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Part 6: Service ontology register

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Partie 6: Registre d'ontologies de service

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 287, *Geographic Information,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 19150 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The Semantic Web has introduced the Web of Data. The Web of Data is essentially an extension of the Web oriented towards machine-processable data as opposed to documents. It can be seen as a tremendous worldwide open database that people can query from their own perspective, understanding or abstraction of real-world phenomena or events. From it, they can find accurate, detailed and appropriate answers as people communicate between one another. This approach involves reasoning capabilities based on ontologies. The Semantic Web brings new opportunities in the geographic information realm to lay out a new generation of standards that will improve semantic interoperability of geographic information.

Fundamentally, 'ontology' comes from the field of philosophy and refers to the study of the nature of the world itself. The information technology and artificial intelligence communities have borrowed the term ontology for the explicit specification of a conceptualization.[4] In the field of geographic information, ontology consists of 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.[2] Information technology and artificial intelligence consider that reality can 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 can exist. An ontology can be formalized differently ranging from weak to strong semantics: taxonomy, thesaurus, conceptual model, and logical theory.[4]

On the Semantic Web, ontology defines the meaning of data and describes it in a format that machines and applications can read. An application using data also has access to the inherent semantics of those data through the ontology associated with them. Ontologies can support integration of heterogeneous data captured by different communities by relating them based on their semantic similarity. The World Wide Web Consortium (W3C) has published the Web Ontology Language (OWL) family of knowledge representation languages for authoring ontologies characterized by formal semantics on the Web.[5],[7]

Geographic information Web services are important components that compose the Web. The Semantic Web can contribute to facilitating the interaction between them by introducing an ontology for geographic information Web Services. It can support geographic information Web services to automate their discovery, composition and invocation in order to enable seamless machine interoperation with minimum human interaction. ISO 19150-4 sets out the ontological framework for the ontological description of geographic information Web services. However, the discovery of such services requires the registration of their implementation ontologies. This document sets out a standard registration and maintenance mechanism for the registration of ISO 19150-4-conformant geographic information service ontologies. The intention is for this document to be potentially referenceable by an ISO Registration Authority standard for setting up an international register of geographic information service ontologies. Annex B of this document provides additional information to enable the registration of GeoWeb service ontology described in other frameworks such as the Semantic Markup for Web Services (OWL-S), the Semantic Web Services Ontology (SWSO), the Web Service Modeling Ontology (WSMO) and the OGC Web Service Common (OWS-C).

This document is not an ISO Registration Authority (RA) document. Any organization may establish a register of service ontologies. If creating an ISO register, this document can act as a supporting document for the ISO RA document for that register.

The purpose of this document is different from that of the ISO/IEC 19763 family of International Standards, which specifies an information artefact called the Registry Summary. The Registry Summary consists of information that describes administrative aspects, the summary of contents and the technical access method of the registry. In contrast, registry based on this document can be described following ISO/IEC 19763-6.

ISO/IEC 18384-3 defines a formal ontology for service-oriented architecture (SOA), an architectural style that supports service orientation. The terms defined in ISO/IEC 18384-3 are key terms from ISO/IEC 18384-1. This document does not provide any architectural style to support service orientation, although GeoWeb service definitions can potentially take advantage of ISO/IEC 18384-3 for their description.

Geographic information — Ontology —

Part 6:
Service ontology register

1 Scope

This document establishes a standard registration and maintenance mechanism for the registration of ISO 19150-4-conformant geographic information service ontologies.

This document makes use of ISO 19135-1 whenever appropriate.

This document does not define semantics operators or rules for ontologies, and does not develop any application ontology.

In relation to ISO 19101-1:2014, 6.2, this document defines and formalizes the following purposes of the ISO geographic information reference model:

— geographic information service components and their behaviour for data processing purposes over the Web; and

— OWL ontologies to cast ISO/TC 211 International Standards to benefit from and support the Semantic Web.

In relation to ISO 19101-1:2014, 8.3, this document addresses the Application:Procedural foundation of the ISO geographic information reference model.

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 19101-1, *Geographic information — Reference model — Part 1: Fundamentals*

ISO 19103, *Geographic information — Conceptual schema language*

ISO 19135-1:2015, *Geographic information — Procedures for item registration — Part 1: Fundamentals*

ISO 19150-4, *Geographic information — Ontology — Part 4: Service ontology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19101-1 and ISO 19135-1 and the following apply.

