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Information technology — Specification of data value domains

Technologies de l'information — Spécifications des domaines de valeurs de données

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Foreword

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

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. 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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this Technical Report of ISO/IEC TR 15452 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 TR 15452 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 32, *Data management and interchange*.

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Introduction

A standardized process of definition and application of data value domains will assist in the sharing and reuse of information across national and international organizations, especially with regard to electronic commerce such as medical commerce and EDI applications.

This Technical Report addresses practical issues encountered in documenting and sharing data. It facilitates the exchange of data values among organizations that use different names, and possibly different languages for equivalent data values.

As new generations of information interchange tools are developed, new technology will enable data to be located faster and more efficiently. Ontologies and other structures for meanings of data elements and data element values will need ways of relating values across these structures. New constructs such as the Global Information Infrastructure must be accommodated. Sets of reusable domain values, with unique identifiers assigned to each value, will provide a mechanism for facilitating this development. This philosophy encourages the assembly of data elements from reusable parts and facilitates the elimination of language barriers.

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Information technology — Specification of data value domains

1 Scope

This Technical Report covers the identification, specification, development and reuse of enumerated, bounded data value domains for data elements. A data value domain in this context refers to the possible valid values of a data element concept and its associated data elements. An enumerated domain is one for which all values can be explicitly expressed in a structured or unstructured set. A bounded domain implies knowledge of the upper and lower limits of the value set.

Major issues addressed include:

Specifying attributes of data value domains and, where applicable, each value within the domain; including assigning a unique identifier to each value in the value domain.

Describing attributes for "conceptual values" of a data element concept domain and "represented values" for a data element derived from it.

Defining reuse of value domains which can be defined and specified in a standardized way and can be applied as components of many data elements.

This Technical Report complements and extends the attributes of data elements specified in ISO/IEC 11179, *Information technology - Specification and standardization of data elements*, especially *Part 3: Basic attributes of data elements*.

This Technical Report is meant to assist users of ISO/IEC 11179. This series of standards is currently undergoing significant revision. When this revision work is completed, the contents of this Technical Report will be either amended or integrated into the 11179 series of standards.

2 References

ISO/IEC 11179-3:1994, *Information technology - Specification and standardization of data elements - Part 3: Basic attributes of data elements.*

ISO/IEC 11179-4:1995, *Information technology - Specification and standardization of data elements - Part 4: Rules and guidelines for the formulation of data definitions.*

ISO/IEC 11179-5:1995, *Information technology - Specification and standardization of data elements - Part 5: Naming and identification principles for data elements.*

ISO/IEC 11179-6, *Information technology - Specification and standardization of data elements - Part 6: Registration of data elements.*

3 Terms and definitions

For the purposes of this Technical Report, the following definitions apply.

3.1 attribute: A characteristic of an object or entity.

3.2 conceptual domain: A set of possible valid value meanings of a data element expressed without representation.

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3.3 context: A designation or description of the application environment or discipline in which a name is applied or from which it originates.

3.4 data element: A unit of data for which the identification, meaning, representation and permissible values are specified by means of a set of attributes.

3.5 data element concept (DEC): A concept that can be represented in the form of a data element, described independently of any particular representation.

3.6 data element representation: A data element component consisting of a value domain and representation class.

3.7 data identifier: A language independent unique identifier of a data element within a registration authority. An unambiguous name for an object within a given context.

3.8 data item: An occurrence of a data element value.

3.9 data value: An element of a value domain.

3.10 data value domain: A set of possible valid values of a data element expressed in a certain representation, for a data element having a value domain.

3.11 enumerated domain: A value domain that is specified by a list of all permissible values.

3.12 identifier: See data identifier.

3.13 international registration data identifier (IRDI): The unique and registered identifier of a data element.

3.14 name: The primary means of identification of objects and concepts for humans.

3.15 object class: A set of ideas, abstractions, or things in the real world that can be identified with explicit boundaries and meaning and whose properties and behavior follow the same rules.

3.16 permissible value (label): An expression of a value meaning in a specific value domain.

3.17 property: A peculiarity common to all members of an object class.

3.18 representation class: A classification of types of representations.

3.19 structure set: A method of placing objects in context, revealing relationships to other objects. Examples include Entity-Relationship Models, taxonomies, and ontologies.

