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Geographic information — Cross-domain vocabularies

Information géographique — Vocabulaires interdomaines

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Foreword

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

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

This second edition cancels and replaces the first edition of ISO 19146:2010 which has been technically revised.

The main changes compared to the previous edition are as follows:

— the principles for the cross-mapping of vocabularies have been revised;

— the vocabulary cross-mapping methodology has been reformatted into requirements and conformance classes;

— the conceptual schema has been revised to harmonize with other ISO/TC 211 standards;

— the conceptual schema has been expanded to include the package Term Cross Map which specifies the classes for registering and managing terminological entries and their cross-mapping.

Introduction

The development of information products frequently requires the acquisition and combination of multiple datasets from different data suppliers. The manner in which the data is combined depends on the nature of the business need under consideration and may vary from the simple assembly of thematic representations through to sophisticated integration, analysis and rendering. In every case, the data suppliers and processors need to share a common understanding of the data's characteristics to ensure their appropriate interpretation and use. The more complex or automated the processing becomes, the more necessary it is for this understanding to be unambiguous.

A challenge that arises when combining disparate datasets stems from differing terminology conventions adopted by the contributing suppliers. Frequently, a dataset will originate from a community of professionals that provide support to a particular industry (for example, road transport). The terminology used to describe the content, relationships and behaviour of the data reflects the industry's alignment of concepts with its specialist culture, conventions and practices. A particular concept, therefore, may be identified by different terms depending on the industry context in which it is used.

The capacity to combine data that have been sourced from different professional communities is dependent upon a common comprehension of the terms and concepts used to describe the business meaning of the data. The availability of cross-mapping that reconciles the semantic differences between the communities' vocabularies is therefore required.

This document establishes a methodology for cross-mapping between vocabularies. It is principally intended for use by geospatial communities but may have wider application.

It is not the objective of this document to define an ontology or taxonomy; its purpose is to provide rules for ensuring consistency when implementing cross-mapping processes. The rules, however, have been developed with regard to taxonomic and ontological concepts and with a view to enabling semantic interoperability. Their application to vocabulary cross-mapping, therefore, can be expected to provide input to any future ontology or taxonomy initiatives.

This document applies the provisions of ISO 19135-1:2015 to the registration of geospatial concepts. It also adopts terms and concepts that are taken from UML and terminology theory and practice.

Geographic information — Cross-domain vocabularies

1 Scope

This document establishes a methodology for cross-mapping vocabularies. It also specifies an implementation of ISO 19135-1:2015 for the purpose of registering cross-mapped vocabulary entries.

Methodologies for the development of ontologies and taxonomies that relate to geographic information and geomatics are not within the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19103:2015, *Geographic information — Conceptual schema language*

ISO 19104:2016, *Geographic information — Terminology*

ISO 19115-1:2014, *Geographic information — Metadata — Part 1: Fundamentals*

ISO 19135-1:2015, *Geographic information — Procedures for item registration — Part 1: Fundamentals*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
associative concept system
concept system (3.1.5) based on *associative relations* (3.1.2)

3.1.2
associative relation
pragmatic relation
relation between two *concepts* (3.1.4) having a non-hierarchical thematic connection by virtue of experience

Note 1 to entry: An associative relation exists between the concepts 'education' and 'teaching', 'baking' and 'oven'.

[SOURCE: ISO 1087-1:2000, 3.2.23]

3.1.3
characteristic
abstraction of a property of an object or of a set of objects

Note 1 to entry: Characteristics are used for describing *concepts* (3.1.4).

[SOURCE: ISO 1087-1:2000, 3.2.4]

3.1.4
concept
unit of knowledge created by a unique combination of *characteristics* (3.1.3)

Note 1 to entry: Concepts are not necessarily bound to particular languages. They are, however, influenced by the social or cultural background which often leads to different categorizations.

[SOURCE: ISO 1087-1:2000, 3.2.1]

3.1.5
concept system
system of concepts
set of *concepts* (3.1.4) structured according to the relations among them

[SOURCE: ISO 1087-1:2000, 3.2.11]

3.1.6
cross-map entry
part of a *cross-mapping* (3.1.8) data collection which documents the cross-mapped relationships between two *concepts* (3.1.4)

3.1.7
cross-map register
register of cross-map entries (3.1.6)

Note 1 to entry: A cross-map register may be realized as a subregister in a hierarchical register. In such cases, the *term* (3.1.28) "cross-map subregister" may be used.

3.1.8
cross-mapping
comparison of *terminological entries* (3.1.31) from different *domains* (3.1.12) to determine their semantic relationship

3.1.9
definition
representation of a *concept* (3.1.4) by a descriptive statement which serves to differentiate it from related concepts

[SOURCE: ISO 1087-1:2000, 3.3.1]

3.1.10
delimiting characteristic
essential characteristic (3.1.14) used for distinguishing a *concept* (3.1.4) from related concepts

Note 1 to entry: The delimiting characteristic *support for the back* may be used for distinguishing the concepts 'stool' and 'chair'

[SOURCE: ISO 1087-1:2000, 3.2.7]

3.1.11
designation
designator
representation of a *concept* (3.1.4) by a sign which denotes it

Note 1 to entry: In terminology work three types of designations are distinguished: symbols, appellations and *terms* (3.1.28).

[SOURCE: ISO 1087-1:2000, 3.4.1]

3.1.12
domain
<general vocabulary> distinct area of human knowledge to which a terminological entry (3.1.31) is assigned

Note 1 to entry: Within a database or other terminology collection, a set of domains will generally be defined. More than one domain can be associated with a given *concept* (3.1.4).

[SOURCE: ISO 19104:2016, 4.11]

3.1.13
domain concept
concept (3.1.4) that is associated with a specific *domain* (3.1.12)

Note 1 to entry: A concept may be associated with several domains and separately identified as a domain concept in relation to each.

3.1.14
essential characteristic
characteristic (3.1.3) which is indispensable to understanding a *concept* (3.1.4)

[SOURCE: ISO 1087-1:2000, 3.2.6]

3.1.15
general concept
concept (3.1.4) which corresponds to two or more objects which form a group by reason of common properties

Note 1 to entry: Examples of general concepts are 'planet', 'tower'.

[SOURCE: ISO 1087-1:2000, 3.2.3]

3.1.16
generic concept
concept (3.1.4) in a *generic relation* (3.1.18) having the narrower *intension* (3.1.20)

Note 1 to entry: In this context, a narrower intension means fewer *characteristics* (3.1.3), resulting in a concept *definition* (3.1.9) with a broader scope.

[SOURCE: ISO 1087-1:2000, 3.2.15, modified — Note 1 to entry has been added.]

3.1.17
generic concept system
concept system (3.1.5) in which *concepts* (3.1.4) that belong to the category of the *subordinate concept* (3.1.25) are part of the extension of the *superordinate concept* (3.1.26)

3.1.18
generic relation
genus-species relation
relation between two *concepts* (3.1.4) where the *intension* (3.1.20) of one of the concepts includes that of the other concept and at least one additional *delimiting characteristic* (3.1.10)

Note 1 to entry: A generic relation exists between the concepts 'word' and 'pronoun', 'vehicle' and 'car', 'person' and 'child'.

[SOURCE: ISO 1087-1:2000, 3.2.21]

3.1.19
homonymy
relation between *designations* (3.1.11) and *concepts* (3.1.4) in a given language in which one designation represents two or more unrelated concepts

Note 1 to entry: An example of homonymy is:

3

— bark;

— 'sound made by a dog';

— 'outside covering of the stem of woody plants';

— 'sailing vessel'.

Note 2 to entry: The designations in the relation of homonymy are called homonyms.

[SOURCE: ISO 1087-1:2000, 3.4.25]

3.1.20
intension
set of *characteristics* (3.1.3) which makes up the *concept* (3.1.4)

[SOURCE: ISO 1087-1:2000, 3.2.9]

3.1.21
monosemy
relation between *designations* (3.1.11) and *concepts* (3.1.4) in a given language in which one designation only relates to one concept

Note 1 to entry: The designations in the relation of monosemy are called monosemes.

[SOURCE: ISO 1087-1:2000, 3.4.23]

3.1.22
operating vocabulary
vocabulary (3.1.32) that is not a *reference vocabulary* (3.1.24)

3.1.23
polysemy
relation between *designations* (3.1.11) and *concepts* (3.1.4) in a given language in which one designation represents two or more concepts sharing certain *characteristics* (3.1.3)

Note 1 to entry: An example of polysemy is:

— bridge;

— 'structure to carry traffic over a gap';

— 'part of a string instrument';

— 'dental plate'.

Note 2 to entry: The designations in the relation of polysemy are called polysemes.

[SOURCE: ISO 1087-1:2000, 3.4.24]

3.1.24
reference vocabulary
vocabulary (3.1.32) that is the basis for terminological comparisons with one or more other vocabularies

3.1.25
subordinate concept
narrower concept
concept (3.1.4) which is either a specific concept or a partitive concept

[SOURCE: ISO 1087-1:2000, 3.2.14]

3.1.26
superordinate concept
broader concept
concept ([3.1.4](#)) which is either a *generic concept* ([3.1.16](#)) or a comprehensive concept

[SOURCE: ISO 1087-1:2000, 3.2.13]

3.1.27
synonymy
relation between or among *terms* ([3.1.28](#)) in a given language representing the same *concept* ([3.1.4](#))

Note 1 to entry: The relation of synonymy exists, for example, between *deuterium* and *heavy hydrogen*.

Note 2 to entry: Terms which are interchangeable in all contexts are called *synonyms*; if they are interchangeable only in some contexts, they are called *quasi-synonyms*.

[SOURCE: ISO 1087-1:2000, 3.4.19]

3.1.28
term
verbal *designation* ([3.1.11](#)) of a *general concept* ([3.1.15](#)) in a specific subject field

Note 1 to entry: A term may contain symbols and can have variants, e.g. different forms of spelling.

Note 2 to entry: In this document, a verbal designation is always a written designation.

[SOURCE: ISO 1087-1:2000, 3.4.3]

3.1.29
terminological data
data related to *concepts* ([3.1.4](#)) or their *designations* ([3.1.11](#))

Note 1 to entry: The more common terminological data include entry *term* ([3.1.28](#)), *definition* ([3.1.9](#)), note, grammatical label, subject label, language identifier, country identifier and source identifier.

[SOURCE: ISO 1087-1:2000, 3.8.1]

3.1.30
terminological dictionary
technical dictionary
collection of *terminological entries* ([3.1.31](#)) presenting information related to *concepts* ([3.1.4](#)) or *designations* ([3.1.11](#)) from one or more specific subject fields

[SOURCE: ISO 1087-1:2000, 3.7.1]

3.1.31
terminological entry
part of a *terminological data* ([3.1.29](#)) collection (ISO 10241-1:2011, 3.1.2) which contains the terminological data related to one *concept* ([3.1.4](#))

Note 1 to entry: A terminological entry prepared in accordance with the principles and methods given in ISO 704 follows the same structural principles whether it is monolingual or multi-lingual.

[SOURCE: ISO 1087-1:2000, 3.8.2, modified — Note 1 to entry has been added.]

3.1.32
vocabulary
terminological dictionary ([3.1.30](#)) which contains *designations* ([3.1.11](#)) and *definitions* ([3.1.9](#)) from one or more specific subject fields

Note 1 to entry: The vocabulary may be monolingual, bilingual or multilingual.

[SOURCE: ISO 1087-1:2000, 3.7.2]

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3.2 Abbreviated terms

The following abbreviated terms are used in this document.

LBS   Location-based services

UML   Unified Modeling Language

3.3 Conceptual schema notation

The conceptual schema specified by this document is described using the Unified Modeling Language (UML) and follows the profile specified by ISO 19103:2015 *Geographic information — Conceptual schema language.*

Several model elements used in this document are defined in packages specified in other International Standards; these are listed in Table 1.

