

With the great help of Keith Gordon

Information technology — Metamodel framework for interoperability (MFI) — Part 2: Core model and basic mapping

Technologie de l'information — Cadre du métamodèle pour l'interopérabilité (MFI) — Partie 2: Modèle de base et de cartographie de base

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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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 19763-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information Technology*, Subcommittee SC 32, *Data management and Interchange*.

ISO/IEC 19763 consists of the following parts, under the general title *Information technology — Metamodel framework for interoperability (MFI)*:

- *Part 1: Reference model*
- *Part 2: Core model and basic mapping*
- *Part 3: Metamodel for ontology registration*
- *Part 5: Metamodel for process model registration*
- *Part 6: Registry summary*
- *Part 7: Metamodel for service registration*
- *Part 8: Metamodel for role and goal model registration*
- *Part 9: On demand model selection [Technical Report]*
- *Part 11: Structured model registering [Technical Report]*
- *Part 12: Metamodel for information model registration*

Introduction

Due to the spread of e-Business and e-Commerce over the Internet, the effective interchange of business transactions or other related information across countries and cultures is an important concern for people in both the IT industry and other non-IT industries.

To follow the current trends, industrial consortia have engaged in the standardization of domain-specific business objects including business process models and software components using common modeling facilities and interchange facilities such as UML and XML. They are very active in standardizing domain-specific business process models and standard modeling constructs such as data elements, entity profiles, and value domains.

However, to promote interoperability across domains, a generic framework for registering so called models and mapping between them is required. This part of ISO/IEC 19763 provides a core model as the base for other parts of ISO/IEC 19763 and the facilities to map between models registered in the other parts of ISO/IEC 19763

NOTE UML is the trademark of the Object Management Group.

Information technology — Metamodel framework for interoperability (MFI) — Part 2: Core model and basic mapping

1 Scope

The primary purpose of the multipart standard ISO/IEC 19763 is to specify a metamodel framework for interoperability. This part of ISO/IEC 19763 specifies the metamodel that provides a facility to register administrative information and common semantics of models and mapping between them.

It does not specify the metamodel of models in a specific language, but provides a common base metamodel to other parts of ISO/IEC 19763, which specify registries that can register models in different languages and mapping among them.

Figure 1 shows the relation this part of ISO/IEC 19763 and other parts of ISO/IEC 19763.

