Technical Specification

ISO/TS 24634

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Management of terminology resources — TermBase eXchange (TBX)-compliant representation of concept relations and subject fields

Gestion des ressources terminologiques — Représentation des relations conceptuelles et des domaines conforme à TermBase eXchange (TBX)

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Contents

Page

Foreword

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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 document 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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 37, *Language and terminology*, Subcommittee SC 3, *Management of terminology resources*.

This second edition cancels and replaces the first edition (ISO/TS 24634:2021), which has been technically revised.

The main changes are as follows:

— addition of TBX markup for concept relations outside the concept entry in 6.2.3;

— typology of associative relations in Table A.1 is adopted from ISO 704:2022, 5.5.5;

— addition of markup samples of concept relations in the backmatter in Annex C.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document describes best practices for specifying subject fields and concept relations in termbases. It also demonstrates how to represent subject fields and concept relations in terminological document instances in a way that is compliant with ISO 30042.

Concept relations for specific TBX dialects are specified in the form of dedicated TBX modules. Subject fields can be declared in the TBX backmatter or implemented through an extensible markup language (XML) namespace. This document is intended to maximize interoperability of these types of information.

Throughout this document, reference is made to data categories (DCs). To maximize interoperability, it is essential that termbases use the same DCs, as described in this document, for the same purposes. DatCatInfo[3] is a publicly available electronic repository of DC specifications. DCs used in the examples in this document are taken from DatCatInfo[3].

This document complements ISO 30042.

Management of terminology resources — TermBase eXchange (TBX)-compliant representation of concept relations and subject fields

1 Scope

This document specifies requirements and recommendations for representing subject fields and concept relations in TBX-compliant terminological document instances. Examples in this document utilize the data category as attribute (DCA) style of TBX markup.

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 1087, *Terminology work and terminology science — Vocabulary*

ISO 12620-1, *Management of terminology resources — Data categories — Part 1: Specifications*

ISO 12620-2, *Management of terminology resources — Data categories — Part 2: Repositories*

ISO 30042, *Management of terminology resources — TermBase eXchange (TBX)*

W3C, *RDF Resource Description Framework*, W3C Recommendation 25 February 2014. Available at: https://www.w3.org/RDF/

W3C, *SKOS Simple Knowledge Organization System Reference*, W3C Recommendation 18 August 2009. Available at: https://www.w3.org/TR/skos-reference/

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1087, ISO 12620-1, ISO 12620-2, ISO 30042 and the following apply.

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

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

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

3.1
concept relation
relation between concepts

[SOURCE: ISO 1087:2019, 3.2.11]

3.2
hierarchical relation
hierarchical concept relation
generic relation (3.3) or *partitive relation* (3.4)

[SOURCE: ISO 1087:2019, 3.2.12]

3.3
generic relation
generic concept relation
genus-species relation
concept relation (3.1) between a generic concept and a specific concept where the intension of the specific concept includes the intension of the generic concept plus at least one additional delimiting characteristic

[SOURCE: ISO 1087:2019, 3.2.13, modified — Example and notes to entry deleted.]

3.4
partitive relation
partitive concept relation
part-whole relation
part-of relation
concept relation (3.1) between a comprehensive concept and a partitive concept

[SOURCE: ISO 1087:2019, 3.2.14, modified — Example deleted.]

3.5
associative relation
associative concept relation
pragmatic relation
non-hierarchical *concept relation* (3.1)

[SOURCE: ISO 1087:2019, 3.2.23, modified — Example deleted.]

3.6
concept entry
terminological entry
part of a *terminological data collection* (3.12) which contains the terminological data related to one concept

[SOURCE: ISO 30042:2019, 3.5, modified — Admitted term "entry" deleted.]

3.7
data category
DC
class of data items that are closely related from a formal or semantic point of view

EXAMPLE /part of speech/, /subject field/, /definition/.

Note 1 to entry: A data category can be viewed as a generalization of the notion of a field in a database.

Note 2 to entry: In running text, such as in this document, data categories are enclosed in forward slashes (e.g. /part of speech/).

[SOURCE: ISO 30042:2019, 3.8, modified —Abbreviated term "DC" added.]

3.8
picklist
list of permissible values of a closed *data category* (3.7)

3.9
subject field
domain
field of special knowledge

[SOURCE: ISO 10241-1:2011, 3.3.1, modified — "domain" replaced with "subject field" as the preferred term. Notes to entry deleted.]