Table 1 — UML package identifiers

Prefix	Package
CI	Citation [ISO 19115-1:2014]
RE	Register [ISO 19135-1:2015]
TR	Terminology Register [ISO 19146:2010]

In earlier versions of ISO/TC 211 standards, the names of UML classes (with the exception of basic data type classes) included a two-letter prefix that identified both the standard and the UML package in which the class was specified. In newer versions of ISO/TC 211 standards, this convention is no longer applied. The two letter prefixes specified for classes adopted from earlier International Standards are continued in this document. Classes and packages new to this document do not use a prefix.

In accordance with the guidance of ISO 19103, all data element names are presented as character strings which combine multiple lower-case words as needed to form precise and understandable names without using any intervening characters (such as "_", "-", or space). For attributes and operation names, association roles, and parameters, capitalization is applied to the first letter of each word after the first word. For package, class, type-specification, and association names, capitalization is also applied to the first letter of the first word.

This document has a normative reference (and conformance class dependency) to ISO 19103, ISO 19104, ISO 19115-1 and ISO 19135-1. The result of this is that all classes (except enumerations and codelists) are stereotyped <<interface>>.

4 Conformance

4.1 Conformance class overview

This document defines conformance classes for:

— Vocabulary cross-mapping methodology;

— Vocabulary cross-map registers.

To conform to this document:

— a vocabulary cross-mapping methodology shall satisfy all of the requirements in Table 2 with the corresponding abstract test suite given in A.1;

— a vocabulary cross-map register shall satisfy all of the requirements in Table 3 with the corresponding abstract test suite given in A.2 and ISO 19135-1:2015, A.1, A.2 and A.3.

4.2 Vocabulary cross-mapping methodology conformance class

Table 2 defines the characteristics of the conformance class for the vocabulary cross-mapping methodology.

Table 2 — Vocabulary cross-mapping methodology conformance class

Conformance class identifier	vocabulary cross-mapping methodology <http://standards.iso.org/iso/19146/conf/cmm>
Standardization target	vocabulary cross-mapping
Dependency	ISO 19104:2016
Requirements	All requirements in Clause 6.
Tests	All tests in A.1.

4.3 Vocabulary cross-map registers conformance class

Table 3 defines the characteristics of the conformance class for vocabulary cross-map registers.

Table 3 — Vocabulary cross-map register conformance class

Conformance class identifier	vocabulary cross-map register <http://standards.iso.org/iso/19146/conf/cmr>
Standardization target	vocabulary cross-map
Dependency	ISO 19103:2015
	ISO 19104:2016
	ISO 19115-1:2014
	ISO 19135-1:2015
Requirements	All requirements in Clause 7.
Tests	All tests in A.2.
	All tests in ISO 19135-1:2015, A.1, A.2 and A.3.

5 Principles for cross-mapping of vocabularies

A vocabulary is the medium through which a national, ethnic or occupational community of interest formalizes and communicates its adopted language. It is an important resource for all who seek an understanding of the community's cultures and practices. The terms and definitions identify the concepts that characterize the community's philosophies, technologies and activities. Its structure and supporting information identify the relationships between the concepts and the context in which they are to be used.

Vocabulary cross-mapping is the medium through which two or more communities of interest formalize and communicate the relationships between their languages. It is also the mechanism through which the terminologies of different communities can be integrated, harmonized and rationalized. While ostensibly a process of comparing terms and definitions, its outcome is highly dependent on the level of cultural understanding that exists between the participating communities. The active involvement of all is required to resolve semantic differences and achieve a common understanding of concepts.

Vocabulary cross-mapping is an integral part of the broader standardization agenda. It should, therefore, be implemented in a manner that complements other standardization practices while respecting and reconciling the cultures, processes and viewpoints of the participating communities. The following

overarching principles (which have equal importance) support this expectation. It is recommended that they be observed during any cross-mapping initiative.

— Cross-mapping should proceed as a collaborative venture.

The active participation of all communities is required to reconcile differing semantics and achieve a common understanding of concepts. A community should not cross-map its vocabulary to that of another community without collaborating with that community.

— Cross-mapping should take place in an open and transparent environment.

All deliberations should take place in an open environment and should be communicated to all participating communities. Each participating community should have unrestricted access to the vocabularies of the other communities. If communities have published their vocabularies in different languages (for example, one community has published in English and another in French), translations of each should be provided in all relevant languages, accompanied by information regarding degree of correspondence (ISO 19104:2016, 8.4.3).

— The authority of each community in relation to its vocabulary should be acknowledged.

Each participating community should be acknowledged as the ultimate authority regarding the correct use and interpretation of its terms and definitions. Terms and conventions applied by each community should be respected.

— A stable reference vocabulary, published in a specified reference language, should be adopted for all cross-mapping undertakings involving a particular discipline.

A reference vocabulary is necessary to provide consistency when multiple cross-mapping initiatives are to be undertaken over a period of time. The reference vocabulary may segment or partition its contents and may include terms and definitions from external sources. A reference vocabulary that replicates terminological entries from recognized industry or International Standards should be used if possible.

In the case of geographic information, the reference vocabulary should be the English terms and definitions included in the ISO 19100 series of standards and published on the ISO Online Browsing Platform (https://www.iso.org/obp/ui/).

— Cross-mapping should not circumvent established processes.

Cross-mapping should not be used to circumvent the established processes of the individual collaborating communities. For example, it should not directly deprecate terms, nor should it nominate new terms and definitions to address perceived gaps in a concept system. However, it may trigger other processes within the collaborating communities to deprecate terms or to improve concept system structures.

— Terminology should be consolidated rather than proliferated.

The purpose of vocabulary cross-mapping is to standardize the association of specific terms with specific concepts. It should not be used as a mechanism for permanently entrenching unnecessary duplication in terminology conventions. The cross-mapping process may facilitate the rationalization of terminology by identifying synonyms for deprecation. Ultimately, the cross-mapping process should lead to the consistent application of terms and definitions.

— Cross-mapping should be recognized through publication in a register.

The cross-mapping should be readily accessible to all user groups if the objective of rationalizing terminology is to be achieved. An authoritative public register should formally report the outcome of a cross-mapping initiative.

— Vocabulary cross-mapping should lead to an expanded knowledge base.

Vocabulary cross-mapping should relate vocabularies that are maintained in various types of knowledge base such as thesaurus, taxonomy and ontology, integrating established domain-based concepts and content into an expanded knowledge base.

— Cross-mapping should accommodate continuous change.

Vocabularies, including reference vocabularies, will evolve over time in response to technology and business process development. The cross-mapping of concepts should be periodically reviewed to identify and accommodate any changes.

6 Vocabulary cross-mapping methodology

6.1 Introduction

The vocabulary cross-mapping methodology specified in this document comprises four stages, being:

— the governance framework stage – in which the working relationship between the participating communities (vocabulary owners) is formalized;

— the reference vocabulary stage – in which the participating communities select a reference vocabulary for the cross-mapping initiative;

— the cross-mapping stage – in which the term and concept relationships between cross-mapped terminological entries are classified;

— the registration and publication stage – in which an authoritative repository for cross-mapping outcomes is provided.

6.2 Governance framework stage

The governance framework stage establishes a governance regime to

— facilitate the smooth progression of the cross-mapping initiative, and

— legitimize the initiative's outcomes to the members of the participating communities of interest.

The governance framework is jointly developed by the participating communities and is the subject of a formal agreement based on a mutual understanding.

> Requirement 1. The participating communities shall co-sponsor any initiative to cross-map their vocabularies. The co-sponsors shall establish an open and transparent governance regime to provide oversight of the project. The governance regime shall be incorporated in a formal agreement between the participating communities.

The formal agreement identifies the roles and processes to be implemented during the initiative. It may also include information regarding resources, schedules and publication arrangements.

> Requirement 2. The formal agreement shall specify:
>
> — the establishment and membership of a steering committee;
>
> — the establishment, membership and reporting obligations of a project team;
>
> — the dispute resolution process;
>
> — the publication arrangements for the completed cross-mapping;
>
> — the ownership of any existing registers and sub-registers utilized during the process;
>
> — the ownership of any new registers and sub-registers established during the process.

The following should be noted.

— The steering committee should ensure that the cross-mapping project is undertaken in accordance with the principles described in Clause 5 of this document.

— The composition and operation of the project team should be determined by the participating communities. In instances where one or more of the communities is an open community, the project team may include all members of that community working through social media.

— The project team's role is to collectively consider the cross-mapping of terms and concepts. During the process, it may identify opportunities to improve a vocabulary's structure or content. The project team should not be empowered to change the content of any vocabulary (unless this is specifically allowed by the affected community). However, it may provide recommendations to the participating communities regarding additions, amendments or retirements from their respective vocabularies.

— In the event that the project team cannot agree on a cross-mapping issue, the issue should be escalated to the steering committee. Members of the steering committee should consult with their communities and subsequently jointly consider the respective positions. If consensus cannot be agreed, then the issue should be recorded as an unresolved conflict.

— The project team should prepare a draft document for the steering committee. The draft should identify instances where cross-mapping has been achieved and the nature of the relationships identified. It should also identify instances where additions or amendments to the vocabularies should be considered. The steering committee members should circulate the draft within their communities, seeking comments. The comments should be provided to the project team. The project team should consider the comments and amend the cross-mapping and draft as appropriate.

— Requirements regarding the documentation and publication of cross-mapping outcomes are specified in 6.5. The project team should submit the final cross-mapping documentation to the steering committee for consideration. Each participating community should seek endorsement for the document's proposals through its normal balloting or approval arrangements. The proposals and outcomes should not be formally adopted until endorsed by all participating communities.

6.3   Reference vocabulary stage

The reference vocabulary stage identifies the reference and operating vocabularies that are to be utilized during the cross-mapping process.

A reference vocabulary shall be selected by each of the participating communities before cross-mapping can begin (see Requirement 3). There are two options, being:

— Agreement by all participants to recognise a single reference vocabulary (for example, a nominated community vocabulary or a vocabulary published by an ISO Technical Committee);

— Each participant adopting its community vocabulary as its reference vocabulary, the cross-mapping being documented differently by each of the participants.

The first option should be adopted wherever possible. However, the latter option may become necessary in situations where a community-based focus has to be retained by a participating community. In such instances, the reference vocabulary for one participant will be an operating vocabulary for other participants.

The vocabularies maintained by each of the communities should be made available to the other participants for the duration of the cross-mapping process.

Requirement 3. Each participating community shall identify and adopt its preferred reference vocabulary prior to commencing cross-mapping.

6.4 Cross-mapping stage

6.4.1 Overview

The purpose of the cross-mapping stage is to

— identify candidate vocabulary entries, and

— undertake term, concept and domain comparisons.

The process requirements are specified in 6.4.2, 6.4.3, 6.4.4 and 6.4.5. Supplementary information regarding the relationships between terms, definitions, concepts and domains is provided in Annex B.

6.4.2 Identification of candidate vocabulary entries

The reference and operating vocabularies should be simultaneously reviewed to identify terminological pairs or clusters that are candidates for cross-mapping. The process for identifying candidate vocabulary records should be jointly determined by the participating communities.

The terminological pairs or clusters should include all instances where the vocabularies contain:

— identical terms with identical definitions;

— identical terms with dissimilar definitions;

— similar definitions for different terms.

In addition, instances where a common underlying concept (for example, the description of a network) has been adopted by two or more participating industries or communities (for example, the electricity supply industry, the water supply industry) but adapted using different terms and definitions to describe generically similar features (for example, 'circuit breaker', 'stop valve') should be included as candidates.

In most cases, the members of a terminological pair or cluster will relate to a common concept system. There may be instances, however, where cross-mapping can be effective in emphasizing the absence of a relationship. Vocabulary records that use similar or identical terms to describe distinctly different concepts provide an example.

ISO 860:2007[2] specifies a methodological approach to the harmonization of concepts, concept systems, definitions and terms. ISO 25964-2:2013[14] provides recommendations regarding cross-mapping between vocabularies.

6.4.3 Term comparison

A term is a designation by which a concept is commonly known. The relationship between the concept and designation may not be unique. A concept may be designated by two or more terms. Similarly, a term may designate two or more concepts.

