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Information technology — Top-level ontologies (TLO) —

Part 4: TUpper

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Foreword

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Introduction

TUpper is a top-level ontology (TLO) conforming to ISO/IEC 21838-1. It contains definitions of its terms and relational expressions and formal representations in OWL 2 and in Common Logic (CL).

Top-level ontologies have traditionally arisen from the approach in which concepts that are common across a set of domains can be axiomatized at a general level. The rationale is that reuse across domains is to be supported through specialization of the general concepts from a top-level ontology. Similarly, semantic integration between ontologies is to be achieved through the general concepts they specialize. The TUpper ontology follows an alternative approach (referred to as the sideways approach) to the conventional top-level ontology paradigm. Rather than think of a top-level ontology as a monolithic axiomatization centred on a taxonomy, the sideways approach considers a top-level ontology to be a modular ontology composed of ontologies that cover concepts including those related to time, process, and space, from which any underlying taxonomy can be inferred. Each module within TUpper is a set of axioms from an existing ISO standard. The central claim is that a top-level ontology is an ontology that has a reduction whose modules are all ontologies that satisfy a subset of the requirements for a top-level ontology in ISO/IEC 21838-1:2021. New top-level ontologies can be designed by the union of different ontologies that already exist rather than harmonizing different ontologies.

The TUpper ontology is designed as a top-level ontology that contains modules from the ontologies within existing international standards, and that extends these modules so as to satisfy the criteria for top level ontologies in ISO/IEC 21838-1. The modules of PSL appear in ISO 18629. The modules for mereotopology and location arise from ISO 19107 and ISO 19150-1. Modules related to units of measure arise from ISO 80000.

TUpper-terms, the natural language specification of TUpper, supports human maintenance and use of the ontology, including use in development of conformant domain ontologies.

Tupper-OWL, the OWL 2 formalization of TUpper, enables TUpper to be integrated with other ontologies expressed in OWL and in related languages, and supports the use of OWL automated reasoners.

TUpper-CL, the CL formalization of TUpper, provides the axiomatization of the intended semantics of TUpper.

This document conforms to ISO/IEC 21838-1.

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Information technology — Top-level ontologies (TLO) —

Part 4:
TUpper

1 Scope

This document describes TUpper as an ontology that is conformant to the requirements specified for top-level ontologies in ISO/IEC 21838-1.

This document describes TUpper as a resource designed to support ontology design, ontology integration, automated reasoning, and semantic integration of heterogeneous information systems.

The following are within the scope of this document:

— definitions of classes and relations in the signature of TUpper;

— axiomatizations of TUpper in OWL 2 and CL;

— documentation of the conformity of TUpper to the requirements specified for top-level ontologies in ISO/IEC 21838-1;

— documentation of the methodology for specifying domain ontologies that conform to TUpper.

The following are outside the scope of this document:

— specification of ontology languages, including the languages RDF, OWL and CL standardly used in ontology development;

— specification of methods for reasoning with ontologies;

— specification of translators between the notations of ontologies developed in different ontology languages.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 21838-1:2021, *Information technology — Top-level ontologies (TLO) — Part 1: Requirements*

ISO/IEC 24707, *Information technology — Common Logic (CL) — A framework for a family of logic-based languages*

3 Terms and definitions

For the purposes of this document, the terms and definitions in ISO/IEC 21838-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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