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Information technology — CDIF semantic metamodel —

Part 3: Data definitions

Technologies de l'information — Métamodèle sémantique CDIF — Partie 3: Definition de données

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Foreword

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

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

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

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

ISO/IEC 15476-3 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and system engineering*.

ISO/IEC 15476 consists of the following parts, under the general title *Information technology — CDIF semantic metamodel*:

— *Part 1: Foundation*

— *Part 2: Common*

— *Part 3: Data definitions*

— *Part 4: Data models*

— *Part 5: Data flow models*

— *Part 6: State/event models*

Introduction

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

ISO/IEC 15474-1:2002**,** *Information technology - CDIF framework - Part 1: Overview* and ISO/IEC 15474-2**,** *Information technology - CDIF framework - Part 2: Modelling and extensibility* should be read first when initially exploring CDIF. The first explains the overall CDIF architecture and how the family of standards fits together. The second explains the scope, and modelling approach in CDIF. The CDIF meta-metamodel and extensibility mechanism are also defined in that document.

This International Standard explains the data definitions subject area of the CDIF semantic metamodel, which defines the primitive data types and the objects which are used for structured data. The CDIF semantic metamodel is used to ensure that the information transferred by tools communicating using CDIF is expressed with an agreed meaning.

This International 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: Subject area overview:

This Clause gives an overview of the coverage of this subject area.

— Clause 7: Subject area summary:

This Clause gives an overview of the content of this subject area.

— Clause 8: Subject area specification:

This Clause gives the formal specification of all the objects defined in the subject area, and the formal reference to those used, but not defined in the subject area.

This document is intended to be used by anyone wishing to understand and/or use CDIF. This document provides a definition of a single subject area of the CDIF semantic metamodel. 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.

This document, ISO/IEC 15474-1:2002*, Information technology - CDIF framework - Part 1: Overview,* and the 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 International 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; and

— Multiple meta-layer modelling.

Information technology — CDIF semantic metamodel —

Part 3:
Data definitions

1 Scope

The CDIF family of International 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 language that is defined for the transfer format also has applicability as a general language for import/export from repositories. The CDIF semantic metamodel defined for CASE also has applicability as the basis of standard definitions for use in repositories.

The International Standards which 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.

