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Information technology — Achieving metadata registry content consistency — Part 3: Value domains

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Foreword

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ISO/IEC TR 20943-3 was prepared by Technical Committee ISO/IEC/TC JTC 1, *Information technology*, Subcommittee SC 32, *Data management and interchange*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO/IEC TR 20943 consists of the following parts, under the general title *Information technology — Achieving metadata registry content consistency*:

— *Part 3: Value domains*

— *Part 1: Data elements*

— *Part 2: eXtensible markup language*

— *Part 3: Value domains*

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Introduction

The exchange of metadata between metadata registries based on International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) 11179 *Information Technology – Metadata registries*, depends not only on registry software that conforms to the standard, but also on metadata contents that are comparable between registries. While the standard has provisions for data specification and registration, there are pragmatic issues pertaining to populating the registries with content. Based on the experiences of organizations that are implementing the standard, technical reports to explore content issues will help current and future users.

Metadata registries can be used to register data elements, value domains, other objects, and associated attributes for many kinds of organizational data resource collections. Metadata registries can store information describing value domains used to specify the allowed values of a data element, the codes in a standard list, and classification schemes.

This technical report is based ISO/IEC FCD 11179, Part 3 (2001-05-01) of the six-part ISO/IEC 11179 standard that describes the organization of a registry for managing the semantics of data. The standard specifies the structure of a registry in the form of a conceptual model. The conceptual model is not intended to be a logical or physical data model for a computer system.

The ISO/IEC FCD 11179, Part 3 (2001-05-01), models a value domain and an associated conceptual domain. Conceptualization and articulation of rules and relationships are needed in the creation of conceptual domains and value domains. Reuse of value domains should be enabled and regularized. *Elementarily equivalent domains* have a relationship between their values that needs to be captured in a metadata registry. Some *conceptually equivalent domains* have relationships between their values, too. These also need to be captured. This Technical Report describes how this can be accomplished.

While metadata registries can be used for storing information about a variety of metadata items, this report addresses only value domains, conceptual domains, and their associated attributes and relationships. The goal of this paper is to ensure that there is a common understanding of the content of the value domain attributes so that metadata can be shared between registries, despite their differences.

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Information technology — Achieving metadata registry content consistency — Part 3: Value domains

1 Scope

1.1 Background

An ISO/IEC 11179 metadata registry (MDR) (hereafter referred to as a "registry") is a tool for the management of shareable data; a comprehensive, authoritative source of reference information about data. It supports the standardization and harmonization processes by recording and disseminating descriptions of data, which facilitates data sharing among organizations and users. It provides links to documents that refer to specific data elements, value domains, and classification schemes and to information systems where those objects are used. When used in conjunction with an information database, the registry enables users to better understand the information obtained.

A registry does not contain data itself. It contains the metadata that is necessary to clearly describe, inventory, analyze, and classify data. It provides an understanding of the meaning, representation, and identification of units of data. The standard identifies the information elements that need to be available for determining the meaning of data to be shared between systems.

1.2 Purpose

The purpose of this technical report is to describe a set of procedures for the consistent registration of value domains and their attributes in a registry. This technical report is not a data entry manual, but a user's guide for conceptualizing a value domain and its components for the purpose of consistently establishing good quality metadata. An organization may adapt and/or add to these procedures as necessary.

1.3 Scope

The scope of this technical report is limited to value domains, conceptual domains, and their associated attributes and relationships. Examples are used throughout the TR to illustrate the concepts described.

1.4 Registration approach – value domains and data elements

There is a choice when registering code sets and other value domains in an ISO/IEC 11179 metadata registry. Some Registration Authorities treat these sets as value domains, and others treat them as data elements. For the purposes of this technical report, the choice will always be to treat the sets as value domains unless explicitly stated. This choice is made to help illustrate the way to register many different kinds of value domains, including examples for registering standard code sets as value domains.

2 References

Standards from which examples have been drawn to be used in this document are listed in the Bibliography.

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ISO/IEC 11179-1:1999, *Information technology - Specification and standardization of data elements - Part 1: Framework for the specification and standardization of data elements.*

ISO/IEC 11179-2:2000, *Information technology - Specification and standardization of data elements - Part 2: Classification for data elements.*

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

ISO/IEC FCD 11179-3:2001, *Information technology – Metadata registries - Part 3: Registry metamodel.*

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 11179-6:1996, *Information technology - Specification and standardization of data elements - Part 6: Registration of data elements.*

ISO/IEC TR 15452:2000, *Information technology - Specification of data value domains.*

ISO/IEC FPDTR 20943-1:2001, *Information technology – Procedures for achieving metadata registry (MDR) content consistency – Part 1: Data elements.*

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3 Terms and definitions

For the purposes of this technical report, the terms and definitions given in ISO/IEC 11179 and ISO/IEC TR 15452 apply. The new terms used in this Technical Report are listed and defined below:

3.1 Conceptually equivalent domains

Value domains that represent the same conceptual domain.

3.2 Elementarily equivalent domains

Let E and F be enumerated and conceptually equivalent domains and p be a permissible value in E, then E and F are **elementarily equivalent domains** if there exists a one-to-one correspondence, D: E→F, between the permissible values of E and F such that the value meanings of p and D(p) are the same. (See Example 4, sub-clause 4.1)

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4 Understanding value domains

This section is devoted to describing several things about value domains:

1) some general facts or principles about value domains

2) the structure or relationships that exist in some value domains

3) code sets as value domains

4) classification schemes as value domains

5) the relationship of data types to value domains

6) use of units of measure

7) the importance of dimensionality

8) classifying value domains

Examples are used throughout to illustrate the ideas.

4.1 General facts

A *Value Domain* is the set of the valid values for a data element. It is used for validation of data in information systems and in data exchange. It is also an integral part of the metadata needed to describe a data element. In particular, a value domain is a guide to the content, form, and structure of the data represented by a data element.

Value domains come in two main types: enumerated and non-enumerated. An *Enumerated Domain* is a value domain where all the valid values are listed. A *Permissible Value* is an valid value in an enumerated domain. It is a combination of some value, or designation, and the meaning of that value. The associated meaning is called the *Value Meaning*. Examples of types of enumerated domains include code sets, standard classifications, and categorizations. A *Non-enumerated Domain* is a value domain where the valid values are expressed using a rule, called a *non-enumerated domain description*. The rule specifies precisely which values belong to the domain and which do not. Examples of types of non-enumerated domains include intervals of numbers, character strings, and bit maps.

Every value domain can represent two kinds of concepts: data element concept (indirectly) and conceptual domain (directly). The *Data Element Concept* is the concept associated with a data element. The value domain is the representation for the data element, and, therefore, indirectly represents the data element concept, too. However, the value domain itself has a concept directly associated with it, independent of any data element it is used to represent. This concept is known as the *Conceptual Domain*.

An example will help to illustrate the distinctions in the discussion, which is shown below in example 1:

EXAMPLE 1 -

Data element name:	Sex of employee – code
Data element concept name:	Sex of employee
Data element concept definition:	The sex of the employee of an organization.
Value domain name:	Human sex codes (1)

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Permissible values:	<1, Male>
	<2, Female>
	<3, Unknown>
Conceptual domain name:	Human sex categories
Conceptual domain definition:	Enumerations of human sexes.

