

Interoperability of knowledge organization systems with and through ontologies

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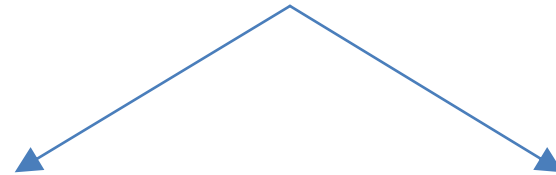
In terms of establishing interoperability one may distinguish...

Data modeling
ontologies
(e.g. SKOS)



Instrument *for*
establishing
interoperability

Reality representation
ontologies
(some biomed. Ontologies
are on the way to such)



Subject *of*
establishing
interoperability
with other KOS

Method for
reengineering
and improving
existing KOS

Data modeling ontologies

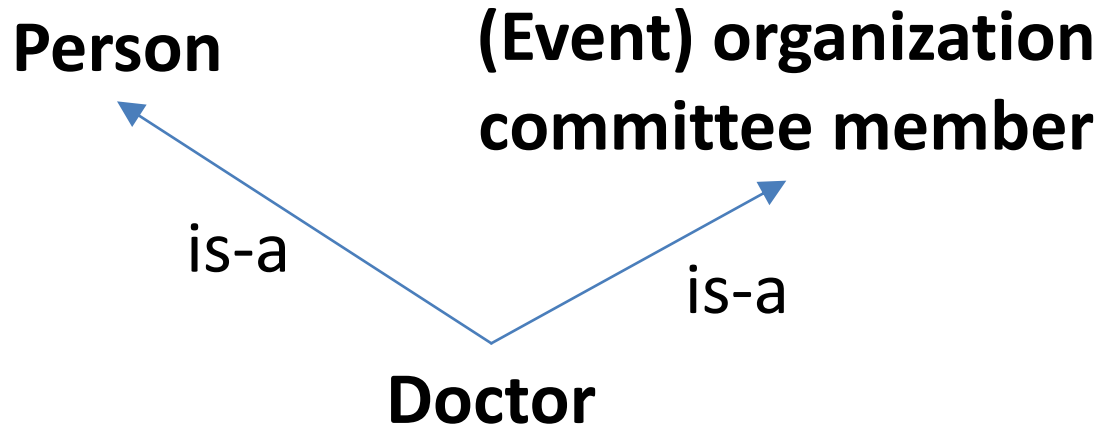
- An “explicit specification of a conceptualization” (Gruber 1993)
- “interface specification”,
“language for communicating with the agent”,
“Data modeling representation at a level of abstraction above specific database designs” (Gruber 2009)
- Semantic data models / conceptual schema (Peckham & Maryanski 1988)

Data modeling ontologies

- Formalism
- No specific method
- SKOS specification (W3C 2009b)
= ontology for thesauri and other KOS
- “Data can be exported, translated, queried, and unified across independently developed systems and services.” (Gruber 2009)

Data modeling ontologies

- Problem when combining ontologies



- Also maintenance and reasoning problem

Reality representation ontologies

- Necessity of *modeling method*
 - OntoClean (Guarino & C. A. Welty 2009)
 - “Ontological realism” (Smith & Ceusters 2010)
 - Fundamental ontological principles (Jansen 2009)
- Describes entities based on their intrinsic (intensional) properties (Guarino et al. 2009)

Semantic Web standards

- OWL has two (model-theoretic) semantics
 - RDF
 - everything is a resource ... triples / graphs all over
 - custom reasoning algorithms necessary
 - matches nature of data modeling ontologies
 - OWL-DL
 - strict separation of individuals and classes
 - strong reasoning support (various profiles)
 - more adequate (yet still limited expressivity) for reality representation ontologies
- Standards do not address method or terminological control

