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Intelligent transport systems — ITS central data dictionaries

Part 1: Requirements for ITS data definitions

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National foreword

This British Standard is the UK implementation of ISO 14817-1:2015.

The UK participation in its preparation was entrusted to Technical Committee EPL/278, Intelligent transport systems.

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

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Intelligent transport systems — ITS central data dictionaries —

Part 1: Requirements for ITS data definitions

Systèmes intelligents de transport — Dictionnaires de données centrales des ITS —

Partie 1: Exigences pour les définitions des données des ITS

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 ISO documents 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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

This first edition of ISO 14817-1, together with ISO 14817-2, cancels and replaces ISO 14817:2002, which has been technically revised.

ISO 14817 consists of the following parts, under the general title *Intelligent transport systems — ITS data dictionaries*:

— *Part 1: Requirements for ITS data definitions*

— *Part 2: Governance of the Central ITS Data Concept Registry*

— *Part 3: Object identifier assignments for ITS data concepts*

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Introduction

Background

This International Standard has been developed by ISO TC 204, in order to provide a framework for the documentation and registration of data that passes through system interfaces within the intelligent transport systems (ITS) domain. It is designed to maximize interoperability and facilitate information re-use across system interfaces.

Vision statement

This International Standard envisions a harmonized approach to ITS data concepts to promote maximum interoperability of data within the ITS sector by the creation and maintenance of the "Central ITS Data Concept Registry" (CIDCR), supported by interface and application specific ITS data dictionaries, created and maintained in a common and interoperable form, and to ensure the minimization of duplication by clear rules for data concept definition and data concept registry management.

Mission statement

The mission is to develop tools that will promote a holistic, integrated approach involving vehicle technology, infrastructure, and the road user to increase transport safety and efficiency. Specifically, this International Standard defines the principles and concepts; scope; field of application; rules and procedures; definition and concept of operation for the CIDCR and ITS functional data dictionaries; and makes provision for the migration of data concepts from ITS functional data dictionaries to the CIDCR so as to maximize interoperability and minimize proliferation of similar (but inconsistently defined) data concept entries.

This International Standard defines the framework, formats, and procedures used to define information and information exchanges within the ITS sector. This International Standard is designed to be used by the ITS community at large, but should be of special interest to application developers, equipment providers, and data concept registry managers.

This International Standard specifies a set of meta-attributes for ITS data concepts, as well as associated conventions and schemes that enable the description, standardization and management of all exchanged ITS data. Through consistent use of these common structures and associated conventions and schemes, interchange of data and information among the various ITS functional subsystems via their specific application systems can be maximized. This International Standard also supports re-use of data elements and other data concepts across various ITS functional subsystems and their specific application systems.

The formats and processes defined within this International Standard are consistent with implementation(s) of the ISO ITS System Architecture defined in the ISO 14813 Standardization deliverables, particularly ISO 14813-2 and ISO 14813-3. This does not preclude the application of data concept registries using alternative international, regional or national system architecture methodologies or techniques, indeed, common formats and processes will ease migration and interoperability between such approaches.

The ITS data concepts that populate the CIDCR or data dictionary may originate from a Computer-Aided Software Engineering (CASE) tool implementation of the ISO 14813 ITS Reference Architecture, from International Standards for ITS, from national implementations for ITS, or from the submission by relevant users. Data dictionary entries are not limited to those generated by object oriented methodologies.

Document overview

This clause provides an overview of this International Standard. Clause 1 identifies the scope of this part of ISO 14817. Clause 2 identifies requirements for conformance to this part of ISO 14817. Clause 3 identifies references required for proper implementation of this part of ISO 14817. Clause 4 defines terms used in this part of ISO 14817 and Clause 5 lists the abbreviations.

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Clause 6 declares the fundamental ITS data concepts and Clause 7 identifies meta-attributes used to document the data concepts declared in Clause 6.

Annex A prescribes which meta-attributes are required for each type of data concept. Annex B specifies the naming conventions and the process for converting among various naming conventions (e.g. between the ITS descriptive name and the ASN.1 name). Annex C contains a listing of preferred data concepts within the ITS domain. Annex D contains the rules for representing data in a data model, along with examples.

