INTERNATIONAL STANDARD

ISO/IEC 19763-16

First edition
2021-09

Information technology — Metamodel framework for interoperability (MFI) —

Part 16: Metamodel for document model registration

Reference number
ISO/IEC 19763-16:2021(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ... **iv**

Introduction ... **v**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms, definitions and abbreviated terms ... **1**
3.1 Terms and definitions ... 1
3.2 Abbreviated terms ... 2

4 Conformance ... **2**
4.1 General ... 2
4.2 Degree of conformance ... 2
4.2.1 General ... 2
4.2.2 Strictly conforming implementation ... 3
4.2.3 Conforming implementation ... 3
4.3 Implementation conformance statement (ICS) ... 3

5 Structure of MFI Document model registration ... **3**
5.1 Overview of MFI Document model registration ... 3
5.2 Association between MFI Document model registration and MFI Core and mapping ... 5
5.3 Metaclasses in MFI Document model registration ... 6
5.3.1 Document_Schema ... 6
5.3.2 Document_Schema_Language ... 7
5.3.3 Document_Schema_Namespace ... 7
5.3.4 Enumerated_Node ... 8
5.3.5 Namespace ... 8
5.3.6 Node ... 8
5.3.7 Node_Enumeration ... 9
5.3.8 Node_Relationship ... 10
5.3.9 Node_Relationship_Type ... 10
5.3.10 Restricted_Node ... 11
5.3.11 Schema_Reuse ... 11
5.3.12 Schema_Reuse_Type ... 12

Annex A (informative) **Description of the metamodel** ... **13**

Annex B (informative) **Relationship of metaclasses to the MDR Metamodel** ... **18**

Annex C (informative) **Examples of document model registration** ... **19**

Bibliography ... **67**

Foreword

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

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

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) or the IEC list of patent declarations received (see patents.iec.ch).

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

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

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

A list of all parts in the ISO/IEC 19763 series can be found on the ISO and IEC websites.

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

Introduction

There is an increasing demand for systems to interoperate by exchanging information and data. These exchanges are sometimes performed using 'documents' such as XML documents and JSON documents. The business information requirements conveyed by these documents are often specified in supporting document models, for example, in XML schemas for XML documents and in JSON schemas for JSON documents.

The information contained in these models – the metadata – can be registered using the facilities specified by this document. Most of the metaclasses specified in this document are subclasses of the metaclasses specified in ISO/IEC 19763-10:2014, 7.1, 7.2 and 7.3.

Where there is an overlap of the universe of discourse of the business information requirements specified in the registered models, the mappings between registered models can then be registered using the facilities specified in ISO/IEC 19763-10:2014, Clause 8, thus enabling further interoperation.

A model registry, as specified using any of the metamodels described in ISO/IEC 19763, uses the common facilities specified in ISO/IEC 11179-3:2013, Clauses 6, 7 and 8. A model registry is, therefore, a part of a metadata registry.

Information technology — Metamodel framework for interoperability (MFI) —

Part 16: Metamodel for document model registration

1 Scope

The primary purpose of the ISO/IEC 19763 series is to specify a metamodel framework for interoperability. This document specifies a metamodel for registering document models (or schemata). Examples of such document models include:

— specifications for XML documents (using XML schema[3]);

— specifications for JSON documents (using JSON schema[2]).

This metamodel was developed taking into account the requirements for both XML schema and JSON schema, but is applicable to all current specifications for document models.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 19763-10:2014, *Information technology — Metamodel framework for interoperability (MFI) — Part 10: Core model and basic mapping*

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

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
document
unit of data that is well-formed according to some agreed specification

Note 1 to entry: In this document, examples of a unit of data that is referred to as a document include, but are not restricted to, XML documents and JSON documents.

[SOURCE: ISO/IEC TR 24716:2007, 4.4, modified — Note 1 has been added.]

3.1.2
document schema
formal specification of the structure of a *document* (3.1.1)

Note 1 to entry: The same schema can be used for multiple documents.

3.1.3
document schema language
language used to specify document schemata

3.1.4
namespace
set of character strings available for naming entities of specific classes within a specific scope

3.1.5
node
elements, comments, processing instructions, and text in a document

[SOURCE: ISO 24531:2013, 4.35 modified — The definition in the source document specifically referred to XML documents but is applicable to all documents; the references to XML and Note 1 have been removed.]

3.1.6
node enumeration
list of named values used as the range of a particular *node* (3.1.5)

3.2 Abbreviated terms

Abbreviated terms	Definition
JSON	JavaScript Object Notation
MFI Core and mapping	Metamodel Framework for Interoperability Core and mapping
MFI Document model registration [a]	Metamodel Framework for Interoperability document model registration
MDR Metamodel	Metadata registries metamodel
URL	Uniform Resource Locator
XML	eXtensible Markup Language
[a] Whenever this abbreviation is used, this document is referring to itself.	

4 Conformance

4.1 General

Any claim of conformance to this document shall support the metamodel specified in Clause 5, depending on a degree of conformance as described below.

4.2 Degree of conformance

4.2.1 General

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

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

4.2.2 Strictly conforming implementation

A strictly conforming implementation:

a) shall support the metamodel specified in Clause 5;

b) shall not use, test, access, or probe for any extension features nor extensions to the metamodel specified in Clause 5.

4.2.3 Conforming implementation

A conforming implementation:

a) shall support the metamodel specified in Clause 5;

b) as permitted by the implementation, may 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 can cause undefined behaviour.

4.3 Implementation conformance statement (ICS)

Any claim of conformance to this document shall include an implementation conformance statement stating:

a) whether it is a strictly conforming implementation (4.2.2) or a conforming implementation (4.2.3);

b) what extensions, if any, are supported or used if it is a conforming implementation.

5 Structure of MFI Document model registration

5.1 Overview of MFI Document model registration

Figure 1 shows the metamodel for the registration of document models such as XML schemas and JSON schemas.

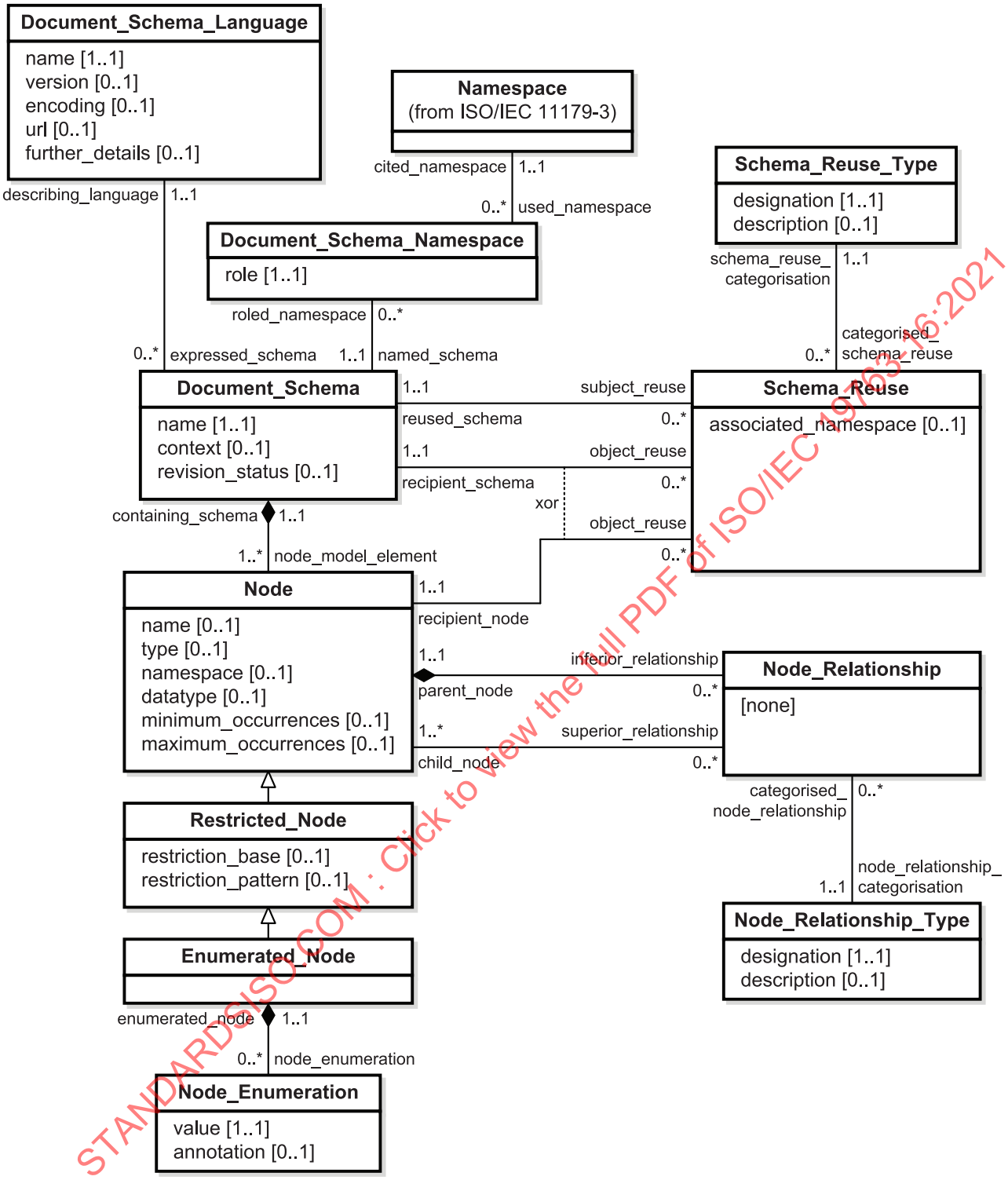


Figure 1 — Metamodel of MFI Document model registration

The metamodel for document model registration comprises the following metaclasses:

— **Document_Schema**

— **Document_Schema_Language**

— **Document_Schema_Namespace**

— **Enumerated_Node**, a subclass of **Restricted_Node**

— **Namespace** (which shall be in accordance with ISO/IEC 11179-3:2013, 7.2.2.3)

— **Node**

— **Node_Enumeration**

— **Node_Relationship**

— **Node_Relationship_Type**

— **Restricted_Node**, a subclass of **Node**

— **Schema_Reuse**

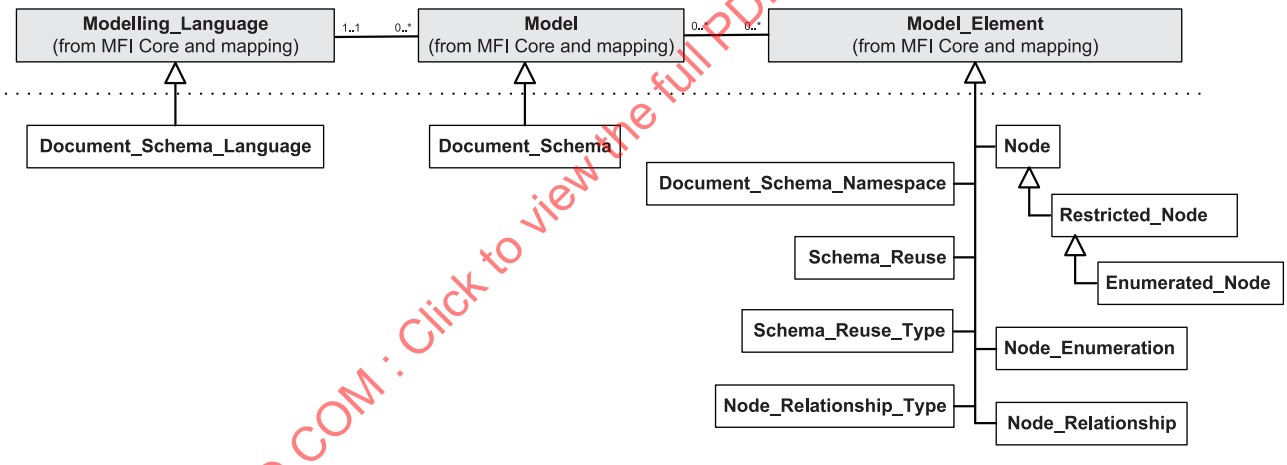
— **Schema_Reuse_Type**

The metamodel is described in detail in Annex A. Detailed specifications of the metaclasses are provided in 5.3.