Several points about value domains need to be made here:

1) The choice of codes used in the value domain above is arbitrary. Another encoding might work just as well, but each encoding is a different value domain. Which encoding to use is determined by the needs of the application and the organization. Example 2 is of another encoding

EXAMPLE 2 -

Value domain name:	Human sex codes (2)
Permissible values:	<M, Male>
	<F, Female>
	<U, Unknown>

2) The number of permissible values (3 in our example) may also be different. We might want a code for representing hermaphrodites or a code for representing transsexuals. Each time new permissible values are added or subtracted, a new value domain, or value domain version, is created. Determining whether a change to a value domain merits the creation of a new value domain or just a new version of an existing value domain is up to the individual registration authority. Example 3 shows an expanded value domain considered as a new one, not a version of an old one.

EXAMPLE 3 -

Value domain name:	Human sex codes (3)
Permissible values:	<M, Male>
	<F, Female>
	<H, Hermaphrodite>
	<T, Transsexual>
	<U, Unknown>

3) All the value domains for human sex codes are associated with the same conceptual domain, however to adequately differentiate the concept that Human sex codes (3) has five categories instead of three, a subordinate conceptual domain may be created that is directly associated with Human sex codes (3). See Example 4. At the highest level, all the value domains (above) represent the idea of categories of human sexes. So, the conceptual domain captures the concept represented by a class of value domains (e.g., human sex codes) needed within a registry.

EXAMPLE 4 -

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<u>Superordinate conceptual domain</u>

Conceptual domain name:	Human sex categories
Conceptual domain definition:	Enumerations of human sexes.

<u>Subordinate conceptual domain</u>

Conceptual domain name:	Human sex categories: 5 values
Conceptual domain definition:	Enumerations of human sexes with 5 categories.

4) The value meaning is used to link equivalent codes across conceptually equivalent domains. In elementarily equivalent domains, each value meaning links equivalent codes between a unique pair of permissible values, one from each value domain, as Example 5 illustrates:

EXAMPLE 5 -

Conceptual domain name:	Human sex categories	
Conceptual domain definition:	Enumerations of human sexes.	
Value domain names:	Human sex codes (1)	Human sex codes (2)
Permissible values:	<1, Male>	<M, Male>
	<2, Female>	<F, Female>
	<3, Unknown >	<U, Unknown>

The correspondence, D, is described as follows:

Let E = Human sex codes (1), F = Human sex codes (2), and D: E→F where

D(<1, Male>) = <M, Male>

D(<2, Female>) = <F, Female>

D(<3, Unknown>) = <U, Unknown>

Each permissible value in one of the two value domains listed above shares its value meaning with that of a permissible value in the other value domain. So, through the use of value meanings, equivalence of values across value domains is achievable, e.g., the values 1 and M mean Male or the values 2 and F mean Female. These two value domains are elementarily equivalent domains.

5) *Sex of employee* (the idea that <u>employees</u> are classified or characterized by sex) and *sex of student* (the idea that <u>students</u> are classified or characterized by sex) are different data element concepts, but they could use the same value domain to represent them. So, a value domain (e.g., Human Sex Codes (1)) may be associated with many data element concepts, and, therefore, data elements.

6) A data element concept is associated with different value domains as needed to describe similar, but different, data elements, and those value domains are conceptualized by the same conceptual domain (e.g., Human Sex Codes (1), Human Sex Codes (2), Human Sex Codes (3)). However, the converse is not true: two value domains under the same conceptual domain do not need to be associated with the same data element concept. Examples 6 and 7 are of this type:

EXAMPLE 6 -

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Value domain name:	Human sex codes (1)
Permissible values:	<1, Male>
	<2, Female>
	<3, Unknown>
Conceptual domain name:	Human sex categories
Conceptual domain definition:	Enumerations of human sexes.
Data element concept name:	Sex of employee
Data element concept definition:	The biological sex of the employee of an organization.

EXAMPLE 7 -

Value domain name:	Human sex codes (2)
Permissible values:	<M, Male>
	<F, Female>
	<U, Unknown>
Conceptual domain name:	Human sex categories
Conceptual domain definition:	Enumerations of human sexes.
Data element concept name:	Sex of student
Data element concept definition:	The biological sex of the student of an educational institution.

7) Value domains do not have to be associated with a data element concept at all. They can be managed independently, such as code sets. For instance, the maintenance organization for a standard code set might make the set publicly available even though it published no data using that value domain.

8) The main difference between a data element concept and a conceptual domain is the data element concept describes the semantic meaning of data represented by a data element. Conceptual domains describe the meaning of the valid values independent of any data element concept.

9) The examples provided so far are for enumerated domains. Non-enumerated domains are used to represent and constrain data through a rule rather than an exhaustive list of values. Example 8 is of a non-enumerated domain and associated data element and data element concept:

EXAMPLE 8 -

Value domain name:	Textual English descriptions
Domain description:	English text up to 60 characters
Conceptual domain name:	Textual descriptions
Conceptual domain definition:	Text describing a thing.

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Data element name:	Industry description for person's job - text
Data element concept name:	Industry description for person's job
Data element concept definition:	The description of the industry within which a person works.

10) It is possible, although rare, for a domain to be both enumerated and non-enumerated. This seemingly paradoxical situation may occur when values fall within a certain range, have a minimum (or maximum) value, and discrete values below the minimum (or above the maximum) are used for special cases. Example 9 will illustrate this:

EXAMPLE 9 -

Value domain name:	Volume in gallons x 1000 and special values	
Domain description:	-2, -1, or all integers greater than or equal to 0.	
Permissible values:	<-1,	Not reported>
	<-2,	Not measurable (e.g., use of well or stream)>
Conceptual domain name:	Volumes	
Conceptual domain definition:	Measures of volume with additional special values.	
Data element name:	Volume of household monthly water usage - gallons	
Data element concept name:	Volume of household monthly water usage	
Data element concept definition:	Volume of water used by a household each month.	

11) Another situation where a value domain is both enumerated and non-enumerated is illustrated in Example 10. Here, special meaning is attached to a finite number of values in a range.

EXAMPLE 10 -

Value domain name:	Preference scale, 0 to 1	
Domain description:	All real numbers between 0 and 1.	
Permissible values	<0,	Will not participate>
	<0.5,	No preference>
	<1,	Will participate>
Conceptual domain name:	Rating scales	
Conceptual domain definition:	A measure of effort, attitude, preference, difficulty, etc.	
Data element name:	Likelihood of voting in the next election, on a scale of 0 to 1	
Data element concept name:	Likelihood of voting in the next election	
Data element concept definition:	A measure of how likely the person will vote in the next election.	

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NOTE – This example requires some further explanation. The data may be obtained by reading a mark made by a respondent on a scale printed on a form. The value is interpolated through finding the ratio of the distance from the mark to the "0" end divided by the length of the entire scale. In addition, the use of both enumerated and non-enumerated qualities is fundamental to this value domain. It is possible to represent the same data element concept by reversing the preference scale, so that "0" means "Will participate" and "1" means " Will not participate". Therefore, value meanings are required to describe these value domains fully.

12) The names of the value domains used in the examples so far seem to imply the data elements they are linked to. Human Sex Codes (1) is an enumerated domain that can only be used as the valid values of a data element that represents the sex of (some) people. Likewise, the non-enumerated domain in Example 10 (Preference Scale, 0 to 1) can only be used as the valid values of a data element that represents preferences. Enumerated domains, in particular, seem especially linked to the data elements for which they are the valid values. However, the following example shows this is not always the case:

EXAMPLE 11 -

Value domain name:	Yes or No codes	
Permissible values	<0,	No>
	<1,	Yes>
Conceptual domain name:	Yes or No representations	
Conceptual domain definition:	Values for Yes and No.	
Data element name:	Person voted in last election, yes or no	
Data element concept name:	Person voted in last election	
Data element concept definition:	Indication whether erson voted in last election.	

