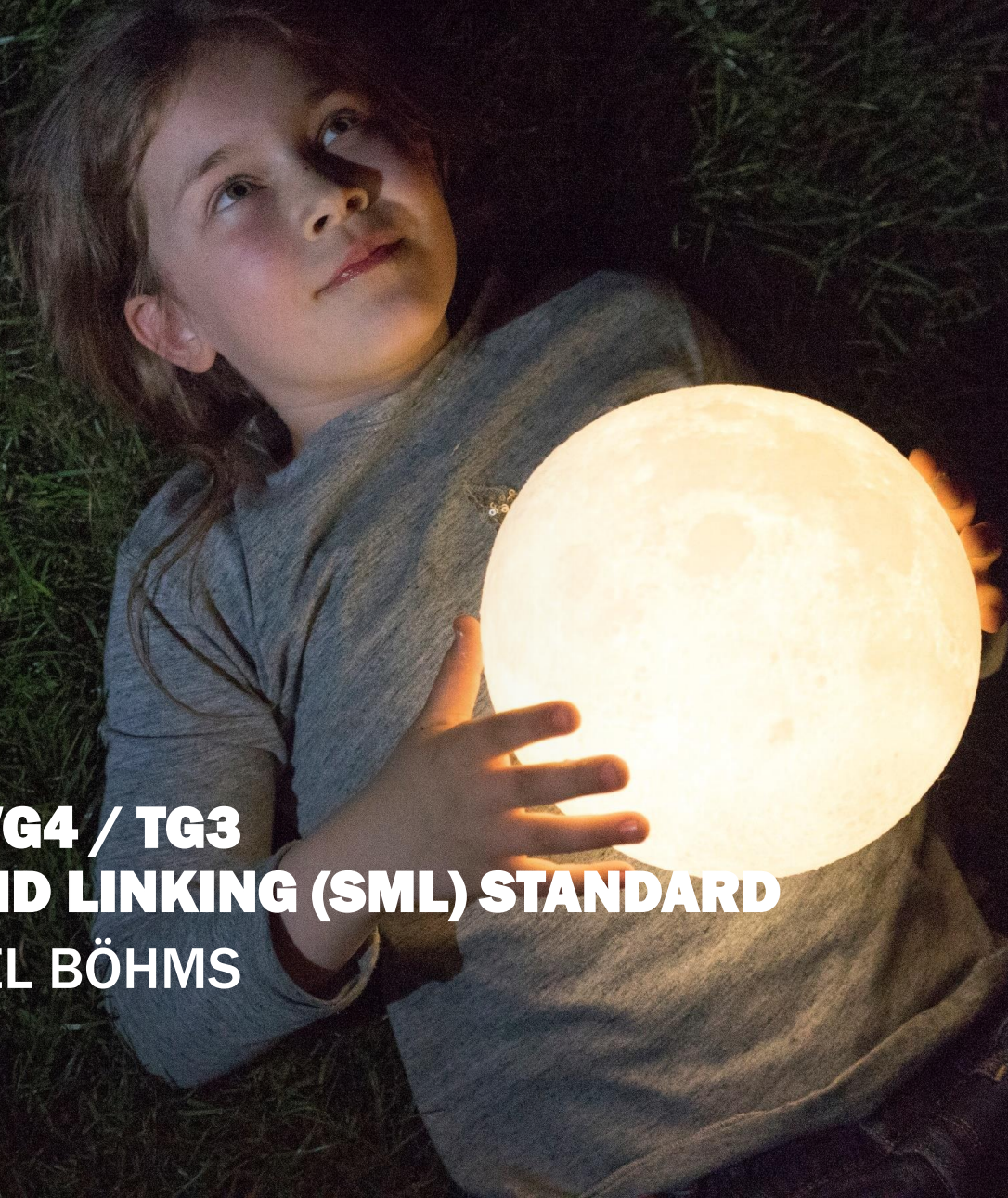


**STATUS OF CEN TC442 / WG4 / TG3  
SEMANTIC MODELLING AND LINKING (SML) STANDARD  
W3C LBD MEETING | MICHEL BÖHMS**

21. September 2022 16:00-17:30h





## › CEN TC442 / WG4 / TG3

- › TC442 “BIM”
- › WG4 “Dictionaries”
- › **NOTE:** beyond, terms/definitions: actually Data/Information Models or in LD-speak: “Ontologies” (compare bSI bSDD)

### **Editorial Team:**

Benno Koehorst (RWS, NL) – Chair  
Michel Böhms (TNO, NL) – Editor, Secretary  
Sara Asmussen (ISERIT, GL)  
Phil Jackson (University of Surrey, UK)  
Davis Kantor (SBB CFF FFS, CH)  
Tim Lemoine (BBRE, BE)  
Martin Schroeder (Bosch, DE)  
Hugo Avalos (Knauf, DE)  
Espen Schulze (Cobuilder, NO)

## › WHY

- There are major social challenges in our built environment
  - Housing shortage, outdated infrastructures, energy transition, need for circularity, ...
- The right digitalization in project and asset management can help the solution of these challenges
  - through an efficient/effective and future-proof data and software landscape
- In turn, SML can contribute to
  - delivering such a future-proof data landscape
  - as a guideline for uniform semantic modeling of assets (incl. products as 'assets-you-can-buy') in the built environment

## › SCOPE

- For all types of assets in the entire built environment
  - Buildings, roads, railway tracks, bridges, tunnels, dikes, maritime constructions, but also:
  - Areas such as public spaces with greenery such as parks and trees
  - Their aggregates and parts
- For the entire asset life cycles and supply chains of these assets
  - Programming, Design, Execution and Management & Use
  - Client, contractor, subcontractor, supplier, manufacturer
- For the entire information lifecycle
  - Acquisition/creation, storage, transformation, derivation, integration, decision support/making

## › KEY USE CASE TYPES

- Data Exchange (data transfer)
  - Not ideal: multiple copies potentially out of sync
  - Ok in case of 'change of ownership' (think supply chain)
- Data Sharing
  - Ideal: one copy
  - Best when 'no change of ownership' (think life cycle)
- Often LD/SW still used for data exchange
  - Data collection in 'centralized' repositories
  - Future: more distributed
    - Federated queries (read)
    - Federated queries (write)
      - Think SOLID/PODS (read-write web), more secure

## › **DISCLAIMER (WRT DISTRIBUTED DATA SHARING)**

- › “In general though, relying on external namespaces is unreliable and is one of the weak spots of the semantic technology stack that just didn't work as well in practice as hoped by its designers. Quite often, publishers of vocabularies don't set up the right content negotiation policies or implementations don't ask for the right files to download. ...
- › Better download local copies as it also supports offline work and will be faster.”
- › Holger Knublaug, TopQuadrant
- › September 2022

