

Information technology — CDIF framework —

Part 2: Modelling and extensibility

ICS 35.080

National foreword

This British Standard reproduces verbatim ISO/IEC 15474-2:2002 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee IST/15, Software engineering, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the ISO/IEC title page, pages ii to vii, a blank page, pages 1 to 46, an inside back cover and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

This British Standard, having been prepared under the direction of the DISC Board, was published under the authority of the Standards Policy and Strategy Committee on 8 November 2002

Amendments issued since publication

Amd. No.	Date	Comments

© BSI 8 November 2002

ISBN 0 580 37949 3

INTERNATIONAL STANDARD

ISO/IEC 15474-2

First edition
2002-10-15

Information technology — CDIF framework —

Part 2: Modelling and extensibility

*Technologies de l'information — Cadre de référence CDIF —
Partie 2: Modélisation et extension*



Contents

1	Scope	1
2	Conformance	2
3	Normative references.....	2
4	Terms and definitions.....	3
4.1	From other standards.....	3
4.1.1	ISO/IEC 15474-1	3
4.1.2	ISO/IEC 13238-1	3
4.2	For this standard	3
5	Symbols (and abbreviated terms).....	4
5.1	Naming and diagramming conventions	4
5.2	Abbreviations	4
6	CDIF meta-metamodel concepts and facilities.....	4
6.1	Introduction	4
6.2	Modelling approach.....	4
6.2.1	Introduction	4
6.2.2	Subject areas.....	5
6.2.3	Many-to-many meta-relationships	5
6.2.4	Attributed meta-relationships	5
6.2.5	Subtyping of meta-entities.....	5
6.2.6	Multiple inheritance in meta-entities.....	6
6.2.7	Subtyping of meta-relationships	7
6.2.8	Multiple inheritance of meta-relationships.....	8
6.2.9	Arity of meta-relationships.....	8
6.2.10	Mutual exclusivity of meta-relationships.....	8
6.3	Subject areas.....	8
6.3.1	Explicit and implicit use of <i>CollectableMetaObjects</i> in subject areas	8
6.3.2	Rules for defining subject area.....	9
6.3.3	Working metamodel	10
6.3.4	Subject area diagrams	10
6.4	Metamodel extensibility	10
6.4.1	Introduction	10
6.4.2	Extensibility.....	11
6.5	Exporter responsibilities.....	12
6.5.1	Introduction	12
6.5.2	Extensibility	12
6.5.3	Maximum output.....	12
6.5.4	Meta-attributes.....	12
6.6	Importer responsibilities.....	12
6.6.1	Introduction	12
6.6.2	Information retention.....	12
6.6.3	Working metamodel	12
6.6.4	Meta-attributes.....	13
7	Modelling conventions.....	13
7.1	Naming of meta-objects	13
7.1.1	Names	13
7.1.2	Uniqueness of names.....	13
7.2	Meta-object graphical notation	13
7.2.1	Introduction	13
7.2.2	Meta-entity symbol	14

