Interoperability and harmonization of digital materials data

M. T. Horsch

Norwegian University of Life Sciences

Fakultet for realfag og teknologi   **Forskergruppe materialteori og -informatikk**

Norges miljø- og biovitenskapelige universitet

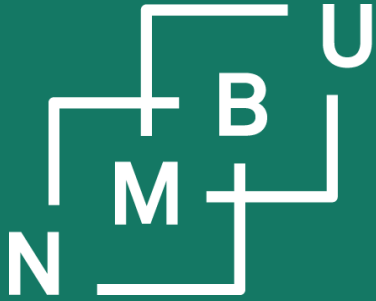Materialteori og -informatikk

Digitalisering på Ås

DigiPass
Know your products!

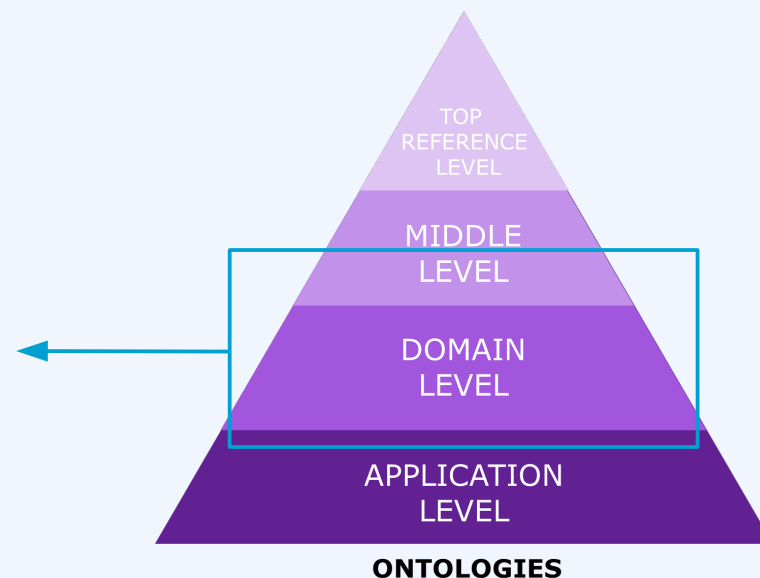# 1. **Interoperability**

2. Harmonization

Types of interoperability

OntoCommons CSA collected and supported the design and alignment of **domain-level interoperability standards**.

The overall analysis of modes of interoperability, relevant tools and components, and recommendations was delivered in the form of **RoDI: The Review of Domain Interoperability**.[1]

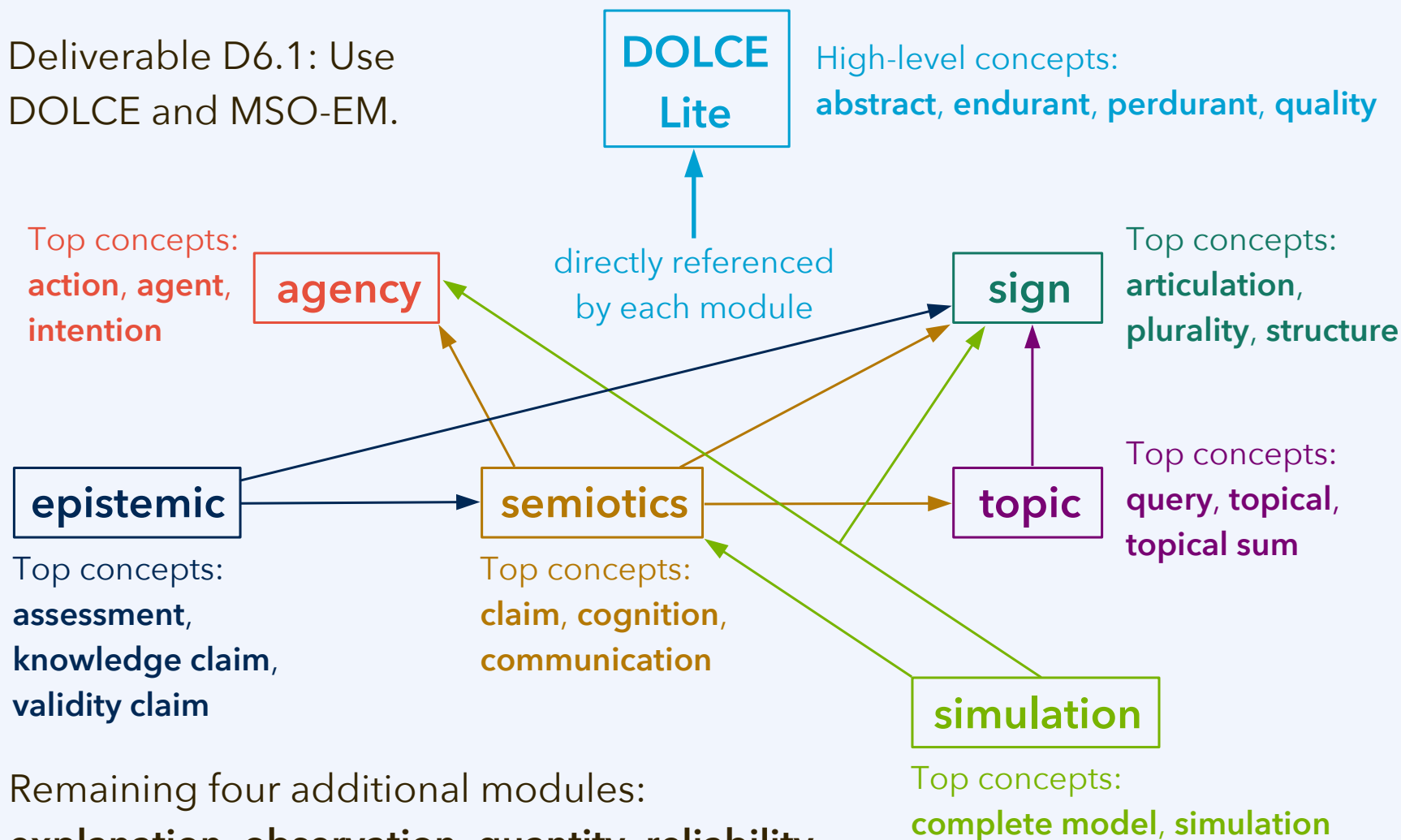In particular, there are **syntactic**, **semantic**, and **pragmatic** modes of interoperability.[1]