The Bibliography includes a list of documents related to this International Standard.

Other parts

ISO 14817-2 defines the operation of the Central ITS Data Concept Registry (CIDCR). ISO 14817-3 specifies how to assign object identifiers.

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Intelligent transport systems — ITS central data dictionaries —

Part 1: Requirements for ITS data definitions

1 Scope

This part of ISO 14817 specifies the logical structure (framework) and the data content (substance) of intelligent transport systems (ITS) data dictionaries (DDs).

Specifically, this part of ISO 14817 specifies the following:

— framework used to identify and define all data concepts;

— meta-attributes used to describe, standardize and manage each of the data concepts defined within this framework;

— requirements used to record these definitions;

— naming conventions for the data concepts;

— a set of preferred data concepts within the ITS domain;

— data modelling method for defining ITS data concepts, when used.

DDs support data concepts derived from any number of international, regional or national system architecture methodologies and/or techniques. Common data formats and operating procedures will ease migration and interoperability between such approaches.

A data concept registry is an electronic data dictionary that supports some additional features. The CIDCR refers to the specific implementation of an ITS data concept registry that is operated under the auspices of ISO/TC 204. The term “data concept registries” may refer to the CIDCR and/or any other national or regional data concept registry that chooses to conform to this part of ISO 14817.

2 Conformance

This part of ISO 14817 prescribes a conceptual model, not a physical implementation. An implementation of this part of ISO 14817 may use different data concepts, different meta-attributes, or different data concepts and different meta-attributes; however, a conforming implementation of this part of ISO 14817 shall provide an unambiguous mapping to and from the physical implementation model and the conceptual meta-model defined by this part of ISO 14817.

Regional and National DDs have the option of adopting data concept definitions from the CIDCR, but are not required to do so.

Table 1 indicates the conformance requirements of data concept registries and data dictionaries.

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Table 1 — Data dictionary and data concept registry conformance[a]

Feature	Data Dictionary	Data Concept Registry[b]
Support all data concepts[c]	✓	✓
Support all mandatory identification meta-attributes[d]	✓	✓
Support all mandatory definitional meta-attributes[e]	✓	✓
Support all mandatory relational meta-attributes[f]	✓	✓
Support all mandatory representational meta-attributes[g]	✓	✓
Support all mandatory administrative meta-attributes[h]		✓
Electronic storage with automated administrative rules[i]		✓

[a] Annex A identifies which meta-attributes are mandatory for specific data concepts.

[b] For data concept registries, "mandatory" meta-attributes shall also include all "assigned" meta-attributes.

[c] As defined in Clause 6.

[d] As defined in 7.1.

[e] As defined in 7.2.

[f] As defined in 7.3.

[g] As defined in 7.4.

[h] As defined in ISO 14817-2.

[i] As defined in ISO 14817-2.

3 Normative references

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

ISO 14817-3:—[1)], *Intelligent transport systems — ITS data dictionaries — Part 3: Object identifier assignments for ITS data concepts*

ISO/IEC 8824-1:—[2)], *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*

ISO/IEC 9834-1, *Information technology — Procedures for the operation of object identifier registration authorities: General procedures and top arcs of the international object identifier tree*

NIMA TR8350.2, Third Edition – Amendment 1, January 2000, Department of Defence – World Geodetic System 1984, Its Definition and Relationships With Local Geodetic Systems, issued by National Imagery and Mapping Agency (NIMA), US Department of Defence

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14817-3 and the following apply.

4.1
abstract
indication of whether the object class is purely abstract or can be instantiated with member objects; abstract object classes typically have non-abstract specializations

1) To be published.

2) To be published. (Revision of ISO 8824-1:2008)

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4.2
aggregate domain
data concept that defines a grouping of data elements and/or data frames

4.3
ASN.1 name
name of a data concept expressed as a valid "typereference" as defined by ISO/IEC 8824-1

4.4
association
semantic relationship between two object classes

4.5
constraint
notation which can be used in association with a type, to define a subtype of that type

[SOURCE: ISO/IEC 8824-1:2008]

4.6
context
universe of discourse in which a name or definition is used

[SOURCE: ISO/IEC 11179-3:2003, 3.3.31]

4.7
contextual name
descriptive word or group of words that labels a data concept within its defined context

4.8
data
re-interpretable representation of information in a formalized manner suitable for communication, interpretation or processing

Note 1 to entry: Data can be processed by human or automatic means.

