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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](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

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

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: Registry metamodel and basic attributes*

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: Adapted from ISO/IEC 11179-3:2013.

#### 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 11179-3:2013.

#### 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 11179-3:2013.

#### 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 ISO/IEC 11179-3:2013.

#### 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 11179-3:2013, 3.1.5.

**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

ISO/IEC 11179-3:2013, *Information technology — Metadata registries (MDR) — Part 3: Registry metamodel and basic attributes*

## 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.

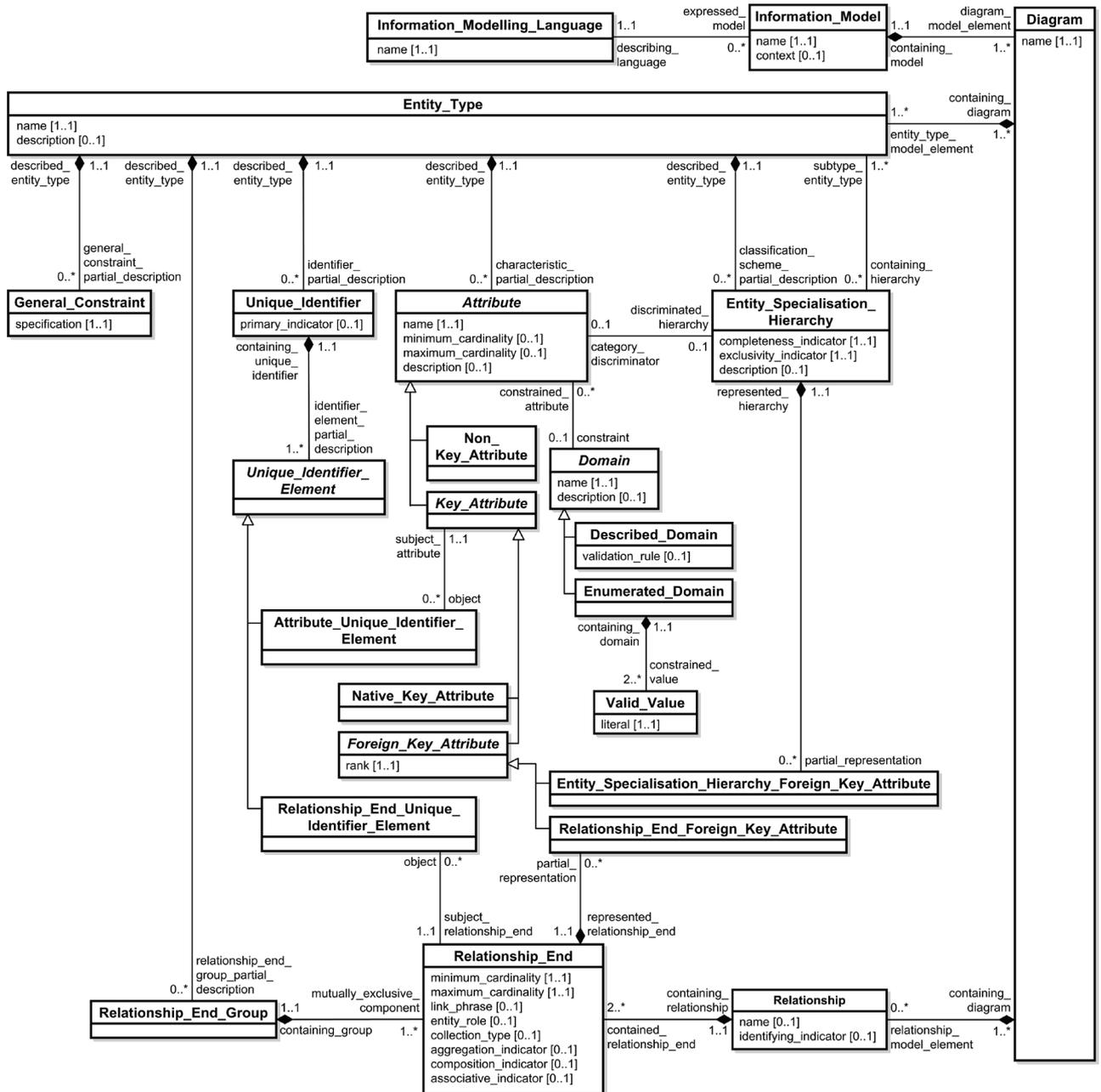


Figure 1 — Metamodel of MFI Information model registration

The metamodel for information model registration comprises the following metaclasses:

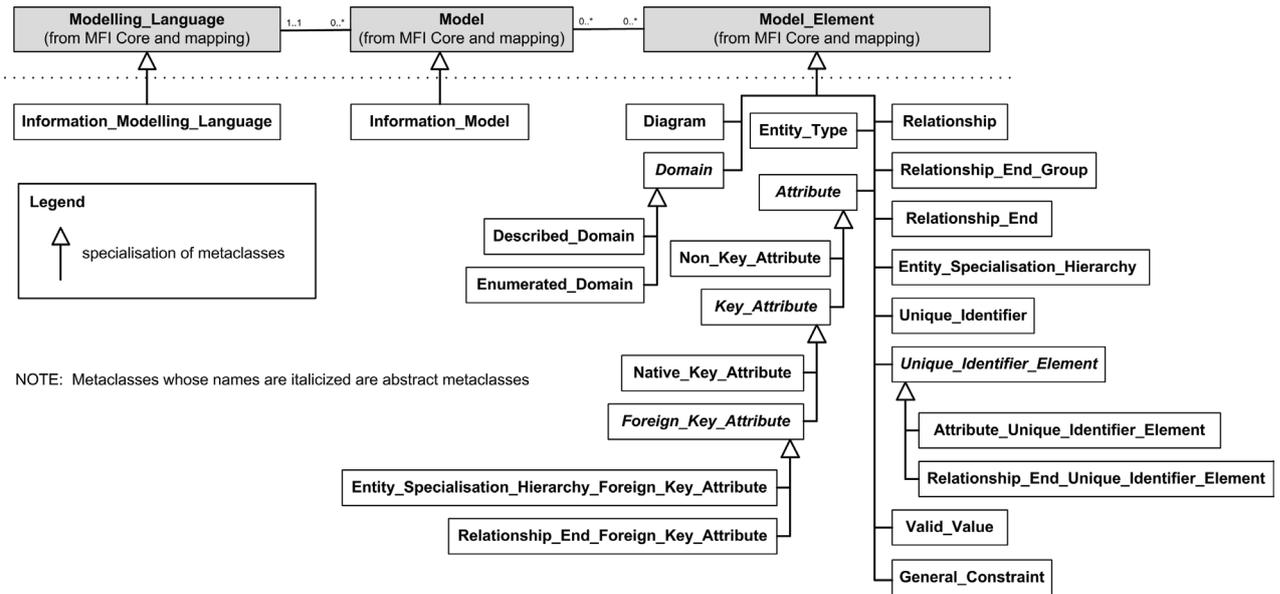
- **Attribute**
- **Attribute\_Unique\_Identifier\_Element**, a subclass of **Unique\_Identifier\_Element**
- **Described\_Domain**, a subclass of **Domain**

- **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	Data Type	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	Data Type	Multiplicity	Description	Inverse	Precedence
[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	Data Type	Multiplicity	Description	Inverse	Precedence
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]					

### 5.3.4 Diagram

Diagram is a metaclass each instance of which represents a representation of a particular diagram. The Diagram metaclass may be used to register information about a schema 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	Data Type	Multiplicity	Description	Inverse	Precedence
name	String	1..1	A name by which this diagram is known.		
containing_model	Information_Model	1..1	The information model of which this diagram is a part	diagram_model_element	No
entity_type_model_element	Entity_Type	1..*	The set of entity types which comprise this information model.	containing_model	Yes
relationship_model_element	Relationship	0..*	The set of relationships which comprise this information model.	containing_model	Yes

### 5.3.5 Domain

Domain is an abstract metaclass each instance of which represents a representation of a particular domain. The Domain metaclass may be used to register information about a data type 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	Data Type	Multiplicity	Description	Inverse	Precedence
name	String	1..1	A name by which this domain is known.		
description	String	0..1	A statement that explains the significance of this domain to the business and or organisation that is the subject of this information model.		
constrained_attribute	Attribute	0..*	The set of attributes whose values are constrained by this domain.	constraint	Yes

### 5.3.6 Entity\_Specialisation\_Hierarchy

Entity\_Specialisation\_Hierarchy is a metaclass each instance of which represents a representation of a particular entity specialisation hierarchy.

#### Superclass

Model\_Element (from MFI Core and mapping)

Attribute	Data Type	Multiplicity	Description		
completeness_indicator	Boolean	1..1	An indicator that specifies whether the instances of the associated entity subtypes that form this particular entity specialisation hierarchy are the complete set of the instances of the entity type that is the supertype or not.		
exclusivity_indicator	Boolean	1..1	An indicator that specifies whether the instances of the associated entity subtypes that form this particular entity specialisation hierarchy are mutually exclusive or not.		
description	String	0..1	A statement that describes the purpose or the classification of this particular entity specialisation hierarchy.		
Reference	Class	Multiplicity	Description	Inverse	Precedence
described_entity_type	Entity_Type	1..1	The entity type whose instances are classified or specialised by this entity specialisation hierarchy.	classification_scheme_partial_description	No
subtype_entity_type	Entity_Type	1..*	The set of entity types that are the entity subtypes that comprise this entity specialisation hierarchy.	containing_hierarchy	Yes
category_discriminator	Attribute	0..1	The attribute that is the category discriminator for this entity specialisation hierarchy.	discriminated_hierarchy	Yes
partial_representation	Entity_Specialisation_Foreign_Key_Attribute	0..*	The set of foreign key attributes that in sequence represent this entity specialisation hierarchy.	represented_hierarchy	Yes

**5.3.7 Entity\_Specialisation\_Hierarchy\_Foreign\_Key\_Attribute**

Entity\_Specialisation\_Hierarchy\_Foreign\_Key\_Attribute is a metaclass each instance of which represents a particular entity specialisation hierarchy foreign key attribute.

**Superclass**

Foreign\_Key\_Attribute

Attribute	Data Type	Multiplicity	Description
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[None]

Reference	Class	Multiplicity	Description	Inverse	Precedence
represented_hierarchy	Entity_Specialisation_Hierarchy	1..1	The entity specialisation hierarchy which has the entity supertype which is represented by this foreign key attribute along with others in sequence.	partial_representation	No

**5.3.8 Entity\_Type**

Entity\_Type is a metaclass each instance of which represents a representation of a particular entity type. The Entity\_Type metaclass may be used to register information about a table 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	Data Type	Multiplicity	Description
-----------	-----------	--------------	-------------

name	String	1..1	A name by which this entity type is known.
description	String	0..1	A statement that explains the significance of this entity type to the business and or organisation that is the subject of this Information Model.

Reference	Class	Multiplicity	Description	Inverse	Precedence
containing_diagram	Diagram	1..1	The diagram which includes this entity type.	entity_type_model_element	No
classification_scheme_partial_description	Entity_Specialisation_Hierarchy	0..*	The set of entity specialisation hierarchies that are used to classify instances of this entity type.	described_entity_type	Yes
containing_hierarchy	Entity_Specialisation_Hierarchy	0..*	The set of entity specialisation hierarchies which include this entity type as a subtype.	subtype_entity_type	No

characteristic_ partial_ description	Attribute	0..*	The set of attributes that are used to qualify, identify, classify, quantify or express the state of any instance of this entity type.	described_ entity_type	Yes
relationship_ end_group_ partial_ description	Relationship_ End_Group	0..*	The set of relationship end groups each of which has this entity type as their host entity type.	described_ entity_type	Yes
identifier_ partial_ description	Unique_ Identifier	0..*	The set of unique identifiers that uniquely identify an instance of this entity type	described_ entity_type	Yes
general_ constraint_ partial_ description	General_ Constraint	0..*	The set of general constraints that apply to instances of this entity type.	described_ entity_type	Yes

### 5.3.9 Enumerated\_Domain

Enumerated\_Domain is a metaclass each instance of which represents a representation of a particular enumerated domain.

#### Superclass

Domain

Attribute	DataType	Multiplicity	Description
-----------	----------	--------------	-------------

[None]

Reference	Class	Multiplicity	Description	Inverse	Precedence
-----------	-------	--------------	-------------	---------	------------

constrained_value	Valid_Value	2..*	The set of valid values that comprise this discrete domain.	containing_domain	Yes
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### 5.3.10 Foreign\_Key\_Attribute

Foreign\_Key\_Attribute is an abstract metaclass each instance of which represents a representation of a particular foreign key attribute.

#### Superclass

Key\_Attribute

Attribute	DataType	Multiplicity	Description
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rank	Integer	1..1	A statement of the position of this foreign key attribute in the foreign key of which it is a part.
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Reference	Class	Multiplicity	Description	Inverse	Precedence
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[None]

### 5.3.11 General\_Constraint

General\_Constraint is a metaclass each instance of which represents a representation of a particular general constraint.

#### Superclass

Model\_Element (from MFI Core and mapping)

Attribute	DataType	Multiplicity	Description
-----------	----------	--------------	-------------

specification	String	1..1	A statement of that formally specifies this constraint.
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Reference	Class	Multiplicity	Description	Inverse	Precedence
-----------	-------	--------------	-------------	---------	------------

described_entity_type	Entity_Type	1..1	The entity type that is constrained by this constraint.	general_constraint_partial_description	No
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### 5.3.12 Information\_Model

Information\_Model is a metaclass each instance of which represents a representation of a particular information model. The Information\_Model metaclass may be used to register information about a catalog in a database structure that conforms to the SQL Core specification as described in ISO/IEC 9075-2:2011.

#### Superclass

Model (from MFI Core and mapping)

Attribute	Data Type	Multiplicity	Description		
name	String	1..1	A name by which this information model is known.		
context	String	0..1	A description of the universe of discourse covered by this information model.		
Reference	Class	Multiplicity	Description	Inverse	Precedence
describing_language	Information_Modelling_Language	1..1	The information modelling language in which this model is expressed.	expressed_model	No
diagram_model_element	Diagram	1..*	The set of diagrams which comprise this information model.	containing_model	Yes

### 5.3.13 Information\_Modelling\_Language

Information\_Modelling\_Language is a metaclass each instance of which represents a representation of a particular information modelling language.

