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CDIF - Integrated Meta-model Common Subject Area		

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Interim Standard

EIA/IS-112

CDIF

CASE Data Interchange Format
A Division of Electronic Industries Association

**CDIF Integrated Meta-model
Common Subject Area**

December 1995

**Electronic Industries Association
CDIF Technical Committee**



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PREFACE

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

EIA/IS-106 CDIF - CASE Data Interchange Format - Overview and EIA/IS-107 CDIF - Framework for Modeling 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 modeling approach in CDIF. The CDIF Meta-meta-model and extensibility mechanism are also defined in that document.

This standard explains the Common subject area of the CDIF Integrated Meta-model, that defines information common to all other objects in the Integrated Meta-model. The CDIF Integrated Meta-model is used to ensure that the information transferred by tools communicating using CDIF is expressed with an agreed meaning.

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.

The material contained in this publication was formulated under the cognizance of the CDIF Technical Committee.

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1. SCOPE

The CDIF Family of Standards is primarily designed to be used as a description of a mechanism for transferring information between CASE 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 Integrated Meta-model defined for CASE 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 *EIA/IS-106 CDIF - CASE Data Interchange Format - Overview*. These standards cover the overall framework, the transfer format and the CDIF Integrated Meta-model.

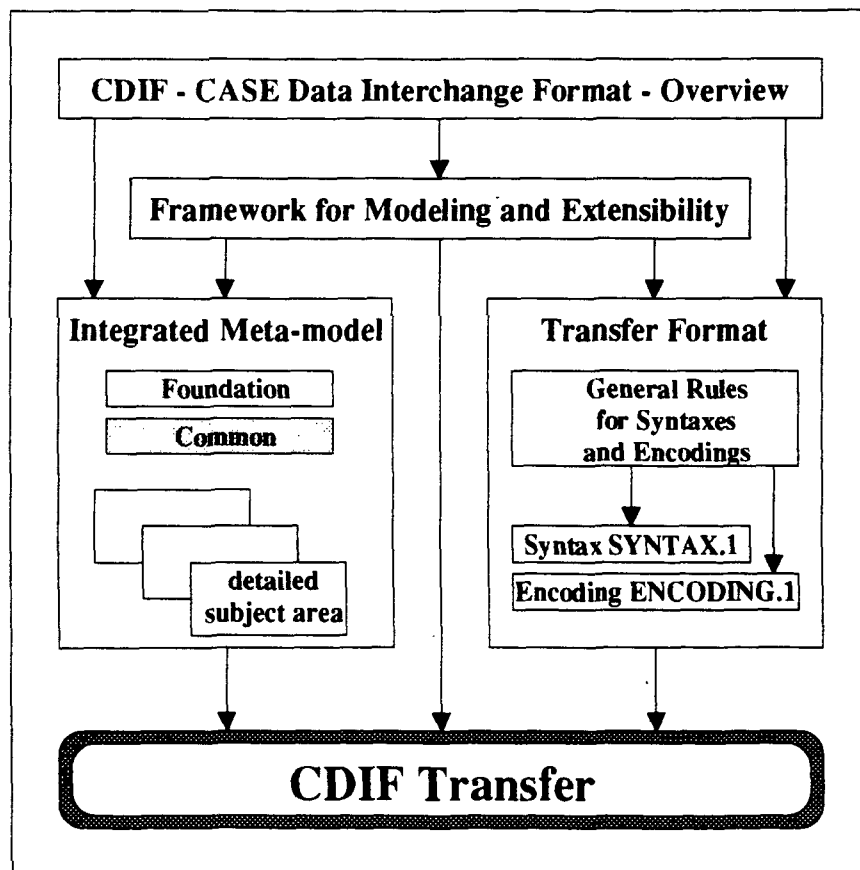


Figure 1
Position in the CDIF Family of Standards

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 standard defines the Common Subject Area of the CDIF Integrated Meta-model. This subject area contains meta-objects that are used as the basis of the other subject area standards, and also meta-relationships and meta-attributes that are applicable to all meta-objects.

2. INTRODUCTION

2.1 Audience

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 Integrated Meta-model. It is suitable for:

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

The document *EIA/IS-106 CDIF - CASE Data Interchange Format - Overview* and the document *EIA/IS-107 CDIF - Framework for Modeling 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 modeling
- CASE tools
- Information repositories
- Data dictionaries
- Multiple meta-layer modeling.