Examples of the registration of document models using this metamodel are provided in Annex C.

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

The associations between the metaclasses specified in this document and the metaclasses in MFI Core and mapping (ISO/IEC 19763-10:2014, 7.1, 7.2 and 7.3) are shown in Figure 2.



Key

specialisation of metaclasses

Figure 2 — Associations between MFI Document model registration and MFI Core and mapping

Document_Schema_Language in this document is a specialisation of (or subclass of) Modelling_Language (in accordance with ISO/IEC 19763-10:2014, 7.1).

Document_Schema in this document is a specialisation of Model (in accordance with ISO/IEC 19763-10:2014, 7.2).

All the remaining metaclasses are specialisations of Model_Element (in accordance with ISO/IEC 19763-10:2014, 7.3).

The association between Document_Schema and Document_Schema_Language in this document is a specialisation of the association between Model (in accordance with ISO/IEC 19763-10:2014, 7.2) and Modelling_Language (in accordance with ISO/IEC 19763-10:2014, 7.1).

The association between Document_Schema and the remaining metaclasses specified in this document are specializations of the association between Model (in accordance with ISO/IEC 19763-10:2014, 7.2) and Model_Element (in accordance with ISO/IEC 19763-10:2014, 7.3).

MFI Core and mapping (ISO/IEC 19763-10:2014, Clause 9) explains that instances of the metaclasses specified in 5.3 can be extended by the types defined in ISO/IEC 11179-3:2013, Clauses 7 and 8. Annex B provides suggested type extension for each of the metaclasses specified in 5.3.

5.3 Metaclasses in MFI Document model registration

5.3.1 Document_Schema

Document_Schema is a metaclass each instance of which represents a representation of a particular document schema.

Superclass

Model (which shall be in accordance with ISO/IEC 19763-10:2014, 7.2)

Attribute	DataType	Multiplicity	Description
name	String	1..1	A statement specifying the name by which this document schema is known.
context	String	0..1	A statement describing the universe of discourse covered by this document schema.
revision_status	String	0..1	A statement describing revision or version status of this document schema.

Reference	Class	Multiplicity	Description	Inverse	Precedence
describing_language	Document_Schema_Language	1..1	The document schema language in which this schema is expressed.	expressed_schema	No
roled_namespace	Document_Schema_Namespace	0..*	The set of namespaces that are cited in this schema.	named_schema	Yes
node_model_element	Node	1..*	The set of nodes contained within this document schema.	containing_schema	Yes
subject_reuse	Schema_Reuse	0..*	The set of schema reuses that record that this schema is reused within another schema (the recipient schema) or as a node in another schema (the recipient node).	reused_schema	Yes
object_reuse	Schema_Reuse	0..*	The set of schema reuses that record that this schema reuses another schema (the reused schema).	recipient_schema	Yes

Constraints

[None]

5.3.2 Document_Schema_Language

Document_Schema_Language is a metaclass each instance of which represents a representation of a particular document schema language.

Superclass

Modelling_Language (which shall be in accordance with ISO/IEC 19763-10:2014, 7.1)

Attribute	DataType	Multiplicity	Description
name	String	1..1	A statement specifying the name by which this document schema language is known.
version	String	0..1	A statement specifying the version of this particular document schema language.
encoding	String	0..1	A statement specifying the encoding that is used within this particular document schema language.
url	String	0..1	A statement specifying the URL that may be used to access the specification of this particular document schema language.
further_details	String	0..1	A statement providing any necessary further details necessary to unambiguously specify this particular document schema language.

Reference	Class	Multiplicity	Description	Inverse	Precedence
expressed_schema	Document_Schema	0..*	The set of document schemas that are expressed in this language.	describing_language	Yes

Constraints

[None]

5.3.3 Document_Schema_Namespace

Document_Schema_Namespace is a metaclass each instance of which represents a representation of a particular namespace that is cited within a schema.

Superclass

Model_Element (which shall be in accordance with ISO/IEC 19763-10:2014, 7.3)

Attribute	DataType	Multiplicity	Description
role	String	1..1	A statement specifying the role that this particular namespace is playing within the related document schema. Examples are “Target”, “Prefix” and “Default”.

Reference	Class	Multiplicity	Description	Inverse	Precedence
cited_namespace	Namespace	1..1	The namespace cited for use with this role in the related document schema.	used_namespace	No
named_schema	Document_ Schema	1..1	The document schema for which this namespace is specified with this role.	roled_namespace	No

Constraints

[None]

5.3.4 Enumerated_Node

Enumerated_Node is a metaclass each instance of which represents a representation of a particular type of node within a schema, a restricted node for which there is a set of permitted values specified for the restricted node.

Superclass

Restricted_Node

Attribute	DataType	Multiplicity	Description
[None]			

Reference	Class	Multiplicity	Description	Inverse	Precedence
node_enumeration	Node_Enumeration	2..*	The set of valid values for this node.	enumerated_node	Yes

Constraints

[None]

5.3.5 Namespace

Namespace is a metaclass defined in ISO/IEC 11179-3:2013, 7.2.2.3. It is shown here to indicate the additional reference required for this document.

Superclass

[None]

Attribute	DataType	Multiplicity	Description
[None]			

Reference	Class	Multiplicity	Description	Inverse	Precedence
used_namespace	Document_Schema_Namespace	0..*	The set of document schema namespace within which this namespace is the cited namespace.	cited_namespace	Yes

Constraints

[None]

5.3.6 Node

Node is a metaclass each instance of which represents a representation of a particular node within a schema. Node has one subclass; Enumerated_Node.

Superclass

Model_Element (which shall be in accordance with ISO/IEC 19763-10:2014, 7.3)

Attribute	DataType	Multiplicity	Description
name	String	0..1	A statement specifying the name for this node.
type	String	0..1	A statement specifying the type of this node. Examples are “simple”, “complex”, “group”, “sequence”, “choice”, “element” and “attribute”.

namespace	String	0..1	A statement specifying the namespace to be used for this node. This shall only exist if the namespace for the node differs from the namespace specified as the default namespace for the document schema of which this node is a component part or if there is no default specified for the document schema.
datatype	String	0..1	A statement specifying the datatype for this node.
minimum_ occurrences	String	0..1	A statement of the minimum number of occurrences of values of this node. In most circumstances this will be "0" (indicating that the note is optional) or "1" (indicating that the node is mandatory).
maximum_ occurrences	String	0..1	A statement of the maximum number of occurrences of values of this node. In most circumstances this will be "1" or "unbounded".

Reference	Class	Multiplicity	Description	Inverse	Precedence
containing_ schema	Document_ Schema	1..1	The schema that contains this node.	node_model_ element	No
object_reuse	Schema_ Reuse	0..*	The set of schema reuses that record that this node reuses a schema (the reused schema).	recipient_ node	Yes
inferior_ relationship	Node_ Relationship	0..*	The set of node relationships through which this node is the parent of other nodes.	parent_node	Yes
superior_ relationship	Node_ Relationship	0..*	The set of node relationships through which this node is the child of other nodes.	child_node	Yes

Constraints

[None]

5.3.7 Node_Enumeration

Node_Enumeration is a metaclass each instance of which represents a representation of a particular permitted value for an enumerated node.

Superclass

Model_Element (which shall be in accordance with ISO/IEC 19763-10:2014, 7.3)

Attribute	DataType	Multiplicity	Description
value	String	1..1	A specification of the actual permitted value.
annotation	String	0..1	A statement describing the meaning of the value.

Reference	Class	Multiplicity	Description	Inverse	Precedence
enumerated_ node	Enumerated_ Node	1..1	The enumerated node for which this value is a permitted value.	node_ enumeration	No

Constraints

[None]

5.3.8 Node_Relationship

Node_Relationship is a metaclass each instance of which represents a representation of a particular relationship between two nodes.

Superclass

Model_Element (which shall be in accordance with ISO/IEC 19763-10:2014, 7.3)

Attribute	DataType	Multiplicity	Description
[None]			

Reference	Class	Multiplicity	Description	Inverse	Precedence
node_ relationship_ categorisation	Node_ Relationship_ Type	1..1	The categorisation of this node relationship.	categorised_ node_ relationship	No
parent_node	Node	1..1	The referenced node that is the parent node in this node relationship.	inferior_ relationship	No
child_node	Node	1..*	The set of referenced nodes, each element of which is a child node in this node relationship.	superior_ relationship	No

Constraints

[None]

5.3.9 Node_Relationship_Type

Node_Relationship_Type is a metaclass each instance of which represents a representation of a particular categorisation of a set of node relationships.

Superclass

Model_Element (which shall be in accordance with ISO/IEC 19763-10:2014, 7.3)

Attribute	DataType	Multiplicity	Description
designation	String	1..1	A statement specifying the category of the associated node relationships.
description	String	0..1	A statement explaining the meaning of the designation statement for this node relationship type.

Reference	Class	Multiplicity	Description	Inverse	Precedence
categorised_ node_ relationship	Node_ Relationship	0..*	The set of node relationships that are categorised by this node relationship type.	node_ relationship_ categorisation	Yes

Constraints

[None]

5.3.10 Restricted_Node

Restricted_Node is a metaclass each instance of which represents a representation of a particular type of node within a schema, a node for which there is a restriction, such as a pattern, placed upon the values of the node.

Superclass

Node

Attribute	DataType	Multiplicity	Description
restriction_base	String	0..1	A statement specifying the datatype within which each of the values of the node is to be specified.
restriction_pattern	String	0..1	A statement specifying any pattern that is to be applied to the values specified for the node.

Reference	Class	Multiplicity	Description	Inverse	Precedence

[None]

Constraints

[None]

5.3.11 Schema_Reuse

Schema_Reuse is a metaclass each instance of which represents a representation of a particular schema reuse within another schema or of a particular schema reuse as a node within a schema.

Superclass

Model_Element (which shall be in accordance with ISO/IEC 19763-10:2014, 7.3)

Attribute	DataType	Multiplicity	Description
associated_namespace	String	0..1	A statement of any namespace associated with the reused schema.

Reference	Class	Multiplicity	Description	Inverse	Precedence
schema_reuse_categorisation	Schema_Reuse_Type	1..1	The categorisation of this schema reuse.	categorised_schema_reuse	No
reused_schema	Document_Schema	1..1	The schema that is reused through this schema reuse.	subject_reuse	No
recipient_schema	Document_Schema	1..1	The schema that reuses the schema designated as the reused schema cited in this schema reuse.	object_reuse	No
recipient_node	Node	1..1	The node that reuses the schema designated as the reused schema cited in this schema reuse.	object_reuse	No

Constraints

One, but not both, of recipient_schema or recipient_node shall exist.

5.3.12 Schema_Reuse_Type

Schema_Reuse_Type is a metaclass each instance of which represents a representation of a particular categorisation of a set of schema reuses.

Superclass

Model_Element (which shall be in accordance with ISO/IEC 19763-10:2014, 7.3)

Attribute	DataType	Multiplicity	Description
designation	String	1..1	A statement specifying the category of the associated schema reuses.
description	String	0..1	A statement explaining the meaning of the designation statement for this schema reuse type.