#### Superclass

Modelling\_Language (from MFI Core and mapping)

Attribute	Data Type	Multiplicity	Description		
name	String	1..1	A name by which this information modelling language is known.		
Reference	Class	Multiplicity	Description	Inverse	Precedence
expressed_model	Information_Model	0..*	The set of information models that are expressed in this language.	describing_language	Yes

### 5.3.14 Key\_Attribute

Key\_Attribute is an abstract metaclass each instance of which represents a representation of a particular key attribute.

#### Superclass

Attribute

Attribute	DataType	Multiplicity	Description	Inverse	Precedence
[None]					
Reference	Class	Multiplicity	Description	Inverse	Precedence
object	Attribute_Unique_Identifier_Element	0..*	The set of attribute unique identifier elements for which this key attribute acts as such a unique identifier element.	subject_attribute	Yes

### 5.3.15 Native\_Key\_Attribute

Native\_Key\_Attribute is a metaclass each instance of which represents a representation of a particular native key attribute.

#### Superclass

Key\_Attribute

Attribute	DataType	Multiplicity	Description	Inverse	Precedence
[None]					
Reference	Class	Multiplicity	Description	Inverse	Precedence
[None]					

### 5.3.16 Non\_Key\_Attribute

Non\_Key\_Attribute is a metaclass each instance of which represents a representation of a particular non-key attribute.

#### Superclass

Attribute

Attribute	DataType	Multiplicity	Description	Inverse	Precedence
[None]					
Reference	Class	Multiplicity	Description	Inverse	Precedence
[None]					

### 5.3.17 Relationship

Relationship is a metaclass each instance of which represents a representation of a particular relationship.

#### Superclass

Model\_Element (from MFI Core and mapping)

Attribute	DataType	Multiplicity	Description
name	String	0..1	A name by which this relationship is known. Some information modelling methods do not provide such a name.

identifying_indicator	Boolean	0..1	If this relationship is a binary 'one-to-many' relationship, an indicator that specifies whether this relationship provides part (or all) of the primary unique identifier for the entity type that is at the 'many' end of the relationship or not. Not all information modelling methods recognise this concept.
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Reference	Class	Multiplicity	Description	Inverse	Precedence
containing_diagram	Diagram	1..1	The diagram which includes this relationship.	relationship_model_element	No
contained_relationship_end	Relationship_End	2..*	The set of relationship ends that comprise this relationship.	containing_relationship	Yes

### 5.3.18 Relationship\_End

Relationship\_End is a metaclass each instance of which represents a particular relationship end.

#### Superclass

Model\_Element (from MFI Core and mapping)

Attribute	Data Type	Multiplicity	Description
minimum_cardinality	String	1..1	A statement of the minimum number of instances of the associated entity type (through the associated relationship end group) that must participate in the relationship of which this relationship end is a part. In most circumstances this will be '0' (indicating that the entity type has optional participation) or '1' (indicating that the entity type has mandatory participation).
maximum_cardinality	String	1..1	A statement of the maximum number of instances of the associated entity type (through the associated relationship end group) that may participate in the relationship of which this relationship end is a part. In most circumstances this will be '1' (indicating that one and only one entity type may participate) or '*' (indicating that an unspecified number of entity types may participate).
link_phrase	String	0..1	A statement that explains the nature of the relationship of which this relationship end is a part from the perspective of the associated entity type (through the associated relationship end group). This is normally expressed in business terms. Not all information modelling methods recognise this concept.
entity_role	String	0..1	A statement that explains the role that the associated entity type (through the associated relationship end group) is playing in the associated relationship. Not all information modelling methods recognise this concept.
collection_type	String	0..1	A statement as to whether the instances of the associated entity type (through the associated relationship end group) are considered to be a 'set', a 'bag' (or 'multiset'), a 'list' or an 'array'. Most information modelling methods do not recognise this concept.

aggregation_ indicator	Boolean	0..1	An indicator that specifies whether the instance of the associated entity type (through the associated relationship end group) is considered to be an aggregation of the instances of the other entity type participating in the relationship (identified through the associated relationship and relationship end group) or not. Most information modelling methods do not recognise this concept.
composition_ indicator	Boolean	0..1	An indicator that specifies whether the instance of the associated entity type (through the associated relationship end group) is considered to be a composition of the instances of the other entity type participating in the relationship (identified through the associated relationship and relationship end group) or not. Most information modelling methods do not recognise this concept.
associative_ indicator	Boolean	0..1	An indicator that specifies whether the instance of the associated entity type (through the associated relationship end group) is an associative entity type or not. Most information modelling methods do not recognise this concept.

Reference	Class	Multiplicity	Description	Inverse	Precedence
containing_ relationship	Relationship	1..1	The relationship of which this relationship end is a part.	contained_ relationship_ end	No
containing_ group	Relationship_ End_ Group	1..1	The relationship end group of which this relationship is one of the relationship ends each of which is mutually exclusive with others in the group.	mutually_ exclusive_ component	No
partial_ representation	Relationship_ End_Foreign_ Key_Attribute	0..*	The set of foreign key attributes that in sequence represent this relationship end.	represented_ relationship_ end	Yes
object	Relationship_ End_Unique_ Identifier_ Element	0..*	The set of relationship end unique identifier elements for which this relationship end acts as such a unique identifier element.	subject_ relationship_ end	Yes

**5.3.19 Relationship\_End\_Foreign\_Key\_Attribute**

Relationship\_End\_Foreign\_Key\_Attribute is a metaclass each instance of which represents a particular relationship end foreign key attribute.

**Superclass**

Foreign\_Key\_Attribute

Attribute	Data Type	Multiplicity	Description
[None]			

Reference	Class	Multiplicity	Description	Inverse	Precedence
represented_relationship_end	Relationship_End	1..1	The relationship end which is, along with others in sequence, represented by this foreign key attribute.	partial_representation	Yes

### 5.3.20 Relationship\_End\_Group

Relationship\_End\_Group is a metaclass each instance of which represents a particular relationship end group.

#### Superclass

Model\_Element (from MFI Core and mapping)

Attribute	Data Type	Multiplicity	Description	Inverse	Precedence
[None]					
Reference	Class	Multiplicity	Description	Inverse	Precedence
described_entity_type	Entity_Type	1..1	The entity type (the host entity type) that is related to other entity types through this relationship end group.	relationship_end_group_partial_description	No
mutually_exclusive_component	Relationship_End	1..*	The set of relationship ends that form part of this group and are mutually exclusive with each other.	containing_group	Yes

### 5.3.21 Relationship\_End\_Unique\_Identifier\_Element

Relationship\_End\_Unique\_Identifier\_Element is a metaclass each instance of which represents a particular relationship end unique identifier element.

#### Superclass

Unique\_Identifier\_Element

Attribute	Data Type	Multiplicity	Description
[None]			

Reference	Class	Multiplicity	Description	Inverse	Precedence
subject_relationship_end	Relationship_End	1..1	The relationship end that is used as this unique identifier element.	object	Yes

### 5.3.22 Unique\_Identifier

Unique\_Identifier is a metaclass each instance of which represents a representation of a particular unique identifier.

#### Superclass

Model\_Element (from MFI Core and mapping)

Attribute	Data Type	Multiplicity	Description
primary_indicator	Boolean	0..1	An indicator that specifies whether this unique identifier is the primary unique identifier of the associated entity or not. Some information modelling methods do not recognise this concept.

Reference	Class	Multiplicity	Description	Inverse	Precedence
described_entity_type	Entity_Type	1..1	The entity type whose instances can be uniquely identified by this unique identifier.	identifier_partial_description	No
identifier_element_partial_description	Unique_Identifier_Element	1..*	The set of unique identifier elements that comprise this unique identifier.	containing_unique_identifier	Yes

### 5.3.23 Unique\_Identifier\_Element

Unique\_Identifier\_Element is an abstract metaclass each instance of which represents a representation of a particular unique identifier element.

#### Superclass

Model\_Element (from MFI Core and mapping)

Attribute	Data Type	Multiplicity	Description
[None]			

Reference	Class	Multiplicity	Description	Inverse	Precedence
containing_unique_identifier	Unique_Identifier	1..1	The unique identifier of which this unique identifier element is a part.	identifier_element_partial_description	No

### 5.3.24 Valid\_Value

Valid\_Value is a metaclass each instance of which represents a representation of a particular valid value.

#### Superclass

Model\_Element (from MFI Core and mapping)

Attribute	Data Type	Multiplicity	Description	Inverse	Precedence
literal	String	1..1	The actual permitted value. In a platform independent model it will probably be the concept, for example, 'Male'. In a platform specific model it will probably be the code, for example, 'M' or '0'.		
containing_domain	Enumerated_Domain	1..1	The enumerated domain of which this valid value is one of the permitted values.	constrained_value	No

# Annex A (informative)

## Description of the metamodel

Figure A.1 repeats the metamodel for the registration of information models, which is then described in detail.

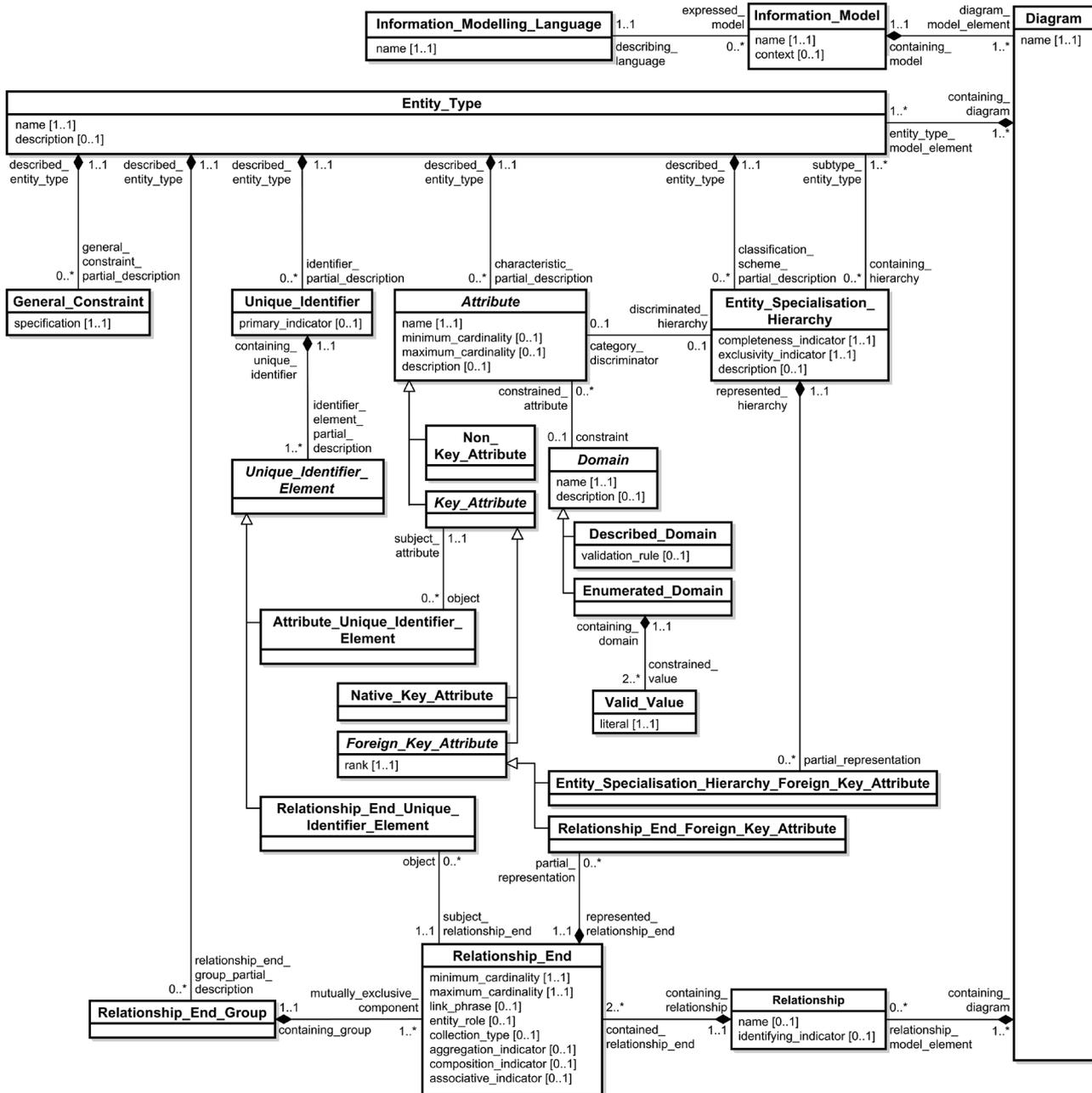


Figure A.1 — Metamodel of MFI Information model registration (repeated)

Each information modelling language is a language or notation that is used to model information requirements in an information model. In addition, each information modelling language:

- may be the language used to express zero, one or more information models (each of which are expressed models); not every information modelling language has to be used to express an information model.
- must have a name, which is a unique name by which this information modelling language is known.

Each information model is a graphical and textual representation of entities and the relationships between them. In addition, each information model:

- must be expressed in one and only one information modelling language (the describing language).
- must be comprised of one or more diagrams (each of which are diagram model elements).
- must have a name, which is a unique name by which this information model is known.
- may have a context, which is a description of the universe of discourse covered by the model; not every information model has to have a context.

Each diagram is a technical document showing part of an information model using graphical symbols. In addition, each diagram:

- must be part of one and only one information model (the containing model).
- must be comprised of one or more entity types (each of which are entity type model elements).
- may be comprised of zero, one or more relationships (each of which are relationship model elements); not every diagram has to be comprised of relationships.
- must have a name, which is a unique name by which this diagram is known.

