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Geographic information — Ontology —

Part 2: Rules for developing ontologies in the Web Ontology Language (OWL)

Information géographique — Ontologie —

Partie 2: Règles pour le développement d'ontologies dans le langage d'ontologie Web (OWL)

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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The Committee responsible for this document is ISO/TC 211, *Geographic information/Geomatics*.

ISO 19150 consists of the following parts, under the general title *Geographic information — Ontology*:

— *Part 1: Framework*

— *Part 2: Rules for developing ontologies in the Web Ontology Language (OWL)*

Semantic operators, *Service ontology*, *Domain ontology registry* and *Service ontology registry* are planned to be covered in future Parts.

Introduction

Fundamentally, ontology comes from philosophy and refers to the study of the nature of the world itself. The information technology and artificial intelligence communities borrowed this term of ontology for the explicit specification of a conceptualization.[2] Information technology and artificial intelligence consider that reality may be abstracted differently depending on the context from which "things" are perceived and, as such, recognize that multiple ontologies about the same part of reality may exist. In geographic information, ontology refers to a formal representation of phenomena of a universe of discourse with an underlying vocabulary including definitions and axioms that make the intended meaning explicit and describe phenomena and their interrelationships.[1] An ontology can be formalized differently ranging from weak to strong semantics: taxonomy, thesaurus, conceptual model, logical theory.[2]

Ontology is a fundamental notion for semantic interoperability on the Semantic Web since it defines the meaning of data and describes it in a format that machines and applications can read. As such, an application using data also has access to their inherent semantics through the ontology associated with it. Therefore, ontologies can support integration of heterogeneous data captured by different communities by relating them based on their semantic similarity. The W3C has proposed the Web Ontology Language (OWL) family of knowledge representation languages for authoring ontologies characterised by formal semantics on the Web.[4,11]

Semantics is an important topic in the field of geographic information. The meaning of geographic information is essential for their discovery, sharing, integration, and use. Geographic information standards have recognized this fact in the standards on rules for application schema (ISO 19109) and the methodology for feature cataloguing (ISO 19110),[7] which are both based on the General Feature Model (GFM). Basically, semantics relates phenomena and signs used to represent them (i.e. data) by the way of concepts. Typically, concepts are maintained in repositories called ontologies.

The ISO geographic information standards have chosen the conceptual modelling language UML[10,12] for the formal representation of abstraction of the reality. Additionally as introduced in ISO/TS 19150-1:2012, there is a need to provide formal representation of abstraction of the reality in OWL to support the Semantic Web. Accordingly, this part of ISO 19150 defines rules to convert UML static views of geographic information and application schemas into OWL ontologies in order to benefit and support interoperability of geographic information over the Semantic Web. These rules are required for:

— ontology description completeness;

— consistency in the set of OWL ontologies for geographic information;

— consistency in conversion of UML diagrams to OWL ontologies; and

— cohesion and unity between UML models and ontologies.

These rules are based on but also extend the OMG's Ontology Definition Metamodel.[11] OWL ontologies are complementary to UML static views and serve different purposes.