# INTERNATIONAL STANDARD

# ISO 19146

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 19146 was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

# Introduction

A common language is an essential prerequisite to effective communication. However, a simple knowledge of a language's vocabulary is insufficient to ensure communication integrity. A word can have several meanings depending on the context in which it is used. Similarly, a concept can be referenced by several words, each communicating a different connotation or level of emphasis.

The issues associated with the correct use of language extend far beyond day-to-day communication. Every field of endeavour, from engineering to cookery, has its own technical language and vocabulary. In order to participate in discussions on a subject, it is necessary to understand both the subject's terminology and the context in which it is to be used. The imprecise use of technical or professional language (for example, by using two terms interchangeably when, in fact, they have distinctly different connotations) gives rise to the same traps and dangers associated with the inappropriate use of a spoken language.

This International Standard establishes a methodology for cross-mapping technical vocabularies that have been adopted by industry-focussed geospatial communities (for example, geospatial communities supporting the transport or utilities industries). The processes relate to the unique identification of concepts and ensuring the existence of monosemic relations between concepts and designations. The methodology aims to ensure the consistent use of cross-mapping processes when associating disparate geospatial vocabularies and identifying synonyms.

It is not the objective of this International Standard to define an ontology or taxonomy for geographic information and geomatics. 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/taxonomy initiatives.

This International Standard applies the provisions of ISO 19135 to the registration of geospatial concepts. An online register of cross-mapped terminology entries, conforming to the requirements of ISO 19135, is associated with this International Standard. Administrative arrangements for the population and maintenance of the online register are beyond the scope of this International Standard. However, the provisions of ISO 19135 relating to the maintenance of registers apply.

This International Standard adopts terms and concepts that are taken from UML and terminology theory and practice. A cross-mapping between the two terminologies can be found in ISO/TR 24156:2008.

# Geographic information — Cross-domain vocabularies

## 1 Scope

This International Standard defines a methodology for cross-mapping technical vocabularies that have been adopted by industry-specific geospatial communities. It also specifies an implementation of ISO 19135 for the registration of geographic information concepts for the purpose of integrating multiple domain-based vocabularies.

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

## 2 Conformance

Any vocabulary cross-mapping that claims conformance to this International Standard shall satisfy all of the conditions specified in the following abstract test suites:

a) Annex A of this International Standard, and

b) ISO 19135:2005, A.1 and A.2 for conformance to ISO 19135.

A vocabulary cross-mapping register established by ISO/TC 211 shall, in addition, satisfy all of the conditions specified in the ISO 19135 abstract test suite for registers established by ISO/TC 211 as specified in ISO 19135:2005, A.3.

## 3 Normative references

The following referenced documents are indispensable for the application 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/TS 19103:2005, *Geographic information — Conceptual schema language*

ISO/TS 19104:2008, *Geographic information — Terminology*

ISO 19115:2003, *Geographic information — Metadata*

ISO 19135:2005, *Geographic information — Procedures for item registration*

## 4 Terms and definitions

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

**4.1**
**associative concept system**
**concept system** based on associative, i.e. thematic or pragmatic, relations

NOTE 1 Adapted from ISO 12620:1999.

NOTE 2 An associative relation exists between the concepts "education" and "teaching", "baking" and "oven".

**4.2**
**characteristic**
abstraction of a property of an object or of a set of objects

[ISO 1087-1:2000, definition 3.2.4]

NOTE Characteristics are used for describing **concepts**.

**4.3**
**concept**
unit of knowledge created by a unique combination of **characteristics**

[ISO 1087-1:2000, definition 3.2.1]

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

**4.4**
**concept system**
system of concepts
set of **concepts** structured according to the relations among them

[ISO 1087-1:2000, definition 3.2.11]

**4.5**
**cross-mapping**
comparison of **terminology entries** from different **domains** to determine their semantic equivalence

**4.6**
**definition**
representation of a **concept** by a descriptive statement which serves to differentiate it from related concepts

[ISO 1087-1:2000, definition 3.3.1]

**4.7**
**delimiting characteristic**
**essential characteristic** used for distinguishing a **concept** from related concepts

[ISO 1087-1:2000, definition 3.2.7]

NOTE The delimiting characteristic *support for the back* may be used for distinguishing the concepts "stool" and "chair".

**4.8**
**designation**
designator
representation of a **concept** by a sign which denotes it

[ISO 1087-1:2000, definition 3.4.1]

NOTE In terminology work three types of designations are distinguished: symbols, appellations and **terms**.

**4.9**
**domain**
⟨general vocabulary⟩ distinct area of human knowledge to which a terminological record is assigned

NOTE 1 Adapted from ISO 12620:1999.

NOTE 2 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**.

**4.10**
**domain concept**
**concept** that is associated with a specific **domain**

NOTE A concept may be associated with several domains and separately identified as a domain concept in relation to each.

**4.11**
**essential characteristic**
**characteristic** which is indispensable to understanding a **concept**

[ISO 1087-1:2000, definition 3.2.6]

**4.12**
**general concept**
**concept** which corresponds to two or more objects which form a group by reason of common properties

[ISO 1087-1:2000, definition 3.2.3]

NOTE Examples of general concepts are “planet”, “tower”.

**4.13**
**generic concept**
**concept** in a **generic relation** having the narrower **intension**

[ISO 1087-1:2000, definition 3.2.15]

**4.14**
**generic concept system**
**concept system** in which concepts that belong to the category of the narrower **concept** are part of the extension of the broader concept

NOTE Adapted from ISO 12620:1999.

**4.15**
**generic relation**
genus-species relation
relation between two **concepts** where the **intension** of one of the concepts includes that of the other concept and at least one additional **delimiting characteristic**

[ISO 1087-1:2000, definition 3.2.21]

NOTE A generic relation exists between the concepts “word” and “pronoun”, “vehicle” and “car”, “person” and “child”.

**4.16**
**homonymy**
relation between **designations** and **concepts** in a given language in which one designation represents two or more unrelated concepts

[ISO 1087-1:2000, definition 3.4.25]

NOTE 1 An example of homonymy is:

bark

1 "sound made by a dog"

2 "outside covering of the stem of woody plants"

3 "sailing vessel"

NOTE 2 The designations in the relation of homonymy are called homonyms.

**4.17**
**intension**
set of **characteristics** which makes up the **concept**

[ISO 1087-1:2000, definition 3.2.9]

**4.18**
**monosemy**
relation between **designations** and **concepts** in a given language in which one designation only relates to one concept

[ISO 1087-1:2000, definition 3.4.23]

NOTE The designations in the relation of monosemy are called monosemes.

**4.19**
**partitive relation**
part-whole relation
relation between two **concepts** where one of the concepts constitutes the whole and the other concept a part of that whole

[ISO 1087-1:2000, definition 3.2.22]

NOTE A partitive relation exists between the concepts "week" and "day", "molecule" and "atom".

**4.20**
**polysemy**
relation between **designations** and **concepts** in a given language in which one designation represents two or more concepts sharing certain **characteristics**

[ISO 1087-1:2000, definition 3.4.24]

NOTE 1 An example of polysemy is:

bridge

1 "structure to carry traffic over a gap"

2 "part of a string instrument"

3 "dental plate"

NOTE 2 The designation in the relation of polysemy are called polysemes.