Each entity type is a set of characteristics common to a collection of entities that are instances of the type. In addition, each entity type:

- must be part of one and only one diagram (the containing diagram).
- may be further defined with zero, one or more entity specialisation hierarchies (each of which is a classification scheme partial description); not every entity type has to be further defined with an entity specialisation hierarchy.
- may be used as a subtype in zero, one or more entity specialisation hierarchies; not every entity type has to be used as a subtype in an entity specialisation hierarchy.
- may be with instances described by values assigned to each of zero, one or more attributes (each of which is a characteristic partial description); not every entity type has to be defined with attributes.
- may be related to others through zero, one or more relationship end groups (each of which is a relationship end group partial description); not every entity type has to be related to others through a relationship end group.
- may be with instances identified by zero, one or more unique identifiers (each of which is an identifier partial description); not every entity type has to be defined with a unique identifier.
- may be further constrained by zero, one or more general constraints (each of which is a general constraint partial description); not every entity type has to be further constrained by a general constraint.
- must have a name, which is a unique name by which this entity type is known.
- may have a description, which is a statement that explains the significance of this entity type to the business and or organisation that is the subject of this information model; not every entity type has to have a description.

Each entity specialisation hierarchy is a means by which instances of an entity type may be classified or specialised. In addition, each entity specialisation hierarchy:

- must be a further description of one and only one entity type (the described entity type).
- must be comprised of one or more entity types (each of which is a subtype within the classification scheme).
- may be categorised by zero or one attribute (the category discriminator); most information modelling methods do not recognise the concept of a categorising attribute so not every entity specialisation hierarchy has to be categorised by an attribute.
- may be partially represented by zero, one or more entity specialisation hierarchy foreign key attributes; most information modelling methods do not recognise the concept of a representing entity specialisation hierarchies using foreign keys so not every entity specialisation hierarchy has to be represented by an entity specialisation hierarchy foreign key attribute.
- must have a completeness indicator, which is an indicator that specifies whether the instances of the associated entity subtypes that form this particular entity specialisation hierarchy are the complete set of the instances of the entity type that is the supertype or not.
- must have an exclusivity indicator, which is an indicator that specifies whether the instances of the associated entity subtypes that form this particular entity specialisation hierarchy are mutually exclusive or not.
- may have a description, which is a statement that describes the purpose or the classification of this particular entity specialisation hierarchy; some information modelling methods do not recognise the concept of describing an entity specialisation hierarchy so not every entity specialisation hierarchy has to have a description.

Each relationship is a set of characteristics common to a collection of connections between instances of two or more entity types, or between instances of one entity type and other instances of the same entity type. In addition, each relationship:

- must be part of one and only one diagram (the containing diagram).
- must be comprised of two or more relationship ends (each of which is a contained relationship end).
- may have a name, which is a name, which may not be unique within the information model, by which this relationship is known; some information modelling methods do not provide such a name so not every relationship has to have a name.
- may have an identifying indicator, which, if this relationship is a binary 'one-to-many' relationship, is an indicator that specifies whether this relationship provides part (or all) of the primary unique identifier for the entity type that is at the 'many' end of the relationship or not; not all information modelling methods recognise this concept so not every relationship has to have an identifying indicator.

Each relationship end is the part of the definition of a relationship as seen from a given entity type (the host). In addition, each relationship end:

- must be part of one and only one relationship (the containing relationship).
- must be mutually exclusive with other relationship ends within one and only one relationship end group (the containing group).
- may be represented by a sequence of zero, one or more relationship end foreign key attributes (each of which is a partial representation); some information modelling methods do not represent relationship ends by foreign key attributes so not every relationship end has to be represented by a sequence of relationship end foreign key attributes.

- may be used as zero, one or more relationship end unique identifier elements (each of which is an object); some information modelling methods do not use relationship ends as unique identifier elements so not every relationship end has been used as a relationship end unique identifier element.
- must have a minimum cardinality, which is a statement of the minimum number of instances of the associated entity type (through the associated relationship end group) that must participate in the relationship of which this relationship end is a part; in most circumstances this will be '0' (indicating that the entity type has optional participation) or '1' (indicating that the entity type has mandatory participation).
- must have a maximum cardinality, which is a statement of the maximum number of instances of the associated entity type (through the associated relationship end group) that may participate in the relationship of which this relationship end is a part; in most circumstances this will be '1' (indicating that one and only one entity type may participate) or '\*' (indicating that an unspecified number of entity types may participate).
- may have a link phrase, which is a statement, normally expressed in business terms, that explains the nature of the relationship of which this relationship end is a part from the perspective of the associated entity type (through the associated relationship end group); some information modelling methods do not use link phrases so not every relationship end has to have a link phrase.
- may have an entity role, which is a statement that explains the role that the associated entity type (through the associated relationship end group) is playing in the associated relationship; some information modelling methods do not use entity role so not every relationship end has to have an entity role.
- may have a collection type, which is a statement as to whether the instances of the associated entity type (through the associated relationship end group) are considered to be a 'set', a 'bag' (or 'multiset'), a 'list' or an 'array'; most information modelling methods do not recognise this concept so not every relationship end has to have a collection type.
- may have an aggregation indicator, which is an indicator that specifies whether the instance of the associated entity type (through the associated relationship end group) is considered to be an aggregation of the instances of the other entity type participating in the relationship (identified through the associated relationship and relationship end group) or not; most information modelling methods do not recognise this concept so not every relationship end has to have an aggregation indicator.
- may have a composition indicator, which is an indicator that specifies whether the instance of the associated entity type (through the associated relationship end group) is considered to be a composition of the instances of the other entity type participating in the relationship (identified through the associated relationship and relationship end group) or not; most information modelling methods do not recognise this concept so not every relationship end has to have a composition indicator.
- may have an associative indicator, which is an indicator that specifies whether the instance of the associated entity type (through the associated relationship end group) is an associative entity type or not; most information modelling methods do not recognise this concept so not every relationship end has to have an associative indicator.

Each relationship end group is a statement that links one or more relationship ends to their host entity type such that they are mutually exclusive. The most common case is where the 'group' comprises just one relationship end. In addition, each relationship end group:

- must be viewed from one and only one entity type (the described entity type).
- must be defined to include one or more relationship ends (each of which is a mutually exclusive component).

Each attribute is a named characteristic of an entity type whose values serve to qualify, identify, classify, quantify or express the state of an instance of an entity type. In addition, each attribute:

- must be either a key attribute or a non-key attribute, but not both.

- must be defined to be part of the description of one and only one entity type (the described entity type).
- may be assigned with values from zero or one domain (the constraint); some information modelling methods do not recognise the concept of assigning a domain to an attribute so not every attribute has to be assigned with values from a domain.
- may be the category discriminator for zero or one entity specialisation hierarchy (the discriminated hierarchy); most information modelling methods do not recognise the concept of a discriminating or categorising attribute so not every attribute has to be a category discriminator for an entity specialisation hierarchy.
- must have a name, which is a unique name for this attribute; in some information modelling methods this will be unique within the entity type (in which case the entity type name must be concatenated with the attribute name to gain model uniqueness) whilst in other information modelling methods this will be unique within the information model.
- may have a minimum cardinality, which is 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); some information modelling methods do not recognise the concept of cardinality of attributes so not every attribute has to have a minimum cardinality.
- may have a maximum cardinality, which is 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 because it is assumed that this the maximum cardinality is '1'; some information modelling methods do not recognise the concept of cardinality of attributes so not every attribute has to have a maximum cardinality.
- may have a description, which is a statement that explains the significance of this attribute to the business and or organisation that is the subject of this information model; some information modelling methods do not recognise the concept of descriptions for attributes so not every attribute has to have a description.

Each non-key attribute is an attribute that is not the unique identifier or an element of a composite unique identifier of an entity type or whose value is fully independent of all relationships or other attributes.

Each key attribute is an attribute whose value contributes in some way to the identification of individual instances of the host entity type or of some related entity type. In addition each key attribute:

- must be either a native key attribute or a foreign key attribute, but not both.
- may be used as zero, one or more attribute unique identifier elements; some attributes may not be used as elements of a unique identifier so not every key attribute has to be used as zero, one or more attribute unique identifier elements.

Each native key attribute is a key attribute whose value contributes in some way to the identification of individual instances of the host entity type.

Each foreign key attribute is a key attribute whose value contributes in some way to the identification of the one related instance of that entity type involved in the associated relationship end. In addition, each foreign key attribute:

- must be either a relationship end foreign key attribute or an entity specialisation hierarchy foreign key attribute, but not both.
- must have a rank, which is a statement of the position of this foreign key attribute in the sequence of the foreign key attributes that make up the foreign key of which this foreign key attribute is a part.

Each relationship end foreign key attribute is a foreign key attribute whose referenced attribute is in an entity type that is related to the entity type for which this foreign key attribute is defined through a relationship. In addition, each relationship end foreign key attribute must be part of a sequence forming a representation of one and only one relationship end (the represented relationship end).

Each entity specialisation hierarchy foreign key attribute is a foreign key attribute whose referenced attribute in the entity supertype of the related entity specialisation hierarchy. In addition, each entity specialisation hierarchy foreign key attribute must be part of a sequence forming a representation of one and only one entity specialisation hierarchy (the represented hierarchy).

Each domain is a collection of values from which an instance of an attribute must take its value. A domain provides a set of business validation rules, format constraints and other properties for one or more attributes. In addition, each domain:

- must be either a described domain or an enumerated domain, but not both.
- may be a constraint on zero, one or more attributes (the constrained attribute).
- must have a name, which is a unique name by which this domain is known.
- may have a description, which is a statement that explains the significance of this domain to the business and or organisation that is the subject of this information model; some information modelling methods do not recognise the concept of descriptions for domains so not every domain has to have a significance statement.

Each described domain is a domain whose values are not drawn from an explicit list of valid values. In addition, each described domain may have a validation rule, which is a statement of the validation that may be applied to this domain. At its simplest this validation rule 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. Some information modelling methods do not recognise the concept of validation rules for domains so not every domain has to have a validation rule.

Each enumerated domain is a domain whose permitted values consist of an explicit list of valid values. In addition, each enumerated domain must be constrained to two or more valid values (each of which is a constrained value).

Each valid value is one of the explicit set of permitted values that comprise an enumerated domain. In addition, each valid value:

- must be for one and only one enumerated domain (the constraining domain).
- must have a literal, which is the actual permitted value; in a platform independent model it will probably be the concept, for example, 'Male' whilst in a platform specific model it will probably be the code, for example, 'M' or '0'.

Each unique identifier is a statement that the values of a specified set of attributes and/or relationship ends are sufficient to uniquely identify an instance of an entity type. In addition, each unique identifier:

- must be defined for one and only one entity type (the described entity type).
- must be comprised of one or more unique identifier elements (each of which is an identifier element partial description).
- may have a primary indicator, which is an indicator that specifies whether this unique identifier instance is the primary unique identifier of the associated entity or not; some information modelling methods do not recognise this concept so not every unique identifier has to have a primary indicator.

Each unique identifier element is a statement that a particular attribute or a particular relationship end is a part of a particular unique identifier. In addition, each unique identifier element:

- must be either an attribute unique identifier element or a relationship end unique identifier element, but not both.
- must be part of one and only one unique identifier (the containing unique identifier).

Each attribute unique identifier element is a unique identifier element that is a statement that a particular attribute is a part of a particular unique identifier. In addition, each attribute unique identifier element must be a role played by one and only one key attribute (the subject attribute).

Each relationship end unique identifier element is a unique identifier element that is a statement that a particular relationship end is a part of a particular unique identifier. In addition, each relationship end unique identifier element must be a role played by one and only one relationship end (the subject relationship end).

Each general constraint is a constraint on the instances of an entity type that cannot be expressed using any other constructs in the metamodel. In addition, each general constraint:

- must be defined to be part of the description of one and only one entity type (the described entity type).
- must have a specification, which is a statement that formally specifies this constraint.

## Annex B (informative)

### Relationship of metaclasses to the MDR Metamodel

As explained in ISO/IEC 19763-10, instances of the metaclasses defined in this part of ISO/IEC 19763 can be extended by types such as defined in the MDR Metamodel as follows:

- Instances of **Information\_Modelling\_Language** may be extended as an **Identified\_Item** and as a **Designatable\_Item**.
- Instances of **Information\_Model** may be extended as an **Administered\_Item** and as a **Designatable\_Item**.
- Instances of **Entity\_Type** may be extended as an **Attached\_Item** and as a **Designatable\_Item**.
- Instances of **Entity\_Specialisation\_Hierarchy** may be extended as an **Attached\_Item** and as a **Designatable\_Item**.
- Instances of **Relationship** may be extended as an **Attached\_Item** and as a **Designatable\_Item**.
- Instances of **Relationship\_End** may be extended as an **Attached\_Item** and as a **Designatable\_Item**.
- Instances of **Relationship\_End\_Group** may be extended as an **Attached\_Item**.
- Instances of **Attribute** (and its subclasses) may be extended as an **Attached\_Item** and as a **Designatable\_Item**.
- Instances of **Domain** (and its subclasses) may be extended as an **Attached\_Item** and as a **Designatable\_Item**.
- Instances of **Valid\_Value** may be extended as an **Attached\_Item** and as a **Designatable\_Item**.
- Instances of **Unique\_Identifier** may be extended as an **Attached\_Item**.
- Instances of **Unique\_Identifier\_Element** (and its subclasses) may be extended as an **Attached\_Item**.
- Instances of **General\_Constraint** may be extended as an **Attached\_Item**.

## Annex C (informative)

### Applicability of information modelling concepts to techniques

Table C.1 shows the applicability of major information modelling concepts to the techniques and notations used in the development of this part of ISO/IEC 19763.