Reference	Class	Multiplicity	Description	Inverse	Precedence
categorised_schema_reuse	Schema_Reuse	0..*	The set of node relationships that are categorised by this node relationship type.	schema_reuse_categorisation	Yes

Constraints

[None]

Annex A
(informative)

Description of the metamodel

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

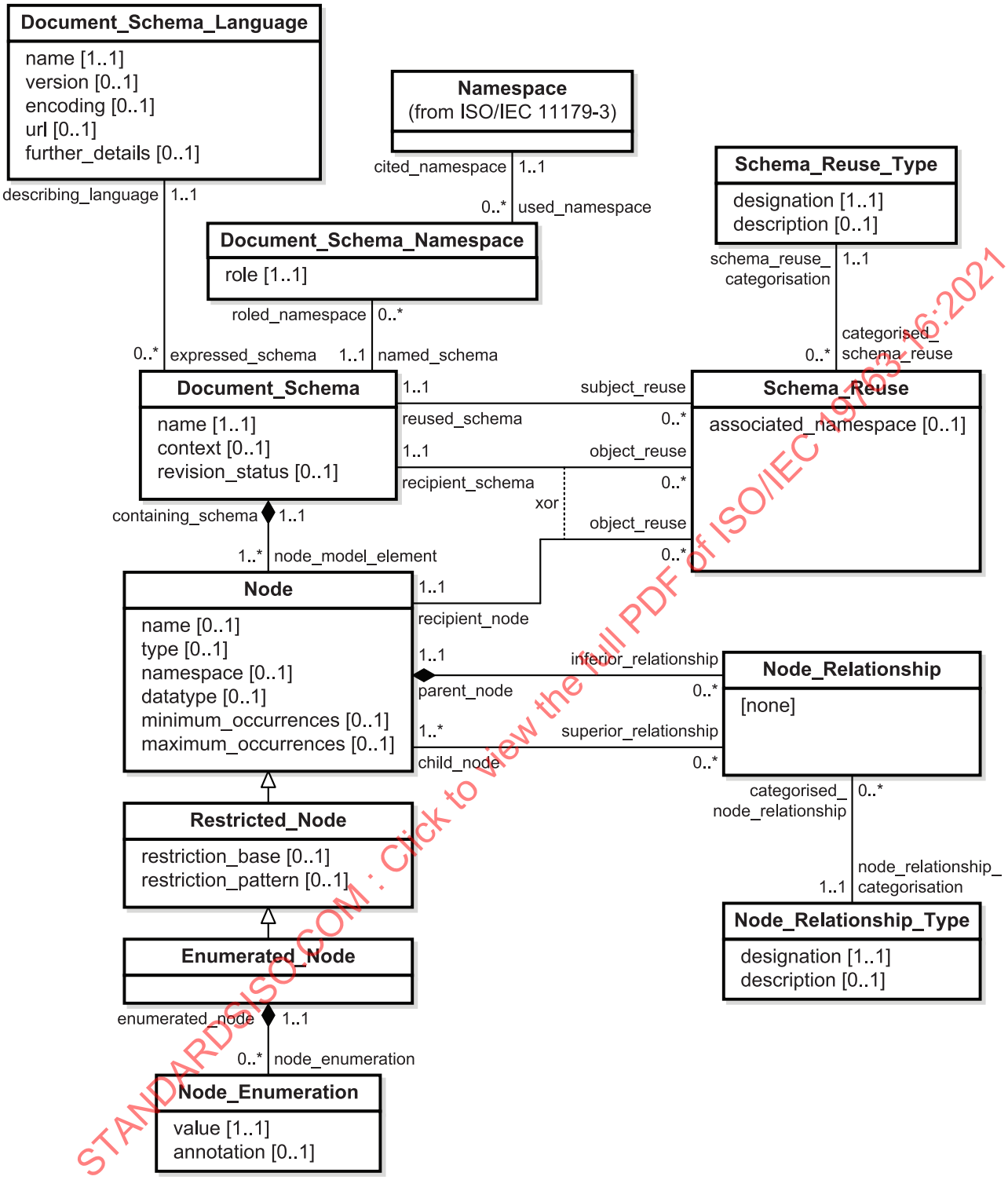


Figure A.1 — Metamodel of MFI Document model registration (repeated)

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

— may be the language used to express zero, one or more document schemas (each of which are an expressed schema); not every document schema language has to be used to express a document schema;

— shall have a name, which is a unique name by which this document schema language is known;

— may have a version, which is a statement specifying the version of this particular document schema language; not every document schema language has to have a version;

— may have an encoding, which is a statement specifying the encoding that is used within this particular document schema language; not every document schema language has to have an encoding;

— may have a URL, which is a statement specifying the URL that may be used to access the specification of this particular document schema language; not every document schema language has to have a URL;

— may have a further_details, which is a statement providing any necessary further details necessary to unambiguously specify this particular document schema language; not every document schema language has to have a further_details.

Each document schema is a textual representation of the information to be included in documents that conform to this document schema. In addition, each document schema:

— shall be expressed in one and only one document schema language (the describing language);

— shall be comprised of one or more nodes (each of which are node model elements);

— may be specified with zero, one or more document schema namespaces (each of which are a roled namespace); not every document schema has to be specified with a document schema namespace;

— may be reused within zero, one or more schema reuses (each of which are a subject reuse); not every document schema has to be specified with a subject schema reuse;

— may be reuser of subject schema cited in zero, one or more schema reuses (each of which are an object reuse); not every document schema has to be specified with an object schema reuse;

— shall have a name, which is a unique name by which this document schema is known;

— may have a context, which is a description of the universe of discourse covered by the document schema; not every document schema has to have a context;

— may have a revision_status, which is a statement describing revision or version status of this document schema; not every document schema has to have a revision_status.

Each document schema namespace is a representation of a particular namespace that is cited within a document schema. In addition, each document schema namespace:

— shall be specified with one and only one namespace (the cited namespace);

— shall be specified for one and only one document schema (the named schema);

— shall have a role, which is a specification of the role that the specified namespace is playing within the related document schema; examples are “Target”, “Prefix” and “Default”.

Each namespace is a set of designations or scoped identifiers for a particular need. In addition to the attributes and relationships defined in the MDR Metamodel, each namespace shall be specified with one and only one document schema namespace (the used namespace).

Each node is a representation of a particular node within a document schema. In addition, each node:

— may be specialised as a restricted node; not every node has to be specialised as a restricted node;

— shall be within one and only one document schema (the containing schema);

— may be reuser of subject schema cited in zero, one or more schema reuse (each of which is an object reuse); not every node has to be specified with an object schema reuse;

— may be specified as superior node within zero, one or more node relationships (each of which is a superior relationship); not every node has to be specified as superior node within a node relationship;

— may be specified as inferior node within zero, one or more node relationships (each of which is an inferior relationship); not every node has to be specified as inferior node within a node relationship;

— may have a name, which is a unique name by which this node is known; not every node has to have a name;

— may have a type, which is a specification of the type of this node; examples are “simple”, “complex”, “group”, “sequence”, “choice”, “element” and “attribute”; not every node has to have a type;

— may have a namespace, which is the namespace to be used for this node; this shall only exist if the namespace for the node differs from the namespace specified as the default namespace for the document schema of which this node is a component part or if there is no default specified for the document schema; not every node has to have a namespace;

— may have a datatype, which is a specification of the datatype for this node; not every node has to have a datatype;

— may have minimum occurrences, which is a statement of the minimum number of occurrences of values of this node; in most circumstances this will be '0' (indicating that the note is optional) or '1' (indicating that the node is mandatory; not every node has to have a statement of minimum occurrences;

— may have maximum occurrences, which is a statement of the maximum number of occurrences of values of this node; in most circumstances this will be “1” or “unbounded”; not every node has to have a statement of maximum occurrences.

Each restricted node is a representation of a particular node within a document schema, a node for which there is a restriction, such as a pattern, placed upon the values of the node. In addition, each restricted node:

— may be specialised as an enumerated node; not every restricted node has to be specialised as an enumerated node;

— may have a restriction base, which is a specification of the datatype within which each of the values of the node is to be specified; not every restricted node has to have a restriction base;

— may have a restriction pattern, which is a specification of any pattern that is to be applied to the values specified for the node; not every restricted node has to have a restriction pattern.

Each enumerated node is a representation of a particular node within a document schema, a restricted node for which there is a set of permitted values specified for the restricted node. In addition, each enumerated node:

— shall be specified with two or more node enumerations (each of which is a node enumeration).

Each node enumeration is a representation of a particular permitted value for an enumerated node. In addition, each node enumeration:

— shall be specified for one and only one enumerated node (the enumerated node);

— shall have a value, which is a specification of the actual permitted value;

— may have an annotation, which is a description of the meaning of the value; not every node enumeration has to have an annotation.

Each node relationship is a representation of a particular relationship between two nodes. In addition, each node relationship:

— shall be categorised with one and only one node relationship type (the node relationship categorisation);

— shall be specified with as parent one and only one node (the parent node);

— shall be specified with as child one or more node (each of which is a child node).

Each node relationship type is a representation of a particular categorisation of a set of nodes relationships. In addition, each node relationship type:

— may be categorisation for zero, one or more node relationship (each of which is a categorised node relationship);

— shall have a designation, which is a statement specifying the category of the associated node relationships;

— may have a description, which is a statement explaining the meaning of the designation statement for this node relationship type; not every node relationship type needs to have a description.

Each schema reuse is a representation of a particular schema reuse within another schema or of a particular schema reuse as a node within a schema. In addition, each schema reuse:

— shall be categorised by one and only one schema reuse type (the schema reuse categorisation);

— shall be specified as reuse of one and only one document schema (the reused schema);

— shall be specified for reuse by either, but not both, one and only one:

  — document schema (the recipient schema);

  — node (the recipient node);

— may have an associated namespace, which is a statement of any namespace associated with the reused schema; not every schema reuse needs to have an associated namespace.

Each schema reuse type is a representation of a particular categorisation of a set of scheme reuses. In addition, each schema reuse type:

— may be categorisation for zero, one or more schema reuse (each of which is a categorised schema reuse);

— shall have a designation, which is a statement specifying the category of the associated schema reuses;

— may have a description, which is a statement explaining the meaning of the designation statement for this schema reuse type; not every schema reuse type needs to have a description.

Annex B
(informative)

Relationship of metaclasses to the MDR Metamodel

As explained in ISO/IEC 19763-10:2014, Clause 9, instances of the metaclasses defined in this document can be extended by the types defined in ISO/IEC 11179-3:2013, Clauses 7 and 8, as follows.

— Instances of **Document_Schema_Language** may be extended as an **Identified_Item** and as a **Designatable_Item**.

— Instances of **Document_Schema** may be extended as an **Administered_Item** and as a **Designatable_Item**.

— Instances of **Node** (and its subclasses **Restricted_Node** and **Enumerated_Node**) may be extended as an **Administered_Item** or an **Attached_Item** and as a **Designatable_Item**.

— Instances of **Node_Enumeration** may be extended as an **Attached_Item** and as a **Designatable_Item**.

— Instances of **Node_Relationship** may be extended as an **Administered_Item**.

— Instances of **Node_Relationship_Type** may be extended as an **Administered_Item** and as a **Designatable_Item**.

— Instances of **Schema_Reuse** may be extended as an **Administered_Item**.

— Instances of **Schema_Reuse_Type** may be extended as an **Administered_Item** and as a **Designatable_Item**.

— Instances of **Document_Schema_Namespace** may be extended as an **Administered_Item**.

Annex C
(informative)

Examples of document model registration

C.1 Overview

This annex illustrates the registration of document models using the metamodel specified in MFI Document 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 "ObjectXXXX" are introduced to help with the description of the examples. The detailed specification of these identifiers is beyond the scope of this document.

C.2 Simple JSON example

This example is based on a student registration scenario which is shown as a UML class diagram at Figure C.1.