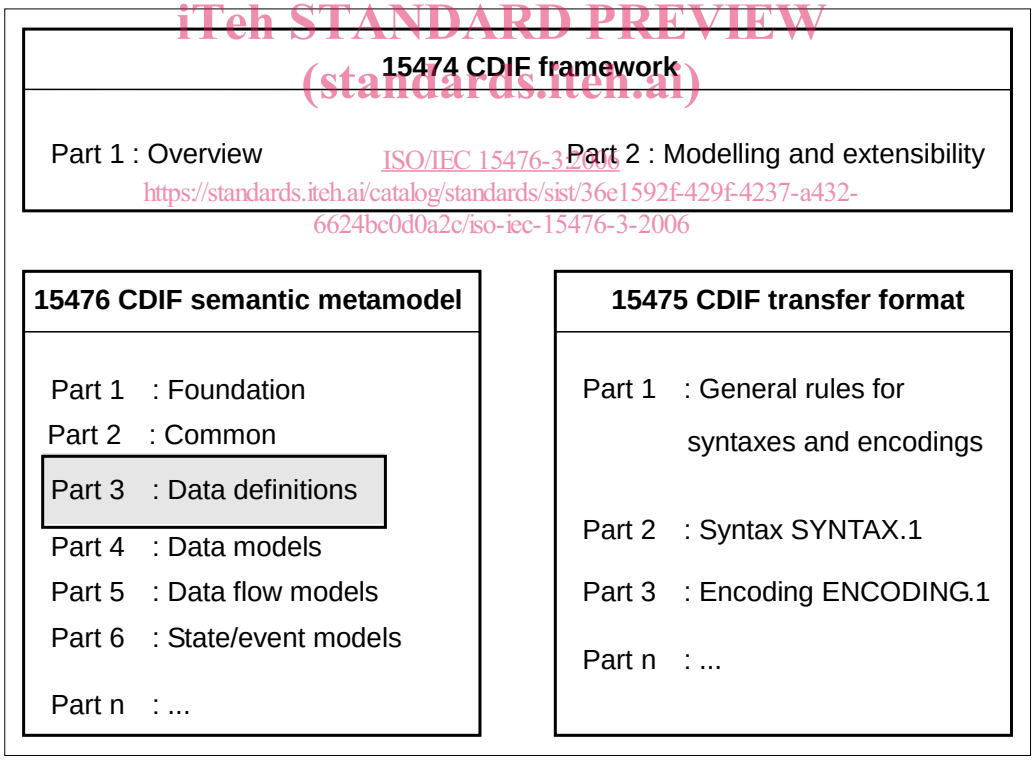

Figure 1 – CDIF family of International Standards

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

This International Standard defines the Data Definition Subject Area of the CDIF semantic metamodel. This subject area contains meta-objects that are used as the basis of the data components of other subject area standards, and also meta-relationships and meta-attributes that are applicable to all data-related meta-objects.

2 Conformance

2.1 General

A product is fully standards conformant to a CDIF subject area standard if and only if it is input-conformant, output-conformant and round-trip conformant to each and every *MetaEntity*, *MetaRelationship*, *MetaAttribute*, and *AttributableMetaObject* which is defined and/or used in that standard, and it is also CDIF architecture conformant. A product may be partially input-conformant, and/or partially output-conformant, and/or partially round-trip conformant to a CDIF subject area standard.

2.2 Input conformance

Input conformance for a specific *MetaEntity*, *MetaRelationship*, *MetaAttribute*, or *AttributableMetaObject* (short: *CollectableMetaObject*) is determined by applying the following test:

A set of meta-data containing all meanings and structures standardized by a CDIF subject area is imported by the product under test. Then the meta-data which has arrived in the product is examined. The following options exist for the relation between the input (CDIF) meta-data and the imported (product) meta-data:

For a specific *CollectableMetaObject*:

1 The product is input conformant if each instance of the specific *CollectableMetaObject* has arrived in the product without change of meaning or structure. If the *CollectableMetaObject* is a meta-entity or meta-relationship, its structural relationships to other *CollectableMetaObjects* have been preserved. If the *CollectableMetaObject* is a meta-attribute, the value of the meta-attribute has been preserved.

2 The product is input morphing conformant if each instance of the specific *CollectableMetaObject* has arrived in the product, but with some changes in meaning or structure. If the *CollectableMetaObject* is a meta-attribute, the value(s) for some instances of the meta-attribute have changed.

3 The product is not input conformant for that *CollectableMetaObject* if neither of the previous tests is satisfied.

2.3 Output conformance

Output conformance for a specific *CollectableMetaObject* is determined by applying the following test:

For the product being tested, a set of meta-data that includes all possible meanings and structures representable in that product is exported. Then the meta-data that has been exported is examined. The following options exist for the relation between the product's meta-data and the exported (CDIF) meta-data:

For a specific *CollectableMetaObject*:

1 The product is output conformant if all of the meaning and structure for the specific *CollectableMetaObject* has been represented as meta-data in the product and has been exported as one or more instances of that *CollectableMetaObject*. If the *CollectableMetaObject* is a meta-attribute, the correct value of the meta-attribute has been exported.

2 The product is output morphing conformant if each instance of meta-data in the product that has the same meaning and structure as the *CollectableMetaObject* has been exported, but some instances have been exported as a different *CollectableMetaObject* or some of the meaning and structure has been changed.

3 If the product does not represent the meaning and structure associated with the *CollectableMetaObject*, output conformance for that *CollectableMetaObject* is not applicable to the product.