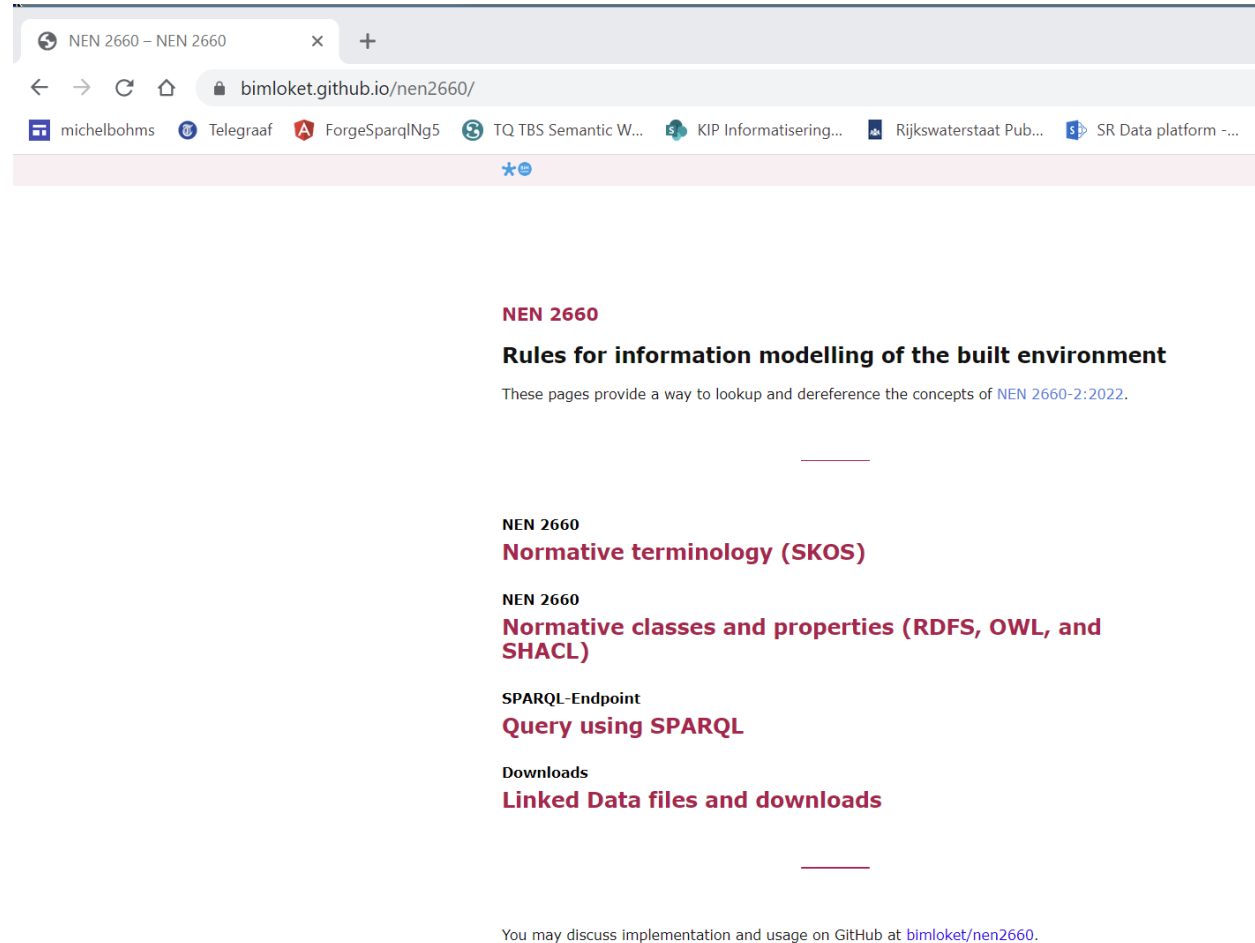
# › PARTLY AGREE BUT INDEED NON-TRIVIAL

› Example NEN-2660-2

› By CROW/BIM Locket

› (quite new for NEN/CEN/ISO)

› In future also for SML



The screenshot shows a web browser window with the address bar displaying 'bimloket.github.io/nen2660/'. The page content includes a header for 'NEN 2660' with the subtitle 'Rules for information modelling of the built environment'. Below this, a paragraph states: 'These pages provide a way to lookup and dereference the concepts of NEN 2660-2:2022.' A horizontal line separates this from the next section, 'NEN 2660 Normative terminology (SKOS)'. Another horizontal line follows. The next section is 'NEN 2660 Normative classes and properties (RDFS, OWL, and SHACL)'. Below this is 'SPARQL-Endpoint Query using SPARQL'. Then 'Downloads' and 'Linked Data files and downloads'. A final horizontal line is present. At the bottom, a note says: 'You may discuss implementation and usage on GitHub at bimloket/nen2660.'

NEN 2660 – NEN 2660

bimloket.github.io/nen2660/

michelbohms Telegraaf ForgeSparqlNg5 TQ TBS Semantic W... KIP Informatisering... Rijkswaterstaat Pub... SR Data platform -...

NEN 2660

**Rules for information modelling of the built environment**

These pages provide a way to lookup and dereference the concepts of NEN 2660-2:2022.

---

NEN 2660

**Normative terminology (SKOS)**

---

NEN 2660

**Normative classes and properties (RDFS, OWL, and SHACL)**

SPARQL-Endpoint

**Query using SPARQL**

Downloads

**Linked Data files and downloads**

---

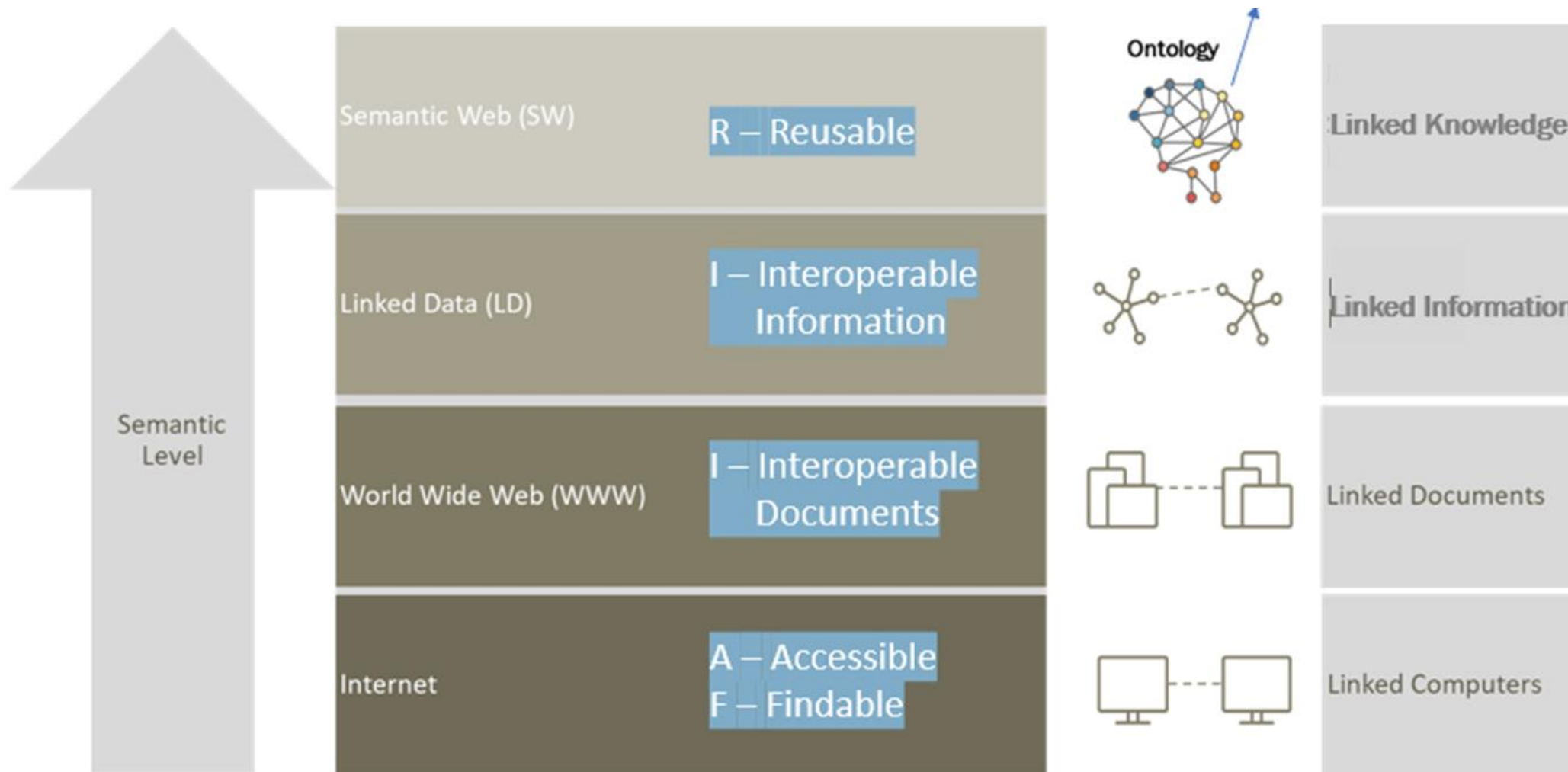
You may discuss implementation and usage on GitHub at [bimloket/nen2660](https://github.com/bimloket/nen2660).

# GUIDING PRINCIPLE

- › FAIRness (gofair.org)
  - › Findable, typically in de cloud
  - › Accessible, securely accessible via the right identification, authentication & autorisation
  - › Interoperable via application of (sets of) open standards
  - › Reusable, well-defined semantics via information models (like ontologies), that are FAIR themselves!
- › + Right data quality depending on context
  - › Relevant, correct, timely, complete, consistent, precise ...