[SOURCE: ISO 11179-1:2004]

4.9
data concept
item that may be stored in a data dictionary that refers to an abstraction or thing in the natural world that can be identified with explicit boundaries and meaning and whose properties and behaviour all follow the same rules

Note 1 to entry: Data concepts can be classified into the following types: object class, value domain, data element, aggregate domain, data frame, message, interface dialogue, dictionary document, or module

4.10
data concept identifier
numeric identifier that shall uniquely and unambiguously identify a data concept within the scope of the DD being managed

4.11
data concept instance
occurrence of a data concept

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4.12
data concept registry
electronic data dictionary that follows precise documented rules for the registration and management of stored data concepts; it typically also includes advanced features for adding, retrieving, and working with its contents

Note 1 to entry: The data concept registry contains meta-attributes about data concepts in terms of their names and representational forms as well as the semantics associated with the data concepts. A data concept registry may contain data that assists information interchange and re-use, both from the perspective of human users and for machine-interpretation of data concepts.

4.13
data concept revision
integer that represents the number of edits that have been made to the data concept since the last update to the major version number

4.14
data concept type
categorization of the kind of data concept

4.15
data concept version
integer that represents the number of normative changes that have been made to approved versions of the associated data concept

4.16
data dictionary
listing of data concepts and their meta-attributes in a consistent format

4.17
data element
data concept represented by a specific value domain and that describes a single atomic property about an object class

Note 1 to entry: A data element is composed of an object class, a property of the represented object class and a value domain.

4.18
data frame
data concept represented by a specific aggregate domain and that describes information of interest through a useful grouping of more atomic properties about one or more object classes

Note 1 to entry: The grouping may be a set, sequence, or a choice.

4.19
data model
graphical and/or lexical representation of data, specifying their properties, structure, and inter-relationships

[SOURCE: ISO 11179-1:2004, 3.2.7]

EXAMPLE A data model might specify that a “Vehicle” may be described by a variety of properties, such as: “make”, “model”, “year”, and “vin” (vehicle identification number). Likewise, a “Collision” might be described by properties such as “occurenceTime”, “severity”, and “vehiclesInvolvedCount”. Finally, the model might depict that a Collision has a many-to-many relationship to a Vehicle. The following provides a sample graphic of this data model.

Note 1 to entry: Within the scope of this part of ISO 14817, data models are depicted using UML Class Diagrams.

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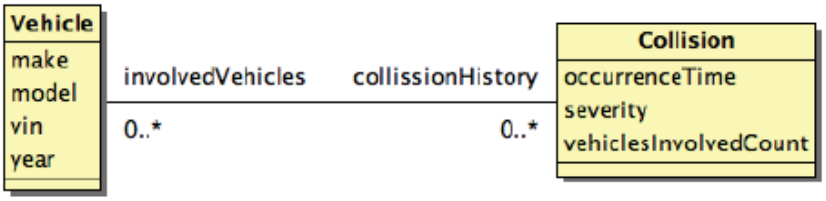

Figure 1 — Sample data model

4.20
data type
set of distinct values, characterized by properties of those values and by operations on those values

[SOURCE: ISO/IEC 11404:2007, 3.12]

4.21
definition
representation of a concept by a descriptive statement that serves to differentiate it from related concepts

[SOURCE: ISO 11179-1:2004, 3.2.8]

4.22
descriptive name
descriptive word or group of words that uniquely labels a data concept within a module

4.23
dialogue
see interface dialogue

4.24
dialogue order rules
rules governing the sequencing of messages to be sent among systems in order to achieve a specified service

4.25
dictionary document
data concept that represents a data dictionary along with supplemental information that may be standardized

4.26
document identifier
identifier that uniquely identifies the document

4.27
format
natural language description of the logical layout of the data concept in relation to interchange of data

4.28
generalization
taxonomic relationship between a more general element and a more specific element where the more specific element is fully consistent with the more general element and contains additional information

[SOURCE: ISO 14813-5:2010]

Note 1 to entry: The more general class is referred to as the superclass.