**Table C.1 — Use of concepts within techniques**

Concept	Applicability						
	Ellis-Barker	IDEF1X	Information Engineering	Chen	Express-G	UML Class Diagrams	SQL DDL
Entity types are named	Yes	Yes	Yes	Yes	Yes	Yes	Yes (as Tables)
Entity types have descriptions	Optional	Optional	Optional	Optional	Optional	Optional	No
Entity specialization hierarchy allowed	Yes	Yes	Yes	No	Yes	Yes	No
Only one entity specialization hierarchy allowed	Yes	Yes	Yes	NA	No	No	NA
Entity specialization hierarchies must be complete	Yes	No	Yes	NA	No	No	NA
Entity subtypes in an entity specialization hierarchy must be mutually exclusive	Yes	Yes	Yes	NA	No	No	NA
Relationships have one name	No	Yes	Yes	Yes	Yes	Optional	NA
Relationships have two names (link phrases), one for each relationship end	Yes	No	No	No	No	No	NA
Relationships are recognised as identifying or non-identifying relationships	Optional	Yes	No	No	No	No	NA
Entity types are given role names to signify their role in a relationship	No	No	No	No	No	Optional	NA
Entity types at a relationship end can be recognized as being in a collection	No	No	No	No	Yes	No	NA
Relationships can be annotated to recognise that the entity types at the other end of the relationship form an 'aggregation'	No	No	No	No	No	Yes	NA
Relationships can be annotated to recognise that the entity types at the other end of the relationship form an 'composition'	No	No	No	No	No	Yes	NA
All relationships are binary relationships	Yes	Yes	Yes	No	Yes	Yes	NA
<i>n</i> -ary relationships allowed	No	No	No	Yes	No	No	NA
Attributes are named	Yes	Yes	Yes	Yes	Yes	Yes	Yes (as Columns)
Attributes have descriptions	Optional	Optional	Optional	Optional	Optional	Optional	No

Table C.1 (continued)

Concept	Applicability						
	Ellis-Barker	IDEF1X	Information Engineering	Chen	Express-G	UML Class Diagrams	SQL DDL
Domains are named	Yes	Yes (as Data Types)	No	No	Yes (as Data Types)	Yes (as Data Types)	Yes (as Data Types)
Domains have descriptions	Optional	Optional	No	No	No	No	No
Foreign keys are documented	No	Yes	Optional	No	No	No	Yes
Unique identifiers using native key attributes and foreign key attributes are documented	No	Yes	Optional	No	No	No	Yes (as Primary Keys)
Unique identifiers using native key attributes and relationships are documented	Optional	No	No	No	No	No	No

## **Annex D** **(informative)**

### **Examples of information model registration**

#### **D.1 General**

This annex illustrates the registration of information models using the metamodel specified in MFI Information model registration. The examples are not exhaustive.

The examples all follow the same format. First the example models are presented and this is then followed by a set of illustrative instances. Each instance is identified with the name of the metaclass in angle brackets.

Object identifiers, of the form "ObjectXXX" are introduced to help with the description of the examples. The detailed specification of these identifiers is beyond the scope of this part of the standard.

#### **D.2 EXPRESS-G example**

This example is based on a car sales scenario which is drawn in EXPRESS-G notation (see [Figure D.1](#)). [Figure D.2](#) provides the object instances to illustrate the registration of this model.

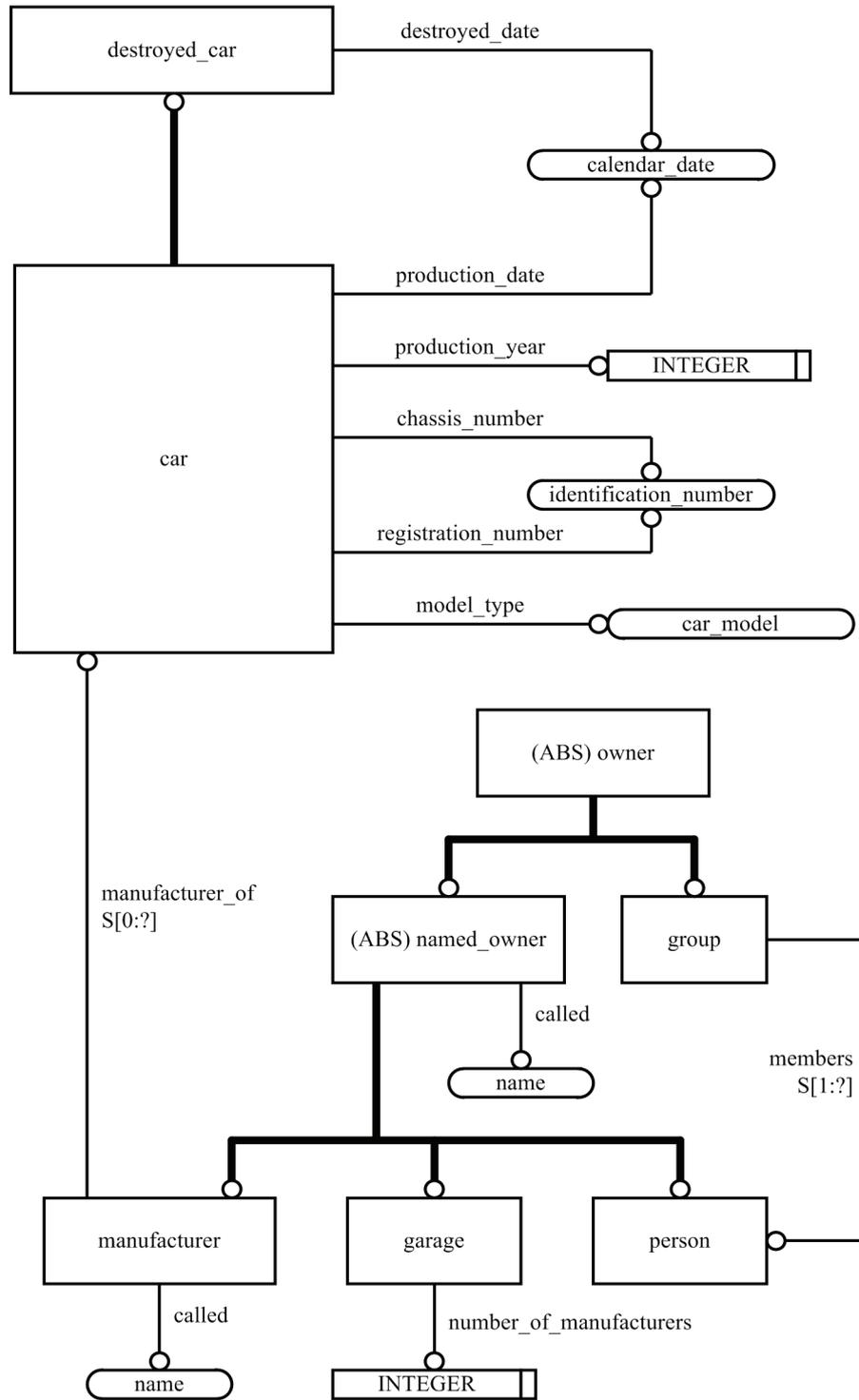


Figure D.1 — Example information model drawn in EXPRESS-G

<Information\_Modelling\_Language>

Object101

Attribute/Reference	Literal/Instance
name	"EXPRESS-G"
expressed_model	Object102

<Information\_Model>

Object102

Attribute/Reference	Literal/Instance
name	"Car Sales Version 2.7"
describing_language	Object101
diagram_model_element	Object103

<Diagram>

Object103

Attribute/Reference	Literal/Instance
name	"Car Sales Version 2.7 Diagram 1"
containing_model	Object102
entity_type_model_element	Object104, Object105, Object106, Object107, Object108, Object109, Object110, Object111
relationship_model_element	Object129, Object130

<Entity\_Type>

Object104

Attribute/Reference	Literal/Instance
name	"car"
containing_diagram	Object103
classification_scheme_partial_description	Object112
characteristic_partial_description	Object115, Object116, Object117, Object118, Object119
relationship_end_group_partial_description	Object136

<Entity\_Type>

Object105

Attribute/Reference	Literal/Instance
name	"destroyed_car"
containing_diagram	Object103
containing_hierarchy	Object112
characteristic_partial_description	Object120

<Entity\_Type>

Object106

Attribute/Reference	Literal/Instance
name	"owner"
containing_diagram	Object103
classification_scheme_partial_description	Object113

<Entity\_Type>

Object107

Attribute/Reference	Literal/Instance
name	"named_owner"
containing_diagram	Object103
classification_scheme_partial_description	Object114
containing_hierarchy	Object113
characteristic_partial_description	Object121

<Entity\_Type>

Object108

Attribute/Reference	Literal/Instance
name	"group"
containing_diagram	Object103
containing_hierarchy	Object113
relationship_end_group_partial_description	Object137

<Entity\_Type>

Object109

Attribute/Reference	Literal/Instance
name	"manufacturer"
containing_diagram	Object103
containing_hierarchy	Object114
characteristic_partial_description	Object122
relationship_end_group_partial_description	Object135

<Entity\_Type>

Object110

Attribute/Reference	Literal/Instance
name	"garage"
containing_diagram	Object103
containing_hierarchy	Object114
characteristic_partial_description	Object123

<Entity\_Type>

Object111

Attribute/Reference	Literal/Instance
name	"person"
containing_diagram	Object103
containing_hierarchy	Object114
relationship_end_group_partial_description	Object138

<Entity\_Specialisation\_Hierarchy>

Object112

Attribute/Reference	Literal/Instance
completeness_indicator	False
exclusivity_indicator	True
described_entity_type	Object104
subtype_entity_type	Object105

<Entity\_Specialisation\_Hierarchy>

Object113

Attribute/Reference	Literal/Instance
completeness_indicator	True
exclusivity_indicator	True
described_entity_type	Object106
subtype_entity_type	Object107, Object108

<Entity\_Specialisation\_Hierarchy>

Object114

Attribute/Reference	Literal/Instance
completeness_indicator	True
exclusivity_indicator	True
described_entity_type	Object107
subtype_entity_type	Object109, Object110, Object111

<Non\_Key\_Attribute>

Object115

Attribute/Reference	Literal/Instance
name	"production_date"
described_entity_type	Object104
constraint	Object125

<Non\_Key\_Attribute>

Object116

Attribute/Reference	Literal/Instance
name	"production_year"
described_entity_type	Object104
constraint	Object124

<Non\_Key\_Attribute>

Object117

Attribute/Reference	Literal/Instance
name	"chassis_number"
described_entity_type	Object104
constraint	Object126

Figure D.2 — Registration of the EXPRESS-G example (Part 1 of 2)

<Non_Key_Attribute> Object118		<Relationship> Object129	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"registration_number"	name	"manufacturer_of"
described_entity_type	Object104	containing_diagram	Object103
constraint	Object126	contained_relationship_end	Object131, Object132

<Non_Key_Attribute> Object119		<Relationship> Object130	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"model_type"	name	"members"
described_entity_type	Object104	containing_diagram	Object103
constraint	Object127	contained_relationship_end	Object133, Object134

<Non_Key_Attribute> Object120		<Relationship_End> Object131	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"destroyed_date"	minimum_cardinality	"One"
described_entity_type	Object105	maximum_cardinality	"One"
constraint	Object125	containing_relationship	Object129
		containing_group	Object135

<Non_Key_Attribute> Object121		<Relationship_End> Object132	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"called"	minimum_cardinality	"One"
described_entity_type	Object107	maximum_cardinality	"Many"
constraint	Object128	collection_type	"Set"
		containing_relationship	Object129
		containing_group	Object136

<Non_Key_Attribute> Object122		<Relationship_End> Object133	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"called"	minimum_cardinality	"One"
described_entity_type	Object109	maximum_cardinality	"One"
constraint	Object128	containing_relationship	Object130
		containing_group	Object137

<Non_Key_Attribute> Object123		<Relationship_End> Object134	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"number_of_manufacturers"	minimum_cardinality	"One"
described_entity_type	Object110	maximum_cardinality	"Many"
constraint	Object124	collection_type	"Set"
		containing_relationship	Object130
		containing_group	Object138

<Described_Domain> Object124		<Relationship_End_Group> Object135	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"INTEGER"	described_entity_type	Object109
constrained_attribute	Object116, Object123	mutually_exclusive_component	Object131

<Described_Domain> Object125		<Relationship_End_Group> Object136	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"calendar_date"	described_entity_type	Object104
constrained_attribute	Object115, Object120	mutually_exclusive_component	Object132

<Described_Domain> Object126		<Relationship_End_Group> Object137	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"identification_number"	described_entity_type	Object108
constrained_attribute	Object117, Object118	mutually_exclusive_component	Object133

<Described_Domain> Object127		<Relationship_End_Group> Object138	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"car_model"	described_entity_type	Object111
constrained_attribute	Object119	mutually_exclusive_component	Object134

<Described_Domain> Object128		<Relationship_End_Group> Object138	
Attribute/Reference	Literal/Instance	Attribute/Reference	Literal/Instance
name	"name"	described_entity_type	Object111
constrained_attribute	Object121, Object122	mutually_exclusive_component	Object134

Figure D.2 — Registration of the EXPRESS-G example (Part 2 of 2)

### D.3 IDEF1X example

This example is based on an employee relationships scenario which is drawn in IDEF1X notation (see [Figure D.3](#)). [Figure D.4](#) provides the object instances to illustrate the registration of this model.