2.2 Structure of this Document

This document is organized into the following sections:

Section 1 'Scope'

This describes the CDIF Family of Standards and positions the current document within the set of documents.

Section 2 'Introduction'

This describes the intended audience, structure and conventions used in the document.

Section 3 'Structure of Subject Area Definition'

This describes in detail the structure of the subsequent sections of this standard including the notation and layout of the diagrams and the detailed definitions.

Section 4 'Subject Area Overview'

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

Section 5 'Subject Area Detailed Definitions'

This gives the detailed definitions of all the objects used in the subject area.

Section 6 'Referenced Meta-object Definitions'

This gives the detailed definitions of objects that are not used in the subject area defined in this Standard, but are referenced by objects that are. These definitions are included to avoid the need to reference multiple standards to obtain the complete definition of the current subject area.

Appendix A 'Questions and Answers'

This includes detailed responses to questions that have been raised by those reviewing this document. It is intended that the inclusion of these will aid the reader in understanding this document, and related issues concerning CDIF.

Glossary

The Glossary contains definitions of terms used within this Standard.

References

The References section contains references to other standards and documents used within this Standard.

Index

A comprehensive index is provided.

2.3 Conventions

The typographical and naming conventions defined below are used throughout the CDIF Family of Standards.

- Double quotes are used to introduce new terms (e.g., "model layer")
- Bold type is used for emphasis (e.g., this is **important**)
- All meta-objects and meta-meta-objects in CDIF (in meta-models and meta-meta-models) are named by concatenating all the words that name the meta-object or meta-meta-object; the first letter of each word is upper-case, the rest are lower-case. These names are shown in italic (e.g., *MetaAttribute*, *AttributeDerivation*, *IsDrawnUsing*, *IsOptional*)
- The names of objects and values for meta-attributes that appear in examples and instance diagrams are shown in bold italic (e.g., ***Customer***, ***TRUE***, ***100***)

Full details of the CDIF Graphical Notation used in the Meta-model and Meta-meta-model can be found in *EIA/IS-107 CDIF - Framework for Modeling and Extensibility*. A summary of the major concepts is given in Section 3.2.3, Diagram(s).

3. STRUCTURE OF SUBJECT AREA DEFINITION

3.1 Introduction

The following subsections describe how the subject area is defined in the remainder of this document. The subject area is first introduced in the Subject Area Overview Section, and the detailed definitions of the objects contained in the subject area are given in the Subject Area Definitions Section.

3.2 Structure of Subject Area Overview

3.2.1 Summary

The Subject Area Overview Section consists of the following sub-sections:

- Description of Major Concepts
- Diagram(s)
- AttributableMetaObject Hierarchy
- MetaEntity Summary
- MetaRelationship Summary

3.2.2 Description of Major Concepts

This provides a textual description of the major concepts in the subject area. It explains the coverage of this subject area and outlines what it is capable of representing.

3.2.3 Diagram(s)

Included in the Subject Area Overview is one meta-model diagram. This diagram is intended to present graphically an overview of the meta-entities and meta-relationships used in this subject area. All CDIF subject area diagrams use the following diagramming notation conventions.

Meta-entities used in the subject area are shown as rectangular boxes, with the name of the meta-entity on a white background. An example is the meta-entity *A* in Figure 2. An additional special notation may be used to represent meta-entities on diagrams of meta-models. If the meta-entity is not used in the subject area, but is used in another subject area and is included for clarity, the box shall be shaded. An example is the meta-entity *B* in Figure 2.