**4.21**
**subordinate concept**
narrower concept
**concept** which is either a specific concept or a partitive concept

[ISO 1087-1:2000, definition 3.2.14]

**4.22**
**superordinate concept**
broader concept
**concept** which is either a **generic concept** or a comprehensive concept

[ISO 1087-1:2000, definition 3.2.13]

**4.23**
**synonymy**
relation between or among **terms** in a given language representing the same **concept**

[ISO 1087-1:2000, definition 3.4.19]

NOTE 1 The relation of synonymy exists, for example, between *deuterium* and *heavy hydrogen*.

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

**4.24**
**term**
verbal **designation** of a **general concept** in a specific subject field

[ISO 1087-1:2000, definition 3.4.3]

NOTE A term may contain symbols and can have variants, e.g. different forms of spelling.

**4.25**
**terminological data**
data related to **concepts** or their **designations**

NOTE The more common terminological data include entry term, **definition**, note, grammatical label, subject label, language identifier, country identifier and source identifier.

[ISO 1087-1:2000, definition 3.8.1]

**4.26**
**terminological dictionary**
technical dictionary
collection of **terminological entries** presenting information related to **concepts** or **designations** from one or more specific subject fields

[ISO 1087-1:2000, definition 3.7.1]

**4.27**
**terminological entry**
part of a **terminological data** collection that contains the terminological data related to one **concept**

[ISO 1087-2:2000, definition 2.22]

**4.28**
**vocabulary**
**terminological dictionary** which contains **designations** and **definitions** from one or more specific **subject fields**

[ISO 1087-1:2000, definition 3.7.2]

NOTE The vocabulary may be monolingual, bilingual or multilingual.

# 5 Symbols and abbreviated terms

The following abbreviated terms are used in this document.

GIS Geographic Information System

LBS Location-Based Services

UML Unified Modeling Language

# 6 Semantic interoperability of geographic information

## 6.1 Introduction

The production of geographic information to address real-world business problems often requires the input of spatio-temporal data sourced from multiple data suppliers. The manner in which the data is combined depends on the nature of the problem under consideration, and may vary from the simple assembly of thematic overlays through to sophisticated integration, analysis and rendering. In every case, the data suppliers and processors must share a common understanding of the data's characteristics to ensure its 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 geospatial 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 geographic information concepts with its specialist culture, conventions and practices. A particular concept, therefore, may be identified by different terms or definitions depending on the industry context in which it is used.

The issue is illustrated by the following example. The branch of mathematics dealing with topology identifies the concepts of “node” and “directed edge”, defining them as follows:

— node – 0-dimensional topological primitive;

— directed edge – directed topological object that represents an association between an edge and one of its orientations.

Similarly, the field of location-based services (LBS) includes the concepts of “junction” and “link”, and defines them as follows:

— junction – single topological node in a network with its associated collection of turns, incoming and outgoing links;

— link – directed topological connection between two nodes (junctions), consisting of an edge and a direction.

In both instances, the LBS term is an alias for the topology term; “junction” is synonymous with “node” and “link” with “directed edge”. The terms and definitions therefore address identical underlying concepts. However the concepts are described within the context of the respective professional disciplines and expressed in language that is more readily acceptable to the respective communities of interest.

 

The ability to communicate the semantics of terms that describe a dataset's components is a prerequisite to data's appropriate use by the wider information community. The comprehension of the information and process elements that convey the meaning of the data is necessary to distinguish common concepts. In instances where conventional geographic information system (GIS) databases are being established, the necessary semantic translation can be accomplished through human intervention at the time of database design and loading. In more dynamic situations however (for example, where the user interface may be on a mobile computing device and the disparate data sets are being received in real-time for instantaneous combination and display), user-assisted integration is not feasible. In such cases, a more rigorous approach to terminology and to the unique identification of common concepts is needed to enable data/service interoperability.

The capacity to combine data that has 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 focus of this International Standard is to help the enabling of semantic interoperability through the cross-mapping of the terms and concepts applied by spatio-temporal user communities.

## 6.2 Principles for cross-mapping of vocabularies

Vocabulary cross-mapping is an integral part of the broader standardization agenda. Accordingly it should be implemented in a manner that complements other standardization practices and maximizes overall benefit to the user community. The following overarching principles, to be observed during any cross-mapping initiative, reinforce this requirement.

— Terminology is to 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.

— Vocabulary cross-mapping shall provide a thesaurus, not a taxonomy or ontology.

  Vocabulary cross-mapping should not be used to develop a taxonomy or ontology. The developers of the relevant International Standards and industry standards should already have established the content of the subject area vocabularies. Cross-mapping should relate the vocabularies of the existing taxonomies, facilitating knowledge indexing and improved information retrieval from disparate industry data sources.

— A stable reference vocabulary, maintained by a recognized standards body, shall 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. It is mandatory that all terms and definitions in the reference vocabulary be published in a recognized International Standard or industry standard.

  NOTE In the case of geographic information, the reference vocabulary should be the English version of the ISO/TC 211 Multi-Lingual Glossary of Terms.

— Cross-mapping shall proceed as a collaborative venture.

  Cross-mapping should take place in an open and transparent manner between the owner of the reference vocabulary and one or more communities of interest. During the process, each community of interest should be acknowledged as the ultimate authority regarding the correct use and interpretation of its terms and definitions. Discipline terms and conventions should be respected.

— Cross-mapping shall not circumvent established processes.

  Cross-mapping shall not be used to circumvent the established processes of the individual collaborating organizations. 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 organizations to deprecate terms or to improve concept system structures.

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

  The cross-mapping must 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 outcome.

— 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.

# 7 Approach

## 7.1 Concepts, definitions and terms

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

— 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), and

— 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 (schematically represented in Figure 1) are encountered:

— 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.

