Purpose and status of the European Virtual Marketplace Ontology (EVMPO)

The ontology work of the VIMMP and MARKETPLACE consortia concerns

- the **European Virtual Marketplace Ontology (EVMPO)**,
- **marketplace-level ontologies** (e.g., "training", "validation", ...),
- **subdomain-specific ontologies** (e.g., "particle-based dynamics", "continuum", ...).

It is our aim to be not only transparent and open in all aspects, but also to become maximally interoperable, ideally by using the same ontologies, jointly agreed on by both consortia. This work is based on the European Materials Modelling Ontology (EMMO) as an upper ontology.

Semantic connections will be made as follows:

- Fundamental paradigmatic categories from EVMPO are connected to the EMMO;
- marketplace-level ontologies elaborate the EVMPO categories at greater detail;
- subdomain-specific ontologies connect to OSMO, a marketplace-level ontology.

Structure of the European Virtual Marketplace Ontology

EVMPO provides a structure for the marketplace-level ontologies by formulating **fundamental paradigmatic categories** which correspond to irreducible terms that are constitutive to the virtual-marketplace paradigm. Consistency with EVMPO, and by implication with EMMO, is a requirement for components of the European Virtual Marketplace Framework.

Terms which are not so closely related to the virtual marketplace paradigm itself, but will presumably occur somewhere in our semantic web (elements from the periodic table, academic qualification of experts, etc.), are **non-paradigmatic**. For this purpose, the EVMPO introduces **one fundamental non-paradigmatic category: "annotation"**.

The purpose of this structure is that both marketplaces can agree on

- **paradigmatic entities**,
- **annotations** which are either directly or indirectly related to paradigmatic entities,

while any marketplace retains the option to extend its own semantic base as required. At any time, any work beyond the agreed joint semantic basis remains possible for any side. To remain compatible with the joint European Virtual Marketplace Framework, however, all such additional works need to avoid logical contradictions with the EVMPO and the EMMO.

List and definition of the fundamental categories

Paradigmatic categories:

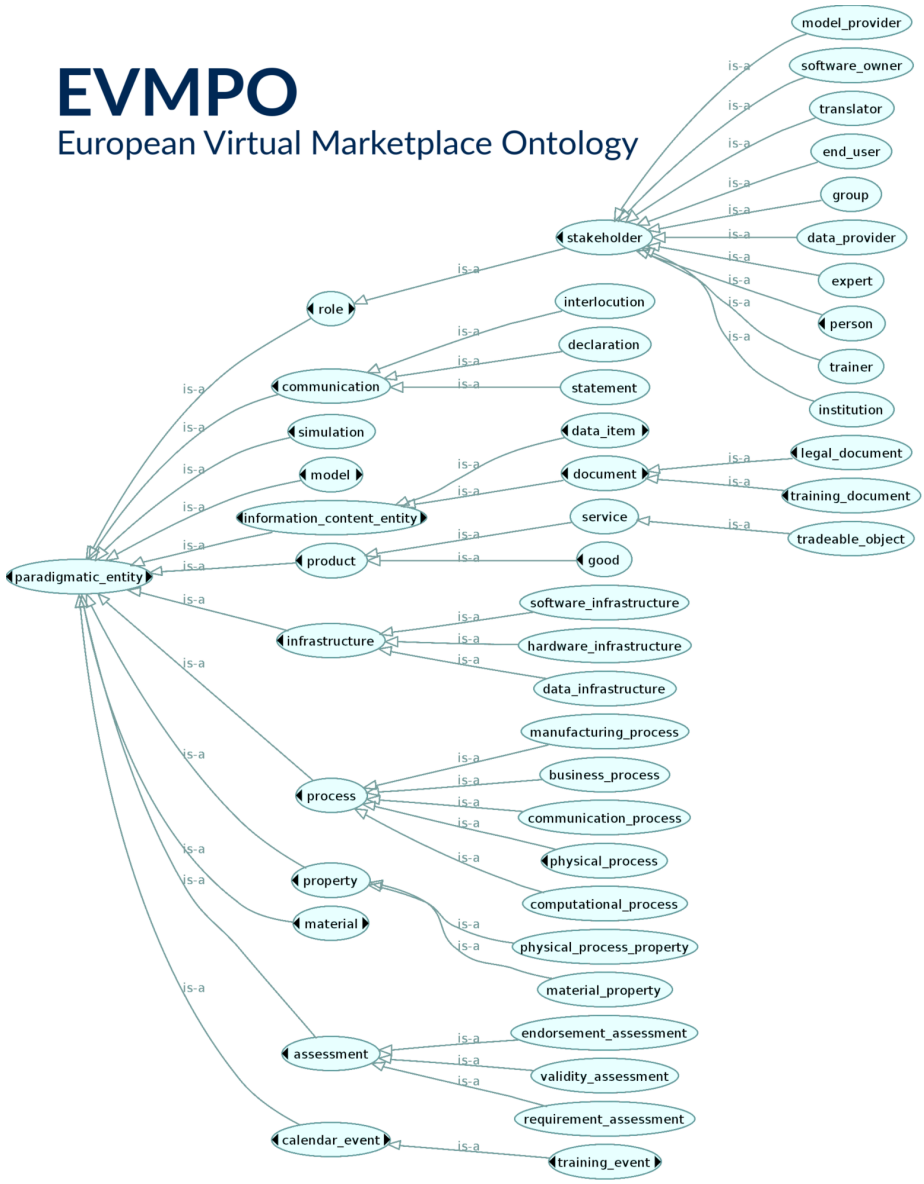
(1) **assessment**, *i.e., proposition on accuracy, performance, or trust in something/someone*
(2) **calendar_event**; *by definition, evmpo:calendar_event is equivalent to ical:Vevent from the W3C iCalendar ontology with Time Zones as Datatypes (also known as ICALTZD)*
(3) **communication**, *i.e., message or action that is communicated by a stakeholder*
(4) **information_content_entity**; *by definition, evmpo:information_content_entity is equivalent to iao:information_content_entity from the Information Artifact Ontology*
(5) **infrastructure**, *i.e., virtual-marketplace infrastructure including DB, hardware, software*