7.2.3	Meta-relationship symbol.....	14
7.2.4	Meta-relationship cardinality symbol	15
7.2.5	Meta-entity subtype hierarchy symbol	16
7.2.6	Meta-relationship subtype hierarchy.....	16
7.2.7	Mutual exclusivity of meta-relationships	17
7.2.8	Instance diagrams.....	17
7.3	Meta-object definition format.....	19
7.3.1	Introduction	19
7.3.2	Subject area definition	19
7.3.3	Meta-entity definition.....	20
7.3.4	Meta-attribute definition	21
7.3.5	Meta-relationship definition	22
7.4	Meta-object reference format.....	23
7.5	Meta-object summary format	24
7.5.1	Introduction	24
7.5.2	<i>AttributableMetaObject</i> classification hierarchy.....	24
7.5.3	MetaEntity and MetaRelationship summaries.....	24
8	Meta-metamodel overview	25
8.1	Introduction	25
8.2	Meta-metamodel description	25
8.3	Meta-metamodel diagram.....	26
9	Meta-metamodel summary.....	26
9.1	<i>AttributableMetaObject</i> classification hierarchy.....	26
9.1.1	Introduction	26
9.1.2	Classification hierarchy	27
9.2	Meta-meta-entity summary	27
9.3	Meta-meta-relationship summary	29
10	Meta-metamodel specification.....	30
10.1	Data types specification.....	30
10.1.1	Introduction	30
10.1.2	Boolean.....	30
10.1.3	Date	30
10.1.4	Enumerated	30
10.1.5	Float	31
10.1.6	Identifier.....	31
10.1.7	Integer.....	31
10.1.8	Point.....	31
10.1.9	String	31
10.1.10	Text	31
10.1.11	Time	31
10.2	Meta-meta-entity and Meta-meta-attribute specifications	32
10.2.1	<i>AttributableMetaObject</i>	32
10.2.2	<i>CollectableMetaObject</i>	33
10.2.3	<i>MetaAttribute</i>	33
10.2.4	<i>MetaEntity</i>	35
10.2.5	<i>MetaObject</i>	36
10.2.6	<i>MetaRelationship</i>	39
10.2.7	<i>SubjectArea</i>	41
10.3	Meta-meta-relationship specifications	42
10.3.1	<i>AttributableMetaObject.HasSubtype.AttributableMetaObject</i>	42
10.3.2	<i>CollectableMetaObject.IsDefinedIn.SubjectArea</i>	43
10.3.3	<i>CollectableMetaObject.IsUsedIn.SubjectArea</i>	44
10.3.4	<i>MetaAttribute.IsLocalMetaAttributeOf.AttributableMetaObject</i>	45
10.3.5	<i>MetaRelationship.HasDestination.MetaEntity</i>	45
10.3.6	<i>MetaRelationship.HasSource.MetaEntity</i>	46

Table of Illustrations

Figure 1 – CDIF family of standards	1
Figure 2 – Multiple inheritance	6
Figure 3 – Multiple inheritance: Invalid meta-attribute, <i>Z1</i>	7
Figure 4 – Example of CDIF graphical notation	14
Figure 5 – The meta-entity symbol	14
Figure 6 – The meta-relationship symbol	15
Figure 7 – A Reflexive meta-relationship	15
Figure 8 – The Meta-relationship cardinality symbol	15
Figure 9 – The Meta-entity subtype hierarchy symbol	16
Figure 10 – The Meta-entity subtype hierarchy symbol: Multiple inheritance	16
Figure 11 – Mutual exclusivity of meta-relationships	17
Figure 12 – Conceptual Diagram and an Instance Diagram	18
Figure 13 – The CDIF meta-metamodel	26

Table of Tables

Table 1 – Inheritance of meta-meta-attribute values by subtype meta-entities	6
Table 2 – Inheritance of meta-meta-attribute values by subtype meta-relationships	8
Table 3 – Contents of subject area definition	19
Table 4 – Contents of meta-entity definition	20
Table 5 – Contents of meta-attribute definition	21
Table 6 – Contents of meta-relationship definition	22
Table 7 – Contents of meta-entity references	23
Table 8 – Contents of meta-relationship references	23
Table 9 – Data types supported by CDIF	30

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 15474 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15474-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and system engineering*.

ISO/IEC 15474 consists of the following parts, under the general title *Information technology — CDIF framework*:

- *Part 1: Overview*
- *Part 2: Modelling and extensibility*

Introduction

This standard will assist the vendors and users of modelling tools and meta-data repositories in developing mechanisms for interchanging information. This standard specifies an element of a family of related standards. When used together, these standards specify a mechanism for transferring information between tools.

ISO/IEC 15474-1:2002, *Information technology — CDIF framework — Part 1: Overview* should be read first when initially exploring CDIF. It explains the overall CDIF Architecture and how the family of standards fits together.

This standard, ISO/IEC 15474-2:2002, *Information technology — CDIF framework — Part 2: Modelling and extensibility*, should also be read before the other standards in the CDIF Family of Standards. It defines the CDIF meta-metamodel and the modelling concepts used throughout CDIF and the extensibility mechanism.

This standard has been developed with the wide support and participation of vendors, users, academia and government involved in or familiar with the CASE industry, its products and the general requirements associated with interchanging information between these products.

This document is organized into the following Clauses:

- Clause 1 to 5 are prescribed ISO/IEC Clauses
- Clause 6: Meta-metamodel concepts and facilities

This defines the meta-metamodel, modelling rules and graphical conventions that are used. The data types supported in metamodels are introduced. The concept of the working metamodel is also explained. It also describes the types of extensibility that may be used when extending the CDIF semantic metamodel.

This Clause also describes the responsibilities of an exporter tool with regard to overlapping semantics and maximum output, and those of an importer tool with regard to the retention of information.