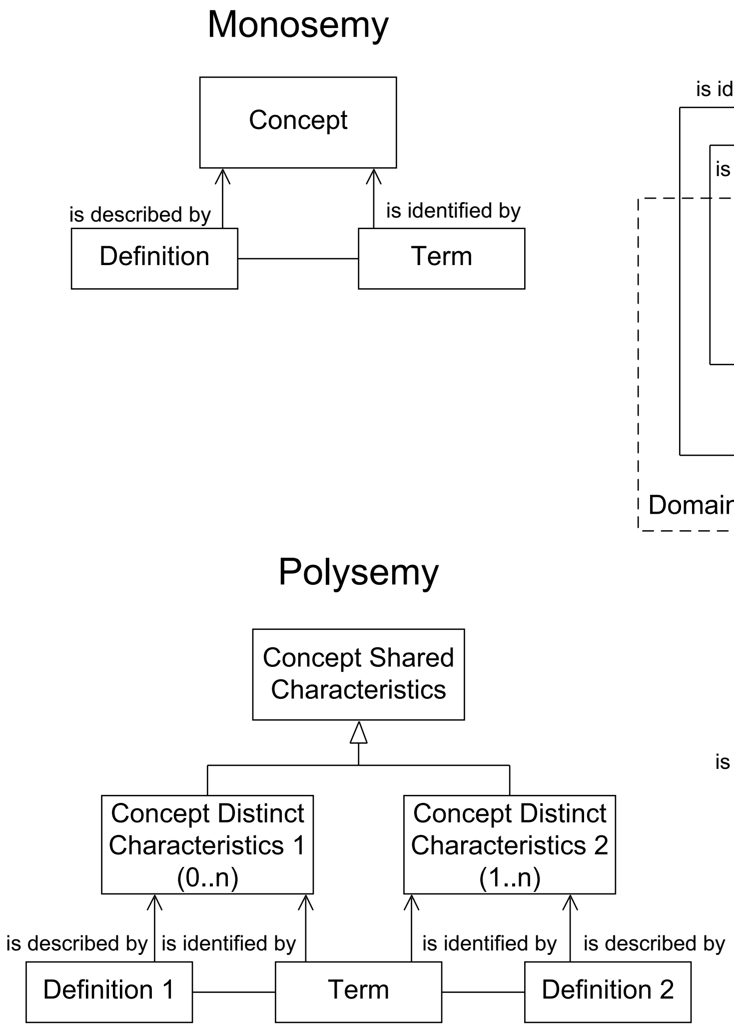


**Figure 1 — Relationships between concepts, definitions and terms**

## 7.2 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 specialized 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, definition 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, definition 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 generalization or specialization 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, definition 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, definition 4.10), and
- 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, definition 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.

## 7.3 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 identification of concepts, and
- the identification of related concepts, leading to their definitive 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 the upper part of Figure 2. 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.

The second prerequisite requires the appropriate cross-mapping of relationships within and between concept systems. This is illustrated schematically in the lower part of Figure 2. The entity *Concept* 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), cross-mapping to generalization, specialization or peer relationships, and
- compound concepts that are constructed from component concepts, cross-mapping to aggregation or component relationships.

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

— domain concepts from different domains can be designated by the same term, and

— the same concept can 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.

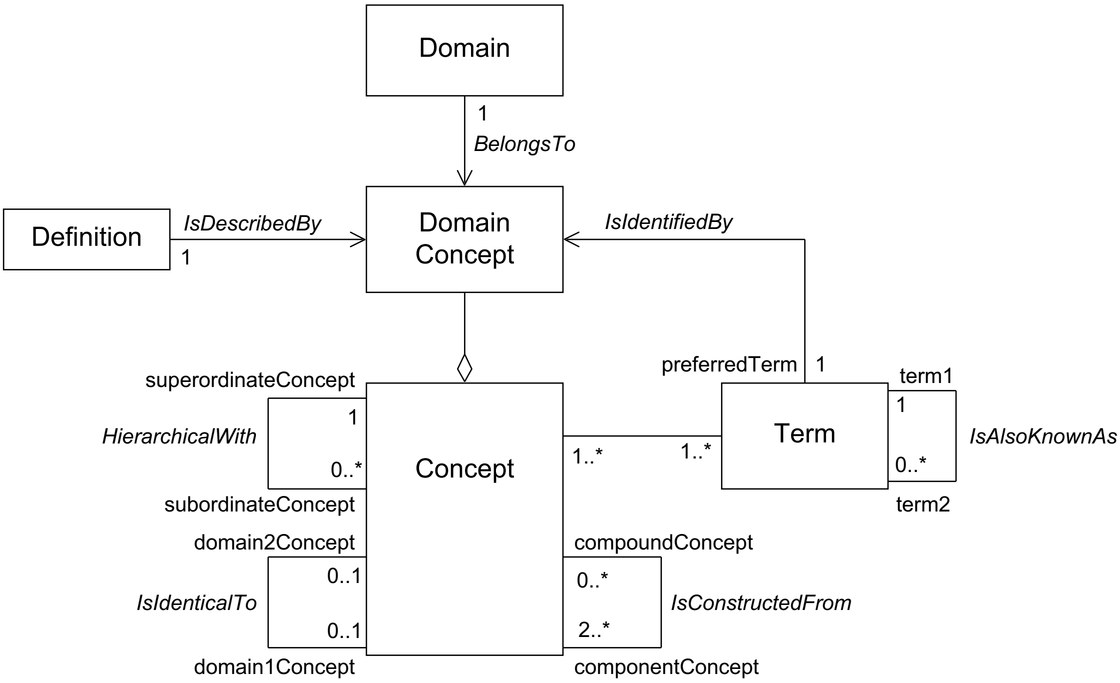


**Figure 2 — Concepts and Domains**

# 8 Vocabulary cross-mapping

## 8.1 Introduction

The methodology for undertaking vocabulary cross-mapping is specified in 8.2 to 8.4. Each cross-mapping undertaking shall pass through four stages, implementing or adopting

— a governance framework – to formalize the relationship between participating vocabulary owners,

— a reference vocabulary – to provide a consistent reference for multiple cross-mapping initiatives,

— a cross-mapping process – to provide a consistent approach to the classification of cross-mapped records, and

— a registration and publication – to provide an authoritative repository for cross-mapping outcomes.

## 8.2 Governance

The vocabulary custodians shall co-sponsor any initiative to cross-map their vocabularies. The sponsors shall establish an open and transparent governance regime to provide oversight of the initiative. The governance regime shall facilitate the smooth progression of the cross-mapping process. It shall also legitimize the process outcomes to the members of the participating communities of interest.

The governance arrangements shall include the following.

— **Formal Agreement** — A proposal to undertake a cross-mapping initiative shall be formally agreed by the governing bodies of the organizations that serve as vocabulary custodians. The agreement may include information regarding resources, schedules and publication arrangements. In instances where the initiative will result in a new register being established, ownership of the register and sub-registers will be identified in the agreement. In instances where the initiative will expand an existing register, the agreement will acknowledge the current ownership of the register and identify the ownership of any new subregisters.

— **Steering Committee** — The participating organizations shall establish a representative steering committee to oversee the initiative. The steering committee shall ensure that the cross-mapping process is undertaken in accordance with the principles described in 6.2 of this International Standard.

— **Project Team** — The steering committee shall establish a project team to undertake the work and prescribe a project management methodology that is appropriate to the task.

— **Vocabulary Cross-Map** — The project team shall 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 shall not be empowered to change the content of any subject vocabulary. However, it may provide recommendations to the participating organizations regarding additions, amendments or deletions from their respective vocabularies. These recommendations shall not form part of the final report unless expressly agreed by the participating body.

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

— **Draft Report** — The project team shall prepare a draft document for the steering committee that recommends cross-mapping. The document shall identify instances where cross-mapping has been achieved and the nature of the relationships identified. The steering committee members shall circulate the document within their organizations, seeking comments. The comments shall be provided to the project team. The project team shall consider the comments and amend the cross-map as appropriate.

— **Final Report and Endorsement** — The project team shall supply a final draft to the steering committee. Each participating organization shall seek endorsement for the proposals through its normal balloting or approval arrangements. The proposals shall not be formally adopted until endorsed by all participating organizations.

— **Publication** — The outcome of the cross-mapping process shall be published in a register as described in Clause 9 of this International Standard. Publication shall take place following endorsement by the participating organizations.

## 8.3 Reference vocabulary

Prior to commencement, each participating organization shall identify their preferred reference vocabulary. There are two options:

— agreement by all participants to recognize a single reference vocabulary (for example, 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 situation may become necessary in situations where an industry-based focus must be retained by a participating organization.

