



BSI Standards Publication

Information technology — Metamodel framework for interoperability (MFI)

Part 12: Metamodel for information model registration

National foreword

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**Information technology — Metamodel
framework for interoperability (MFI) —**

**Part 12:
Metamodel for information model
registration**

*Technologies de l'information — Cadre du métamodèle pour
l'interopérabilité (MFI) —*

*Partie 12: Métamodèle pour l'enregistrement du modèle
d'information*



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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.

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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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, 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: Framework*
- *Part 3: Metamodel for ontology registration*
- *Part 5: Metamodel for process model registration*
- *Part 6: Registry Summary*
- *Part 10: MFI Core model and basic mapping*
- *Part 12: Metamodel for information model registration*

The following parts are under preparation:

- *Part 7: Metamodel for service registration*
- *Part 8: Metamodel for role and goal registration*
- *Part 9: On demand model selection*
- *Part 13: Metamodel for forms registration*

Introduction

There is an increasing demand for systems to interoperate by exchanging data. For these data exchanges to be meaningful, it is essential that the business information requirements that are met by the data stored in these systems are understood so that suitable data exchange mechanisms can be developed.

Business information requirements, including the semantic meaning of the information, are often represented by information models before the databases that are an integral part of the systems are designed. These models are often called logical models. The subsequent design of the database structure can also be considered to be another form of information model.

Where there is an overlap of the universe of discourse of two systems, the information models for these two systems can be registered using the facilities specified by this part of ISO/IEC 19763. The mappings between these two models can then be registered using the facilities specified by ISO/IEC 19763-10. An interface between the two systems can then be designed, enabling the two systems to interoperate by exchanging information.

Information technology — Metamodel framework for interoperability (MFI) —

Part 12: Metamodel for information model registration

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 a metamodel for registering information models. This metamodel was developed taking into account two distinct types of information models such as

- those that are used to document the information requirements of a particular area of interest, and
- those that represent the structure of a database which are often expressed using a Database Definition Language (DDL).

Information models that represent information requirements can be developed using a number of different common diagramming techniques and notations. The metamodel specified in this part of ISO/IEC 19763 was developed to cover the registration of models expressed using the following techniques and notations:

- Express-G, an ISO standard entity-relationship modelling notation, as described in Reference [8];
- IDEF1X, a US Federal standard entity-relationship modelling notation, as described in References [6] and [12];
- the entity-relationship modelling notation first developed by Harry Ellis and Richard Barker and later adopted by Oracle for its CASE*Method and by the UK's CCTA for SSADM (Structured Systems Analysis and Design Method), as described in Reference [2];
- the UML Class Diagram notation, as described in References [13] and [14];
- the original entity-relationship modelling notation proposed by Peter Chen, as described in Reference [4];
- the Information Engineering entity-relationship modelling notation, as described in Reference [11].

It is understood that these selected techniques represent all of the essential features of all information modelling techniques used to represent information requirements.

The registration of information models that represent the structure of a database is limited in the metamodel specified in this part of ISO/IEC 19763 to those database structures that conform to the Core SQL specification. Core SQL is the set of features defined in the conformance requirements specified in ISO/IEC 9075-2 and ISO/IEC 9075-11.

The registration of information models that are expressed using notations such as Object Role Modeling (ORM) and "Natural language Information Analysis Method" (NIAM), collectively known as fact-based models, is out of scope for this part of ISO/IEC 19763.

2 Conformance

2.1 General

An implementation claiming conformance with this part of ISO/IEC 19763 shall support the metamodel specified in [Clause 5](#) depending on the degree of conformance as described below.

2.2 Degree of conformance

2.2.1 General

The distinction between “strictly conforming” and “conforming” implementations is necessary to address the simultaneous needs for interoperability and extensions. This part of ISO/IEC 19763 describes specifications that promote interoperability. Extensions are motivated by the needs of the users, vendors, institutions, and industries, but are not specified by this part of ISO/IEC 19763.

A strictly conforming implementation could be limited in usefulness, but is maximally interoperable with respect to this part of ISO/IEC 19763. A conforming implementation can be more useful, but could be less interoperable with respect to this part of ISO/IEC 19763.