- Clause 7: CDIF modelling conventions

This contains the diagramming and documentation conventions used in the CDIF semantic metamodels and in the meta-metamodel specified in this document.

- Clause 8: Meta-metamodel overview

This contains an overview of the CDIF meta-metamodel. This clause includes a meta-metamodel diagram.

- Clause 9: Meta-metamodel summary

This contains an overview of the CDIF meta-metamodel. This clause includes an *AttributableMetaObject* hierarchy, a meta-meta-entity summary and a meta-meta-relationship summary

- Clause 10: Meta-metamodel specification

This contains the full definitions of all the objects in the CDIF meta-metamodel.

Information technology — CDIF framework —

Part 2: Modelling and extensibility

1 Scope

The CDIF family of standards is primarily designed to be used as a description of a mechanism for transferring information between modelling tools. It facilitates a successful transfer when the authors of the importing and exporting tools have nothing in common except an agreement to conform to CDIF.

The CDIF family of standards includes a semantic metamodel and a transfer format definition. It also includes the specification of a meta-metamodel and associated rules that define a framework for the semantic metamodel and the transfer format. The language that is defined for the transfer format also has applicability as a general language for Import/Export for repositories. The CDIF semantic metamodel also has applicability as the basis of standard definitions for use in repositories.

The standards that form the complete family of CDIF Standards are documented in ISO/IEC 15474-1:2002, *Information technology - CDIF framework - Part 1: Overview*. These standards cover the overall framework, the transfer format and the CDIF semantic metamodel.

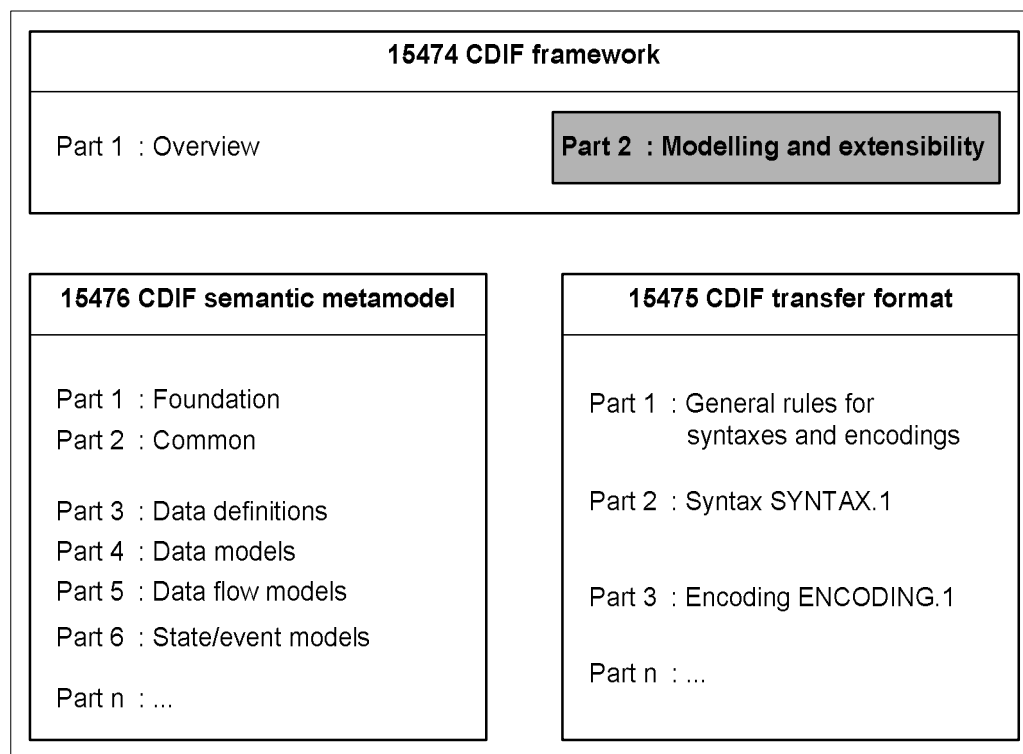


Figure 1 – CDIF family of standards

The diagram in Figure 1 depicts the various standards that comprise the CDIF family of standards. The shaded box depicts this Standard and its position in the CDIF family of standards.

This document (ISO/IEC 15474-2:2002, *Information technology - CDIF framework - Part 2: Modelling and extensibility*) includes the definition of the CDIF meta-metamodel and describes the rules and notations used throughout the CDIF family of standards. The rules for extending the CDIF semantic metamodel are also defined.