Note 2 to entry: The more specific class is referred to as the subclass.

Note 3 to entry: "Fully consistent" means that the subclass has all of the *properties* (4.47) and relationships of the superclass.

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4.29
historic ASN.1 name
ASN.1 name assigned to a data concept that does not follow the current naming convention

4.30
historic descriptive name
descriptive name assigned to a data concept that does not follow the current naming convention

4.31
identifier
sequence of characters, capable of uniquely identifying that with which it is associated, within a specified context

[SOURCE: ISO/IEC 11179-1]

4.32
interface dialogue
data concept that defines bi-directional communication sequence between two parties in accordance with predetermined protocols

4.33
international object identifier tree
tree whose root corresponds to ISO/IEC 9834-1 and whose nodes correspond to Registration Authorities responsible for allocating arcs from a parent node

[SOURCE: ISO/IEC 9834-1:2012, 3.5.5]

4.34
lower camel case term
string consisting of one or more words, where each word within the string, except for the first, starts with an upper-case letter and all other letters are lowercase; the words follow each other without any space; hyphens and numbers may be used, but the first character of the string must be a lower case alphabetic character; a hyphen may not be the last character or occur multiple times in sequence

4.35
message
data concept that is a grouping of data elements, data frames, or data elements and data frames that is used to convey a complete set of information

Note 1 to entry: For the purposes of this part of ISO 14817, a message is an abstract description; it is not a specific instance.

4.36
message instance
occurrence of a message containing the actual values for the data elements and/or data frames

4.37
meta-
Greek prefix denoting a description that is one level of abstraction above the concept being described

4.38
meta-attribute
documenting characteristic of a data concept that is stored in a DD

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4.39
metadata
documenting characteristic of a data concept that is provided in a message

Note 1 to entry: Documenting characteristics are termed "meta-attributes" when stored in a DD, but are termed metadata when provided within the same message instance as the actual value. For example, a data element may be defined within the DD with a specific unit of measure, such as meters; the Unit of Measure field is a defined meta-attribute. Alternatively, the unit of measure may be defined at runtime within a message, especially for items such as unit of currency. The field within a message that defines the unit of currency for an included value would be termed "metadata".

4.40
module
data concept that contains the formal syntactic definition, and optionally the semantic definition, of a defined set of other data concepts that are all version-controlled as a single unit; a module can be represented in multiple languages (e.g., ASN.1 or XML Schema) and compiled by computer systems

4.41
multiplicity
number of instances of the subject data concept that may be associated with the object class that it describes

4.42
name
indexical term used by humans as a means of identifying data elements and other data concepts

4.43
nested object class
object class that represents a logical group of data elements and data frames that describe some aspect of the larger object class by which the nested object class is contained

Note 1 to entry: Nested object classes are used to describe object classes that are contained within another object class and are used for conceptual objects rather than tangible objects.

EXAMPLE A message sign object class might have a nested object class for the messages stored in its library, where each message is described by a number of properties, such as message number, message content, message owner, etc.

4.44
nominal version
identifier that represents a version number that the data concept is more generally known by

4.45
object class
description of a set of objects that share the same properties, relationships, and semantics

Note 1 to entry: Adapted from ISO/IEC 11179-1; an object class is conceptually similar to an ISO/IEC 11179 object, but it does not include operations or methods and ISO/IEC 11179 "attributes" are called "properties" in this part of ISO 14817.

4.46
object identifier
ordered list of primary integer values from the root of the international object identifier tree to a node, which unambiguously identifies that node

[SOURCE: ISO/IEC 9834-1:2012, 3.5.11]

4.47
parent object class
object class that the data concept describes

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4.48
precursor
historical, semantically similar data concept within the same DD, which this data concept has replaced or is replacing

4.49
property
characteristic common to all members of an object class

[SOURCE: ISO/IEC 11179-3]

Note 1 to entry: This is defined as a distinct data concept within ISO 11179, but is rolled into the definition of a data element within this part of ISO 14817 to simplify DD design.