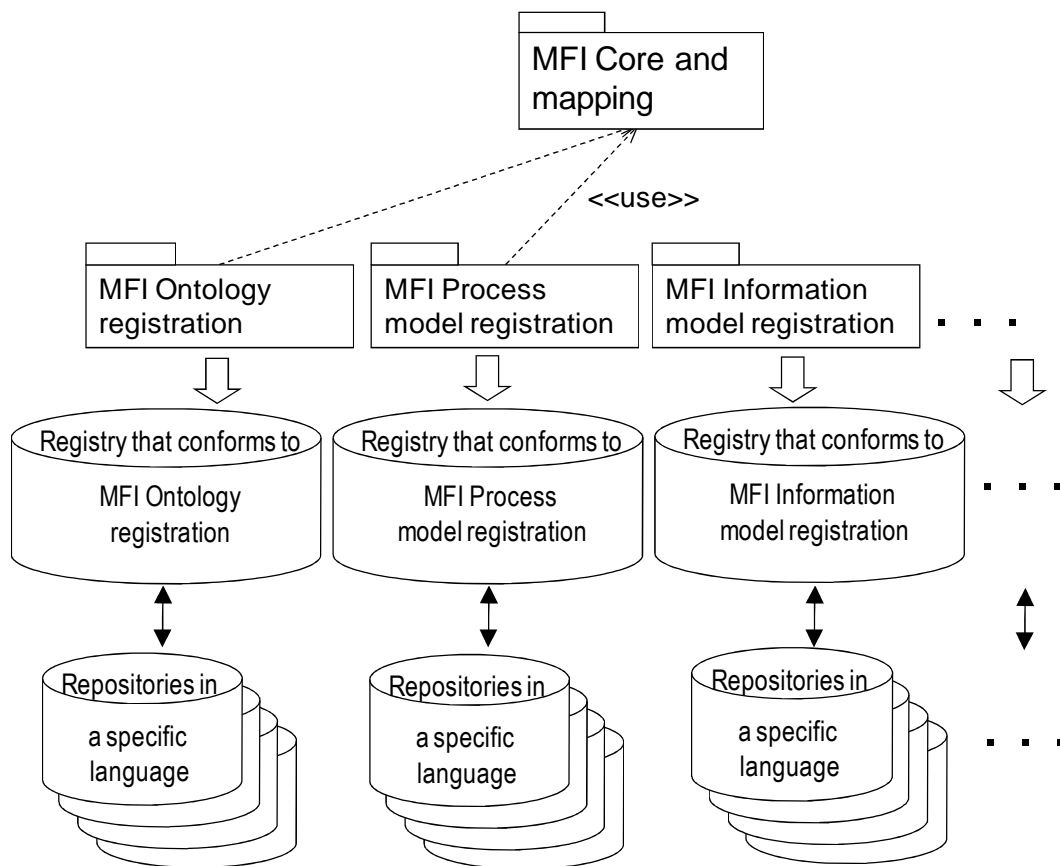


Figure 1 — Relation between MFI Core and Mapping and other parts

2 Normative references

The following referenced documents are indispensable for the application 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 DIS 19505-2 Information technology -- OMG Unified Modeling Language (OMG UML) Version 2.1.2 - Part 2: Superstructure

ISO/IEC 11179-3:2012, Information technology – Metadata registries (MDR) – Part 3: Registry metamodel and basic attributes

ISO/IEC 11179-6, Information technology – Metadata registries (MDR) – Part 6: Registration

ISO/IEC 19763-1, Information technology – Metamodel framework for interoperability (MFI) – Part 1: Reference model

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 DIS 19505-2, ISO/IEC 11179-3:2012, ISO/IEC 11179-6, ISO/IEC 19763-1 and the following apply.

3.1.1 modeling language

language or notation that is used to model some aspect of a domain of interest

3.1.2 model

representation of some aspect of a domain of interest

NOTE models can be used to express a set of information requirements, processes, services, roles, goals or some other aspect of a domain of interest

3.1.3 model element

element or component in a model

NOTE examples of model elements are an entity type in an information model, an event in a process model, a service operation in a service model, or an actor in a role and goal model.

3.1.4 model element set

means by which a set of model elements are grouped together for the purposes of mapping, with each set forming one half of a model element set mapping

3.1.5 model mapping

statement that the domains represented by two models overlap and there is a need to register details of the correspondence between the structures in the models that semantically represent this overlap to achieve interoperability

3.1.6 model element set mapping

part of a model mapping, comprising two sets of model elements, one from each of the models being mapped, that model similar real-world requirements.

3.1.7

model element set mapping type
classification for a set of model element set mappings

3.2 Abbreviated terms**MFI**

Metamodel framework for interoperability

MFI Core and Mapping

ISO/IEC 19763-2, Information technology – Metamodel framework for interoperability (MFI) – Part 2: Core model and basic mapping

MDR

Metadata Registry

UML

ISO/IEC DIS 19505-2 Information technology -- OMG Unified Modeling Language (OMG UML) Version 2.1.2 -
- Part 2: Superstructure

IRI

Internationalized Resource Identifier^[1]

4 Conformance**4.1 General**

An implementation claiming conformance to this part of ISO/IEC 19763 shall support some part of the metamodel specified in this part of ISO/IEC 19763, 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 one of the two levels of conformance to this part of ISO/IEC 19763, depending on what packages it supports.

4.2.2 Conformance Level 1

The metamodel specified in 6 Core_Model package is supported.

4.2.3 Conformance Level 2

The metamodels specified in 6 Core_Model package and 7 Basic_Mapping_Model package are supported.