ISO and IEC maintain terminology 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/

3.1
service
distinct part of the functionality that is provided by an entity through interfaces

[SOURCE: ISO 19119:2016, 4.1.12]

4 Abbreviated terms and namespaces

4.1 Abbreviated terms

GeoWeb service	geographic information web service
ISO RA	ISO registration authority
OGC	Open Geospatial Consortium
OWL	web ontology language
OWL-S	semantic markup for web services
OWS-C	OGC web service common
SOA	service-oriented architecture
SWSO	semantic web services ontology
UML	unified modelling language
URI	universal resource identifier
W3C	World Wide Web Consortium
WSMO	web service modelling ontology

4.2 Namespaces

The name and contact information of the maintenance agency for this document can be found at www.iso.org/maintenance_agencies.

19150-6ServiceOntologyRegister

Requirements class for the identification and description of service ontology register
https://standards.isotc211.org/iso19150/-6/1/req/ServiceOntologyRegister/

19150-6ServiceOntologyRegister-conf

Conformance class for the identification and description of service ontology register
https://standards.isotc211.org/iso19150/-6/1/conf/ServiceOntologyRegister/

19150-6ServiceOntologyRegisterImplementation

Requirements class for the implementation of a service ontology register
https://standards.isotc211.org/iso19150/-6/1/req/ServiceOntologyRegisterImplementation/

19150-6ServiceOntologyRegisterImplementation-conf

Conformance class for the implementation of a service ontology register https://standards.isotc211.org/iso19150/-6/1/conf/ServiceOntologyRegisterImplementation/

19150-6ServiceOntologyRegisterManagement

Requirements class for the management of a service ontology register https://standards.isotc211.org/iso19150/-6/1/req/ServiceOntologyRegisterManagement/

19150-6ServiceOntologyRegisterManagement-conf

Conformance class for the management of a service ontology register https://standards.isotc211.org/iso19150/-6/1/conf/ServiceOntologyRegisterManagement/

5 Conformance

Any service ontology register claiming conformance with this document shall pass the requirements described in the abstract test suite, presented in Annex A.

The abstract test suite is organized in the following conformance classes:

— identification and description of a service ontology register (19150-6ServiceOntologyRegister-conf);

— implementation of a service ontology register (19150-6ServiceOntologyRegisterImplementation-conf); and

— management of a service ontology register (19150-6ServiceOntologyRegisterManagement-conf).

6 Register structure

6.1 General

Geographic information Web services (GeoWeb services) are important components that compose the Web. GeoWeb service ontologies facilitate the interaction between GeoWeb services on the Semantic Web, such as discovery, composition and invocation. The description of GeoWeb services was standardized in ISO 19150-4.

A service ontology register aims to enable organizations that develop and maintain descriptions of GeoWeb service in conformance with ISO 19150-4 to provide their user communities with searching and discovering functionalities of GeoWeb Service ontologies.

A service ontology register provides the mechanism for the registration of ISO 19150-4 GeoWeb service ontologies and their maintenance in the register.

This clause provides the detailed structure of the ISO standardized service ontology register which follows and conforms to ISO 19135-1. ISO 19135-1 specifies procedures to be followed in preparing and maintaining registers of items of geographic information.

6.2 Fundamental structure of the register

The service ontology register is made of three classes that are ServiceOntologyRegister, ServiceOntologyRegisterItemClass, and RegisteredServiceOntology as depicted in Figure 1. These classes are specializations of the ISO 19135-1 RE_Register, RE_Itemclass, and RE_RegisterItem classes respectively. They are described in detail in 6.3, 6.4 and 6.5 respectively.

The service ontology register is a simple register that contains registered service ontologies (i.e. the "items") of a single item class. It is the simplest structure to manage, since the same elements of information are recorded for all items in the register. It imposes a small cost burden on any one register manager.

The requirements for representing a service ontology register have one requirement class, identified as https://standards.isotc211.org/iso19150/-6/1/req/ServiceOntologyRegister/ (i.e. 19150-6ServiceOntologyRegister) and are listed in Table 1.