3.10
subject-field classification
logical structure of the *subject fields* (3.9) and subfields dealt with in a *terminological data collection* (3.12)

3.11
termbase
terminology database
database comprising a *terminological data collection* (3.12)

[SOURCE: ISO 30042:2019, 3.28]

3.12
terminological data collection
resource consisting of *concept entries* (3.6) with associated metadata and documentary information

EXAMPLE A TBX document instance.

[SOURCE: ISO 30042:2019, 3.29, modified — Abbreviated term "TDC" and example "ISO 1087" deleted.]

4 Subject fields

4.1 General

Termbases, particularly large ones, should be organized according to subject fields. In this case, there may be a /subject field/ data category at the concept level (this is implemented as a <descrip> element).

A picklist shall be used as the content model for subject fields. If the organization has a taxonomy that reflects its field of activity, the subject-field classification should reflect that taxonomy. Subject-field classifications can be declared in the backmatter of a TBX document instance, or through an XML namespace. In this document, the backmatter approach is described. The XML namespace approach requires a data category as tag (DCT) style of TBX markup and can be modelled in parallel to the backmatter method.

A given TBX document instance can use more than one subject-field classification.

4.2 Specifying the name of the subject-field classification

The name of the subject-field classification used in a TBX document instance shall be declared in the TBX header.

EXAMPLE 1

```
<tbxHeader>
 <fileDesc>
  <sourceDesc>
   <p type="source">Termbase from ABC company</p>
   <p type="subjectFieldClass" id="ABC-Class">ABC Subject-Field Classification</p>
  </sourceDesc>
 </fileDesc>
</tbxHeader>
```

Additional information about the subject field shall be provided in the backmatter, as described in Clause 5. For this purpose, the id attribute acts as a unique pointer to the relevant section in the backmatter.

When more than one subject-field classification is used in a TBX document instance, the additional name declaration shall be provided.

EXAMPLE 2

```
<tbxHeader>
 <fileDesc>
  <sourceDesc>
   <p type="source">Termbase from ABC company</p>
   <p type="subjectFieldClass" id="ABC-Class">ABC Subject-Field Classification</p>
   <p type="subjectFieldClass" id="DEF-Class">DEF Subject-Field Classification</p>
  </sourceDesc>
 </fileDesc>
</tbxHeader>
```

If the additional subject-field classification is a result of the merging of two termbases, the name of the termbase can also be provided.

EXAMPLE 3

```
<tbxHeader>
 <fileDesc>
  <sourceDesc>
   <p type="source">Termbase from ABC company</p>
   <p type="subjectFieldClass" id="ABC-Class">ABC Subject-Field Classification</p>
   <p type="source">Termbase from DEF company</p>
   <p type="subjectFieldClass" id="DEF-Class">DEF Subject-Field Classification</p>
  </sourceDesc>
 </fileDesc>
</tbxHeader>
```

4.3 Defining the scope of subject-field values

Terminologists and other users of termbases often find it difficult to determine which subject field a concept should be assigned to. This is largely because historically the scope and meaning of subject fields themselves have not been defined for the users. Therefore, a clear description of the scope of each subject field should be available to users of the termbase. In this document, a method is described for recording this information in the backmatter of a TBX document instance.

Some termbases use a publicly available subject-field classification, such as EuroVoc[4] or Lenoch[5]. These sources provide descriptions of the scope and meaning of their subject fields, and therefore, it is recommended to avoid duplicating this information in a termbase.

Termbases that adopt a unique subject-field classification should include information about the scope of the subject-field values in the backmatter of the TBX document instance.

In all cases, the subject-field description should be available or known to termbase users when they are assigning a subject-field value to a concept entry. Figure 1 shows an example of a subject-field description from an existing termbase.

Subject field

- •Start date: 2010-01-08
- •End date:
- •Number of occurrences: 2845
- •Allow single language module: No
- •Created by: user_131216
- •Creation date: 2010-01-08 11:25:36
- •Last modified by: user_8217
- •Last modified date: 2012-09-14 11:56:20
- •Code: BCO
- •Notes:
  - •2012-01-16 : Added synonyms and notes (user_131216).
  - •2012-02-14 : Modified synonyms and added definitions (user_131216).
  - •2012-09-14 : Modified SF descriptor in the definitions (user_8217).