4.3 Degree of conformance**4.3.1 General**

In each conformance level, there are two degrees of conformance, that is, “rigidly conforming” and “flexible conforming”.

4.3.2 Rigidly conforming implementation

If all the metaclasses in the one or more metamodels supported are specified what types (including none) specified in 5.5, ISO/IEC 11179-3:2012 they are and if any of their instances are not allowed further extensions by any types of specified in 5.5, ISO/IEC 11179-3:2012, then it is a rigidly conforming implementation.

4.3.3 Flexibly conforming implementation

If at least one metaclasses in the one or more metamodels allows that their instances are extended by one or more types specified in 5.5, ISO/IEC 11179-3:2012, further than the types their metaclasses are, it is a flexibly conforming implementation.

4.4 Implementation Conformance Statement (ICS)

An implementation claiming conformance to this part of ISO/IEC 19763 shall include an Implementation Conformance Statement stating:

- a) which conformance level it claims(4.2);
- b) whether it is a rigidly conforming implementation or a flexibly conforming implementation (4.3).
- c) what types (including none) specified in 5.5, ISO/IEC 11179-3:2012 each of the metaclasses in the one or more metamodels supported is specified as.

NOTE Other parts of ISO/IEC 19873 will require a conformance to this part of ISO/IEC 19763 as a part of its conformance claim. It will follow 4.4.

5 Overview of MFI Core and mapping

5.1 Basic Structure

MFI Core and mapping is specified using ISO/IEC DIS 19505-2 and consists of two packages: **Core_Model** package and **Basic_Mapping_Model** package. Figure 2 shows the package structure of MFI Core and Mapping.

Core_Model package specifies a core model that is inherited by other parts of ISO/IEC 19763 to register administered information and common semantics of models. **Basic_Mapping_Model** package specifies a basic mapping model that is inherited by other parts of ISO/IEC 19763 to register administered information and basic semantics of mappings between models.

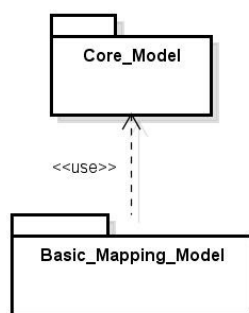


Figure 2 — Package structure of MFI Core and Mapping

5.2 Overview of Core_Model package

Figure 3 shows the metamodel in **Core_Model** package.

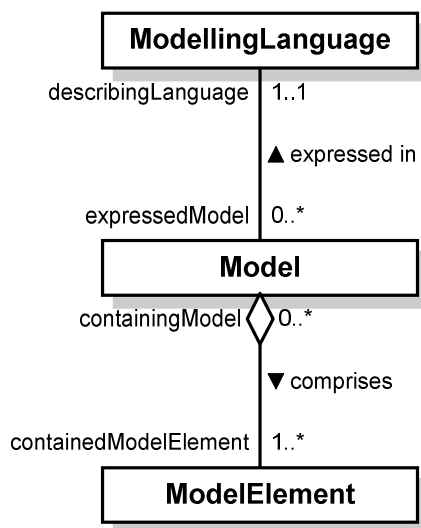


Figure 3 — Metamodel in the Core_Model package

It comprises the following metaclasses:

- **Modeling_Language**
- **Model**
- **Model_Element**

The metaclasses that represent models in other parts of ISO/IEC 19763 will be subclasses of **Model** and the metaclasses representing the content of these models will be subclasses of **Model_Element**. Some of the metaclasses in other parts of ISO/IEC 19763 inherited from **Model** or **Model_Element** may override some attributes and/or references of the metaclasses defined in this part. The metaclasses that represent language in which these models are expressed will be subclasses of **Modeling_Language**.

Each modelling language is a language or notation that is used to express ontologies and/or model information requirements, processes, services, roles, goals or some other set of concepts that can be modelled.

Each model is an ontology or is used to represent a set of information requirements, processes, services, roles, goals or some other set of concepts that can be represented in a model.