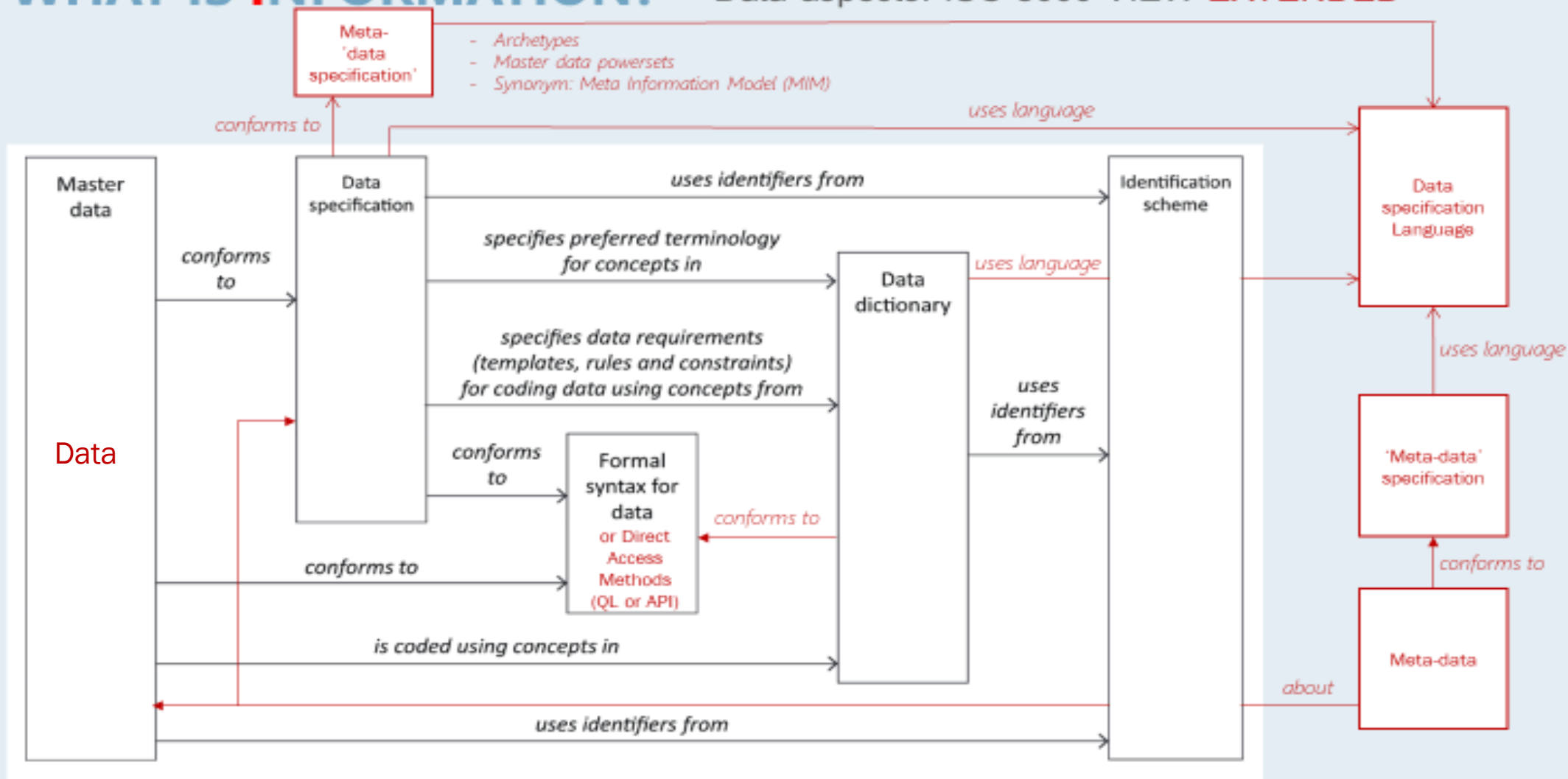
# FAIRNESS POWERED BY LINKED DATA/SEMANTIC WEB



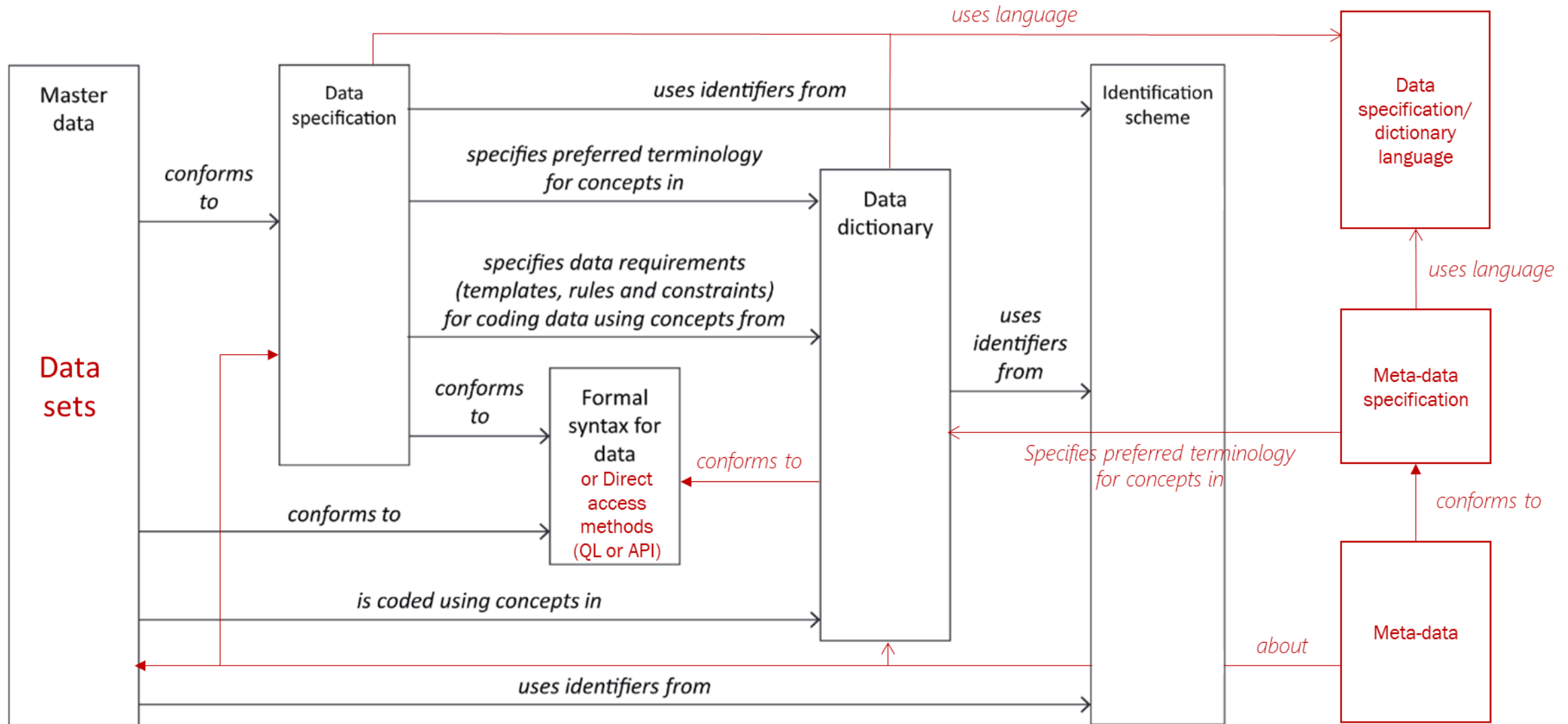
# DATA? WHAT DATA?