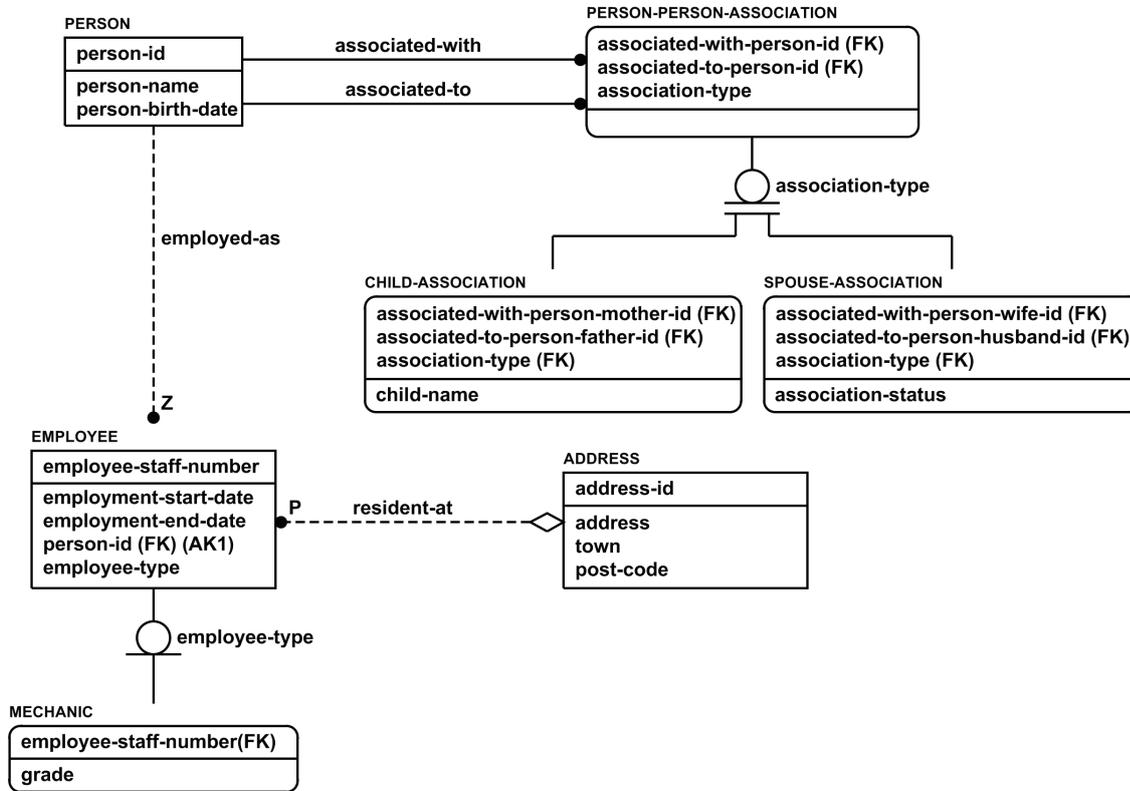


Figure D.3 — Example information model drawn in IDEF1X

<Information_Modelling_Language> Object201	
Attribute/Reference	Literal/Instance
name	"IDEF1X"
expressed_model	Object202

<Information_Model> Object202	
Attribute/Reference	Literal/Instance
name	"Employee Relationships V0.4"
describing_language	Object201
diagram_model_element	Object203

<Diagram> Object203	
Attribute/Reference	Literal/Instance
name	"Employee Relationships V0.4 Diagram 1"
containing_model	Object202
entity_type_model_element	Object204, Object205, Object206, Object207, Object208, Object209, Object210
relationship_model_element	Object213, Object214, Object215, Object216

<Entity_Type> Object204	
Attribute/Reference	Literal/Instance
name	"PERSON"
containing_diagram	Object203
characteristic_partial_description	Object234, Object235, Object236
relationship_end_group_partial_description	Object225, Object227, Object229
identifier_partial_description	Object277

<Entity_Type> Object205	
Attribute/Reference	Literal/Instance
name	"EMPLOYEE"
containing_diagram	Object203
classification_scheme_partial_description	Object211
characteristic_partial_description	Object237, Object238, Object239, Object240, Object241
relationship_end_group_partial_description	Object230, Object231
identifier_partial_description	Object278, Object 279

Figure D.4 — Registration of the IDEF1X example (Part 1 of 7)

<Entity\_Type>

Object206

Attribute/Reference	Literal/Instance
name	"MECHANIC"
containing_diagram	Object203
containing_hierarchy	Object211
characteristic_partial_description	Object242, Object243
identifier_partial_description	Object280

<Entity\_Type>

Object207

Attribute/Reference	Literal/Instance
name	"ADDRESS"
containing_diagram	Object203
characteristic_partial_description	Object244, Object245, Object246, Object247
relationship_end_group_partial_description	Object232
identifier_partial_description	Object281

<Entity\_Type>

Object208

Attribute/Reference	Literal/Instance
name	"PERSON-PERSON-ASSOCIATION"
containing_diagram	Object203
classification_scheme_partial_description	Object212
characteristic_partial_description	Object248, Object249, Object250
relationship_end_group_partial_description	Object226, Object228
identifier_partial_description	Object282

<Entity\_Type>

Object209

Attribute/Reference	Literal/Instance
name	"CHILD-ASSOCIATION"
containing_diagram	Object203
containing_hierarchy	Object212
characteristic_partial_description	Object251, Object252, Object253, Object254
identifier_partial_description	Object283

<Entity\_Type>

Object210

Attribute/Reference	Literal/Instance
name	"SPOUSE-ASSOCIATION"
containing_diagram	Object203
containing_hierarchy	Object212
characteristic_partial_description	Object255, Object256, Object257, Object258
identifier_partial_description	Object284

<Entity\_Specialisation\_Hierarchy>

Object211

Attribute/Reference	Literal/Instance
completeness_indicator	False
exclusivity_indicator	True
described_entity_type	Object205
subtype_entity_type	Object206
category_discriminator	Object241
partial_representation	Object242

<Entity\_Specialisation\_Hierarchy>

Object212

Attribute/Reference	Literal/Instance
completeness_indicator	True
exclusivity_indicator	True
described_entity_type	Object208
subtype_entity_type	Object209, Object210
category_discriminator	Object250
partial_representation	Object251, Object252, Object253, Object255, Object256, Object257

<Relationship>

Object213

Attribute/Reference	Literal/Instance
name	"associated-with"
containing_diagram	Object203
identifying_indicator	True
contained_relationship_end	Object217, Object218

<Relationship>

Object214

Attribute/Reference	Literal/Instance
name	"associated-to"
containing_diagram	Object203
identifying_indicator	True
contained_relationship_end	Object219, Object220

<Relationship>

Object215

Attribute/Reference	Literal/Instance
name	"employed_as"
containing_diagram	Object203
identifying_indicator	False
contained_relationship_end	Object221, Object222

<Relationship>

Object216

Attribute/Reference	Literal/Instance
name	"resident-at"
containing_diagram	Object203
identifying_indicator	False
contained_relationship_end	Object223, Object224

<Relationship\_End>

Object217

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
containing_relationship	Object213
containing_group	Object225

<Relationship\_End>

Object218

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
containing_relationship	Object213
containing_group	Object226
partial_representation	Object248

<Relationship\_End>

Object219

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
containing_relationship	Object214
containing_group	Object227

<Relationship\_End>

Object220

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
containing_relationship	Object214
containing_group	Object228
partial_representation	Object249

<Relationship\_End>

Object221

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
containing_relationship	Object215
containing_group	Object229

Figure D.4 — Registration of the IDEF1X example (Part 2 of 7)

<Relationship\_End>

Object222

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
containing_relationship	Object215
containing_group	Object230
partial_representation	Object240

<Relationship\_End>

Object223

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"Many"
containing_relationship	Object216
containing_group	Object231

<Relationship\_End>

Object224

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"One"
containing_relationship	Object216
containing_group	Object232

<Relationship\_End\_Group>

Object225

Attribute/Reference	Literal/Instance
described_entity_type	Object204
mutually_exclusive_component	Object217

<Relationship\_End\_Group>

Object226

Attribute/Reference	Literal/Instance
described_entity_type	Object208
mutually_exclusive_component	Object218

<Relationship\_End\_Group>

Object227

Attribute/Reference	Literal/Instance
described_entity_type	Object204
mutually_exclusive_component	Object219

<Relationship\_End\_Group>

Object228

Attribute/Reference	Literal/Instance
described_entity_type	Object208
mutually_exclusive_component	Object220

<Relationship\_End\_Group>

Object229

Attribute/Reference	Literal/Instance
described_entity_type	Object204
mutually_exclusive_component	Object221

<Relationship\_End\_Group>

Object230

Attribute/Reference	Literal/Instance
described_entity_type	Object205
mutually_exclusive_component	Object222

<Relationship\_End\_Group>

Object231

Attribute/Reference	Literal/Instance
described_entity_type	Object205
mutually_exclusive_component	Object223

<Relationship\_End\_Group>

Object232

Attribute/Reference	Literal/Instance
described_entity_type	Object207
mutually_exclusive_component	Object224

<Native\_Key\_Attribute>

Object234

Attribute/Reference	Literal/Instance
name	"person-id"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object204
object	Object285

<Non\_Key\_Attribute>

Object235

Attribute/Reference	Literal/Instance
name	"person-name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object204

<Non\_Key\_Attribute>

Object236

Attribute/Reference	Literal/Instance
name	"person-birth-date"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object204

<Native\_Key\_Attribute>

Object237

Attribute/Reference	Literal/Instance
name	"employee-staff-number"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object205
object	Object286

<Non\_Key\_Attribute>

Object236

Attribute/Reference	Literal/Instance
name	"employment-start-date"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object205

<Non\_Key\_Attribute>

Object239

Attribute/Reference	Literal/Instance
name	"employment-end-date"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object205

<Relationship\_End\_Foreign\_Key\_Attribute>

Object240

Attribute/Reference	Literal/Instance
name	"person-id"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	1
described_entity_type	Object205
object	Object287
represented_relationship_end	Object222

Figure D.4 — Registration of the IDEF1X example (Part 3 of 7)

<Non\_Key\_Attribute>

Object241

Attribute/Reference	Literal/Instance
name	"employee_type"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object205
constraint	Object261
discriminated_hierarchy	Object211

<Entity\_Specialisation\_Hierarchy\_Foreign\_Key\_Attribute>

Object242

Attribute/Reference	Literal/Instance
name	"employee-staff-number"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	1
described_entity_type	Object206
object	Object288
represented_hierarchy	Object211

<Non\_Key\_Attribute>

Object243

Attribute/Reference	Literal/Instance
name	"grade"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object206
constraint	Object262

<Native\_Key\_Attribute>

Object244

Attribute/Reference	Literal/Instance
name	"address-id"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object207
object	Object289

<Non\_Key\_Attribute>

Object245

Attribute/Reference	Literal/Instance
name	"address"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object207

<Non\_Key\_Attribute>

Object246

Attribute/Reference	Literal/Instance
name	"town"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object207

<Non\_Key\_Attribute>

Object247

Attribute/Reference	Literal/Instance
name	"post-code"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object207

<Relationship\_End\_Foreign\_Key\_Attribute>

Object248

Attribute/Reference	Literal/Instance
name	"associated-with-person-id"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	1
described_entity_type	Object208
object	Object290
represented_relationship_end	Object218

<Relationship\_End\_Foreign\_Key\_Attribute>

Object249

Attribute/Reference	Literal/Instance
name	"associated-to-person-id"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	1
described_entity_type	Object208
object	Object291
represented_relationship_end	Object220

<Native\_Key\_Attribute>

Object250

Attribute/Reference	Literal/Instance
name	"association-type"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object208
constraint	Object259
object	Object292
discriminated_hierarchy	Object212

<Entity\_Specialisation\_Hierarchy\_Foreign\_Key\_Attribute>

Object251

Attribute/Reference	Literal/Instance
name	"associated-with-person-mother-id"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	1
described_entity_type	Object209
object	Object293
represented_hierarchy	Object212

<Entity\_Specialisation\_Hierarchy\_Foreign\_Key\_Attribute>

Object252

Attribute/Reference	Literal/Instance
name	"associated-to-person-father-id"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	2
described_entity_type	Object209
object	Object294
represented_hierarchy	Object212

<Entity\_Specialisation\_Hierarchy\_Foreign\_Key\_Attribute>

Object253

Attribute/Reference	Literal/Instance
name	"association-type"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	3
described_entity_type	Object209
constraint	Object259
object	Object295
represented_hierarchy	Object212

Figure D.4 — Registration of the IDEF1X example (Part 4 of 7)

<Non\_Key\_Attribute>

Object254

Attribute/Reference	Literal/Instance
name	"child-name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object209

<Entity\_Specialisation\_Hierarchy\_Foreign\_Key\_Attribute>

Object255

Attribute/Reference	Literal/Instance
name	"associated-with-person-wife-id"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	1
described_entity_type	Object210
object	Object296
represented_hierarchy	Object212

<Entity\_Specialisation\_Hierarchy\_Foreign\_Key\_Attribute>

Object256

Attribute/Reference	Literal/Instance
name	"associated-to-person-husband-id"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	2
described_entity_type	Object210
object	Object297
represented_hierarchy	Object212

<Entity\_Specialisation\_Hierarchy\_Foreign\_Key\_Attribute>

Object257

Attribute/Reference	Literal/Instance
name	"association-type"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	3
described_entity_type	Object210
constraint	Object259
object	Object298
represented_hierarchy	Object212

<Non\_Key\_Attribute>

Object258

Attribute/Reference	Literal/Instance
name	"association-status"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object210
constraint	Object260

<Enumerated\_Domain>

Object259

Attribute/Reference	Literal/Instance
name	"association-type"
constrained_attribute	Object250, Object253, Object257
constrained_value	Object263, Object264

<Enumerated\_Domain>

Object260

Attribute/Reference	Literal/Instance
name	"association-status"
constrained_attribute	Object258
constrained_value	Object265, Object266, Object267, Object268, Object269, Object270, Object271

<Enumerated\_Domain>

Object261

Attribute/Reference	Literal/Instance
name	"employee-type"
constrained_attribute	Object241
constrained_value	Object272, Object273

<Enumerated\_Domain>

Object262

Attribute/Reference	Literal/Instance
name	"grade"
constrained_attribute	Object243
constrained_value	Object274, Object275, Object276

<Valid\_Value>

Object263

Attribute/Reference	Literal/Instance
literal	"child-association"
containing_domain	Object259

<Valid\_Value>

Object264

Attribute/Reference	Literal/Instance
literal	"spouse-association"
containing_domain	Object259

<Valid\_Value>

Object265

Attribute/Reference	Literal/Instance
literal	"current-marriage"
containing_domain	Object260

<Valid\_Value>

Object266

Attribute/Reference	Literal/Instance
literal	"current-civil-partnership"
containing_domain	Object260

<Valid\_Value>

Object267

Attribute/Reference	Literal/Instance
literal	"current-cohabitation"
containing_domain	Object260

<Valid\_Value>

Object268

Attribute/Reference	Literal/Instance
literal	"separated"
containing_domain	Object260

<Valid\_Value>

Object269

Attribute/Reference	Literal/Instance
literal	"divorced"
containing_domain	Object260

<Valid\_Value>

Object270

Attribute/Reference	Literal/Instance
literal	"wife-deceased"
containing_domain	Object260

<Valid\_Value>

Object271

Attribute/Reference	Literal/Instance
literal	"husband-deceased"
containing_domain	Object260

Figure D.4 — Registration of the IDEF1X example (Part 5 of 7)

<Valid_Value>	
Object272	
Attribute/Reference	Literal/Instance
literal	"mechanic"
containing_domain	Object261

<Valid_Value>	
Object273	
Attribute/Reference	Literal/Instance
literal	"other-employee"
containing_domain	Object261

<Valid_Value>	
Object274	
Attribute/Reference	Literal/Instance
literal	"trainee-mechanic"
containing_domain	Object262

<Valid_Value>	
Object275	
Attribute/Reference	Literal/Instance
literal	"trained-mechanic"
containing_domain	Object262

