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BSI Standards Publication

Information technology — Metamodel framework for interoperability (MFI)

Part 3: Metamodel for ontology registration

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

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 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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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 32, *Data management and interchange*.

This third edition cancels and replaces the second edition (ISO/IEC 19763-3:2010), which has been technically revised.

The main changes compared to the previous edition are as follows:

— no direct inheritance from Administered Item of ISO/IEC 11179-3 in 5.2 and 5.4 to align with ISO/IEC 19763-10;

— clarification in 5.4 that "Ontology_Language", "Ontology_Whole", "Ontology_Component" and "Ontology_Atomic_Construct" are inherited from "Modelling_Language", "Model" or "Model_Element" of ISO/IEC 19763-10;

— changes of attribute and reference names in 5.4 and 5.5 to align with ISO/IEC 19763-10 (see Annex D);

— editorial changes throughout the document to fully align with ISO/IEC Directives Part 2.

A list of all parts in the ISO/IEC 19763 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.

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Introduction

Interoperability among heterogeneous application systems serves to improve business performance. To promote it, unambiguous and formal specifications of the systems, especially of their inputs and outputs, are indispensable. Ontologies have a key role for that.

Several efforts to establish standards associated with ontologies have been made. But, most of them specify languages or are based on some particular language. To promote ontology-based interoperability, in addition to them, a generic framework for registering administrative and evolution information related to ontologies, independent of languages, is necessary.

This document provides a generic framework for registering administrative and evolution information related to ontologies.

The metamodels of ontologies expressed in specific languages and the mappings among them are specified in other specifications such as Reference [1].

Figure 1 illustrates the MFI ontology registration specified in this document.

