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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:

— 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]

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.