This document is intended to be used by anyone wishing to understand and/or use CDIF. This document provides an introduction to the entire CDIF family of standards. It is suitable for:

- Those evaluating CDIF,
- Those who wish to understand the principles and concepts of a CDIF transfer, and
- Those developing importers and exporters.

The document, ISO/IEC 15474-1:2002, *Information technology - CDIF framework - Part 1: Overview*, and this framework document ISO/IEC 15474-2:2002, *Information technology - CDIF framework - Part 2: Modelling and extensibility*, should be read first when initially exploring CDIF and before attempting to read other documents in the CDIF family of standards.

While there are no specific prerequisites for reading this document, it will be helpful for the reader to have familiarity with the following:

- Entity-Relationship-Attribute modelling;
- Modelling (CASE) tools;
- Information repositories;
- Data dictionaries;
- Multiple meta-layer modelling.

2 Conformance

A product is CDIF architecture conformant if and only if it can, as a property of that product, represent the product's metamodel instances, and/or the product's metamodel using the concepts defined in the ISO/IEC 15474-2:2002, *Information technology — CDIF framework — Part 2: Modelling and extensibility* ("Framework document"), and all the concepts defined in the standard ISO/IEC 15476-1:2002, *Information technology — CDIF semantic metamodel — Part 1: Foundation* ("Foundation document"), and obeys all the constraints and rules for metamodels and meta-data defined in the Framework document, and obeys all the rules and constraints defined in the Foundation document. Conformance to the graphical notation as defined in the Framework document is not required.

3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 15474. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 15474 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 15474-1:2002, *Information technology — CDIF framework — Part 1: Overview*

ISO/IEC 13238-1:—¹⁾, *Information technology — Data management export/import — Part 1: Standardization framework*

ISO/IEC 15476-1:2002, *Information technology — CDIF semantic metamodel — Part 1: Foundation*

¹⁾ To be published.

4 Terms and definitions

For the purposes of this part of ISO/IEC 15474, the following definitions apply. Unless otherwise noted, the definitions are specific to this part of ISO/IEC 15474.

4.1 From other standards

4.1.1 ISO/IEC 15474-1

This part of ISO/IEC 15474 makes use of the following terms defined in ISO/IEC 15474-1:

Arity
 Associative entity
 Attributed relationship
 Cardinality
 CDIF
 CDIF family of standards
 CDIF graphical notation
 CDIF semantic metamodel
 CDIF meta-metamodel
 Characteristic entity
 Constraint
 Encoding
 Entity
 Instance
 Semantic metamodel
 Kernel entity
 Meta-attribute
 Meta-entity
 Meta-meta-attribute
 Meta-meta-entity
 Meta-metamodel
 Meta-meta-relationship
 Metamodel
 Meta-object
 Meta-relationship
 Model
 Model layers
 N-ary relationship
 Relationship
 Role
 Subject area
 Syntax
 Working metamodel

4.1.2 ISO/IEC 13238-1

This part of ISO/IEC 15474 makes use of the following terms from ISO/IEC 13238-1:

Transfer file
 CDIF transfer file
 Exporter
 Importer

4.2 For this standard

For the purpose of this part of ISO/IEC 15474 new terms are defined when introduced. Double quotes are used to introduce new terms (e.g., "model layer").

5 Symbols (and abbreviated terms)

5.1 Naming and diagramming conventions

Conventions for naming, diagramming, describing and defining meta-objects can be found in Clause 7 of this document. Unless otherwise noted, they are applicable to meta-meta-objects named, diagrammed, described and defined in this document.

5.2 Abbreviations

The following abbreviations are used in this international standard:

CDIF CASE Data Interchange Format (originally)

ERA Entity-Relationship-Attribute modelling

6 CDIF meta-metamodel concepts and facilities

6.1 Introduction

This clause describes the concepts of the CDIF meta-metamodel. An overview and a diagram of the CDIF meta-metamodel are included in Clause 8 Meta-metamodel overview. A summary of the meta-metamodel is included in Clause 9 Meta-metamodel summary. The formal definition can be found in Clause 10 Meta-metamodel specification.

