

# 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

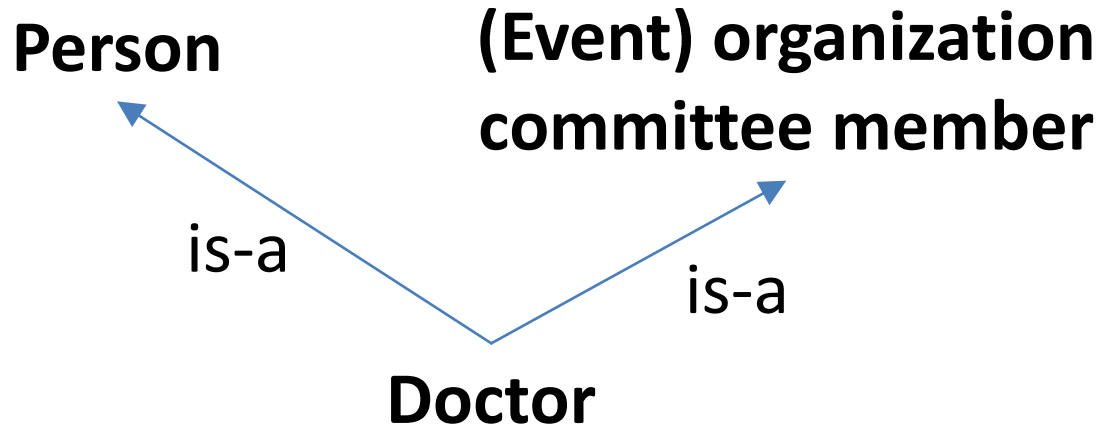
- An “explicit specification of a conceptualization” (Gruber 1993)
- “interface specification”,  
“language for communicating with the agent”,  
“Data modeling representation at a level of abstraction above specific database designs” (Gruber 2009)
- Semantic data models / conceptual schema (Peckham &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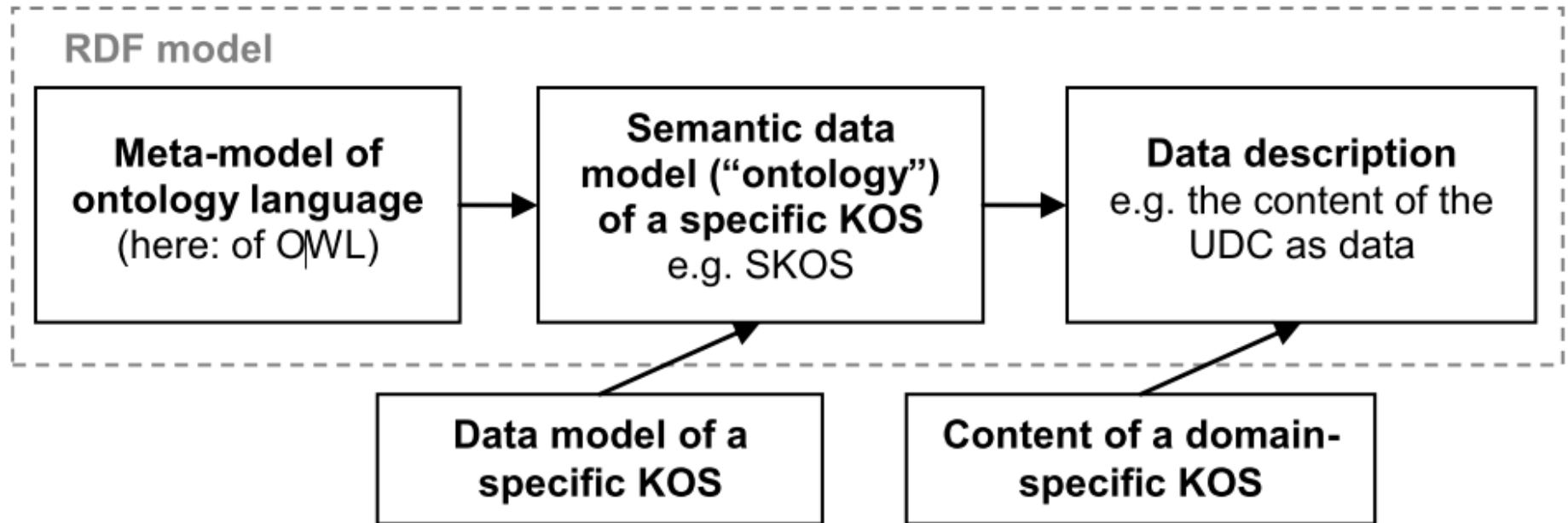


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# Data modeling ontologies *for* establishing interoperability



- 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

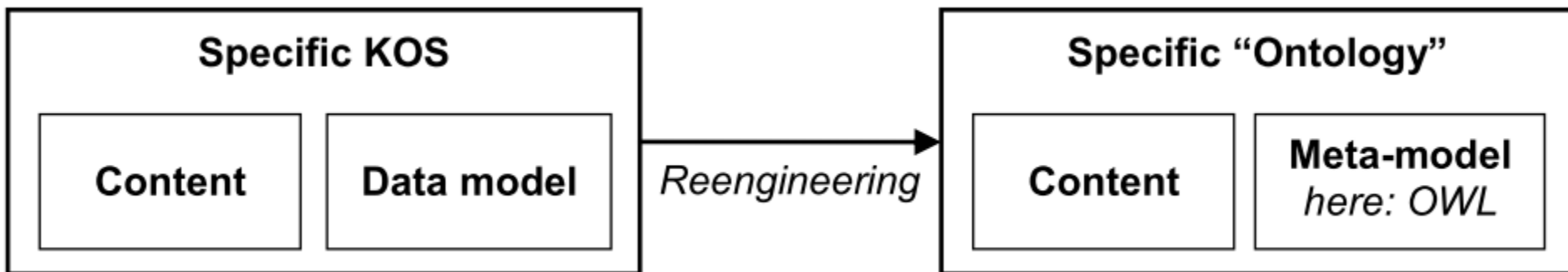
# Difference classifications vs. reality representation ontologies

- 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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