<Valid_Value>	
Object276	
Attribute/Reference	Literal/Instance
literal	"lead-mechanic"
containing_domain	Object262

<Unique_Identifier>	
Object277	
Attribute/Reference	Literal/Instance
primary_indicator	True
described_entity_type	Object204
identifier_element_partial_description	Object285

<Unique_Identifier>	
Object278	
Attribute/Reference	Literal/Instance
primary_indicator	True
described_entity_type	Object205
identifier_element_partial_description	Object286

<Unique_Identifier>	
Object279	
Attribute/Reference	Literal/Instance
primary_indicator	False
described_entity_type	Object205
identifier_element_partial_description	Object287

<Unique_Identifier>	
Object280	
Attribute/Reference	Literal/Instance
primary_indicator	True
described_entity_type	Object206
identifier_element_partial_description	Object288

<Unique_Identifier>	
Object281	
Attribute/Reference	Literal/Instance
primary_indicator	True
described_entity_type	Object207
identifier_element_partial_description	Object289

<Unique_Identifier>	
Object282	
Attribute/Reference	Literal/Instance
primary_indicator	True
described_entity_type	Object208
identifier_element_partial_description	Object290, Object291, Object292

<Unique_Identifier>	
Object283	
Attribute/Reference	Literal/Instance
primary_indicator	True
described_entity_type	Object209
identifier_element_partial_description	Object293, Object294, Object295

<Unique_Identifier>	
Object284	
Attribute/Reference	Literal/Instance
primary_indicator	True
described_entity_type	Object210
identifier_element_partial_description	Object296, Object297, Object298

<Attribute_Unique_Identifier_Element>	
Object285	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object277
subject_attribute	Object234

<Attribute_Unique_Identifier_Element>	
Object286	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object278
subject_attribute	Object237

<Attribute_Unique_Identifier_Element>	
Object287	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object279
subject_attribute	Object240

<Attribute_Unique_Identifier_Element>	
Object288	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object280
subject_attribute	Object242

<Attribute_Unique_Identifier_Element>	
Object289	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object281
subject_attribute	Object244

Figure D.4 — Registration of the IDEF1X example (Part 6 of 7)

<Attribute_Unique_Identifier_Element> Object290	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object282
subject_attribute	Object248

<Attribute_Unique_Identifier_Element> Object291	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object282
subject_attribute	Object249

<Attribute_Unique_Identifier_Element> Object292	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object282
subject_attribute	Object250

<Attribute_Unique_Identifier_Element> Object293	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object283
subject_attribute	Object251

<Attribute_Unique_Identifier_Element> Object294	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object283
subject_attribute	Object252

<Attribute_Unique_Identifier_Element> Object295	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object283
subject_attribute	Object253

<Attribute_Unique_Identifier_Element> Object296	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object284
subject_attribute	Object255

<Attribute_Unique_Identifier_Element> Object297	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object284
subject_attribute	Object256

<Attribute_Unique_Identifier_Element> Object298	
Attribute/Reference	Literal/Instance
containing_unique_identifier	Object284
subject_attribute	Object257

Figure D.4 — Registration of the IDEF1X example (Part 7 of 7)

### D.4 Ellis-Barker example

This example is based on a vehicle servicing scenario which is drawn in Ellis-Barker notation (see [Figure D.5](#)). [Figure D.6](#) provides the object instances to illustrate the registration of this model.

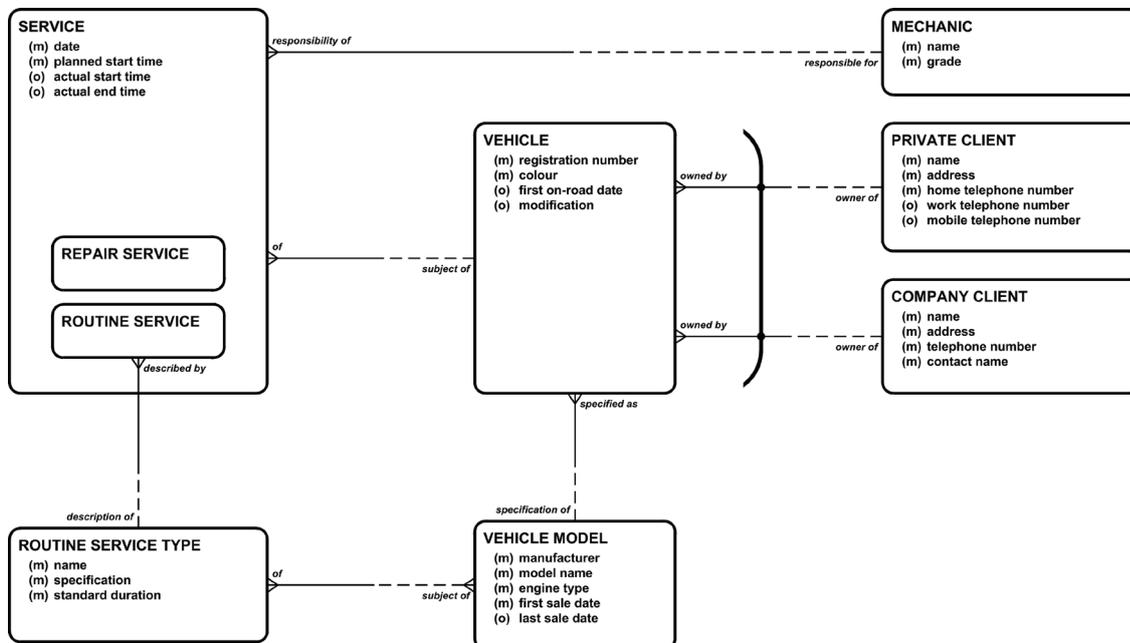


Figure D.5 — Example information model drawn in ‘Ellis-Barker’ notation

<Information\_Modelling\_Language>

Object301

Attribute/Reference	Literal/Instance
name	"E-R (Ellis-Barker)"
expressed_model	Object302

<Information\_Model>

Object302

Attribute/Reference	Literal/Instance
name	"Robinson Motors Vehicle Service Recording Ver 1.0"
describing_language	Object301
diagram_model_element	Object303

<Diagram>

Object303

Attribute/Reference	Literal/Instance
name	"Robinson Motors Vehicle Service Recording Ver 1.0 Diagram 1"
containing_model	Object302
entity_type_model_element	Object304, Object310, Object315, Object318, Object324, Object329, Object333, Object339, Object341
relationship_model_element	Object365, Object369, Object374, Object379, Object384, Object389, Object394

<Entity\_Type>

Object304

Attribute/Reference	Literal/Instance
name	"PRIVATE CLIENT"
description	"has significance as a client of Robinson Motors who is the personal owner of a vehicle serviced by Robinson Motors"
containing_diagram	Object303
characteristic_partial_description	Object305, Object306, Object307, Object308, Object309
relationship_end_group_partial_description	Object363

<Non\_Key\_Attribute>

Object305

Attribute/Reference	Literal/Instance
name	"name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object304
constraint	Object342

<Non\_Key\_Attribute>

Object306

Attribute/Reference	Literal/Instance
name	"address"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object304
constraint	Object343

<Non\_Key\_Attribute>

Object307

Attribute/Reference	Literal/Instance
name	"home telephone number"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object304
constraint	Object344

<Non\_Key\_Attribute>

Object308

Attribute/Reference	Literal/Instance
name	"work telephone number"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object304
constraint	Object344

<Non\_Key\_Attribute>

Object309

Attribute/Reference	Literal/Instance
name	"mobile telephone number"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object304
constraint	Object344

<Entity\_Type>

Object310

Attribute/Reference	Literal/Instance
name	"COMPANY CLIENT"
description	"has significance as a client of Robinson Motors who is the company owner of a vehicle serviced by Robinson Motors"
containing_diagram	Object303
characteristic_partial_description	Object311, Object312, Object313, Object314
relationship_end_group_partial_description	Object371

<Non\_Key\_Attribute>

Object311

Attribute/Reference	Literal/Instance
name	"name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object310
constraint	Object345

<Non\_Key\_Attribute>

Object312

Attribute/Reference	Literal/Instance
name	"address"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object310
constraint	Object343

<Non\_Key\_Attribute>

Object313

Attribute/Reference	Literal/Instance
name	"telephone number"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object310
constraint	Object344

<Non\_Key\_Attribute>

Object314

Attribute/Reference	Literal/Instance
name	"contact name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object310
constraint	Object342

Figure D.6 — Registration of the Ellis-Barker example (Part 1 of 6)

<Entity\_Type>

Object315

Attribute/Reference	Literal/Instance
name	"MECHANIC"
description	"has significance as an employee of Robinson Motors who is qualified to repair vehicles"
containing_diagram	Object303
characteristic_partial_description	Object316, Object317
relationship_end_group_partial_description	Object396

<Non\_Key\_Attribute>

Object316

Attribute/Reference	Literal/Instance
name	"name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object315
constraint	Object342

<Non\_Key\_Attribute>

Object317

Attribute/Reference	Literal/Instance
name	"grade"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object315
constraint	Object346

<Entity\_Type>

Object318

Attribute/Reference	Literal/Instance
name	"VEHICLE MODEL"
description	"has significance as the specification of one or more of the vehicles serviced by Robinson Motors"
containing_diagram	Object303
characteristic_partial_description	Object319, Object320, Object321, Object322, Object323
relationship_end_group_partial_description	Object376, Object377

<Non\_Key\_Attribute>

Object319

Attribute/Reference	Literal/Instance
name	"manufacturer"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object318
constraint	Object345

<Non\_Key\_Attribute>

Object320

Attribute/Reference	Literal/Instance
name	"model name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object318
constraint	Object350

<Non\_Key\_Attribute>

Object321

Attribute/Reference	Literal/Instance
name	"engine type"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object318
constraint	Object351

<Non\_Key\_Attribute>

Object322

Attribute/Reference	Literal/Instance
name	"first sale date"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object318
constraint	Object354

<Non\_Key\_Attribute>

Object323

Attribute/Reference	Literal/Instance
name	"last sale date"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object318
constraint	Object354

<Entity\_Type>

Object324

Attribute/Reference	Literal/Instance
name	"VEHICLE"
description	"has significance as a vehicle serviced by Robinson Motors"
containing_diagram	Object303
characteristic_partial_description	Object325, Object326, Object327, Object328
relationship_end_group_partial_description	Object367, Object372, Object391

<Non\_Key\_Attribute>

Object325

Attribute/Reference	Literal/Instance
name	"registration number"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object324
constraint	Object355

<Non\_Key\_Attribute>

Object326

Attribute/Reference	Literal/Instance
name	"colour"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object324
constraint	Object356

<Non\_Key\_Attribute>

Object327

Attribute/Reference	Literal/Instance
name	"first on-road date"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object324
constraint	Object354

<Non\_Key\_Attribute>

Object328

Attribute/Reference	Literal/Instance
name	"modification"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object324
constraint	Object357

Figure D.6 — Registration of the Ellis-Barker example (Part 2 of 6)

<Entity\_Type>

Object329

Attribute/Reference	Literal/Instance
name	"ROUTINE SERVICE TYPE"
description	"has significance as the specification of a routine service that is specified for a particular vehicle model"
containing_diagram	Object303
characteristic_partial_description	Object330, Object331, Object332
relationship_end_group_partial_description	Object381, Object 382

<Non\_Key\_Attribute>

Object330

Attribute/Reference	Literal/Instance
name	"name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object329
constraint	Object358

<Non\_Key\_Attribute>

Object331

Attribute/Reference	Literal/Instance
name	"specification"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object329
constraint	Object359

<Non\_Key\_Attribute>

Object332

Attribute/Reference	Literal/Instance
name	"standard duration"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object329
constraint	Object360

<Entity\_Type>

Object333

Attribute/Reference	Literal/Instance
name	"SERVICE"
description	"has significance as a job of work carried out on a vehicle by Robinson Motors; it may be a routine service or a repair service"
containing_diagram	Object303
classification_scheme_partial_description	Object334
characteristic_partial_description	Object335, Object336, Object337, Object338
relationship_end_group_partial_description	Object387, Object392

<Entity\_Specialisation\_Hierarchy>

Object334

Attribute/Reference	Literal/Instance
completeness_indicator	True
exclusivity_indicator	True
described_entity_type	Object333
subtype_entity_type	Object339, Object341

<Non\_Key\_Attribute>

Object335

Attribute/Reference	Literal/Instance
name	"date"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object333
constraint	Object354

<Non\_Key\_Attribute>

Object336

Attribute/Reference	Literal/Instance
name	"planned start time"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object333
constraint	Object361

<Non\_Key\_Attribute>

Object337

Attribute/Reference	Literal/Instance
name	"actual start time"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object333
constraint	Object361

<Non\_Key\_Attribute>

Object338

Attribute/Reference	Literal/Instance
name	"actual end time"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object333
constraint	Object361

<Entity\_Type>

Object339

Attribute/Reference	Literal/Instance
name	"REPAIR SERVICE"
description	"has significance as a type of service which is carried out as a result of a malfunction of the vehicle or an accident"
containing_diagram	Object303
containing_hierarchy	Object334
characteristic_partial_description	Object340

<Non\_Key\_Attribute>

Object340

Attribute/Reference	Literal/Instance
name	"description"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object339
constraint	Object362

Figure D.6 — Registration of the Ellis-Barker example (Part 3 of 6)

<Entity\_Type>

Object341

Attribute/Reference	Literal/Instance
name	"ROUTINE SERVICE"
description	"has significance as a type of service which is carried out as part of the routine maintenance of the vehicle"
containing_diagram	Object303
containing_hierarchy	Object334
relationship_end_group_partial_description	Object386

<Described\_Domain>

Object342

Attribute/Reference	Literal/Instance
name	"person names"
constrained_attribute	Object305, Object314, Object316

<Described\_Domain>

Object343

Attribute/Reference	Literal/Instance
name	"addresses"
constrained_attribute	Object306, Object312

<Described\_Domain>

Object344

Attribute/Reference	Literal/Instance
name	"telephone numbers"
constrained_attribute	Object307, Object308, Object309, Object313

<Described\_Domain>

Object345

Attribute/Reference	Literal/Instance
name	"company names"
constrained_attribute	Object311, Object319

<Enumerated\_Domain>

Object346

Attribute/Reference	Literal/Instance
name	"mechanic grades"
constrained_attribute	Object317
constrained_value	Object347, Object348, Object349