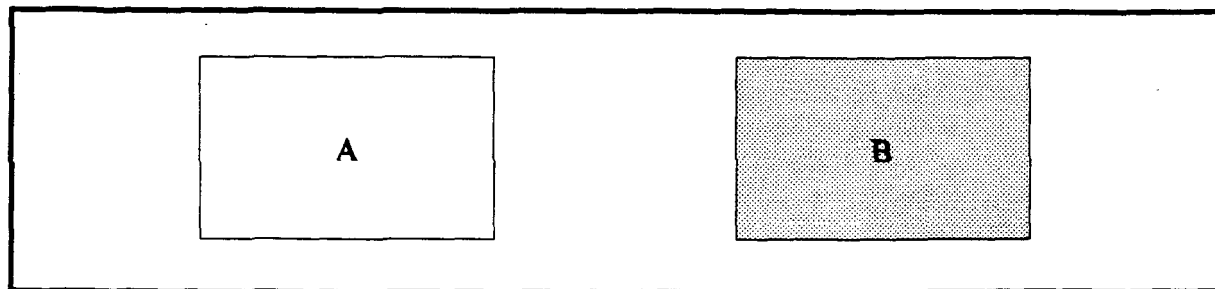


Figure 2
Conventions for Representing Meta-entities

Meta-relationships are normally represented by a line joining the source and destination entities, with the name of the meta-relationship given next to the line. An arrow on the line indicates the direction in which to read the name. The meta-relationship *C* in Figure 3 is an example of this. Additionally, two special notations may be used to represent meta-relationships on diagrams of meta-models.

If a meta-relationship is included in the diagram for clarification, but it is not used in the subject area, the text of the meta-relationship name shall be back-shaded. This is shown for the meta-relationship *D* in Figure 3.

If a supertype meta-entity that participates in a meta-relationship is not included in the diagram, the inherited meta-relationship shall be shown on the diagram as a broken line to/from the inheriting subtype meta-entity. This is shown for the meta-relationship *E* in Figure 3.

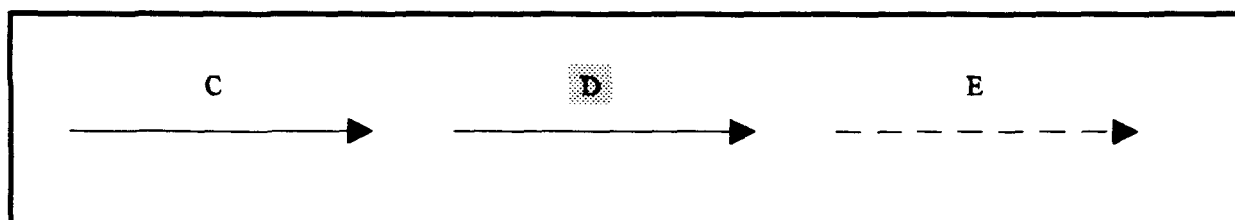


Figure 3
Conventions for Representing Meta-relationships

Full details of the CDIF Graphical Notation used in the Meta-model and the Meta-meta-model can be found in *EIA/IS-107 CDIF - Framework for Modeling and Extensibility*.

3.2.4 AttributableMetaObject Hierarchy

The AttributableMetaObject Hierarchy in the Subject Area Overview section contains all the meta-entities and meta-relationships used in the subject area. It also identifies all supertypes required to relate the meta-objects used back to *RootObject*. Other subtypes of objects shown in the hierarchy, where neither they nor any of their subtypes are used in this subject area, are not shown.

The AttributableMetaObject Hierarchy is presented as an indented list of meta-object names. The indentation indicates the subtyping; all names indented below a given name are subtypes of that meta-object. For example, if *Car* and *Truck* are both subtypes of *Vehicle*, this would be shown as follows:

```
Vehicle
  Car
  Truck
```

A meta-entity or meta-relationship and all its subtypes can be duplicated in the hierarchy due to multiple inheritance. Where this occurs, the duplicate entries are shown in *italics*.

The overall AttributableMetaObject supertype, *RootObject*, defined in *EIA/IS-111 CDIF - Integrated Meta-model - Foundation Subject Area*, is shown at the top of the hierarchy.

3.2.5 MetaEntity and MetaRelationship Summaries

Summaries are given of all the meta-entities and meta-relationships used in the Subject Area. The meta-entity definitions are given first, in alphabetical order, followed by the meta-relationship definitions, also in alphabetical order.

For each meta-entity used in the subject area, all the meta-attributes, both inherited and local, are listed. The inherited meta-attributes are shown first, in *italics*, sequenced alphabetically within parent meta-entity. The local meta-attributes are then listed alphabetically in normal font. The optionality, whether mandatory or optional, of each meta-attribute is given.

For each meta-relationship all the meta-attributes are listed sequenced alphabetically. Inherited and local meta-attributes are shown in the same way as for meta-entities. The optionality of each meta-attribute is given.