## WHAT IS INFORMATION?

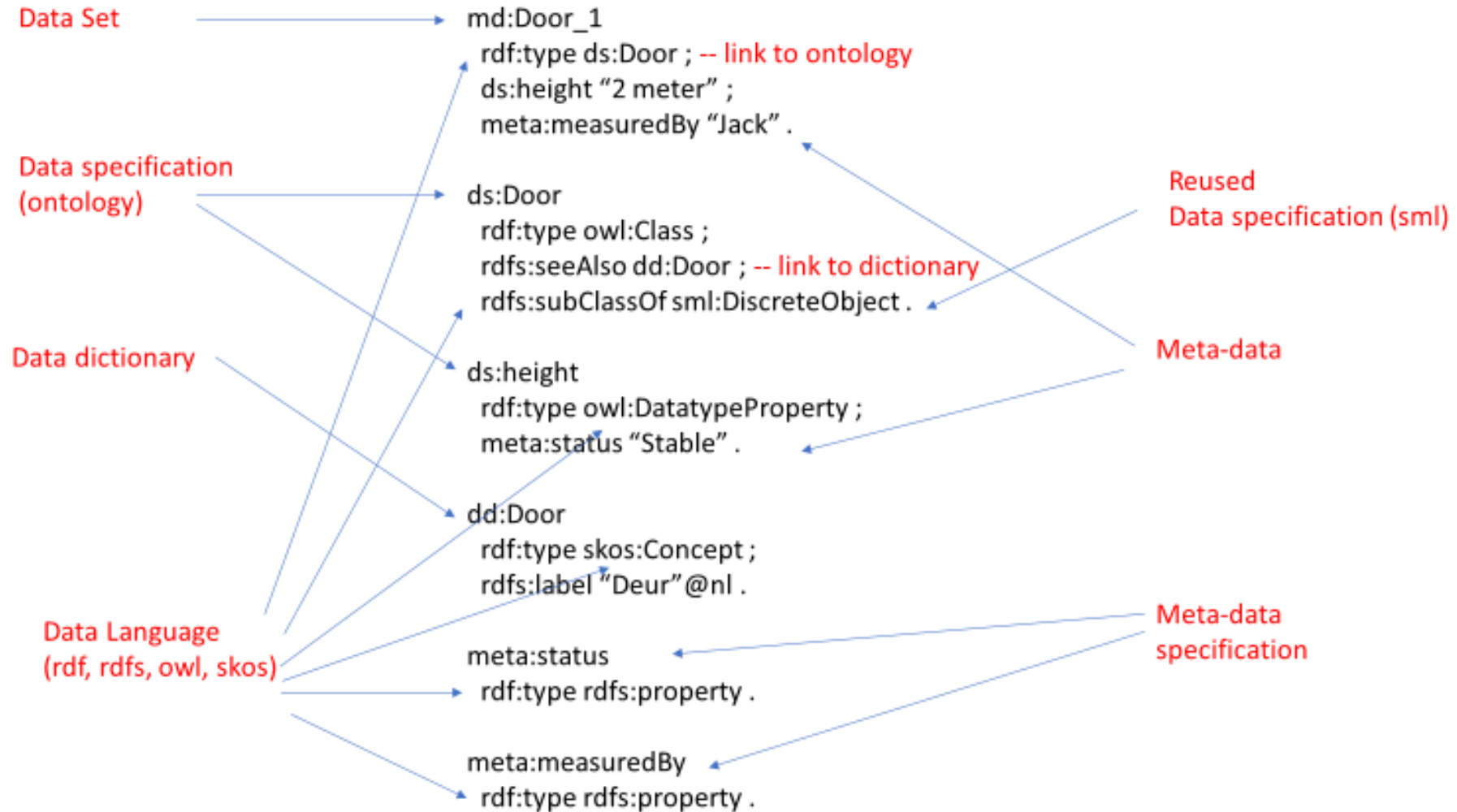
Data aspects: ISO 8000 VIEW **EXTENDED**