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

## 8.4 Cross-mapping process

### 8.4.1 Cross-mapping stages

The cross-mapping process shall proceed through two stages:

— identification of candidate vocabulary records;

— term, definition and domain comparison.

### 8.4.2 Identification of candidate vocabulary records

The reference and operating vocabularies shall be simultaneously reviewed to identify record pairs/clusters that are candidates for cross-mapping. The specific technique adopted for the initial filtering shall be at the discretion of the participating organizations. However, the adopted methodology should consider instances where the vocabularies include

— identical terms with identical definitions,

— identical terms with dissimilar definitions, and

— similar definitions for different terms.

In addition, instances where a common underlying concept (for example, the description of networks) has been adopted by two or more participating industries or organizations (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 record pair/cluster will relate to a common concept system. There can 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.

### 8.4.3 Term and concept comparison

The term and concept relationships between candidate vocabulary records shall be determined using the classification scheme in Table 1.

A term provides the identifier by which a concept is commonly recognized. The identifier, however, might not be unique; it is possible for totally unrelated concepts to share the same term. It is therefore necessary to determine whether occurrence of identical terms is indicative of a synonymic, polysemic or homonymic relationship.

Similarly, the characteristics of a concept that make it unique are described by its definition. The concept comparison shall identify the extent to which the same characteristics are represented in the reference and operating vocabularies.

**Table 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 |

### 8.4.4 Domain comparison

The domain to which each term and concept belong shall be identified. This is particularly necessary in instances where the same or similar terms are being used to identify different concepts. The domain identifiers shall be drawn from a controlled list to ensure consistent usage. In the case of ISO/TC 211 cross-mapping, the controlled list shall be established and maintained by the ISO/TC 211 Terminology Maintenance Group.

## 8.5 Documentation and publication

The term and concept relationships, together with the domain identifiers, shall be published in a vocabulary register (Clause 9).

In instances where synonyms exist within the same domain, the preferred term shall be clearly identified.

Recommendations regarding amendments to the content of either the reference or operating vocabularies, including the deprecation of terms, shall be provided to the appropriate custodian group for consideration. The custodian group shall consider the recommendations, and if accepted, implement the processes and procedures necessary to amend the vocabulary.

# 9 Vocabulary register

## 9.1 Overview

The reference and operating vocabularies, together with cross-mapping relationships and classifications, shall be published in an ISO 19135-compliant register. The structure of the register shall be hierarchical as specified in ISO 19135:2005, 7.1.4, each vocabulary (reference and operating) being recorded in a separate subregister. The principal register shall contain information that describes the subregisters. The cross-mapping shall link the related terminology entries in the relevant subregisters.

The subregisters may be owned by different vocabulary custodians. There is no requirement for the subregisters to be physically co-located.

The register shall provide the flexibility to accommodate changes over time (due to technology or other reasons) through the association of dates of validity. If an item is superseded by another item, the date the succession occurred shall be captured, along with references to and from the item that superseded it. The review of any cross-mapping involving the superseded item shall also be reported.

## 9.2 Register management

### 9.2.1 Register owner

The principal register and reference vocabulary subregister shall belong to the register owner. The register owner shall be responsible for

— the operation and maintenance of the register (including coordinating the establishment of subregisters by other organizations), and

— the replication of content from its published or endorsed documents (including its sponsored International Standards).

The register owner shall also be responsible for informing industry bodies that have participated in cross-mapping initiatives of subsequent additions, deletions or amendments to the reference vocabulary.

Other subregisters are owned by the owners of individual domain vocabularies.

### 9.2.2 Submitting organizations

The owner of any operating vocabulary that has been cross-mapped to the reference vocabulary shall be a submitting organization. Each submitting organization 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, and

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

In addition, each submitting organization shall be responsible for advising the register owner of any changes to its terminology.

A submitting organization may publish its subregister as a “community of practice” reference vocabulary. This shall be achieved through an appropriately constructed application.

### 9.2.3 Register manager

The owner of the reference vocabulary shall appoint the register manager. The register manager shall be responsible for coordinating the operation and ongoing development of the register, including

— registration of new items,

— liaison with industry body representatives on cross-mapping policy and administrative matters,

— circulating cross-mapping proposals for comment,

— publishing the register, and

— reporting on the status of the register as required.

## 9.3 Register schema

### 9.3.1 Introduction

The cross-domain vocabulary register schema (Figure 3) consists of one package, Terminology Register (TR), which specifies classes for recording terminological entries and their cross-mapping.

Each class and data type is documented in a separate subclause. Where a class or data-type uses, inherits or realizes an element of another International Standard, it is so identified and the manner in which the use, inheritance or realization is achieved is specified.