4.50
referenced data element
data element that is referenced by the current data concept

4.51
referenced data frame
data frame that is referenced by the current data concept

4.52
referenced message
message that is employed in the current interface dialogue

4.53
remarks
comments or other information pertinent to the data concept

4.54
semantics
branch of linguistic science that deals with the meaning of words

[SOURCE: ISO/IEC 11179-5]

4.55
source
document or other reference that was used to develop the pertinent data concept

4.56
successor
newer, semantically similar data concept within the same DD, which has replaced or is replacing this data concept

4.57
superclass
object class that is a generalization of the current object class

4.58
synonym
semantically similar data concept

4.59
syntax
set of rules defining the way in which data is put together with appropriate identifiers, delimiters, separator character(s), and other non-data characters to form messages

[SOURCE: ISO 21849:2006]

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4.60
uniform resource locator
string for identifying resources on the Internet (such as Web pages) by specifying the address of the resource and the access protocol used

4.61
unit of measure
actual units in which the associated values are measured

[SOURCE: ISO 11179-3:2003, 3.3.1334 modified.]

4.62
upper camel case term
string of one or more words where each word within the string starts with an upper-case letter and the remainder of each word is in lowercase; the words follow each other without any space; hyphens and numbers may be used, but the first character of the string must be an upper case alphabetic character; a hyphen may not be the last character or occur multiple times in sequence

4.63
value domain
data concept that defines a set of permissible values

4.64
valid value rule
natural language text definition of the rule(s) by which permissible legal instances of a data element or a value domain are identified

5 Symbols and abbreviated terms

ASN.1 Abstract Syntax Notation One

ANSI American National Standards Institute

CASE Computer-Aided Software Engineering

CIDCR Central ITS Data Concept Registry

DCI Data concept identifier

DD Data dictionary

NOTE By definition, a data concept registry is a specialized type of a data dictionary; thus the DD symbol also applies to data concept registries.

IEC International Electrotechnical Commission

ISO International Organization for Standardization

ITS Intelligent transport system(s)

N/A not applicable

OID object identifier

OSI Open System Interconnection

TC Technical Committee

UBL Universal Business Language

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UML Unified Modelling Language

URL Uniform Resource Locator

6 Data concepts

6.1 Summary of data concepts

This Clause explains the nine *data concepts* (4.9) applicable to this part of ISO 14817, as listed in 7.2.3. Data concepts refer to abstractions and things in the natural world that can be identified with explicit boundaries and meaning. The properties and behaviour of these data concepts all follow the same set of rules. Within ITS, there may be data concepts to represent, for example, a bus route and relevant information about it.

At the lowest level, a *value domain* (4.64) is a data concept that defines allowed syntax that can be used to express a piece of information. Value domains provide minimal semantic information other than what the set of values are to be used for. C.1 defines several value domains, for example, "text" is a value domain that represents a human pronounceable textual string that is represented by an ASN.1 UTF8String.

The primary purpose of value domains is to provide standard representational forms for data elements. A *data element* (4.17) describes a single atomic *property* (4.50) of an *object class* (4.46). For example, a vehicle (object class) may have a colour (property) that can be represented by a colour code list (value domain). The object class "vehicle" describes the core concept being described, the property "colour" identifies what is being described about the object class, and the value domain "colour code" provides a representational form. The three concepts combined are called a data element.

Some concepts are complex and are represented with multiple related data elements. For example, a two-dimensional location is often described by a latitude and a longitude. These two items are grouped together into a structure known as an *aggregate domain* (4.2) called GeoLocation.2D, as defined in C.4.9. Similar to a value domain, an aggregate domain is a generic representation that can be used in multiple contexts; it provides a representational form, but provides little in the way of semantics (i.e. location of what). Each item within an aggregate domain should be defined as its own data element or data frame. For example, the latitude field within the GeoLocation.2D structure is defined as the "latitude" property of the "GeoLocation" object class with a value domain of MeasureType.

A *data frame* (4.18) is a complex data element; in other words, whereas a data element is by definition elemental and represented by a value domain, a data frame is complex and represented by an aggregate domain. For example, a vehicle (object class) may have a location (property) represented by the GeoLocation.2D aggregate domain. The three concepts combine form the data frame.

A *message* (4.36) is a set of data elements and/or data frames that convey a complete thought. An *interface dialogue* (4.33) defines the permissible sequence(s) of messages that may be exchanged between entities.