(6) **material**; *by definition, evmpo:material is equivalent to emmo:material*
(7) **model**; *by definition, evmpo:model is equivalent to emmo:model*
(8) **process**; *i.e., temporal evolution of one or multiple entities*[1]
(9) **product**, *i.e., any good or service, marketed off-site or on the virtual marketplace*[2]
(10) **property**; *by definition, evmpo:property is equivalent to emmo:property*
(11) **role**; *by definition, evmpo:role is equivalent to emmo:role*[3]
(12) **simulation**, *i.e., simulation workflow (including a single simulation as special case)*

Non-paradigmatic category:

(a) **annotation**, *i.e., non-paradigmatic aspect associated with an entity covered by EVMPO*

Subclass relation graph of the paradigmatic branches



1 The subclass **"physical_process"** is stated to be a subclass of *emmo:process*.
2 The subclass **"tradeable_object"** specifically refers to a **service offered on a virtual marketplace**.
3 The subclass **"stakeholder"** refers to an **individual/institution/group that acts on a virtual marketplace**.

Technical Annex

1. Mutual disjointness and non-disjointness of EVMPO categories

The following classes are defined to be mutually disjoint:

- "paradigmatic_entity" and "annotation"
- "model" and "simulation" (in OSMO, these are both specified in detail)

2. Simplification of the EVMPO structure by March 2019

Previous versions of EVMPO, until February 2019, included "non_paradigmatic_entity" as a superclass of "annotation". Since in several discussions we agreed that all non-paradigmatic marketplace-related entities are annotations, this is not required any more (it would be equivalent to "annotation"), by which now only "annotation" is left, becoming the topmost non-paradigmatic class. The same previous versions of EVMPO included subclasses of "annotation" associated with each of the branches ("communication_annotation", "simulation_annotation", etc.). These have been eliminated, because the same entities tend to appear as annotations in multiple marketplace-level ontologies. Hence this is not a helpful way to categorize annotations.

Accordingly, the classes called "XXX_related_entity" (or similar), that were previously introduced as a common superclass of "XXX" and "XXX_annotation" for any paradigmatic category "XXX", are not needed any more, since "XXX_annotation" does no longer occur as a class. The relation "has_annotation" is categorized into subproperties ("has_XXX_annotation") according to the domain, not the range. This is easier and further simplifies the EVMPO class structure.