When comparing terms from different vocabularies during a cross-mapping initiative, it is necessary to determine whether two or more terms:

— are identical and designate the same concept;

— are different but designate the same concept, indicating a synonymic relationship between the terms;

— are identical but designate different concepts, indicating polysemic or homonymic relationships between the term instances;

— are different and designate different concepts.

Synonymic relationships are common within vocabularies as well as between vocabularies. In a terminological entry, the preferred term and any admitted terms have a synonymic relationship.

A polysemic relationship exists when a single term designates two or more concepts that share certain characteristics. Consider, for example, the term "constraint". In the context of location based services, its definition is:

"restriction on how a link or turn may be traversed by a vehicle, such as vehicle classification, physical or temporal constraint" [ISO 19133:2005, 4.16][13]

In the context of Unified Modeling Language, however, its definition is

"condition or restriction expressed in natural language text or in a machine readable language for the purpose of declaring some of the semantics of an element" [ISO 19103:2015, 4.13]

The definitions share the characteristic "restriction", creating a polysemic relationship between the occurrences of the term.

A homonymic relationship exists between designations when a single designation represents two or more unrelated concepts. Consider, for example, the term "attitude". In the context of an airborne sensor, its definition is:

"orientation of a body, described by the angles between the axes of that body's coordinate system and the axes of an external coordinate system" [ISO 19116:2004, 4.2][10]

In the context of psychology, its definition is:

"a relatively enduring organization of beliefs, feelings, and behavioral tendencies towards socially significant objects, groups, events or symbols" [Hogg, & Vaughan 2005, p. 150][15]

There is no relationship between the concepts described by the two definitions, creating homonymic relationship between occurrences of the term.

Examples of term comparisons are provided in Annex C.

Requirement 4. The term relationships between candidate vocabulary records shall be determined and assigned one of the following classifications:
— identical;
— synonymic;
— polysemic;
— homonymic;
— none.

6.4.4   Domain specification

In instances where there are polysemic or homonymic relationships between terms, it will be necessary to associate concept domains with the respective terminological entries. Domain specification may also be necessary when other term relationships exist.

Requirement 5. In instances where there is a polysemic or homonymic relationship between cross-mapped terms, the domain to which each of the respective terminological entries belong shall be specified.

In instances where the classification of a term relationship is "identical", "synomymic" or "none", the domain to which each of the respective terminological entries belong shall be specified if it is not clearly inferred from the respective entry.

The domain names shall be drawn from a controlled list to ensure consistent usage.

6.4.5 Concept comparison

The characteristics of a concept that makes it unique are described by its definition. The concept comparison identifies the extent to which the same characteristics are represented in the vocabulary records being compared.

Requirement 6. The concept relationships between reference and operating vocabulary records shall be determined and assigned one of the following classifications:

— identical – when the reference concept and operating concept are identical;

— generalization – when the reference concept is a generalization of the operating concept;

— specialization – when the reference concept is a specialization of the operating concept;

— peer – when the reference concept and operating concept share characteristics inherited from a common superordinate concept;

— component – where the reference concept is a component of the operating concept;

— aggregation – where the reference concept is an aggregation of two or more operating concepts;

— user-defined – where the relationship between the reference concept and the operating concept is specified by a user-defined classification;

— none – where there is no relationship between the reference concept and the operating concept.

In cases where a user-defined relationship is nominated, information describing the nature of the relationship and the criteria for its use shall be provided.

Examples of concept comparisons are included in Annex C.

6.5 Documentation and publication stage

The purpose of the documentation and publication stage is to present the results of the cross-mapping initiative to the participating communities. The deliverables from this stage are:

— A document informing the steering committee of the outcome of the cross-mapping initiative, emphasizing the opportunities for the participating communities to further rationalize and align their vocabularies (Requirement 7);

— The provision of a register that provides the participating communities (and, if appropriate, the general public) with access to the cross-mapping (Requirement 8).

Requirement 7. Recommendations regarding additions or amendments to the content of either the reference or operating vocabularies, including the deprecation of terms or terminological entries, shall be provided to the appropriate participating community for consideration. The participating community shall consider the recommendations, and if accepted, implement the processes and procedures necessary to amend the vocabulary.

Requirement 8. The term and concept relationships, together with the domain identifiers, shall be published in a register that can be accessed by the participating communities of interest. The register shall comply with Clause 7 of this document.

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7 Cross-map register

7.1 Overview

This clause specifies the requirements to be satisfied when establishing and operating an ISO 19135-1:2015-compliant cross-map register.

The requirements regarding register management are specified in 7.2. The requirements regarding the content and structure of the register are specified in Requirement 9 and elaborated in 7.3.

It should be noted that a single cross-map register may be used to register the results from multiple cross-mapping initiatives. In such cases, the register shall include a separate reference vocabulary subregister, operating vocabulary subregister and cross-map entry subregister for each initiative.

The subregisters in a cross-map register may be owned by different organizations or communities. There is no requirement that the subregisters be physically co-located.

Requirement 9. A cross-map register shall be structured as an ISO 19135-1:2015-compliant hierarchical register (ISO 19135-1:2015, Clause 8). The principal register shall contain information that describes the subregisters. For each cross-mapping initiative included in the register, there shall be:

— a separate subregister containing the reference vocabulary;

— a separate subregister containing the operating vocabulary;

— a separate subregister containing cross-map entries.

7.2 Register management

7.2.1 Register stakeholder general requirements

Requirement 10. Every register and subregister shall have:

— a register owner;

— a register manager;

— at least one submitting organization or community.

7.2.2 Register owner

Requirement 11. The register owner shall perform the functions specified in Requirements 1 to 5 of ISO 19135-1:2015.

7.2.3 Register manager

Requirement 12. The register manager shall perform the functions specified in Requirements 6, 7, 8, 9, 11 and 12 of ISO 19135-1:2015.

The register manager shall be responsible for informing community bodies that have participated in cross-mapping initiatives, of subsequent additions, deletions or amendments to any included vocabulary.

7.2.4 Submitting organizations or communities

Requirement 13. Each submitting organization or community shall be responsible for:

— verifying the correct input of its terminology into the register;

— confirming that the outcome of the cross-mapping process has been correctly recorded;

— securing any necessary authorization to allow the cross-mapped terms to be published on the register;

— advising the register owner of any changes to its terminology.

7.2.5 Management of registers

Requirement 14. A vocabulary cross-map register shall be managed in accordance with Requirements 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23 in ISO 19135-1:2015.

7.3 Register schema

7.3.1 Introduction

This clause specifies a conceptual schema for a vocabulary cross-map register.

The schema conforms to the provisions of ISO 19135-1:2015 and ISO 19104:2016, 10.5.

The schema establishes a single package, Term Cross Map. The package groups together eight classes and two enumerations that are required for registering and managing vocabulary cross-mapping instances. The classes are subtypes of classes specified in ISO 19135-1:2015, Annex B and ISO 19104:2016, 10.5. They are described in 7.3.4 to 7.3.13 and illustrated in Figure 2.

The schema retains the semantics of the attributes and associations inherited from ISO 19135-1:2015 and ISO 19104:2016. However, some are subject to additional constraints.

Requirement 15. A vocabulary cross-map register shall conform to the schema (presented in UML) that is specified in 7.3.2 to 7.3.13 of this document.

7.3.2 Packages

The dependencies among packages specified or referenced in this document are identified in Figure 1.
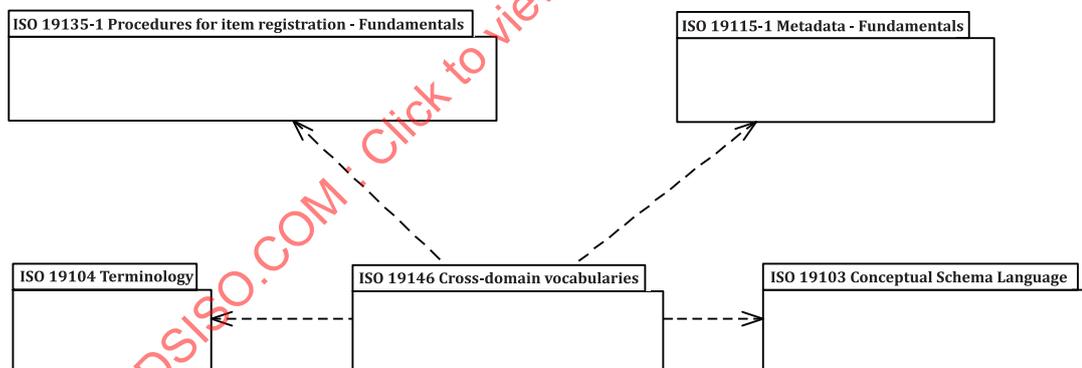
Figure 1 — Dependencies of packages specified in this document

7.3.3 Vocabulary cross-map register schema

An overview of the vocabulary cross-map register schema is provided in Figure 2.
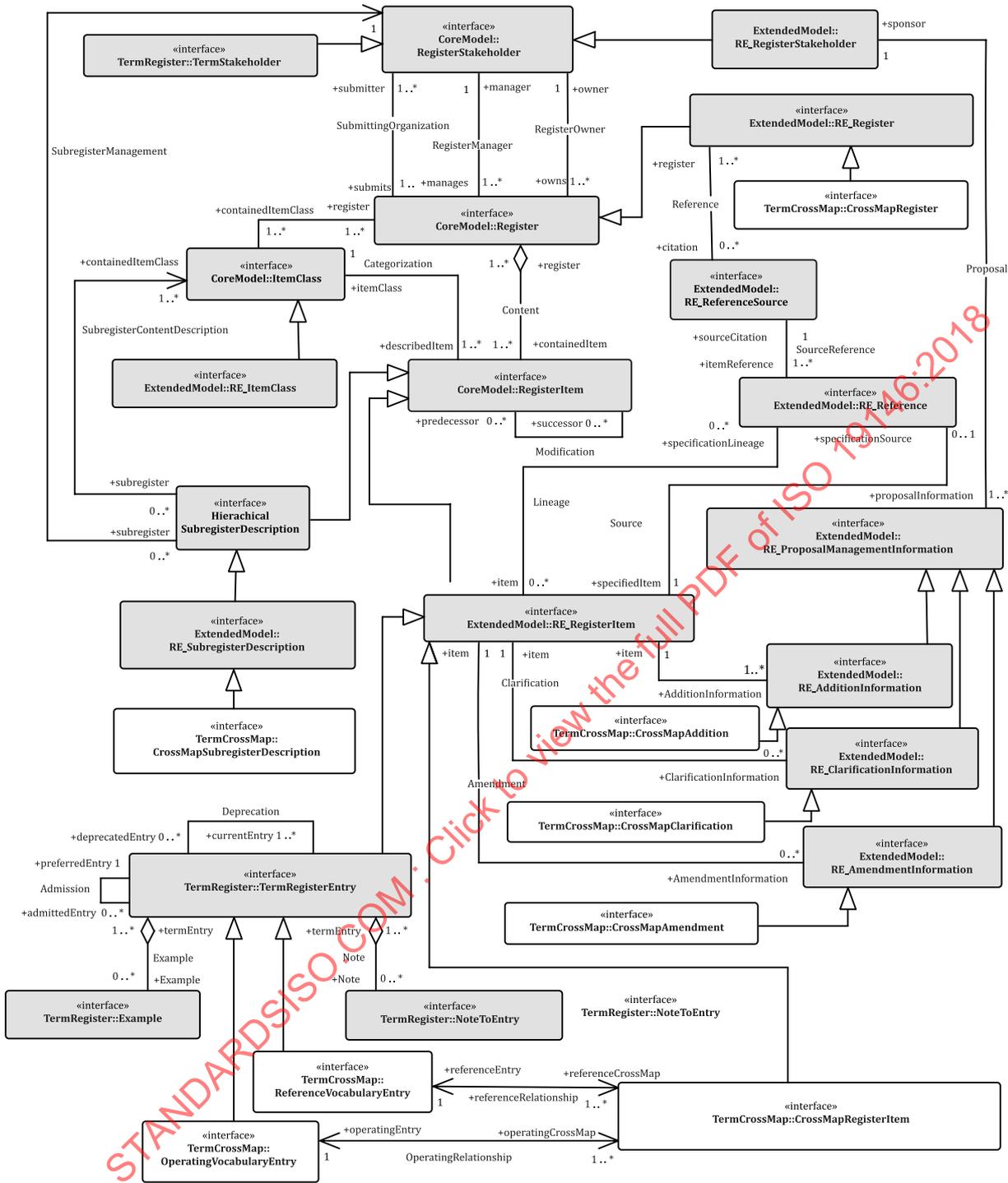
Figure 2 — Vocabulary cross-map register schema

7.3.4 CrossMapRegister class

The class CrossMapRegister (Figure 3) is a subclass of RE_Register specified in ISO 19135-1:2015, B.2.2.2. It specifies information items for describing a cross-map register and its subregisters. It inherits five attributes and one association from the class RE_Register. In addition, through RE_Register, it inherits a further three attributes and five associations from the class Register (ISO 19135-1:2015, 7.2.2).