## › A BIT SIMPLER, NO MIM



## THE BIGGER PICTURE

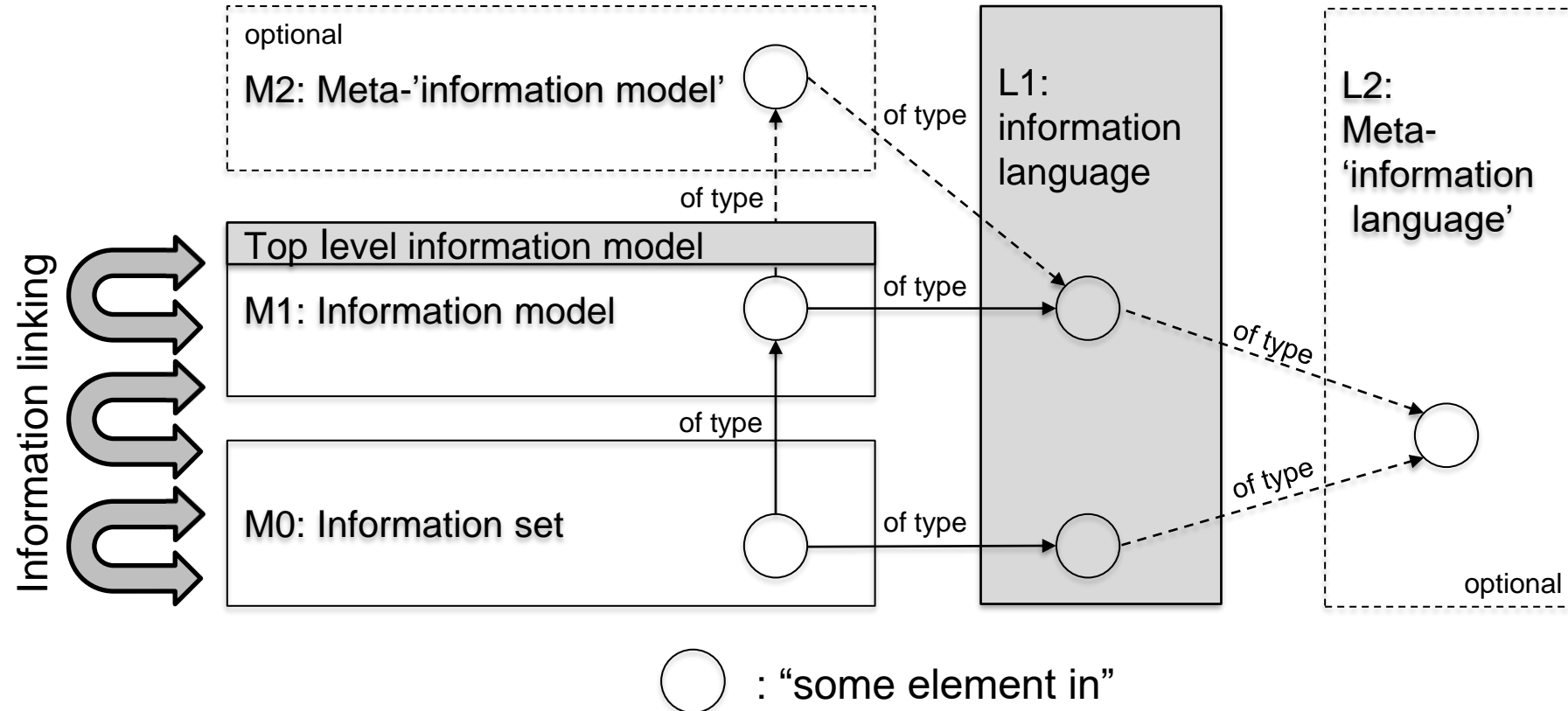




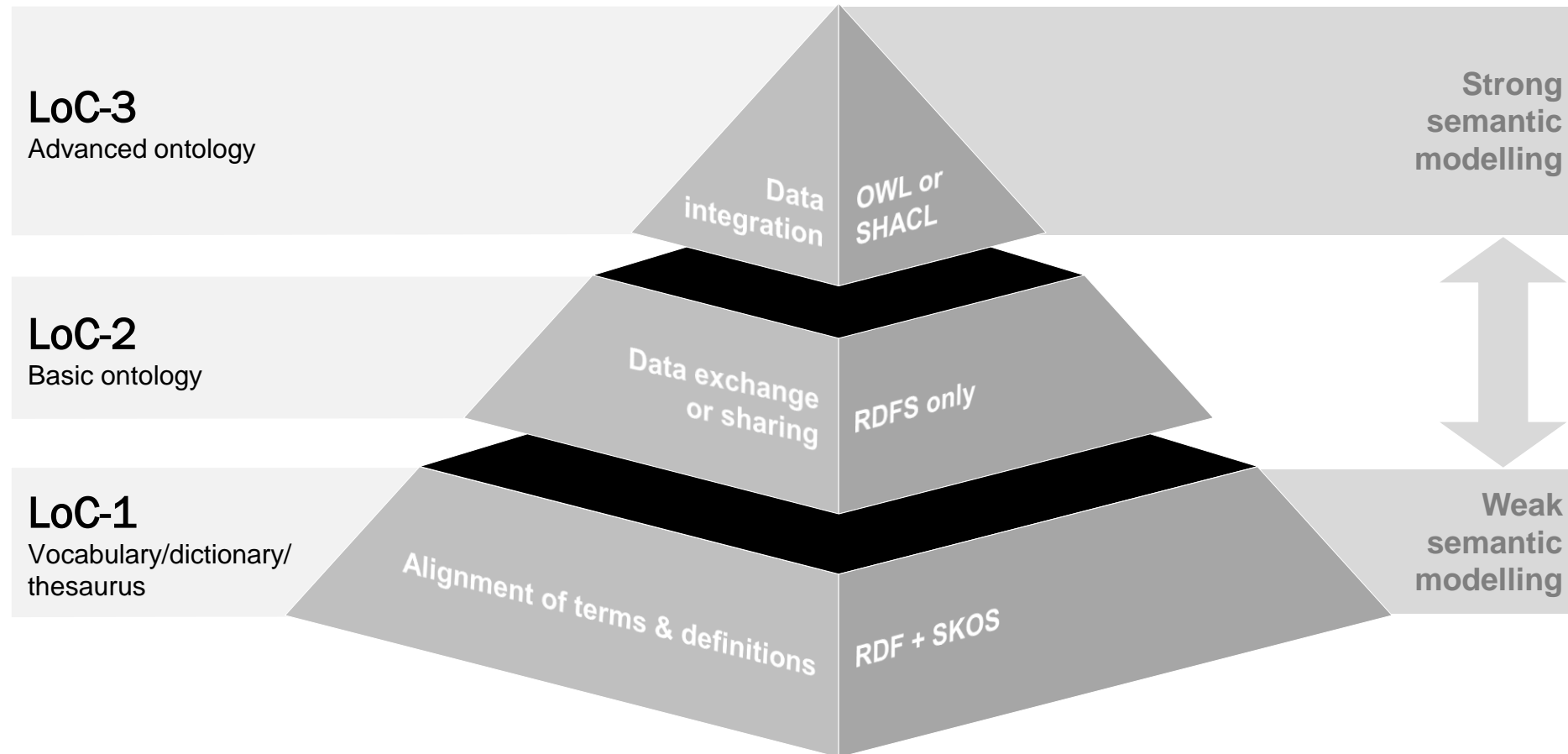
## › SML OFFERING

- Technology choices: data formats, direct access methods and modeling languages
  - Here: W3C Linked Data / Semantic Web technology: Turtle/JSON-LD, SPARQL, RDF/RDFS/OWL/SHACL
- A generic top-level information model
  - Objects, Activities, States, Events and their interrelationships
- Generic & domain-specific modelling patterns

