OntoCommons Project
OntoCommons Ecosystem (OCES)

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The most tangible outcome – OntoCommons Ecosystem

OCES is a combination of fully harmonized ontology artifacts (from top to domain) and associated tools and methodologies for building upon existing and creating future ontologies. The complementary components of OCES therefore provide a complete solution for data documentation in the NMBP domains.
Ontologies harmonisation

**OntoCommons will provide harmonisation between ontologies, through Top Reference Ontology through a multilevel alignment:**

- **Syntactic** alignment (OWL, FOL, etc.) for all the ontologies that will be part of the OES.

- **Terminological** alignment enabling a minimum taxonomical interoperability between ontologies, by pasting a sub-branch of one ontology under another ontology.

- **Semantic** alignment will be targeted primarily by OntoCommons only within TLO branches.

- **Formatting** alignment including e.g. labelling of classes, the definition of terms and the annotations.

The OCES will adopt a pluralist approach for the ontological representation of a domain of interest, meaning that more than one upper ontology may be adopted.
Intra and Cross-ontology interoperability

**Intra-ontology interoperability**: The capability to enable data sharing between a single semantic representation of data from TLO to ALO coming from a monistic ontology/domain approach (one-to-one exclusive relation between ontology and domain of interest). This type of interoperability will be addressed by OntoCommons within a TLO ontology branch whose lower ontology levels share a common semantic framework.

**Cross-ontology interoperability**: the capability to enable data sharing between different semantic representations of data from different TLOs branches coming from a pluralistic ontology/domain approach.
Status of TRO

- BFO to DOLCE and vice versa is already published (v0.3).
- Now working on DOLCE – EMMO mappings.
Bridge concept

- **Standalone ontology entities** with an extensive documentation: a practical dictionary tailored for ontology-implementation.
  - Explicitly connected to the core Knowledge Domain Resources and Standards but still separated.

- They are akin to **universal adapters/converters**, supporting (and facilitating) strong semantic alignments among a plurality of ontologies.
  - Interoperability for data exchange

- (Vertical) Mediated connection result from multiple connections. Reasoning spreads downwards (in general from higher to lower-level ontologies).

- (Horizontal) Data sharing is established

- Secondary benefits: Disambiguity, Modularisation
LOT Methodology

- Ont. Devel.
- Users
- Experts

Ontology requirements specification
- ORSD

Ontology implementation
- Ontology

Ontology publication
- Online ontology

Ontology maintenance
- Issues, bugs, etc.

Legend
- Actors
- Activity
- Artefacts

(input) Artefact reference
(output) activity flow
Components of the ontology ecosystem toolkit

<table>
<thead>
<tr>
<th>Requirement specification</th>
<th>Implementation</th>
<th>Publication</th>
<th>Maintenance</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept extractor</td>
<td>(Visual) Drafting</td>
<td>Repository</td>
<td>Validator</td>
<td>API / library</td>
</tr>
<tr>
<td>Constraints specification</td>
<td>Editing</td>
<td>Modulariser</td>
<td>Test executor</td>
<td>Query engine</td>
</tr>
<tr>
<td>Test specification</td>
<td>Source editing</td>
<td>Documentor</td>
<td>Populator</td>
<td>Reasoner</td>
</tr>
<tr>
<td></td>
<td>Matcher</td>
<td></td>
<td></td>
<td>Visualiser</td>
</tr>
</tbody>
</table>

- Issue tracking
- Version management
Ontology Encoding (OCES Technical Principle)

- IRI Convention
  - OCIRI Grammar (based on RFC3987) — separate for TLO, MLO, DLO
  - Permanent host resolver (purl, w3id, doi, ARK)
  - Opaque identifier Scheme

A class ‘Plastic’ in a domain ontology called ‘plastonto’
http://purl.ontocommons.eu/ontology/dlo/srao-0000211/plastonto#oxy4f

- Metadata Convention
  - Common set of annotation properties for
    - Ontology metadata, Term metadata, Mapping metadata (SSSOM)
    - Based on MOD, OMV, DC, IOF-av, EMMO-av, FIBO-av

- Language and expressivity, Reasoner and prover, Serialisation format, Versioning scheme, Development management and issue tracking
**Bridge Concept Template**

**ONTOCOMMONS BRIDGE-CONCEPT**

**MATERIAL DEVICE**

<table>
<thead>
<tr>
<th>General Concept Info:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRI:</td>
</tr>
<tr>
<td>OWL Type:</td>
</tr>
<tr>
<td>Concept Elucidation:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Labels:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labels used to address the concept, ordered as:</td>
</tr>
<tr>
<td>skos:prefLabel: Device</td>
</tr>
<tr>
<td>skos:altLabel: Tool (BROAD)</td>
</tr>
<tr>
<td>skos:hiddenLabel: Instrument</td>
</tr>
</tbody>
</table>

**Knowledge Domain Resources:**

- [Wikipedia](https://en.wikipedia.org/wiki/Tool): "a device is usually a constructed tool"; "a tool is an object that can extend an individual's ability to modify features of the surrounding environment. Although many animals use simple tools, only human beings, whose use of stone tools dates..."

https://github.com/OntoCommons/OntologyFramework/blob/dev/bridge-concept-template.md
Deliverable D3.4 contains detailed requirement for NMBP domains based on 11 use cases and stakeholder’s input.
**Ontology Recommender**

Get recommendations for the most relevant ontologies based on an input from a biomedical text or a list of keywords.

**Recommended ontologies**

<table>
<thead>
<tr>
<th>POS</th>
<th>ONTOLOGY</th>
<th>FINAL SCORE</th>
<th>COVERAGE SCORE</th>
<th>ACCEPTANCE SCORE</th>
<th>DETAIL SCORE</th>
<th>SPECIALIZE</th>
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<tbody>
<tr>
<td>1</td>
<td>MCOL</td>
<td>73.3</td>
<td>100.0</td>
<td>0.0</td>
<td>88.5</td>
<td>Manufacturing, Service, Description Language</td>
</tr>
<tr>
<td>2</td>
<td>ICF-CORE</td>
<td>58.7</td>
<td>66.7</td>
<td>0.0</td>
<td>87.5</td>
<td>Maintenance, Management</td>
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<tr>
<td>3</td>
<td>SIMPFM</td>
<td>40.4</td>
<td>33.3</td>
<td>0.0</td>
<td>47.1</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>4</td>
<td>GRACE</td>
<td>34.0</td>
<td>33.3</td>
<td>0.0</td>
<td>41.2</td>
<td>Manufacturing</td>
</tr>
</tbody>
</table>

**Industry 4.0 Knowledge Graph (I4KG)**

The Industry 4.0 Knowledge Graph (I4KG) or previously Standards Ontology (SToL) represents standards, standardization organizations and standardization frameworks for the Industry 4.0 area.

**Industrial MAintenance Management Ontology (IMAMO)**

IMAMO-Powar and OWL class diagram version were developed by Hadi Hary et al in the scope of the transnational IMIC at Technical Institute, University of Hamburg.
Ontology Editing (and data documentation)

- Two primary editors (completely free, natively hosted) are recommended.
- Currently being integrated to the ecosystem platform (IndustryPortal)
FAIRness improvement with O’FAIRe in IndustryPortal
OntoComm ons “Ontology-driven data documentation for Industry Commons” has received funding from the European Union’s Horizon Programme call H2020 -NMBP-TO-IND-2020-singlestage, Grant Agreement number 958371

Thanks

Questions?

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