The requirements regarding the CrossMapRegister class are specified in Requirement 16.
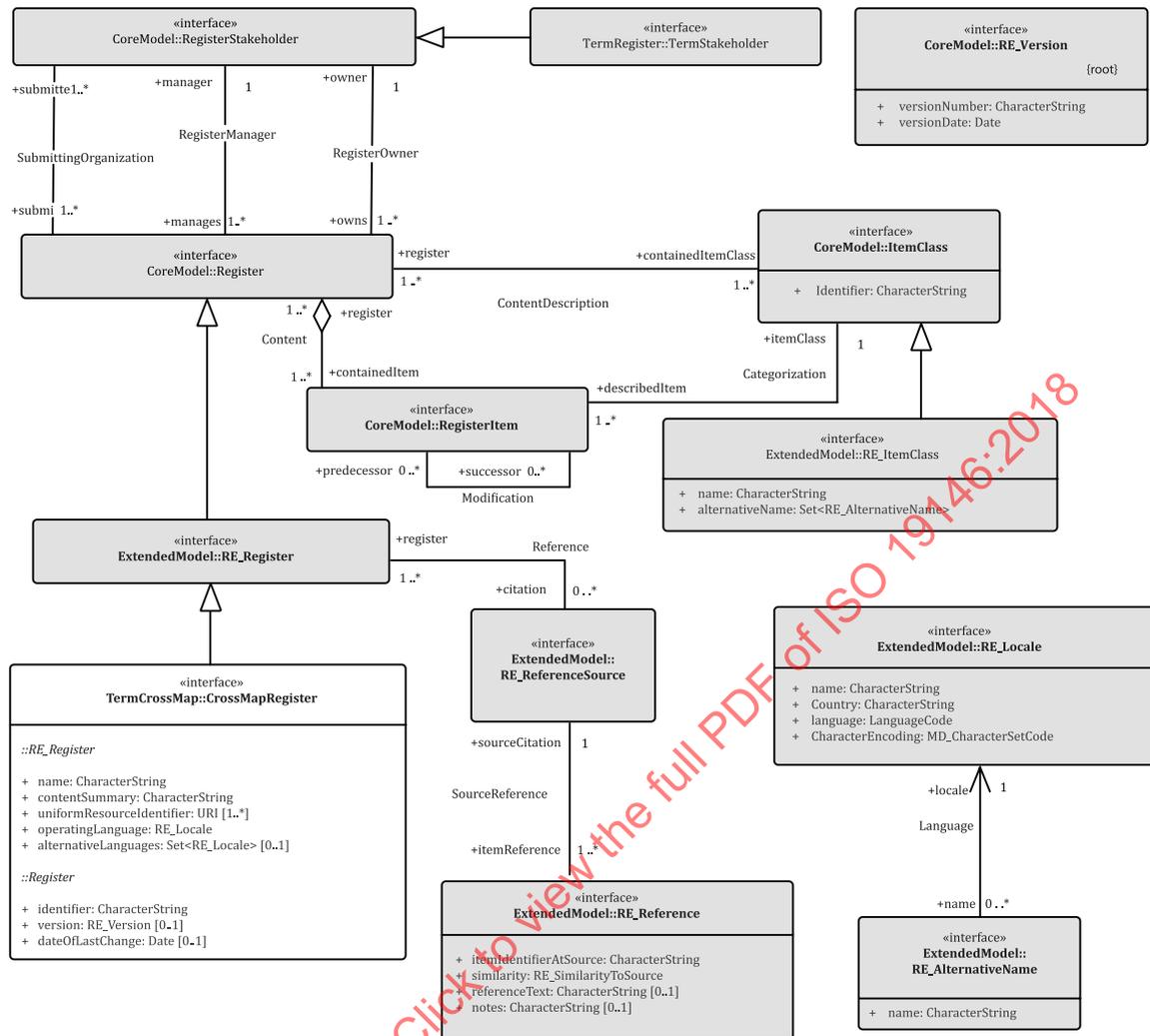
Figure 3 — CrossMapRegister class

Requirement 16. A terminology register schema shall include the CrossMapRegister class.

Separate instances of CrossMapRegister shall be included for the principal register and each sub-register.

CrossMapRegister shall inherit the three attributes from class Register described in Table 4.

CrossMapRegister shall inherit the five attributes from class RE_Register described in Table 5.

CrossMapRegister shall inherit the five associations from class Register described in Table 6. The target role 'containedItemClass' shall be subject to the following constraint.

—   If the register is a principal register, the item class shall be "reference vocabulary" (3.1.24), "operating vocabulary" (3.1.22) or "cross-map register" (3.1.7).

—   If the register is a subregister that is a reference vocabulary or operating vocabulary, the item class shall be "terminological entry" (3.1.31).

—   If the register is a subregister that is a cross-map register, the item class shall be "cross-map entry" (3.1.6).

CrossMapRegister shall inherit the one association from class RE_Register described in Table 7.

CrossMapRegister itself shall not specify any attributes or associations.

Table 4 — Attributes inherited from Register (via RE_Register)

Name	Definition	M/C/O	Max Occur	Data Type	Domain
identifier	compact and human-readable designator that is used to uniquely denote that register within the set of registers maintained by the register owner EXAMPLE ISO/TC 211 Cross-Map 1.	M	1	Character-String	Free text
version	specification of a unique state in the life of the register, represented as an instance of RE_Version (ISO 19135-1:2015, B.2.2.4) Note 1 to entry: A value for version shall be provided if dateOfLastChange is omitted.	C	1	Class	No specified domain.
dateOfLastChange	date of the most recent change to the status of an item in the register Note 1 to entry: A value for dateOfLastChange shall be provided if version is omitted.	C	1	Date	Gregorian calendar

Table 5 — Attributes inherited from RE_Register

Name	Definition	M/C/O	Max Occur	Data Type	Domain
name	compact and human-readable designator that is used to uniquely denote that register within the set of registers maintained by the register owner EXAMPLE ISO/TC 211 Cross-Map 1.	M	1	Character-String	Free text
contentSummary	general statement of the purpose for which items in the register are made available to potential users EXAMPLE 1 "A compilation of cross-mapped terminological entries, relating terminology published in ISO/TC 211-sponsored International Standards and Technical Specifications to those published by <a nominated organization>".	M	1	Character-String	Free text
uniformResource Identifier	information about online resources associated with the register EXAMPLE www.isotc211.org/TermCrossMap1.htm	M	N	URI	No specified domain
operatingLanguage	language, country information and character encoding for the proper interpretation of the content of character strings in the register, represented as an instance of the class RE_Locale (ISO 19135-1:2015, B.2.2.3) EXAMPLE Operating language name English Operating language code eng Operating language country 826 Operation language character encoding 5	M	1	Class	No specified domain
alternativeLanguages	summary of alternative locales used by items in a register, represented as a set of instances of the class RE_Locale (ISO 19135-1:2015, B.2.2.3) Note 1 to entry: Inclusion of this attribute is conditional upon at least one alternative language being used. An instance of this attribute shall be included for each alternative locale.	C	N	Set	No specific domain

Table 6 — Associations inherited from Register (via RE_Register)

Target Class	Target Role Name	Definition	M/C/O	Max Occur
RegisterStakeholder (ISO 19135-1:2015, 7.3.2)	manager	identifies the TermStakeholder that is the manager of the register	M	1
RegisterStakeholder (ISO 19135-1:2015, 7.3.2)	owner	identifies the TermStakeholder that is owner of the register	M	1
RegisterStakeholder (ISO 19135-1:2015, 7.3.2)	submitter	identifies the TermStakeholder that is a submitting organization to the register	M	N
RegisterItem (ISO 19135-1:2015, 7.5.2)	containedItem	connects an instance of a register or subregister to one or more instances of contained items	M	N
ItemClass (ISO 19135-1:2015, 7.4.2)	containedItemClass	describes the characteristics of a class of items held in a register or subregister Note 1 to entry: In the case of a principal register, the item class shall be "reference vocabulary" (3.1.24), "operating vocabulary" (3.1.22) or "cross-map register" (3.1.7). In the cases of a subregister that is a reference vocabulary or operating vocabulary, the item class shall be "terminological entry" (3.1.31). In the case of a subregister that is a cross-map register, the item class shall be "cross-map entry" (3.1.6).	M	N

Table 7 — Associations inherited from RE_Register

Target Class	Target Role Name	Definition	M/C/O	Max Occur
RE_ReferenceSource (ISO 19135-1:2015, B.2.6.3)	citation	identifies the reference source for one or more items in the CrossMapRegister	O	N

7.3.5 CrossMapRegisterItem class

The class CrossMapRegisterItem (see Figure 4) is a subclass of RE_RegisterItem (see ISO 19135-1:2015, B.2.3.2). It specifies elements of information to be recorded for each cross-map entry in a cross-map subregister.

CrossMapRegisterItem inherits seven attributes and five associations from RE_RegisterItem. In addition, through RE_RegisterItem, it inherits six attributes and four associations from the class RegisterItem (see ISO 19135-1:2015, 7.5.2).

The requirements regarding the CrossMapRegisterItem class, its attributes and associations are specified in Requirement 17.
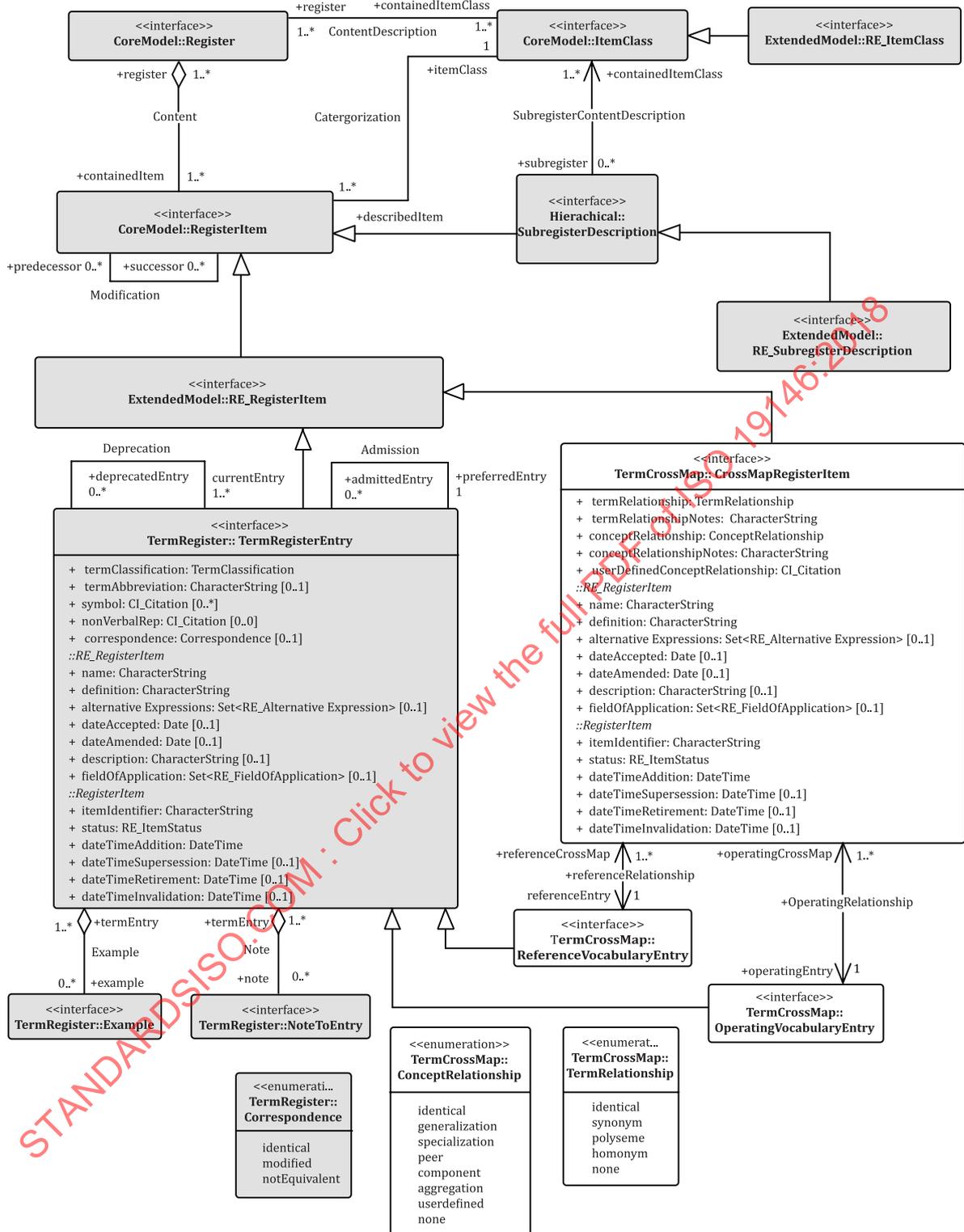
Figure 4 — CrossMapRegisterItem class