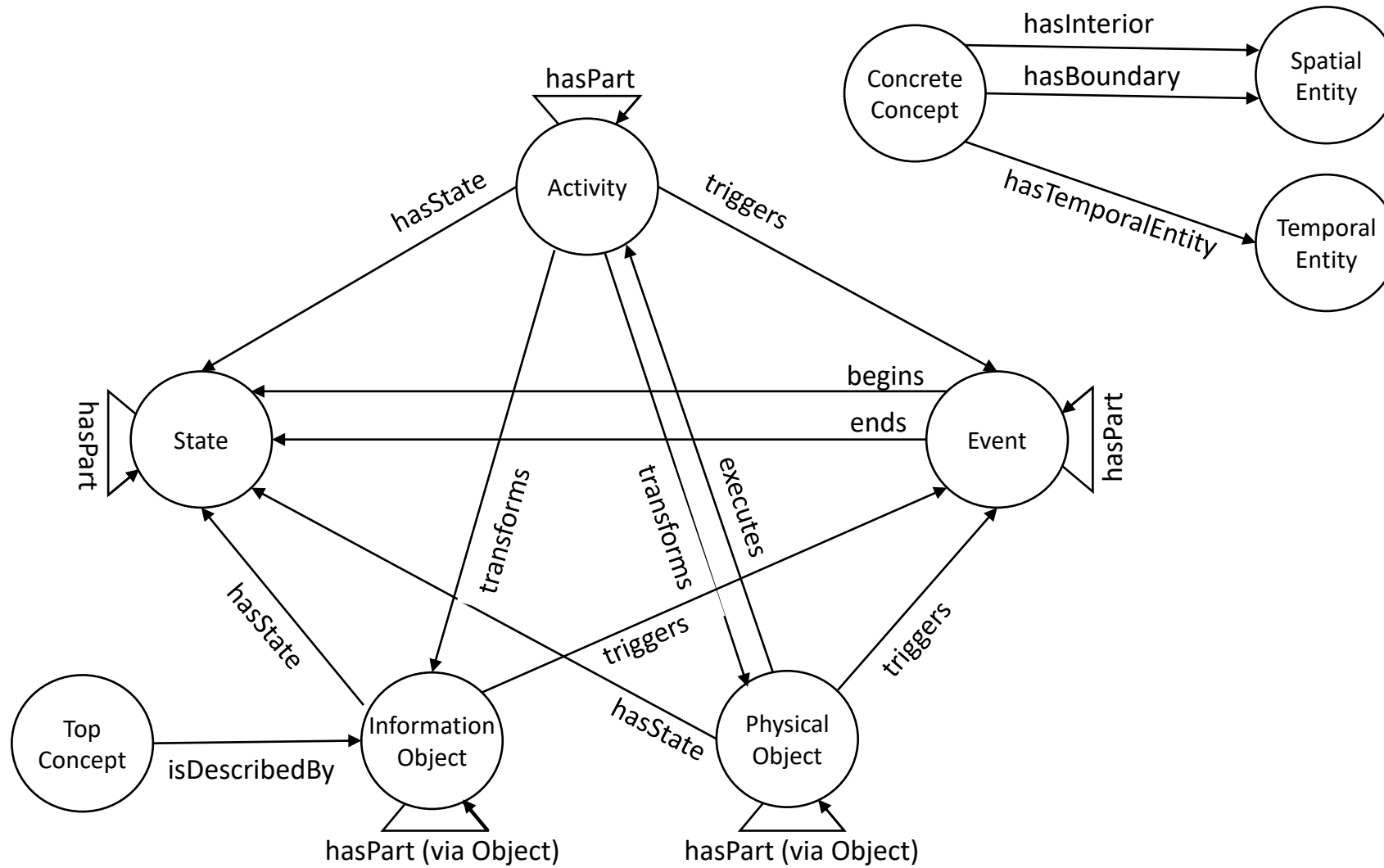
## › SML OFFERING



## › CAPABILITIES



# TOPLEVEL

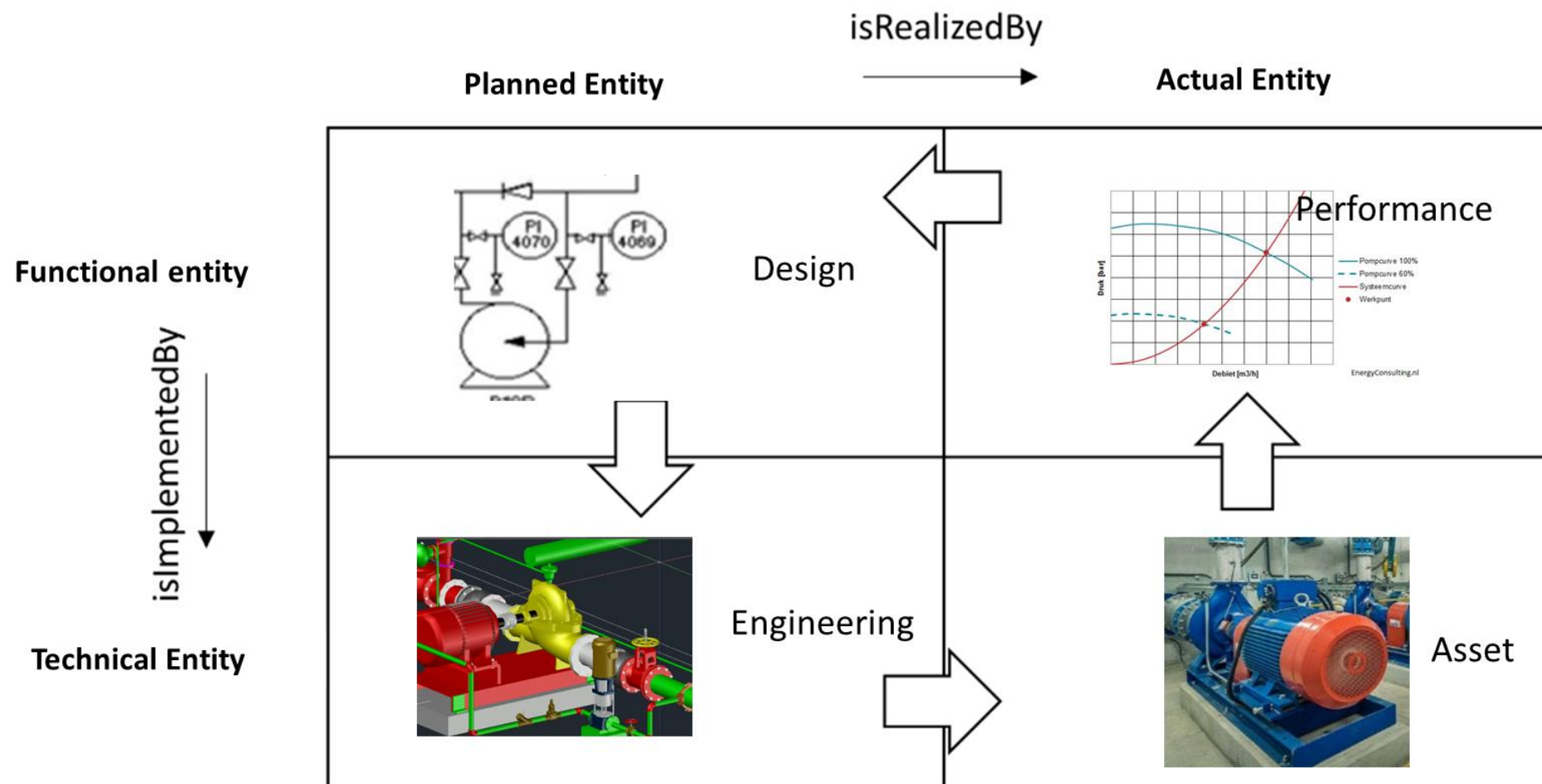




## › **MODELLING PATTERNS**

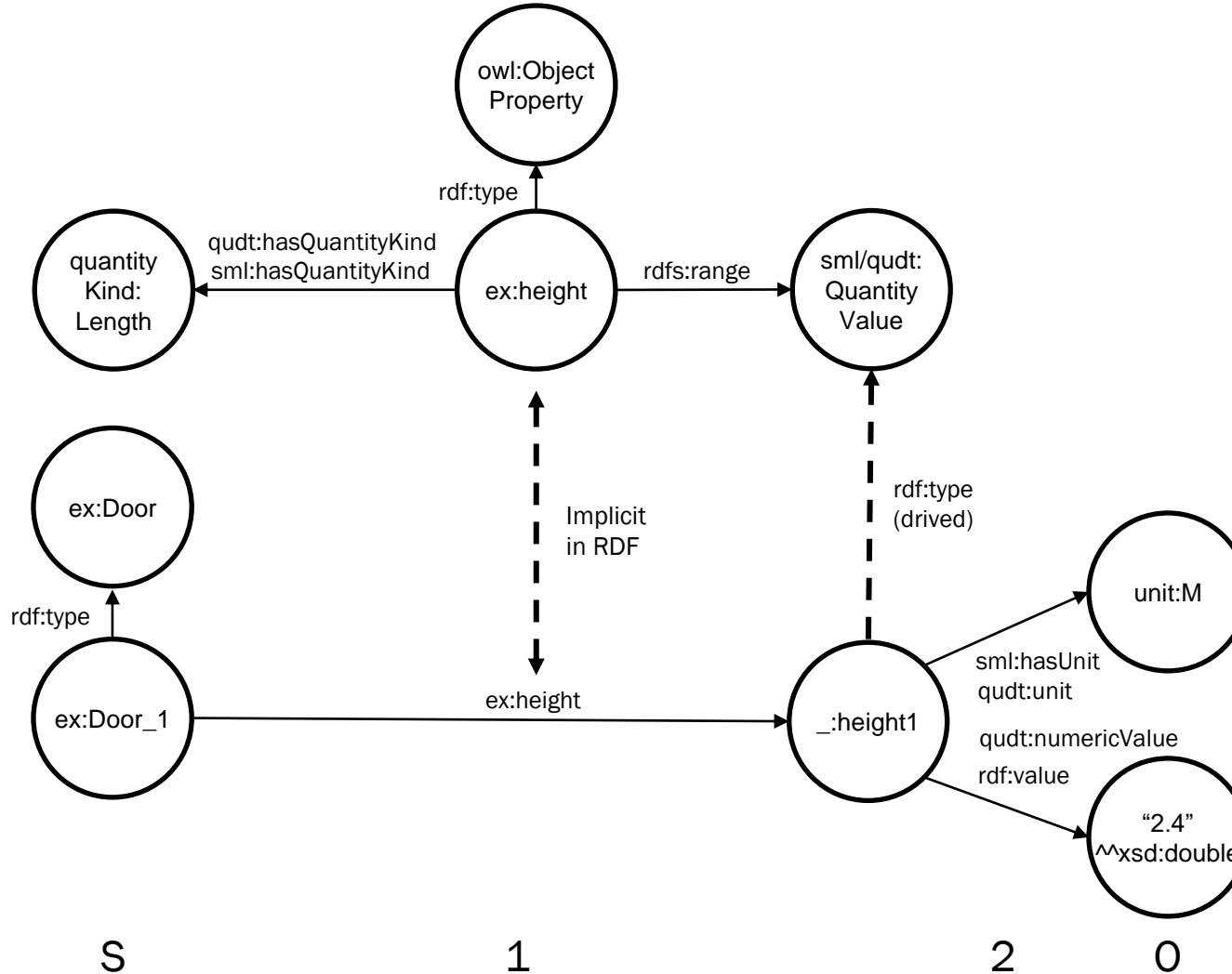
- › Identification, naming and annotation
- › Specialization (“taxonomy”)
- › Decomposition and grouping
- › Materialization (concrete, steel, wood, asphalt)
- › Quantities, units and quantity kinds & Qualities
- › Spatial areas versus real objects
- › Planned things versus realized things
- › Things versus roles of things (space versus kitchen), aka functional versus technical
- › Interactions between things (forces, information and material exchanges)
- › Unstructured requirements

# › ENABLING SYSTEMS ENGINEERING



# › PROPERTY MODELLING

- › Simple (~OPM L1)
  - › No objectification
  - › Unit/Quantity kinds implicit, in name or in datatype
- › Complex (~OPM L2: subject/object)
  - › Complex value: QuantityKind (QualityKind/RelationReference)
- › Complicated (~OPM L3)
  - › Objectified predicate and value
  - › W3C SOSA including extended QUDT usage
    - qudt:QuantityValue
    - qudt:value, qudt:numericValue
    - qudt:unit, qudt:hasQuantityKind

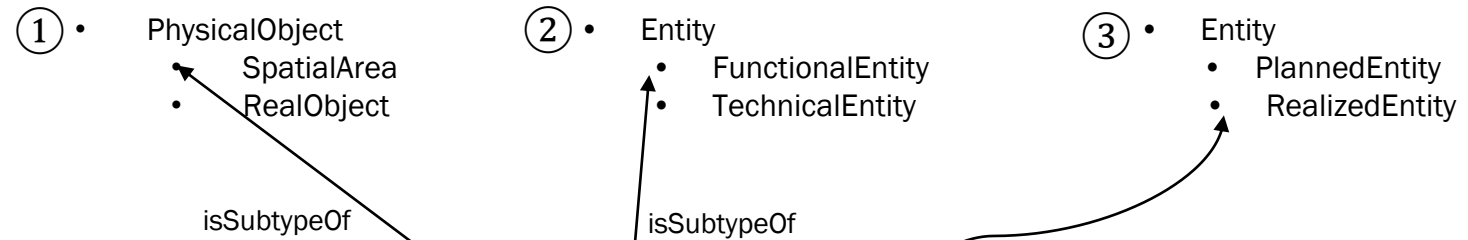




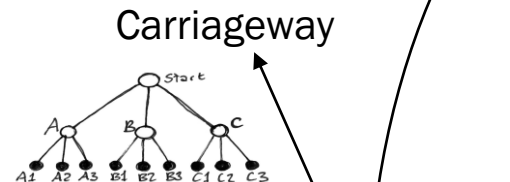
# APPLICATION

Technology, Top Level & Modelling patterns

~~SML Top level model~~



SML compliant  
Ontology



SML compliant  
Information Set ("data source")

Carriageway\_122

isOfType

isOfType

## › RELATED

- ISO 21597 Information Container for Data Delivery (ICDD)
- buildingSmart IFC/bSDD (in STEP/XML/LD/JSON)
- W3C LBD BOT (Building Topology Ontology)
- CEN TC442 Data Templates (“86/87”), ISO 12006-3

### Industry application (NL)

- RWS OTL
- Amsterdam OTL
- OTL-Gelderland
- Waternet OTL (W-OTL)
- IMBOR-LD 2022 (urban public)
- GWSW (urban Water)
- GWSL (urban Light)
- TenneT OTL (high voltage power supply)
- CB-NL (NL generic ontology below SML top-level), .....need?
- PIM: Pavement Information Model (Boskalis, BAM Infra, Heijmans , Van Gelder, Dura Vermeer, KWS)

## › PIM EXAMPLE

### Frequentie sweep

Frequentie		Stijfheid	
0,1	Hz	1750	MPa
0,2	Hz	2420	MPa
0,5	Hz	3569	MPa
1,0	Hz	4650	MPa
2,0	Hz	5910	MPa
5,0	Hz	7824	MPa
8,0	Hz	8884	MPa
10,0	Hz	9392	MPa
20,0	Hz	11103	MPa
30,0	Hz	12166	MPa
0,1	Hz	1731	MPa

:ART00408

a :AsfaltMengsel ;

:frequentieSweep \_:QuantityValue\_fs .