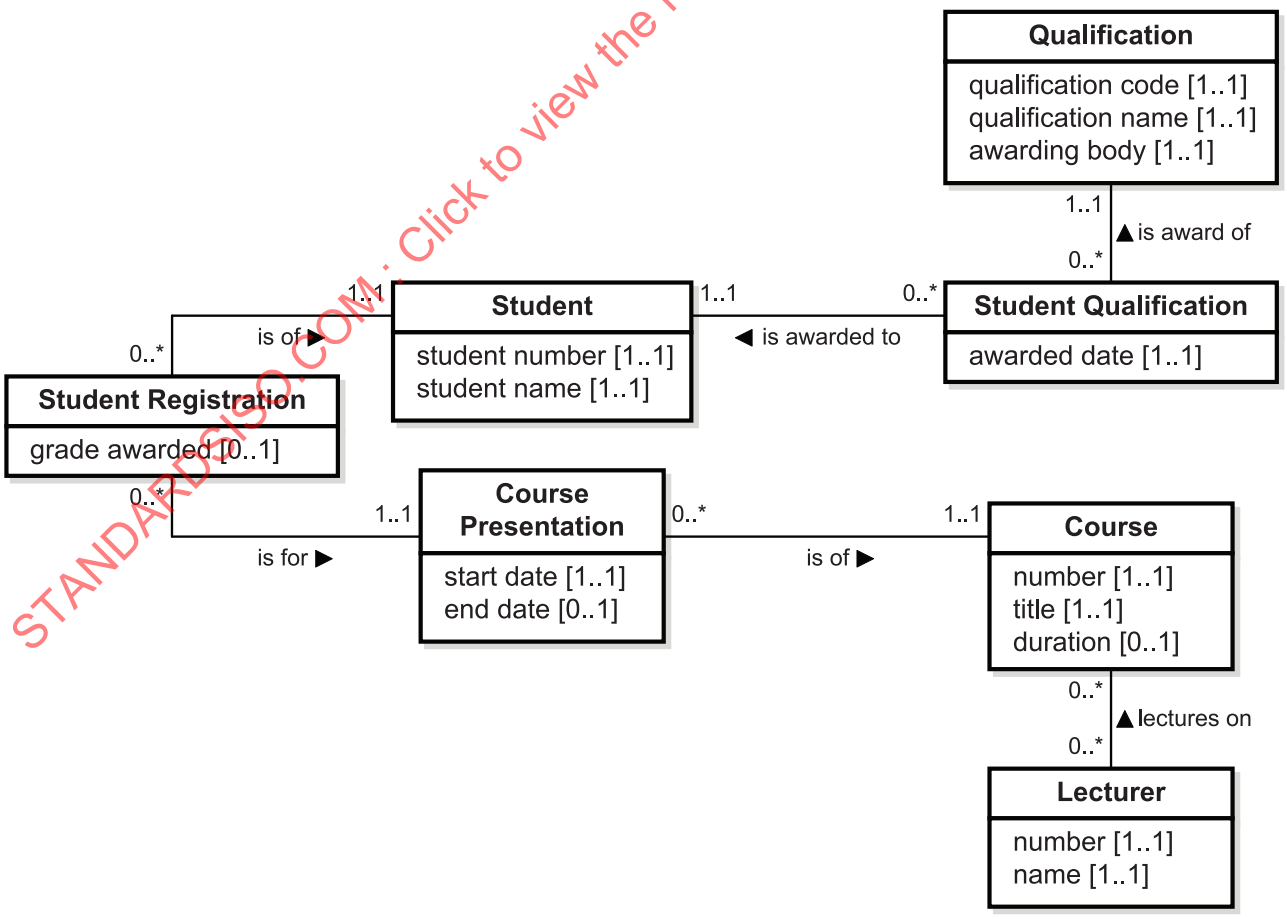


Figure C.1 — UML class diagram for the student registration scenario

The JSON Schema for this scenario is given in Figure C.2.

```
{
    "$schema": "http://json-schema.org/schema#",
    "$id": "http://mydomain.ac.uk/schemas/course-presentation.json",
    "title": "course presentation JSON Schema",
    "type": "object",
    "properties": {
        "course": {"$ref": "#/definitions/course"},
        "start-date": {"type": "string"},
        "end-date": {"type": "string"},
        "registrations": {
            "type": "array",
            "items": [{"$ref": "#/definitions/student-registration"}]
        }},
        "required": [
            "course",
            "start-date"
        ]
    ,
    "definitions": {
        "student-registration": {
            "type": "object",
            "properties": {
                "student" : {"$ref": "#/definitions/student"},
                "grade-awarded": {"$ref": "#/definitions/grade"}
            },
            "required": ["student"]
        },
        "course": {
            "type": "object",
            "properties": {
                "number": {"type": "string"},
                "title": {"type": "string"},
                "duration": {"type": "string"},
                "course-lecturer": {
                    "type": "array",
                    "items": [{"$ref": "#/definitions/lecturer"}]
                }
            },
            "required": [
                "number",
                "title"
            ]
        },
        "grade": {
            "type": "string",
            "enum": [
                "a",
                "b",
                "c",
                "d",
                "e"
            ]
        },
        "lecturer": {
            "type": "object",
            "properties": {
                "number": {"type": "string"},
                "name": {"type": "string"}
            },
```


Figure C.2 — JSON schema for the student registration scenario (1 of 2)

```
            "required": [
                "number",
                "name"
            ]
        },
        "student": {
            "type": "object",
            "properties": {
                "student-number": {"type": "string"},
                "student-name": {"type": "string"},
                "student-qualifications": {
                    "type": "array",
                    "items": [{"$ref": "#/definitions/award"}]
                }
            },
            "required": [
                "student-number",
                "student-name"
            ]
        },
        "award": {
            "type": "object",
            "properties": {
                "qualification" : {"$ref": "#/definitions/qualification"},
                "award-date": {"type": "string"}
            },
            "additional-properties": "false",
            "required": [
                "qualification",
                "award-date"
            ]
        },
        "qualification": {
            "type": "object",
            "properties": {
                "qualification-code": {"type": "string"},
                "qualification-name": {"type": "string"},
                "awarding-body": {"type": "string"}
            },
            "required": [
                "qualification-code",
                "qualification-name",
                "awarding-body"
            ]
        }
    }
}
```

Figure C.2 — JSON schema for the student registration scenario (2 of 2)

Figure C.3 provides the object instances to illustrate the registration of this JSON schema.

<Document_Schema_Language>
Object1001

Attribute/Reference	Literal/Instance
name	"http://json-schema.org/schema#"
expressed_schema	Object1101

<Node_Relationship_Type>
Object1051

Attribute/Reference	Literal/Instance
designation	"property within object"
categorised_node_relationship	Object1103, Object1111, Object1117, Object1130, Object1134, Object1140, Object1145

<Node_Relationship_Type>
Object1052

Attribute/Reference	Literal/Instance
designation	"reference by parent to child"
categorised_node_relationship	Object1105, Object1109, Object1113, Object1115, Object1122, Object1138, Object1142

<Document_Schema>
Object1101

Attribute/Reference	Literal/Instance
name	"http://mydomain.ac.uk/schemas/course-presentation.json"
context	"course presentation JSON Schema"
describing_language	Object1001
node_model_element	Object1102, Object1104, Object1106, Object1107, Object1108, Object1110, Object1112, Object1114, Object1116, Object1118, Object1119, Object1120, Object1121, Object1123, Object1129, Object1131, Object1132, Object1133, Object1135, Object1136, Object1137, Object1139, Object1141, Object1143, Object1144, Object1146, Object1147, Object1148

<Node>
Object1102

Attribute/Reference	Literal/Instance
name	"course-presentation"
type	"object"
containing_schema	Object1101
inferior_relationship	Object1103

<Node_Relationship>
Object1103

Attribute/Reference	Literal/Instance
parent_node	Object1102
child_node	Object1104, Object1106, Object1107, Object1108
node_relationship_categorisation	Object1051

<Node>
Object1104

Attribute/Reference	Literal/Instance
name	"course"
type	"property-array"
minimum_occurrences	"1"
containing_schema	Object1101
inferior_relationship	Object1105
superior_relationship	Object1103

<Node_Relationship>
Object1105

Attribute/Reference	Literal/Instance
parent_node	Object1104
child_node	Object1116
node_relationship_categorisation	Object1052

<Node>
Object1106

Attribute/Reference	Literal/Instance
name	"start-date"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1103

Figure C.3 — Registration of the JSON schema for the student registration scenario (1 of 6)

<Node>
Object1107

Attribute/Reference	Literal/Instance
name	"end-date"
type	"property"
datatype	"string"
containing_schema	Object1101
superior_relationship	Object1103

<Node>
Object1108

Attribute/Reference	Literal/Instance
name	"registrations"
type	"property-array"
containing_schema	Object1101
inferior_relationship	Object1109
superior_relationship	Object1103

<Node_Relationship>
Object1109

Attribute/Reference	Literal/Instance
parent_node	Object1108
child_node	Object1110
node_relationship_ categorisation	Object1052

<Node>
Object1110

Attribute/Reference	Literal/Instance
name	"student-registration"
type	"object"
containing_schema	Object1101
inferior_relationship	Object1111
superior_relationship	Object1110

<Node_Relationship>
Object1111

Attribute/Reference	Literal/Instance
parent_node	Object1110
child_node	Object1112, Object1114
node_relationship_ categorisation	Object1051

<Node>
Object1112

Attribute/Reference	Literal/Instance
name	"student"
type	"property"
minimum_occurrences	"1"
containing_schema	Object1101
inferior_relationship	Object1113
superior_relationship	Object1111

<Node_Relationship>
Object1113

Attribute/Reference	Literal/Instance
parent_node	Object1112
child_node	Object1133
node_relationship_ categorisation	Object1052

<Node>
Object1114

Attribute/Reference	Literal/Instance
name	"grade-awarded"
type	"property"
containing_schema	Object1101
inferior_relationship	Object1115
superior_relationship	Object1111

<Node_Relationship>
Object1115

Attribute/Reference	Literal/Instance
parent_node	Object1114
child_node	Object1123
node_relationship_ categorisation	Object1052

<Node>
Object1116

Attribute/Reference	Literal/Instance
Name	"course"
Type	"object"
containing_schema	Object1101
inferior_relationship	Object1117
superior_relationship	Object1105

Figure C.3 — Registration of the JSON schema for the student registration scenario (2 of 6)

<Node_Relationship>
Object1117

Attribute/Reference	Literal/Instance
parent_node	Object1116
child_node	Object1118, Object1119, Object1120, Object1121
node_relationship_ categorisation	Object1051

<Node>
Object1118

Attribute/Reference	Literal/Instance
name	"number"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1117

<Node>
Object1119

Attribute/Reference	Literal/Instance
name	"title"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1117

<Node>
Object1120

Attribute/Reference	Literal/Instance
name	"duration"
type	"property"
datatype	"string"
containing_schema	Object1101
superior_relationship	Object1117

<Node>
Object1121

Attribute/Reference	Literal/Instance
name	"course-lecturer"
type	"property-array"
containing_schema	Object1101
inferior_relationship	Object1122
superior_relationship	Object1117

<Node_Relationship>
Object1122

Attribute/Reference	Literal/Instance
parent_node	Object1121
child_node	Object1129
node_relationship_ categorisation	Object1052

<Enumerated_Node>
Object1123

Attribute/Reference	Literal/Instance
name	"grade"
type	"object"
datatype	"string"
containing_schema	Object1101
node_enumeration	Object1124, Object1125, Object1126, Object1127, Object1128
superior_relationship	Object1115

<Node_Enumeration>
Object1124

Attribute/Reference	Literal/Instance
value	"a"
enumerated_node	Object1123

<Node_Enumeration>
Object1125

Attribute/Reference	Literal/Instance
value	"b"
enumerated_node	Object1123

Figure C.3 — Registration of the JSON schema for the student registration scenario (3 of 6)

<Node_Enumeration>
Object1126

Attribute/Reference	Literal/Instance
value	"c"
enumerated_node	Object1123

<Node_Enumeration>
Object1127

Attribute/Reference	Literal/Instance
value	"d"
enumerated_node	Object1123

<Node_Enumeration>
Object1128

Attribute/Reference	Literal/Instance
value	"e"
enumerated_node	Object1123

<Node>
Object1129

Attribute/Reference	Literal/Instance
name	"lecturer"
type	"object"
containing_schema	Object1101
inferior_relationship	Object1130
superior_relationship	Object1122

<Node_Relationship>
Object1130

Attribute/Reference	Literal/Instance
parent_node	Object1129
child_node	Object1131, Object1132
node_relationship_ categorisation	Object1051

<Node>
Object1131

Attribute/Reference	Literal/Instance
name	"number"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1130

<Node>
Object1132

Attribute/Reference	Literal/Instance
name	"name"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1130

<Node>
Object1133

Attribute/Reference	Literal/Instance
Name	"student"
Type	"object"
containing_schema	Object1101
inferior_relationship	Object1134
superior_relationship	Object1113

<Node_Relationship>
Object1134

Attribute/Reference	Literal/Instance
parent_node	Object1133
child_node	Object1135, Object1136, Object1137
node_relationship_ categorisation	Object1051

<Node>
Object1135

Attribute/Reference	Literal/Instance
name	"student-number"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1134

Figure C.3 — Registration of the JSON schema for the student registration scenario (4 of 6)

<Node>
Object1136

Attribute/Reference	Literal/Instance
name	"student-name"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1134

<Node>
Object1137

Attribute/Reference	Literal/Instance
name	"student-qualifications"
type	"property-array"
containing_schema	Object1101
inferior_relationship	Object1138
superior_relationship	Object1134

<Node_Relationship>
Object1138

Attribute/Reference	Literal/Instance
parent_node	Object1137
child_node	Object1139
node_relationship_ categorisation	Object1052