Requirement 17. A term cross-map register schema shall include the CrossMapRegisterItem class.

CrossMapRegisterItem shall inherit the six attributes from RegisterItem described in Table 8.

CrossMapRegisterItem shall inherit the seven attributes from RE_RegisterItem described in Table 9.

CrossMapRegisterItem shall specify the five attributes described in Table 10.

CrossMapRegisterItem shall inherit the four associations from RegisterItem described in Table 11. The target role 'itemClass' shall be subject to the following constraint:

— The item class to which the instance of CrossMapRegisterItem shall connect shall be "cross-map entry" (3.1.6).

CrossMapRegisterItem shall inherit the five associations from RE_RegisterItem described in Table 12.

CrossMapRegisterItem shall specify the two associations described in Table 13.

Table 8 — Attributes inherited from RegisterItem

Name	Definition	M/C/O	Max Occur	Data Type	Domain
itemIdentifier	character string that is used to uniquely denote an item within an item class	M	1	Character-String	Free text
status	registration status of the Register-Item, represented as an instance of the enumeration RE_ItemStatus (ISO 19135-1:2015, 7.5.2)	M	1	Class	"submitted" "valid" "superseded" "retired" "invalid"
dateTimeAddition	date and time on which the item was added	M	1	DateTime	Gregorian calendar
dateTimeSupersession	date and time on which an item has been superseded Note 1 to entry: A value shall be provided if the value of *status* is "superseded".	C	1	DateTime	Gregorian calendar
dateTimeRetirement	date and time on which an item has been retired Note 1 to entry: A value shall be provided if the value of *status* is "retired".	C	1	DateTime	Gregorian calendar
dateTimeInvalidation	date and time on which an item has been invalidated Note 1 to entry: A value shall be provided if the value of *status* is "invalid".	C	1	DateTime	Gregorian calendar

Table 9 — Attributes inherited from RE_RegisterItem

Name	Definition	M/C/O	Max Occur	Data Type	Domain
name	compact and human-readable designator (term) that is used to denote a concept Note 1 to entry: In vocabulary cross-mapping, the name shall be a designator that identifies an instance of cross-mapping between two vocabulary entries.	M	1	Character-String	Free text
definition	definition of the concept expressed in the language of the register or subregister Note 1 to entry: In vocabulary cross-mapping, the definition shall describe the two vocabulary entries being cross-mapped.	M	1	Character-String	Free text
alternativeExpressions	set of instances of RE_AlternativeExpression (ISO 19135-1:2015, B.2.3.3), each specifying an alternative name and optionally additional information in a locale different from that of the register.	O	1	Set	No specified domain
dateAccepted	date on which a proposal to add the item to the register was accepted Note 1 to entry: The date value is identical to that assigned to the conditional attribute CrossMapAddition.dateDisposed (7.3.8 and Table 18).	C	1	Date	Gregorian calendar
dateAmended	date on which a proposal to supersede or retire the item was accepted Note 1 to entry: The date value is identical to that assigned to the conditional attribute CrossMapAmendment.dateDisposed (7.3.9 and Table 18).	C	1	Date	Gregorian calendar
description	description of the concept embodied by the item and expressed in the operating language of the register Note 1 to entry: The "description" contains information about the term and concept cross-mapping that is not specified by the definition element.	O	1	Character-String	Free text
fieldOfApplication	set of instances of RE_FieldOfApplication (ISO 19135-1:2015, B.2.3.4), each of which describe a kind of use of the item	O	1	Set	No specified domain

Table 10 — CrossMapRegisterItem attributes

Name	Definition	M/C/O	Max Occur	Data Type	Domain
termRelationship	relationship of the reference term to the operating term represented as an instance of the enumeration TermRelationship (7.3.12)	M	1	Class	"identical" "synonymic" "polysemic" "homonymic" "unrelated"
termRelationshipNotes	information supporting the determination of termRelationship	O	1	Character-String	Free text
conceptRelationship	relationship of the reference concept to the operating concept, represented as an instance of the enumeration ConceptRelationship (7.3.13)	M	1	Class	"identical" "generalization" "specialization" "peer" "component" "aggregation" "user-defined" "none"
conceptRelationship-Notes	information supporting the determination of conceptRelationship	O	1	Character-String	Free text
userDefinedCitation	reference to a resource describing the user-defined classification adopted to describe a concept relationship. Note 1 to entry: This attribute is conditional. It shall only be used if a user-defined classification for a concept relationship has been adopted.	C	1	Class	CI_Citation

Table 11 — Associations inherited from RegisterItem

Target Class	Target Role Name	Definition	M/C/O	Max Occur
Register (ISO 19135-1:2015, 7.2.2)	register	connects an instance of a "Register-Item" to its register	M	N
ItemClass (ISO 19135-1:2015, 7.4.2)	itemClass	connects an instance of a "Register-Item" to an "ItemClass" Note 1 to entry: If the "RegisterItem" is an entry in a reference vocabulary or operating vocabulary, the item class shall be "terminological entry" (3.1.31). If the "RegisterItem" is an entry in a cross-map register, the item class shall be "cross-map entry" (3.1.6).	M	1
RegisterItem (ISO 19135-1:2015, 7.5.2)	predecessor	Describes a previous concept of the "RegisterItem". Note 1 to entry: The association provides a link from a valid entry to a superseded or retired entry.	O	N
RegisterItem (ISO 19135-1:2015, 7.5.2)	successor	Describes a later concept of the "RegisterItem". Note 1 to entry: The association provides a link from a superseded or retired entry to a valid entry.	O	N

Table 12 — Associations inherited from RE_RegisterItem

Target Class	Target Role Name	Definition	M/C/O	Max Occur
RE_AdditionInformation (ISO 19135-1:2015, B.2.7.2)	additionInformation	connects to addition information associated with the "RegiseterItem"	M	N
RE_AmendmentInformation (ISO 19135-1:2015, B.2.7.3)	amendmentInformation	connects to any amendment information associated with the "RegisterItem"	O	N
RE_ClarificationInformation (ISO 19135-1:2015, B.2.7.4)	clarificationInformation	connects to any clarification information associated with the "RegisterItem"	O	N
RE_Reference (ISO 19135-1:2015, B.2.6.2)	specificationSource	identifies the reference information describing the specification source for the "RegisterItem"	O	1
RE_Reference (ISO 19135-1:2015, B.2.6.2)	specificationLineage	identifies any lineage information for the "RegisterItem"	O	N

Note 1 to entry: In cases where a register item is an instance of ReferenceVocabularyEntry or OperatingVocabularyEntry, the target roles 'additionInformation', "amendmentInformation" and "clarificationInformation" connect to instances of TermAddition (ISO 19104:2016, 10.5.11), TermAmendment (ISO 19104:2016, 10.5.12) and TermClarification (ISO 19104:2016, 10.5.13) respectively.

Note 2 to entry: In cases where a register item is an instances of CrossMapRegisterItem, the target roles 'additionInformation', "amendmentInformation" and "clarificationInformation" connect to instances of CrossMapAddition (7.3.8), CrossMapAmendment (7.3.9) and CrossMapClarification (7.3.10) respectively.

Table 13 — CrossMapRegisterItem associations

Target Class	Target Role Name	Definition	M/C/O	Max Occur
ReferenceVocabularyEntry (7.3.6)	referenceEntry	connects an instance of CrossMapRegisterItem to an instance of ReferenceVocabularyEntry	M	1
OperatingVocabularyEntry (7.3.7)	operatingEntry	connects an instance of CrossMapRegisterItem to an instance of OperatingVocabularyEntry	M	1

7.3.6 ReferenceVocabularyEntry class

The class ReferenceVocabularyEntry (see Figure 4) is a subclass of TermRegisterEntry (see ISO 19104:2016, 10.5.8). It specifies elements of information to be recorded for each terminological entry in a reference vocabulary.

The requirements regarding the ReferenceVocabularyEntry class, its attributes and associations are specified in Requirement 18.

Requirement 18. A term cross-map register schema shall include the ReferenceVocabularyEntry class.

ReferenceVocabularyEntry shall inherit the six attributes from RegisterItem described in Table 8.

ReferenceVocabularyEntry shall inherit the seven attributes from RE_RegisterItem described in Table 9. The attribute "fieldOfApplication" shall be subject to the following constraints.

— The data item "RE_FieldOfApplication.name" associated with "fieldOfApplication" shall specify the name of the domain to which the instance of ReferenceVocabularyEntry belongs.

— The data item "RE_FieldOfApplication.description" associated with "fieldOfApplication" shall describe the domain to which the instance of ReferenceVocabularyEntry belongs.

ReferenceVocabularyEntry shall inherit the five attribute from TermRegisterEntry that are described in Table 14.

ReferenceVocabularyEntry shall inherit the four associations from RegisterItem described in Table 11. The target role 'itemClass' shall be subject to the following constraint:

— The item class to which the instance of CrossMapRegisterItem shall connect shall be "terminological entry" (3.1.31).

ReferenceVocabularyEntry shall inherit the five associations from RE_RegisterItem that are described in Table 12.

ReferenceVocabularyEntry shall inherit the six associations from TermRegisterEntry that are described in Table 15.

ReferenceVocabularyEntry shall specify the single associations described in Table 16.