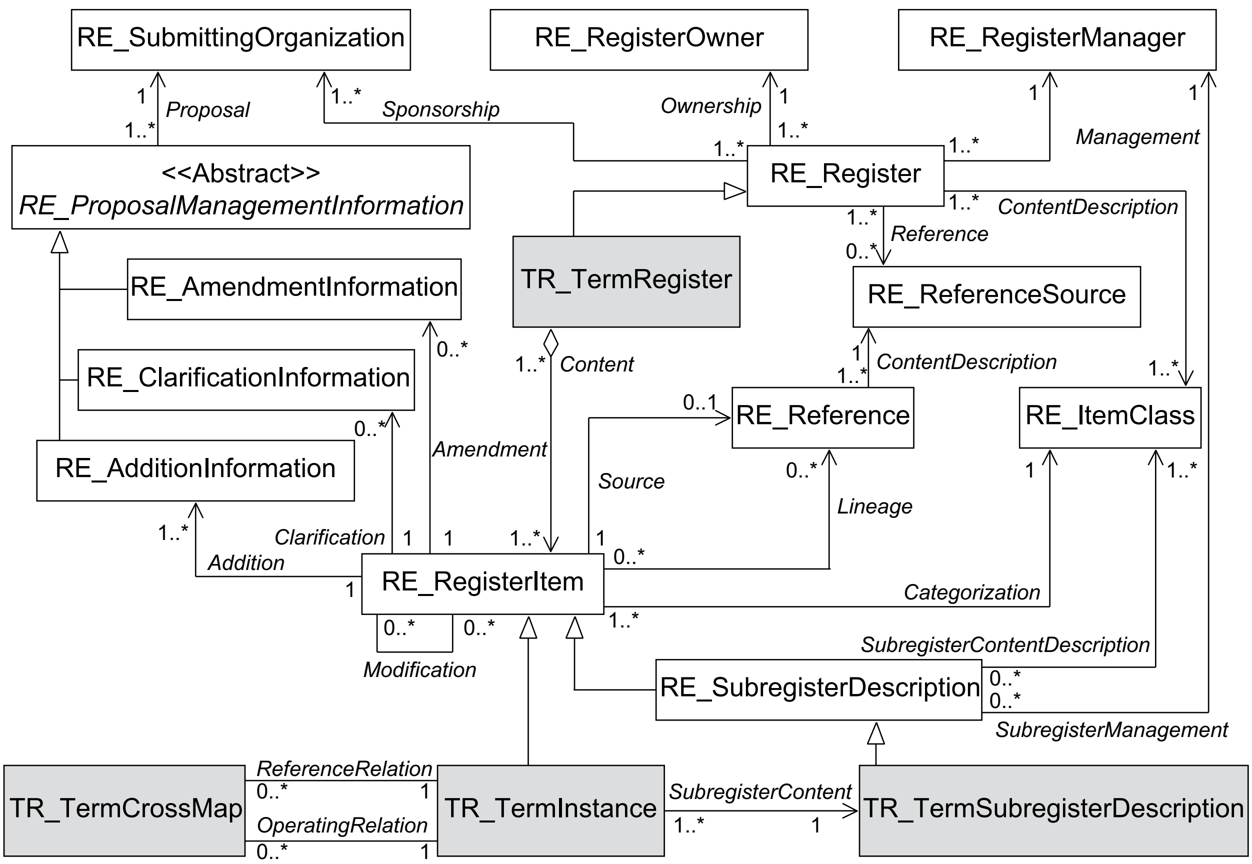


**Figure 3 — Vocabulary register schema**

### 9.3.2 Notation

The conceptual schema specified in this International Standard is described using the Unified Modeling Language (UML) following the guidance of ISO/TS 19103:2005.

As specified by ISO/TS 19103:2005, names of UML classes, with the exception of basic data type classes, include a unique two-letter prefix that identifies the standard and the UML package in which the class is defined. Several model elements used in this International Standard are defined in packages specified in other International Standards; these are listed in Table 2 along with the prefixes for the package specified in this International Standard.

**Table 2 — UML package identifiers**

| Prefix | Package |
|---|---|
| CI | Citation [ISO 19115] |
| RE | Register [ISO 19135] |
| TR | Terminology Register |

In accordance with ISO/TS 19103:2005, 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.

Unless otherwise stated, all data elements are mandatory.

### 9.3.3 Packages

The dependencies among packages specified or referenced in this International Standard are identified in Figure 4.

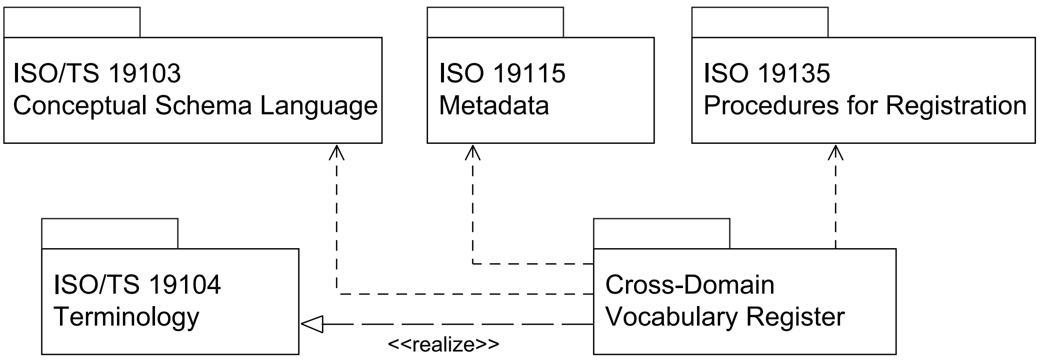


**Figure 4 — Dependencies of packages specified in this International Standard**

### 9.3.4 TR_TermRegister

The class TR_TermRegister (Figure 3) specifies information about the vocabulary register itself. TR_TermRegister is a subclass of RE_Register, specified in ISO 19135:2005, 8.2. It inherits seven attributes and six associations from RE_Register (Table 3).

**Table 3 — Elements inherited from RE_Register**

| Name | Type | Definition |
|---|---|---|
| name | attribute | designator that is used to uniquely denote the register within the set of registers maintained by the register owner |
| contentSummary | attribute | general statement of the purpose for which items in the register are made available |
| uniformResource Identifier | attribute | information about online resources associated with the register |
| operatingLanguage | attribute | language, country information and character encoding for the proper interpretation of the content of character strings in the register |
| alternativeLanguages | attribute | additional language used by items in the register |
| version | attribute | specification of a unique state in the life of the register |
| dateOfLastChange | attribute | date of the most recent change to the status of an item in the register |
| manager | role | RE_RegisterManager that manages the register |
| owner | role | RE_RegisterOwner that owns the register |
| submitter | role | RE_SubmittingOrganization that has submitted proposals for changes to the content of the register |
| citation | role | RE_ReferenceSource that describes the sources (documents or registers) from which items in the RE_Register have been taken |
| containedItem | role | RE_RegisterItem held in the register |
| containedItemClass | role | RE_ItemClass that describes the characteristics of a class of items held in the register |

### 9.3.5 TR_TermSubregisterDescription

#### 9.3.5.1 Introduction

The class TR_TermSubregisterDescription (Figure 5) is a subclass of RE_SubregisterDescription (ISO 19135:2005, 8.14). It is used in the principal register to describe affiliated subregisters containing the reference vocabulary and each operating vocabulary. It inherits eleven attributes and eleven associations from RE_SubregisterDescription. Of these, two attributes and two associations originate directly from RE_SubregisterDescription (Table 4). The additional nine attributes and nine associations originate from the class RE_RegisterItem (ISO 19135:2005, 8.8) (Table 5).

The semantics of the attributes and associations are unchanged, but a few are subject to additional constraints or conditions specified in this subclause. In addition, TR_TermSubregisterDescription has two attributes and an association that are specific to the class.

#### 9.3.5.2 name

TR_TermSubregisterDescription inherits the attribute *name* from RE_SubregisterDescription. The value of name shall be identical to the value of *RE_Register.name* as specified in the subregister (ISO 19135:2005, 8.14.2).

EXAMPLE ISO/TC 211 Multi-Lingual Glossary of Terms - English.

#### 9.3.5.3 definition

The inherited attribute *definition* shall be used to describe the nature of the subregister (ISO 19135:2005, 8.8.7).

EXAMPLE Register of terms and definitions in International Standards and Technical Specifications published by ISO/TC 211.

 

#### 9.3.5.4 type

The attribute *type* shall use a value from the <<CodeList>> TR_TermSubregisterType that specifies whether the subregister contains the reference vocabulary or an operating vocabulary. In each register, only one subregister should be specified as containing a reference vocabulary.

#### 9.3.5.5 domain

The attribute *domain* shall be represented as a set of instances of TR_Domain, each of which shall describe the domain to which the subregister belongs. The set of instances shall take the form of a controlled list that shall be established and maintained by the register owner.

#### 9.3.5.6 SubregisterContent

The association *SubregisterContent* connects the TR_TermSubregisterDescription to the set of TR_TermInstance (9.3.6) held in the subregister. The association shall be navigable from termRecord to termSubregister, but need not be navigable in the reverse direction.

**Table 4 — Elements originating and inherited from RE_SubregisterDescription**

| Name | Type | Definition |
|---|---|---|
| uniformResourceIdentifier | attribute | instance of CI_OnLineResource (ISO 19115:2003, B.3.2.5, row 396) |
| operatingLanguage | attribute | instance of RE_Locale that is used to specify language, country information and character encoding for the proper interpretation of the content of character strings in the subregister |
| containedItemClass | role | instances of RE_ItemClass each of which describes the characteristics of a class of items held in the subregister |
| subregisterManager | role | instance of RE_RegisterManager that provides information about the register manager that manages the subregister |

### 9.3.6 TR_TermInstance

#### 9.3.6.1 Introduction

The class TR_TermInstance (Figure 5) shall be derived from class RE_RegisterItem, as specified in ISO 19135:2005, 8.8, shall realize the relevant elements of ISO/TS 19104:2008, 7.1 (see 9.3.6.5), and specify information about the terms and definitions. It inherits nine attributes and nine associations from RE_RegisterItem (Table 5). It adds three further associations.