2.2.2 Strictly conforming implementation

A strictly conforming implementation

- a) shall support the metamodel specified in [Clause 5](#), and
- b) shall not use, test, access, or probe for any extension features nor extensions to the metamodel specified in [Clause 5](#).

2.2.3 Conforming implementation

A conforming implementation

- a) shall support the metamodel specified in [Clause 5](#), and
- b) as permitted by the implementation, can use, test, access, or probe for any extension features or extensions to the metamodel specified in [Clause 5](#).

NOTE 1 All strictly conforming implementations are also conforming implementations.

NOTE 2 The use of extensions to the metamodel could cause undefined behaviour.

2.3 Implementation Conformance Statement (ICS)

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

- a) whether it is a strictly conforming implementation ([2.2.2](#)) or a conforming implementation ([2.2.3](#)), and
- b) what extensions, if any, are supported or used if it is a conforming implementation.

3 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE One or more terms and definitions of the referenced International Standards listed below are used in Clause 4 Terms and definitions.

ISO/IEC 9075-1:2011, *Information technology — Database languages — SQL — Part 1: Framework (SQL/Framework)*

ISO/IEC 9075-2:2011, *Information technology — Database languages — SQL — Part 2: Foundation (SQL/Foundation)*

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

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

4 Terms, definitions, and abbreviated terms

4.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.2 Terms for concepts used in this part of 19763

4.2.1

aggregation

special form of *relationship* (4.2.37) that specifies a whole-part relationship between the aggregate (whole) and a component part

Note 1 to entry: Adapted from ISO/TS 19103:2005, 4.2.2.

4.2.2

association

semantic *relationship* (4.2.37) between two *object classes* (4.2.35)

Note 1 to entry: ^{A1} Adapted from ISO/IEC 11179-3:2023, 3.1.5. ^{A1}

4.2.3

associative entity type

information model element (4.2.25) that has both *relationship* (4.2.37) and *entity type* (4.2.21) properties

Note 1 to entry: May also be known as an association class.

Note 2 to entry: An associative entity type can be seen as a relationship that also has entity type properties or as an entity type that also has relationship properties.

Note 3 to entry: Adapted from ISO/IEC 19501:2005, 5.46.1.

4.2.4

attribute

named characteristic of an *entity type* (4.2.21) whose values serve to qualify, identify, classify, quantify or express the state of an instance of an entity type

4.2.5

attribute unique identifier element

unique identifier element (4.2.45) that is a statement that a particular *attribute* (4.2.4) is part of a particular *unique identifier* (4.2.44)

4.2.6

cardinality

number of elements in a *collection* (4.2.8)

Note 1 to entry: Adapted from ISO/IEC 9075-2:2011.

4.2.7

catalog

named *collection* (4.2.8) of *schemas* (4.2.42) in a database environment

Note 1 to entry: Within this part, this definition applies only to the registration of database structures that conform to the SQL Core specification as described in ISO/IEC 9075-2:2011.

Note 2 to entry: Adapted from ISO/IEC 9075-1:2011.

4.2.8

collection

aggregation of similar *objects* (4.2.34)

EXAMPLE set, bag (or multiset), list, array

Note 1 to entry: Adapted from ISO/HL7 21731:2006.

4.2.9

column

component of a *table* (4.2.43) that is a *collection* (4.2.8) of values all of the same defined *data type* (4.2.11)

Note 1 to entry: Within this part, this definition applies only to the registration of database structures that conform to the SQL Core specification as described in ISO/IEC 9075-2:2011.

4.2.10

composition

form of *aggregation* (4.2.1) which requires that a part instance be included in, at most, one composite at a time and that the composite object is responsible for the creation and destruction of the parts; composition may be recursive

Note 1 to entry: Adapted from ISO/IEC 19501:2005, 5.48.1.

4.2.11

data type

set of representable values

[SOURCE: ISO/IEC 9075-1:2011, 3.1.1.4]

4.2.12

described domain

domain (4.2.15) that is specified by a *description* (4.2.13) or specification such as a rule, a procedure, or a range (i.e. interval)

Note 1 to entry: May also be known as a non-enumerated domain or a continuous domain.