4 In all other cases, the product is not output conformant for that *CollectableMetaObject*.

2.4 Round-trip conformance

Round-trip conformance for a specific *CollectableMetaObject* is determined by applying the following test:

A set of meta-data containing all meanings and structures standardized by a CDIF subject area is imported by the product under test. Then the meta-data is exported again. The following options exist for the relation between the input meta-data and the output meta-data:

For a specific *CollectableMetaObject*:

1 The product is round-trip conformant if the meaning and structure of each instance of the *CollectableMetaObject* is preserved without changes during the round-trip. For a vendor to claim round-trip conformance, it is also necessary for the tool to be able to perform create, read, update, and delete operations on the imported (product) meta-data corresponding to the instances of the *CollectableMetaObject*.

2 The product is round-trip morphing conformant if each instance of the input *CollectableMetaObject* is preserved, but with some changes in meaning and/or structure. If the *CollectableMetaObject* is a meta-entity or meta-relationship, some of its instances' structural relationships to other *CollectableMetaObjects* have changed, or some instances have been transformed into other *CollectableMetaObjects*, or instances of other *CollectableMetaObjects* have been transformed into instances of the *CollectableMetaObject.* If the *CollectableMetaObject* is a meta-attribute, the values of some instances of the meta-attribute have changed or the domain of the meta-attribute has changed.

3 In all other cases, the product is not round-trip conformant for that CollectableMetaObject.

3 Normative references

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

ISO 31-1:1992 *Quantities and units – Part 1: Space and time*

ISO 4217:2001, *Codes for the representation of currencies and funds*

ISO/IEC 9945-1:1996, *Information technology – Portable Operating System Interface (POSIX) –Part 1: System Application Program Interface (API) [C Language]*

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

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

ISO/IEC 15474-2, *Information technology — CDIF framework — Part 2: Modelling and extensibility*

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

ISO/IEC 15476-2, *Information technology — CDIF semantic metamodel — Part 2: Common*

ISO/IEC 15476-4 *Information technology — CDIF semantic metamodel — Part 4: Data models*

CHARACTER SETS, IANA, available at <http://www.iana.org/assignments/character-sets>

4 Terms and definitions

For the purposes of this document, the following definitions apply. Unless otherwise noted, the definitions are specific to this International Standard.

4.1 From other International Standards

4.1.1 ISO/IEC 15474-1

This part of ISO/IEC 15476 makes use of the following terms defined in ISO/IEC 15474-1:

CDIF
CDIF family of standards
CDIF semantic metamodel
CDIF meta-metamodel
CDIF transfer
Instance
Meta-attribute
Meta-entity
Metamodel
Meta-object
Meta-relationship
Model
Subject area
Transfer
Transfer format

4.1.2 ISO/IEC 13238-1

This part of ISO/IEC 15476 makes use of the following terms from ISO/IEC 13238-1:

Exporter
Importer

4.1.3 For this International Standard

For the purpose of this part of ISO/IEC 15476 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, diagramming and definition conventions

Conventions for naming, diagramming, describing and defining meta-objects can be found in Clause 7 of the framework document (ISO/IEC 15474-2:2002*, Information technology - CDIF framework - Part 2: Modelling and extensibility*).

5.2 Abbreviations

The following abbreviation is used in this International Standard:

CDIF CASE Data Interchange Format (originally)

6 Data definition subject area overview

6.1 Introduction

The Data Definition Subject Area provides support for describing data objects and provides a data typing scheme. It allows for simple and complex structures, array and pointer qualification and domain specification. The Data Definition Subject Area diagrams are shown in Figure 9 through Figure 14.

6.2 Data Typing

A data type is described by one or more Attributes, and each of these Attributes may have a defined data type, represented by the meta-entity DataType. This Subject Area does not cover the internal representation of information within the basic data types; it only covers the concept of the type of information represented.