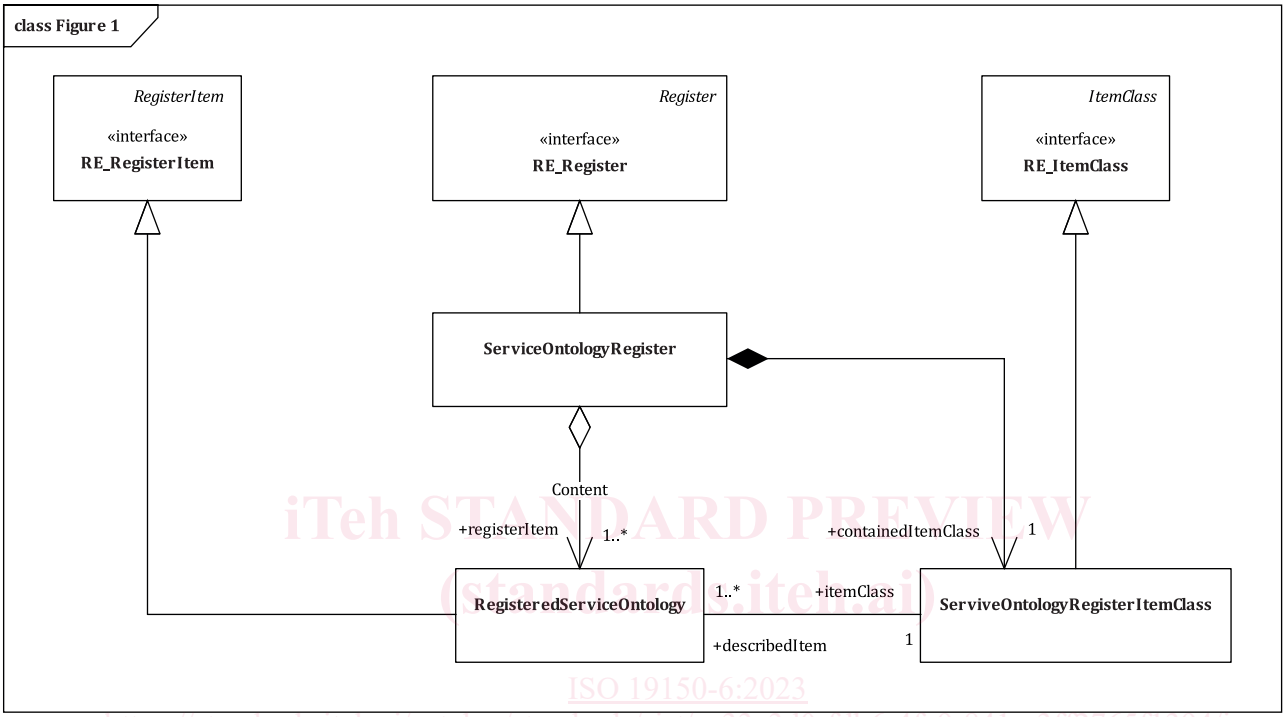

Figure 1 — Service ontology register fundamental class structure

Table 1 — Requirements class for ServiceOntologyRegister

Requirements class	
19150-6ServiceOntologyRegister = https://standards.isotc211.org/iso19150/-6/1/req/ServiceOntologyRegister/	
Target type	Service ontology register
Dependency	https://standards.iso.org/iso/19103/ed-2/en/ (Conceptual schema language)
Dependency	https://standards.iso.org/iso/19135/-1/ed-2/en/ (Procedures for item registration – Fundamentals)
Dependency	https://standards.iso.org/iso/19150/-4/ed-1/en/ (Ontology – Service ontology)
Requirement	19150-6ServiceOntologyRegister:ServiceOntologyRegister
Requirement	19150-6ServiceOntologyRegister:ServiceOntologyRegisterItemClass
Requirement	19150-6ServiceOntologyRegister:RegisteredServiceOntology

6.3 Service ontology register

6.3.1 Introduction

The class ServiceOntologyRegister (Figure 2) specifies information about the register itself.