#### 9.3.6.2 ReferenceRelation

The association ReferenceRelation shall connect an instance of TR_TermInstance in the reference vocabulary subregister to a set of zero or more instances of TR_TermCrossMap. The association shall be navigable in both directions.

#### 9.3.6.3 OperatingRelation

The association *OperatingRelation* shall connect an instance of TR_TermInstance in the operating vocabulary subregister to a set of zero or more instances of TR_TermCrossMap. The association shall be navigable in both directions.

#### 9.3.6.4 SubregisterContent

The association *SubregisterContent* connects each instance of TR_TermInstance held in the subregister to an instance of TR_TermSubregisterDescription (9.3.5). The association shall be navigable from termRecord to termSubregister, but need not be navigable in the reverse direction.

**Table 5 — Elements originating and inherited from RE_RegisterItem**

| Name | Type | Definition |
|---|---|---|
| itemIdentifier | attribute | positive integer that is used to uniquely denote the item within the register |
| name | attribute | compact and human-readable designator that is used to denote a register concept |
| status | attribute | registration status of the RE_RegisterItem |
| dateAccepted | attribute | date on which a proposal to add the item to the register was accepted |
| dateAmended | attribute | date on which a proposal to supersede or retire the item was accepted |
| definition | attribute | precise statement of the nature, properties, scope, or essential qualities of the concept realized by the item |
| description | attribute | nature, properties, scope, or non-essential qualities of the concept realized by the item |
| fieldOfApplication | attribute | instance of RE_FieldOfApplication that describes a kind of use of the item |
| alternativeExpressions | attribute | instances of RE_AlternativeExpression each specifying an alternative name and optionally additional information about the item in a language other than the *operatingLanguage* of the register |
| register | role | RE_Register in which the register item is contained |
| itemClass | role | RE_ItemClass that describes the item class of which the register item is a member |
| additionInformation | role | instance of RE_AdditionInformation that contains information about the process of adding this RE_RegisterItem to the register |
| amendmentInformation | role | instance of RE_AmendmentInformation that contains information about the process of amending this RE_RegisterItem |
| clarificationInformation | role | instance of RE_ClarificationInformation that contains information about the process of clarifying this RE_RegisterItem |
| specificationSource | role | instance of RE_Reference that identifies the source of the register item |
| specificationLineage | role | instances of RE_Reference that provide information about the development of the item specification |
| predecessor | role | instance of RE_RegisterItem that was replaced by this instance |
| successor | role | instance of RE_RegisterItem that superseded this instance |

#### 9.3.6.5 Realization of ISO/TS 19104:2008, 7.1

Table 6 specifies the manner in which the class TR_TermInstance realizes relevant elements of ISO/TS 19104:2008, 7.1. For each attribute, the line number and conditionality from ISO/TS 19104 is listed.

**Table 6 — Realization of ISO/TS 19104:2008, 7.1**

| ISO/TS 19104:2008, 7.1 | | TR_TermInstance |
|---|---|---|
| *entryNumber* | (7.1.a; Mandatory) | Association *Source* to Attribute *RE_Reference.itemIdentifierAtSource* |
| *entryLanguageIdentifier* | (7.1.b; Optional) | Association *Content* to Attribute *RE_Register.operatingLanguage (RE_Locale.language)* |
| *preferredTerm* | (7.1.c; Mandatory) | Attribute TR_*TermInstance.name* |
| *abbreviatedTerm* | (7.1.d; Optional) | Attribute TR_*TermInstance.alternativeExpressions (RE_AlternativeExpression.name)* |
| *admittedTerms* | (7.1.e; Optional) | Attribute *TR_TermInstance.alternativeExpressions (RE_AlternativeExpression.name)* |
| *definition* | (7.1.f; Mandatory) | Attribute *TR_TermInstance.definition* |
| *deprecatedTerms* | (7.1.g; Optional) | Attribute *TR_TermInstance.alternativeExpressions (RE_AlternativeExpression.name)* |
| *references* | (7.1.h; Optional) | Association *Source* to Attribute *RE_Reference.itemIdentifierAtSource* |
| *examples* | (7.1.i; Optional) | Attribute *TR_TermInstance.description* |
| *notes* | (7.1.j; Optional) | Attribute *TR_TermInstance.description* |
| *beginningDate* | (7.1.l; Mandatory) | Attribute *TR_TermInstance.dateAccepted* |
| *endingDate* | (7.1.m; Optional) | Attribute *TR_TermInstance.dateAmended* |

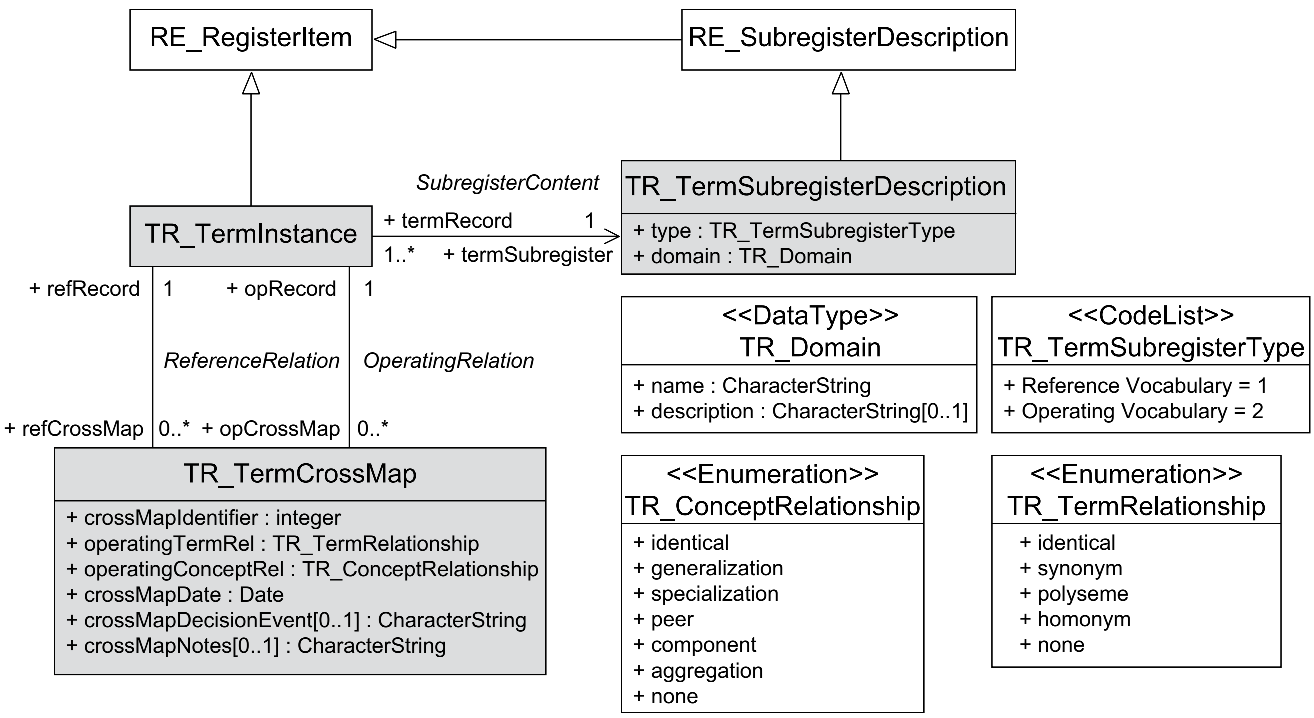


**Figure 5 — TR_TermCrossMap**

### 9.3.7 TR_TermCrossMap

#### 9.3.7.1 Introduction

The class TR_TermCrossMap (Figure 5) specifies information about the cross-mapping between entries in the reference and operating vocabulary subregisters. It has six attributes and two associations.