Each model element is an element or component in a model, such as a non-logical symbol in an ontology, an entity type in an information model, an event in a process model, a service operation in a service model, or an actor in a role and goal model.

Each model shall be expressed in one and only one modelling language. Each modelling language may be the language used for one or more models.

Each model shall be comprised of one or more model elements. Each model element may be part of one or more models.

The exact specification of each metaclass in the **Core_Model** package is given in 6.

5.3 Overview of the Basic_Mapping_Model package

Figure 4 shows the metamodel in the **Basic_Mapping_Model** package.

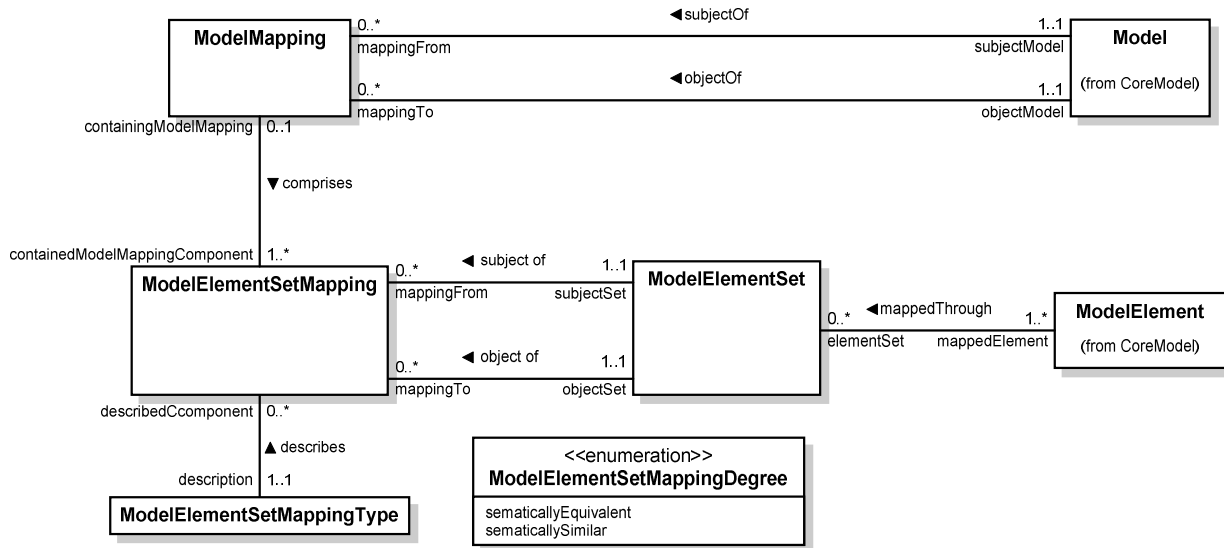


Figure 4 — Metamodel in the Basic_Mapping_Model package

It comprises the following metaclasses:

- **Model_Mapping**
- **Model_Element_Set_Mapping**
- **Model_Element_Set_Mapping_Type**
- **Model_Element_Set**

Each model mapping is a mapping from a model to another model, one of which is the subject model and the other is the object model.

Each model element set is the means by which a set of model elements are grouped together for the purposes of mapping, with each set forming one half of a model element set mapping.

Each model element set mapping is part of a model mapping. Each model element set mapping comprises a set of model elements from the subject model and a set of elements from the object model that model similar real-world requirements.

Each model element set mapping type is a classification for a set of model element mappings.

Each model mapping shall be of one and only one model, which is the subject model. Each model may be the subject of one or more model mappings.

Each model mapping shall be to one and only one model, which is the object model. Each model may be the object of one or more model mappings.

Each model element set mapping shall be described by one and only one model element set mapping type. Each model element set mapping type may be the description of one or more model element set mappings.

Each model element set mapping shall be of one and only one model element set, which is the subject model element set. Each model element set may be the subject of one or more model element set mappings.