Table 14 — Attributes inherited from TermRegisterEntry

Name	Definition	M/C/O	Max Occur	Data Type	Domain
termClassification	classification of the term, represented as an instance of the enumeration TermClassification (ISO 19104:2016, 10.5.8)	M	1	enumeration	"preferred" "admitted" "deprecated" "equivalent"
termAbbreviation	designation formed by omitting words or letters from a longer form and designating the same concept (ISO 1087-1:2000, 3.4.9) Note 1 to entry: This attribute is conditional. It shall be included if an abbreviation has been defined and is routinely used.	C	N	Character-String	Free text
symbol	reference to a resource containing a representation of the symbol, presented as an instance of CI_Citation (ISO 19115-1:2014, B.16) Note 1 to entry: This attribute is conditional. It shall be included if a symbol is a conventionally used designation of the concept or is internationally standardized.	C	N	Class	CI_Citation
nonVerbalRep	reference to a resource containing the non-verbal representation (ISO 19104:2016, 4.19), presented as an instance of CI_Citation (ISO 19115-1:2014, B.16) Note 1 to entry: This attribute is conditional. It shall be included if a representation is widely recognized and is in common use.	C	N	Class	CI_Citation
correspondence	degree to which the technical content of a culturally and/or linguistically adapted terminological entry corresponds to that of the entry in the reference language, represented as an instance of the enumeration Correspondence (ISO 19104:2016, 10.5.8)	O	1	Enumeration	"identical", "modified" "notEquivalent"

Table 15 — Associations inherited from TermRegisterEntry

Target Class	Target Role Name	Definition	M/C/O	Max Occur
TermRegisterEntry (ISO 19104:2016, 10.5.8)	admittedEntry	connects an entry containing a preferred term to an entry containing an admitted term	O	N
TermRegisterEntry (ISO 19104:2016, 10.5.8)	preferredEntry	connects an entry containing an admitted term to an entry containing a preferred term	M	1
TermRegisterEntry (ISO 19104:2016, 10.5.8)	deprecatedEntry	connects an entry containing a preferred or admitted term to an entry containing a deprecated term	O	N

Table 15 *(continued)*

Target Class	Target Role Name	Definition	M/C/O	Max Occur
TermRegisterEntry (ISO 19104:2016, 10.5.8)	currentEntry	connects an entry containing a deprecated term to an entry containing a preferred or admitted term	M	N
Example (ISO 19104:2016, 10.5.9)	example	connects an entry to examples that further illustrate the concept represented by the entry	O	N
NoteToEntry (ISO 19104:2016, 10.5.10)	note	connects an entry to notes to entry providing additional information about the concept represented by the entry	O	N

Table 16 — ReferenceVocabularyEntry associations

Target Class	Target Role Name	Definition	M/C/O	Max Occur
CrossMapRegisterItem (7.3.5)	referenceCrossMap	connects an instance of ReferenceVocabularyEntry to an instance of CrossMapRegisterItem	M	N

7.3.7 OperatingVocabularyEntry class

The class OperatingVocabularyEntry (see Figure 4) is a subclass of TermRegisterEntry (see ISO 19104:2016, 10.5.8). It specifies elements of information to be recorded for each terminological entry in an operating vocabulary.

The requirements regarding the OperatingVocabularyEntry class, its attributes and associations are specified in Requirement 19.

Requirement 19. A term cross-map register schema shall include the OperatingVocabularyEntry class.

OperatingVocabularyEntry shall inherit the six attributes from RegisterItem described in Table 8.

OperatingVocabularyEntry shall inherit the seven attributes from RE_RegisterItem described in Table 9. The attribute "fieldOfApplication" shall be subject to the following constraints.

— The data item "RE_FieldOfApplication.name" associated with "fieldOfApplication" shall specify the name of the domain to which the instance of OperatingVocabularyEntry belongs.

— The data item "RE_FieldOfApplication.description" associated with "fieldOfApplication" shall describe the domain to which the instance of OperatingVocabularyEntry belongs.

OperatingVocabularyEntry shall inherit the five attribute from TermRegisterEntry that are described in Table 14.

OperatingVocabularyEntry shall inherit the four associations from RegisterItem that are described in Table 11. The target role 'itemClass' shall be subject to the following constraint:

— The item class to which the instance of CrossMapRegisterItem shall connect shall be "terminological entry" (3.1.31).

OperatingVocabularyEntry shall inherit the five associations from RE_RegisterItem that are described in Table 12.

OperatingVocabularyEntry shall inherit the six associations from TermRegisterEntry that are described in Table 15.

OperatingVocabularyEntry shall specify the single association that is described in Table 17.

Table 17 — OperatingVocabularyEntry associations

Target Class	Target Role Name	Definition	M/C/O	Max Occur
CrossMapRegisterItem (7.3.5)	operatingCrossMap	connects an instance of OperatingVocabularyEntry to an instance of CrossMapRegisterItem	M	N

7.3.8 CrossMapAddition class

The class CrossMapAddition (Figure 5) is a subclass of RE_AdditionInformation (ISO 19135-1:2015, B.2.7.2). It specifies elements of management information to be recorded for each proposal to add a cross-map entry. It inherits one association from the class RE_AdditionInformation. In addition, through RE_AdditionInformation, it inherits eight attributes and one association from the class RE_ProposalManagementInformation (ISO 19135-1:2015, B.2.5.2).

The requirements regarding the CrossMapAddition class, its attributes and associations are specified in Requirement 20.

Requirement 20. A term cross-map register schema shall include the CrossMapAddition class.

CrossMapAddition shall inherit the eight attributes from RE_ProposalManagementInformation that are described in Table 18.

CrossMapAddition shall inherit the one association from RE_ProposalManagementInformation that is described in Table 19.

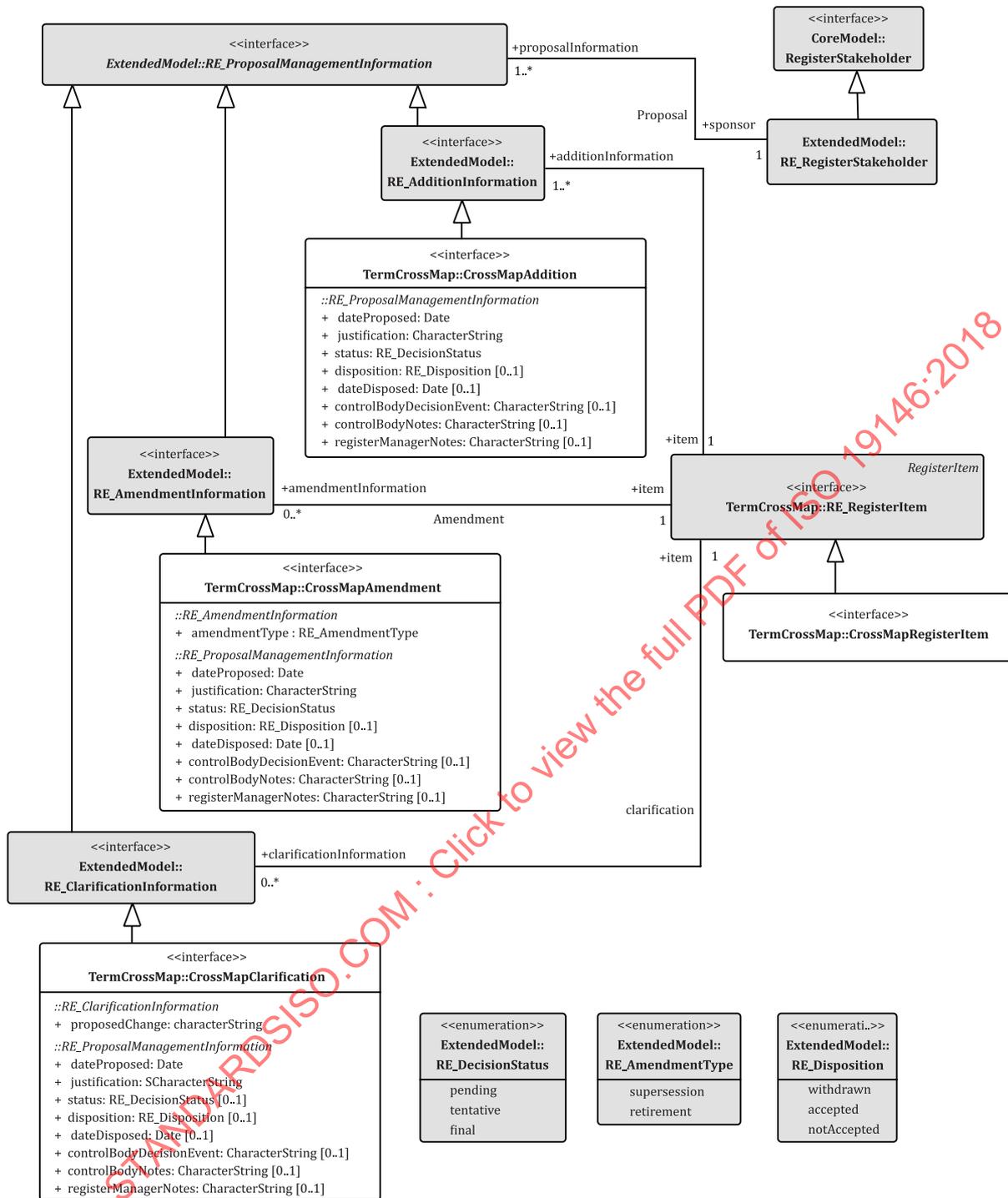CrossMapAddition shall inherit the one association from RE_AdditionInformation that is described in Table 20.

Figure 5 — CrossMapAddition, CrossMapAmendment and CrossMapClarification classes

Table 18 — Attributes inherited from RE_ProposalManagementInformation

Name	Definition	M/C/O	Max Occur	Data Type	Domain
dateProposed	the date on which the proposal was entered into the register	M	1	Date	Gregorian calendar
justification	explanation of why the proposal should be implemented EXAMPLE "The cross-map entry has been collaboratively developed by ISO/TC 211 and <organization name>."	M	1	Character-String	Free text
status	standing of the proposal within the approval process, represented as an instance of the enumeration RE_DecisonStatus (ISO 19135-1:2015, B.2.5.2)	M	1	Class	"pending" "tentative" "final"
disposition	disposition of the proposal, represented as an instance of the enumeration RE_Disposition (ISO 19135-1:2015, B.2.5.2) Note 1 to entry: This attribute is conditional. A value shall be provided if the value of *status* is "tentative" or "final".	C	1	Class	"withdrawn" "accepted" "notAccepted"
dateDisposed	date on which the disposition of the proposal was determined Note 1 to entry: This attribute is conditional. A value shall be provided if the value of status is "tentative" or "final".	C	1	Date	Gregorian calendar
controlBodyDecision-Event	identifies a meeting or other event associated with the control body's decision concerning the proposal	O	1	Character-String	Free text
controlBodyNotes	notes relevant to the control body's decision concerning the proposal. Individual entries within the notes should be dated	O	1	Character-String	Free text
registerManagerNotes	notes relevant to the register manager's handling of the proposal. Individual entries within the notes should be dated	O	1	Character-String	Free text

Table 19 — Associations inherited from RE_ProposalManagementInformation

Target Class	Target Role Name	Definition	M/C/O	Max Occur
RE_RegisterStakeholder (ISO 19135-1:2015, 7.3.2 and B.2.5.2)	sponsor	identifies the TermStakeholder that is submitting proposal management information to the register	M	1

Table 20 — Associations inherited from RE_AdditionInformation

Target Class	Target Role Name	Definition	M/C/O	Max Occur
RE_RegisterItem (ISO 19135-1:2015, B.2.3.2)	item	identifies the CrossMapRegisterEntry to which the information in CrossMapAddition is related	M	1

7.3.9 CrossMapAmendment class

The class CrossMapAmendment (Figure 5) is a subclass of RE_AmendmentInformation (ISO 19135-1:2015, B.2.7.3). It specifies elements of management information to be recorded for each proposal to amend a cross-map entry. It inherits one attribute and one association from the class RE_AmendmentInformation. In addition, through RE_AmendmentInformation, it inherits eight attributes and one association from the class RE_ProposalManagementInformation (ISO 19135-1:2015, B.2.5.2).

The requirements regarding the CrossMapAmendment class, its attributes and associations are specified in Requirement 21.

Requirement 21. A term cross-map register schema shall include the CrossMapAmendment class.

CrossMapAmendment shall inherit the eight attributes from RE_ProposalManagementInformation that are described in Table 18.

CrossMapAmendment shall inherit the one attribute from RE_AmendmentInformation that is described in Table 21.

CrossMapAmendment shall inherit the one association from RE_ProposalManagementInformation that is described in Table 19.

CrossMapAmendment shall inherit the one association from RE_AmendmentInformation that is described in Table 22.