3.3 Structure of Subject Area Detailed Definitions

3.3.1 Summary

The Subject Area Detailed Definitions section consists of the following sub-sections:

- Subject Area Definition
- MetaEntity Definitions
- MetaRelationship Definitions

3.3.2 Subject Area Definition

This is the formal definition of the instance of the meta-entity called *SubjectArea* (SA). It contains the information listed in Table 1.

Table 1
Contents of Subject Area Definition

5.2 Subject Area Definition
NAME..... subject area name
CDIFMETAIDENTIFIER
DESCRIPTION
USAGE.....
ALIASES
CONSTRAINTS.....
VERSIONNUMBER.....

3.3.3 MetaEntity Definitions

The definition of each meta-entity used in the subject area is structured according to the classes of information listed in Table 2.

For each meta-entity:

- Inherited meta-attributes are listed by supertype meta-entity in a top-down hierarchical order. Within each sub-list, meta-attributes are listed alphabetically.
- Inherited meta-relationships are grouped by source meta-entity (listed in alphabetical order). Within each group, the inherited meta-relationships are sorted alphabetically by "verb" name and then alphabetically by destination meta-entity name. Inherited abstract meta-relationships are not listed.
- Local meta-attributes are listed alphabetically
- Detailed local meta-attribute descriptions are listed alphabetically.

Structure of Subject Area Definition

Table 2
Contents of Meta-entity Definition

5.N.N	Meta-entity Name
NAME	meta-entity name
CDIFMETAIDENTIFIER	
SUBTYPEOF	List of direct supertypes of the meta-entity... meta-entity name [not] in this SA
SUPERTYPEOF	List of direct subtypes of the meta-entity within this subject area... meta-entity name
DESCRIPTION	
USAGE.....	
ALIASES	
CONSTRAINTS.....	
TYPE	
INHERITED META-ATTRIBUTES	
	List of meta-attributes inherited from all supertypes of the meta-entity, with the name of the meta-object for which the meta-attribute is defined...
	meta-attribute name from meta-entity name [not] in this SA
LOCAL META-ATTRIBUTES	
	List of meta-attributes defined for the meta-entity...
	meta-attribute name
INHERITED META-RELATIONSHIPS	
	List of instantiable meta-relationships inherited from all supertypes of the meta-entity...
	meta-relationship name [not] in this SA
LOCAL META-RELATIONSHIPS	
	List of meta-relationships defined for the meta-entity...
	meta-relationship name
Full definitions of all local meta-attributes appear at this point. See Table 3 for format of local meta-attribute definitions.	

Table 3
Contents of Local Meta-attribute Definition

META-ATTRIBUTE NAME.....	meta-attribute name
CDIFMETAIDENTIFIER	
DESCRIPTION	
USAGE.....	
ALIASES	
CONSTRAINTS.....	
DATA TYPE	
DOMAIN	
LENGTH.....	
ISOPTIONAL.....	

3.3.4 MetaRelationship Definitions

The definition of each meta-relationship used in the subject area is structured according to the classes of information listed in Table 4.

For each meta-relationship:

- Inherited meta-attributes are listed by supertype meta-relationship in a top-down hierarchical order. Within each sub-list, meta-attributes are listed alphabetically
- Local meta-attributes are listed alphabetically
- Detailed local meta-attribute descriptions are listed alphabetically.

Table 4
Contents of Meta-relationship Definition

5.N.N	Full Meta-relationship Name
NAME	meta-relationship name
CDIFMETAIDENTIFIER	
SUBTYPEOF	List of direct supertypes of the meta-relationship... meta-relationship name [not] in this SA
SUPERTYPEOF	List of direct subtypes of the meta-relationship within this subject area... meta-relationship name
MINSOURCECARD	Minimum source meta-entity cardinality
MAXSOURCECARD	Maximum source meta-entity cardinality
MINDESTCARD	Minimum destination meta-entity cardinality
MAXDESTCARD	Maximum destination meta-entity cardinality
DESCRIPTION	
USAGE	
ALIASES	
CONSTRAINTS	
INHERITED META-ATTRIBUTES	
List of meta-attributes inherited from all supertypes of the meta-relationship, with the name of the meta-object for which the meta-attribute is defined...	
meta-attribute name	from meta-relationship name [not] in this SA
LOCAL META-ATTRIBUTES	
List of meta-attributes defined for the meta-relationship...	
meta-attribute name	
Full definitions of all local meta-attributes appear at this point. See Table 3 for format of local meta-attribute definitions.	