<Valid\_Value>

Object347

Attribute/Reference	Literal/Instance
literal	"Mechanic Class 1"
containing_domain	Object346

<Valid\_Value>

Object348

Attribute/Reference	Literal/Instance
literal	"Mechanic Class 2"
containing_domain	Object346

<Valid\_Value>

Object349

Attribute/Reference	Literal/Instance
literal	"Trainee Mechanic"
containing_domain	Object346

<Described\_Domain>

Object350

Attribute/Reference	Literal/Instance
name	"model names"
constrained_attribute	Object320

<Enumerated\_Domain>

Object351

Attribute/Reference	Literal/Instance
name	"engine types"
constrained_attribute	Object321
constrained_value	Object352, Object353

<Valid\_Value>

Object352

Attribute/Reference	Literal/Instance
literal	"Petrol"
containing_domain	Object351

<Valid\_Value>

Object353

Attribute/Reference	Literal/Instance
literal	"Diesel"
containing_domain	Object351

<Described\_Domain>

Object354

Attribute/Reference	Literal/Instance
name	"calendar dates"
constrained_attribute	Object322, Object323, Object327, Object335

<Described\_Domain>

Object355

Attribute/Reference	Literal/Instance
name	"vehicle registration numbers"
constrained_attribute	Object325

<Described\_Domain>

Object356

Attribute/Reference	Literal/Instance
name	"vehicle colours"
constrained_attribute	Object326

<Described\_Domain>

Object357

Attribute/Reference	Literal/Instance
name	"vehicle modifications"
constrained_attribute	Object328

<Described\_Domain>

Object358

Attribute/Reference	Literal/Instance
name	"service names"
constrained_attribute	Object330

<Described\_Domain>

Object359

Attribute/Reference	Literal/Instance
name	"service specifications"
constrained_attribute	Object331

<Described\_Domain>

Object360

Attribute/Reference	Literal/Instance
name	"intervals"
constrained_attribute	Object332

Figure D.6 — Registration of the Ellis-Barker example (Part 4 of 6)

<Described\_Domain>

Object361

Attribute/Reference	Literal/Instance
name	"times"
constrained_attribute	Object336, Object337, Object338

<Described\_Domain>

Object362

Attribute/Reference	Literal/Instance
name	"repair service descriptions"
constrained_attribute	Object340

<Relationship\_End\_Group>

Object363

Attribute/Reference	Literal/Instance
described_entity_type	Object304
mutually_exclusive_component	Object364

<Relationship\_End>

Object364

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
link_phrase	"owner of"
containing_relationship	Object365
containing_group	Object363

<Relationship>

Object365

Attribute/Reference	Literal/Instance
containing_diagram	Object303
contained_relationship_end	Object364, Object366

<Relationship\_End>

Object366

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
link_phrase	"owned by"
containing_relationship	Object365
containing_group	Object367

<Relationship\_End\_Group>

Object367

Attribute/Reference	Literal/Instance
described_entity_type	Object324
mutually_exclusive_component	Object366, Object368

<Relationship\_End>

Object368

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
link_phrase	"owned by"
containing_relationship	Object369
containing_group	Object367

<Relationship>

Object369

Attribute/Reference	Literal/Instance
containing_diagram	Object303
contained_relationship_end	Object368, Object370

<Relationship\_End>

Object370

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
link_phrase	"owner of"
containing_relationship	Object369
containing_group	Object371

<Relationship\_End\_Group>

Object371

Attribute/Reference	Literal/Instance
described_entity_type	Object310
mutually_exclusive_component	Object370

<Relationship\_End\_Group>

Object372

Attribute/Reference	Literal/Instance
described_entity_type	Object324
mutually_exclusive_component	Object373

<Relationship\_End>

Object373

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
link_phrase	"specified as"
containing_relationship	Object374
containing_group	Object372

<Relationship>

Object374

Attribute/Reference	Literal/Instance
containing_diagram	Object303
contained_relationship_end	Object373, Object375

<Relationship\_End>

Object375

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
link_phrase	"specification of"
containing_relationship	Object374
containing_group	Object376

<Relationship\_End\_Group>

Object376

Attribute/Reference	Literal/Instance
described_entity_type	Object318
mutually_exclusive_component	Object375

<Relationship\_End\_Group>

Object377

Attribute/Reference	Literal/Instance
described_entity_type	Object318
mutually_exclusive_component	Object378

<Relationship\_End>

Object378

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"Many"
link_phrase	"subject of"
containing_relationship	Object379
containing_group	Object377

Figure D.6 — Registration of the Ellis-Barker example (Part 5 of 6)

<Relationship>

Object379

Attribute/Reference	Literal/Instance
containing_diagram	Object303
contained_relationship_end	Object378, Object380

<Relationship\_End>

Object380

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
link_phrase	"of"
containing_relationship	Object379
containing_group	Object381

<Relationship\_End\_Group>

Object381

Attribute/Reference	Literal/Instance
described_entity_type	Object329
mutually_exclusive_component	Object380

<Relationship\_End\_Group>

Object382

Attribute/Reference	Literal/Instance
described_entity_type	Object329
mutually_exclusive_component	Object383

<Relationship\_End>

Object383

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
link_phrase	"description of"
containing_relationship	Object384
containing_group	Object382

<Relationship>

Object384

Attribute/Reference	Literal/Instance
containing_diagram	Object303
contained_relationship_end	Object383, Object385

<Relationship\_End>

Object385

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
link_phrase	"described by"
containing_relationship	Object384
containing_group	Object386

<Relationship\_End\_Group>

Object386

Attribute/Reference	Literal/Instance
described_entity_type	Object341
mutually_exclusive_component	Object385

<Relationship\_End\_Group>

Object387

Attribute/Reference	Literal/Instance
described_entity_type	Object333
mutually_exclusive_component	Object388

<Relationship\_End>

Object388

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
link_phrase	"of"
containing_relationship	Object389
containing_group	Object387

<Relationship>

Object389

Attribute/Reference	Literal/Instance
containing_diagram	Object303
contained_relationship_end	Object388, Object390

<Relationship\_End>

Object390

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
link_phrase	"subject of"
containing_relationship	Object389
containing_group	Object391

<Relationship\_End\_Group>

Object391

Attribute/Reference	Literal/Instance
described_entity_type	Object324
mutually_exclusive_component	Object390

<Relationship\_End\_Group>

Object392

Attribute/Reference	Literal/Instance
described_entity_type	Object333
mutually_exclusive_component	Object393

<Relationship\_End>

Object393

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
link_phrase	"responsibility of"
containing_relationship	Object394
containing_group	Object392

<Relationship>

Object394

Attribute/Reference	Literal/Instance
containing_diagram	Object303
contained_relationship_end	Object393, Object395

<Relationship\_End>

Object395

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
link_phrase	"responsible for"
containing_relationship	Object394
containing_group	Object396

<Relationship\_End\_Group>

Object396

Attribute/Reference	Literal/Instance
described_entity_type	Object315
mutually_exclusive_component	Object395

Figure D.6 — Registration of the Ellis-Barker example (Part 6 of 6)

## D.5 UML Class Diagram example

This example is based on a sales order processing scenario which is drawn as a UML Class Diagram (see Figure D.7). Figure D.8 provides the object instances to illustrate the registration of this model.

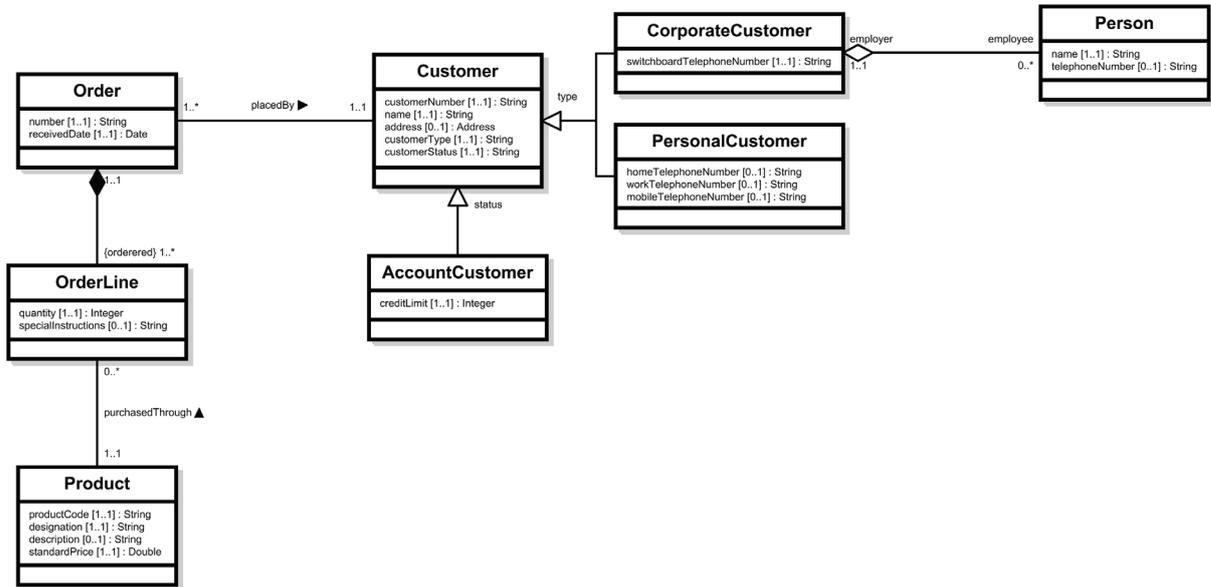


Figure D.7 — Example information model drawn as a UML Class Diagram

**<Information\_Modelling\_Language>**

Object401

Attribute/Reference	Literal/Instance
name	"UML Class Diagram"
expressed_model	Object402

**<Information\_Model>**

Object402

Attribute/Reference	Literal/Instance
name	"Johnson Brothers Ltd sales order processing system (implemented)"
describing_language	Object401
diagram_model_element	Object403

**<Diagram>**

Object403

Attribute/Reference	Literal/Instance
name	"Johnson Brothers Ltd sales order processing system (implemented) Diagram 1"
containing_model	Object402
entity_type_model_element	Object404, Object412, Object414, Object418, Object420, Object423, Object426, Object429
relationship_model_element	Object447, Object452, Object457, Object462

**<Entity\_Type>**

Object404

Attribute/Reference	Literal/Instance
name	"Customer"
containing_diagram	Object403
classification_scheme_partial_description	Object405, Object406
characteristic_partial_description	Object407, Object408, Object409, Object410, Object411
relationship_end_group_partial_description	Object450

**<Entity\_Specialisation\_Hierarchy>**

Object405

Attribute/Reference	Literal/Instance
completeness_indicator	True
exclusivity_indicator	True
description	"type"
described_entity_type	Object404
subtype_entity_type	Object412, Object414
category_discriminator	Object410

**<Entity\_Specialisation\_Hierarchy>**

Object406

Attribute/Reference	Literal/Instance
completeness_indicator	False
exclusivity_indicator	True
description	"status"
described_entity_type	Object404
subtype_entity_type	Object418
category_discriminator	Object411

**<Non\_Key\_Attribute>**

Object407

Attribute/Reference	Literal/Instance
name	"customerNumber"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object404
constraint	Object440

Figure D.8 — Registration of the UML Class Diagram example (Part 1 of 5)

<Non\_Key\_Attribute>

Object408

Attribute/Reference	Literal/Instance
name	"name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object404
constraint	Object440

<Non\_Key\_Attribute>

Object409

Attribute/Reference	Literal/Instance
name	"address"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object404
constraint	Object444

<Non\_Key\_Attribute>

Object410

Attribute/Reference	Literal/Instance
name	"customerType"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object404
constraint	Object434
discriminated_hierarchy	Object405

<Non\_Key\_Attribute>

Object411

Attribute/Reference	Literal/Instance
name	"customerStatus"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object404
constraint	Object437
discriminated_hierarchy	Object406

<Entity\_Type>

Object412

Attribute/Reference	Literal/Instance
name	"CorporateCustomer"
containing_diagram	Object403
characteristic_partial_description	Object413
containing_hierarchy	Object405
relationship_end_group_partial_description	Object449

<Non\_Key\_Attribute>

Object413

Attribute/Reference	Literal/Instance
name	"switchboardTelephoneNumber"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object412
constraint	Object440

<Entity\_Type>

Object414

Attribute/Reference	Literal/Instance
name	"PersonalCustomer"
containing_diagram	Object403
characteristic_partial_description	Object415, Object416, Object417
containing_hierarchy	Object405

<Non\_Key\_Attribute>

Object415

Attribute/Reference	Literal/Instance
name	"homeTelephoneNumber"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object414
constraint	Object440

<Non\_Key\_Attribute>

Object416

Attribute/Reference	Literal/Instance
name	"workTelephoneNumber"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object414
constraint	Object440

<Non\_Key\_Attribute>

Object417

Attribute/Reference	Literal/Instance
name	"mobileTelephoneNumber"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object414
constraint	Object440

<Entity\_Type>

Object418

Attribute/Reference	Literal/Instance
name	"AccountCustomer"
containing_diagram	Object403
characteristic_partial_description	Object419
containing_hierarchy	Object406

<Non\_Key\_Attribute>

Object419

Attribute/Reference	Literal/Instance
name	"creditLimit"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object418
constraint	Object442

<Entity\_Type>

Object420

Attribute/Reference	Literal/Instance
name	"Person"
containing_diagram	Object403
characteristic_partial_description	Object421, Object422
relationship_end_group_partial_description	Object445

<Non\_Key\_Attribute>

Object421

Attribute/Reference	Literal/Instance
name	"name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object420
constraint	Object440

Figure D.8 — Registration of the UML Class Diagram example (Part 2 of 5)

<Non\_Key\_Attribute>

Object422

Attribute/Reference	Literal/Instance
name	"telephoneNumber"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object420
constraint	Object440

<Entity\_Type>

Object423

Attribute/Reference	Literal/Instance
name	"Order"
containing_diagram	Object403
characteristic_partial_description	Object424, Object425
relationship_end_group_partial_description	Object454, Object455

<Non\_Key\_Attribute>

Object424

Attribute/Reference	Literal/Instance
name	"number"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object423
constraint	Object440