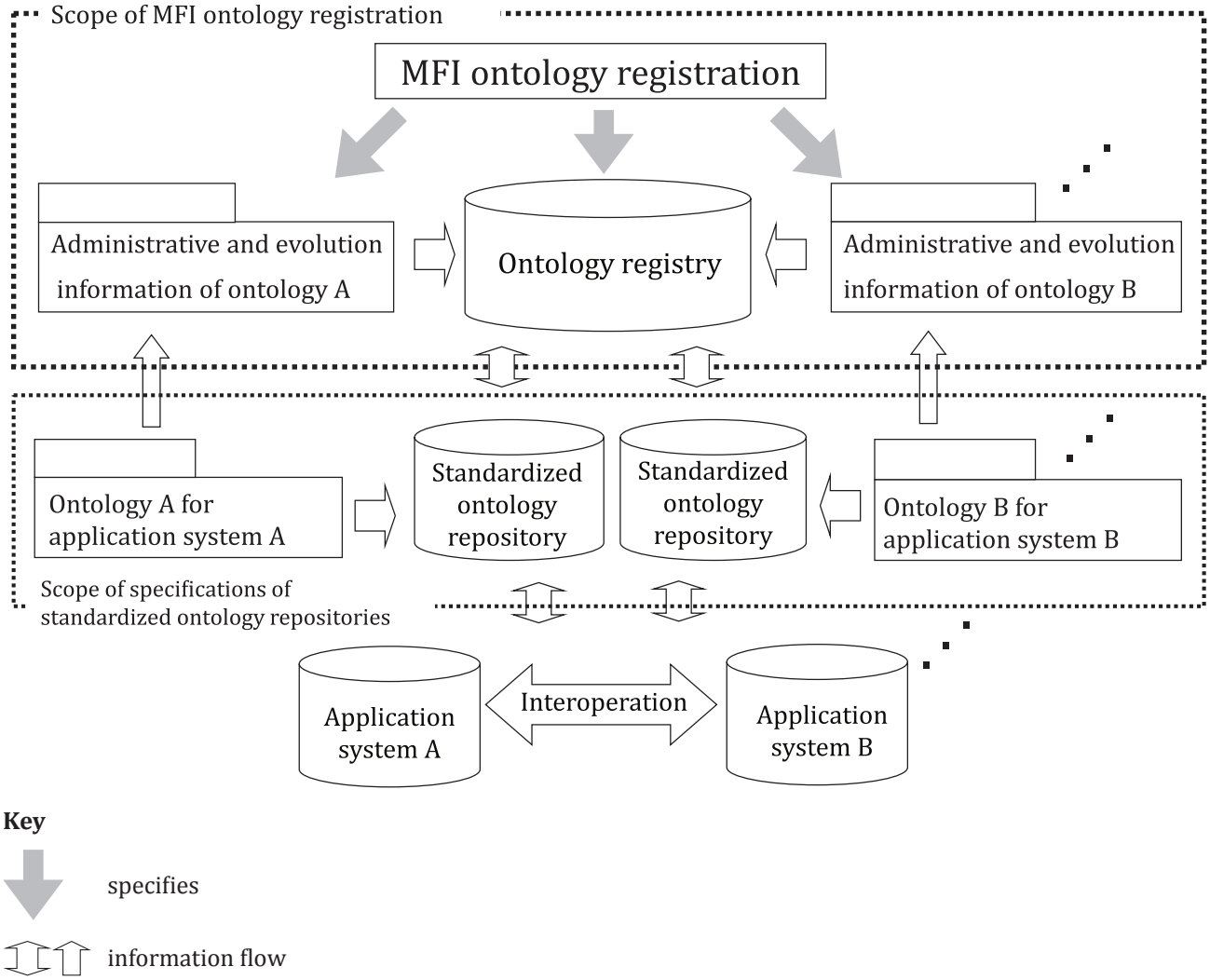

Figure 1 — MFI ontology registration

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Information technology — Metamodel framework for interoperability (MFI) —

Part 3: Metamodel for ontology registration

1 Scope

This document specifies the metamodel that provides a facility to register administrative and evolution information related to ontologies.

The metamodel is intended to promote interoperability among application systems, by providing administrative and evolution information related to ontologies, accompanied with standardized ontology repositories that register ontologies themselves in specific languages.

This document does not specify the metamodels of ontologies expressed in specific languages and the mappings among them.

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.

〚A1〛 ISO/IEC 11179-3, *Information technology — Metadata registries (MDR) — Part 3: Metamodel for registry common facilities* 〚A1〛

ISO/IEC 19763-1, *Information technology — Metamodel framework for interoperability (MFI) — Part 1: Framework*

ISO/IEC 19763-10, *Information technology — Metamodel framework for interoperability (MFI) — Part 10: Core model and basic mapping*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 11179-3, ISO/IEC 19763-1 and ISO/IEC 19763-10 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 http://www.electropedia.org/

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3.1.1 Terms on ontology

3.1.1.1
ontology
specification of concrete or abstract things, and the relationships among them, in a prescribed domain of knowledge

Note 1 to entry: The specification should be computer processable.

3.1.1.2
reference registered ontology
ontology (3.1.1.1 that is registered in a registry that conforms to MFI ontology registration and that is usable and sharable by a community of interest

3.1.1.3
local registered ontology
ontology (3.1.1.1 that is registered in a registry that conforms to MFI ontology registration and that is specialized for defined applications

3.1.2 Other terms

3.1.2.1
sentence
statement that has a truth value

3.1.2.2
symbol
most primitive lexical construct that is a part of a *sentence* (3.1.2.1)

3.1.2.3
logical symbol
symbol (3.1.2.2 whose meaning is defined by its language

EXAMPLE In KIF, "not" and "or" are logical symbols.

3.1.2.4
authoritative extent
extent that determines whether a thing can use another thing

Note 1 to entry: A thing can use another thing if and only if the authoritative extent of the former is less than or equal to the authoritative extent of the latter because the usage of the latter by the former does not affect the authoritative extent of the former since the authoritative level of the latter is greater than or equal to the one of the former.

EXAMPLE A product with some authoritative extent can only use as its component a part with an authoritative extent which is greater than or equal to the one of it, to keep its authoritative extent.

Note 2 to entry: In this document, an authoritative extent is used to determine whether a Local_Item can consist of or use another Local_Item. See 5.5.2 Local_Item.