<Node>
Object1139

Attribute/Reference	Literal/Instance
Name	"award"
Type	"object"
containing_schema	Object1101
inferior_relationship	Object1140
superior_relationship	Object1138

<Node_Relationship>
Object1140

Attribute/Reference	Literal/Instance
parent_node	Object1139
child_node	Object1141, Object1143
node_relationship_ categorisation	Object1051

<Node>
Object1141

Attribute/Reference	Literal/Instance
name	"qualification"
type	"property"
minimum_occurrences	"1"
containing_schema	Object1101
inferior_relationship	Object1142
superior_relationship	Object1140

<Node_Relationship>
Object1142

Attribute/Reference	Literal/Instance
parent_node	Object1141
child_node	Object1144
node_relationship_ categorisation	Object1052

<Node>
Object1143

Attribute/Reference	Literal/Instance
name	"award-date"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1140

<Node>
Object1144

Attribute/Reference	Literal/Instance
Name	"qualification"
Type	"object"
containing_schema	Object1101
inferior_relationship	Object1145
superior_relationship	Object1142

<Node_Relationship>
Object1145

Attribute/Reference	Literal/Instance
parent_node	Object1144
child_node	Object1146, Object1147, Object1148
node_relationship_ categorisation	Object1051

Figure C.3 — Registration of the JSON schema for the student registration scenario (5 of 6)

<Node>
Object1146

Attribute/Reference	Literal/Instance
name	"qualification-code"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1145

<Node>
Object1147

Attribute/Reference	Literal/Instance
name	"qualification-name"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1145

<Node>
Object1148

Attribute/Reference	Literal/Instance
name	"awarding-body"
type	"property"
datatype	"string"
minimum_occurrences	"1"
containing_schema	Object1101
superior_relationship	Object1145

Figure C.3 — Registration of the JSON schema for the student registration scenario (6 of 6)

C.3 Simple XML example

This example is based on the same student registration scenario shown as a UML class diagram at Figure C.1. The XML schema for this scenario is at Figure C.4.

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
                              elementFormDefault="qualified">
<--name of schema = "student-registration.xsd"-->
    <xs:element name="qualification">
        <xs:complexType>
            <xs:sequence>
                <xs:element name="qualification-code"
                            type="xs:string"
                            minOccurs="1"
                            maxOccurs="1"/>
                <xs:element name="qualification-name"
                            type="xs:string"
                            minOccurs="1"
                            maxOccurs="1"/>
                <xs:element name="awarding-body"
                            type="xs:string"
                            minOccurs="1"
                            maxOccurs="1"/>
            </xs:sequence>
        </xs:complexType>
    </xs:element>
```

Figure C.4 — XML Schema for the student registration scenario (1 of 3)

```
<xs:element name="student">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="student-number"
                        minOccurs="1"
                        maxOccurs="1"
                        type="xs:string"/>
            <xs:element name="student-name"
                        minOccurs="1"
                        maxOccurs="1"
                        type="xs:string"/>
            <xs:element name="student-qualification"
                        minOccurs="0"
                        maxOccurs="unbounded">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element ref="qualification"
                                    minOccurs="1"
                                    maxOccurs="1"/>
                        <xs:element name="awarded-date"
                                    type="xs:date"
                                    minOccurs="1"
                                    maxOccurs="1"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<xs:element name="lecturer">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="number"
                        type="xs:string"
                        minOccurs="1"
                        maxOccurs="1"/>
            <xs:element name="name"
                        type="xs:string"
                        minOccurs="1"
                        maxOccurs="1"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<xs:element name="course">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="number"
                        type="xs:string"
                        minOccurs="1"
                        maxOccurs="1"/>
            <xs:element name="title"
                        type="xs:string"
                        minOccurs="1"
                        maxOccurs="1"/>
            <xs:element name="duration"
                        type="xs:duration"
                        minOccurs="0"
                        maxOccurs="1"/>
            <xs:element ref="lecturer"
                        minOccurs="0"
                        maxOccurs="unbounded"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>
```


Figure C.4 — XML Schema for the student registration scenario (2 of 3)