The CDIF meta-metamodel is defined using the same facilities that are used to define the CDIF metamodel (and could be used to define models). It is, therefore, quite common to get the names of the objects at the different meta-layers confused. To minimize this problem, the reader should remember the following:

- The components of the meta-metamodel are known as meta-meta-objects (i.e., meta-meta-entities, meta-meta-relationships and meta-meta-attributes);
- The components of the metamodel are known as meta-objects (i.e., meta-entities, meta-relationships and meta-attributes);
- The components of models are known as objects (e.g., processes, entities, flows);
- The names of the components in the meta-metamodel usually have a single meta- as a prefix (e.g., there is a meta-meta-entity, in the meta-metamodel, known as *MetaAttribute*);
- The names of the components in the metamodel usually have no meta prefix.

The CDIF meta-metamodel is the definition of the concepts used to develop CDIF-conformant metamodels. This includes the Entity-Relationship-Attribute diagramming technique and information definition requirements pertinent to the metamodel development process.

6.2 Modelling approach

6.2.1 Introduction

Because the CDIF meta-metamodel is used to define metamodels, it must be capable of expressing a complete description of a metamodel. A CDIF conformant metamodel contains three types of objects: entities, relationships and attributes; these objects in the metamodel are properly known as meta-entities, meta-relationships and meta-attributes. These objects are used to model the information content of the metamodel, and in fact, it is a rule in CDIF, that any single concept, or set of information may only be represented one way; that is, although there may be several ways of modelling a concept, only one will be included in the model.

The meta-metamodel is composed of two things:

- An Entity-Relationship-Attribute model that is used to describe the CDIF metamodel. This Entity-Relationship-Attribute model is also self-describing (i.e., is defined using itself).
- A graphical notation for representing occurrences (i.e., instances) of the meta-metamodel. This notation is used in CDIF in two ways: to depict the contents of subject areas in the CDIF metamodel, and to depict the CDIF meta-metamodel itself.

It is important for the reader to remember that the rules in this clause apply only to the metamodels defined using the CDIF meta-metamodel. In particular, these rules do not relate to Entity-Relationship-Attribute models that are transferred during a CDIF transfer (see ISO/IEC 15476-4:—, *Information technology — CDIF semantic metamodel — Part 4: Data models* for further information).

This clause describes some general modelling rules that are part of the definition of the CDIF meta-metamodel. They are described with a meta- prefix. The rules apply to the CDIF semantic metamodel and all extensions defined using the extensibility mechanism. The rules are also adhered to by the CDIF meta-metamodel²⁾.

6.2.2 Subject areas

The CDIF semantic metamodel is a single integrated model that is a description of the set of concepts and notations used to define an information model. This model is huge; therefore, it is partitioned into manageable sections by building views of the underlying metamodel. These partitions, or "subject areas" as they are known, group together collectable meta-objects (meta-entities, meta-relationships and meta-attributes) that address a particular aspect within the Systems Development Life Cycle (e.g., Data Flow Modelling), or that provide similar functionality (e.g., Data Definition). Meta-objects may be shared by many subject areas. They are defined in one subject area, and referred to in other subject areas.

6.2.3 Many-to-many meta-relationships

The CDIF meta-metamodel supports many-to-many meta-relationships.

6.2.4 Attributed meta-relationships

The CDIF meta-metamodel supports attributed meta-relationships.

6.2.5 Subtyping of meta-entities

The CDIF meta-metamodel provides support for subtyping (sometimes known as specialization) and its converse, supertyping (sometimes known as generalization).

In particular, a meta-entity may be defined to be a "subtype" of another meta-entity. The subtype meta-entity inherits all of the meta-attributes and meta-relationships of its immediate and indirect supertype meta-entities.

Supertyping is used as a classification mechanism to group meta-objects with a substantial level of common semantics; an importer can use this classification as an aid to deciding how to represent any meta-object that is not directly representable within the importing tool.

Subtype meta-entities have unique *CDIFMetaIdentifiers*; that is, the *CDIFMetaIdentifier* is not inherited from the parent. The *Description*, *Constraints*, *Usage*, and *Aliases* that were defined for the parent meta-entity are inherited. These textual fields may also be expanded in the local definition of the subtype meta-entity. Subtype meta-entities inherit all the meta-attributes that have been defined for the parent meta-entity, and all those of its antecedents. The characteristics of the meta-attribute (for example, *Name*) are unchanged when inherited by a subtype meta-entity. Additional, local, meta-attributes may be defined specific to the subtype meta-entity.