3.2 Abbreviated terms

IRI	internationalized resource identifier (see Reference [2])
KIF	knowledge interchange format (see Reference [3])
MDR	metadata registry
MFI	metamodel framework for interoperability

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ODM ontology definition metamodel (see Reference [1])

OWL web ontology language (see Reference [4])

UML unified modeling language (see Reference [12])

4 Conformance

4.1 General

An implementation claiming conformance to this document shall support one or both of the metamodels specified in this document and may or shall not support any extensions, depending on which level of conformance and which degree of conformance it claims.

4.2 Levels of conformance

4.2.1 General

An implementation may conform to either of the two levels of conformance to this document, depending on what packages it supports.

4.2.2 Conformance level 1

The metamodel specified in subclause 5.5 is supported.

4.2.3 Conformance level 2

The metamodels specified in subclauses 5.5 and 5.6 are supported.

4.3 Degree of conformance

4.3.1 General

In each conformance level, the distinction between "strictly conforming" and "conforming" implementations is necessary to address the simultaneous needs for interoperability and extensions. This document describes specifications that promote interoperability. Extensions are motivated by needs of users, vendors, institutions and industries, but are not specified by this document.

A strictly conforming implementation can be limited in usefulness but is maximally interoperable with respect to this document. A conforming implementation can be more useful but can be less interoperable with respect to this document.

4.3.2 Strictly conforming implementation

A strictly conforming implementation for some conformance level:

a) shall support the metamodels required in the conformance level;

b) shall not support any extensions to the metamodels required in the conformance level.

4.3.3 Conforming implementation

A conforming implementation:

a) shall support the metamodels required in the conformance level;

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b) may support extensions to the metamodels required in the conformance level, and the extensions shall be consistent with the metamodels required in the conformance level.

4.4 Implementation conformance statement (ICS)

An implementation claiming conformance to this document shall include an implementation conformance statement stating:

a) which conformance level it claims (4.2);

b) whether it is a strictly conforming implementation or a conforming implementation (4.3);

c) what extensions are supported if it is a conforming implementation.

5 Structure of MFI ontology registration

5.1 Overview of MFI ontology registration

MFI ontology registration consists of two packages: Basic_Model package and Evolution_Model package. Figure 2 shows the package structure of MFI ontology registration.

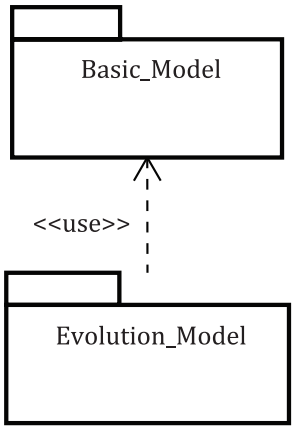

Figure 2 — Package structure of MFI ontology registration

The Basic_Model package is used to register administrative information related to ontologies, independently of the languages that are used to express them. The basic idea is that almost any ontology consists of several sentences and that each sentence uses several non-logical symbols. The metaclasses in Basic_Model package include Ontology_Whole, Ontology_Component and Ontology_Atomic_Construct, which have administrative information of ontologies, sentences and non-logical symbols respectively. Since an ontology evolves, Basic_Model package can register as many versions of an ontology as necessary. But, in Basic_Model package, each version of an ontology is treated as a different ontology.

The Evolution_Model package is used to register information on how an ontology evolves from one version to another. Evolution_Model package basically consists of three metaclasses, Registered_Ontology_Whole_Evolution, Registered_Ontology_Component_Evolution and Registered_Ontology_Atomic_Construct_Evolution, which have evolution information on Registered_Ontology_Whole, Registered_Ontology_Component and Registered_Ontology_Atomic_Construct respectively.

5.2 Overview of Basic_Model package

Figure 3 shows the metamodel in Basic_Model package.