4.2 Structure in value domains

Often, value domains have relationships between them. These can occur in many ways. There are relationships between value domains and between the individual values in (possibly) different value domains. Any time there is a relationship between individual values in different value domains, there is a relationship between the value domains, too.

Value domains and permissible values can have relationships between them. Conceptual domains can be related to each other, too, so the shared conceptual domain for two related value domains may not be the conceptual domain for the individual value domains. A conceptual domain does not have to be represented by any value domains in an ISO/IEC 11179 metadata registry.

There are two main types of relationships that need to be described: relationships between value domains, and relationships between values in one or more value domains. Both kinds of relationships are illustrated in the following real examples detailed in the next sub-clauses.

4.2.1 International Standard Industrial Classification (ISIC)

The **International Standard Industrial Classification** (ISIC, rev. 3), maintained by the United Nations Statistics Division (on the Web at http://esa.un.org/unsd/cr/registry/regcst.asp?Cl=2&Lg=1), is a four level hierarchy used to classify industries for economic analyses within countries and internationally (see also sub-clause 4.4). The four levels have names and they represent levels of detail in the hierarchy. The names of the levels and the number of items in each level are

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Level 1: Tabulation Categories 17 items

Level 2: Divisions 60 items

Level 3: Groups 159 items

Level 4: Classes 259 items

Each item at each of the first three levels has one or more items of detail at the next lower level. Here is an example:

EXAMPLE 12 –

Hierarchy:

Tabulation Category: G - Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods

Division: 51 - Wholesale trade and commission trade, except of motor vehicles and motorcycles

Group: 513 - Wholesale of household goods

Class: 5131 - Wholesale of textiles, clothing and footwear

Four levels are shown within the wholesale and retail trade tabulation category. There are several choices at each level and explanatory notes to help the user understand the concepts.

The example indicates that the ISIC is really composed of four related value domains, one for each level. They are related for two reasons: 1) each domain (level) is a categorization of industries; 2) the values in each domain are a generalization of the items in the level below it, or the items in each domain are a specialization of the item in the level above it. In the example above, for instance, item 51 generalizes item 513 (and items 511, 512, 514, 515, & 519). The items in the Group level are specializations of the item (51) in the Division level.

The following example shows the conceptual domains and value domains necessary to register ISIC:

EXAMPLE 13 –

Conceptual domain (general) name: Industrial Classification Systems

Conceptual domain definition: Nested levels of codes representing categories of industries.

Conceptual domain name: Industrial classification systems, Level 1

Conceptual domain definition: First level codes representing categories of industries.

Conceptual domain relationship: specialization of {Industrial Classification Systems}

Value domain name: Tabulation Category of ISIC

Permissible values: <A, Agriculture, hunting and forestry>

<B, Fishing>

…

<Q, Extra-territorial organizations and bodies>

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Conceptual domain name: Industrial classification systems, Level 2

Conceptual domain definition: Second level codes representing categories of industries.

Conceptual domain relationship: specialization of {Industrial Classification Systems}

Value domain name: Division, ISIC

Permissible values: <01, Agriculture, hunting and related service activities>

<02, Forestry, logging and related service activities>

<05, Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing>

…

<99, Extra-territorial organizations and bodies>

Conceptual domain name: Industrial classification systems, Level 3

Conceptual domain definition: Third level codes representing categories of industries.

Conceptual domain relationship: specialization of {Industrial Classification Systems}

Value domain name: Group, ISIC

Permissible values: <011, Growing of crops; market gardening; horticulture>

…

<020, Forestry, logging and related service activities>

…

<050, Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing>

…

<990, Extra-territorial organizations and bodies>

Conceptual domain name: Industrial classification systems, Level 4

Conceptual domain definition: Fourth level codes representing categories of industries.

Conceptual domain relationship: specialization of {Industrial Classification Systems}

Value domain name: Class, ISIC

Permissible values: <0111, Growing of cereals and other crops n.e.c.>

<0112, Growing of vegetables, horticultural specialties and nursery products>

…

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<0200, Forestry, logging and related service activities>

…

<0500, Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing>

…

<9900, Extra-territorial organizations and bodies>

In this example, the relationships between the value domains are maintained through the relationship of the value domain to its conceptual domain and the fact that each conceptual domain is related to the same generalized conceptual domain. The relationships between the values of different domains is maintained through the codes (values) themselves. The number of characters in the code determines the level. The left most character is the first level code, the two left-most characters are the second level code, and so on.

The ISO/IEC 11179 metamodel for metadata registries does not support other types of relationships between values in two value domains. If the registration authority determines that this is necessary for the function of the registry, the necessary extensions to the metamodel need to be added.

4.2.2 Logical Observation Identifiers Names and Codes (LOINC)

Another example of a set of domains requiring relationships is the LOINC. The Logical Observation Identifiers Names and Codes (LOINC) provides a standard set of universal names and codes for identifying individual laboratory results, clinical observations, and diagnostic study observations in the health care arena. Details are available at the Web site at http://www.regenstrief.org/loinc/loinc.htm.

The LOINC has a basic structure defined in the *LOINC Users Guide* as follows:

> The fully specified name of a test result or clinical observation has five or six main parts including: the name of the component or analyte measured (e.g. glucose, propranolol), the property observed (e.g. substance concentration, mass, volume), the timing of the measurement (e.g. is it over time or momentary), the type of sample (e.g. urine, serum), the scale of measurement (e.g., qualitative vs. quantitative), and where relevant, the method of the measurement (e.g., radioimmune assay, immune blot). These can be described formally with the following syntax.
>
> **<Analyte/component>:<kind of property of observation or measurement>:<time aspect>:<system (sample)>:<scale>:<method>**
>
> The colon character, ":", is part of the name and is used to separate the main parts of the name.
>
> The first part of the name can be further divided up into three subparts, separated by carats (^). The first subpart can contain up to three levels of increasing taxonomic specification, separated by dots (.). The third and fourth parts of the name (time aspect and system/sample) can also be modified by a second subpart, separated from the first by a carat. In the case of time aspect, the modifier can indicate that the observation is one selected on the basis of the named criterion (maximum, minimum, mean, etc.); in the case of system, the modifier identifies the origin of the specimen if not the patient (e.g., blood donor, fetus, blood product unit).

Providing details as in the case of ISIC above is not instructive. The description of LOINC is very complex and is beyond the scope for this Technical Report. From the short description above, it is clear that multiple code sets are used to specify a LOINC record; some of the code sets have relationships with each other, at the code set level and at the code value level; and a conceptual domain relationship is necessary to capture all the relationships across the various value domains.

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4.3 Code sets as value domains

Code sets are lists of permissible values, therefore they are examples of value domains. They contain a code, or value, and the meaning of that value. See the sex codes examples above. Most often, the meaning is captured through a word or short phrase in natural language that evokes the concept. Sometimes the code set documents contain multiple encodings for the same meanings, e.g., ISO 3166 *Country Codes*. Often, code sets are maintained as ISO standards.

As in the sex codes example, using codes to designate well known meanings is a useful trick. It started in the information technology community when people needed to store data about a characteristic of an object of interest (e.g., households, patients, factories, etc.) and use the fewest number of bytes when doing it. Using codes makes programming easier, because fixed length data is easier to handle than variable length. Also, it is easier to maintain codes in a database than it is descriptive words.