3.20 value meaning: A valid value in a conceptual domain.

3.21 value meaning identifier (VMID): A label that uniquely identifies a value meaning.

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4 Data element components

Figure 1 represents a set of components of a data element, one of which is a **data element concept** (DEC). The data element concept is composed of the object class and property, and related to a set of value meanings collectively known as a **conceptual domain**.

Each member of the conceptual domain is identified by a **value meaning identifier** (VMID). The set of members is represented by the **value meaning** box of figure 1. These items consist of some form of name and/or definition (descriptor) which characterizes a data value.

A **data element** is formed by adding a representation to a DEC. A representation consists of a **representation class** and a **data value domain,** which itself is composed of a set of **permissible values**. Data elements are identified by an **international registration data identifier** (IRDI), as described in ISO/IEC 11179-6.

Identification at the item level can thus be established by the assignment of a combination of IRDI and VMID. The IRDI represents all components of a data element. The VMID identifies each value meaning.

Annexes A through C describe the applications of these building blocks of data sharing and reuse with examples

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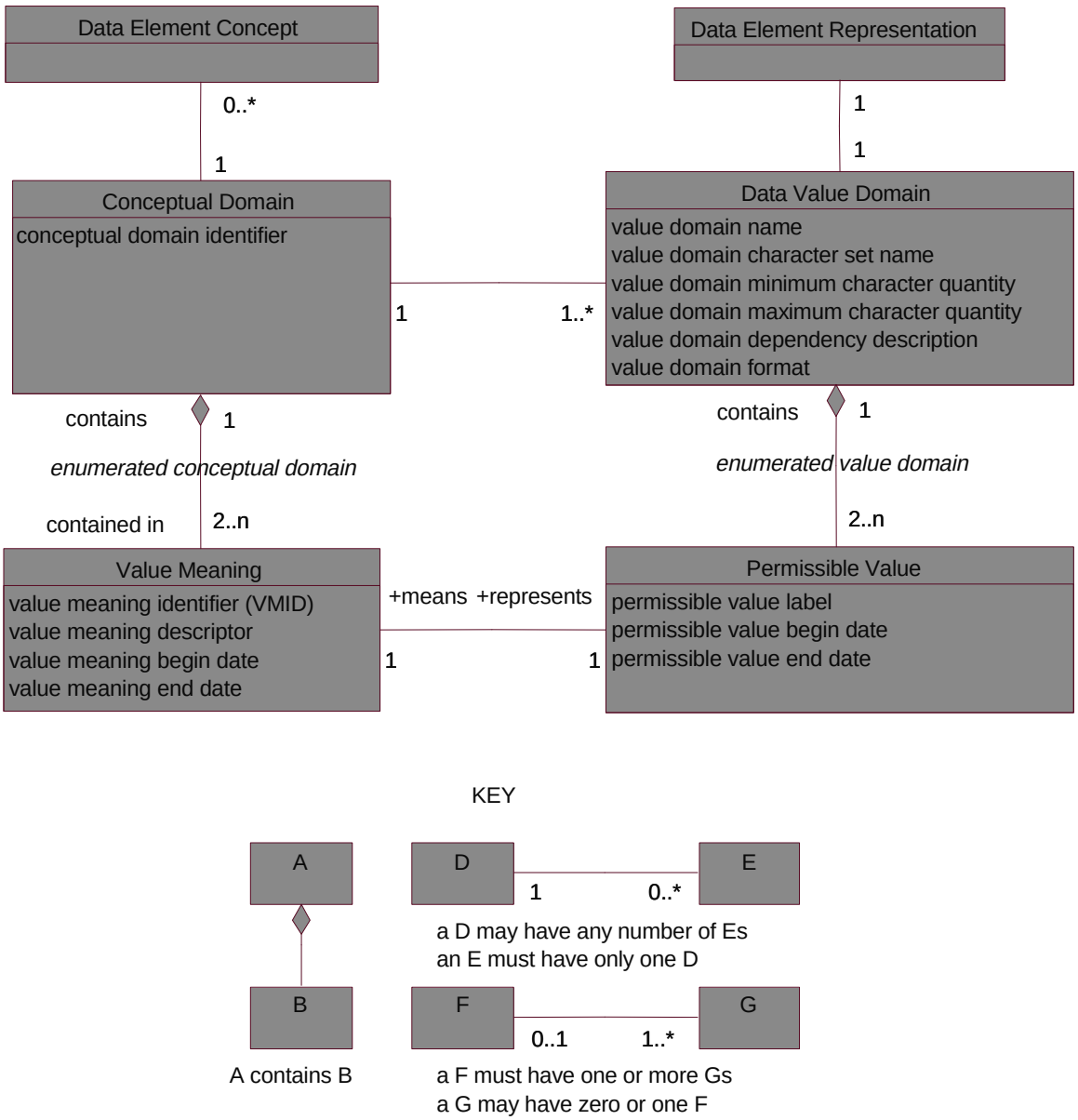