Each model element set mapping shall be to one and only one model element set, which is the object model element set. Each model element set may be the object of one or more model element set mappings.

Each model mapping shall be comprised of one or more model element set mappings. Each model element set mapping shall be part of one or more model mappings.

Each model element set shall be comprised of one or more model elements. Each model element may be mapped though one or more model element sets.

Thus, for example, consider mapping together a UML class model (the subject model) with an IDEF1X information model (the object model) where both are describing the same universe of discourse. The UML class model includes a many-to-many association with an associative class. These are all model elements of the subject model that can be grouped into a model element set. The construct in the IDEF1X model that meets the same requirement is two one-to-many relationships with a single intersection entity type. Similarly, these are all model elements of the object model and can also be grouped into another model element set. These two model element sets become the subject model element set and the object model element set of the model element set mapping. This model element set mapping is described by a model element set mapping with a label of "Many-to-many replaced by an intersection entity type."

The exact specification of each metaclass in the **Basic_Mapping_Model** package is given in 7..

5.4 Notation for defining metaclasses

In this part of ISO/IEC 19763, metaclasses are defined the following notation and format using ISO/IEC DIS 19505-2. Other parts of ISO/IEC 19763 also use this notation and format unless otherwise specified.

A metaclass is defined at its relevant subclause.

Title of a subclause is the metaclass name and the first paragraph is a brief description of the metaclass.

Its direct superclass are shown under the heading of **Superclass**.

Its attributes are listed and defined under the heading of **Attribute**, **Data Type**, **Multiplicity** and **Description**.

Its reference are listed and defined under the heading of **Reference**, **Class**, **Multiplicity** and **Description**.

If a class has other constraints, they are described in a natural language under the heading of **Constraints**.

In UML, an association is equivalent with a reference and its inverse reference. In this part of ISO/IEC 19763, to define a metaclass, an association is not used, but a reference is used. A reference is defined at a metaclass that is responsible for a link and/or links of the association. Multiplicity constraints of the inverse directions are specified in a diagram. A metamodel of this part of ISO/IEC 19763 is conceptual and does not specify the navigability of association. It depends on implementation. So, even if the reference of the inverse direction is not defined, it does not necessarily mean that it is not navigable.

For better understandability, a diagram shows associations, rather than references. A reference name is showed as a role name. For simplicity, a diagram does not show attributes.

Multiplicity constraints of attributes and references of a metaclass are to be enforced when registration status of an instance of the metaclass is "recorded" or higher.

NOTE Registration statuses are defined in ISO/IEC 11179-6.

6 Core_Model package

6.1 Modeling_Language

Modeling_Language is a metaclass each instance of which represents a language or notation that is used to model information requirements, processes, services, roles, goals or some other set of concepts that can be modelled.

Superclass

None

Attribute

All attributes are described in the description of the types in Edition 3 of ISO/IEC 11179 Part 3 that are used to extend instances of this metaclass.

Constraints

None

6.2 Model

Model is a metaclass each instance of which represents a model that is used to model information requirements, processes, services, roles, goals or some other set of concepts that can be modelled.

Superclass

None

Attribute	Datatype	Multiplicity	Description
IRI	String	1..1	The IRI that identifies the corresponding model.
Reference	Class	Multiplicity	Description
describingLanguage	Modeling_Language	1..1	The language used for this model.
containedModelElement	Model_Elemnt	1..*	The set of model elements that are part of this model.

Constraints

None

NOTE An inferred link can be a value of reference "complisedOf".

6.3 Model_Element

Model_Element is a metaclass each instance of which represents an element or component in a model, such as an entity type in an information model, an event in a process model, a service operation in a service model, or an actor in a role and goal model.

Superclass

None

Attribute

All attributes are described in the description of the types in Edition 3 of ISO/IEC 11179 Part 3 that are used to extend instances of this metaclass.

Reference	Class	Multiplicity	Description
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None

Constraints

None

7 Basic_Mapping_Model package

7.1 Model_Mapping

Model_Mapping is a metaclass each instance of which represents a mapping from a model to another model, one of which is known as the subject model and the other is known as the object model.