Code sets are used as value domains in many subject matter areas and standards. In the US health care community, the following quote (accessible form the Web site http://aspe.os.dhhs.gov/admnsimp/faqcode.htm describes the use of code sets

> Under HIPAA [Health Insurance Portability and Accountability Act], a "code set" is any set of codes used for encoding data elements, such as tables of terms, medical concepts, medical diagnosis codes, or medical procedure codes. Medical data code sets used in the health care industry include coding systems for diseases, impairments, other health related problems, and their manifestations; causes of injury, disease, impairment, or other health-related problems; actions taken to prevent, diagnose, treat, or manage diseases, injuries, and impairments; and any substances, equipment, supplies, or other items used to perform these actions. Code sets for medical data are required for data elements in the administrative and financial health care transaction standards adopted under HIPAA for diagnoses, procedures, and drugs.

In the manufacturing standards community (ISO/TC184/SC4), the standard ISO 10303 – *Industrial automation systems and integration – Product data representation and exchange* – contains many examples of the use of code sets as value domains for data elements. The following example comes from Part 21: *Implementation methods: Clear text encoding of the exchange structure*:

EXAMPLE 14 – (This example is taken almost verbatim from ISO 10303-21, sub-clause 8.2.4)

> The **section_language** entity identifies the default language for string values in a data section. The attribute **default_language** shall contain the name of the language. The name of the language shall be encoded as set forth in ISO 639 – *Code for the representation of the names of languages*. The attribute **section** shall contain the name of a data section in the exchange structure for which the default language shall apply. If the exchange structure contains a single, unnamed, data section, no value shall be provided for the attribute **section** (see 10.2.2). The header section of an exchange structure shall contain at most one **section_language** instance where no value is provided for the attribute **section**. If present, the default language encoded by this instance shall apply to all data sections in the exchange structure for which no other **section_language** instance applies.

NOTE - ISO 639 defines two and three letter, lowercase symbol codes for languages.

Another three examples, taken from Part 41 – *Integrated generic resource: Fundamentals of product description and support* – are the following: (Compare with sub-clauses 4.6 and 4.7)

EXAMPLE 15 – (This example is taken almost verbatim from ISO 10303-41, sub-clause 21.3.11 – **measure_value**)

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A **measure_value** is a value as defined in ISO 31:(all parts) – *Quantities and units*. Some example values are:

length_measure

mass_measure

time_measure

electric_current_measure

EXAMPLE 16 – (This example is taken almost verbatim from ISO 10303-41, sub-clause 21.3.19 – **si_prefix**)

An **si_prefix** is the name of a prefix that may be associated with an **si_unit.** The definitions of SI prefixes are specified in ISO 1000:1992 – *SI units and recommendations for the use of their multiples and of certain other units*. Some example values are:

exa: see ISO 1000.

peta: see ISO 1000.

tera: see ISO 1000.

pico: see ISO 1000.

femto: see ISO 1000.

atto: see ISO 1000.

EXAMPLE 17 – (This example is taken almost verbatim from ISO 10303-41, sub-clause 21.3.20 – **si_unit_name**)

An **si_unit_name** is the name of an SI unit.

NOTE -The definitions of the names of SI units are specified in ISO 1000

Some example values are

metre: see ISO 1000.

gram: see ISO 1000.

NOTE - ISO 1000 gives "kilogram" as the SI unit name. This part of ISO 10303 uses "gram" as the SI unit name.

second: see ISO 1000.

kelvin: see ISO 1000.

ampere: see ISO 1000.

4.4 Classification schemes as value domains

Some code sets have structure built into them. Every code set with structure (as described above in sub-clause 4.2) is both a classification scheme and value domain. Some people say that every code set, even every enumerated

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domain, is a classification scheme. This distinction does not seem to be worth debating, but it is important to realize that many classification schemes (the ones that are also code sets) are value domains.

The US health care community has adopted many international classifications for use as code sets in their work. The following list shows some of the classifications is use:

International Classification of Diseases, 9th Edition, Clinical Modification, (ICD-9-CM), Volumes 1 and 2, for the following conditions:

1) Diseases

2) Injuries

3) Impairments

4) Other health related problems and their manifestations

5) Causes of injury, disease, impairment, or other health-related problems

International Classification of Diseases, 9th Edition, Clinical Modification, (ICD-9-CM), Volume 3 Procedures, for the following procedures or other actions taken for diseases, injuries, and impairments on hospital inpatients reported by hospitals:

1) Prevention

2) Diagnosis

3) Treatment

4) Management

The international statistical community has adopted several classifications as code sets, such as

International Standard Industrial Classification (ISIC) is used by statistical agencies and international statistical organizations to classify business establishments and to report economic statistics. Within organizations that maintain registers of business establishments, it is a code set for the data element that represents the industry category to which each establishment belongs.

Countries and groups of countries have their own standard industrial classifications (SIC), also. The ISIC is a four-tiered hierarchy SIC. In North America (Canada, Mexico, and United States), the **North American Industrial Classification System** (NAICS) was first published in 1997. It is a four-tiered hierarchy SIC of industry classes and codes, too. It is used similarly to the ISIC across countries, but each North American country has added more levels of detail to serve the needs of their own constituents. Other countries have similarly detailed classifications of industries.

Correspondence tables are created to map one SIC to another. They are especially important for mapping new versions of an SIC to the next older version of it. These correspondence tables are used by analysts to maintain time series tables across breaks in the series caused by the SIC updates. Correspondence tables are not limited to use for SICs. They are used for any standard classification or sets of similar classifications (see below). The ISO/IEC 11179 metamodel of a metadata registry does not contain a correspondence table class. If a registration authority deems it necessary to include correspondence tables in its registry, then local extensions to the metamodel must be made.

In addition to industrial classifications, there are standard occupational classifications (SOC) in use, too. Many countries have adopted SOC systems for use in reporting statistics. The occupations that companies hire employees

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for are classified, aggregated, and reported through the use of the SOCs. Individual descriptions of jobs by people are also classified using SOC and SIC together.

These examples provided above are in no way exhaustive. They are provided to give the reader an idea of the breadth of the use of classifications across subject matter areas and as code sets for data elements.

4.5 Data types and value domains

ISO/IEC 11404 – *Language independent data types* – defines data types as consisting of a value space (i.e., value domain) and sets of characterizing operations and properties. A value space by itself is not enough to specify a data type.

ISO/IEC 11179 only addresses value domains, however, identifying a data type with a value domain is important for sharing and understanding data. Data types are fundamental to the declaration of variables (data elements) in programming languages and are implicit in the construction of entities and classes in data modelling.

The example shows how the same data can have different data types.

EXAMPLE 18 -

#1

Value domain name: Volume (in gallons)

Domain description: Non-negative integers

Data type Integer

#2

Value domain name: Volume (in gallons)

Domain description: Non-negative integers

Data type Character

Data that belongs to each one of these value domains looks the same on a computer screen or printed on paper, but the data look much different to computer programs. Transferring data belonging to the integer data value domain requires writing a different program to receive it than for data belonging to the character data

– value domain. The data type does not provide all the information necessary to complete the transfer; some additional machine dependent parameters must be known, but they are out of scope of ISO/IEC 11179.

So, it is at the data transfer level that the data type becomes an issue. The difference is so important for applications to work properly that the value domains in the above example must be considered as different. Then, associating each value domain with the same data element concept requires the formation of separate data elements. In this way, the proper understanding of the data is ensured.

In the ISO/IEC 11179 metamodel for a metadata registry, *data type* has four attributes: *name*, *description*, *scheme*, and *annotation*. It is sufficient to supply the name of the data type, a description of its derivation (if applicable), the scheme from which the primitive or derivation came (e.g., ISO/IEC 11404), and any other appropriate descriptive notes. This way, the user of the metadata registry can understand the meaning of the listed data type, but the ISO/IEC 11179 metadata registry does not need to support the machinery for deriving data types. This is especially important because there are many schemes for supporting data types, new ones are generated periodically, and it is impractical to build a model to support them all.