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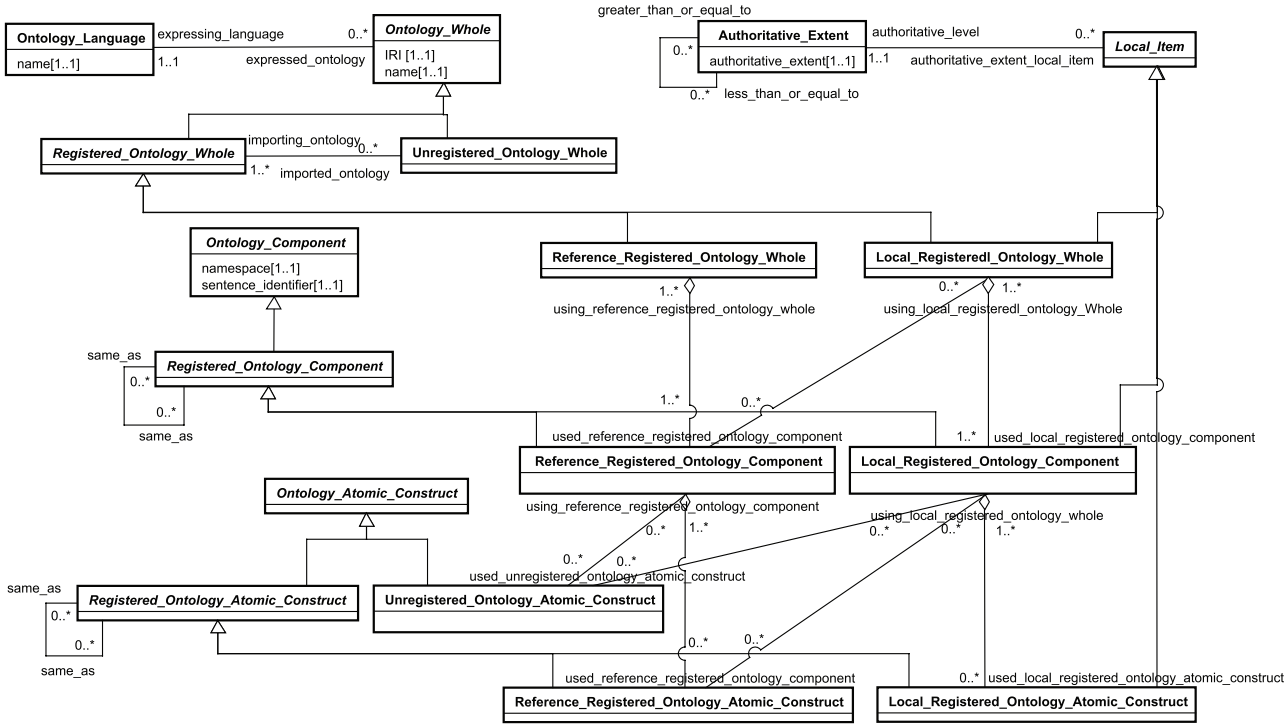

NOTE Metaclasses whose names are italicized are abstract metaclasses.

Figure 3 — Metamodel in Basic_Model package

Ontology_Whole is an abstract metaclass that represents an ontology and contains the associated administrative information. Ontology_Language is used as the reference "expressing_language" of Ontology_Whole to indicate a language that is used to express an ontology that is represented by Ontology_Whole. Ontology_Component is an abstract metaclass that represents a sentence contained in ontologies and contains the associated administrative information. The granularity of a sentence is not specified but is a user's choice. Ontology_Atomic_Construct is an abstract metaclass that represents a non-logical symbol that is used in sentences and contains the associated administrative information.

Ontology_Whole has two direct subclasses, Registered_Ontology_Whole and Unregistered_Ontology_Whole. Registered_Ontology_Whole is an abstract metaclass that represents an ontology that is registered in a registry that conforms to MFI ontology registration. Unregistered_Ontology_Whole is a metaclass that represents an ontology that is not registered but imported by an ontology that is registered in a registry that conforms to MFI ontology registration.

Ontology_Component has only one direct subclass Registered_Ontology_Component. Registered_Ontology_Component is an abstract metaclass that represents an ontology that is registered in a registry that conforms to MFI ontology registration. Any instance of Ontology_Component is a Registered_Ontology_Component since a sentence that is not registered in a registry that conforms to MFI ontology registration is out of scope.

Similar to Ontology_Whole, Ontology_Atomic_Construct has two direct subclasses, Registered_Ontology_Atomic_Construct and Unregistered_Ontology_Atomic_Construct. Registered_Ontology_Atomic_Construct is an abstract metaclass that represents a non-logical symbol that is registered in a registry that conforms to MFI ontology registration. Unregistered_Ontology_Atomic_Construct is a metaclass that represents a non-logical symbol that is not registered but used by a sentence that is registered in a registry that conforms to MFI ontology registration.