Figure 1. Data Element Components

5 Specification of data value domains

In the discussion below, data element attributes (in **bold**) are placed in relationship to the data element components in figure 1. They are specified in 5.2 below. Those data element attributes which have equivalent attributes in ISO/IEC IS 11179-3 are marked with an asterisk (*).

5.1 Data element component descriptions

5.1.1 Data element concept components

A data element concept is related to one conceptual domain. As a conceptual domain may be related to more than one data element concept, it has a **conceptual domain identifier**. The conceptual domain contains the value meaning set which has, as attributes, a **value meaning descriptor** and a unique identifier. The latter is used to identify each item of the set of value meanings and is called the **value meaning identifier** (VMID). The value meaning descriptor may contain either a name or definition, or both. In addition, each value meaning can be time-stamped with **value meaning begin date** and **value meaning end date** attributes.

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5.1.2 Data element representation components

The value meaning is related to permissible values. This establishes the relationship between a value meaning and its valid value occurrences among differing value domain sets. The **permissible value label*** attribute serves to identify each item in the value domain set. There is a direct relationship between the VMID and each equivalent permissible value label in each value domain. Each permissible value can be time-stamped with **permissible value begin date** and **permissible value end date** attributes.

The value domain attributes include the **value domain name, value domain character set name*, value domain minimum character quantity*** and **value domain maximum character quantity***. **Value domain dependency description*** allows recording of relationships among value domains; for instance, the meaning of one domain may depend on a condition imposed by the value meaning of a permissible value of another domain. **Value domain format*** (5.3) is optional.

The value domain may be subsetted into subtypes according to the method of defining the set of information they contain, i.e., rule, procedure, enumeration, and range. Only the enumeration subtype can contain permissible values and is the main focus of this Technical Report.

The representation class describes the representation category to which the value domain belongs. This preserves the value domain's relationship to a more general level of representation, such as name, code or number, which can itself be defined and modeled. The **representation class name*** identifies the representation class.

The entities, attributes and relationships associated with representation class record information about the structure set, such as a taxonomy, from which the representation class is derived. ISO/IEC WD 11179-2 describes taxonomy structures for data element derivation.

The value domain may also be ordered by a structure set. Attributes and relationships that describe the structure of a value domain are specified in 5.4.

A data element is composed of a conceptual domain expressed by a value domain. The **international registration data identifier** (IRDI) identifies the data element. Any single occurrence of a data item in the value domain can be uniquely identified by the IRDI in combination with the VMID of the value meaning.

5.1.3 Specification of conceptual domain

The conceptual domain is specified by a human interpretable method; e.g., name or textual description. A conceptual domain may be represented by one of its associated representation value domains if the representation value domain satisfies this criterion.

5.1.4 Rules for the value meaning identifier

It is possible that one of the existing value domains may serve as the VMID. The value domain would have to satisfy the criteria for a VMID:

- **Uniqueness**. Only one VMID is assigned to each value meaning descriptor. VMIDs are not reused among conceptual domain values.
- **Uniform size and format**. No suffixes, prefixes or other variations in the VMID representation are allowed.
- **Completeness**. There is exactly one occurrence of the VMID for each possible valid value in the conceptual domain.
- **Non-significance**. No meaning is attached to the VMID.

One value domain cannot simultaneously represent both the conceptual domain and the set of VMIDs.

5.2 Attribute Specification

The attributes will be specified in the format of ISO/IEC 11179-3, with a variation regarding the name and context, in the order in which they appeared in 5.1. Name and Context descriptors will appear in pairs when more than one name is used, as described in ISO/IEC 11179-5. The format description is given below.