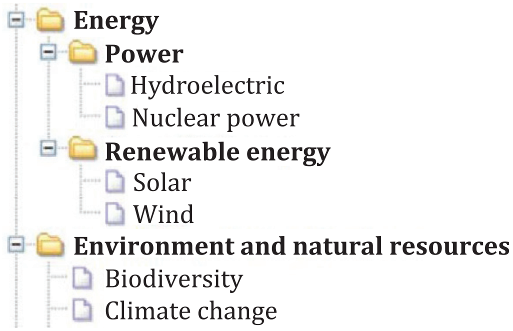
Languages

- •English
  - •Descriptor: Aquaculture
  - •Synonyms: aquiculture; aquafarming; fish breeding; fish culture; fish farming;fish husbandry; fish rearing; fish spawning; shellfish farming; shellfishery
  - •Definition: Terms related to both seawater farming (mariculture or sea farming) and freshwater farming, i.e. the cultivation of marine or fresh water aquatic plants or animals. Includes breeding or raising fish (fishfarming or pisciculture) and various shellfish such as shrimp, crayfish, oysters, mussels, scallops and aballone. Can also include pearl farming (pearl culture), seaweed farming (algal culture or algoculture) and coral farming (coral culture or coral gardening). Note that names of species are classified in subject fields under Botany (SF) or Zoology (SG).
- •French
  - •Descriptor: Aquaculture
  - •Synonyms: aquiculture; culture marine; piscifacture; thalassoculture
  - •Definition: Comprend la terminologie de l'élevage et de la multiplication des animaux et des plantes aquatiques, à des fins commerciales. Ce domaine regroupe la terminologie liée non seulement à l'aquaculture marine (mariculture), mais à l'élevage en eau douce (potamoculture). Comprend l'élevage de poissons (pisciculture ou élevage piscicole) et de crustacés tels que les crevettes (pénéiculture ou crevetticulture) ou les écrevisses (astaciculture), et l'élevage des coquillages (conchylicuture), notamment la culture des moules (mytiliculture), des huîtres (ostréiculture), des pétoncles ou des coquilles Saint-Jacques (pectiniculture) et des ormeaux (halioticulture). Peut également comprendre la culture d'algues (algoculture ou phycoculture), et la culture des perles (perliculture) ou du corail (culture de coraux ou coralliculture). Nota : Les noms d'espèces sont classés dans des domaines sous Botanique (SF) ou Zoologie (SG).
- •Spanish
  - •Descriptor: Acuicultura
  - •Synonyms:
  - •Definition:
- •Portuguese
  - •Descriptor: Aquicultura
  - •Synonyms:
  - •Definition:

Figure 1 — Sample description of the “aquaculture” subject field

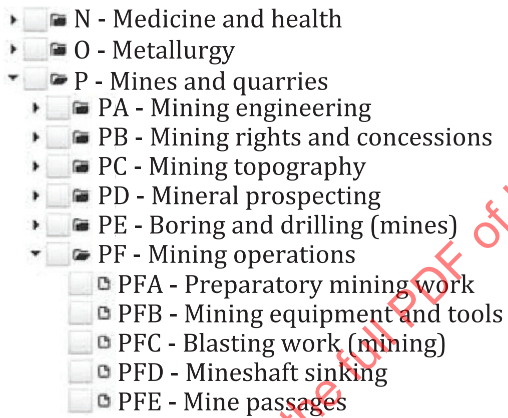
4.4 Hierarchy of subject fields

Frequently it is not sufficient to have a simple list of subject-field values without any parent/child relationships (referred to as a “flat” list). For subsetting and search purposes, large termbases can benefit from a multi-level hierarchy of subject fields. Figure 2 shows a multi-level subject-field classification, with “Energy” having two subordinate levels, and “Environment and natural resources” having one subordinate level. Figure 3 shows another example from the field of mining.



NOTE Sample from Reference [6].

Figure 2 — Multi-level subject-field classification



NOTE Sample from Reference [7].

Figure 3 — Multi-level subject-field classification

4.5 Representing subject-field values in concept entries

4.5.1 General

In a TBX document instance, the value of a subject field in a specific concept entry is indicated as the content of a <descrip> element with the "subjectField" type attribute value.