Note 2 to entry: Adapted from  ISO/IEC 11179-31:2023, 3.6. 

4.2.13

description

property of an *information model element* (4.2.25) that is a statement explaining the significance of this information model element to the business and/or organisation that is the subject of this *information model* (4.2.24)

Note 1 to entry: May also be known as a significance statement.

4.2.14

diagram

technical document showing part of an *information model* (4.2.24) using graphical symbols

Note 1 to entry: A model can consist of one or more diagrams.

Note 2 to entry: Adapted from ISO 29845:2011.

4.2.15 domain

collection (4.2.8) of values from which the instance of an *attribute* (4.2.4) must take its value

Note 1 to entry: A domain provides a set of business validation rules, format constraints, and other properties for one or more attributes.

Note 2 to entry: The term domain is used in this part of ISO/IEC 19763 purely in the sense that the term is used in modelling information requirements using techniques such as entity-relationship modelling and object oriented modelling. The term should not be confused with its use in contexts such as “business domain” and “domain of discourse”.

4.2.16 entity

concrete or abstract thing that exists, did exist, or might exist about which information may need to be held in support of business operations

Note 1 to entry: Some *information modelling methods* (4.2.27) use entity for their main information modelling construct, whilst others use *entity type* (4.2.21); in this part of ISO/IEC 19763 the term entity type is used in preference to entity.

Note 2 to entry: Can also be known as an entity instance (in those information modelling methods that use entity for their main information modelling construct) or an *object* (4.2.34) (in those information modelling methods that use *object class* (4.2.35) for their main information modelling construct).

Note 3 to entry: Adapted from  ISO/IEC 2382:2015, 2121433 

4.2.17 entity relationship model

information model (4.2.24) based on *entity types* (4.2.21) and their *attributes* (4.2.4) and *relationships* (4.2.37)

4.2.18 entity role

role that an *entity type* (4.2.21) is playing in a *relationship* (4.2.37)

4.2.19 entity specialisation hierarchy

means by which instances of an *entity type* (4.2.21) can be classified or specialised

Note 1 to entry: Can also be known as an entity generalisation hierarchy, an entity subtype hierarchy, an entity type classification or an entity classification.

4.2.20 entity subtype

subset of the instances of an *entity type* (4.2.21), known as the supertype, that share common *attributes* (4.2.4) and/or *relationships* (4.2.37) distinct from other subsets

Note 1 to entry: Can also be known as a subtype, an object subclass, or a subclass.

4.2.21 entity type

set of characteristics common to a *collection* (4.2.8) of *entities* (4.2.16) that are instances of the type

Note 1 to entry: Some *information modelling methods* (4.2.27) use entity type for their main information modelling construct, whilst others use entity. In this part of ISO/IEC 19763, the term entity type is used in preference to entity.

Note 2 to entry: Can also be known as an entity (in those information modelling methods that use entity for their main information modelling construct) or an *object class* (4.2.35) (in those information modelling methods that use object class for their main information modelling construct).

4.2.22

enumerated domain

domain (4.2.15) that is specified by a list of all its *valid values* (4.2.46)

Note 1 to entry: Can also be known as a discrete domain.

Note 2 to entry: Adapted from ^{A1} ISO/IEC 11179-31:2023, 3.7. ^{A1}

4.2.23

foreign key attribute

key attribute (4.2.28) whose value contributes in some way to the identification of the one related instance of that *entity type* (4.2.21) involved in the associated *relationship end* (4.2.37)

Note 1 to entry: A foreign key attribute provides or contributes to an alternative representation of the *relationship* (4.2.37) concerned. Its value must be drawn from the *domain* (4.2.15) of the corresponding key attribute of the related entity type.

4.2.24

information model

graphical and textual representation of *entities* (4.2.16) and the *relationships* (4.2.37) between them

Note 1 to entry: Can also be known as a data model, a conceptual data model, a logical data model, an *entity relationship model* (4.2.17), an object class diagram, or a database definition.