<Non\_Key\_Attribute>

Object425

Attribute/Reference	Literal/Instance
name	"receivedDate"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object423
constraint	Object441

<Entity\_Type>

Object426

Attribute/Reference	Literal/Instance
name	"OrderLine"
containing_diagram	Object403
characteristic_partial_description	Object427, Object428
relationship_end_group_partial_description	Object459, Object460

<Non\_Key\_Attribute>

Object427

Attribute/Reference	Literal/Instance
name	"quantity"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object426
constraint	Object442

<Non\_Key\_Attribute>

Object428

Attribute/Reference	Literal/Instance
name	"specialInstructions"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object426
constraint	Object440

<Entity\_Type>

Object429

Attribute/Reference	Literal/Instance
name	"Product"
containing_diagram	Object403
characteristic_partial_description	Object430, Object431, Object432, Object433
relationship_end_group_partial_description	Object464

<Non\_Key\_Attribute>

Object430

Attribute/Reference	Literal/Instance
name	"productCode"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object429
constraint	Object440

<Non\_Key\_Attribute>

Object431

Attribute/Reference	Literal/Instance
name	"designation"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object429
constraint	Object440

<Non\_Key\_Attribute>

Object432

Attribute/Reference	Literal/Instance
name	"description"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object429
constraint	Object440

<Non\_Key\_Attribute>

Object433

Attribute/Reference	Literal/Instance
name	"price"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object429
constraint	Object443

<Enumerated\_Domain>

Object434

Attribute/Reference	Literal/Instance
name	"customerTypes"
constrained_attribute	Object410
constrained_value	Object435, Object436

<Valid\_Value>

Object435

Attribute/Reference	Literal/Instance
literal	"Corporate"
containing_domain	Object434

<Valid\_Value>

Object436

Attribute/Reference	Literal/Instance
literal	"Personal"
containing_domain	Object434

Figure D.8 — Registration of the UML Class Diagram example (Part 3 of 5)

<Enumerated\_Domain>

Object437

Attribute/Reference	Literal/Instance
name	"customerStatus"
constrained_attribute	Object411
constrained_value	Object438, Object439

<Valid\_Value>

Object438

Attribute/Reference	Literal/Instance
literal	"Account"
containing_domain	Object437

<Valid\_Value>

Object439

Attribute/Reference	Literal/Instance
literal	"Casual"
containing_domain	Object437

<Described\_Domain>

Object440

Attribute/Reference	Literal/Instance
name	"String"
constrained_attribute	Object407, Object408, Object413, Object415, Object416, Object417, Object421, Object422, Object424, Object428, Object430, Object431, Object432

<Described\_Domain>

Object441

Attribute/Reference	Literal/Instance
name	"Date"
constrained_attribute	Object425

<Described\_Domain>

Object442

Attribute/Reference	Literal/Instance
name	"Integer"
constrained_attribute	Object419, Object427

<Described\_Domain>

Object443

Attribute/Reference	Literal/Instance
name	"Double"
constrained_attribute	Object433

<Described\_Domain>

Object444

Attribute/Reference	Literal/Instance
name	"Address"
constrained_attribute	Object409

<Relationship\_End\_Group>

Object445

Attribute/Reference	Literal/Instance
described_entity_type	Object420
mutually_exclusive_component	Object446

<Relationship\_End>

Object446

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
entity_role	"employee"
aggregation_indicator	True
composition_indicator	False
containing_relationship	Object447
containing_group	Object445

<Relationship>

Object447

Attribute/Reference	Literal/Instance
containing_diagram	Object403
contained_relationship_end	Object446, Object448

<Relationship\_End>

Object448

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
entity_role	"employer"
aggregation_indicator	False
composition_indicator	False
containing_relationship	Object447
containing_group	Object449

<Relationship\_End\_Group>

Object449

Attribute/Reference	Literal/Instance
described_entity_type	Object412
mutually_exclusive_component	Object448

<Relationship\_End\_Group>

Object450

Attribute/Reference	Literal/Instance
described_entity_type	Object404
mutually_exclusive_component	Object451

<Relationship\_End>

Object451

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
aggregation_indicator	False
composition_indicator	False
containing_relationship	Object452
containing_group	Object450

<Relationship>

Object452

Attribute/Reference	Literal/Instance
name	"placedBy"
containing_diagram	Object403
contained_relationship_end	Object451, Object453

Figure D.8 — Registration of the UML Class Diagram example (Part 4 of 5)

<b>&lt;Relationship_End&gt;</b>	
Object453	
Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"Many"
aggregation_indicator	False
composition_indicator	False
containing_relationship	Object452
containing_group	Object454

<b>&lt;Relationship_End_Group&gt;</b>	
Object454	
Attribute/Reference	Literal/Instance
described_entity_type	Object423
mutually_exclusive_component	Object453

<b>&lt;Relationship_End_Group&gt;</b>	
Object455	
Attribute/Reference	Literal/Instance
described_entity_type	Object423
mutually_exclusive_component	Object456

<b>&lt;Relationship_End&gt;</b>	
Object456	
Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
aggregation_indicator	False
composition_indicator	False
containing_relationship	Object457
containing_group	Object455

<b>&lt;Relationship&gt;</b>	
Object457	
Attribute/Reference	Literal/Instance
containing_diagram	Object403
contained_relationship_end	Object456, Object458

<b>&lt;Relationship_End&gt;</b>	
Object458	
Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"Many"
collection_type	List
aggregation_indicator	False
composition_indicator	True
containing_relationship	Object457
containing_group	Object459

<b>&lt;Relationship_End_Group&gt;</b>	
Object459	
Attribute/Reference	Literal/Instance
described_entity_type	Object426
mutually_exclusive_component	Object458

<b>&lt;Relationship_End_Group&gt;</b>	
Object460	
Attribute/Reference	Literal/Instance
described_entity_type	Object426
mutually_exclusive_component	Object461

<b>&lt;Relationship_End&gt;</b>	
Object461	
Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
aggregation_indicator	False
composition_indicator	False
containing_relationship	Object462
containing_group	Object460

<b>&lt;Relationship&gt;</b>	
Object462	
Attribute/Reference	Literal/Instance
name	"purchasedThrough"
containing_diagram	Object403
contained_relationship_end	Object461, Object463

<b>&lt;Relationship_End&gt;</b>	
Object463	
Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
aggregation_indicator	False
composition_indicator	False
containing_relationship	Object462
containing_group	Object464

<b>&lt;Relationship_End_Group&gt;</b>	
Object464	
Attribute/Reference	Literal/Instance
described_entity_type	Object429
mutually_exclusive_component	Object463

Figure D.8 — Registration of the UML Class Diagram example (Part 5 of 5)

## D.6 SQL CREATE TABLE statements example

This example is based on a vehicle manufacturing scenario which is depicted as a set of SQL CREATE TABLE statements (see Figure D.9). Figure D.10 provides the object instances to illustrate the registration of this set of SQL CREATE TABLE statements.

```

CREATE TABLE organisation
( organisation_name VARCHAR(20),
  organisation_address VARCHAR(250),
  PRIMARY KEY (organisation_name)
);

CREATE TABLE vehicle_model
( organisation_name VARCHAR(20),
  model_name VARCHAR(40),
  specification VARCHAR(250),
  PRIMARY KEY (organisation_name, model_name),
  FOREIGN KEY (organisation_name) REFERENCES organisation
);

CREATE TABLE vehicle
( organisation_name VARCHAR(20),
  model_name VARCHAR(40),
  chassis_number VARCHAR(30),
  first_registration_date DATE,
  PRIMARY KEY (organisation_name, chassis_number),
  FOREIGN KEY (organisation_name, model_name) REFERENCES vehicle_model
);

```

Figure D.9 — Example information model depicted as a set of SQL CREATE TABLE statements

<Information\_Modelling\_Language>  
Object501

Attribute/Reference	Literal/Instance
name	"SQL"
expressed_model	Object502

<Information\_Model>  
Object502

Attribute/Reference	Literal/Instance
name	"SQL Catalog #1"
describing_language	Object501
diagram_model_element	Object503

<Diagram>  
Object503

Attribute/Reference	Literal/Instance
name	"SQL Schema for Vehicle Manufacturing"
containing_model	Object502
entity_type_model_element	Object504, Object509, Object516
relationship_model_element	Object528, Object533

<Entity\_Type>  
Object504

Attribute/Reference	Literal/Instance
name	"organisation"
containing_diagram	Object503
characteristic_partial_description	Object505, Object506
relationship_end_group_partial_description	Object526
identifier_partial_description	Object507

<Native\_Key\_Attribute>  
Object505

Attribute/Reference	Literal/Instance
name	"organisation_name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object504
constraint	Object524
object	Object508

<Non\_Key\_Attribute>  
Object506

Attribute/Reference	Literal/Instance
name	"organisation_address"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object504
constraint	Object524

<Unique\_Identifier>  
Object507

Attribute/Reference	Literal/Instance
primary_indicator	True
described_entity_type	Object504
identifier_element_partial_description	Object508

<Attribute\_Unique\_Identifier\_Element>  
Object508

Attribute/Reference	Literal/Instance
containing_unique_identifier	Object507
subject_attribute	Object505

Figure D.10 — Registration of the example set of SQL CREATE TABLE statements (Part 1 of 3)

<Entity\_Type>

Object509

Attribute/Reference	Literal/Instance
name	"vehicle_model"
containing_diagram	Object503
characteristic_partial_description	Object510, Object511, Object512
relationship_end_group_partial_description	Object530, Object531
identifier_partial_description	Object513

<Relationship\_End\_Foreign\_Key\_Attribute>

Object510

Attribute/Reference	Literal/Instance
name	"organisation_name"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	1
described_entity_type	Object509
constraint	Object524
object	Object514
represented_relationship_end	Object529

<Native\_Key\_Attribute>

Object511

Attribute/Reference	Literal/Instance
name	"model_name"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object509
constraint	Object524
object	Object515

<Non\_Key\_Attribute>

Object512

Attribute/Reference	Literal/Instance
name	"specification"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object509
constraint	Object524

<Unique\_Identifier>

Object513

Attribute/Reference	Literal/Instance
primary_indicator	True
described_entity_type	Object509
identifier_element_partial_description	Object514, Object515

<Attribute\_Unique\_Identifier\_Element>

Object514

Attribute/Reference	Literal/Instance
containing_unique_identifier	Object513
subject_attribute	Object510

<Attribute\_Unique\_Identifier\_Element>

Object515

Attribute/Reference	Literal/Instance
containing_unique_identifier	Object513
subject_attribute	Object511

<Entity\_Type>

Object516

Attribute/Reference	Literal/Instance
name	"vehicle"
containing_diagram	Object503
characteristic_partial_description	Object517, Object518, Object519, Object520
relationship_end_group_partial_description	Object535
identifier_partial_description	Object521

<Relationship\_End\_Foreign\_Key\_Attribute>

Object517

Attribute/Reference	Literal/Instance
name	"organisation_name"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	1
described_entity_type	Object516
constraint	Object524
object	Object522
represented_relationship_end	Object534

<Relationship\_End\_Foreign\_Key\_Attribute>

Object518

Attribute/Reference	Literal/Instance
name	"model_name"
minimum_cardinality	"One"
maximum_cardinality	"One"
rank	2
described_entity_type	Object516
constraint	Object524
represented_relationship_end	Object534

<Native\_Key\_Attribute>

Object519

Attribute/Reference	Literal/Instance
name	"chassis_number"
minimum_cardinality	"One"
maximum_cardinality	"One"
described_entity_type	Object516
constraint	Object524
object	Object523

<Non\_Key\_Attribute>

Object520

Attribute/Reference	Literal/Instance
name	"first_registration_date"
minimum_cardinality	"Zero"
maximum_cardinality	"One"
described_entity_type	Object516
constraint	Object525

<Unique\_Identifier>

Object521

Attribute/Reference	Literal/Instance
primary_indicator	True
described_entity_type	Object516
identifier_element_partial_description	Object522, Object523

Figure D.10 — Registration of the example set of SQL CREATE TABLE statements (Part 2 of 3)

<Attribute\_Unique\_Identifier\_Element>

Object522

Attribute/Reference	Literal/Instance
containing_unique_identifier	Object521
subject_attribute	Object517

<Attribute\_Unique\_Identifier\_Element>

Object523

Attribute/Reference	Literal/Instance
containing_unique_identifier	Object521
subject_attribute	Object519

<Described\_Domain>

Object524

Attribute/Reference	Literal/Instance
name	"VARCHAR"
constrained_attribute	Object505, Object506, Object510, Object511, Object512, Object517, Object518, Object519

<Described\_Domain>

Object525

Attribute/Reference	Literal/Instance
name	"DATE"
constrained_attribute	Object520

<Relationship\_End\_Group>

Object526

Attribute/Reference	Literal/Instance
described_entity_type	Object504
mutually_exclusive_component	Object527

<Relationship\_End>

Object527

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
containing_relationship	Object528
containing_group	Object526

<Relationship>

Object528

Attribute/Reference	Literal/Instance
containing_diagram	Object503
contained_relationship_end	Object527, Object529

<Relationship\_End>

Object529

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
containing_relationship	Object528
containing_group	Object530
partial_representation	Object510

<Relationship\_End\_Group>

Object530

Attribute/Reference	Literal/Instance
described_entity_type	Object509
mutually_exclusive_component	Object529

<Relationship\_End\_Group>

Object531

Attribute/Reference	Literal/Instance
described_entity_type	Object509
mutually_exclusive_component	Object532

<Relationship\_End>

Object532

Attribute/Reference	Literal/Instance
minimum_cardinality	"One"
maximum_cardinality	"One"
containing_relationship	Object533
containing_group	Object531

<Relationship>

Object533

Attribute/Reference	Literal/Instance
containing_diagram	Object503
contained_relationship_end	Object532, Object534

<Relationship\_End>

Object534

Attribute/Reference	Literal/Instance
minimum_cardinality	"Zero"
maximum_cardinality	"Many"
containing_relationship	Object533
containing_group	Object535
partial_representation	Object517, Object518

<Relationship\_End\_Group>

Object535

Attribute/Reference	Literal/Instance
described_entity_type	Object516
mutually_exclusive_component	Object534

Figure D.10 — Registration of the example set of SQL CREATE TABLE statements (Part 3 of 3)

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