3.4 Structure of Referenced Meta-object Definitions

This section contains the formal definitions of meta-objects referenced by the definitions of meta-objects used in the subject area. These will include the *AttributableMetaObject RootObject*, since this is the root of the *AttributableMetaObject* Hierarchy, and it may also include other meta-entities and meta-relationships.

The definitions are given in the following order: *AttributableMetaObject*, meta-entities, then meta-relationships. Within each section, they are listed in alphabetical order. The definition layout for the *AttributableMetaObject* is the same as that of the meta-entity; both meta-entity and meta-relationship definitions follow the same layout as that defined for the Subject Area Detailed Definitions section.

4. SUBJECT AREA OVERVIEW

4.1 Description of Major Concepts

4.1.1 Introduction

The Common Subject Area is intended to cover concepts such as synonyms, decomposition, and audit data, that are common or useful to all of the CDIF Integrated Meta-model. The Common Subject Area covers aspects required for all objects described in a CDIF Transfer. Concepts defined here include alternate names, details of the tool user who created or updated any object, and constraints on objects.

4.1.2 Classification

The CDIF Integrated Meta-model is hierarchical in nature. The top of the Integrated Meta-model is *RootEntity*. *RootEntity* establishes a set of common meta-attributes and meta-relationships to be inherited by all meta-objects. *RootEntity* is an abstract supertype that should not be instantiated and shall not have any supertypes defined.

There are two main subtypes defined for *RootEntity* - *SemanticInformationObject* and *PresentationInformationObject*. The other subtypes are *AbstractionLevel*, *AlternateName*, *TextualConstraint*, and *ToolUser*. These are all described in the following sub-sections.

4.1.3 Semantic Information

SemanticInformationObject is the supertype of all meta-entities defined within the semantic information portion of the CDIF Integrated Meta-model. These describe model objects (e.g., objects in a general business model). All meta-entities that convey semantic information, defined in the set of standards forming the CDIF Integrated Meta-model, other than *RootEntity* and *SemanticInformationObject*, are defined as either direct or indirect subtypes of *SemanticInformationObject*.

The meta-entity *SemanticInformationObject* is given local meta-attributes of *BriefDescription* and *FullDescription*.

In this Subject Area, *SemanticInformationObject* has three subtypes: *DataObject*, *ProcessObject*, and *Derivation*.

4.1.4 Presentation Information

PresentationInformationObject is the supertype for all the meta-entities defined within the presentation information portion of the CDIF Integrated Meta-model. These contain the graphical information about the associated semantic models. For example, the location and shape of an object in the semantic model.

4.1.5 Naming

The concept of a "Name" for an object varies considerably from method to method and object to object. In some cases, an object can have a short name, a long name and alternates or synonyms for each. In other cases, no distinct name is required. Due to these differences, no *Name* meta-attributes have been provided at a high level in the *AttributableMetaObject* Hierarchy to be automatically inherited. Name meta-attributes have been added specifically as required. These meta-attributes have been called *Name* and *LongName* when used.

Often objects can be given alternate names, or synonyms. These are optional, and there may be more than one provided. To cater for this in a standard manner, an *AlternateName* meta-entity has been provided which can be related to any instance of *RootEntity* and its other subtypes, except *AlternateName*. This provides a simple way of defining such alternates, but it shall only be used where either *Name*, *LongName*, or both, are provided as meta-attributes of the meta-entity to which it is related. Alternatives for *Name* and *LongName* are recorded in the *OtherName* and *OtherLongName* meta-attributes of *AlternateName*, respectively. *AlternateName* shall not be used to provide a name for an object where no *Name* or *LongName* meta-attribute has been provided since a name is only **alternate** where there is one already defined. When it is necessary to add a name to an unnamed object, such naming should be done through the use of extensibility by adding an explicit *Name* meta-attribute.

Consider a data type called ***CustomerNumber***; it may also be known by other names in the system being modeled, including ***CustomerNo*** and ***CustNo***. These are synonyms for the same data type. The name ***CustomerNumber*** would be held in the *Name* meta-attribute of the instance of *DataType*. Each of the synonyms would be held in a separate instance of *AlternateName* in the *OtherName* meta-attribute. These two instances of *AlternateName* would be related to the instance of *DataType* by the meta-relationship *RootEntity.Has.AlternateName*. This set of meta-objects records that the data type has two synonyms.