#### 9.3.7.2 crossMapIdentifier

The attribute *crossMapIdentifier* shall be represented as a positive integer (i.e. greater than zero) that is used to uniquely denote an instance of cross-mapping within the register and is intended for information processing. Values shall be assigned sequentially in the order in which cross-mapping instances are nominated for entry into the register. Once a value has been assigned, it shall not be reused.

#### 9.3.7.3 operatingTermRel

The attribute *operatingTermRel* shall be represented as an instance of TR_TermRelationship that identifies the relationship of the reference term to the operating term.

#### 9.3.7.4 operatingConceptRel

The attribute *operatingConceptRel* shall be represented as an instance of TR_ConceptRelationship that identifies the relationship of the reference concept to the operating concept.

#### 9.3.7.5 crossMapDate

The attribute *crossMapDate* shall be represented as an instance of the class <<Date>> as specified in ISO/TS 19103:2005, 6.5.2.8 and specify the (full precision) date on which the cross-mapping between the reference terminology entry and the operating terminology entry was finalized.

#### 9.3.7.6 crossMapDecisionEvent

The optional attribute *crossMapDecisionEvent* shall be represented as a CharacterString that identifies a meeting or other event associated with the cross-mapping decision.

#### 9.3.7.7 crossMapNotes

The optional attribute *crossMapNotes* shall be represented as a CharacterString containing notes relevant to the cross-mapping decision process. Individual entries in the notes should be dated.

#### 9.3.7.8 ReferenceRelation

The association *ReferenceRelation* shall connect a TR_TermCrossMap instance to a single instance of TR_TermInstance in the reference vocabulary subregister. The association shall be navigable in both directions.

#### 9.3.7.9 OperatingRelation

The association *OperatingRelation* shall connect a TR_TermCrossMap instance to a single instance of TR_TermInstance in an operating vocabulary subregister. The association shall be navigable in both directions.

### 9.3.8 TR_Domain

#### 9.3.8.1 Introduction

The <<DataType>> class TR_Domain (Figure 5) contains two attributes that describe an information domain represented by the concepts described in the vocabulary.

#### 9.3.8.2 name

The attribute *name* shall be represented as CharacterString that identifies the information domain.

#### 9.3.8.3 description

The optional attribute *description* shall be represented as a CharacterString that describes the information domain.

### 9.3.9 TR_TermRelationship

TR_TermRelationship (Figure 5) is an <<Enumeration>> that provides values for describing the relationship of an operating term to a reference term. The domain of TR_TermRelationship is specified in Table 7.

**Table 7 — Values of TR_TermRelationship**

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

### 9.3.10 TR_ConceptRelationship

TR_ConceptRelationship (Figure 5) is an <<Enumeration>> that provides values for describing the relationship of an operating concept to a reference concept. The domain of TR_ConceptRelationship is specified in Table 8.

**Table 8 — Values of TR_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. |
| none | There is no relationship between the operating concept and the reference concept. |

#### 9.3.11 TR_TermSubregisterType

TR_TermSubregisterType (Figure 5) is a <<CodeList>> that provides values for describing whether a subregister contains the reference vocabulary or an operating vocabulary (9.3.5.4). The domain of TR_TermSubregisterType is specified in Table 9.

**Table 9 — Values of TR_TermSubregisterType**

| Value | Meaning |
|---|---|
| 1 | Reference Vocabulary |
| 2 | Operating Vocabulary |

# Annex A
(normative)

# Abstract test suite

## A.1 General conformance

### A.1.1 Governance framework

a) Test Purpose: Verify that the cross-mapping of terms and concepts has been co-sponsored by the owners of the reference and operating vocabularies and that both owners have endorsed the cross-mapping recommendations.

b) Test Method: Request information from the register owner or register manager.

c) Reference: 8.2

d) Test Type: Basic

### A.1.2 Reference vocabulary

a) Test Purpose: Verify that a recognized industry vocabulary has been adopted as a reference vocabulary.

b) Test Method: Review the information regarding the register, the register owner and the register manager to confirm the credentials of the vocabulary.

c) Reference: 8.3

d) Test Type: Basic

### A.1.3 Term comparison

a) Test Purpose: Verify that the preferred terms in each pair of cross-mapped reference and operating vocabulary entries have been compared and classified.

b) Test Method: Inspect the vocabulary register to ensure that the operating term relationship field has been populated according to the classification system specified in 8.4.3 of this International Standard. Request extracts from the final report (8.2) from the register owner or register manager concerning the determination of the term relationships.

c) Reference: 8.4.3

d) Test Type: Basic

### A.1.4 Concept comparison

a) Test Purpose: Verify that the concepts as described by the definitions in each pair of cross-mapped reference and operating vocabulary entries have been compared and classified.

b) Test Method: Inspect the vocabulary register to ensure that the operating concept relationship field has been populated according to the classification system specified in 8.4.3 of this International Standard. Request extracts from the final report (8.2) from the register owner or register manager concerning the determination of the concept relationships.

c) Reference: 8.4.3

d) Test Type: Basic

### A.1.5 Domain allocation

a) Test Purpose: Verify that the reference and operating vocabulary entries have each been related to a domain and that each is unique within its domain.

b) Test Method: Inspect the vocabulary register to ensure that the domain field has been populated according to the controlled list of domains.

c) Reference: 8.4.4

d) Test Type: Basic

### A.1.6 Publication of cross-mapping

a) Test Purpose: Verify that the cross-mapping of terms and concepts has been published in an ISO 19135-compliant register that is accessible by the relevant communities of interest and/or the general public.