A *module* (4.41) represents a set of other data concepts that are all version-controlled as a single unit. This is useful so that one portion of a standard can be updated without breaking backwards compatibility with other portions of a standard.

A *dictionary document* (4.25) is any document approved by some authority that defines data interface details. A dictionary document is typically a formal standard approved by a standards development organization such as ISO, but a governmental entity or private company may also develop dictionary documents to record their custom designs.

Figure 2 provides an overview of how the nine data concepts inter-relate and can be documented.

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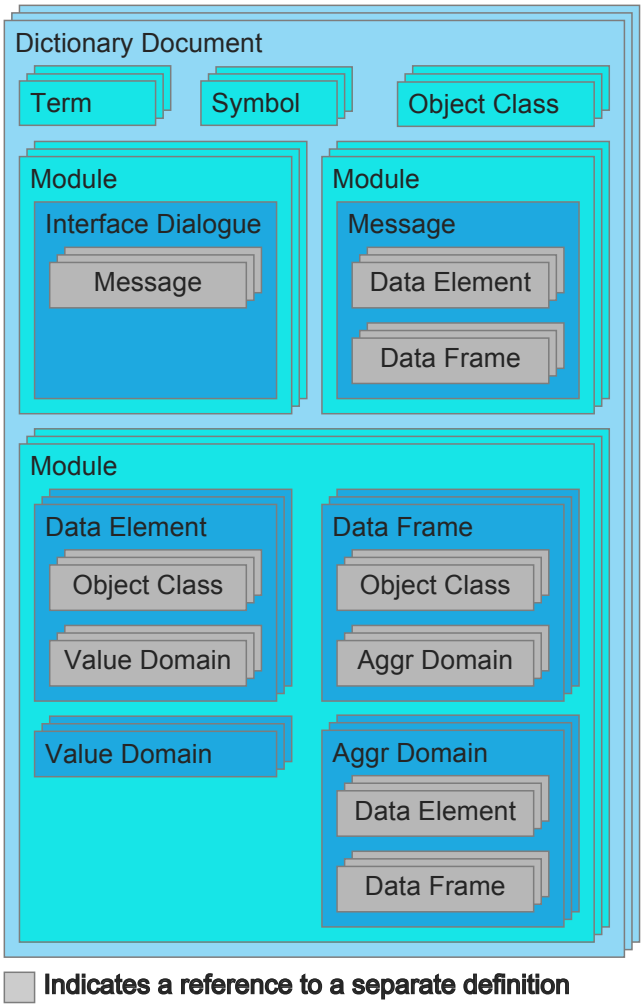

Figure 2 — Documenting Data Concepts

A dictionary document should formally define the *object classes* described within the document. The development of object classes forces the developers of the dictionary document to consider the exact structure of the data that they are defining. This is important so that when data concepts are recorded in the CIDCR, they fully define their own context in a clear and unambiguous way.

A dictionary document will typically define a number of modules. Modules can be categorized into one of three types.

Each interface dialogue should be defined within its own module to improve version control. If a future version of the dictionary document needs to only modify a single interface dialogue, the changes can be made without impacting the backwards compatibility of any of the other interface dialogues. Each interface dialogue will reference potentially multiple messages.

Likewise, each message should be defined within its own module to promote proper version control for similar reasons. Each message will reference some combination of data elements and data frames.

The third type of module defines the fundamental data concepts that are contained within messages, i.e. data elements, value domains, data frames, and aggregate domains. All of this information can be defined within a single module, or may be broken into sub-modules, often with references between them. In order to promote reuse of modules across dictionary document, it is often useful to have the following modules:

— the ISO-14817-1-Domains-1 module as defined in C.6;

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— a custom value domain module, if needed;

— a data element module for each object class included in the dictionary document;

— a minimal set of modules for each object class that define aggregate domains and data frames.

Care should be taken when defining modules for aggregate domains and data frames so that circular references are not created between modules. In addition, the developers should also consider dividing modules if there is a perceived benefit for re-usability by other dictionary documents.

The definition of a data element includes a reference to both a parent object class and a value domain. The definition of a data frame includes a reference to both a parent object class and an aggregate domain.