EXAMPLE 1

```
<descrip type="subjectField">Nuclear power</descrip>
```

If the TBX document instance features more than one subject-field classification, a <descripGrp> element can be used to indicate the relevant subject-field classification.

EXAMPLE 2

```
<descripGrp>
 <descrip type="subjectField">Nuclear power</descrip>
 <descrip type="subjectFieldClass">ABC-Class</descrip>
</descripGrp>
```

However, in cases where the subject-field classification comprises more than one level, information about the position of the subject-field value within the overall hierarchy is also required.

The position of a subject field in a multi-level hierarchy, such as the one represented by "Energy > Power > Nuclear power" from Figure 2, can be represented in concept entries in the following two ways:

a) by referencing its position in the backmatter, where the full subject-field classification is described; or

b) by indicating its position in the concept entry itself.

4.5.2 Referencing the backmatter

The full hierarchy of the entire subject-field classification can be defined once in the backmatter of a TBX document instance by using unique identifiers to link the levels (see Clause 5). A concept entry can fulfil the subject field requirement simply by specifying a single value (e.g. "Nuclear power"). The position of this value in the hierarchy can be determined by consulting the backmatter (the content of the <back> element). This approach enables the definition of the entire hierarchy with a single inclusion in the TBX document instance. However, the position of "Nuclear power" in the hierarchy is not visible in the TBX entry in the TBX document instance.

EXAMPLE

```
<descrip type="subjectField" id="ABC-Class-SF1-1-2">Nuclear power</descrip>
```

where ABC-Class identifies the subject-field classification in the backmatter, and `SF1-1-2` points to the ID of the relevant value in that classification.

4.5.3 Expressing the position of the subject-field value in each concept entry

The position of each value in the hierarchy can be expressed each time the value occurs in a concept entry by specifying the relevant section of the hierarchy. For instance, for the value "Nuclear power" shown in Figure 2, "Energy|Power|Nuclear power" shall be specified in the concept entry. The advantage of this method is that readers of the TBX document instance can see the hierarchical position of this subject-field value in the concept entry itself. The disadvantage is data redundancy, since this information is repeated in all entries that contain that value.

The TBX markup shown in the following example shall be used, including the pipe character (|) to separate the subject-field values, and adopting the order of highest to lowest in the hierarchy:

EXAMPLE

```
<descrip type="subjectField">Energy|Power|Nuclear power</descrip>
```

4.6 Using a publicly available subject-field classification

When a publicly available subject-field classification is adopted, such as EuroVoc[4] or Lenoch[5], the name of the subject-field classification and a unique identifier shall be declared in the TBX header as described in 4.2.

EXAMPLE 1

```
<tbxHeader>
 <fileDesc>
  <sourceDesc>
  <p type="subjectFieldClass" id="EuroVoc">EuroVoc</p>
  </sourceDesc>
 </fileDesc>
</tbxHeader>
```

The fact that this is a public classification shall be indicated in the backmatter, as well as a uniform resource identifier (URI) pointing to the location of the public classification (see Clause 5).

In a concept entry, the subject-field value, taken from the public classification, shall be declared in a <descrip> element.

EXAMPLE 2

```
<descrip type="subjectField">taxation</descrip>
```

There is no need to indicate the position in the hierarchy, since this information is available from the public subject-field classification.

5 Representing subject-field classifications in the backmatter

In the backmatter, the list of subject-field classifications shall be provided in a <refObjectSec> element. Each subject-field classification is identified by the unique identifier that was used in the header. Information about whether the classification is private or public, and how many levels there are in the hierarchy, is provided in <item> elements. After the <refObjectSec> element, the full description of each subject-field classification shall be provided using SKOS RDF markup in accordance with W3C *RDF Resource Description Framework* and *SKOS Simple Knowledge Organization System Reference*.

The following example shows a sample markup in a TBX document instance that includes three different subject-field classifications. It is followed by a description of one of the subject-field classifications in SKOS markup. The use of <skos:Concept> in SKOS refers to the “subject field” in TBX, and the <skos:definition> allows for describing the scope of the subject field.