\_:QuantityValue\_fs

:frequentieSweepElement \_:QuantityValue\_1 ;

:frequentieSweepElement \_:QuantityValue\_2 ;

... .

\_:QuantityValue\_1

a sml:QuantityValue ;

:checkdata true ;

:frequentie \_:QuantityValue\_1a ;

:stijfheid \_:QuantityValue\_1b ;

.

\_:QuantityValue\_1a

a sml:QuantityValue ;

rdf:value 0.1 ;

sml:hasUnit unit:HZ ;

.

\_:QuantityValue\_1b

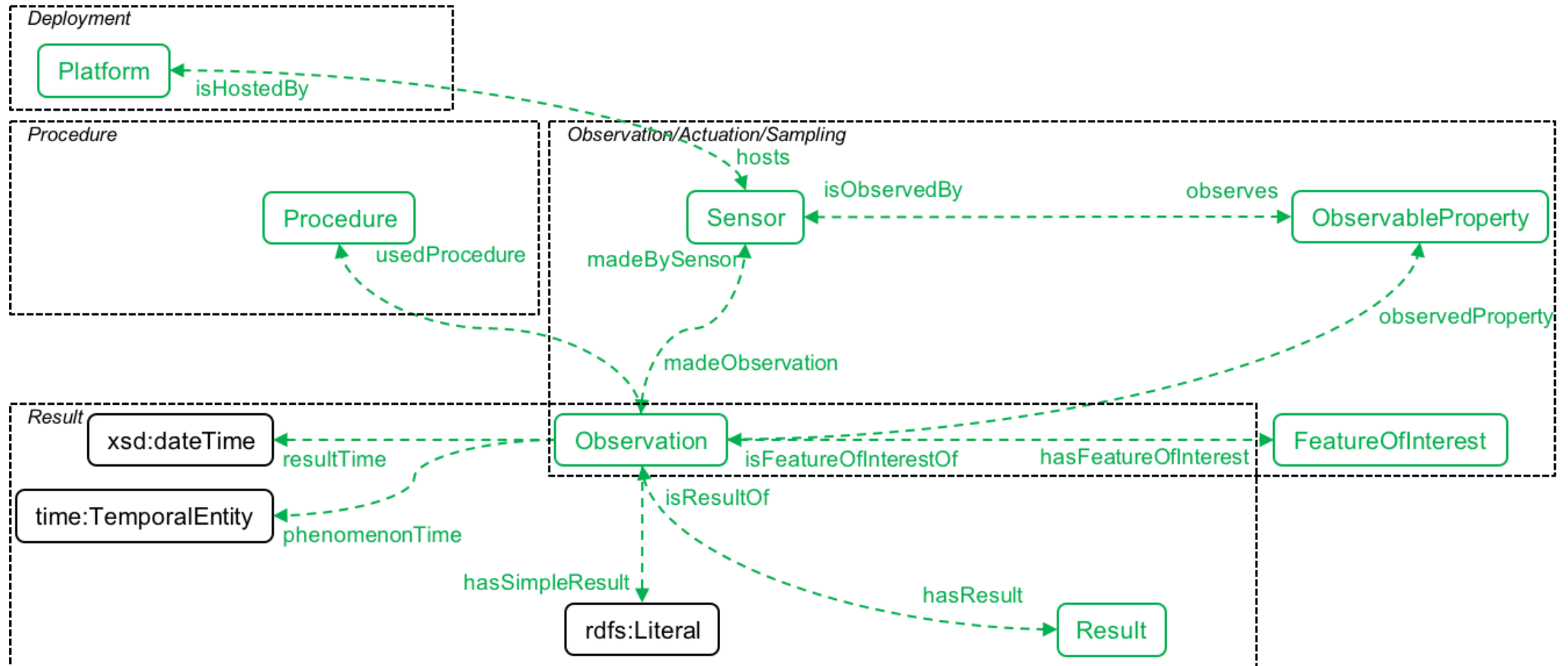
a sml:QuantityValue ;

rdf:value 1750 ;

sml:hasUnit unit:MegaPA ;

.