Now consider how to record which synonym is being used in any particular context - this is where the meta-relationship *RootEntity.Uses.AlternateName* is required. The following example, where different organizations refer to vendors as either Vendors, Contractors, or Suppliers, shows how the CDIF Integrated Meta-model supports this concept. Assume that the part of a subject area dealing with contracts includes the *Organization* and *Resource* meta-entities and a meta-relationship called *Organization.Utilizes.Resource*. Assume, also, that the *Vendor* instance of *Resource* has two *AlternateNames*: *Supplier* and *Contractor*. If an organization, say Reprographics, uses the term *Vendor* to refer to those it relies on for service, this would be recorded with an instance of *Organization.Utilizes.Resource* from the *Reprographics* instance of *Organization* to the *Vendor* instance of *Resource*. If another organization, FoodServices, refers to the vendor for cafeteria operations as a *Supplier*, this would be recorded via an instance of *Organization.Utilizes.Resource* relating the *FoodServices* instance of *Organization* to the *Vendor* instance of *Resource*. But an instance of *RootEntity.Uses.AlternateName* between *FoodServices* and *Supplier* is used to indicate that the *Supplier* *AlternateName* is what FoodServices calls vendors. Figure 4 shows both the subject area fragment and a depiction of the instances discussed in this example.

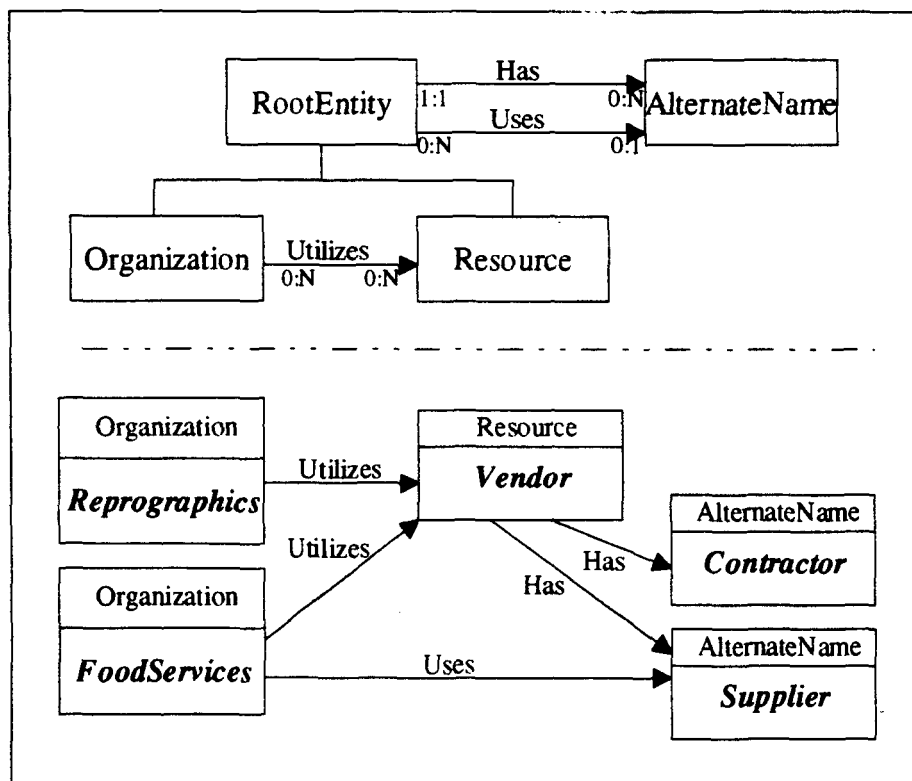


Figure 4
AlternateName Example

4.1.6 Audit Data

The audit data supported by the Common Subject Area are the details of who created and updated any object. This is represented through meta-relationships from *RootEntity* to the *ToolUser* meta-entity.

4.1.7 Constraints

The *TextualConstraint* meta-entity enables constraints to be attached to any semantic object or set of objects. The constraint is expressed in text, either in one of a set of computable languages or in some other formal or informal language. The supported set of languages is defined in Section 4.1.11, Computable Languages.