Registered_Ontology_Whole has two direct subclasses, Reference_Registered_Ontology_Whole and Local_Registered_Ontology_Whole. Reference_Registered_Ontology_Whole represents a reference registered ontology and Local_Registered_Ontology_Whole represents a local registered ontology.

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Similarly, Registered_Ontology_Component has two direct subclasses, Reference_Registered_Ontology_Component and Local_Registered_Ontology_Component. Reference_Registered_Ontology_Component represents a sentence contained in ontologies that are represented by Reference_Registered_Ontology_Whole. Local_Registered_Ontology_Component represents a sentence contained in ontologies that are represented by Local_Registered_Ontology_Whole. A sentence that is represented by Reference_Registered_Ontology_Component may also be contained in ontologies that are represented by Local_Registered_Ontology_Whole, but a sentence that is represented by Local_Registered_Ontology_Component cannot be contained in ontologies that are represented by Reference_Registered_Ontology_Whole.

Similarly, Registered_Ontology_Atomic_Construct also has two direct subclasses, Reference_Registered_Ontology_Atomic_Construct and Local_Registered_Ontology_Atomic_Construct. Reference_Registered_Ontology_Atomic_Construct represents a non-logical symbol that is used in sentences that are represented by Reference_Registered_Ontology_Component. Local_Registered_Ontology_Atomic_Construct represents a non-logical symbol that is used in sentences that are represented by Local_Registered_Ontology_Component. A non-logical symbol that is represented by Reference_Registered_Ontology_Atomic_Construct may also be used in sentences that are represented by Local_Registered_Ontology_Component, but a non-logical symbol that is represented by Local_Registered_Ontology_Atomic_Construct cannot be used in sentences that are represented by Reference_Registered_Ontology_Component.

Local_Item is an abstract metaclass that is a collectively exhaustive superclass of Local_Registered_Ontology_Whole, Local_Registered_Ontology_Component and Local_Registered_Ontology_Atomic_Construct. Authoritative_Extent is used as the reference "authoritative_level" of Local_Item to indicate whether a Local_Item can consist of or use another Local_Item. A sentence that is represented by Local_Registered_Ontology_Component may also be contained in ontologies that are represented by Local_Registered_Ontology_Whole whose value of "authoritative_level" is less than or equal to the value of "authoritative_level" of this Local_Registered_Ontology_Component. A non-logical symbol that is represented by Local_Registered_Ontology_Atomic_Construct may also be used in sentences that are represented by Local_Registered_Ontology_Component whose value of "authoritative_level" is less than or equal to the value of "authoritative_level" of this Local_Registered_Ontology_Atomic_Construct.

The exact specification of each metaclass in Basic_Model package is given in subclause 5.5. Annex B shows how each metaclass in Basic_Model package is used for registering administrative information related to ontologies.

5.3 Overview of Evolution_Model package

Figure 4 shows the metamodel in Evolution_Model package.

Item_Evolution is an abstract metaclass that is a collectively exhaustive superclass of Registered_Ontology_Whole_Evolution, Registered_Ontology_Component_Evolution and Registered_Ontology_Atomic_Construct_Evolution. Registered_Ontology_Whole_Evolution is a metaclass that indicates what a Registered_Ontology_Whole evolves to and is possibly composed of Registered_Ontology_Component_Evolution. Registered_Ontology_Component_Evolution is a metaclass that indicates what a Registered_Ontology_Component evolves to and is possibly composed of Registered_Ontology_Atomic_Construct_Evolution. Registered_Ontology_Atomic_Construct_Evolution is a metaclass that indicates what a Registered_Ontology_Atomic_Construct evolves to. Evolution information on Unregistered_Ontology_Whole and Unregistered_Ontology_Atomic_Construct is out of scope since they are not registered.

The exact specification of each metaclass in Evolution_Model package is given in subclause 5.6. Annex C shows how each metaclass in Evolution_Model package is used for registering information on how an ontology evolves from one version to another.

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