4.2.25

information model element

element of an *information model* (4.2.24) that can be represented graphically and/or textually

Note 1 to entry: Typical information model elements are *entity types* (4.2.21), *relationship ends* (4.2.37), and *unique identifiers* (4.2.44).

4.2.26

information modelling language

language or notation that is used to model information requirements in an *information model* (4.2.24)

4.2.27

information modelling method

approach to developing an *information model* (4.2.24) using a particular *information modelling language* (4.2.26)

4.2.28

key attribute

attribute (4.2.4) whose value contributes in some way to the identification of individual instances of the host *entity type* (4.2.21) or of some related entity type

4.2.29

link phrase

statement that explains the nature, expressed in business terms, of a *relationship* (4.2.37) from the perspective of one of the associated *entity types* (4.2.21)

4.2.30

maximum cardinality

statement of the maximum number of elements that can exist in a *collection* (4.2.8)

4.2.31

minimum cardinality

statement of the minimum number of elements that can exist in a *collection* (4.2.8)

4.2.32

native key attribute

key attribute (4.2.28) whose value contributes in some way to the identification of individual instances of the host *entity type* (4.2.21)

4.2.33**non-key attribute**

attribute (4.2.4) that is not the unique identifier or an element of a composite *unique identifier* (4.2.44) of an *entity type* (4.2.21), or whose value is fully independent of all *relationships* (4.2.37) or other *attributes* (4.2.4)

4.2.34**object**

anything perceivable or conceivable

Note 1 to entry: Adapted from ISO 1087-1:2000, 3.1.1.

4.2.35**object class**

description (4.2.13) of a set of *objects* (4.2.34) that share the same *attributes* (4.2.4), operations, methods, *associations* (4.2.2), and semantics

Note 1 to entry: Adapted from  ISO/IEC 11179-3:2023, 3.1.1. 

4.2.36**object class model**

information model (4.2.24) based on *object classes* (4.2.35) and their *attributes* (4.2.4) and *associations* (4.2.2)

4.2.37**relationship**

set of characteristics common to a *collection* (4.2.8) of connections between instances of two or more *entity types* (4.2.21), or between instances of one entity type and other instances of the same entity type

Note 1 to entry: Can also be known as an *association* (4.2.2) when the *information model* (4.2.24) is based upon *object classes* (4.2.35).

4.2.38**relationship end**

part of the definition of a *relationship* (4.2.37) as seen from a given *entity type* (4.2.21) which is known as the host

Note 1 to entry: Can also be known as an association end when the *information model* (4.2.24) is based upon *object classes* (4.2.35).

4.2.39**relationship end group**

statement that links one or more *relationship ends* (4.2.37) to their host *entity type* (4.2.21) such that they are mutually exclusive

Note 1 to entry: The most common case is where the 'group' comprises of just one relationship end.

4.2.40**relationship end unique identifier element**

unique identifier element (4.2.45) that is a statement that a particular *relationship end* (4.2.38) is a part of a particular *unique identifier* (4.2.44)

4.2.41**row**

sequence of values in a *table* (4.2.43), one for each *column* (4.2.9) of the table

Note 1 to entry: Within this part, this definition applies only to the registration of database structures that conform to the SQL Core specification as described in ISO/IEC 9075-2:2011.

**4.2.42
schema**

persistent, named collection of descriptors for *objects* (4.2.34) in a database

Note 1 to entry: Within this part, this definition applies only to the registration of database structures that conform to the SQL Core specification as described in ISO/IEC 9075-2:2011.

Note 2 to entry: Adapted from ISO/IEC 9075-1:2011.

**4.2.43
table**

basic construct used to represent data in the SQL database language

Note 1 to entry: Within this part, this definition applies only to the registration of database structures that conform to the SQL Core specification as described in ISO/IEC 9075-2:2011.

**4.2.44
unique identifier**

statement that the values of a specified set of *attributes* (4.2.4) and/or *relationship ends* (4.2.38) are sufficient to uniquely identify an instance of an *entity type* (4.2.21)

Note 1 to entry: Can also be known as a key or a unique key.

