SRC-AP-VB3: an application profile for metadata assets maintained in VocBench3

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1. Introduction

This document defines the application profile of SKOS assets managed using VocBench3[1]. *VocBench3* is a web-based, multilingual, collaborative development platform for managing OWL ontologies, SKOS(XL) thesauri and generic RDF datasets. *SKOS* is a common data model for sharing and linking knowledge organization systems via the Web. The SKOS data model provides a standard, low-cost migration path for porting existing knowledge organization systems to the Semantic Web. SKOS also provides a lightweight, intuitive language for developing and sharing new knowledge organization systems. It may be used on its own, or in combination with formal knowledge representation languages such as the Web Ontology language (OWL)[2].

The scope of the application profile is originally intended for, but not limited to, the reference metadata assets managed by the Publications Office of the European Union. *Reference metadata* assets refer to thesauri, taxonomies, authority tables, reference tables, controlled vocabularies, etc. Examples of such assets maintained by the Publications Office are EuroVoc thesaurus, Corporate Body, Language and Country authority lists. The complete list of assets can be found on EU Vocabularies Website.

An *Application Profile* (AP) is a specification that re-uses terms from one or more base standards, adding more specificity by identifying mandatory, recommended and optional elements to be used for a particular application, as well as recommendations for controlled vocabularies to be used.

The Application Profile specified in this document is based on the specification of the Simple Knowledge Organization System (SKOS). SKOS is an *RDF*[3] vocabulary designed to facilitate interoperability between controlled vocabularies published on the Web as Linked Open Data. Additional classes and properties from other well-known vocabularies are re-used where necessary.

The work does not cover implementation issues like mechanisms to edit or publish metadata assets and expected behaviour of systems implementing the Application Profile other than what is defined in the Conformance Statement.

The Application Profile is intended to facilitate controlled vocabularies exchange and therefore the classes and properties defined in this document are only relevant for the controlled vocabularies to be exchanged; there are no requirements for communicating systems to implement specific technical environments. The only requirement is that the systems can export and import data in RDF in conformance with this Application Profile.

2. Context of use

The use case that this specification intends to enable is authoring with VocBench3 of all thesauri and controlled vocabularies managed by the Publications Office of the European Union.

The basic use case involves the following actors:

- EuroVoc team, in charge of the maintenance of EuroVoc thesaurus, and the publication and dissemination of thesauri maintained by other EU institutions.
- MDR team, in charge of the maintenance and dissemination of the authority tables shared among EU institutions.

(1) Stellato, A., Fiorelli, M., Turbati, A., Lorenzetti, T., Van Gemert, W.,Dechandon, D., Laaboudi-Spoiden, C., Gerencser, A., Waniart, A.,Costetchi, E., and Keizer, J. (forthcoming). VocBench 3: a Collab-orative Semantic Web Editor for Ontologies, Thesauri and Lexicons.Semantic Web journal. link

(2) Bechhofer, S., & Miles, A. (2009). SKOS Simple Knowledge Organization System Reference. https://www.w3.org/TR/skos-reference/

(3) Wood, D., Lanthaler, M., & Cyganiak, R. (2014). RDF 1.1 Concepts and Abstract Syntax.

- Other teams of the EU institutions who wish to edit their classifications, taxonomies, thesauri and authority tables as Linked Open Data, to facilitate their reuse.

3. Terminology used

In the following sections, classes and properties are grouped under headings "mandatory", "recommended" and "optional". These terms have the following meaning.

- *Mandatory class*: a receiver of data MUST be able to process information about instances of the class; a sender of data MUST provide information about instances of the class.
- *Recommended class*: a receiver of data MUST be able to process information about instances of the class; a sender of data MUST provide information about instances of the class, if it is available.
- *Optional class*: a receiver MUST be able to process information about instances of the class; a sender MAY provide the information but is not obliged to do so.
- *Mandatory property*: a receiver MUST be able to process the information for that property; a sender MUST provide the information for that property.
- *Recommended property*: a receiver MUST be able to process the information for that property; a sender SHOULD provide the information for that property if it is available.
- *Optional property*: a receiver MUST be able to process the information for that property; a sender MAY provide the information for that property but is not obliged to do so.

The meaning of the terms MUST, MUST NOT, SHOULD and MAY in this section and in the following sections are as defined in RFC 2119[(4)].

In the given context, the term "processing" means that receivers must accept incoming data and transparently provide these data to applications and services. It does neither imply nor prescribe what applications and services finally do with the data (parse, convert, store, make searchable, display to users, etc.).

4. Used vocabularies

This Application Profile reuses classes and properties from various existing specifications. Classes and properties specified in the next sections have been taken from the following namespaces.