TOP REFERENCE LEVEL

MIDDLE LEVEL

DOMAIN LEVEL

APPLICATION LEVEL

ONTOLOGIES

	data	human	organization	software
data (d)	$d \leftrightarrow d$	$d \leftrightarrow h$	$d \leftrightarrow o$	$d \leftrightarrow s$
human (h)	—	$h \leftrightarrow h$	$h \leftrightarrow o$	$h \leftrightarrow s$
organization (o)	—	—	$o \leftrightarrow o$	$o \leftrightarrow s$
software (s)	—	—	—	$s \leftrightarrow s$

Matrix structure for interoperability requirements: Who interoperates with whom?

[1]S. Chiacchiera *et al.*, OntoCommons deliverable 3.8, "Finalized Review of Domain Interoperability," **2023**.

Foundational and mid level in DigiPass

Deliverable D6.1: Use
DOLCE and MSO-EM.

DOLCE Lite

High-level concepts:
abstract, **endurant**, **perdurant**, **quality**

directly referenced by each module

Top concepts:
action, **agent**,
intention

agency

sign

Top concepts:
articulation,
plurality, **structure**

epistemic

semiotics

topic

Top concepts:
query, **topical**,
topical sum

Top concepts:
assessment,
knowledge claim,
validity claim

Top concepts:
claim, **cognition**,
communication

simulation

Top concepts:
complete model, **simulation**

Remaining four additional modules:
explanation, **observation**, **quantity**, **reliability**.

Epistemic metadata

Epistemic metadata are the information that **establishes the knowledge status** of data or digital objects.[1,2]

> **Questions we must answer to establish the knowledge status:**
>
> **a)** "what **knowledge claim φ** has been formulated?,"
> **b)** "where do the data and the claim come from?" (**provenance**),
> **c)** "what **validity claim** was made about φ?,"
> **d)** "why should we accept any of this?" (**grounding**).

Key epistemic metadata items are the **knowledge claims** made based on data, their **provenance**, **validation** and **reproducibility**, and **epistemic grounding**.