**4.2.45
unique identifier element**

statement that a particular *attribute* (4.2.4) or a particular *relationship end* (4.2.38) is a part of a particular *unique identifier* (4.2.44)

**4.2.46
valid value**

one of the explicit set of permitted values that comprise an *enumerated domain* (4.2.22)

**4.2.47
validation rule**

statement of the validation that may be applied to a *described domain* (4.2.12)

Note 1 to entry: This can be a reference to a *data type* (4.2.11) to be applied to *attributes* (4.2.4), a range of values or a 'format mask', or any other expression that constrains the *domain* (4.2.15).

4.3 Abbreviated terms

IRI

Internationalized Resource Identifier

MFI Core and mapping

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

MFI Information model registration

ISO/IEC 19763-12, *Information technology — Metamodel framework for interoperability — Part 12: Metamodel for information model registration*

MDR Metamodel

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

5 Structure of MFI Information model registration

5.1 Overview of MFI Information model registration

Figure 1 shows the metamodel for the registration of information models developed using the common diagramming techniques and notations listed in Clause 1 above. This metamodel can also be used for registering database structure specifications that conform to the SQL Core specification.

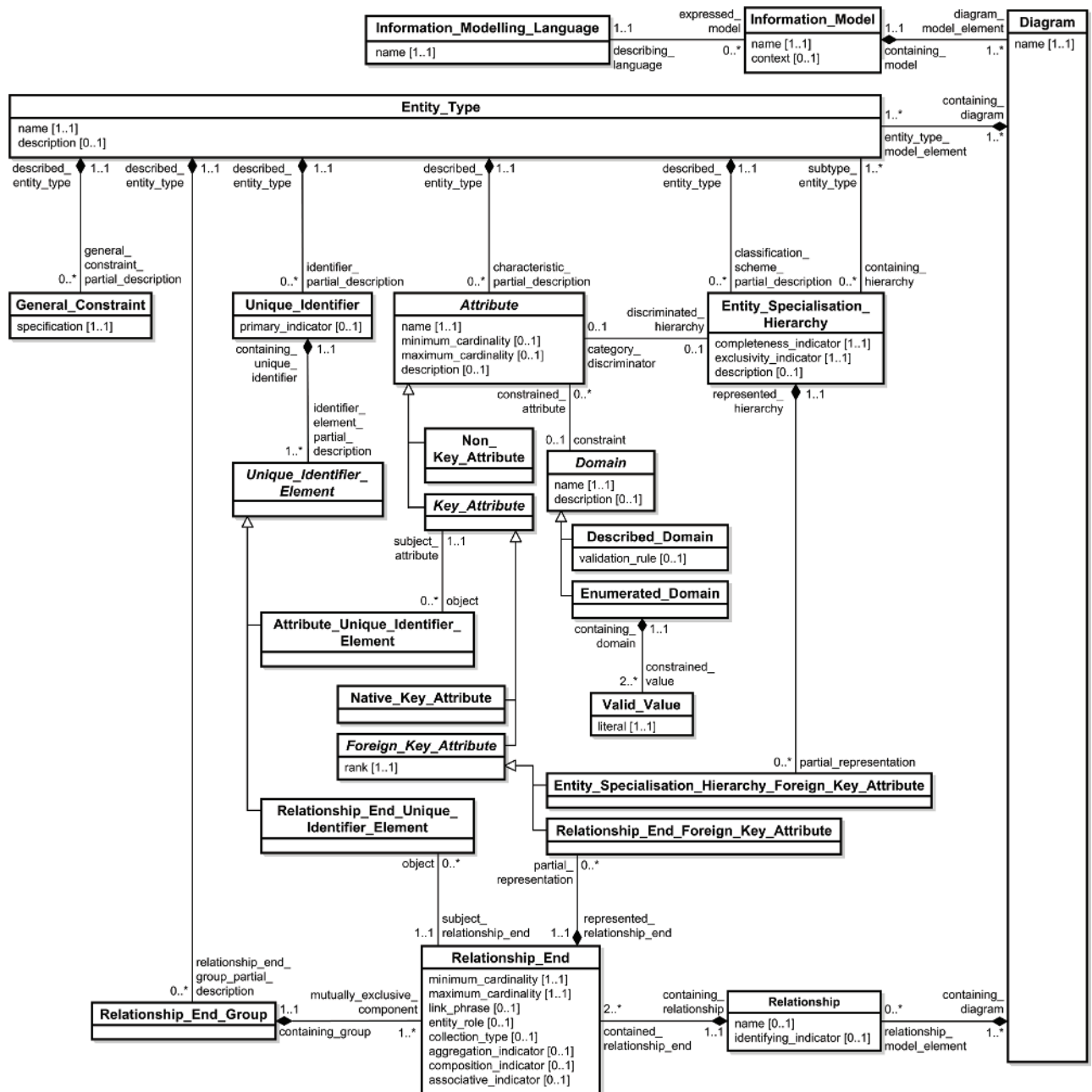


Figure 1 — Metamodel of MFI Information model registration