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Name: The attribute name.

Context: The context in which the name is used.

Definition: Description of the attribute.

Obligation: States whether an attribute must be present, and the condition for which it is required.

Comments: Additional information.

Cardinality: For relationships, a formal statement of the number of occurrences of each attribute allowed.

5.2.1 Data element concept attributes

Name: conceptual domain identifier

Context: this Technical Report

Definition: The unique identifier of a conceptual domain.

Obligation: required

Comments: As a conceptual domain may be reused among data element concepts, an identifier is required.

Name: value meaning descriptor

Context: this Technical Report

Definition: A name or definition of the meaning of a permissible value.

Obligation: required

Comments: The value meaning is part of the conceptual domain. It does not include a description of the type of representation that a value meaning might assume.

Name: value meaning identifier (VMID)

Context: this Technical Report

Definition: The label that uniquely identifies a value meaning.

Obligation: conditional; required if the domain is enumerated.

Comments: The value meaning is part of the conceptual domain. The VMID and the IRDI together uniquely identify a particular data element item occurrence.

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Name: value meaning begin date

Context: this Technical Report

Definition: The date this value meaning was entered in the conceptual domain.

Obligation: conditional; required if the domain is enumerated.

Comments: This attribute, together with value meaning end date, enables time stamping for each value meaning.

Name: value meaning end date

Context: this Technical Report

Definition: The date this value meaning was deleted from the conceptual domain.

Obligation: conditional; required if the value meaning is no longer current.

Comments: This attribute, together with value meaning begin date, enables time stamping for each value meaning. This attribute must be present when the value meaning is out of date.

5.2.2 Data element representation attributes

Name: permissible value label

Context: this Technical Report

Name: permissible value

Context: ISO/IEC 11179-3

Definition: An expression of a value meaning in a specific value domain.

Obligation: required

Comments: Each label represents one member of a set of permissible values.

Name: permissible value begin date

Context: this Technical Report

Definition: The date this permissible value was entered in the value domain.

Obligation: conditional; required if the domain is enumerated.

Comments: This attribute, together with permissible value end date, enables time stamping for each permissible value.

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Name: permissible value end date

Context: this Technical Report

Definition: The date this permissible value was deleted from the value domain.

Obligation: conditional; required if the permissible value is no longer current.

Comments: This attribute, together with value meaning begin date, enables time stamping for each permissible value. This attribute must be present when the permissible value is out of date.

Name: value domain name

Context: this Technical Report

Definition: A name by which a value domain is known.

Obligation: required

Comments: A naming convention may be used to produce a structured name.

Name: value domain character set name

Context: this Technical Report

Definition: The natural language character set used by a value domain.

Obligation: optional

Context: this Technical Report

Name: minimum size of data element values

Context: 11179-3

Definition: The minimum number of storage units (of the corresponding datatype) to represent the data element value.

Obligation: conditional; required if values are character data.

Comments: If maximum character quantity minus minimum character quantity equals zero, the number of characters allowed is fixed.

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Name: value domain maximum character quantity

Context: this Technical Report

Name: maximum size of data element values

Context: 11179-3

Definition: The maximum number of storage units (of the corresponding datatype) to represent the data element value.

Obligation: conditional; required if values are character data.

Comments: If maximum character quantity minus minimum character quantity equals zero, the number of characters allowed is fixed.

Name: value domain dependency description

Context: this Technical Report

Name: related data reference; type of relationship

Context: 11179-3

Definition: The description of the type of association with another value domain with which this value domain is linked.

Obligation: conditional; required if an association exists.

Comments: The attributes in 11179-3 are intended to describe more types of relationships.

Name: representation class name

Context: this Technical Report

Name: form of representation

Context: 11179-3

Definition: The name or description of the form of representation for the data element, e.g., “quantitative value,” “code,” “text,” “icon.”

Obligation: required

Comments: The representation class is determined by the classification scheme. See ISO/IEC CD 11179-2 for the full set of classification attributes.

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Name: international registration data identifier (IRDI)

Context: this Technical Report

Name: identifier

Context: 11179-3

Definition: A language independent unique identifier of a data element within a registration authority. An unambiguous name for an object within a given context.

Obligation: required

Comments: Used in combination with the VMID to identify a data item.