```
    <xs:element name="course-presentation">
        <xs:complexType>
            <xs:sequence>
                <xs:element ref="course"
                            minOccurs="1"
                            maxOccurs="1"/>
                <xs:element name="start-date"
                            type="xs:date"
                            minOccurs="1"
                            maxOccurs="1"/>
                <xs:element name="end-date"
                            type="xs:date"
                            minOccurs="0"
                            maxOccurs="1"/>
                <xs:element name="student-registration"
                            minOccurs="0"
                            maxOccurs="unbounded">
                    <xs:complexType>
                        <xs:sequence>
                            <xs:element ref="student"
                                        minOccurs="1"
                                        maxOccurs="1"/>
                            <xs:element name="grade-awarded"
                                        type="xs:string"
                                        minOccurs="0"
                                        maxOccurs="1"/>
                        </xs:sequence>
                    </xs:complexType>
                </xs:element>
            </xs:sequence>
        </xs:complexType>
    </xs:element>
        <xs:simpleType name="grade">
        <xs:restriction base="xs:string">
            <xs:enumeration value="a"/>
            <xs:enumeration value="b"/>
            <xs:enumeration value="c"/>
            <xs:enumeration value="d"/>
            <xs:enumeration value="e"/>
        </xs:restriction>
    </xs:simpleType>
</xs:schema>
```

Figure C.4 — XML Schema for the student registration scenario (3 of 3)

Figure C.5 provides the object instances to illustrate the registration of this XML schema.

<Document_Schema_Language>
Object2001

Attribute/Reference	Literal/Instance
name	"xml"
version	"1.0"
encoding	"UTF-8"
expressed_schema	Object2101

<Namespace>
Object2002

Attribute/Reference	Literal/Instance
identifier	"http://www.w3.org/2001/XMLSchema"
used_namespace	Object2102

<Node_Relationship_Type>
Object2051

Attribute/Reference	Literal/Instance
designation	"sequence within group"
categorised_node_relationship	Object2104, Object2111, Object2119, Object2127, Object2135, Object2146, Object2156

<Node_Relationship_Type>
Object2052

Attribute/Reference	Literal/Instance
designation	"element within sequence"
categorised_node_relationship	Object2106, Object2113, Object2121, Object2129, Object2137, Object2148, Object2158

<Node_Relationship_Type>
Object2053

Attribute/Reference	Literal/Instance
designation	"element within group"
categorised_node_relationship	Object2117, Object2125, Object2133, Object2144, Object2154

<Node_Relationship_Type>
Object2054

Attribute/Reference	Literal/Instance
designation	"reference by parent to child"
categorised_node_relationship	Object2142, Object2150, Object2160

<Document_Schema>
Object2101

Attribute/Reference	Literal/Instance
name	"student-registration.xsd"
describing_language	Object2001
roled_namespace	Object2102
node_model_element	Object2103, Object2105, Object2107, Object2108, Object2109, Object2110, Object2112, Object2114, Object2115, Object2116, Object2118, Object2120, Object2122, Object2123, Object2124, Object2126, Object2128, Object2130, Object2131, Object2132, Object2134, Object2136, Object2138, Object2139, Object2140, Object2141, Object2143, Object2145, Object2147, Object2149, Object2151, Object2152, Object2153, Object2155, Object2157, Object2159, Object2161

<Document_Schema_Namespace>
Object2102

Attribute/Reference	Literal/Instance
role	"Prefix"
cited_namespace	Object2002
named_schema	Object2101

<Node>
Object2103

Attribute/Reference	Literal/Instance
name	"qualification"
type	"complex"
containing_schema	Object2101
inferior_relationship	Object2104

<Node_Relationship>
Object2104

Attribute/Reference	Literal/Instance
parent_node	Object2103
child_node	Object2105
node_relationship_categorisation	Object2051

Figure C.5 — Registration of the XML Schema for the student registration scenario (1 of 8)

<Node>
Object2105

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object2101
inferior_relationship	Object2106
superior_relationship	Object2104

<Node_Relationship>
Object2106

Attribute/Reference	Literal/Instance
parent_node	Object2105
child_node	Object2107, Object2108, Object2109
node_relationship_ categorisation	Object2052

<Node>
Object2107

Attribute/Reference	Literal/Instance
name	"qualification-code"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2106

<Node>
Object2108

Attribute/Reference	Literal/Instance
name	"qualification-name"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2106

<Node>
Object2109

Attribute/Reference	Literal/Instance
name	"awarding-body"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2106

<Node>
Object2110

Attribute/Reference	Literal/Instance
name	"student"
type	"complex"
containing_schema	Object2101
inferior_relationship	Object2111
superior_relationship	Object2160

<Node_Relationship>
Object2111

Attribute/Reference	Literal/Instance
parent_node	Object2110
child_node	Object2112
node_relationship_ categorisation	Object2051

<Node>
Object2112

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object2101
inferior_relationship	Object2113
superior_relationship	Object2111

<Node_Relationship>
Object2113

Attribute/Reference	Literal/Instance
parent_node	Object2112
child_node	Object2114, Object2115, Object2116
node_relationship_ categorisation	Object2052

Figure C.5 — Registration of the XML Schema for the student registration scenario (2 of 8)

<Node>
Object2114

Attribute/Reference	Literal/Instance
name	"student-number"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2113

<Node>
Object2115

Attribute/Reference	Literal/Instance
name	"student-name"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2113

<Node>
Object2116

Attribute/Reference	Literal/Instance
name	"student-qualification"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"unbounded"
containing_schema	Object2101
inferior_relationship	Object2117
superior_relationship	Object2113

<Node_Relationship>
Object2117

Attribute/Reference	Literal/Instance
parent_node	Object2116
child_node	Object2118
node_relationship_ categorisation	Object2053

<Node>
Object2118

Attribute/Reference	Literal/Instance
type	"complex"
containing_schema	Object2101
inferior_relationship	Object2119
superior_relationship	Object2117

<Node_Relationship>
Object2119

Attribute/Reference	Literal/Instance
parent_node	Object2118
child_node	Object2120
node_relationship_ categorisation	Object2051

<Node>
Object2120

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object2101
inferior_relationship	Object2121
superior_relationship	Object2119

<Node_Relationship>
Object2121

Attribute/Reference	Literal/Instance
parent_node	Object2120
child_node	Object2122, Object2123
node_relationship_ categorisation	Object2052

<Node>
Object2122

Attribute/Reference	Literal/Instance
name	"qualification"
type	"element"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2121

Figure C.5 — Registration of the XML Schema for the student registration scenario (3 of 8)

<Node>
Object2123

Attribute/Reference	Literal/Instance
name	"awarded-date"
type	"element"
datatype	"xs:date"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2121

<Node>
Object2124

Attribute/Reference	Literal/Instance
name	"lecturer"
type	"element"
containing_schema	Object2101
inferior_relationship	Object2125
superior_relationship	Object2142

<Node_Relationship>
Object2125

Attribute/Reference	Literal/Instance
parent_node	Object2124
child_node	Object2126
node_relationship_ categorisation	Object2053

<Node>
Object2126

Attribute/Reference	Literal/Instance
type	"complex"
containing_schema	Object2101
inferior_relationship	Object2127
superior_relationship	Object2125

<Node_Relationship>
Object2127

Attribute/Reference	Literal/Instance
parent_node	Object2126
child_node	Object2128
node_relationship_ categorisation	Object2051

<Node>
Object2128

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object2101
inferior_relationship	Object2129
superior_relationship	Object2127

<Node_Relationship>
Object2129

Attribute/Reference	Literal/Instance
parent_node	Object2128
child_node	Object2130, Object2131
node_relationship_ categorisation	Object2052

<Node>
Object2130

Attribute/Reference	Literal/Instance
name	"number"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2129

<Node>
Object2131

Attribute/Reference	Literal/Instance
name	"name"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2129

<Node>
Object2132

Attribute/Reference	Literal/Instance
name	"course"
type	"element"
containing_schema	Object2101
inferior_relationship	Object2133
superior_relationship	Object2150

Figure C.5 — Registration of the XML Schema for the student registration scenario (4 of 8)

<Node_Relationship>
Object2133

Attribute/Reference	Literal/Instance
parent_node	Object2132
child_node	Object2134
node_relationship_ categorisation	Object2053

<Node>
Object2134

Attribute/Reference	Literal/Instance
type	"complex"
containing_schema	Object2101
inferior_relationship	Object2135
superior_relationship	Object2133

<Node_Relationship>
Object2135

Attribute/Reference	Literal/Instance
parent_node	Object2134
child_node	Object2136
node_relationship_ categorisation	Object2051

<Node>
Object2136

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object2101
inferior_relationship	Object2137
superior_relationship	Object2135

<Node_Relationship>
Object2137

Attribute/Reference	Literal/Instance
parent_node	Object2136
child_node	Object2138, Object2139, Object2140, Object2141
node_relationship_ categorisation	Object2052

<Node>
Object2138

Attribute/Reference	Literal/Instance
name	"number"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2137

<Node>
Object2139

Attribute/Reference	Literal/Instance
name	"title"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2137

<Node>
Object2140

Attribute/Reference	Literal/Instance
name	"duration"
type	"element"
datatype	"xs:duration"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2137

<Node>
Object2141

Attribute/Reference	Literal/Instance
type	"element"
minimum_occurrences	"0"
maximum_occurrences	"unbounded"
containing_schema	Object2101
inferior_relationship	Object2142
superior_relationship	Object2137

Figure C.5 — Registration of the XML Schema for the student registration scenario (5 of 8)

<Node_Relationship>
Object2142

Attribute/Reference	Literal/Instance
parent_node	Object2141
child_node	Object2124
node_relationship_ categorisation	Object2054

<Node>
Object2143

Attribute/Reference	Literal/Instance
name	"course-presentation"
type	"element"
containing_schema	Object2101
inferior_relationship	Object2144

<Node_Relationship>
Object2144

Attribute/Reference	Literal/Instance
parent_node	Object2143
child_node	Object2145
node_relationship_ categorisation	Object2053

<Node>
Object2145

Attribute/Reference	Literal/Instance
type	"complex"
containing_schema	Object2101
inferior_relationship	Object2146
superior_relationship	Object2144

<Node_Relationship>
Object2146

Attribute/Reference	Literal/Instance
parent_node	Object2145
child_node	Object2147
node_relationship_ categorisation	Object2051

<Node>
Object2147

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object2101
inferior_relationship	Object2148
superior_relationship	Object2146

<Node_Relationship>
Object2148

Attribute/Reference	Literal/Instance
parent_node	Object2147
child_node	Object2149, Object2151, Object2152, Object2153
node_relationship_ categorisation	Object2052

<Node>
Object2149

Attribute/Reference	Literal/Instance
type	"element"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
inferior_relationship	Object2150
superior_relationship	Object2148

<Node_Relationship>
Object2150

Attribute/Reference	Literal/Instance
parent_node	Object2149
child_node	Object2132
node_relationship_ categorisation	Object2054

<Node>
Object2151

Attribute/Reference	Literal/Instance
name	"start-date"
type	"element"
datatype	"xs:date"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2148

<Node>
Object2152

Attribute/Reference	Literal/Instance
name	"end-date"
type	"element"
datatype	"xs:date"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object2101
superior_relationship	Object2148

Figure C.5 — Registration of the XML Schema for the student registration scenario (6 of 8)

<Node>
Object2153

Attribute/Reference	Literal/Instance
name	"student-registration"
type	"element"
minimum_occurrences	"0"
maximum_occurrences	"unbounded"
containing_schema	Object2101
inferior_relationship	Object2154
superior_relationship	Object2148

<Node_Relationship>
Object2154

Attribute/Reference	Literal/Instance
parent_node	Object2153
child_node	Object2155
node_relationship_ categorisation	Object2053

<Node>
Object2155

Attribute/Reference	Literal/Instance
type	"complex"
containing_schema	Object2101
inferior_relationship	Object2156
superior_relationship	Object2154

<Node_Relationship>
Object2156

Attribute/Reference	Literal/Instance
parent_node	Object2155
child_node	Object2157
node_relationship_ categorisation	Object2051

<Node>
Object2157

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object2101
inferior_relationship	Object2158
superior_relationship	Object2156

<Node_Relationship>
Object2158

Attribute/Reference	Literal/Instance
parent_node	Object2157
child_node	Object2159, Object2161
node_relationship_ categorisation	Object2052

<Node>
Object2159

Attribute/Reference	Literal/Instance
type	"element"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object2101
inferior_relationship	Object2160
superior_relationship	Object2158

<Node_Relationship>
Object2160

Attribute/Reference	Literal/Instance
parent_node	Object2159
child_node	Object2110
node_relationship_ categorisation	Object2054

<Enumerated_Node>
Object2161

Attribute/Reference	Literal/Instance
name	"grade-awarded"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object2101
inferior_relationship	Object2160
superior_relationship	Object2158
restriction_base	"xs:string"
node_enumeration	Object2162, Object2163, Object2164, Object2165, Object2166,

<Node_Enumeration>
Object2162

Attribute/Reference	Literal/Instance
value	"a"
enumerated_node	Object2161

Figure C.5 — Registration of the XML Schema for the student registration scenario (7 of 8)

<Node_Enumeration>
Object2163

Attribute/Reference	Literal/Instance
value	"b"
enumerated_node	Object2161

<Node_Enumeration>
Object2165

Attribute/Reference	Literal/Instance
value	"d"
enumerated_node	Object2161

<Node_Enumeration>
Object2164

Attribute/Reference	Literal/Instance
value	"c"
enumerated_node	Object2161

<Node_Enumeration>
Object2166

Attribute/Reference	Literal/Instance
value	"e"
enumerated_node	Object2161

Figure C.5 — Registration of the XML Schema for the student registration scenario (8 of 8)

C.4 More complex XML example

This example is based on an order processing scenario which is shown as a UML class diagram at Figure C.6.

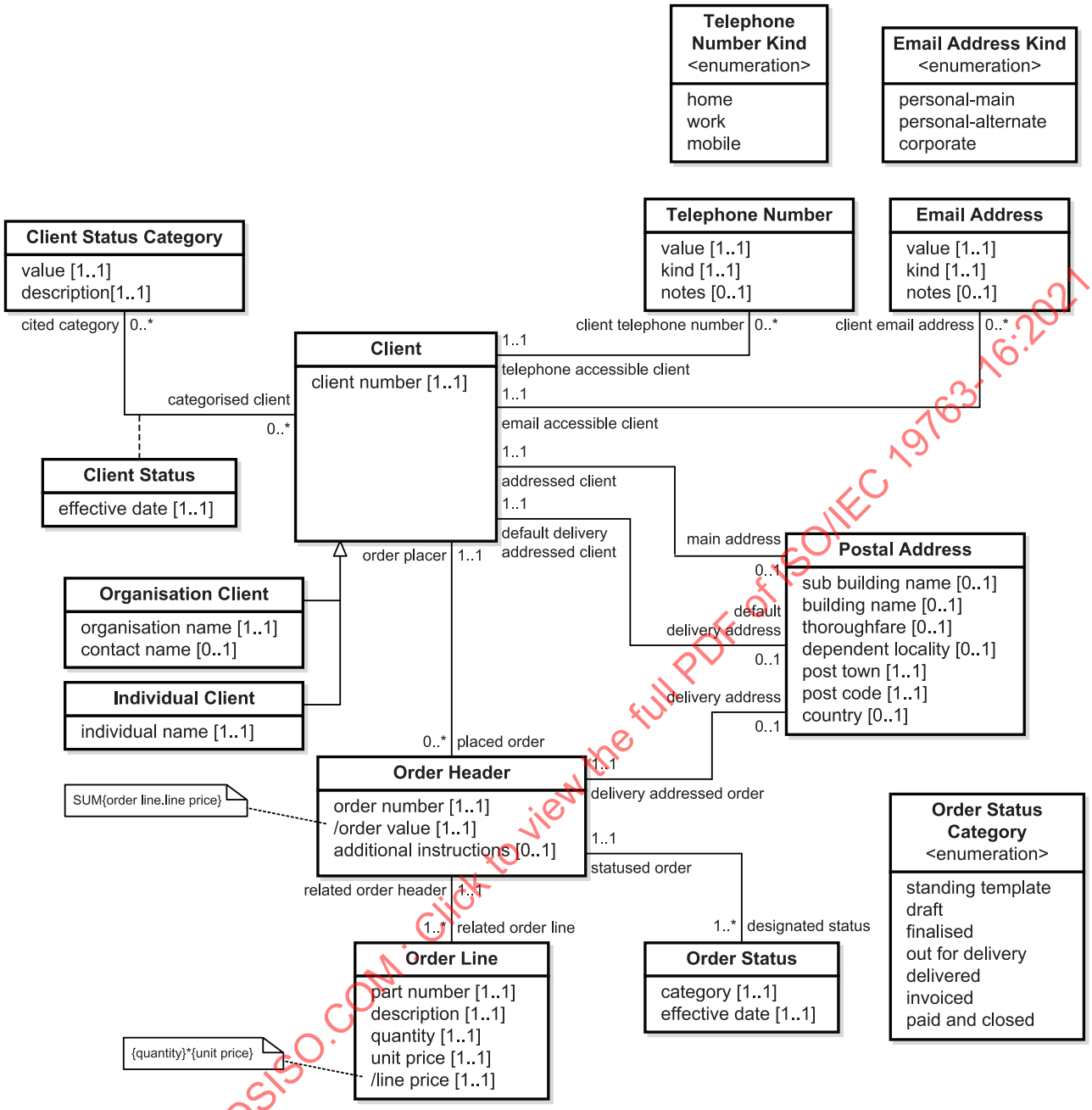


Figure C.6 — UML class diagram for the order processing scenario

There are three XML Schemas for this scenario:

— the XML Schema for the 'postal address' area of the scenario (see Figure C.7);

— the XML Schema for the 'client' area of the scenario (see Figure C.8);

— the XML Schema for the 'order' area of the scenario (see Figure C.9).

```
<?xml version="1.0" encoding="UTF-8"?>
<--name of schema = "example-standard address.xsd"-->
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
           elementFormDefault="qualified"
           targetNamespace="http://mycompany.co.uk">

    <xs:complexType name="address">
        <xs:sequence>
            <xs:element name="sub-building-name"
                        type="xs:string"
                        maxOccurs="1"
                        minOccurs="0"/>
            <xs:element name="building-name"
                        type="xs:string"
                        maxOccurs="1"
                        minOccurs="0"/>
            <xs:element name="throughfare"
                        type="xs:string"
                        maxOccurs="1"
                        minOccurs="0"/>
            <xs:element name="dependent-locality"
                        type="xs:string"
                        maxOccurs="1"
                        minOccurs="0"/>
            <xs:element name="post-town"
                        type="xs:string"
                        maxOccurs="1"
                        minOccurs="1"/>
            <xs:element name="postcode"
                        type="xs:string"
                        maxOccurs="1"
                        minOccurs="1"/>
            <xs:element name="country"
                        type="xs:string"
                        maxOccurs="1"
                        minOccurs="0"/>
        </xs:sequence>
    </xs:complexType>
</xs:schema>
```

Figure C.7 — XML Schema for the 'postal address' area of the order processing scenario

```
<?xml version="1.0" encoding="UTF-8"?>
<--name of schema = "example-client.xsd"-->
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
           elementFormDefault="qualified"
           targetNamespace="http://mycompany.co.uk"
           xmlns:mycompany="http://mycompany.co.uk">
    <xs:include schemaLocation="example-standard-address.xsd"
               namespace=="http://mycompany.co.uk"/>

    <xs:group name="party-group">
        <xs:sequence>
            <xs:element name="telephone"
                        type="mycompany:telephone-number-type"
                        minOccurs="0"
                        maxOccurs="unbounded"/>
            <xs:element name="email"
                        type="mycompany:email-address-type"
                        minOccurs="0"
                        maxOccurs="unbounded"/>
            <xs:element name="postal-address"
                        type="mycompany:postal-address-type"
                        minOccurs="0"
                        maxOccurs="unbounded"/>
        </xs:sequence>
    </xs:group>

    <xs:complexType name="telephone-number-type">
        <xs:sequence>
            <xs:element name="number"
                        type="xs:string"
                        minOccurs="1"
                        maxOccurs="1"/>
            <xs:element name="notes"
                        type="xs:string"
                        minOccurs="0"
                        maxOccurs="1"/>
        </xs:sequence>
        <xs:attribute name="kind"
                      type="mycompany:telephone-number-kind"
                      use="required"/>
    </xs:complexType>