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4.6 Units of measure

The allowed values of value domains reflect how humans quantify the world. Many of these quantifications have units of measure associated with them. There are many types of measures, each with many choices for units of measure (see sub-clause 4.7, too), which the following list shows:

Revenues -	Dollars, Euros
Blood cell counts -	Counts
Mass -	Grams
Height -	Inches, Centimeters
Speed -	Miles per hour, Meters per second
Wavelength -	Ångströms
Concentrations -	Parts per million
Sedimentation -	Milliliters per hour

Usually, we encounter the unit of measure when analyzing the data represented by a data element. However, it makes sense from several perspectives to link units of measure with value domains when managing them in a metadata registry. The metamodel of a metadata registry described in ISO/IEC FCD 11179-3:2001 links units of measure with value domains. ISO 1000:1992 – *Si units and recommendations for the use of their multiples and of certain other units* – contains a more detailed description of SI and other kinds of units of measure. See also the *Unified Code for Units of Measure*, by G. Schadow and C. McDonald (1999), located on the Web at http://aurora.rg.iupui.edu/UCUM/.

Consider enumerated domains with the following example 19:

EXAMPLE 19 -

Value domain name:	Age categories	
Permissible values:	1	0 – 15, years
	2	16 – 29, years
	3	30 – 64, years
	4	65 – above, years
Conceptual domain name:	Categorizations of ages of people	
Conceptual domain definition:	Categories representing ranges of people's ages.	

The enumerated domain above uses a unit of measure, years, to help label the ranges that define the categories that comprise the domain. Notice, the use of the unit of measure contained in the value meanings is fundamental to the understanding of each range. Another enumerated domain with the same range values but different value meanings is a different domain, because an enumerated domain contains permissible values – defined to be value/value meaning pairs.

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The example shows some enumerated domains need to have the unit of measure attached to them. There is no need to know any associated data elements to see that the unit of measure is required to confer meaning to the values in the permissible values of this domain. Recall, however, from the examples of sex codes in sub-clause 4.1 that units of measure are not applicable for every enumerated domain.

For non-enumerated domains, the choice is the same. The units of measure associated with the allowed values of the domain help determine the "value meanings" for the domain. Different units of measure associated with the same range of values determine different value domains. Example 20 showing two value domains illustrates the point:

EXAMPLE 20 -

#1

Value domain name:	Volume (in whole gallons)
Domain description:	Non-negative integers
Conceptual domain name:	Volumes
Conceptual domain definition:	Measures of volume.

#2

Value domain name:	Volume (in whole liters)
Domain description:	Non-negative integers
Conceptual domain name:	Volumes
Conceptual domain definition:	Measures of volume.

The value domains in the examples above are conceptually equivalent and share the same Domain description. However, the same numbers from each domain (with the exception of zero!) do not mean the same thing. One liter is not the same volume as one gallon. For this reason, changing the unit of measure changes the domain.

4.7 Dimensionality

Dimensionality is the name applied to the conceptual part of units of measure. Measures such as meters per second, miles per hour, and furlongs per fortnight are all measures of speed. Measures such as pounds and newtons are measures of force. The members of each set above belong to the same class, or are said to have the same dimensionality.

In the language of mathematics, dimensionality forms an equivalence class on the set of all units of measure. The equivalence between two units of measure is determined by the existence of an invertible transformation of one set of units to the other. This means that two units of measure have the same dimensions if there exists a function that maps values in one unit of measure to values in the other and the inverse of the function maps values in the second units back to values in the first. Recognizing when these functions exist and when they do not is an important aspect of maintaining a registry. The two examples below illustrate this:

EXAMPLE 21: Fahrenheit - Celsius temperature conversion

$$F° = (9/5)\ C° + 32 \quad \text{and} \quad C° = (5/9)\ (F° - 32)$$

EXAMPLE 22: Inches - Centimetres length conversion

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In = (2.54)xCm and Cm = In/(2.54)

See *Measurement Units in XML Datatypes*, by F. Olken and J. McCarthy (1999), located on the Web at http://pueblo.lbl.gov/~olken/mendel/w3c/xml.schema.wg/units/syntax.htm. Again, see the *Unified Code for Units of Measure*, by G. Schadow and C. McDonald (1999), located on the Web at http://aurora.rg.iupui.edu/UCUM/ for related ideas.

It is very important for the registrar and subject matter specialists that manage value domains in a metadata registry to understand dimensionality. The users of the registry need to know whether data supplied in one set of units can be transformed into another. Units of measure used in conceptually equivalent domains must have the same dimensionality. Example 23 of two non-enumerated domains will illustrate this:

EXAMPLE 23 -

Conceptual domain name:	Amounts in monetary units
Conceptual domain definition:	Numbers signifying monetary values (in units).
Value domain name (1):	Amounts in whole dollars
Domain description (1):	Non-negative integers
Value domain name (2):	Amounts in whole euros
Domain description (2):	Non-negative integers

There exists a way to translate dollars to euros and back again, and it is evident that these are conceptually equivalent domains. They both represent the same idea, which is "amounts of money". However, the example also illustrates a problem. Money conversion requires a function that changes almost continuously for some applications, e.g., banking, because exchange rates fluctuate so often. Issues of this sort will require much monitoring if they are important to the function of the registry.

The following is a (partial) list of possible problem areas with dimensionality and the difficulty stewards and users may face in converting units:

1) Transforming monetary units (see above)

2) The difference between transforming temperature at a given time and place and transforming temperature intervals

3) The difference between transforming date and time for a specific event and transforming intervals of dates or times

4) Recognizing that some SI and English (or some other system of) units have the same dimensionality

4.8 Classifying value domains

Value domains are classified in one of two main ways, either through associations with the terms in a classification scheme, or through the use of *Representation Class*. Representation class is a special classification scheme represented in the metamodel for a metadata registry for classifying value domains. The value domain, its attributes, and its associations with data type and unit of measure make up the representation for a data element. So, the representation class is a classification of representations. It is very simple in structure, essentially a list of key words. These words are designations for concepts describing the class of representation. Here, several examples that appeared before will now have a representation class term included:

EXAMPLE 24 -

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Value domain name:	Human sex codes (1)
Permissible values:	1 Male
	2 Female
	3 Unknown
Conceptual domain name:	Categorizations of human sexes
Conceptual domain definition:	Enumeration of concepts of human sexes.
Representation class term:	Categories

EXAMPLE 25 -

Value domain name:	Textual English descriptions
Domain description:	English text up to 60 characters
Conceptual domain name:	Textual descriptions
Conceptual domain definition:	Text describing an activity or thing.
Representation class term:	Text

EXAMPLE 26 -

Value domain name:	Volume (in whole liters)
Domain description:	Non-negative integers
Conceptual domain name:	Volumes
Conceptual domain definition:	Volumes expressed in different units of measure.
Representation class term:	Numeric with units of measure

5 Registering value domains

This clause contains a description of the detail needed to register a value domain in an ISO/IEC 11179 metadata registry. Two examples are given, one for an enumerated domain and the other for a non-enumerated domain. The discussion will focus on the unique requirements for registering value domains.

5.1 Rules for registering value domains

In general, the following classes in the model are related to value domains and conceptual domains. They are populated when registering value domains and conceptual domains in an ISO/IEC 11179 metadata registry -

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Value domain

Value domain relationship (if necessary)

Conceptual domain

Conceptual domain relationship (if necessary)

Value meanings (if value domain is enumerated, or rarely non-enumerated)

Enumerated domain or Non-enumerated domain (possibly both)

If enumerated –

Value

Permissible value (Associate Value with Value meaning)

If non-enumerated -

Description

Unit of measure (if necessary)

Data type

Representation class

A model in UML notation for the value domain – conceptual domain portion of the metamodel for metadata registries is provided in Annexe A. The model shows the classes, with their names, attributes, and relationships. The optionality and the cardinality of each attribute and relationship are provided.