Each aggregate domain will reference some combination of data elements and data frames.

The nine data concepts can be categorized into three main groups, which are as follows.

— Documentation data concepts include dictionary document and module.

— Data model data concepts include object class, value domain, and data element.

— Interface data concepts include interface dialogue, message, data frame, and aggregate domain.

Each of these groups of data concepts is described in the following clauses.

6.2 Documentation Data Concepts

This part of ISO 14817 encourages the use of the Unified Modelling Language (UML) to document relationships among data. However, UML can also be used to document a metamodel, i.e. a data model that specifies one or more other data models. In other words, a metamodel is at a higher level of abstraction. Rather than defining data relationships among ITS data concepts (e.g. “Vehicle” “Collision”, etc.) it is used to define relationships between the types of data concepts defined in this part of ISO 14817 (i.e. “object class”, “data element”, “dictionary document”, etc.). Within this part of ISO 14817, metamodels are always designated by labelling each UML class with the stereotype “metaclass”.

Figure 3 depicts the metamodel that defines relationships among the documentation data concepts. Documentation data concepts include the top-level data concepts that we described in Figure 2.

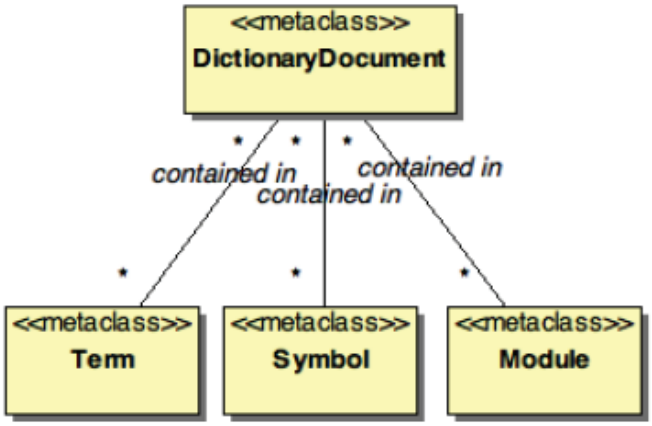

Figure 3 — Framework of documentation data concepts

Each box in the diagram corresponds to a data concept defined in this part of ISO 14817. The lines between data concepts indicate associations. The asterisk (*) next to the end of each line indicates that there may be multiples of the data concept. Thus, the diagram indicates that a dictionary document may contain many modules. It also indicates that a given module may be contained in multiple dictionary documents.

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6.2.1 Dictionary Document

A dictionary document data concept may represent a standard or any other formal specification that defines or references other data concepts. It shall be comprised of zero or more modules and object classes that are approved as a single unit in order to fulfil a specific set of requirements. The actual document may also contain additional text and/or information that are not recorded within the data concept representation.

NOTE The "dictionary document" data concept is designed to allow for the proper management and version control of data concepts that are used by multiple documents. It does not replace the actual documents; it merely represents them within a DD.

A dictionary document contains definitions of other data concepts. Ideally, the definitions of these other data concepts should be generated from the CIDCR to ensure consistency among the various dictionary documents that reference the same data concepts.

6.2.2 Module

A module shall be a group of interface and data model data concepts that are version controlled as a unit and can be represented in a computer readable file in order to exchange these data concepts. A given module may appear in multiple dictionary documents. Each such use should be recorded in the module's "context" meta-attribute. In order to best manage version control, a module should either contain a single interface dialogue, a single message, or some combination of other data concepts.

6.3 Data model Data Concepts

Data model data concepts are data concepts that appear in a data model. Figure 4 depicts the various data model data concepts used in this part of ISO 14817 and their relationships.