Table 21 — Attributes inherited from RE_AmendmentInformation

Name	Definition	M/C/O	Max Occur	Data Type	Domain
amendmentType	identifies the type of amendment proposed, represented as an instance of the enumeration RE_AmendmentType (ISO 19135-1:2015, B.2.7.3)	M	1	Class	"supersession" "retirement"

Table 22 — Associations inherited from RE_AmendmentInformation

Target Class	Target Role Name	Definition	M/C/O	Max Occur
RE_RegisterItem (ISO 19135-1:2015, B.2.3.2)	item	identifies the CrossMapRegisterEntry to which the information in CrossMapAmendment is related	M	1

7.3.10 CrossMapClarification class

The class CrossMapClarification (Figure 5) is a subclass of RE_ClarificationInformation (ISO 19135-1:2015, B.2.7.4). It specifies elements of management information to be recorded for each proposal to clarify a cross-map entry. It inherits one attribute and one association from the class RE_ClarificationInformation. In addition, through RE_ClarificationInformation, it inherits eight attributes and one association from the class RE_ProposalManagementInformation (ISO 19135-1:2015, B.2.5.2).

The requirements regarding the CrossMapClarification class, its attributes and associations are specified in Requirement 22.

Requirement 22. A term cross-map register schema shall include the CrossMapClarification class.

CrossMapClarification shall inherit the eight attributes from RE_ProposalManagementInformation that are described in Table 18.

CrossMapClarification shall inherit the one attribute from RE_ClarificationInformation that is described in Table 23.

CrossMapClarification shall inherit the one association from RE_ProposalManagementInformation that is described in Table 19.

CrossMapClarification shall inherit the one association from RE_ClarificationInformation that is described in Table 24.

Table 23 — Attributes inherited from RE_ClarificationInformation

Name	Definition	M/C/O	Max Occur	Data Type	Domain
proposedChange	description of the clarification identifying: — the elements of the register item that are changed; — the prior and subsequent values of each	M	1	Character-String	Free text

Table 24 — Associations inherited from RE_ClarificationInformation

Target Class	Target Role Name	Definition	M/C/O	Max Occur
RE_RegisterItem (ISO 19135-1:2015, B.2.3.2)	item	identifies the CrossMapRegisterEntry to which the information in CrossMap-Clarification is related	M	1

7.3.11 CrossMapSubregisterDescription class

The class CrossMapSubregisterDescription (Figure 6) is a subclass of RE_SubregisterDescription (ISO 19135-1:2015, B.2.8.2). It is used in a principal register to describe affiliated subregisters. It inherits two attributes from RE_SubregisterDescription. In addition, through RE_SubregisterDescription, it inherits six attributes and four associations from RegisterItem (ISO 19135-1:2015, 7.5.2) and two associations from SubregisterDescription (ISO 19135-1:2015, 8.4.2).

CrossMapSubregisterDescription has three attributes that are specific to the class.

The requirements regarding the CrossMapSubregisterDescription class, its attributes and associations are specified in Requirement 23.

Figure 6 — CrossMapSubregisterDescription class

Requirement 23. A term cross-map register schema shall include the CrossMapSubregisterDescription class.

CrossMapSubregisterDescription shall be associated with the principal register and specify information about the affiliated subregisters.

CrossMapSubregisterDescription shall inherit the six attributes from RegisterItem that are described in Table 8. The attribute itemIdentifier shall be subject to the following constraints.

— The attribute itemIdentifier shall uniquely identify the subregister with which it is associated.

   EXAMPLE 1   "ISO/TC 211 cross-map 1 – Reference vocabulary".

   EXAMPLE 2   "ISO/TC 211 cross-map 1 – Cross-map register".

CrossMapSubregisterDescription shall inherit the two attributes from RE_SubregisterDescription that are described in Table 25.

CrossMapSubregisterDescription shall specify the three attributes that are described in Table 26.

CrossMapSubregisterDescription shall inherit the four associations from RegisterItem that are described in Table 11. The target role itemClass shall be subject to the following constraint:

— The item classes to which the instances of CrossMapSubregisterDescription connect shall be "reference vocabulary" (3.1.24), "operating vocabulary" (3.1.22) and "cross-map register" (3.1.7).

CrossMapSubregisterDescription shall inherit the two associations from SubregisterDescription (via RE_SubregisterDescription) that are described in Table 27. The target role containedItemClass shall be subject to the following constraint:

— The item class to which each instance of CrossMapSubregisterDescription connects shall be (in the case of a subregister that is a reference vocabulary or operating vocabulary) "terminological entry" (3.1.31) or (in the case of a subregister that is a cross-map register) "cross-map entry" (3.1.6).

Table 25 — Attributes inherited from RE_SubregisterDescription

Name	Definition	M/C/O	Max Occur	Data Type	Domain
uniformResourceIdentifier	URI referencing information about online resources associated with the subregister	M	1	URI	No specified domain
operatingLanguage	specifies language, country information and character encoding for the proper interpretation of the content of character strings in the subregister, represented as an instance of the class RE_Locale (ISO 19135-1:2015, B.2.2.3) EXAMPLE Operating language name English Operating language code eng Operating language country 826 Operation language character encoding 5	M	1	Class	No specified domain

Table 26 — CrossMapSubregisterDescription attributes

Name	Definition	M/C/O	Max Occur	Data Type	Domain
contentSummary	general statement of the purpose for which items in the subregister are made available to potential users EXAMPLE "A compilation of terminological entries published in ISO/TC 211-sponsored International Standards and Technical Specifications that have been used in Cross-Map 1".	M	1	Character-String	Free text
referenceVocabulary	specifies whether the subregister is a reference vocabulary	M	1	Boolean	0 = No, 1 = Yes
alternativeLanguages	summary of alternative locales used by items in a subregister, represented as instances of the class RE_Locale (ISO 19135-1:2015, B.2.2.3)	M	N	Class	No specified domain

Table 27 — Associations inherited from SubregisterDescription (via RE_SubregisterDescription)

Target Class	Target Role Name	Definition	M/C/O	Max Occur
ItemClass (ISO 19135-1:2015, 7.4.2)	containedItemClass	describes the characteristics of a class of items held in the subregister Note 1 to entry: In the case of a reference vocabulary or operating vocabulary subregister, the contained item class shall be "terminological entry" (3.1.31). In the case of a subregister that is a cross-map register, the contained item class shall be "cross-map entry" (3.1.6).	M	N
RegisterStakeholder (ISO 19135-1:2015, 7.3.2)	subregisterManager	identifies the TermStakeholder that is the manager of the subregister	M	1

7.3.12   TermRelationship enumeration

TermRelationship (Figure 3) is an <<enumeration>> that provides values for describing the relationship of an operating term to a reference term. The domain of TermRelationship is specified in Table 28.

Table 28 — Domain of TermRelationship

Value	Meaning
identical	The reference term is identical to the operating term and designates the same concept
synonymic	The reference term and operating term are different but designate the same concept
polysemic	The reference term and operating term are identical but designate distinctly different concepts that share certain characteristics
homonymic	The reference term and operating term are identical but designate distinctly different concepts that share no characteristics
none	There is no relationship between the reference term and operating term

7.3.13 ConceptRelationship enumeration

ConceptRelationship (Figure 3) is an <<enumeration>> that provides values for describing the relationship of an operating concept to a reference concept. The domain of ConceptRelationship is specified in Table 29.

Table 29 — Domain of ConceptRelationship

Value	Meaning
identical	The reference concept and operating concept are identical
generalization	The reference concept is a generalization of the operating concept
specialization	The reference concept is a specialization of the operating concept
peer	The reference concept and operating concept share characteristics inherited from a common superordinate concept
component	The reference concept is a component of the operating concept
aggregation	The reference concept is an aggregation of two or more operating concepts
userDefined	The relationship between the reference concept and the operating concept is specified by a user-defined classification.
none	There is no relationship between the operating concept and the reference concept.

Annex A
(normative)

Abstract test suite

A.1 Vocabulary cross-mapping methodology conformance class

A.1.1 Governance framework stage

a) Test Purpose: Verify that the cross-mapping of terms and concepts has been co-sponsored by the participating communities and that a governance regime has been incorporated in a formal agreement between the communities.

b) Test Method: Request information from the participating communities, including the owners of the reference and operating vocabularies.

c) Reference: Clause 6, Requirements 1 and 2.

d) Test Type: Basic.

A.1.2 Reference vocabulary stage

a) Test Purpose: Verify that each participating community has identified and adopted its preferred reference vocabulary.

b) Test Method: Review the information in the vocabulary cross-mapping register to confirm the credentials of the reference vocabulary.

c) Reference: Clause 6, Requirement 3.

d) Test Type: Basic.

A.1.3 Cross-mapping stage — Term comparison

a) Test Purpose: Verify that the relationship between the terms in each pair of cross-mapped vocabulary entries has been classified.

b) Test Method: Inspect the cross-map subregister in the vocabulary cross-mapping register to ensure that the term relationship field has been populated according to the classification system specified by Requirement 4 of this document.

c) Reference: Clause 6, Requirement 4.

d) Test Type: Basic.

A.1.4 Cross-mapping stage — Domain allocation

a) Test Purpose: Verify that cross-mapped vocabulary entries are associated with domains (and are unique within those domains) in instances where there are polysemic or homonymic relationships between terms.

b) Test Method: Inspect the reference vocabulary subregister and operating vocabulary subregister in the vocabulary cross-mapping register to ensure that the data fields associated with the "field of application" attribute are populated with values from a controlled list of domains.

c) Reference: Clause 6, Requirement 5.

d) Test Type: Basic.

A.1.5 Cross-mapping stage — Concept comparison

a) Test Purpose: Verify that the relationship between the concepts (as described by their associated definitions) in each pair of cross-mapped vocabulary entries has been classified.

b) Test Method: Inspect the cross-map subregister in the vocabulary cross-mapping register to ensure that the concept relationship field has been populated according to the classification system specified in Requirement 6 of this document.

c) Reference: Clause 6, Requirement 6.

d) Test Type: Basic.

A.1.6 Documentation and publication stage — Documentation

a) Test Purpose: Verify that recommendations regarding amendments to the content of the reference or operating vocabularies, including the deprecation of terms, have been provided to the appropriate communities of interest for consideration.

b) Test Method: Request information from the participating communities regarding any recommendations stemming from the cross-mapping project.

c) Reference: Clause 6, Requirement 7.

d) Test Type: Basic.

A.1.7 Documentation and publication stage — Publication

a) Test Purpose: Verify that the cross-mapping of terms and concepts has been published in a register that is accessible by the relevant communities of interest and (if applicable) the general public. Verify that the register complies with Clause 7 of this document.

b) Test Method: Request information from the owner of the reference or operating vocabulary, regarding the location of the register and the conditions relating to community/general access. Confirm the existence of the register, that it has been populated, and that it can be accessed under the conditions advised. Confirm that it satisfies the abstract test suit specified in A.2 of this document.

c) Reference: Clause 6, Requirement 8.

d) Test Type: Basic.

A.2 Vocabulary cross-mapping register conformance class

A.2.1 Register management

a) Test Purpose: Verify that the register has a management system that addresses all requirements.

b) Test Method: Request information about the register from the register owner. Verify that required information is included.

c) Reference: Clause 7, Requirements 10 to 14.

d) Test Type: Basic.

A.2.2 Register schema

a) Test Purpose: Verify that the items in the register include the minimum content specified by the register schema.

b) Test Method: Inspect each of a sample of entries in the register to ensure that they include all elements of information required by this document.

c) Reference: Clause 7, Requirements 9, 15 to 23.

d) Test Type: Basic.

Annex B
(informative)

Terminology and domains

B.1 Concepts, definitions and terms

The development of a terminological entry for inclusion in a vocabulary requires the simultaneous resolution of three issues, being:

— the identification of the concept;

— the nomination of a designation (usually a term) for that concept;

— the construction of a definition, associated with the designation, that unambiguously describes the concept.

Ideally, the consistent resolution of the three will be guided by the principle that:

— for each concept there is a single term (and vice-versa);

— for each concept there is a single definition (and vice versa);

producing a monosemic relationship between a term and a uniquely defined concept. In practice, however, three other types of relationship are encountered, being:

— synonymy, where two or more terms represent the same concept;

— polysemy, where a designation represents two or more concepts that share certain characteristics;

— homonymy, where a designation represents two or more unrelated concepts.

The ambiguities inherent in the synonymic, polysemic and homonymic relationships are inhibitors to the realization of semantic interoperability.