Superclass

None

Attribute

All attributes are described in the description of the types in Edition 3 of ISO/IEC 11179 Part 3 that are used to extend instances of this metaclass.

Reference	Class	Multiplicity	Description
subjectModel	Model	1..1	The model that is the subject of this model mapping.
objectModel	Model	1..1	The model that is the object of this model mapping.
containedModelElementSetMapping	Model_Element_Set_Mapping	1..*	The set of model mapping components which comprise this model mapping.

Constraints

None

7.2 Model_Element_Set_Mapping

ModelElementSetMapping is a metaclass each instance of which represents some part of model mapping; each model element set mapping comprises a set of model elements from the subject model and a set of model elements from the object model that model similar real-world requirements.

Superclass

None

Attribute	Datatype	Multiplicity	Description
degree	Model_Element_Set_Mapping_Degree	1..1	The degree of semantic equivalence exhibited by this model mapping component.

All other attributes are described in the description of the types in Edition 3 of ISO/IEC 11179 Part 3 that are used to extend instances of this metaclass.

Reference	Class	Multiplicity	Description
subjectSet	Model_Element_Set	1..1	The model element set that forms the subject of this model mapping component.
objectSet	Model_Element_Set	1..1	The model element set that forms that forms the object of this model mapping component.
description	Model_Element_Mapping_Type	1..1	The model element mapping type that describes or classifies this model mapping component.

Constraints

None

7.3 Model_Element_Mapping_Type

Model_Element_Mapping_Type is a metaclass each instance of which represents a classification for a set of model mapping components.

Superclass

None

Attribute

All attributes are described in the description of the types in Edition 3 of ISO/IEC 11179 Part 3 that are used to extend instances of this metaclass.

Reference	Class	Multiplicity	Description
None			

Constraints

None

7.4 Model_Element_Set

Model_Element_Set is a metaclass each instance of which represents the means by which a set of model elements are grouped together for the purposes of mapping; each set forms one half of a model mapping component.

Superclass

None

Attribute

All attributes are described in the description of the types in Edition 3 of ISO/IEC 11179 Part 3 that are used to extend instances of this metaclass.

Reference	Class	Multiplicity	Description
mappedElement	Model_Element	1..*	The set of model elements that comprise this model mapping component set.

Constraints

None

7.5 Model_Element_Set_Mapping_Degree

A scale of degree of a model element set mapping comprised of: 'semantically_Equivalent', 'semantically_Similar'.

Annex A (informative)

Recommended Types

The followings are the recommended types for some of the metaclasses of this part of ISO/IEC 19763.

- A **Modeling_Language** is extended as an **Identified_Item** and as a **Designatable_Item**.
- A **Model** is extended as an **Administered_Item** and as a **Designatable_Item**.
- A **Model_Element** is extended as an **Administered_Item** or as an **Attached_Item** as appropriate and also as a **Designatable_Item**.
- A **Model_Mapping** is extended as an **Identified_Item** and as a **Designatable_Item** [unless we are going to register model mappings, in which case it will be extended as an **Administered_Item** and as a **Designatable_Item**].
- A **Model_Element_Set** is to be extended as an **Identified_Item** and as a **Designatable_Item** [unless we are going to register model mappings, in which case it will be **Administered_Item** and **Designatable_Item**].
- A **Model_Element_Set_Mapping** is to be extended as an **Identified_Item** and as a **Designatable_Item**, [unless we are going to register model mappings, in which case it will be extended as an **Administered_Item** or as an **Attached_Item** and also as a **Designatable_Item**].
- A **Model_Element_Set_Mapping_Type** is to be extended as an **Identified_Item** and as a **Designatable_Item**.

Annex B
(informative)

Mapping Example

[To follow]

Bibliography

- [1] M. Duerst, et. al., RFC 3987 – Internationalized Resource Identifiers (IRIs), January 2005