The metamodel for information model registration comprises the following metaclasses:

- **Attribute**
- **Attribute_Unique_Identifier_Element**, a subclass of **Unique_Identifier_Element**
- **Described_Domain**, a subclass of **Domain**

- **Diagram**
- **Domain**
- **Entity_Specialisation_Hierarchy**
- **Entity_Specialisation_Hierarchy_Foreign_Key_Attribute**, a subclass of **Foreign_Key_Attribute**
- **Entity_Type**
- **Enumerated_Domain**, a subclass of **Domain**
- **Foreign_Key_Attribute**, a subclass of **Key_Attribute**
- **General_Constraint**
- **Information_Model**
- **Information_Modelling_Language**
- **Key_Attribute**, a subclass of **Attribute**
- **Native_Key_Attribute**, a subclass of **Key_Attribute**
- **Non_Key_Attribute**, a subclass of **Attribute**
- **Relationship**
- **Relationship_End**
- **Relationship_End_Foreign_Key_Attribute**, a subclass of **Foreign_Key_Attribute**
- **Relationship_End_Group**
- **Relationship_End_Unique_Identifier_Element**, a subclass of **Unique_Identifier_Element**
- **Unique_Identifier**
- **Unique_Identifier_Element**
- **Valid_Value**

The metamodel is described in detail in [Annex A](#) (informative). Detailed specifications of the metaclasses are provided in [Clause 5.3](#) below.

5.2 Association between MFI Information model registration and MFI Core and mapping

The associations between the metaclasses in MFI Information model registration and the metaclasses in MFI Core and mapping are shown in [Figure 2](#).