EXAMPLE 1

```
<back>
 <refObjectSec type="subjectFieldClass">
  <refObject id="ABC-Class">
   <itemSet>
    <item type="subjectFieldClassType">private</item>
    <item type="subjectFieldClassLevels">2</item>
   </itemSet>
  </refObject>
  <refObject id="DEF-Class">
   <itemSet>
    <item type="subjectFieldClassType">private</item>
    <item type="subjectFieldClassLevels">1</item>
   </itemSet>
  </refObject>
  <refObject id="EuroVoc">
   <itemSet>
    <item type="subjectFieldClassType">public</item>
    <item type="subjectFieldClassURI">https://eur-lex.europa.eu/browse/
      eurovoc.html</item>
   </itemSet>
  </refObject>
 </refObjectSec>
 <rdf:RDF>
  <skos:ConceptScheme rdf:ID="ABC-Class">
   <skos:Concept rdf:ID="SF1">
   <skos:definition>The Energy subject field covers all forms of energy, both
   renewable and non-renewable.</skos:definition>
   <skos:prefLabel xml:lang="en">Energy</skos:prefLabel>
   <skos:prefLabel xml:lang="fr">Énergie</skos:prefLabel>
   <skos:narrower rdf:resource="SF1-1">Power</skos:narrower>
   <skos:scopeNote>...</skos:scopeNote>
   </skos:Concept>
   <skos:Concept rdf:ID="SF1-1">
   <skos:definition>The Power subject field covers all forms of energy that
   are non-renewable.</skos:definition>
   <skos:prefLabel xml:lang="en">Power</skos:prefLabel>
   <skos:prefLabel xml:lang="fr">Puissance</skos:prefLabel>
   <skos:narrower rdf:resource="SF1-1-2">Nuclear power</skos:narrower>
   <skos:broader rdf:resource="SF1">Energy</skos:broader>
   <skos:scopeNote>...</skos:scopeNote>
   </skos:Concept>
   <skos:Concept rdf:ID="SF1-1-2">
   <skos:definition>The Nuclear power subject field covers power that is
   generated through the process of fission.</skos:definition>
   <skos:prefLabel xml:lang="en">Nuclear power</skos:prefLabel>
```

```
   <skos:prefLabel xml:lang="fr">Puissance nucléaire</skos:prefLabel>
   <skos:broader rdf:resource="SF1-1">Power</skos:broader>
   <skos:scopeNote>...</skos:scopeNote>
   </skos:Concept>
  </skos:ConceptScheme>
  <skos:ConceptScheme rdf:ID="DEF-Class">
  ...
  </skos:ConceptScheme>
 </rdf:RDF>
</back>
```

When RDF and SKOS markup is used, the appropriate namespace declaration shall be included in the root <tbx> element.

EXAMPLE 2

```
<tbx xml:lang="en" style="dca" type="TBX-dialect"
 xmlns="urn:iso:std:iso:30042:ed-2"
 xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
 xmlns:skos="http://www.w3.org/2004/02/skos/core#">
```

6 Concept relations

6.1 Typology of concept relations

Concept relations reflect the links between concept entries. ISO 704 should be used as a guideline for determining the types of concept relations in any termbase. Users are allowed to extend or subset this set of concept relations for their own purposes. The full typology of concept relations for the termbase in question shall be declared in a TBX module definition.

ISO 704 distinguishes three types of concept relations: generic, partitive and associative. Concept relations can be hierarchical or non-hierarchical. Hierarchical relations reflect a superordinate or subordinate relation between the concept entry in question and another concept entry. They are generic relations and partitive relations.

Associative relations are non-hierarchical. An example of an associative relation is "school" and "learn". ISO 704:2022, 5.5.5, provides a two-level typology of associative relations. The top level comprises the following types:

— contiguity;

— sequential;

— activity;

— origination;

— instrumental;

— interactional;

— transmission;

— opposite.

Each of these types is further divided into subtypes. For example, sequential relations include four subtypes: temporal, spatial, causal and developmental. For the full typology of associative relations, see Annex A. Customized associative relations are also permitted. See Annex B for examples.

6.2 Implementation of concept relations

6.2.1 General

Concept relations can be realized as information within a concept entry, indicating the type of relation and the target concept ID, or outside the concept entry, indicating the type of relation, the source concept ID and the target concept ID.