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 ISO 19135:2005, A.1 and A.2.

c) Reference: 8.5

d) Test Type: Basic

# Annex B
(informative)

## Cross-mapping examples

| | | |
|---|---|---|
| Case 1 | The terms are identical and the operating definition has very similar wording to the reference definition. | |
| Example | <u>Reference Term</u><br>coordinate (ISO 19111:2007)<br><u>Reference Definition</u><br>one of a sequence of *n* numbers designating the position of a point in *n*-dimensional space | <u>Operating Term</u><br>coordinate (ISO 17572-1:2008)<br><u>Operating Definition</u><br>one of an ordered set of *N* numbers designating the position of a point in *N*-dimensional space |
| Relationships | Reference Term to Operating Term<br>Reference Concept to Operating Concept | **Identical**<br>**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 | <u>Reference Term</u><br>accuracy (ISO 3534-2:2006)<br><u>Reference Definition</u><br>closeness of agreement between a test result or measurement result and the true value | <u>Operating Term</u><br>accuracy (ISO 17572-1:2008)<br><u>Operating Definition</u><br>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<br>Reference Concept to Operating Concept | **Identical**<br>**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 | <u>Reference Term</u><br>geographic identifier (ISO 19112:2003)<br><u>Reference Definition</u><br>spatial reference in the form of a label or code that identifies a location | <u>Operating Term</u><br>location reference (ISO 17572-1:2008)<br><u>Operating Definition</u><br>label which is assigned to a location |
| Relationships | Reference Term to Operating Term<br>Reference Concept to Operating Concept | **Synonymic**<br>**Identical** |

| | | |
|---|---|---|
| Case 4 | The terms are identical but the reference definition describes a concept that is a generalization of the concept described by the operating definition. | |
| Example 1 | Reference Term<br>datum (ISO 19111:2007)<br>Reference Definition<br>parameter or set of parameters that define the position of the origin, the scale, and the orientation of a coordinate system | Operating Term<br>datum (ISO 17572-1:2008)<br>Operating Definition<br>set of parameters and control points used to accurately define the three-dimensional shape of the Earth<br>NOTE The corresponding datum is the basis for a planar coordinate reference system. |
| Example 2 | Reference Term<br>junction (ISO 19133:2005)<br>Reference Definition<br>single topological node in a network with its associated collection of turns, incoming and outgoing links | Operating Term<br>junction (ISO 17572-1:2008)<br>Operating Definition<br>elementary element in the road network, connecting two or more road elements |
| Relationships | Reference Term to Operating Term<br>Reference Concept to Operating Concept | **Polysemic**<br>**Generalization** |

| | | |
|---|---|---|
| Case 5 | The terms are not identical and the reference definition describes a concept that is a generalization of the concept described by the operating definition. | |
| Example | Reference Term<br>junction (ISO 19133:2005)<br>Reference Definition<br>single topological node in a network with its associated collection of turns, incoming and outgoing links | Operating Term<br>road crossing (ISO 17572-1:2008)<br>Operating Definition<br>location where two or more roads connect or intersect<br>NOTE A road crossing may be simple, corresponding to one junction, or complex, including internal road elements and junctions. |
| Relationships | Reference Term to Operating Term<br>Reference Concept to Operating Concept | **None**<br>**Generalization** |

| | | |
|---|---|---|
| Case 6 | The terms are not identical and the reference definition describes a concept that is a specialization of the concept described by the operating definition. | |
| Example | Reference Term<br>spatial reference system (ISO 19112:2003)<br>Reference Definition<br>system for identifying position in the real world | Operating Term<br>location referencing system (ISO 17572-1:2008)<br>Operating Definition<br>complete system by which location references are generated, according to a location referencing method, and communicated, including standards, definitions, software, hardware, and databases |
| Relationships | Reference Term to Operating Term<br>Reference Concept to Operating Concept | **None**<br>**Specialization** |

| | | |
|---|---|---|
| Case 7 | The reference definition and operating definition describe concepts that are different specializations of the same superordinate concept. | |
| Example | <u>Reference Term</u><br>geodetic coordinate reference system (ISO 19111:2007)<br><u>Reference Definition</u><br>coordinate reference system based on a geodetic datum | <u>Operating Term</u><br>engineering coordinate reference system (ISO 19111:2007)<br><u>Operating Definition</u><br>coordinate reference system based on an engineering datum |
| Relationships | Reference Term to Operating Term<br>Reference Concept to Operating Concept | **None**<br>**Peer** (via "coordinate reference system") |

| | | |
|---|---|---|
| Case 8 | The reference definition describes a concept that is included as an implicit or explicit component of the operating concept. | |
| Example | <u>Reference Term 1</u><br>geodetic datum (ISO 19111:2007)<br><u>Reference Definition 1</u><br>datum describing the relationship of a two- or three-dimensional coordinate system to the Earth<br><u>Reference Term 2</u><br>ground control point (ISO 19115-2:2009)<br><u>Reference Definition 2</u><br>point on the Earth that has an accurately known geographic position | <u>Operating Term</u><br>datum (ISO 17572-1:2008)<br><u>Operating Definition</u><br>set of parameters and control points used to accurately define the three-dimensional shape of the Earth<br>NOTE The corresponding datum is the basis for a planar coordinate reference system. |
| Relationships | Reference Term to Operating Term<br>Reference Concept to Operating Concept | **None**<br>**Component (of Operating Concept)** |

| | | |
|---|---|---|
| Case 9 | The reference definition implicitly or explicitly aggregates one or more concepts that are described by the operating definition. | |
| Example | <u>Reference Term</u><br>network (ISO 19133:2005)<br><u>Reference Definition</u><br>abstract structure consisting of a set of 0-dimensional objects called junctions, and a set of 1-dimensional objects called links that connect the junctions, each link being associated with a start (origin, source) junction and end (destination, sink) junction | <u>Operating Term 1</u><br>road Element (ISO 17572-1:2008)<br><u>Operating Definition 1</u><br>linear section of the road network which is designed for vehicular movement having a junction at each end<br>NOTE It serves as the smallest unit of the road network at GDF Level 1 that is independent.<br><u>Operating Term 2</u><br>road crossing (ISO 17572-1:2008)<br><u>Operating Definition 2</u><br>location where two or more roads connect or intersect<br>NOTE A road crossing may be simple, corresponding to one junction, or complex, including internal road elements and junctions.<br><u>Operating Term 3</u><br>junction (Derived from ISO 17572-1:2008)<br><u>Operating Definition 3</u><br>elementary element in the road network, connecting two or more road elements |
| Relationships | Reference Term to Operating Term<br>Reference Concept to Operating Concept | **None**<br>**Aggregation (of Operating Concepts)** |

| | | |
|---|---|---|
| Case 10 | The reference term is identical to the operating term but the reference definition is not related to the same concept as the operating definition. | |
| Example | <u>Reference Term</u><br>operation (ISO 19119:2005)<br><u>Reference Definition</u><br>specification of a transformation or query that an object may be called to execute | <u>Operating Term</u><br>operation (ISO 19103:2005)<br><u>Operating Definition</u><br>service that can be requested from an object to affect behaviour |
| Relationships | Reference Term to Operating Term<br>Reference Concept to Operating Concept | **Homonymic**<br>**None** |

| | | |
|---|---|---|
| Case 11 | The reference term is similar but not identical to the operating term and the reference definition and operating definition describe different concepts. | |
| Example | <u>Reference Term</u><br>link position (ISO 19133:2005)<br><u>Reference Definition</u><br>position within a network on a link defined by some strictly monotonic measure associated with that link | <u>Operating Term</u><br>link location (ISO 17572-1:2008)<br><u>Operating Definition</u><br>location identifiable by a part of the road network database having one identifier or having a uniquely identifiable combination of attributes throughout the continuous stretch |
| Relationships | Reference Term to Operating Term<br>Reference Concept to Operating Concept | **None**<br>**None** |

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