4.1.8 Derivation

Derivations between objects can be represented through use of the *Derivation* meta-entity, using the *UsedIn* and *ProducedBy* meta-relationships to associate the objects. The *Derivation* meta-entity can be used to describe a weak form of derivation, such as instances of *Entity* being derived from instances of *Store* on a *DataFlowModel*. Stronger forms of derivation can also be described, for example where one object is an implementation of another. The derivation is expressed in text, either in one of a set of computable languages or in some other formal or informal language. These are defined in Section 4.1.11, Computable Languages.

4.1.9 Abstraction Levels

The abstraction level at which any object is used or defined in a user model can be defined through the use of the meta-entity *AbstractionLevel*. The level of abstraction, for example **Conceptual**, **Logical** or **Physical**, is held in the *Name* meta-attribute of an instance of *AbstractionLevel*. All the meta-entities used at that level are then connected to it through the meta-relationship *SemanticInformationObject.IsCategorizedInAbstractionLevel*. A given meta-entity instance can be used in multiple abstraction levels; for example the same definition of Entity **Customer** may be valid at both a conceptual and logical level.

Where an object at a lower level of abstraction is a more concrete description or implementation of an object at a higher level of abstraction, this is recorded using the derivation mechanism described in Section 4.1.8, Derivation. The meta-attribute *IsRealizationOf* on the *Derivation* meta-entity indicates this form of derivation.

4.1.10 Data Object Content

The data content of a *DataObject* can be described by the use of the Data Definition Subject Area, defined in *EIA/IS-113 CDIF - Integrated Meta-model - Data Definition Subject Area*.

4.1.11 Computable Languages

Where meta-attributes may contain definitions of algorithmic processes, the languages that can be used to define the algorithms have been limited to a small set, covering the most appropriate ones for the problem domain. Any other language, either computable or natural, may be used, but the type of the language will not be specified unless extensibility has been used.

The set of allowable languages is defined in Table 5.

Table 5
Allowable Values for Computable Languages and appropriate references¹

Ada	ANSI/MIL-STD-1815A, American National Standard for Information Systems - Reference Manual for the Ada® Programming Language
C	ISO/IEC 9899, International Standard for Programming Languages - C
COBOL	ISO 1989, International Standard - for information systems - programming language - COBOL
FORTRAN	ISO 1539
MUMPS	ANSI/MDC X11.1
PASCAL	ANSI/IEEE 770/X8.97 and ANSI/IEEE 770/X8.160
PL1	ANSI X8.58
SQL	ISO/IEC 9075, Information Technology - Database Languages - SQL
Other	Any language other than those indicated by explicit values of the enumerated type.

¹See the References section of this document for a complete description of the Standards or documents which serve as the specification for the listed Computable Languages.