B.2 Concept systems

The relationship of a concept to other concepts is reflected through its position in a concept system.

There are several categories of concept systems. A generic concept system is hierarchical in character and relates superordinate concepts to their more specialised subordinate concepts. The specialization may reflect the context provided by a field of knowledge and be effected by constraining the superordinate concept's attributes, associations or behaviours. Consider, for example, the concepts:

— coverage – feature that acts as a function to return values from its range for any direct position within its spatial, temporal or spatiotemporal domain (ISO 19123:2005, 4.1.7);

— discrete coverage – coverage that returns the same feature attribute values for every direct position within any single spatial object, temporal object, or spatiotemporal object in its domain (ISO 19123:2005, 4.1.12).

The concepts form part of the same hierarchical concept system, "discrete coverage" being a subordinate concept to "coverage". During cross-mapping, the association between the two could be identified as generalisation or specialisation depending on the direction of the relationship.

A concept will frequently aggregate the attributes, behaviours and relationships of other concepts, forming a compound concept from distinctly separate components. Consider, for example, the concept:

— coordinate reference system - coordinate system which is related to an object by a datum" (ISO 19111:2007, 4.8).

This combines the concepts:

— coordinate system - set of mathematical rules for specifying how coordinates are to be assigned to points (ISO 19111:2007, 4.10);

— datum - parameter or set of parameters that define the position of the origin, the scale, and the orientation of a coordinate system (ISO 19111:2007, 4.14).

Note that the further decomposition of 'coordinate system' and 'datum' into component concepts is also possible (for example, into 'coordinate', 'origin', 'scale') as is aggregation into more complex concepts (for example, 'Cartesian coordinate system', 'compound coordinate reference system').

The ability to systematically relate concepts, both within and across concept systems is a precursor to the cross-mapping of vocabularies. The absence of this ability is a further inhibitor to the realization of semantic interoperability.

B.3 Domains, uniqueness and cross-mapping

There are two prerequisites to the accomplishment of semantic interoperability, particularly if automated recognition of concepts is required. They are:

— the establishment of one-to-one relationships between concept, definition and term, leading to the unique designation of concepts;

— the identification of related concepts, leading to their cross-mapping.

The first prerequisite requires the transformation of synonymous, polysemic and homonymic relationships into monosemic relationships. This is achieved by associating a domain with each concept. A domain is a distinct field of human knowledge or application to which a terminological record is assigned. Examples of domains include road transport, geographic information and land cover. A domain can be viewed as an associative concept system, a collection of closely and/or loosely associated concepts that apply to a single thematic field of endeavour.

The required relationship between domains, concepts, definitions and terms is illustrated schematically in Figure B.1. The entity *Domain Concept* encapsulates the requirement that, within each domain, every concept-definition-term combination is unique. Further emphasis is provided by association multiplicities that require each instance of *Domain Concept* to belong to one and only one *Domain*, to be described by one and only one *Definition*, and to be identified by one and only one *Term*. Very often, the required unique combinations are provided by an existing taxonomy.
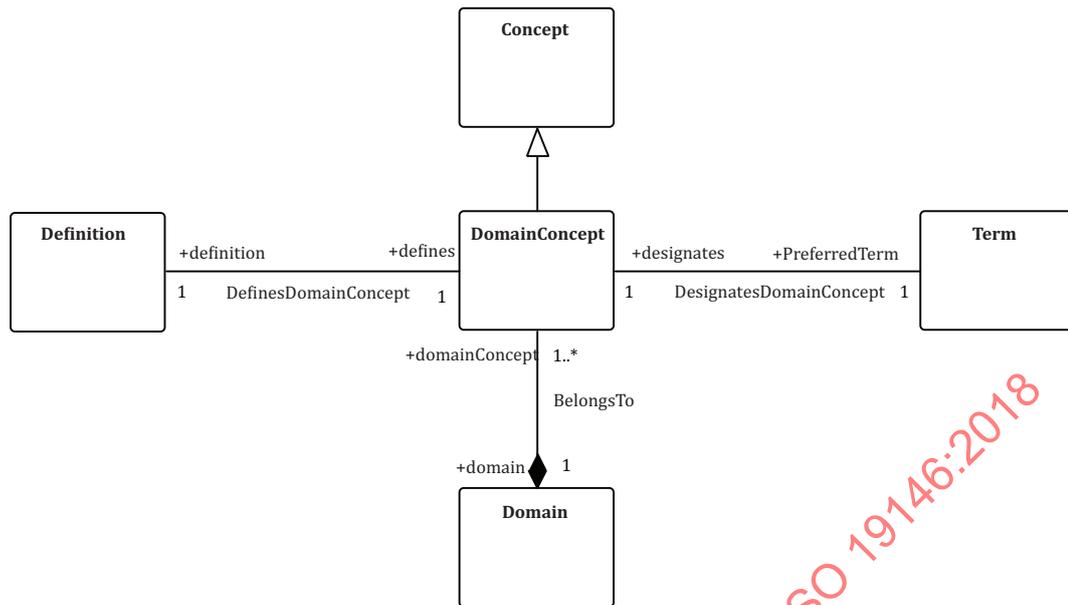
Figure B.1 — Terms, Definitions, Concepts and Domains

The second prerequisite requires the appropriate cross-mapping of relationships within and between concept systems. This is illustrated schematically in Figure B.2. The entity *UniverseOfConcepts* aggregates every instance of *Domain Concept* from every domain. Within this aggregation there are:

— concepts that are identical but associated with different domains;

— concept systems associating subordinate concepts to a common superordinate concept (associated with the same or different domains), producing generalization, specialization or peer relationships;

— compound concepts that are constructed from component concepts, producing aggregation or component relationships.

In addition, the association multiplicity between *UniverseOfConcepts* and *Term* recognizes that:

— domain concepts from different domains may be designated by the same term;

— the same concept may be designated by different terms (synonyms) in different domains reflecting different contexts.

The identification and documentation of these relationships is necessary to develop consistent cross-domain vocabularies. The process through which it is achieved is vocabulary cross-mapping.
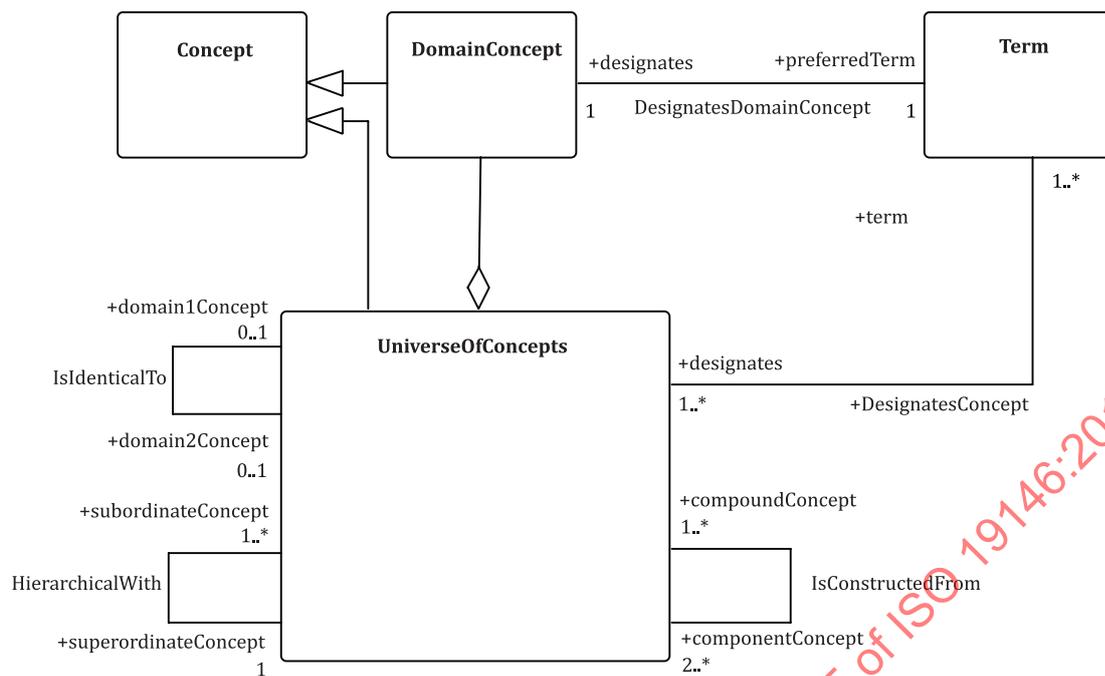
Figure B.2 — Complex Concepts

Annex C
(informative)

Cross-mapping examples

C.1 Relationship combinations

Table C.1 illustrates term relationship/concept relationship combinations that may occur in practice. The following should be noted.

— The column "Definition Characteristics" describes the characteristics of a pair of definitions, one belonging to the reference vocabulary, the other belonging to the operating vocabulary.

— The column "Terms Identical" indicates whether the terms associated with the pair of definition are identical or different.

— The column "Term Relationship" identifies the proposed term relationship classification, being one of the values specified in Requirement 4.

— The column "Concept Relationship" identifies the proposed concept relation classification, being one of the values specified in Requirement 6.

Table C.1 — Term and concept relationships

Definition Characteristics	Terms Identical	Term Relationship	Concept Relationship
The reference definition and operating definition are identical	Yes	Identical	Identical
	No	Synonymic	Identical
The reference definition and operating definition describe **exactly** the same concept (attributes, relationships and behaviour) but using different wording	Yes	Identical	Identical
	No	Synonymic	Identical
The reference definition and operating definition describe **exactly** the same concept (attributes, relationships and behaviour) but in the context of different fields of application	Yes	Identical	Identical
	No	Synonymic	Identical
The reference definition describes a concept that is a generalization of the concept described by the operating definition	Yes	Polysemic	Generalization
	No	None	Generalization
The reference definition describes a concept that is a specialization of the concept described by the operating definition	Yes	Polysemic	Specialization
	No	None	Specialization
The reference definition and operating definition describe concepts that are different specializations of the same superordinate concept	Yes	Polysemic	Peer
	No	None	Peer
The reference definition describes a concept that is included as an implicit or explicit component of the operating concept	Yes	Polysemic	Component
	No	None	Component
The reference definition implicitly or explicitly aggregates one or more concepts that are described by the operating definition	Yes	Polysemic	Aggregation
	No	None	Aggregation
The reference definition is not related to the same concept as the operating definition	Yes	Homonymic	None
	No	None	None

C.2   Examples

The following tables provide examples of term relationship/concept relationship combinations.

Case 1	The terms are identical and the operating definition has very similar wording to the reference definition.	
Example	Reference Term Coordinate (ISO 19111) Reference Definition one of a sequence of n numbers designating the position of a point in n-dimensional space	Operating Term Co-ordinate (ISO/CD 17572-1) Operating Definition One of an ordered set of N numbers designating the position of a point in N-dimensional space.
Relationships	Reference Term to Operating Term	**Identical**
	Reference Concept to Operating Concept	**Identical**

Case 2	The operating definition describes exactly the same concept as the reference definition but uses different wording (i.e. each phrase in the operating definition has a phrase of identical meaning in the reference definition and vice-versa).	
Example	Reference Term Accuracy (ISO 3534-1) Reference Definition closeness of agreement between a test result and the accepted reference value	Operating Term Accuracy (ISO/CD 17572-1) Operating Definition The measure of closeness of results of observations, computations or estimates to the true values or the values accepted as being true.
Relationships	Reference Term to Operating Term Reference Concept to Operating Concept	**Identical** **Identical**

Case 3	The terms are different but the operating definition is a restyled version of a reference definition and describes the identical concept (i.e. each phrase in the operating definition has a phrase of identical meaning in the reference definition and vice-versa).	
Example	Reference Term Geographic Identifier (ISO 19112) Reference Definition spatial reference in the form of a label or code that identifies a location	Operating Term Indirect Referencing (ISO/CD 17572-1) Operating Definition Referencing based on descriptive identifiers, rather than geographic coordinates.
Relationships	Reference Term to Operating Term Reference Concept to Operating Concept	**Synonymic** **Identical**