Figure 3 shows a fragment of the meta-model illustrating how data typing is represented. Figure 4 is an instance diagram of the model elements in Figure 3. Note that in the instance diagrams, values of meta-attributes (usually Name) are only given where they are required.

The data type of each Attribute is defined by relating it to the meta-entity DataType and its subtypes. These are described in subclauses 6.8 to 6.11. In the instance diagrams, the most appropriate subtype of DataType is used.

The meta-attribute Name of the meta-entity Attribute allows a local name to be defined for the attribute. If no value is given, then it is assumed that the name is the same as that of the underlying DataType. A default value for the Attribute can be defined using the meta-attribute DefaultValue, as can the optionality, using the meta-attribute IsOptional (The meta-attributes, DefaultValue and IsOptional, are defined in ISO/IEC 15476-4 *Data models*).

6.3 The General Structuring Mechanism

6.3.1 Introduction

Support for the decomposition and structuring of objects into other objects, and the reuse of definitions, is provided by a general structuring mechanism. This mechanism is defined in ISO/IEC 15476-2:2002*, Information Technology - CDIF Semantic Metamodel - Part 2: Common*, and is also used in other CDIF subject areas.

In this subject area DataTypes may be structured. Structuring of DataTypes is performed using the general structuring mechanism because its definition may be used for several objects in different contexts.

6.3.2 Meta-entities and Meta-relationships

The general structuring mechanism used in this subject area makes use of the following meta-entities:

- ComponentObject
- DefinitionObject

and the following meta-relationships:

- DefinitionObject.Contains.ComponentObject
- ComponentObject.References.DefinitionObject.

Figure 2 shows the part of meta-model for the general structuring mechanism related to meta-entity DataType.

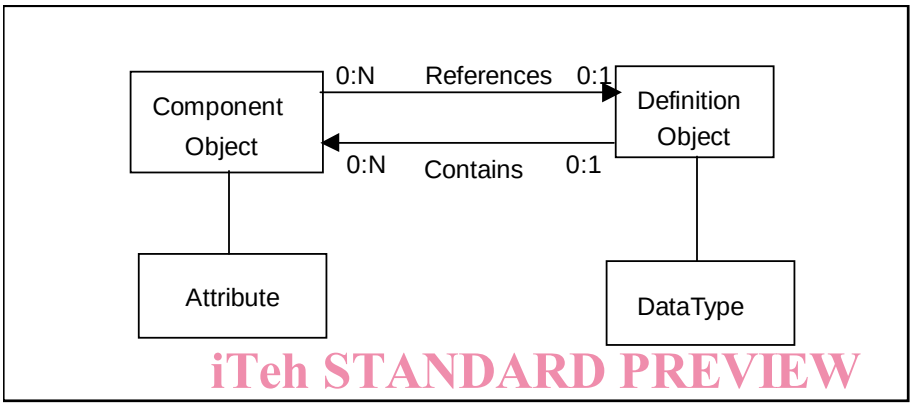

Figure 2 – Part of general Structuring Mechanism for data definitions subject area

Figure 3 and Figure 4 show how the general structuring mechanism represent a hierarchical data structure. The combination of the meta-relationship DefinitionObject.Contains.ComponentObject which is used for data structure and the meta-relationship ComponentObject.References.DefinitionObject which is used for data declaration is shown in Figure 3. The sample instance diagram is Figure 4. In this case, two data named **Customer** and **Order** are defined. Both data definition have fixed length sting type named **CustomerNumber.**