    <xs:simpleType name="telephone-number-kind">
        <xs:restriction base="xs:string">
            <xs:enumeration value="home"/>
            <xs:enumeration value="work"/>
            <xs:enumeration value="mobile"/>
        </xs:restriction>
    </xs:simpleType>
```


Figure C.8 — XML Schema for the 'client' area of the order processing scenario (1 of 4)

```
<xs:simpleType name="email-address-kind">
    <xs:restriction base="xs:string">
        <xs:enumeration value="personal-main"/>
        <xs:enumeration value="personal-alt"/>
        <xs:enumeration value="corporate"/>
    </xs:restriction>
</xs:simpleType>

<xs:simpleType name="email-address-string">
    <xs:restriction base="xs:string">
        <xs:pattern value="[^@]+@[^\.]+\..+"/>
    </xs:restriction>
</xs:simpleType>

<xs:simpleType name="postal-address-kind">
    <xs:restriction base="xs:string">
        <xs:enumeration value="home"/>
        <xs:enumeration value="corporate"/>
    </xs:restriction>
</xs:simpleType>

<xs:complexType name="postal-address-type">
    <xs:complexContent>
        <xs:extension base="example-standard-address.xsd">
            <xs:attribute name="kind"
                          type="mycompany:postal-address-kind"
                          use="required"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

<xs:complexType name="email-address-type">
    <xs:sequence>
        <xs:element name="address"
                    type="mycompany:email-address-string"/>
        <xs:element name="notes"
                    type="xs:string"
                    maxOccurs="1"
                    minOccurs="0"/>
    </xs:sequence>
    <xs:attribute name="kind"
                  type="mycompany:email-address-kind"
                  use="optional"/>
</xs:complexType>
```


Figure C.8 — XML Schema for the 'client' area of the order processing scenario (2 of 4)

```
<xs:element name="client">
    <xs:complexType>
        <xs:sequence>
            <xs:choice>
                <xs:group ref="mycompany:individual"
                          minOccurs="1"
                          maxOccurs="1"/>
                <xs:group ref="mycompany:organisation"
                          minOccurs="1"
                          maxOccurs="1"/>
            </xs:choice>
            <xs:group ref="mycompany:party-group"
                      minOccurs="1"
                      maxOccurs="1"/>
            <xs:element name="default-delivery-address"
                        minOccurs="0"
                        maxOccurs="1"
                        type="example-standard-address.xsd"/>
            <xs:element name="notes"
                        type="xs:string"
                        minOccurs="0"
                        maxOccurs="1"/>
        </xs:sequence>
        <xs:attribute name="status"
                      type="mycompany:client-status-type"
                      use="required"/>
    </xs:complexType>
</xs:element>

<xs:simpleType name="client-status-type">
    <xs:restriction base="xs:string">
        <xs:enumeration value="active">
            <xs:annotation>
                <xs:documentation>client is active and has
                        been contacted within the last year
                    </xs:documentation>
            </xs:annotation>
        </xs:enumeration>
        <xs:enumeration value="inactive">
            <xs:annotation>
                <xs:documentation>client has been marked as inactive
                        through to no contact/sales</xs:documentation>
            </xs:annotation>
        </xs:enumeration>
        <xs:enumeration value="hold">
            <xs:annotation>
                <xs:documentation>client is active but no new sales
                        should be made until account is cleared
                    </xs:documentation>
            </xs:annotation>
        </xs:enumeration>
    </xs:restriction>
</xs:simpleType>
```


Figure C.8 — XML Schema for the 'client' area of the order processing scenario (3 of 4)

```
    <xs:group name="individual">
        <xs:sequence>
            <xs:element name="name"
                        type="xs:string"
                        minOccurs="1"
                        maxOccurs="1"/>
        </xs:sequence>
    </xs:group>

    <xs:group name="organisation">
        <xs:sequence>
            <xs:element name="for-attention-of"
                        type="xs:string"
                        minOccurs="0"
                        maxOccurs="1"/>
            <xs:element name="organisation-name"
                        type="xs:string"
                        minOccurs="1"
                        maxOccurs="1"/>
        </xs:sequence>
    </xs:group>
</xs:schema>
```

Figure C.8 — XML Schema for the 'client' area of the order processing scenario (4 of 4)

```
<?xml version="1.0" encoding="UTF-8"?>
<--name of schema = "example-order.xsd"-->
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
           elementFormDefault="qualified"
           targetNamespace="http://mycompany.co.uk"
           xmlns:mycompany="http://mycompany.co.uk">
    <xs:include schemaLocation="example-standard-address.xsd"/>
    <xs:include schemaLocation="example-client.xsd"/>

    <xs:element name="sales-order">
        <xs:complexType>
            <xs:sequence>
                <xs:element ref="mycompany:client"
                            minOccurs="1"
                            maxOccurs="1"/>
                <xs:element name="delivery-address"
                            minOccurs="1"
                            maxOccurs="1"
                            type="example-standard-address.xsd"/>
                <xs:element name="order-value"
                            type="xs:decimal"/>
                <xs:element name="order-items">
                    <xs:complexType>
```

Figure C.9 — XML Schema for the 'order' area of the order processing scenario (1 of 2)

```
                        <xs:sequence>
                            <xs:element name="order-item"
                                        type="mycompany:order-item-type"
                                        minOccurs="1"
                                        maxOccurs="unbounded"/>
                            <xs:element name="additional-instructions"
                                        type="xs:string"
                                        minOccurs="0"
                                        maxOccurs="1"/>
                        </xs:sequence>
                    </xs:complexType>
                </xs:element>
            </xs:sequence>
            <xs:attribute name="sales-order-status"
                          type="mycompany:sales-order-status-type"/>
        </xs:complexType>
    </xs:element>

    <xs:complexType name="order-item-type">
        <xs:sequence>
            <xs:element name="part-no"
                        type="xs:string"
                        minOccurs="1"
                        maxOccurs="1"/>
            <xs:element name="description"
                        type="xs:string"
                        minOccurs="1"
                        maxOccurs="1"/>
            <xs:element name="quantity"
                        type="xs:string"
                        minOccurs="1"
                        maxOccurs="1"/>
            <xs:element name="unit-price"
                        type="xs:decimal"
                        minOccurs="1"
                        maxOccurs="1"/>
            <xs:element name="line-price"
                        type="xs:decimal"
                        minOccurs="1"
                        maxOccurs="1"/>
        </xs:sequence>
    </xs:complexType>