6.2.2 TBX markup for concept relations within the concept entry

The TBX markup for concept relations as declared in this document utilizes the <descrip> element. The target concept is identified by the value of the target attribute, which is a unique concept identifier. The type and direction of the relation is indicated by using values of the type attribute which indicate the nature of the target concept in relation to the source concept. For example:

— `genericConcept`: indicates that the target concept is the superordinate concept in a generic relation;

— `specificConcept`: indicates that the target concept is the subordinate concept in a generic relation;

— `comprehensiveConcept`: indicates that the target concept is the superordinate concept in a partitive relation;

— `partitiveConcept`: indicates that the target concept is the subordinate concept in a partitive relation;

— `associativeConcept`: indicates that the target concept is in an associative relation.

Associative relations can optionally express either additional subtypes or roles or both (see Annex A). These are indicated using the <descripNote> element. See Annex B for examples.

6.2.3 TBX markup for concept relations outside the concept entry

Maintaining concept relations within the concept entry presents a number of challenges, including:

— bidirectional concept relations like the generic relation would have to be maintained manually to be consistent (from the superordinate to the subordinate and vice versa);

— if the concept relation DC is maintained at the concept level, the language of the target term to which the relation points would have to be clearly specified;

— if the concept relation DC is maintained at the language level, this would result in storing the relation multiple times in several languages, causing the number of relations for an individual concept entry to grow exponentially as languages are added;

— if the given term of the concept relation is no longer the preferred term of the target concept, all concept relations in all concept entries pointing to that respective concept would have to be updated.

The above list illustrates why a solution where concept relations are maintained in a specific data structure outside the concept entry can be preferable. Such a solution supports easy display of concept relations (in concept diagrams or concept models) in different languages, automatic generation of bidirectional concept relations and consistent maintenance of all concept relations.

If concept relations are maintained outside the concept entry, export and import of terminological data to and from TBX would require that all concept relations be transferred from the data structure outside the concept entry to each individual concept entry on both export and import. Therefore, a TBX-compliant solution is needed to support both the interchange of concept entries and a data structure for concept relations outside the concept entry.

Concept relations are expressed in the backmatter, where the section shall start with the XML expression <refObjectSec type="conceptRelations">. In <itemSet>, the type of the relation (relationType) links one concept (sourceConcept) to another concept (targetConcept). The type of relation (relationType) can be “generic”, “partitive” or “associative”. If associative relations are specified in more detail, the subtype (relationSubType) and the role (relationRole) shall be added in the relation specification. Annex C shows examples of concept relations that are maintained outside the concept entry using the backmatter of a TBX document instance.

In some termbases, both standardized and user-specific concept relations are defined. Standardized hierarchical and associative relations are used to connect concept entries. Additional user-specific concept relations serve to express other types of ontological dependencies between concepts.

The user-defined concept relation is defined in the backmatter and shall start with the XML expression <refObjectSec type="relationDefinition">. The relation shall have a unique ID and the type of the relation (relationType) shall be “associative”. The “relationDirection” specifies if the relation is “unidirectional” or “bidirectional” and a name of the relation is given using the “relationName” statement, if desired in several languages. Example 2 in Annex C shows a solution for the specification and interchange of user- or application-specific concept relations that are not supported by the traditional concept relations defined in ISO 704. This representation also allows for interchange of the individual relation names in several languages (e.g. English and German).

Annex A
(informative)

Typology of associative relations

The typology of associative relations in Table A.1 is adopted from ISO 704:2022, 5.5.5.

Table A.1 — Types and subtypes of associative relations

Type (description)	Subtype (relation role)	Example(s)
contiguity relation (based on proximity between objects)	enhancement relation (tool – accessory)	‘smartphone’ – ‘selfie stick’
	attachment relation (tool – connection)	‘computer screen’ – ‘HDMI port’
	locative relation (container – contained; contained – contained)	‘milk carton’ – ‘milk’; ‘fish’ – ‘shellfish’ (with regard to sea)
	material relation (concrete item – material)	‘seawater’ – ‘salt’ (one of several materials); ‘steel tyre’ – ‘steel’ (one material only)
	property relation (material – state)	‘air’ – ‘humidity’
	ownership relation (object – owner)	‘public enterprise’ – ‘state’
	rank relation (level of hierarchy – level of hierarchy)	‘chair’ – ‘vice-chair’
sequential relation (based on a criterion for ordering objects)	temporal relation (earlier occurrence – later occurrence)	‘production’ – ‘consumption’
	spatial relation (object in space – object in space)	‘floor’ – ‘ceiling’
	causal relation (cause – effect)	‘humidity’ – ‘corrosion’
	developmental relation (step of a process – step of a process)	‘tadpole’ – ‘frog’