Table 1. List of ontologies and their namespace definitions

Ontology	Prefix	URI
Simple Knowledge Organization System	skos	http://www.w3.org/2004/02/skos/core#
Simple Knowledge Organization System eXtension for Labels	skoxl	http://www.w3.org/2008/05/skos-xl#
DCMI Metadata Terms	dct	http://purl.org/dc/terms/
Dublin Core Metadata Element Set	dc	http://purl.org/dc/elements/1.1/
Publications Office Extensions Ontology	euvoc	http://publications.europa.eu/ontology/euvoc
Lexicon Model for Ontologies	lemon	http://lemon-model.net/lemon

[(4)] IETF. RFC 2119. Key words for use in RFCs to Indicate Requirement Levels. http://www.ietf.org/rfc/rfc2119.txt

Ontology	Prefix	URI
LexInfo 2.0	lexinfo	http://www.lexinfo.net/ontology/2.0/lexinfo#
OWL 2 Web Ontology Language	owl	http://www.w3.org/2002/07/owl#
RDF Schema Vocabulary	rdfs	http://www.w3.org/2000/01/rdf-schema#
Resource Description Framework	rdf	http://www.w3.org/1999/02/22-rdf-syntax-ns#
XML Schema Definition	xsd	http://www.w3.org/2001/XMLSchema#

There is also a list of controlled vocabularies used to restrict the value range on some properties. The values belong to the following namespaces.

Table 2. List of controlled vocabularies and their namespace definitions

Vocabulary name	Prefix	URI
EuroVoc domains	domain	http://eurovoc.europa.eu/domain/
Notation type	notation	http://publications.europa.eu/resource/authority/notation-type
Label type	label	http://publications.europa.eu/resource/authority/label-type
Use context	context	http://publications.europa.eu/resource/authority/use-context

5. Graphical representation

The graphical representation of the Application Profile is provided in the form of an UML class diagram[(5)] and is depicted in the figure below. The boxes represent classes while the arrow connections represent properties establishing relations to other classes. The attributes inside boxes represent properties providing either literal data values or relation to other classes that omitted from the diagram. Both, arrows and attributes, are labelled with the property names prefixed with the namespace where they are defined.

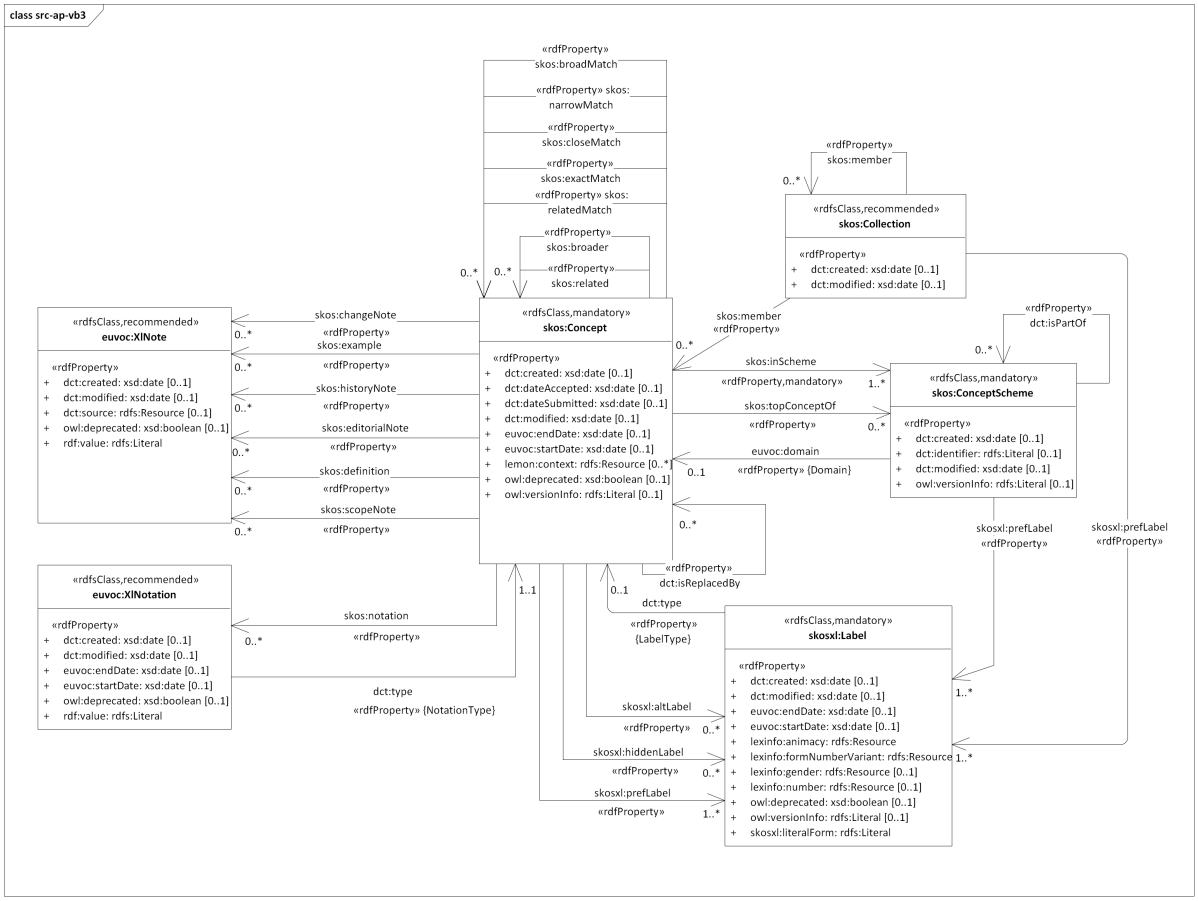
The cardinality specifications on the connector (_ .. _) arrows and next to the attributes, marked in square brackets ([ ]) represent constraints on how the property may be employed on the class instances and has a normative meaning. The first number means minimum cardinality constraint and the second means maximum cardinality constraint. The minimum cardinality constraint is zero (0 .. _) for optional properties and one (1 .. _) for mandatory properties. The maximum cardinality constraint is usually unspecified (_ .. *) or limited to one (_ .. 1) and has no normative value in this application profile. If the cardinality is not specified then the implied meaning is exactly one (1..1).