²⁾ The CDIF modelling rules may be used at any meta-level; they may be used to create models.

In the same way that meta-attributes are inherited, any meta-relationships that are defined with the parent meta-entity as the source or destination are inherited by subtype meta-entities. None of the characteristics of the meta-relationship are changed by its use by a subtype; that is, the *Name*, *Cardinality*, *CDIFMetaIdentifier*, *Aliases*, *Constraints*, *Description*, and *Usage*, are unchanged. Notice that even the full name of the meta-relationship is unchanged and will contain the name of the supertype meta-entity rather than that of the subtype.

A summary of the inheritance rules for subtype meta-entities is shown in Table 1.

Table 1 – Inheritance of meta-meta-attribute values by subtype meta-entities

META-META-ATTRIBUTE	Inherited by Subtype Meta-entity
ALIASES	Yes, may be extended
CDIFMETALIDENTIFIER	No
CONSTRAINTS	Yes, may be extended
DESCRIPTION	Yes, may be extended
ISABSTRACT	No
NAME	No
TYPE	No
USAGE	Yes, may be extended

6.2.6 Multiple inheritance in meta-entities

A meta-entity may have multiple supertypes, allowing for "multiple inheritance". In this case, the subtype inherits all of the meta-attributes and meta-relationships of all of its supertypes (and their supertypes, etc.).

There are several situations that occur when using multiple-inheritance that either seem to, or do, present inheritance conflicts.

When several inheritance threads of a meta-entity converge at a common supertype, the inheriting meta-entity does not inherit multiple copies of the meta-attributes and meta-relationships from that point to the top of the hierarchy; it only inherits one copy. Figure 2 shows meta-entity **A** having two subtype meta-entities (**B** and **C**), which are both supertype meta-entities of meta-entity **D**. Both local and inherited meta-attributes for all meta-entities are shown.

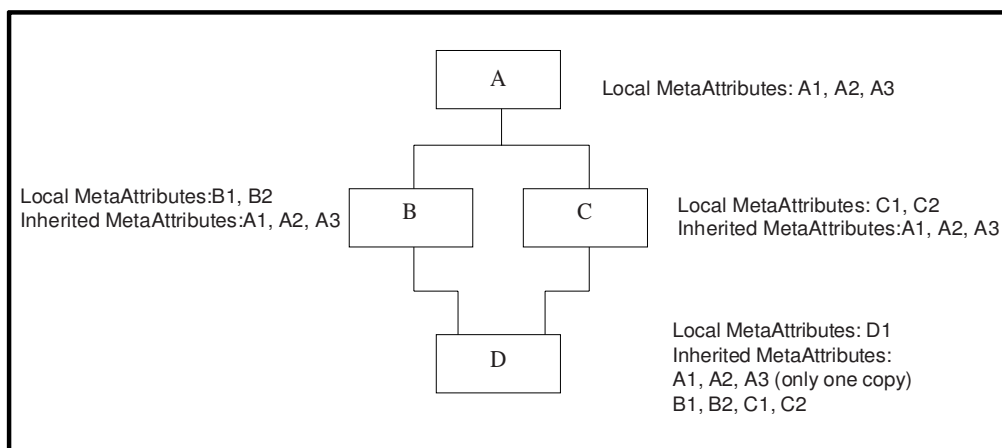


Figure 2 – Multiple inheritance

The other potential conflict occurs when a meta-entity inherits meta-attributes from two supertypes, both having a meta-attribute with the same name that are, in fact, different meta-attributes. The behaviour for CDIF is undefined in these circumstances. To guarantee proper (predictable) behaviour from importers and exporters, this situation

must be avoided. The CDIF semantic metamodel and CDIF meta-metamodel are defined ensuring that this does not occur.

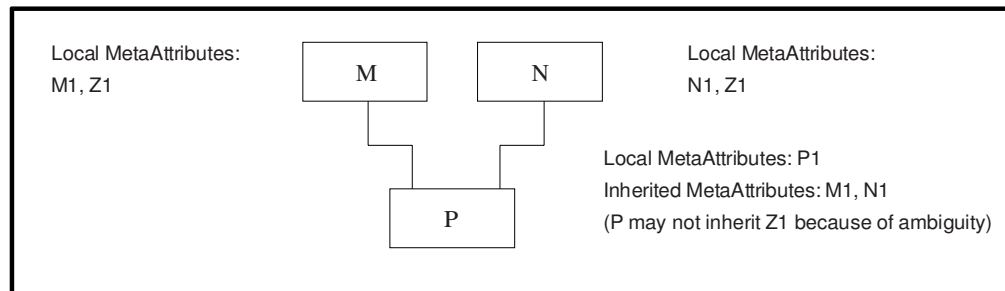


Figure 3 – Multiple inheritance: Invalid meta-attribute, Z1

Figure 3 shows an invalid inheritance example, where the meta-entity **P** has two supertype meta-entities (**M** and **N**) that both have an identically named meta-attribute, **Z1**.