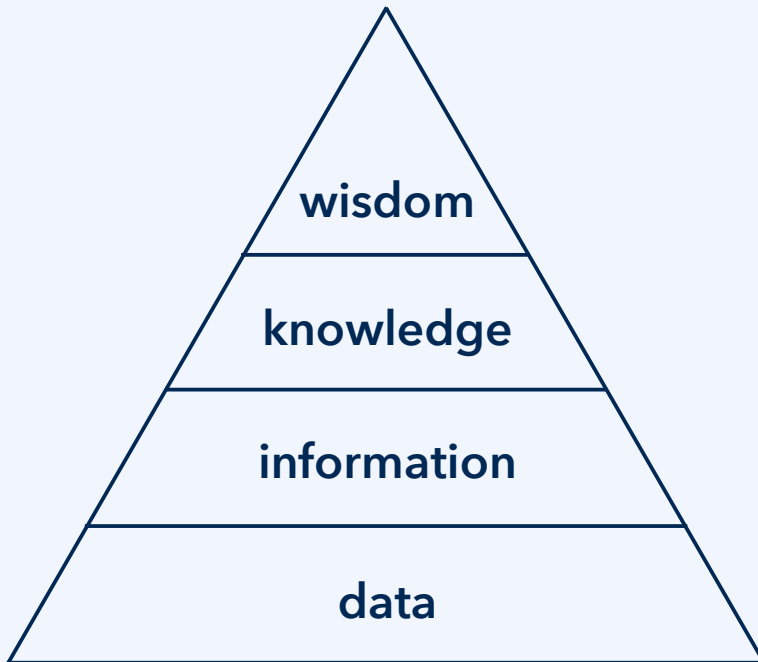[1]In *Proc. JOWO 2022*, CEUR *vol.* **3249**: *p. 2 (CAOS)*, CEUR-WS, **2022**.
[2]In *Proc. FOIS 2023*, *pp.* 302–319, doi:10.3233/faia231136, IOS, **2023**.

Interoperability and the DIKW pyramid

Hierachy of data, information, knowledge, and wisdom (**DIKW pyramid**[1]).

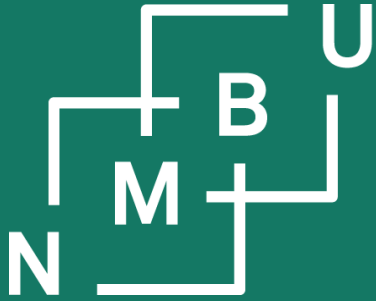[1]J. Rowley, *J. Inform. Sys.* **33**: 163–180, doi:10.1177/0165551506070706, **2009**.

Pragmatic competency and interoperability, including agreed good practices.

Epistemic metadata documentation: Establish the knowledge status.

Semantic interoperability: Data become information if their meaning is agreed.
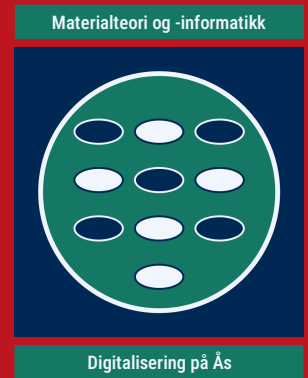
Syntactic interoperability: Data exchanged in an agreed format.

1. Interoperability
2. **Harmonization**

Harmonization

Title of this talk (not chosen by me! …):
"Interoperability and **harmonization** of digital materials data"

Another talk at this workshop (Timothée Harvey):
"Data quality and **harmonization**"

word not in my active vocabulary at all before 28.4.2025

I am clearly not an expert for "data harmonization", at least not using that term.

The term is in use for something similar to what (in the applied ontology community) is called ontology alignment, *i.e.*, dealing with semantic heterogeneity.

"Data harmonization" as an academic term, similar and related to ontology alignment, is very distinct from "harmonization" as it occurs in our context.

Harmonization

Title of this talk (not chosen by me! …):
"Interoperability and **harmonization** of digital materials data"

Another talk at this workshop (Timothée Harvey):
"Data quality and **harmonization**"

What does harmonization mean to us, and in the context of the DPP?

"Harmonization" is EU lingo. It occurs in regulations, including some that are directly relevant to digital product passports. (We'll look at them in a minute.)

What does it mean in an EU context?

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What does it mean in an EU context? See summary of Article 288:

– Minimum harmonization: "a <u>directive</u> sets minimum standards [...] Member States have the right to set higher standards."
– Maximum harmonization: "Member States have to introduce rules with minimum and maximum standards set in the <u>directive</u>."

Harmonization in relevant regulations

Title of this talk:
"Interoperability and **harmonization** of digital materials data"

Mentioned in ESPR:

Preamble (13): "create an effective and future-proof harmonised **regulatory framework**", "different harmonised **type-approval systems** under legal Union acts"

This addresses **pragmatic interoperability**, or "wisdom" in the DIKW pyramid.

Harmonization in relevant regulations

Title of this talk:

"Interoperability and **harmonization** of digital materials data"

Mentioned in ESPR (let us just look at the first occurrences, as there are many):

Preamble (13): "create an effective and future-proof harmonised *regulatory framework*",
"different harmonised *type-approval systems* under legal Union acts"

Preamble (30): "that the repairability score be based on a harmonised *methodology* specified for the product or product group"

Preamble (39): "essential requirements, either in the form of harmonised *standards*"

Preamble (50): "laying down harmonised *conditions* for the marketing of construction products (the 'construction products Regulation')"