5.3 Reuse of data value domains

Data value domains are sharable among data elements with similar data element concepts. The attributes and relationships below are identified as necessary to implement this process.

The data concept attributes have been described in 5.2.1.

Name: value domain format

Context: this Technical Report

Name: layout of representation

Context: ISO/IEC 11179-3

Definition: A template for the structure of the elements of a value domain.

Obligation: optional

In addition, relationships are identified as follows:

Name: data element relationship

Context: this Technical Report

Definition: The relationship between the data element concept and the data element representation.

Comments: Data element is identified by the IRDI.

Cardinality: A data element representation must derive meaning from exactly one data element concept.

A data element concept may provide meaning to any number of data element representations.

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Name: data element concept has conceptual domain relationship

Context: this Technical Report

Definition: The relationship between the data element concept and the conceptual domain.

Comments: While a DEC may relate to only one conceptual domain, a conceptual domain may be applied to multiple DEC's.

Cardinality: A conceptual domain must enumerate one or more data element concepts.

A data element concept must have exactly one conceptual domain.

Name: conceptual domain contains conceptual domain relationship

Context: this Technical Report

Definition: The recursive relationship between two conceptual domains.

Comments: One conceptual domain can be a subset of another.

Cardinality: A conceptual domain may be contained in any number of conceptual domains.

A conceptual domain may contain any number of conceptual domains.

Name: conceptual domain contains value meaning relationship

Context: this Technical Report

Definition: One conceptual domain contains a set of value meanings.

Comments: The conceptual value meanings do not show any form of representation. They are identified by the VMID.

Cardinality: A conceptual domain may contain any number of value meanings.

A value meaning must be contained in one or more conceptual domains.

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Name: value meaning defines permissible value

relationship

Context: this Technical Report

Definition: The link between each value meaning of a conceptual domain (identified by the VMID) and the equivalent permissible value in each value domain.

Comments: While each value meaning occurrence in the conceptual domain may be represented by one or more value domain occurrences, there may be one or more value domain representations (but only one per value domain) for each value meaning occurrence in the conceptual domain.

Cardinality: A permissible value must represent one or more value meanings.

A value meaning must be represented by one or more permissible values.

Name: value domain contains permissible value

relationship

Context: this Technical Report

Definition: A relationship between permissible values and a value domain.

Comments: Each enumerated value domain set must have at least two possible valid values.

Cardinality: A permissible value must be contained in one or more value domains.

A value domain must contain two or more permissible values.

Name: value domain has representation class relationship

Context: this Technical Report

Definition: The relationship of a value domain to a representation class.

Comments: There can be many value domains described by any one representation class. The representation class may be regarded as a more general level of representation than the value domain.

Cardinality: A data element must have exactly one representation class.

A data element must be represented with exactly one value domain.

A representation class may be describing any number of data elements.

A value domain must provide representation to one or more data elements.

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5.4 Structure in value domains

Many value domains are structure sets. Attributes and relationships that describe the organization of these sets are specified below. Figure 2 shows their relationship to the data element components in figure 1. Annex C shows an example of a data element with (some of) its values documented as members of a structure set.

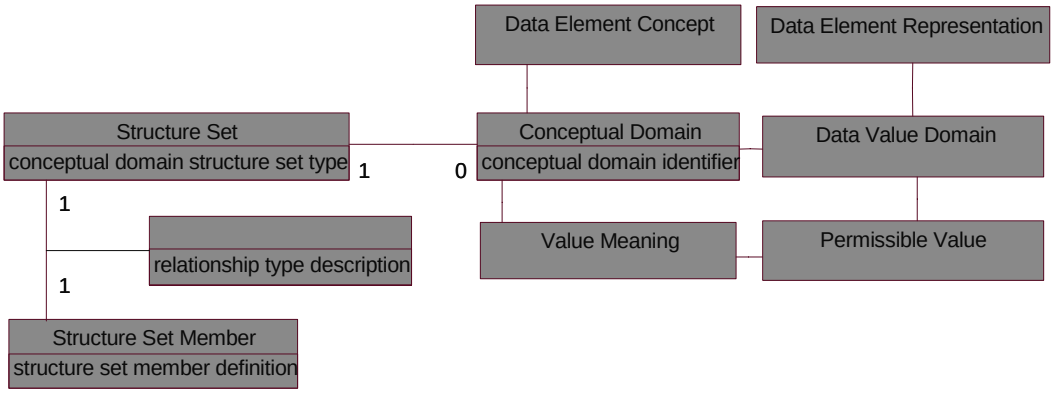

Figure 2. Structure Set Specification

5.4.1 Structure set specification attributes

Name: Conceptual domain structure set type

Context: this Technical Report

Definition: The type of structure set by which this conceptual domain is organized.

