The eNanoMapper Ontology

Harnessing ontologies to enable data integration for nanomaterial risk assessment

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Overview

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   - What is an ontology?
   - What is an ontology?
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eNanoMapper

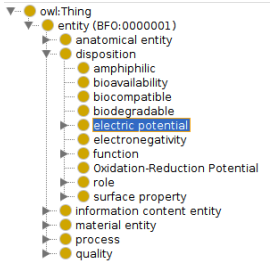
- **eNanoMapper** is a broader European project which aims to address data and model interoperability challenges for data management for engineered nanomaterial safety.
- **The eNanoMapper ontology** is an application ontology and reuses parts of several ontologies to describe the full domain of nanomaterial safety assessment.

Figure 1: The eNanoMapper logo

What is an ontology?

- A formal description of a domain (a means to capture knowledge about things) **?**
- It consists of three syntactical categories: **Entities**, **Expressions** and **Axioms**, which can be given annotations for further description.
- All entities (classes, object properties, named individuals...) are uniquely identified by a sequence of characters called IRI.

Figure 2: A class (highlighted in blue) in the hierarchy view of the ontology it is contained in.



What is an ontology?

Figure 3: A class in an ontology text file (the ontology document). IRIs in blue.

```
<!-- http://purl.obolibrary.org/obo/PATO_0001464 -->

<owl:Class rdf:about="http://purl.obolibrary.org/obo/PATO_0001464">

<rdfs:subClassOf rdf:resource="http://purl.obolibrary.org/obo/PATO_0001018"/>

<rdfs:subClassOf rdf:resource="http://purl.obolibrary.org/obo/BFO_0000016"/>

<obo:IAO_0000115
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">

A quality that is equal to the potential energy per unit charge associated with a
static (time-invariant) electric field, also called the electrostatic potential.

</obo:IAO_0000115>

<oboInOwl:hasOBONamespace
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">quality</oboInOwl:
hasOBONamespace>

<oboInOwl:id
rdf:datatype="http://www.w3.org/2001/XMLSchema#string">PATO:0001464</
oboInOwl:id>

<oboInOwl:inSubset
rdf:resource="http://purl.obolibrary.org/obo/pato#attribute_slim"/>

<oboInOwl:inSubset
rdf:resource="http://purl.obolibrary.org/obo/pato#scalar_slim"/>

<rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">electric
potential</rdfs:label>

</owl:Class>
```

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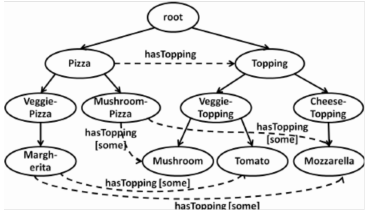
What is an ontology?

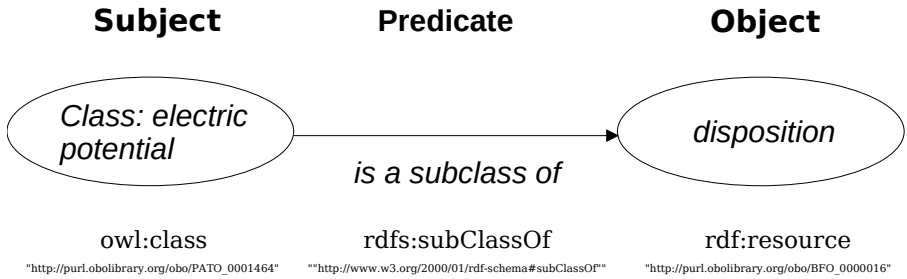
- Most ontologies use the W3C standard language for ontologies, Web Ontology Language **OWL**.
- OWL ontologies are mainly stored in `.owl` files, which are a sort of **RDF** document.
- **RDF** (Resource Description Framework) is a standard for data exchange. It defines **triples** of **(subject, predicate, object)**.
- These triples form labeled graphs where the edge (predicate) represents the link between two resources (subject and object)

Figure 4: The pizza ontology, visualized as a graph (add source)



What is an ontology?

Figure 5: A graph with two nodes (Subject and Object) and a triple connecting them (Predicate)



What is an ontology?

Figure 6: The triple in the previous figure as included in the `.owl` document file of the ontology it is contained in.

```
<!-- http://purl.obolibrary.org/obo/PATO_0001464 -->

<owl:Class rdf:about="http://purl.obolibrary.org/obo/PATO_0001464">
<rdfs:subClassOf rdf:resource="http://purl.obolibrary.org/obo/BFO_0000016"/>
 (...)
</owl:Class>
```

What is an ontology?

- **Foundation ontologies**: they provide the most abstract or general classes, i.e., the top-level classes we see in a hierarchy view of our ontology.
- **Application ontologies**:
- **Domain ontologies**

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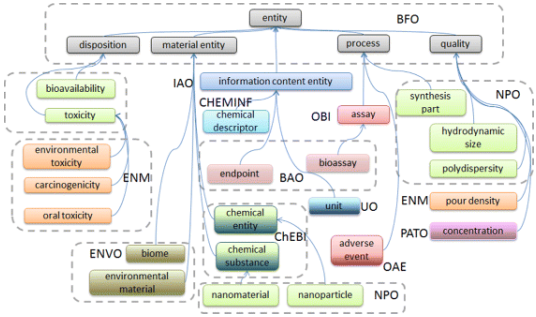
Development and QC

Pointers about this...

Composition of the eNanoMapper ontology

Figure 7: eNM ontology yadda quote



Uses of the eNM ontology

Pointers about this...

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What is still needed

- OWL is not the best at modularity, but the eNM ontology heavily relies on importing modules. This leads to complications in class hierarchies, duplicate imports, etc.
- This peculiarity

Migrating the ontology development?

... ODK for automation, standardisation, interoperability... is it convenient for enm?

References I