4.2 Diagram

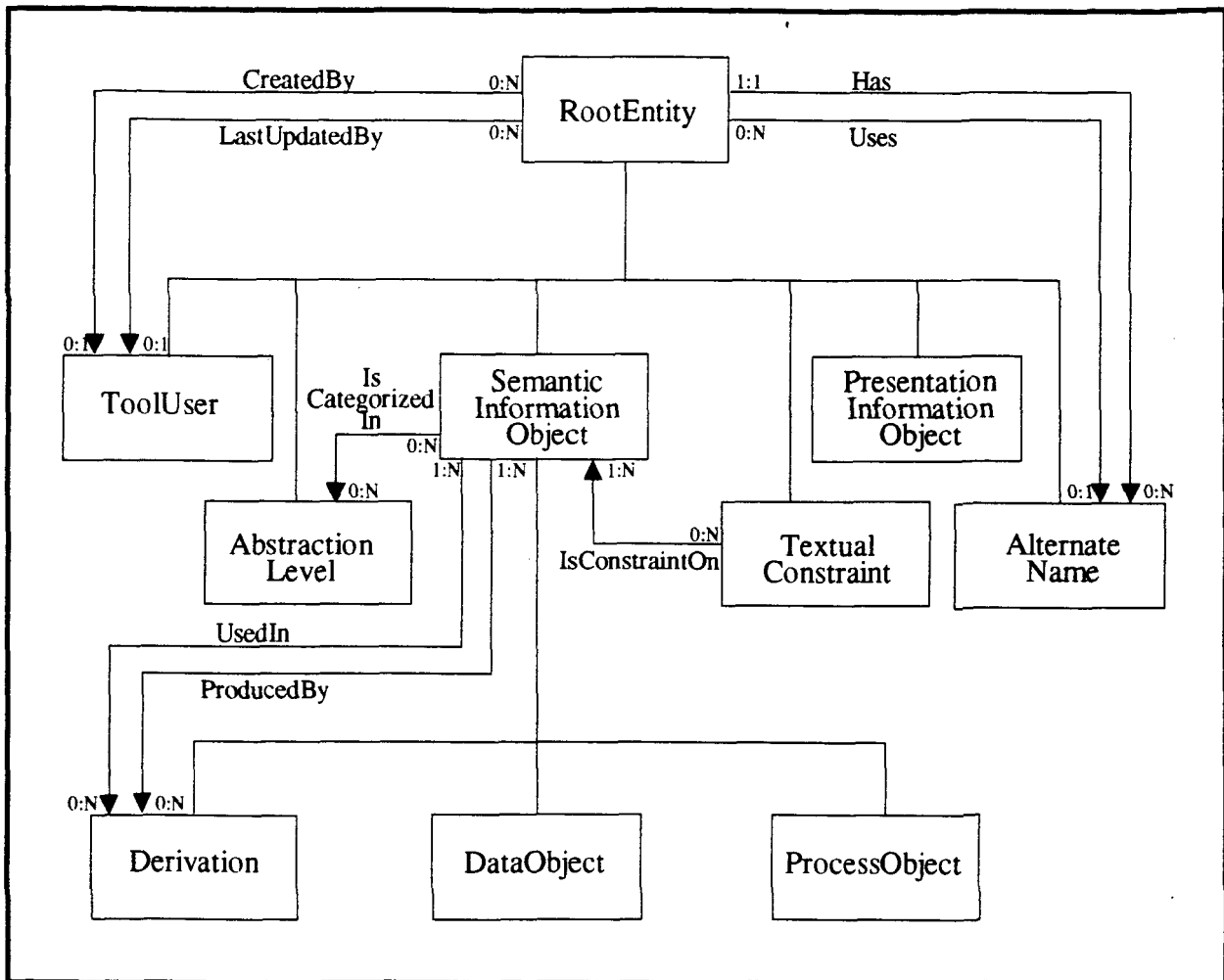


Figure 5
Common Subject Area

4.3 AttributableMetaObject Hierarchy

MetaObjectName	Subject Area ¹
RootObject	not in this SA
RootEntity	in this SA
AbstractionLevel	in this SA
AlternateName	in this SA
PresentationInformationObject	in this SA
SemanticInformationObject	in this SA
DataObject	in this SA
Derivation	in this SA
ProcessObject	in this SA
TextualConstraint	in this SA
ToolUser	in this SA
RootEntity.IsRelatedTo.RootEntity	not in this SA
RootEntity.CreatedBy.ToolUser	in this SA
RootEntity.Has.AlternateName	in this SA
RootEntity.LastUpdatedBy.ToolUser	in this SA
RootEntity.Uses.AlternateName	in this SA
SemanticInformationObject.IsCategorizedIn.AbstractionLevel	in this SA
SemanticInformationObject.ProducedBy.Derivation	in this SA
SemanticInformationObject.UsedIn.Derivation	in this SA
TextualConstraint.IsConstraintOn.SemanticInformationObject	in this SA

¹Those objects in this subject area are defined in Section 5; the others are defined in Section 6.

4.4 MetaEntity Summary

MetaEntity Name

Inherited MetaAttribute Name

Local MetaAttribute Name

Mandatory/Optional

AbstractionLevel

CDIFIdentifier

Mandatory

DateCreated

Optional

DateUpdated

Optional

TimeCreated

Optional

TimeUpdated

Optional

Name

Mandatory

AlternateName

CDIFIdentifier

Mandatory

DateCreated

Optional

DateUpdated

Optional

TimeCreated

Optional

TimeUpdated

Optional

OtherLongName

Optional

OtherName

Optional

DataObject

CDIFIdentifier

Mandatory

DateCreated

Optional

DateUpdated

Optional

TimeCreated

Optional

TimeUpdated

Optional

BriefDescription

Optional

FullDescription

Optional

Name

Optional