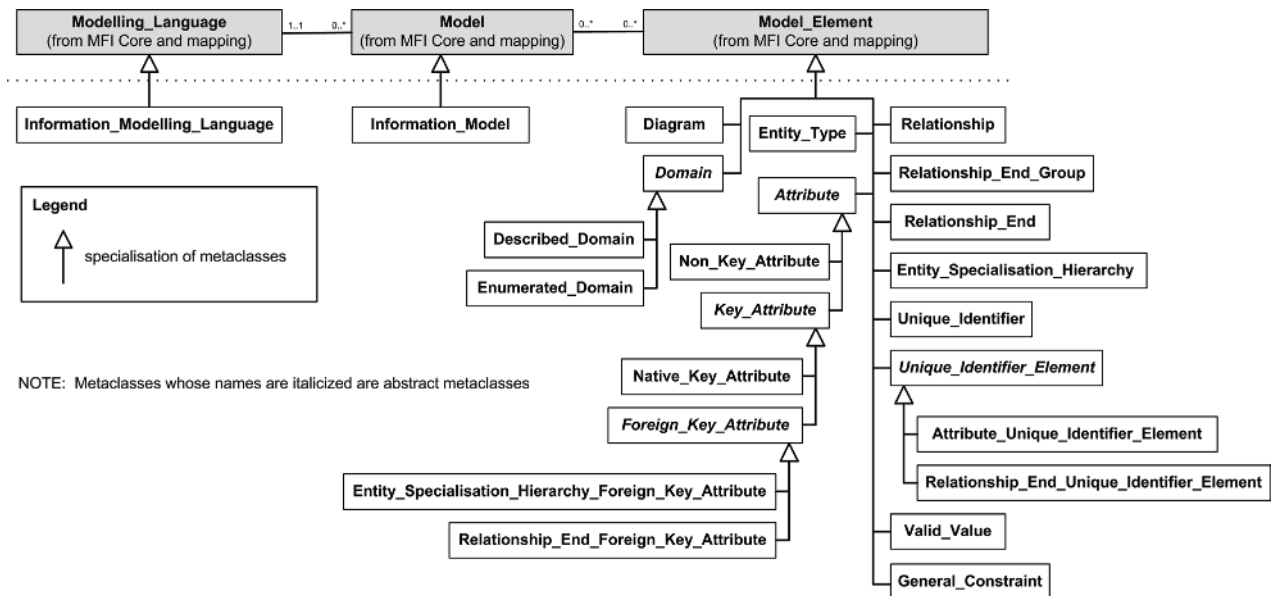


Figure 2 — The associations between MFI Information model registration and MFI Core and mapping

Information_Modelling_Language in MFI Information model registration is a specialisation of (or subclass of) Modelling_Language in MFI Core and mapping.

Information_Model in MFI Information model registration is a specialisation of Model in MFI Core and mapping.

All the remaining metaclasses are specialisations of Model_Element in MFI Core and mapping.

The association between Information_Model and Information_Modelling_Language in MFI Information model registration is a specialisation of the association between Model and Modelling_Language in MFI Core and mapping.

The association between Information_Model and Diagram in MFI Information model registration is a specialization of the association between Model and Model_Element in MFI Core and mapping.

5.3 Metaclasses in MFI Information Model Registration

5.3.1 Attribute

Attribute is an abstract metaclass each instance of which represents a representation of a particular attribute. The Attribute metaclass may be used to register information about a column in a database structure that conforms to the SQL Core specification as described in ISO/IEC 9075-2:2011.

Superclass

Model_Element (from MFI Core and mapping)

Attribute	DataType	Multiplicity	Description		
name	String	1..1	A name for this attribute.		
minimum_cardinality	String	1..1	A statement of the minimum number of occurrences of values of this attribute for any particular instance of the associated entity type. In most circumstances this will be '0' (indicating that the attribute is optional) or '1' (indicating that the attribute is mandatory).		
maximum_cardinality	String	0..1	A statement of the maximum number of occurrences of values of this attribute for any particular instance of the associated entity type. In most information modelling methods this is not specified.		
description	String	0..1	A statement that explains the significance of this attribute to the business and or organisation that is the subject of this information model.		
Reference	Class	Multiplicity	Description	Inverse	Precedence
described_entity_type	Entity_Type	1..1	The entity type instances which are qualified, identified, classified, quantified or whose state is otherwise expressed by this attribute.	characteristic_partial_description	No
constraint	Domain	0..1	The domain which acts as a constraint on the values taken by this attribute.	constrained_attribute	No
discriminated_hierarchy	Entity_Specialisation_Hierarchy	0..1	The entity specialisation hierarchy for which this attribute is the category discriminator.	category_discriminator	No

5.3.2 Attribute_Unique_Identifier_Element

Attribute_Unique_Identifier_Element is a metaclass each instance of which represents a particular attribute unique identifier element.

Superclass

Unique_Identifier_Element

Attribute	DataType		Multiplicity	Description	
[None]					
Reference	Class	Multiplicity	Description	Inverse	Precedence
subject_attribute	Key_Attribute	1..1	The native key attribute that is used as this unique identifier element.	object	No

5.3.3 Described_Domain

Described_Domain is a metaclass each instance of which represents a representation of a particular described domain.

Superclass

Domain

Attribute	DataType	Multiplicity	Description		
validation_rule	String	0..1	A statement of the validation that may be applied to this domain. At its simplest it may just be a statement of the data type that may be applied to attributes. It might show upper and lower bounds of a range of values. It might be a 'format mask'. Or, it may be any combination of these.		
Reference	Class	Multiplicity	Description	Inverse	Precedence
[None]					