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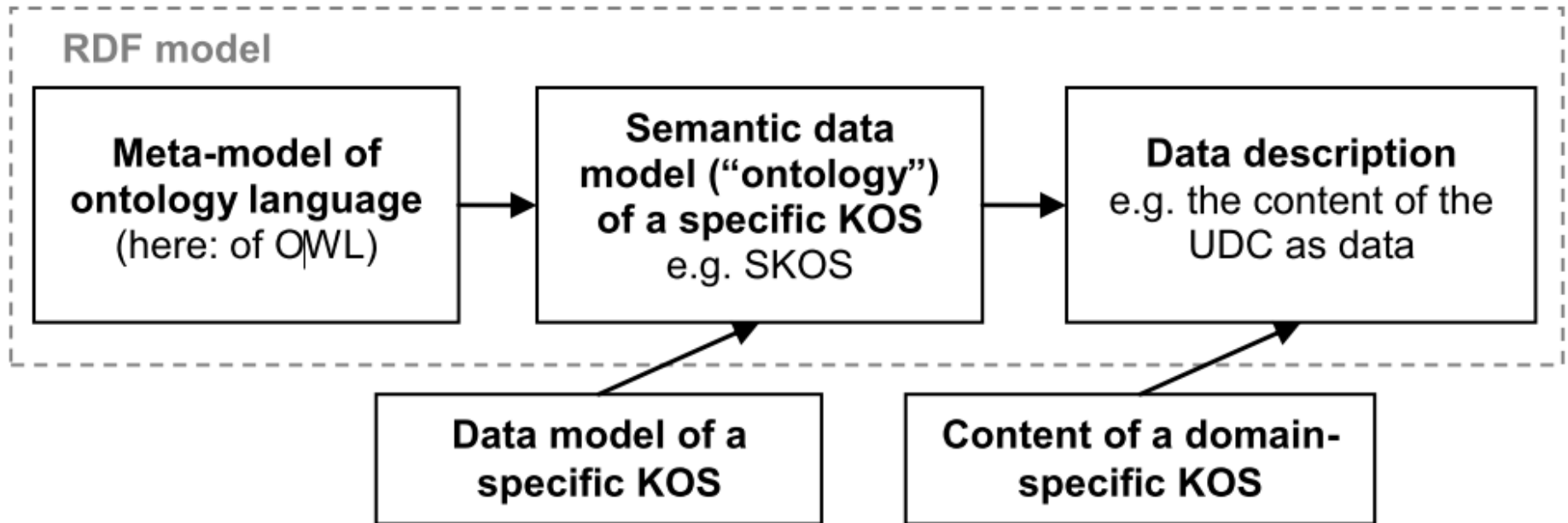
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Data modeling ontologies *for* establishing interoperability



- Interoperability in the sense of an *enabling infrastructure* ... Ontology?

Reengineering KOS using (reality representation) ontological methods

- Central:
 - Individuals representing particulars/objects
 - Classes (universals) abstracting objects *intensionally*
- Expression more domain knowledge than in KOS, e.g. properties
- Way hierarchy is applied
 - Precise semantics of is-a, part-of
 - Methods such as OntoClean (Guarino)
- Relation to classification method unclear

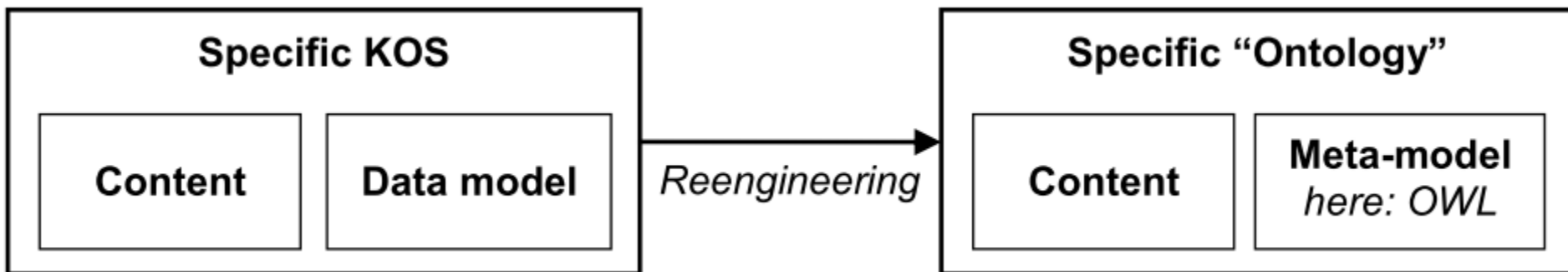
Difference classifications vs. reality representation ontologies

- 0 Common auxiliaries of general characteristics
- 03 Common auxiliaries of **materials**
- 032 Naturally occurring mineral materials
- 033 Manufactured mineral-based materials
- 034 Metals **Ambiguous**
- 035 Materials of mainly organic origin **Overlap**
- 036 Macromolecular materials. Rubbers and plastics
- 037 Textiles. Fibres. Yarns. Fabrics. Cloth
- 039 Other materials **Not intensionally definable**

Refining relationships (in thesauri)?

- Birds *associated with* Ornithology
a bird *is subject in* an ornithology

→ Change of structure *and* content



Reengineering KOS using (reality representation) ontological methods

- Pros
 - Logical structure
 - Permit reasoning
 - Improved search expansion
 - Easier to maintain
- Cons
 - Initial effort

Interoperability between reality representation ontologies and KOS

- Do *complex* domain ontologies exist?
 - Generally reengineered KOS
 - Efforts particularly in the biomedical domain (e.g. Gene Ontology, NCI thesaurus)
- Still many uncertainties:
 - Method
 - Purpose
 - Quality
 - Definition

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