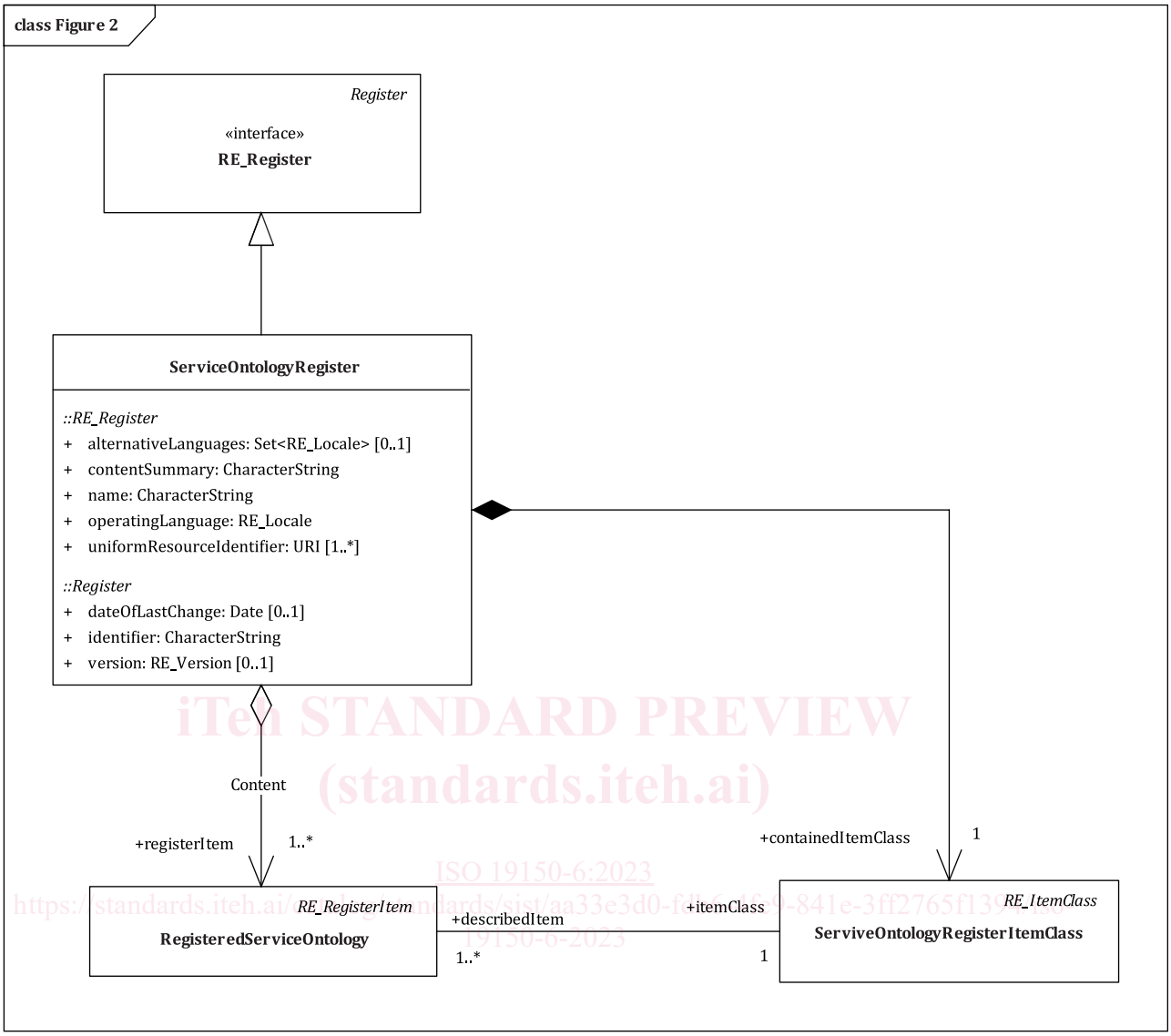

Figure 2 — ServiceOntologyRegister class

6.3.2 Requirements

Table 2 lists the requirements for ServiceOntologyRegister.

Table 2 — ServiceOntologyRegister requirement

Requirement
19150-6ServiceOntologyRegister:ServiceOntologyRegister
ServiceOntologyRegister is a subclass of RE_Register, specified in ISO 19135-1:2015, B.2.2, and shall inherit all its properties (i.e. attributes and roles). They are further described in 6.3.3.

6.3.3 Properties

Table 3 describes the ServiceOntologyRegister properties.

ServiceOntologyRegister is a subclass of RE_Register, specified in ISO 19135-1:2015, B.2.2. It inherits height attributes and six association roles from RE_Register and Register (Table 3).

Table 3 — ServiceOntologyRegister properties

Name	Type	Multiplicity	Inheritance	Definition
identifier	(attribute) CharacterString	1	Register	designator that uniquely denotes the register within the set of registers maintained by the register owner NOTE This attribute is equal to the attribute *name.*
version	(attribute) RE_Version	0..1	Register	specification of a unique state in the life of the register
dateOfLastChange	(attribute) Date	0..1	Register	date of the most recent change to the status of an item in the register
manager	(role) RegisterStakeholder	1	Register	register stakeholder that manages the register
owner	(role) RegisterStakeholder	1	Register	register stakeholder that owns the register
submitter	(role) RegisterStakeholder	1..*	Register	register stakeholder that has submitted proposals for changes to the content of the register
containedItem	(role) ServiceOntologyRegisterItem	1..*	Register	item held in the service ontology register
containedItemClass	(role) ServiceOntologyItemClass	1	Register	item class that describes the characteristics of the class of items held in the service ontology register
name	(attribute) CharacterString	1	RE_Register	human-readable designator that uniquely denotes the register within the set of registers maintained by the register owner NOTE This attribute is equal to the attribute *identifier.*
contentSummary	(attribute) CharacterString	1	RE_Register	general statement of the purpose for which items in the register are made available to users
uniformResourceIdentifier	(attribute) URI	1..*	RE_Register	information about online resources associated with the register
operatingLanguage	(attribute) RE_Locale	1	RE_Register	primary language, country information and character encoding for the proper interpretation of the content of character strings in the register
alternativeLanguages	(attribute) Set<RE_Locale>	0..1	RE_Register	additional languages used in the register by item alternative expressions and item class alternative names other than the register operating language
citation	(role) RE_ReferenceSource	0..*	RE_Register	reference source that describes the sources (documents or registers) from which items in the register have been taken