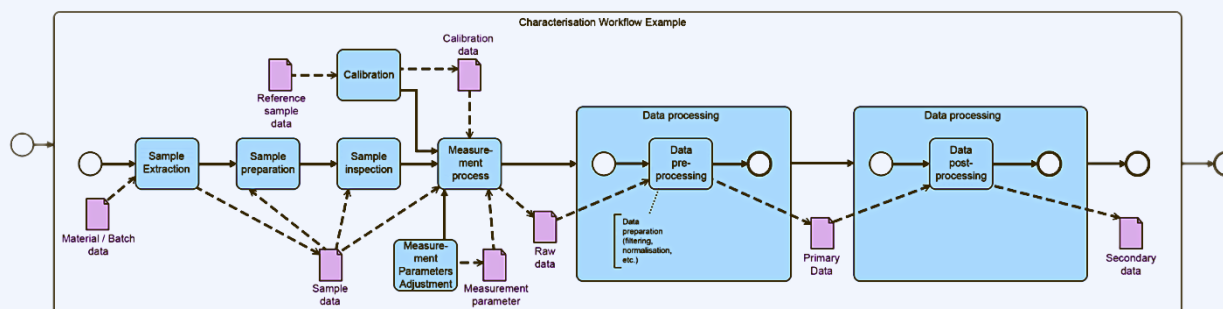Preamble (55): "harmonised rules on the destruction of unsold consumer products are necessary"

Conclusion: No mention "harmonization of data," since to the EU, harmonization is about (mainly legally) agreed processes and rules, not data.

This addresses **pragmatic interoperability**, or "wisdom" in the DIKW pyramid.

Characterization CWA 17815:2025

To conclude, we are now not mainly concerned with metadata standardization.
(That *is* important, but it is *not* what is meant by "harmonization.")

Harmonized standards refers to technical standards; a CWA is a draft standard.
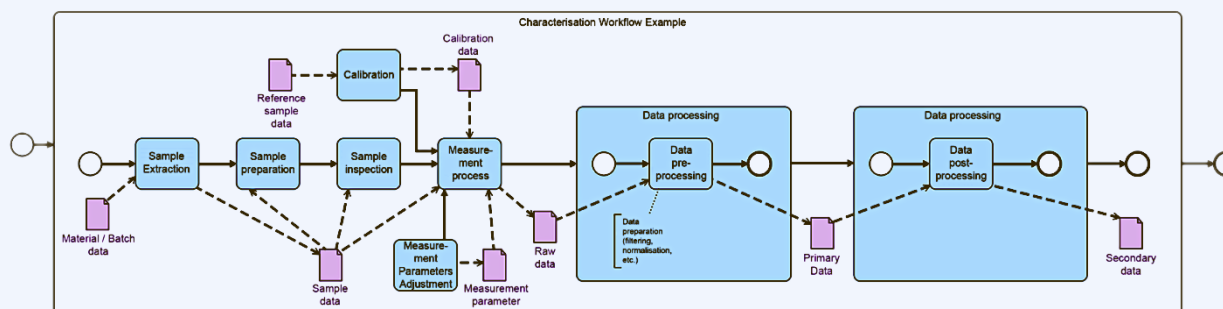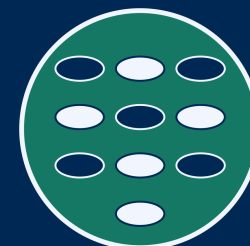

CWA 17815 is based on CHADA
tables (version 2) and comes with its
own BPMN-related diagram notation.

Characterization CWA 17815:2025

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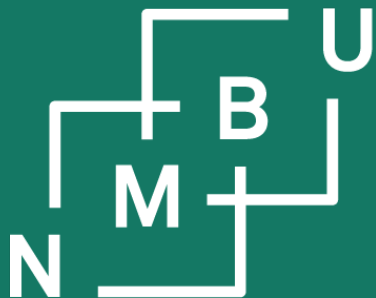
Harmonized standards refers to technical standards; a CWA is a draft standard.

CWA 17815:2025, "Materials characterization: Terminology and structured documentation," is the most recent outcome from EMMC and EMCC activities.

Characterisation Workflow Example

CWA 17815 is based on CHADA tables (version 2) and comes with its own BPMN-related diagram notation.

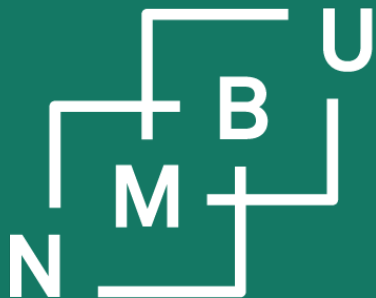For the DPP we will need more: Harmonization of measurement processes, data quality and curation.

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DigiPass CSA M12 consortial meeting: Virtual pre-workshop on
Standardization of Characterization Data for Digital Passports, 28th April 2025

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