Table A.1 *(continued)*

Type (description)	Subtype (relation role)	Example(s)
activity relation (based on an action object)	agent relation (action – actor)	‘teach’ – ‘teacher’
	object relation (action – object)	‘energy conversion’ – ‘energy’; publication’ – ‘book’
	tool relation (action – instrument)	‘click’ – ‘computer mouse’
	manner relation (action – method)	‘teach’ – ‘e-learning’
	locational relation (action – place)	‘learn’ – ‘school’
	purpose relation (action – objective)	‘medical examination’ – ‘diagnosis’
	result relation (action – beneficiary)	‘hospital discharge’ – ‘patient’
	patient relation (action – patient)	‘psychotherapy’ – ‘client’
origination relation (based on the origin of an object)	originator relation (producer – product)	‘baker’ – ‘bread’
	ingredient relation (raw material – product)	‘wood’ – ‘desk’
	instrument-product relation (tool – product)	‘oven’ – ‘bread’
instrumental relation (based on a tool used for specific purposes)	agent-instrument relation (professional – tool employed)	‘painter’ – ‘brush’
	object-instrument relation (object – tool used for handling)	‘time’ – ‘clock’; ‘screw’ – ‘screwdriver’
	instrument-patient relation (tool employed – patient)	‘baby sling’ – ‘baby’
interactional relation (based on a two-way connection between objects)	dependency relation (controlled – controller; controller – controlled; agent – patient)	‘pointer’ – ‘computer mouse’; ‘employer’ – ‘employee’; ‘interviewer’ – ‘interviewee’
	representational relation (entity – representative)	‘length’ – ‘metre’; ‘country’ – ‘flag’
transmission relation (based on the sender-receiver principle)	sender-receiver relation (sender – receiver)	‘satellite’ – ‘parabolic dish antenna’; ‘seller’ – ‘buyer’
	sender relation (sender – object)	‘mobile phone’ – ‘text message’; ‘seller’ – ‘merchandise’
	receiver relation (object – receiver)	‘text message’ – ‘mobile phone’; ‘merchandise’ – ‘buyer’
opposite relation (based on objects that can be viewed as opposites of each other)	contrary relation (essential characteristics of two or more concepts viewed as opposites)	‘positive correlation’ – ‘zero correlation’ – ‘negative correlation’
	contradictory relation (negation between two concepts)	‘hairy-headedness’ – ‘baldness’ ‘conformity’ – ‘nonconformity’

Annex B
(informative)

Markup samples for concept relations in the <body> element

This annex provides markup samples that illustrate how concept relations can be expressed in the main <body> of a TBX document instance.

EXAMPLE 1 Pointing to a generic concept in a generic relation:

```
<conceptEntry id="CID-102">
 ...
 <descrip type="genericConcept" target="CID-101">hybrid electric vehicle</descrip>
 ...
  <term>hybrid electric car</term>
 ...
</conceptEntry>
```

EXAMPLE 2 Pointing to a specific concept in a generic relation:

```
<conceptEntry id="CID-101">
 ...
 <descrip type="specificConcept" target="CID-102">hybrid electric car</descrip>
 ...
  <term>hybrid electric vehicle</term>
 ...
</conceptEntry>
```

EXAMPLE 3 Pointing to a comprehensive concept in a partitive relation:

```
<conceptEntry id="CID-104">
 ...
 <descrip type="comprehensiveConcept" target="CID-103">battery</descrip>
 ...
  <term>cell</term>
 ...
</conceptEntry>
```

EXAMPLE 4 Pointing to a partitive concept in a partitive relation:

```
<conceptEntry id="CID-103">
 ...
 <descrip type="partitiveConcept" target="CID-104">cell</descrip>
 ...
  <term>battery</term>
 ...
</conceptEntry>
```

EXAMPLE 5 Pointing to an associative concept with no subtype:

```
<conceptEntry id="CID-102">
 ...
 <descrip type="associativeConcept" target="CID-105">regenerative braking</descrip>
 ...
  <term>hybrid electric car</term>
 ...
</conceptEntry>
```