Obligation: optional

Comments: Examples of use include "biological taxonomy," "MPD substance taxonomy," "Library of Congress classification system."

Name: Structure set member definition

Context: this Technical Report

Definition: The type of component(s) by which the structure set classifies this value meaning.

Obligation: conditional; mandatory if conditional domain structure set type is used.

Comments: Examples of use include "branch," "node," "taxon."

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Name: Relationship type description

Context: this Technical Report

Definition: This attribute defines the type of relationship between two members of a structure set.

Obligation: conditional; mandatory if conceptual domain structure set type is used.

Comments: Examples of use include "superset," "subset," "parent," "child," "part-of," etc. Note: this is an attribute of the "structure set has member" relationship.

The relationships among these attributes follow:

Name: Structure set has member relationship

Context: this Technical Report

Definition: The relationship between the structure set and the type of component that inhabits the structure set.

Comments: The structure set may contain many types of components.

Cardinality: A structure set may have many members.

A structure set member must belong to one structure set.

Name: Conceptual domain has structure set relationship

Context: this Technical Report

Definition: The relationship between a conceptual domain and a structure set.

Comments: If a conceptual domain is structured, this relationship documents that fact.

Cardinality: A conceptual domain may be organized by a structure set.

A structure set may organize many domains.

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Annex A

Conceptual domains for data element concepts

Conceptual domains consist of sets of possible valid values of a data element to which no representation has been assigned. The members of the set are described by name or definition, or both, whatever is necessary to identify the items. An identifier is assigned to each member and used in each value domain to consistently relate the same conceptual meaning of each value among different types of representation.

For example, based on the ISO standard 3166, **Codes for the representation of names of countries**, for each item in the set an identifier can be assigned. The conceptual domain characterized by ISO 3166 can be named "Country identifier" (a combination of **object class** "country" and **property** "identifier")

This example is also used in ISO/IEC 11179-3.

Conceptual domain identifier: Country identifier

Context: ISO 3166

Value Meaning Descriptor (name or definition or both)		VMID
Afghanistan	<Geopolitical information>	001
Albania	""	002
Algeria		003
American Samoa	""	004
Andorra		005

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Another example illustrates how EDI information can constitute a conceptual domain. This data element appears as an example in ISO/IEC 11179-3.

Conceptual domain identifier: Currency qualifier

Context: UN-EDIFACT 6343

Value Meaning Descriptor	VMID
The monetary unit involved in the transaction for customs valuation.	001
The monetary unit involved in the transaction for insurance purposes.	002
The local monetary unit.	003
The monetary unit used for calculation in an invoice.	004

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Annex B

Representational data value domains

One data element concept can have many representations of its conceptual domain by which it is stored, processed and transmitted in information systems. For instance, ISO 3166 describes the set of conceptual values of the data element concept "Country identifier" by five value domains: short name in English, official name in English, alpha-2 code, alpha-3 code, and numeric code. The relationships among the members of the sets of various representations must be established by cross-reference to a common identifier, the VMID.

The values can be listed in a table or the relationships may be otherwise explicitly described. Relationships may also be established by reference to an existing standard. These must be understood by parties exchanging information.

Examples of the relationships among the value domains of the data element concepts in Annex A appear below.

Conceptual domain identifier: Country identifier

Context: ISO 3166

VMID	Value domain name Short name in English	Value domain name 2-alpha code	. . .
001	Afghanistan	AF	
002	Albania	AL	
003	Algeria	DZ	
004	American Samoa	AS	
005	Andorra	AD	

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Conceptual domain identifier: Currency qualifier

Context: UN-EDIFACT 6343

VMID	Value domain name Value name	Value domain name Value code
001	Customs valuation currency	1
002	Insurance currency	2
003	Home currency	3
004	Invoicing currency	4

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Annex C

Data value domain reuse

Conceptual domains are reused as implementations of their values, that is, as value domains. A data element can use a subset of an existing value domain. Value subsets, such as that represented by the data element "Trading partner country code," can be described by listing the VMIDs of the permitted values.