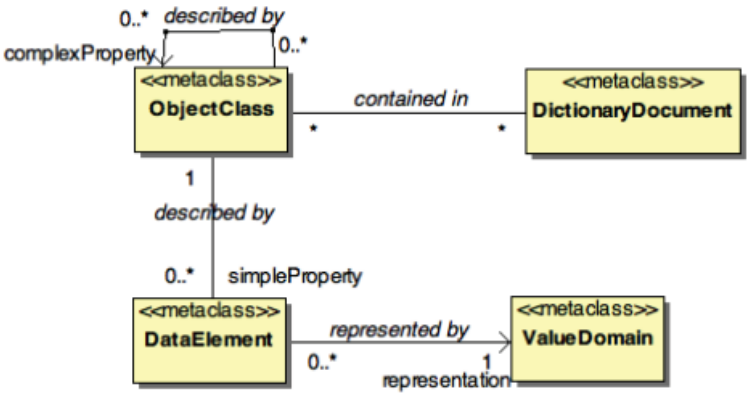

Figure 4 — Framework of data model data concepts

NOTE ISO 11179-3 defines several other data concepts, such as "property", "data element concept", "conceptual domain", etc. This part of ISO 14817 acknowledges the theoretical existence of such concepts, but it does not require the specification of these data concepts within ITS dictionary documents. Instead, this part of ISO 14817 simplifies the number of data concepts being defined.

An object class may be contained in multiple dictionary documents and each dictionary document may contain multiple object classes. Data elements and value domains are contained in zero or more modules (not shown in Figure 4 for brevity) and each module may contain multiple data elements and value domains (not shown in Figure 4 for brevity.)

An object class may be described by zero or more simple properties, each of which is termed a "data element". Data elements describe some aspect of exactly one object class and have exactly one representation as defined by a value domain. A value domain defines the exact representational form for a piece of data and may be used by multiple data elements.

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An object class may also be described by zero or more complex properties, represented as other object classes. In other words, an object class (e.g. “Collision”) can have an association with another object class (e.g. “Vehicle”) to describe some property of the first object class (e.g. “involvedVehicles”); “involvedVehicles” must be represented as an object class because it has its own set of data elements (e.g. “make”, “model”, “vin”, etc.) that describe each involved vehicle. While this part of ISO 14817 recognizes these associations exist, it does not require DDs to define these.

A sample data model is provided in Figure 5. This sample indicates that the object class Collisions has a complex property of reports that is represented by zero or more Collision object classes. Each Collision object class is described by three simple properties (i.e. data elements): occurrenceTime (represented as a date-time), severity (represented as a code), and vehiclesInvolved (represented as a quantity). Each Collision object class is also described by a complex property called involvedVehicles, which is represented by zero or more Vehicle object classes. Each Vehicle object class is described by five simple properties: make (represented as a name), model (represented as a name), vin (represented as an identifier), year (represented as an identifier), and licensePlate (represented as an identifier).

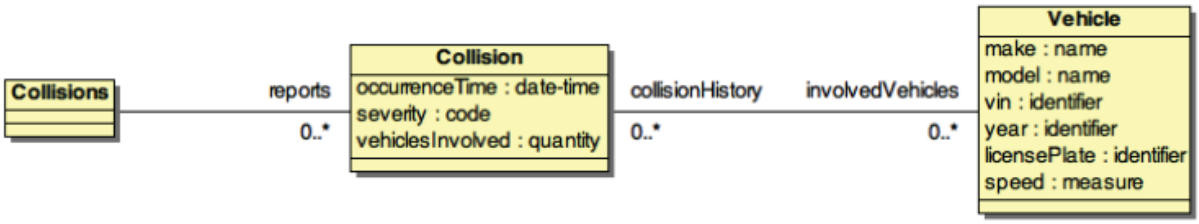

Figure 5 — Sample data model

6.3.1 Object class

An object class shall describe a set of object instances that share the same properties, relationships and semantics within a given domain of discourse about which there is a need to represent some information. Modifiers that qualify or further specialize the object class may be used. In Figure 5, the object classes illustrated are “Collisions”, “Collision”, and “Vehicle”.

6.3.2 Data element

A data element shall be a formalized representation of some information (i.e. a property) about an object class, with an explicit value domain. Figure 5 depicts eight data elements:

— “Collision.occurrenceTime:dateTime”;

— “Collision.severity:code”;

— “Collision.vehiclesInvolved:quantity”;

— “Vehicle.make:name”;

— “Vehicle.model:name”;

— “Vehicle.vin:identifier”;

— “Vehicle.year:identifier”;

— “Vehicle.licencePlate:identifier”.

A data element may further refine a referenced value domain.

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