6.2.7 Subtyping of meta-relationships

A meta-relationship may be defined to be a subtype of another meta-relationship.

A subtype meta-relationship may be defined at the 'level' in the meta-entity hierarchy where the supertype meta-relationship was defined (that is, with the same source and destination meta-entities as the supertype). Alternatively, the source meta-entity or destination meta-entity, or both, may be subtypes of the source and destination meta-entities in the supertype meta-relationship.

Each subtype meta-relationship has a unique *CDIFMetaIdentifier*; that is, it does not inherit the *CDIFMetaIdentifier* from the supertype meta-relationship.

The cardinalities of the subtype meta-relationship are defined locally; however, they may only be as constrained, or more constrained than at the supertype level. Therefore, the minimum cardinality of the subtype must be greater than, or equal to, that of the supertype, and the maximum cardinality must be less than, or equal to, that of the supertype.

The other, textual, characteristics of the subtype meta-relationship are inherited from the supertype meta-relationship but may be further refined for the subtype.

The immediate and indirect subtype meta-relationship inherits any meta-attributes that have been defined for the supertype meta-relationship. None of the characteristics of the meta-attributes are changed. Additional meta-attributes may be created for the subtype meta-relationship.

A summary of the inheritance rules for subtype meta-relationships is shown in Table 2.

Table 2 – Inheritance of meta-meta-attribute values by subtype meta-relationships

META-META-ATTRIBUTE	Inherited by Subtype Meta-relationship
ALIASES	Yes, may be extended
CDIFMETAIDENTIFIER	No
CONSTRAINTS	Yes, may be extended
DESCRIPTION	Yes, may be extended
ISABSTRACT	No
MAXDESTCARD	No, must be locally defined
MAXSOURCECARD	No, must be locally defined
MINDESTCARD	No, must be locally defined
MINSOURCECARD	No, must be locally defined
NAME	No
USAGE	Yes, may be extended

Between any pair of meta-entities, there may be both a supertype meta-relationship (possibly due to inheritance by a subtype meta-entity) and a subtype meta-relationship defined. There may not be an instance of both the supertype meta-relationship and the subtype meta-relationship between the same pair of meta-entity instances. However, in most cases it is expected that the supertype meta-relationship will be abstract (not instantiable), which means that the condition of an instance of both supertype and subtype meta-relationships between the same instance pair will not arise.

6.2.8 Multiple inheritance of meta-relationships

Meta-relationships may inherit from multiple supertypes in the same way that meta-entities may inherit from multiple supertypes. The discussion in Clause 6.2.6, Multiple inheritance in meta-entities, that describes potential inheritance conflicts arising from multiple inheritance applies equally to multiple inheritance of meta-relationships, and the diagrams, although depicting meta-entities (in boxes) may be read as though the boxes represent meta-relationships.

6.2.9 Arity of meta-relationships³⁾

The CDIF semantic metamodel, and any extensions, must be defined using binary meta-relationships rather than n-ary meta-relationships. (Note that the functionality of n-ary relationships is covered in the Data Models subject area in the CDIF semantic metamodel, see ISO/IEC 15476-4:—, *Information technology — CDIF semantic metamodel — Part 4: Data models*.)

6.2.10 Mutual exclusivity of meta-relationships

In metamodels mutual exclusivity of meta-relationships is documented as a constraint on the meta-relationships that are in the exclusivity group.

6.3 Subject areas

6.3.1 Explicit and implicit use of *CollectableMetaObjects* in subject areas

Subject areas may contain some *CollectableMetaObjects* that are explicitly defined and/or used and, may contain some that are implicitly used through inheritance.

A meta-object is used in the subject area (and thus included in Clause 10, Specification of the subject area) when:

³⁾ The arity of a relationship may also be called the degree of the relationship. A binary relationship has an arity of two; a ternary relationship has an arity of three, etc.