Conceptual domain identifier: Trading partner country identifier

Context: Trade treaty xx

VMID	Value domain name Short name in English	Value domain name 2-alpha code
002	Albania	AL
004	American Samoa	AS
005	Andorra	AD

The recursive relationship, in which a value domain can be a subset of a larger value domain, is used to express this. The value domain of Country code contains the value domain of Trading partner country code.

The full description of data elements based on these value domains follows. The format is taken from ISO/IEC 11179-3; the attribute names, however, are those used in the normative text of this Technical Report.

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Data element and value meaning identifier examples

Name:	Country name	Trading partner country code
Context:	ANSI/ISO/NISO	fictional
IRDI:	3166	4488
Definition:	The names of all the countries of the world.	A subset of 3166, selected by trading treaty.

Data concept attributes

Conceptual domain id:	Country identifier	Country identifier
Value meaning identifier (VMID):	001-220	002 004 005 . . .
Value meaning description:	Identifiers for all the countries of the world.	Identifiers for some of the countries of the world.
V.m. date in:	19940101	19950603
V.m. date out:		

Data element representation attributes

Value domain name:	short name in English	2-alpha code
Rep. class name:	name	code
V.d. character set name:	alphabetic character	numeric character
V.d.min. char. quantity:	4	2
V.d.max. char. quantity:	40	2

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Permissible value label:	All names of countries in short English form listed in ISO 3166	some 2-alpha codes for countries listed in ISO 3166, modified as described in trade treaty xx.
P.v. date in:	19940101	19950603
P.v. date out:		
V.d. dependency desc:	none	This value domain is a subset of ISO 3166.
V.d. format:	text	AA
Name:	Currency qualifier code	
Context:	UN-EDIFACT standard	
IRDI:	6343	
Definition:	Code giving a specific meaning to a coded currency.	

Data concept attributes

Conceptual domain id:	Currency identifier
Value meaning identifier (VMID):	001-017
Value meaning description:	A set of specific meanings for the element "Currency."
V.m. date in:	Consult the registration authority for each value's date.
V.m. date out:	19990101 - A new standard will be issued.

Data element representation attributes

Value domain name:	Value code
Rep. class name:	code
V.d. character set name:	numeric character
V.d.min. char. quantity:	1
V.d.max. char. quantity:	2

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Permissible value label: See Currency qualifier table in Annex B.

P.v. date in: Consult the registration authority for each value's date.

P.v. date out: 19990101 - A new standard will be issued.

V.d. dependency desc: This element assigns qualifiers to UNTDID-EDED-6345-S93A standard data element, "Currency."

V.d. format: n-nn

Data element using structure set for conceptual domain example

Name: Hatchery fish name

Context: Unified hatchery data registry

IRDI: 8282

Definition: All fish that are raised by fish hatcheries.

Data concept attributes

Conceptual domain id: Fish identification

Value meaning

identifier (VMID): 001-?

Value meaning

description: The set of names of fish that are raised in hatcheries.

V.m. date in: 19970711

V.m. date out:

Data element representation attributes

Value domain name: Latin genus and species name

Rep. class name: name

V.d. character set name: alphabetic character

V.d.min. char. quantity: 10

V.d.max. char. quantity: 25

Permissible value label: Salmo clarki

P.v. date in: 19970711

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P.v. date out:

Permissible value label: Salmo gairdneri

P.v.date in: 19970720

P.v. date out:

Permissible value label: Salmo trutti

P.v.date in: 19970720

P.v. date out:

V.d. dependency desc: This is a subset of all names of fish.

V.d. format: text

Structure set specification attributes

Concept. domain s.s. type: Biological taxonomy

Struct. set member def.: Genus and species

Relationship type desc.: Genus is a subset of family.

Relationship type desc.: Species is a subset of genus.

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[2] ISO/IEC 11179-1, *Information technology — Specification and standardization of data elements — Part 1: Framework for the specification and standardization of data elements.*

[3] ISO/IEC 11179-2, *Information technology — Specification and standardization of data elements — Part 2: Classification for data elements.*

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