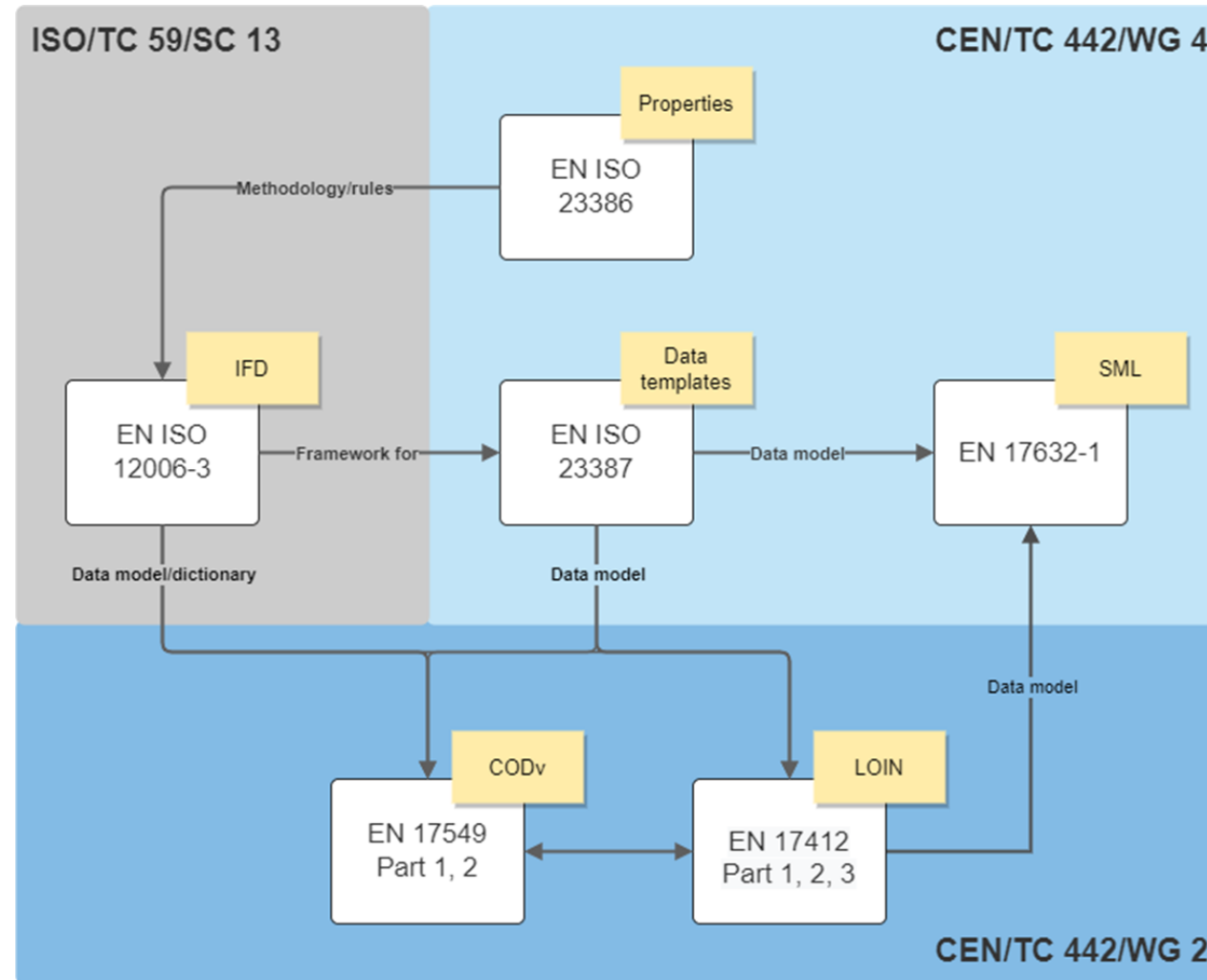
# › PIM EXAMPLE



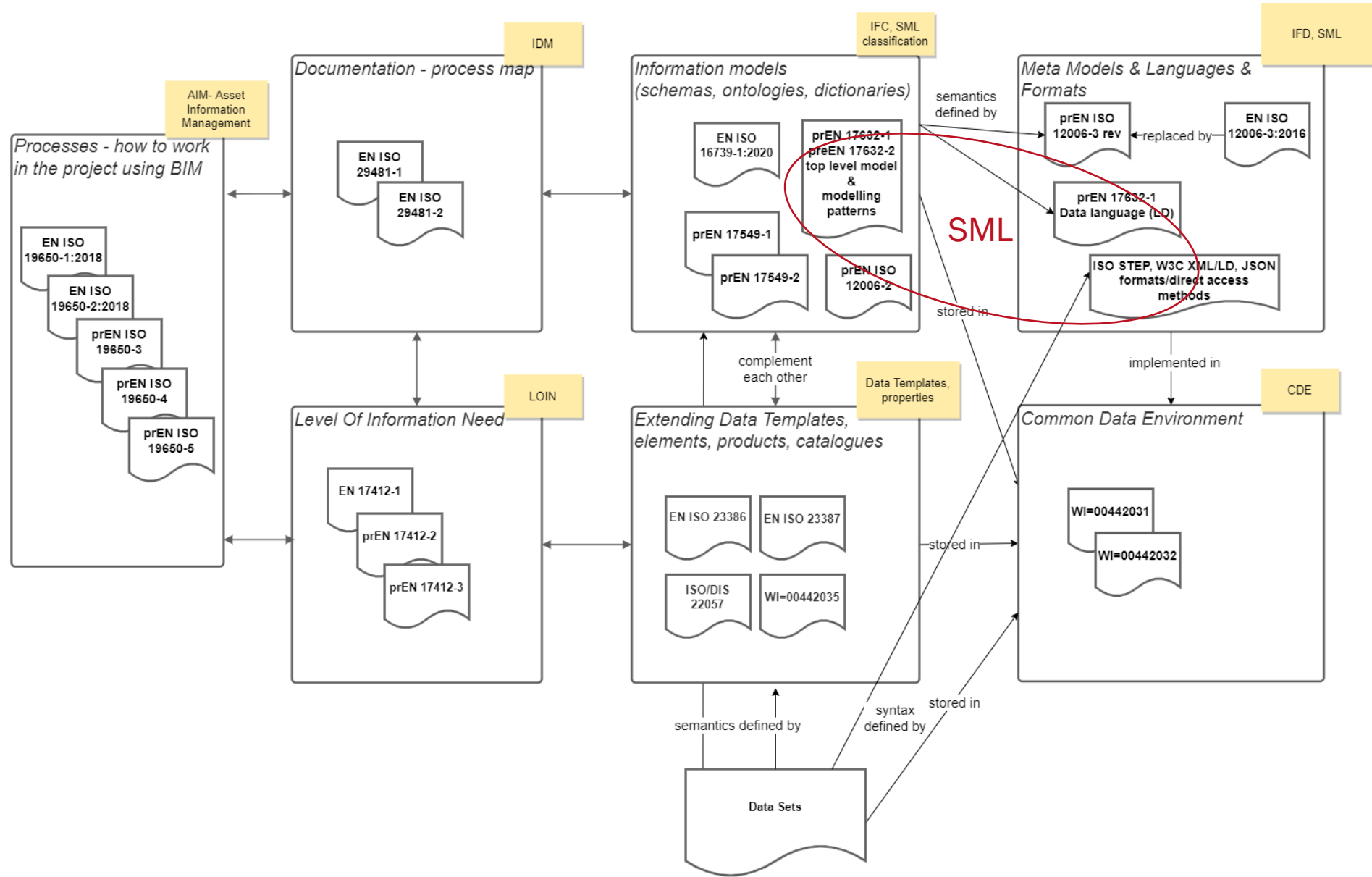


# THE BIGGER PICTURE

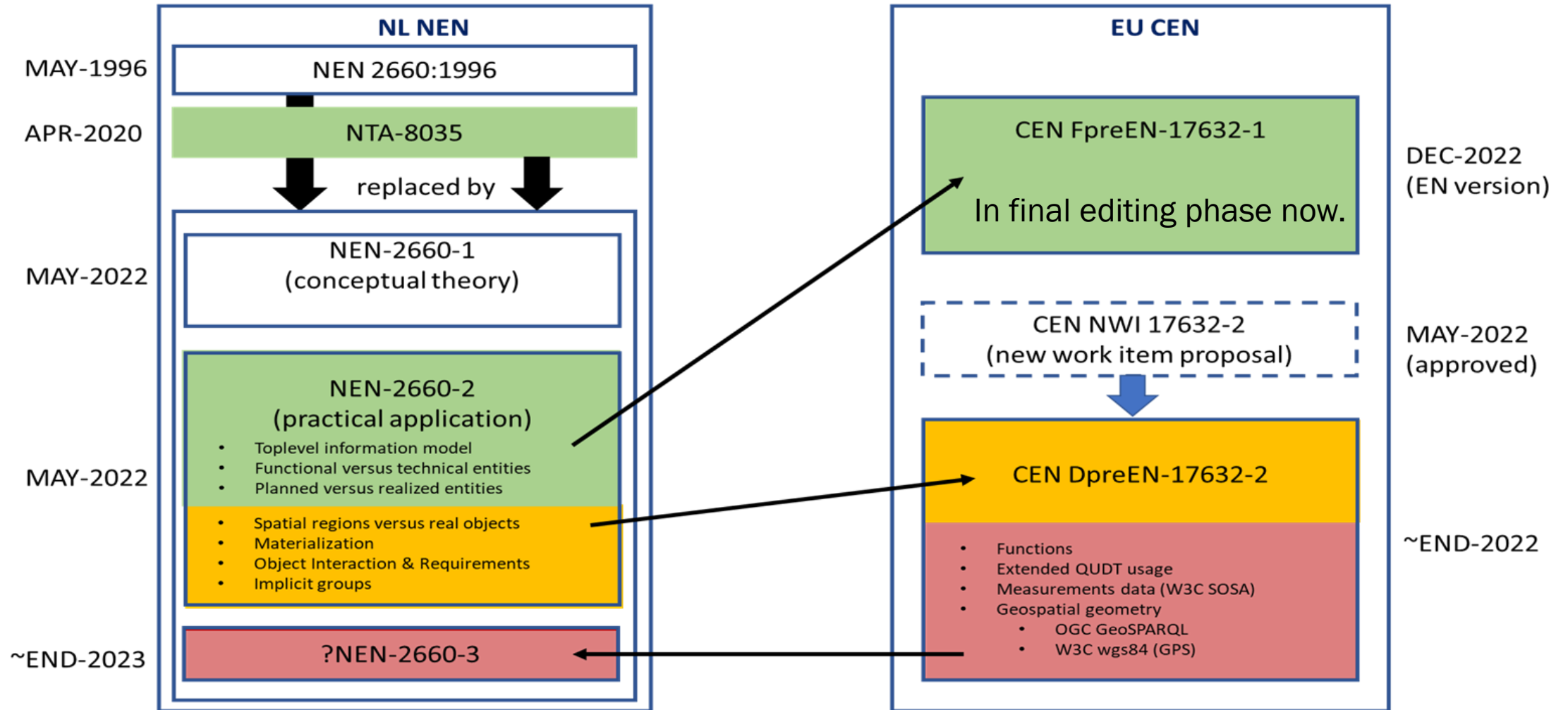
## ISO TC59/SC13 & TC442



Proposed Update No. 1, under discussion in WG4-WG7



# › PROCESS, STATUS & STEPS







› **THANK YOU FOR  
YOUR TIME**

**TNO** innovation  
for life