    <xs:simpleType name="sales-order-status-type">
        <xs:restriction base="xs:string">
            <xs:enumeration value="standing-template"/>
            <xs:enumeration value="draft"/>
            <xs:enumeration value="finalised"/>
            <xs:enumeration value="picked"/>
            <xs:enumeration value="out-for-delivery"/>
            <xs:enumeration value="delivered"/>
            <xs:enumeration value="invoiced"/>
            <xs:enumeration value="paid-and-closed"/>
        </xs:restriction>
    </xs:simpleType>
</xs:schema>
```


Figure C.9 — XML Schema for the 'order' area of the order processing scenario (2 of 2)

Figure C.10 provides the object instances to illustrate the registration of these three XML Schemas.

<Document_Schema_Language>
Object3001

Attribute/Reference	Literal/Instance
name	"xml"
version	"1.0"
encoding	"UTF-8"
expressed_schema	Object3101, Object3201, Object3301

<Namespace>
Object3011

Attribute/Reference	Literal/Instance
identifier	"http://www.w3.org/2001/XMLSchema"
used_namespace	Object3102, Object3202, Object3302

<Namespace>
Object3012

Attribute/Reference	Literal/Instance
identifier	"http://mycompany.co.uk"
used_namespace	Object3103, Object3203, Object3303

<Schema_Reuse_Type>
Object3021

Attribute/Reference	Literal/Instance
designation	"is-imported-into"
categorised_schema_reuse	Object3204, Object3304, Object3305, Object3237

<Node_Relationship_Type>
Object3051

Attribute/Reference	Literal/Instance
designation	"sequence within group"
categorised_node_relationship	Object3105, Object3206, Object3213, Object3233, Object3241, Object3249, Object3266, Object3271, Object3307, Object3314, Object3322

<Node_Relationship_Type>
Object3052

Attribute/Reference	Literal/Instance
designation	"element within sequence"
categorised_node_relationship	Object3107, Object3208, Object3215, Object3235, Object3243, Object3251, Object3268, Object3273, Object3309, Object3316, Object3324

<Node_Relationship_Type>
Object3053

Attribute/Reference	Literal/Instance
designation	"attribute within group"
categorised_node_relationship	Object3218, Object3238, Object3246, Object3259, Object3319

<Node_Relationship_Type>
Object3054

Attribute/Reference	Literal/Instance
designation	"choice within element"
categorised_node_relationship	Object3253

<Document_Schema>
Object3101

Attribute/Reference	Literal/Instance
name	"example-standard-address.xsd"
describing_language	Object3001
roled_namespace	Object3102, Object3103
subject_reuse	Object3204, Object3304, Object3237
node_model_element	Object3104, Object3106, Object3108, Object3109, Object3110, Object3111, Object3112, Object3113, Object3114,

<Document_Schema_Namespace>
Object3102

Attribute/Reference	Literal/Instance
role	"Prefix"
cited_namespace	Object3011
named_schema	Object3101

<Document_Schema_Namespace>
Object3103

Attribute/Reference	Literal/Instance
role	"Target"
cited_namespace	Object3012
named_schema	Object3101

<Node>
Object3104

Attribute/Reference	Literal/Instance
name	"address"
type	"complex"
containing_schema	Object3101
inferior_relationship	Object3105

Figure C.10 — Registration of the XML Schemas for the order processing scenario (1 of 13)

<Node_Relationship>
Object3105

Attribute/Reference	Literal/Instance
parent_node	Object3104
child_node	Object3106
node_relationship_ categorisation	Object3051

<Node>
Object3106

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object3101
inferior_relationship	Object3107
superior_relationship	Object3105

<Node_Relationship>
Object3107

Attribute/Reference	Literal/Instance
parent_node	Object3106
child_node	Object3108, Object3109, Object3110, Object3111, Object3112, Object3113, Object3114
node_relationship_ categorisation	Object3052

<Node>
Object3108

Attribute/Reference	Literal/Instance
name	"sub-building-name"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3101
superior_relationship	Object3107

<Node>
Object3109

Attribute/Reference	Literal/Instance
name	"building-name"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3101
superior_relationship	Object3107

<Node>
Object3110

Attribute/Reference	Literal/Instance
name	"thoroughfare"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3101
superior_relationship	Object3107

<Node>
Object3111

Attribute/Reference	Literal/Instance
name	"dependent-locality"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3101
superior_relationship	Object3107

<Node>
Object3112

Attribute/Reference	Literal/Instance
name	"post-town"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object3101
superior_relationship	Object3107

<Node>
Object3113

Attribute/Reference	Literal/Instance
name	"postcode"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object3101
superior_relationship	Object3107

Figure C.10 — Registration of the XML Schemas for the order processing scenario (2 of 13)

<Node>
Object3114

Attribute/Reference	Literal/Instance
name	"country"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3101
superior_relationship	Object3107

<Document_Schema>
Object3201

Attribute/Reference	Literal/Instance
name	"example-client.xsd"
describing_language	Object3001
roled_namespace	Object3202, Object3203
subject_reuse	Object3305
object_reuse	Object3204
node_model_element	Object3205, Object3207, Object3209, Object3210, Object3211, Object3212, Object3214, Object3216, Object3217, Object3219, Object3220, Object3224, Object3228, Object3229, Object3232, Object3234, Object3236, Object3239, Object3240, Object3242, Object3244, Object3245, Object3247, Object3248, Object3250, Object3252, Object3254, Object3255, Object3256, Object3257, Object3258, Object3260, Object3261, Object3265, Object3267, Object3269, Object3270, Object3272, Object3274, Object3275

<Document_Schema_Namespace>
Object3202

Attribute/Reference	Literal/Instance
role	"Prefix"
cited_namespace	Object3011
named_schema	Object3201

<Document_Schema_Namespace>
Object3203

Attribute/Reference	Literal/Instance
role	"Target"
cited_namespace	Object3012
named_schema	Object3201

<Schema_Reuse>
Object3204

Attribute/Reference	Literal/Instance
reused_schema	Object3101
recipient_schema	Object3201
schema_reuse_ categoristaion	Object3021

<Node>
Object3205

Attribute/Reference	Literal/Instance
name	"party-group"
type	"group"
containing_schema	Object3201
inferior_relationship	Object3206

<Node_Relationship>
Object3206

Attribute/Reference	Literal/Instance
parent_node	Object3205
child_node	Object3207
node_relationship_ categorisation	Object3051

<Node>
Object3207

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object3201
inferior_relationship	Object3208
superior_relationship	Object3206

<Node_Relationship>
Object3208

Attribute/Reference	Literal/Instance
parent_node	Object3207
child_node	Object3209, Object3210, Object3211
node_relationship_ categorisation	Object3052

<Node>
Object3209

Attribute/Reference	Literal/Instance
name	"telephone"
type	"element"
datatype	"mycompany:telephone-number-type"
minimum_occurrences	"0"
maximum_occurrences	"unbounded"
containing_schema	Object3201
superior_relationship	Object3208

Figure C.10 — Registration of the XML Schemas for the order processing scenario (3 of 13)

<Node>
Object3210

Attribute/Reference	Literal/Instance
name	"email"
type	"element"
datatype	"mycompany:email-address-type"
minimum_occurrences	"0"
maximum_occurrences	"unbounded"
containing_schema	Object3201
superior_relationship	Object3208

<Node>
Object3211

Attribute/Reference	Literal/Instance
name	"postal-address"
type	"element"
datatype	"mycompany:postal-address-type"
minimum_occurrences	"0"
maximum_occurrences	"unbounded"
containing_schema	Object3201
superior_relationship	Object3208

<Node>
Object3212

Attribute/Reference	Literal/Instance
name	"telephone-number-type"
type	"complex"
containing_schema	Object3201
inferior_relationship	Object3213, Object3218

<Node_Relationship>
Object3213

Attribute/Reference	Literal/Instance
parent_node	Object3212
child_node	Object3214
node_relationship_ categorisation	Object3051

<Node>
Object3214

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object3201
inferior_relationship	Object3215
superior_relationship	Object3213

<Node_Relationship>
Object3215

Attribute/Reference	Literal/Instance
parent_node	Object3214
child_node	Object3216, Object3217
node_relationship_ categorisation	Object3052

<Node>
Object3216

Attribute/Reference	Literal/Instance
name	"number"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3215

<Node>
Object3217

Attribute/Reference	Literal/Instance
name	"notes"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3215

<Node_Relationship>
Object3218

Attribute/Reference	Literal/Instance
parent_node	Object3212
child_node	Object3219
node_relationship_ categorisation	Object3053

<Node>
Object3219

Attribute/Reference	Literal/Instance
name	"kind"
type	"attribute"
datatype	"mycompany:telephone-number-kind"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3218

Figure C.10 — Registration of the XML Schemas for the order processing scenario (4 of 13)

<Enumerated_Node>
Object3220

Attribute/Reference	Literal/Instance
name	"telephone-number-kind"
type	"simple"
containing_schema	Object3201
restriction_base	"xs:string"
node_enumeration	Object3221, Object3222, Object3223

<Node_Enumeration>
Object3221

Attribute/Reference	Literal/Instance
value	"home"
enumerated_node	Object3220

<Node_Enumeration>
Object3222

Attribute/Reference	Literal/Instance
value	"work"
enumerated_node	Object3220

<Node_Enumeration>
Object3223

Attribute/Reference	Literal/Instance
value	"mobile"
enumerated_node	Object3220

<Enumerated_Node>
Object3224

Attribute/Reference	Literal/Instance
name	"email-address-kind"
type	"simple"
containing_schema	Object3201
restriction_base	"xs:string"
node_enumeration	Object3225, Object3226, Object3227

<Node_Enumeration>
Object3225

Attribute/Reference	Literal/Instance
value	"personal-main"
enumerated_node	Object3224

<Node_Enumeration>
Object3226

Attribute/Reference	Literal/Instance
value	"personal-alt"
enumerated_node	Object3224

<Node_Enumeration>
Object3227

Attribute/Reference	Literal/Instance
value	"corporate"
enumerated_node	Object3224

<Restricted_Node>
Object3228

Attribute/Reference	Literal/Instance
name	"email-address-string"
type	"simple"
containing_schema	Object3201
restriction_base	"xs:string"
restriction_pattern	"[^@]+@[^\.]+\..+"

<Enumerated_Node>
Object3229

Attribute/Reference	Literal/Instance
name	"postal-address-kind"
type	"simple"
containing_schema	Object3201
restriction_base	"xs:string"
node_enumeration	Object3230, Object3231

<Node_Enumeration>
Object3230

Attribute/Reference	Literal/Instance
value	"home"
enumerated_node	Object3229

<Node_Enumeration>
Object3231

Attribute/Reference	Literal/Instance
value	"corporate"
enumerated_node	Object3229

<Node>
Object3232

Attribute/Reference	Literal/Instance
name	"postal-address-type"
type	"complex"
containing_schema	Object3201
inferior_relationship	Object3233

Figure C.10 — Registration of the XML Schemas for the order processing scenario (5 of 13)

<Node_Relationship>
Object3233

Attribute/Reference	Literal/Instance
parent_node	Object3232
child_node	Object3234
node_relationship_ categorisation	Object3051

<Node>
Object3234

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object3201
inferior_relationship	Object3235
superior_relationship	Object3233

<Node_Relationship>
Object3235

Attribute/Reference	Literal/Instance
parent_node	Object3234
child_node	Object3236
node_relationship_ categorisation	Object3052

<Node>
Object3236

Attribute/Reference	Literal/Instance
type	"extension"
containing_schema	Object3201
object_reuse	Object3237
inferior_relationship	Object3238

<Schema_Reuse>
Object3237

Attribute/Reference	Literal/Instance
reused_schema	Object3101
recipient_node	Object3236
schema_reuse_ categoristaion	Object3021

<Node_Relationship>
Object3238

Attribute/Reference	Literal/Instance
parent_node	Object3236
child_node	Object3239
node_relationship_ categorisation	Object3053

<Node>
Object3239

Attribute/Reference	Literal/Instance
name	"kind"
type	"attribute"
datatype	"mycompany:postal-address-kind"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3238

<Node>
Object3240

Attribute/Reference	Literal/Instance
name	"email-address-type"
type	"complex"
containing_schema	Object3201
inferior_relationship	Object3241

<Node_Relationship>
Object3241

Attribute/Reference	Literal/Instance
parent_node	Object3240
child_node	Object3242
node_relationship_ categorisation	Object3051

<Node>
Object3242

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object3201
inferior_relationship	Object3243, Object3246
superior_relationship	Object3241

<Node_Relationship>
Object3243

Attribute/Reference	Literal/Instance
parent_node	Object3242
child_node	Object3244, Object3245
node_relationship_ categorisation	Object3052

Figure C.10 — Registration of the XML Schemas for the order processing scenario (6 of 13)

<Node>
Object3244

Attribute/Reference	Literal/Instance
name	"address"
type	"element"
datatype	"mycompany:email-address-string"
containing_schema	Object3201
superior_relationship	Object3243

<Node>
Object3245

Attribute/Reference	Literal/Instance
name	"notes"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3243

<Node_Relationship>
Object3246

Attribute/Reference	Literal/Instance
parent_node	Object3242
child_node	Object3247
node_relationship_categorisation	Object3053

<Node>
Object3247

Attribute/Reference	Literal/Instance
name	"kind"
type	"attribute"
datatype	"mycompany:email-address-kind"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3246

<Node>
Object3248

Attribute/Reference	Literal/Instance
name	"client"
type	"complex"
containing_schema	Object3201
inferior_relationship	Object3249, Object3259

<Node_Relationship>
Object3249

Attribute/Reference	Literal/Instance
parent_node	Object3248
child_node	Object3250
node_relationship_categorisation	Object3051

<Node>
Object3250

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object3201
inferior_relationship	Object3251
superior_relationship	Object3249

<Node_Relationship>
Object3251

Attribute/Reference	Literal/Instance
parent_node	Object3250
child_node	Object3252, Object3256, Object3257, Object3258
node_relationship_categorisation	Object3052

<Node>
Object3252

Attribute/Reference	Literal/Instance
type	"choice"
containing_schema	Object3201
inferior_relationship	Object3253
superior_relationship	Object3251

<Node_Relationship>
Object3253

Attribute/Reference	Literal/Instance
parent_node	Object3252
child_node	Object3254, Object3255
node_relationship_categorisation	Object3054

<Node>
Object3254

Attribute/Reference	Literal/Instance
type	"element"
datatype	"mycompany:individual"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3253

Figure C.10 — Registration of the XML Schemas for the order processing scenario (7 of 13)

<Node>
Object3255

Attribute/Reference	Literal/Instance
type	"element"
datatype	"mycompany:organisation"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3253

<Node>
Object3256

Attribute/Reference	Literal/Instance
type	"element"
datatype	"mycompany:party-group"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3251

<Node>
Object3257

Attribute/Reference	Literal/Instance
name	"default-delivery-address"
type	"element"
datatype	"example-standard-address.xsd"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3251

<Node>
Object3258

Attribute/Reference	Literal/Instance
name	"notes"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3251

<Node_Relationship>
Object3259

Attribute/Reference	Literal/Instance
parent_node	Object3248
child_node	Object3260
node_relationship_ categorisation	Object3053

<Node>
Object3260

Attribute/Reference	Literal/Instance
name	"status"
type	"attribute"
datatype	"mycompany:client-status-type"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3259

<Enumerated_Node>
Object3261

Attribute/Reference	Literal/Instance
name	"client-status-type"
type	"simple"
containing_schema	Object3201
restriction_base	"xs:string"
node_enumeration	Object3262, Object3263, Object3264

<Node_Enumeration>
Object3262

Attribute/Reference	Literal/Instance
value	"active"
annotation	"client is active and has been contacted within the last year"
enumerated_node	Object3261

<Node_Enumeration>
Object3263

Attribute/Reference	Literal/Instance
value	"inactive"
annotation	"client has been marked as inactive through no contact/ sales"
enumerated_node	Object3261

Figure C.10 — Registration of the XML Schemas for the order processing scenario (8 of 13)

<Node_Enumeration>
Object3264

Attribute/Reference	Literal/Instance
value	"hold"
annotation	"client is active but no new sales should be made until account is cleared"
enumerated_node	Object3261

<Node>
Object3265

Attribute/Reference	Literal/Instance
name	"individual"
type	"group"
containing_schema	Object3201
inferior_relationship	Object3266

<Node_Relationship>
Object3266

Attribute/Reference	Literal/Instance
parent_node	Object3265
child_node	Object3267
node_relationship_ categorisation	Object3051

<Node>
Object3267

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object3201
inferior_relationship	Object3268
superior_relationship	Object3266

<Node_Relationship>
Object3268

Attribute/Reference	Literal/Instance
parent_node	Object3267
child_node	Object3269
node_relationship_ categorisation	Object3052

<Node>
Object3269

Attribute/Reference	Literal/Instance
name	"name"
type	"element"
datatype	"xs:string"
minimum_occurrences	"1"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3268

<Node>
Object3270

Attribute/Reference	Literal/Instance
name	"organisation"
type	"group"
containing_schema	Object3201
inferior_relationship	Object3271

<Node_Relationship>
Object3271

Attribute/Reference	Literal/Instance
parent_node	Object3270
child_node	Object3272
node_relationship_ categorisation	Object3051

<Node>
Object3272

Attribute/Reference	Literal/Instance
type	"sequence"
containing_schema	Object3201
inferior_relationship	Object3272
superior_relationship	Object3271

<Node_Relationship>
Object3273

Attribute/Reference	Literal/Instance
parent_node	Object3272
child_node	Object3274, Object3275
node_relationship_ categorisation	Object3052

<Node>
Object3274

Attribute/Reference	Literal/Instance
name	" for-attention-of"
type	"element"
datatype	"xs:string"
minimum_occurrences	"0"
maximum_occurrences	"1"
containing_schema	Object3201
superior_relationship	Object3273

Figure C.10 — Registration of the XML Schemas for the order processing scenario (9 of 13)