

Ontology Links in the Distributed Ontology Language (DOL)

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Distributed Ontologies and Links

DOL is the **Distributed Ontology Language** being standardized in the course of the OntoOp (**O**ntology **I**ntegration and **I**nteroperability) activity (ISO Working Draft 17347).

A **distributed ontology** consists of

- **basic ontologies**

- in a single ontology language and a single logic
- multiple basic ontologies possibly in different languages/logics

- **links** between basic ontologies:

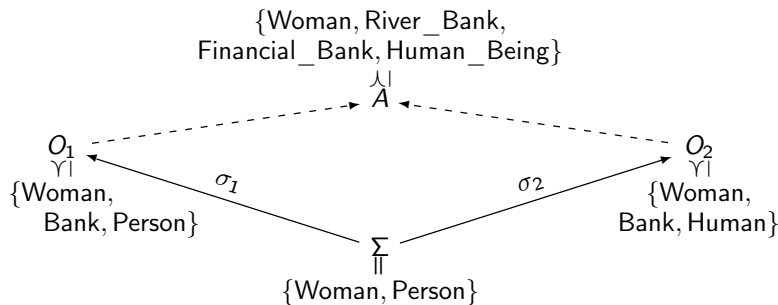
- **logical links**: so far interpretations (a.k.a. views), module relations, and imports; have a formal semantics
- **alignments**: informal semantics

Logical Links (I): Interpretations

interpretation `i` : foaf: to people: =
logic `log:OWLtoCommonLogic`,
`foaf:Person` \mapsto `people:HumanBeing`

- Interprets the FOAF OWL ontology in terms of a Common Logic ontology about people
- ... after a logic translation and renaming entities
- Not shown here: Entities with same local name implicitly mapped to each other (where they exist), e.g. *foaf:Agent* to *people:Agent*; entity map needs to cover all entities of the source ontology
- Note: *prefix:name* syntax abbreviates IRIs, e.g. *http://xmlns.com/foaf/0.1/Agent*.

Interpretation Example: V-Alignment



interpretation $\sigma_1 : \Sigma$ to O_1

interpretation $\sigma_2 : \Sigma$ to O_2 with $\text{Person} \mapsto \text{Human}$

ontology $A = \text{combine } O_1 \ O_2$

Logical Links (II): Module relations

- DOL supports **extraction of modules** from an ontology (given a **restriction signature**), ...
- ... but also the **declaration** that one ontology is a module of another one (creates a proof obligation).

Suppose *foafPeople* is an ontology that declares *foaf:Person*, *foaf:knows* and all axioms known about them in the original FOAF ontology; then we can write:

module *m* : foafPeople **of** foaf: **for** foaf:Person, foaf:knows

(Informal) Alignments

- An (informal) alignment is a set of **correspondences** between entities of a source ontology and a target ontology.
- Each correspondence has a relation and a confidence measure $0 \leq c \leq 1$
 - default relation: (non-logical) equivalence
 - further relations from the Alignment API (some are OWL-specific): subsumption, instance of, incompatibility
 - arbitrary other relations possible (in DOL: any IRI; in the Alignment API: any Java class name)

DOL Syntax for Alignments (I)

- DOL largely reuses the syntax of the Alignment API (<http://alignapi.gforge.inria.fr/format.html>)
- Some examples in DOL Text syntax follow; DOL RDF and DOL XML (under development) will be similar.

Empty alignment:

```
alignment a : 01 to 02
```

First pair of entities equivalent, second and third one “similar” (with custom relation, third one with custom confidence instead of default 1); assuming O_1 with signature $\{a, b, c\}$ and O_2 with signature $\{x, y, z\}$

```
alignment a 11 : 01 to 02 %% 11 = Align. API syntax for bijective
a = x,                %% = is a relation defined by the Alignment API
b my:similarTo y, %(correspond-b-to-y)%,          %% naming it ...
c my:similarTo 0.75 z      %% for later reference or annotation
```

DOL Syntax for Alignments (II)

- DOL uses an extensible registry of logics, ontology languages, logic and ontology language translations, etc.
- All of these are identified by IRIs and accessible as linked open data (try e.g. <http://purl.net/dol/logics/SROIQ>)
- Correspondence relations also part of the registry: “=” expands into <http://purl.net/dol/rerelations/Equivalent>, which we declare equivalent to (via *owl:sameAs*) `java:fr.inrialpes.exmo.align.impl.rel.EquivRelation` from the Alignment API.
- No need to expand the fixed number (4×4) of alignment *types* into registry IRIs – except when using DOL RDF syntax.

DOL Syntax for Alignments (III)

Shorthands when multiple correspondences share the same relation and confidence; different way of writing previous example:

```
alignment a 11 : 01 to 02 =
  relation foo:similarTo 0.75 {
    %% unless stated otherwise, this holds for all correspond's.
    a = x,
    b ↦ 1 y, %% using default relation
    c ↦ z %% using default relation and confidence
  }
```

DOL Syntax for Alignments (IV)

Suppose we had larger signatures (e.g.

$\exists \text{http} : // O_1 - \text{namespace/Concept} \in$

$\Sigma(O_1), \text{http} : // O_2 - \text{namespace/Concept}$): shorthand for applying default correspondence to all entities with the same local names:

```
alignment a 11 : 01 to 02 =
  relation foo:similarTo 0.75 {
    a  $\mapsto$  x,
    b  $\mapsto$  y,
    c  $\mapsto$  z,
    * %% maps Concept  $\mapsto$  Concept
  }
```