The stereotypes, marked in the double angle brackets (<< >>), used in the diagram are based on RDFS model. They have an indicative and not a semantic value. The "mandatory", "optional" and "recommended" stereotypes are normative and have the meaning defined in the terminology section .

In curly brackets ({ }) are provided the value constraints on the property values. These constraints refer to controlled list of values that should meet a minimum set of requirements.

(5) Class diagram, https://en.wikipedia.org/wiki/Class_diagram

Figure 1. UML class diagram of SRC-AP-VB3 application profile



6. src-ap-vb3.xmi

euvoc:XlNotation

A notation is a string of characters used to uniquely identify a concept within a specified context.

Like the skosxl:Label class reifies SKOS label statements, XlNotation reifies SKOS notation statements. This class permits, if needed, to maintain the historical view of the values and add additional provenance descriptions.

Table 3. Properties

Name	Type	Cardinality	Definition
dct:created	xsd:date	0..1	Date of creation of the resource.
dct:modified	xsd:date	0..1	Date of modification of the resource.
euvoc:endDate	xsd:date	0..1	End of the validity period. If a resource has an end date then it must be marked as deprecated.
euvoc:startDate	xsd:date	0..1	Beginning of the validity period.
owl:deprecated	xsd:boolean	0..1	States whether the resource is current or deprecated. By deprecating a resource, it means that it should not be used in new documents. Deprecation is a feature commonly used in versioning software to indicate that a particular feature is preserved for backward-compatibility purposes, but may be phased out in the future.
rdf:value	rdfs:Literal	1..1	The literal form of the notation.
dct:type	skos:Concept	1..1	Specify the context where a specified notation is considered unique.

euvoc:XlNote

Like the skosxl:Label class reifies SKOS label statements, XlNote reifies SKOS note statements (i.e. skos:editorialNote, skos:example, skos:historyNote, skos:definition, skos:scopeNote and skos:changeNote). This class permits, if needed, to maintain the historical view of the values and add additional provenance descriptions.

Table 4. Properties

Name	Type	Cardinality	Definition
dct:created	xsd:date	0..1	Date of creation of the resource.
dct:modified	xsd:date	0..1	Date of modification of the resource.
dct:source	rdfs:Resource	0..1	A related resource from which the described resource is derived. The described resource may be derived from the related resource in whole or in part. Recommended best practice is to identify the related resource by means of a string conforming to a formal identification system.
owl:deprecated	xsd:boolean	0..1	States whether the resource is current or deprecated. By deprecating a resource, it means that it should not be used in new documents. Deprecation is a feature commonly used in versioning software to indicate that a particular feature is preserved for backward-compatibility purposes, but may be phased out in the future.
rdf:value	rdfs:Literal	1..1	The literal form of the note.

rdfs:Resource

All things described by RDF are called resources, and are instances of the class rdfs:Resource. This is the class of everything.

skos:Collection

Table 5. Properties

Name	Type	Cardinality	Definition
dct:created	xsd:date	0..1	
dct:modified	xsd:date	0..1	
skos:member	skos:Collection	0..*	
skos:member	skos:Concept	0..*	
skosxl:prefLabel	skosxl:Label	1..*	
skos:member	skos:