The model contains some basic rules for registering value domains and conceptual domains in an ISO/IEC 11179 metadata registry. Some of the rules were stated in the preceding paragraphs and sections. Others are discussed here. In addition, some of the rationale for the rules is lost in the modelling notation.

1) A conceptual domain can exist by itself, i.e., it does need an associated value domain for it to exist; but, a value domain must have an associated conceptual domain.

Some conceptual domains are not linked directly to value domains. So, the conceptual domain stands alone. Example 12 in sub-clause 4.2.1 illustrates this.

2) Value meanings must be carefully maintained. See sub-clauses 4.1 – 4.4.

Value meanings are the means to link different designations in different enumerated domains with the same meaning; the means to track changes to the meaning of a designation over time; and the means to build correspondence tables between classifications. Similar concepts are often represented across classifications; mapping these concepts to each other is important for data users who need to compare different data classified to similar but different classification schemes.

3) Enumerated and non-enumerated sub-types of value domains are not exclusive. This means some value domains can have an enumerated part and a non-enumerated part. See example 8 in sub-clause 4.1.

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It is easy to think that the sub-types are exclusive, i.e., either one or the other is true, but not both. Almost all examples are of one type or the other. However, special circumstances sometimes necessitate the creation of unusual value domains.

4) Data type is a very important component and must be carefully documented, as described in sub-clause 4.5.

Data type is required for successful data transfers. The problem is that there are many mechanisms for specifying a data type. There are programming languages, database query languages, data transfer languages, abstract data definition languages, and other standards. Each one has its own way of describing and naming its allowed data types. Not all of these specifications allow the same kinds of data types. Data types with the same name in different specifications do not always mean the same thing. Not all specifications have the same primitive data types. The ways of generating new data types from the primitive ones differ across specifications.

ISO/IEC 11179 does not require the user to use one specification for naming or describing data types. It does require the user to provide the name of the specification and the name or derivation of the data type, so the user can determine the meaning of the data type.

5) Units of measure describe data values and help determine comparability between data from different sources. They are a required part of the documentation for any measurement, either from an experiment or through a statistical process. See sub-clauses 4.6 and 4.7.

Units of measure are grouped into classes by dimensionality. Dimensionality is a concept for units of measure and is associated with the conceptual domain. Units of measure used in conceptually equivalent domains must have the same dimensionality.

6) A value meaning does not have to be associated with a permissible value. A permissible value must have an associated value meaning.

7) A conceptual domain is a set of value meanings for enumerated domains. Item 6 (above) implies that the set of value meanings does not have to be in one-to-one correspondence with the permissible values for any of the value domains representing the conceptual domain. In addition, conceptually equivalent enumerated domains do not have to be elementarily equivalent domains. Non-elementarily equivalent, but conceptually equivalent, domains might even have the same number of permissible values.

The issue of how many permissible values conceptually equivalent enumerated domains must share is open to interpretation. Relating a value domain to a conceptual domain is a subject matter expert's decision. Two reasonable people may differ in their choices. Needs of the organization, needs of internal users, needs of outside users, and needs dictated by standards all have an influence.

The following example shows three conceptually equivalent, but non-elementarily equivalent, enumerated domains, two with the same number of permissible values.

EXAMPLE 27 -

Value domain name:	School subject codes (1)	
Permissible values:	1	Mathematics
	2	Language
	3	Foreign Language
	4	History
	5	Other

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Conceptual domain name:	Categorizations of school subjects
Conceptual domain definition:	Enumeration of concepts of school subjects.

EXAMPLE 28 -

Value domain name:	School subject codes (2)
Permissible values:	1 Mathematics
	2 Language
	3 Foreign Language
	4 European History
	5 Pan-American History
	6 Other
Conceptual domain name:	Categorizations of school subjects
Conceptual domain definition:	Enumeration of concepts of school subjects.

EXAMPLE 29 -

Value domain name:	School subject codes (3)
Permissible values:	1 Mathematics
	2 Language
	3 Foreign Language
	4 African History
	5 Asian History
	6 Other
Conceptual domain name:	Categorizations of school subjects
Conceptual domain definition:	Enumeration of concepts of school subjects.

5.2 Strategies

Strategies and steps to register value domains can be broken into two large categories, those for enumerated domains and those for non-enumerated domains. The main strategy is provided in a series of steps. The steps do not have to be followed in the order given. The given steps are not exhaustive.

For any domain, do the following:

1) Understand what values are allowed. This requires a full understanding of the rule defining the allowed values for a non-enumerated domain or understanding the structure of values and their meanings for an enumerated domain. It

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may not be possible to know all the permissible values of an enumerated domain at first, but understanding the content, meaning, and form of typical examples is necessary.

2) Determine whether a suitable conceptual domain exists in the registry for the value domain. If not, then a new one must be created and entered into the registry. It may be hard to determine which of several existing conceptual domains is the appropriate one for the given value domain. This is best determined through the work of a team, which includes the registrar and appropriate subject matter experts.

3) If an appropriate conceptual domain already exists, then determine whether the value domain itself already exists. Examine all the conceptually equivalent value domains representing the selected conceptual domain. If the given value domain is new, then it must created and entered into the registry.

4) If the value domain is non-enumerated, then the rule, units of measure, and dimensionality need to be determined.

5) If the value domain is enumerated, then the values and the value meanings of each permissible value must be determined.

6) If the conceptual domain existed previously, then the value meanings for that conceptual domain must be checked against each of the value meanings for the new enumerated domain. Enter any value meanings that did not previously exist. Mark the permissible values where the value meanings already exist in the registry.

7) Enter the permissible values, using links to previously existing value meanings. There is no need to manage the set of values. Values may be repeated in the registry.

8) Determine if the conceptual domain is related to other conceptual domains. This is especially true when registering a set of value domains such as a classification (see sub-clause 4.4). The classification is often represented as a hierarchy, and a hierarchy of conceptual domains is created to capture the concepts that each level (value domain) represents.

9) Determine if the value domain is related to other value domains. This is especially true when registering a set of value domains such as a classification (see sub-clause 4.4). The classification is often represented as a hierarchy, and the relationship between the levels is represented as relationships between the value domains.

10) Currently, the metamodel for metadata registries does not handle relationships between permissible values. Relationships do exist in cases where value meanings are the same across value domains, and the relationship is realized by the links to a common value meaning. Relationships also exist in hierarchical code structures such as a classification (see sub-clause 4.4), and the relationship is realized through the structure of the value, i.e., code, itself.

5.3 Examples

There are two examples in this sub-clause, each illustrating the registration of a value domain.

5.3.1 Enumerated domain

The first example is for a linked set of enumerated domains, contained in the standard ISO 3166 – *Country Codes*. This section demonstrates how to register enumerated domains (in this case, code sets) in an ISO/IEC 11179 metadata registry. Four code sets contained in ISO 3166 are registered: short English name, 2 character alpha code, 3 character alpha code, and 3 character numeric code. Each permissible value in each code set is linked to the corresponding value meaning that defines those values. These links establish a correspondence across each of the value domains on an element-by-element basis. The set of value meanings is registered along with a conceptual domain.