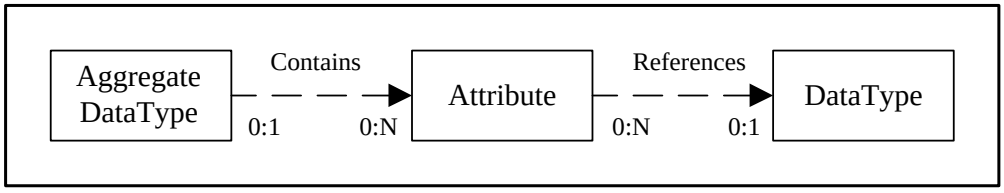

Figure 3 – Meta-model fragment for simple attribution with defined DataTypes

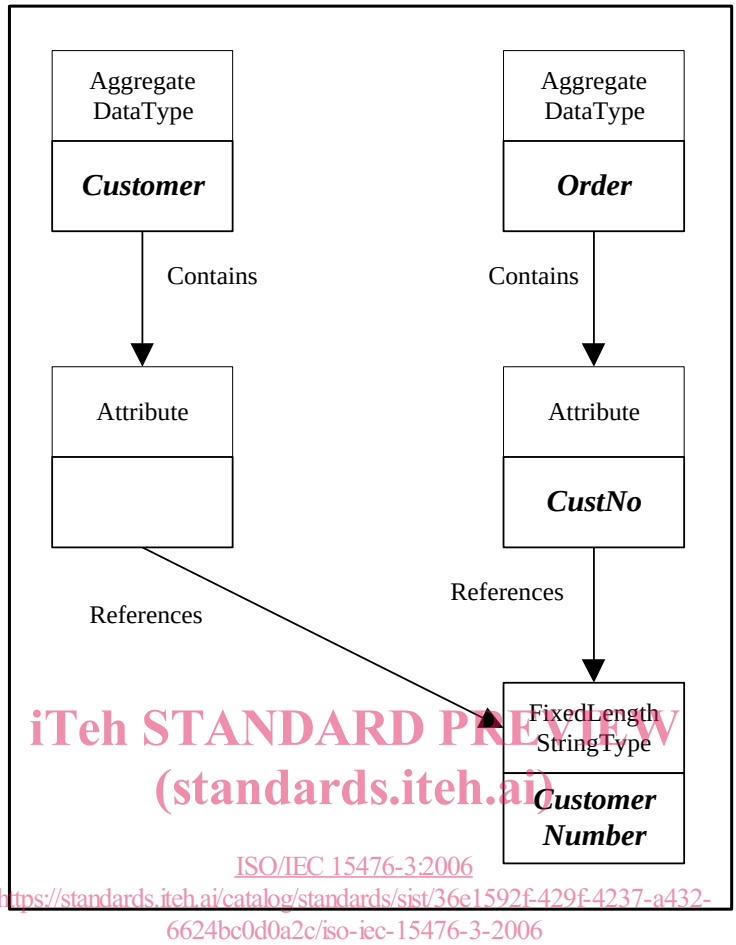

Figure 4 – Instance Diagram showing simple attribution with defined DataTypes

6.3.3 DefinitionObject and ComponentObject

DefinitionObject serves as an abstract supertype for all decomposition and structure definitions that may be reused. A *DefinitionObject* represents the definition of a *ComponentObject*, using meta-relationship *ComponentObject.References.DefinitionObject*. A *DefinitionObject* may contain *ComponentObjects*, using the *DefinitionObject.Contains.ComponentObject* meta-relationship. The *ComponentObjects* contained in a *DefinitionObject* represent the components of the definition.

Both *ComponentObject* and *DefinitionObject* represent abstract concepts and thus shall not be instantiated. Instead, appropriate subtypes, provided by this or other subject areas, are used for instantiating data definitions.

A subtype of *DefinitionObject* may be referenced by any number of *ComponentObjects* indicating that all those *ComponentObjects* share the same definition. For example, in Figure 5, *Attributes* ***a*** and ***b*** share the same definition, *AggregateDataType* ***MyStruct***.

Instances of the subtypes of *ComponentObject* are used to describe the structure of a deta described by a *DefinitionObject*. There may be any number instances of *ComponentObjects* per instance of *DefinitionObject*. In Figure 5, *Attributes* ***x*** and ***y*** comprise the structure of ***MyStruct***.