EXAMPLE 30 –

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Registration of Conceptual Domain		
1	Conceptual Domain	
	Conceptual Domain Context	ISO 3166
	Conceptual Domain Name	Countries of the World
	Conceptual Domain Definition	The primary geopolitical entities of the world.
	CD Identifier/Version Number (DI:VI)	(93-273-8065) 1234:1
2	Value Meanings	
	Value Meaning ID	10001
	Meaning Text	The primary geopolitical entity known as <Democratic Republic of Afghanistan>
	VM Begin Date	19971001
	VM End Date	(Not applicable)
	Value Meaning ID	10002
	Meaning Text	The primary geopolitical entity known as <People's Socialist Republic of Albania>
	VM Begin Date	19971001
	VM End Date	(Not applicable)
	. . . .	
	Value Meaning ID	10220
	Meaning Text	The primary geopolitical entity known as <Republic of Zimbabwe>
	VM Begin Date	19971001
	VM End Date	(Not applicable)
5	Other Metadata Attributes	
	Origin	ISO 3166-1:1997, Codes for the representation of names of countries and their subdivisions -- Part 1: Country codes

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Registration of Conceptual Domain		
		subdivisions -- Part 1: Country codes
	Comment	(Not Applicable)
	Submitting organization	Bureau of Labor Statistics
	Data Steward	Dan Gillman
6	**Classification**	
	Keyword	Country, World
	Group	Geopolitical Entities, Country Identifiers
	Object	Country
	Layer of abstraction	Conceptual Domain
7	**Quality Control**	
	Registration Status	Standard
	Administrative Status	Final

Registration of Value Domain #1		
3	**Value Domain**	
	Value Domain Context	ISO 3166-1:1997
	Value Domain (VD) Name	Short English-Language Country Names
	Value Domain Name Context	Registry
	Value Domain Definition	Short English-language names of all countries.
	VD Identifier/Version Number (DI:VI)	(93-273-8065) 9876:1

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Registration of Value Domain #1		
	Conceptual Domain ID for this Value Domain	1234:1
	Domain Type	Enumerated
	Data Type	Character string
	Data Type Scheme	C programming language
	Minimum Characters	4
	Maximum Characters	44
	Format	%s
	Unit of Measure	(Not Applicable)
	Precision	(Not Applicable)
	VD Origin (Enumerated)	ISO 3166-1:1997
	VD Explanatory Comment	(Not applicable)
4	**Permissible Values**	
	Values	Afghanistan
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10001
	Values	Albania
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10002
	. . . .	
	Values	Zimbabwe
	PV Begin Date	19971001
	PV End Date	(Not applicable)

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Registration of Value Domain #1		
	Value Meaning ID	10220
5	**Other Metadata Attributes**	
	Origin	ISO 3166-1:1997, Codes for the representation of names of countries and their subdivisions -- Part 1: Country codes
	Comment	(Not Applicable)
	Submitting organization	Bureau of Labor Statistics
	Data Steward	Dan Gillman
7	**Quality Control**	
	Registration Status	Standard
	Administrative Status	Final

Registration of Value Domain #2		
3	**Value Domain**	
	Value Domain Context	ISO 3166-1:1997
	Value Domain (VD) Name	2 Character Alphanumeric Country Codes
	Value Domain Name Context	Registry
	Value Domain Definition	2 Character Alphanumeric Codes for all countries
	VD Identifier/Version Number (DI:VI)	(93-273-8065) 9877:1
	Conceptual Domain ID for this Value Domain	1234:1
	Domain Type	Enumerated

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Registration of Value Domain #2		
	Data Type	Character string of length 2
	Data Type Scheme	C programming language
	Minimum Characters	(Not Applicable)
	Maximum Characters	(Not Applicable)
	Format	%2c
	Unit of Measure	(Not Applicable)
	Precision	(Not Applicable)
	VD Origin (Enumerated)	ISO 3166-1:1997
	VD Explanatory Comment	(Not applicable)
4	**Permissible Values**	
	Values	AF
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10001
	Values	AL
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10002
	. . . .	
	Values	ZW
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10220

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Registration of Value Domain #2		
5	**Other Metadata Attributes**	
	Origin	ISO 3166-1:1997, Codes for the representation of names of countries and their subdivisions -- Part 1: Country codes
	Comment	(Not Applicable)
	Submitting organization	Bureau of Labor Statistics
	Data Steward	Dan Gillman
7	**Quality Control**	
	Registration Status	Standard
	Administrative Status	Final

Registration of Value Domain #3		
3	**Value Domain**	
	Value Domain Context	ISO 3166-1:1997
	Value Domain (VD) Name	3 Character Alphanumeric Country Codes
	Value Domain Name Context	Registry
	Value Domain Definition	3 Character Alphanumeric Codes for all countries
	VD Identifier/Version Number (DI:VI)	(93-273-8065) 9878:1
	Conceptual Domain ID for this Value Domain	1234:1
	Domain Type	Enumerated
	Data Type	Character string of length 3
	Data Type Scheme	C programming language

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Registration of Value Domain #3		
	Minimum Characters	(Not Applicable)
	Maximum Characters	(Not Applicable)
	Format	%3c
	Unit of Measure	(Not Applicable)
	Precision	(Not Applicable)
	VD Origin (Enumerated)	ISO 3166-1:1997
	VD Explanatory Comment	(Not applicable)
4	**Permissible Values**	
	Values	AFG
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10001
	Values	ALB
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10002
	. . . .	
	Values	ZWE
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10220
5	**Other Metadata Attributes**	
	Origin	ISO 3166-1:1997, Codes for the representation of names of countries and their subdivisions -- Part 1: Country codes

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Registration of Value Domain #3		
	Comment	(Not Applicable)
	Submitting organization	Bureau of Labor Statistics
	Data Steward	Dan Gillman
7	**Quality Control**	
	Registration Status	Standard
	Administrative Status	Final

Registration of Value Domain #4		
3	**Value Domain**	
	Value Domain Context	ISO 3166-1:1997
	Value Domain (VD) Name	3 Character Numeric Country Codes
	Value Domain Name Context	Registry
	Value Domain Definition	3 Character Numeric Codes for all countries
	VD Identifier/Version Number (DI:VI)	(93-273-8065) 9879:1
	Conceptual Domain ID for this Value Domain	1234:1
	Domain Type	Enumerated
	Data Type	Numeric Character of length 3
	Data Type Scheme	C programming language
	Minimum Characters	(Not Applicable)
	Maximum Characters	(Not Applicable)
	Format	%3c

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Registration of Value Domain #4		
	Unit of Measure-	(Not Applicable)
	Precision	(Not Applicable)
	VD Origin (Enumerated)	ISO 3166-1:1997
	VD Explanatory Comment	(Not applicable)
4	**Permissible Values**	
	Values	004
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10001
	Values	008
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10002
	. . . .	
	Values	716
	PV Begin Date	19971001
	PV End Date	(Not applicable)
	Value Meaning ID	10220
5	**Other Metadata Attributes**	
	Origin	ISO 3166-1:1997, Codes for the representation of names of countries and their subdivisions -- Part 1: Country codes
	Comment	(Not Applicable)
	Submitting organization	Bureau of Labor Statistics
	Data Steward	Dan Gillman

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Registration of Value Domain #4		
7	**Quality Control**	
	Registration Status	Standard
	Administrative Status	Final

5.3.2 Non-enumerated domain

This clause provides a specific example of the registration of a non-enumerated domain from an international standard, ISO 6709-1983, *Standard representation of latitude, longitude and altitude for geographic point locations*. Latitude is a measure of the angular distance on a meridian north or south of the equator. The standard provides for a variable format and more than one representation for recording the latitude measure: degrees and decimal degrees, and sexagesimal (i.e., degrees, minutes, and seconds). The standard also includes more than one representation and format for longitude, and a flexible format for altitude. In addition, a standard format for data transfer is included in the standard.

Geographic information specialists increasingly prefer the measurement of locational coordinates in degrees and decimal degrees, though many organizations continue to measure latitude and longitude in degrees, minutes, and seconds. Therefore, we choose to register this value domain for latitude measured in degrees, minutes, and seconds.

EXAMPLE 31 -

Registration of Conceptual Domain		
1	**Conceptual Domain**	
	Conceptual Domain Name Context	Measures of latitude
	Conceptual Domain Name Context	Registry
	Conceptual Domain Definition	All latitude measures of points north and south of the equator.
	Conceptual Domain Definition Context	Registry
	CD Identifier/Version Number (DI:VI)	(93-273-8065) 2345:1
2	**Value Meanings**	

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Registration of Conceptual Domain		
	Value Meaning ID	(Not Applicable)
	Meaning Text	(Not Applicable)
	VM Begin Date	(Not Applicable)
	VM End Date	(Not Applicable)
5	**Other Metadata Attributes**	
	Origin	ISO 6709: 1983, Standard representation of latitude, longitude, and altitude for geographic point locations.
	Comment	(Not Applicable)
	Submitting organization	Bureau of Labor Statistics
	Data Steward	Dan Gillman
6	**Classification**	
	Keyword	Horizontal coordinate, Spatial, Latitude
	Group	Geographic Point Location
	Object	Latitude
	Layer of abstraction	Conceptual Domain
7	**Quality Control**	
	Registration Status	Standard
	Administrative Status	Final

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Registration of Value Domain		
3	**Value Domain**	
	Value Domain (VD) Name	Sexagesimal Measure of Latitude
	Value Domain Name Context	Registry
	Value Domain Definition	Sexagesimal measure of the angle formed by a point on the surface of the earth, the center of the earth, and a the point on the equator directly north or south of the given point.
	Value Domain Definition Context	Registry
	VD Identifier/Version Number (DI:VI)	(93-273-8065) 8765:1
	Conceptual Domain ID for this Value Domain	2345:1
	Domain Type	Non-Enumerated
	Non-Enumerated Domain Description	Latitude measure on the equator or north of the equator is positive; latitude measure south of the equator is negative. The range of values for degrees (DD in the format) is 0 – 90; the range of values for minutes (MM in the format) is 0 – 59; and the range of values for seconds (SS or SS.SSSSS in the format) is 0 – 59 or 0 – 59.99999.
	Data Type	Character Varying
	Data Type Scheme	ANSI/ISO SQL
	Minimum Characters	7
	Maximum Characters	13
	Format	+/-DDMMSS to +/-DDMMSS.SSSSS
	Unit of Measure	(Not Applicable)
	Precision	(Not Applicable)
	VD Origin	ISO 6709
	VD Explanatory Comment	(Not Applicable)
4	**Permissible Values**	

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Registration of Value Domain		
	Values	(Not Applicable)
	PV Begin Date	(Not Applicable)
	PV End Date	(Not Applicable)
	Value Meaning ID	(Not Applicable)
5	**Other Metadata Attributes**	
	Origin	ISO 6709: 1983, Standard representation of latitude, longitude, and altitude for geographic point locations.
	Comment	(Not Applicable)
	Submitting organization	Bureau of Labor Statistics
	Data Steward	Dan Gillman
7	**Quality Control**	
	Registration Status	Standard
	Administrative Status	Final

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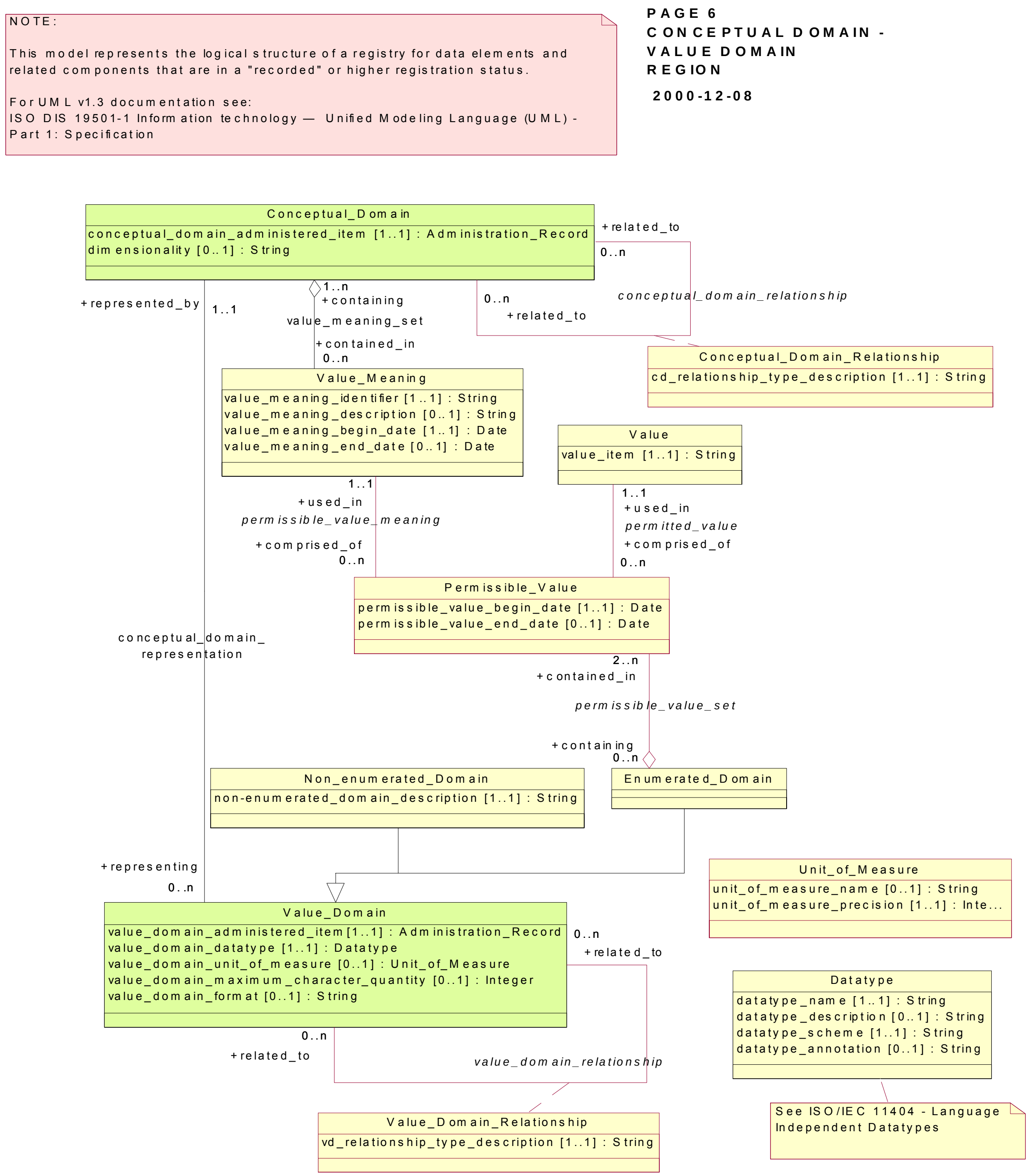
Annex A Metamodel for value domains and conceptual domains

This Annex A includes the portion of the metamodel from ISO/IEC CD 11179-3 that describes value domains, conceptual domains, their attributes, and the relationships between them. The metamodel is included here for easy reference. A complete description of the metamodel and the UML (Unified Modeling Language) used to depict the metamodel are contained in ISO/IEC CD 11179-3.



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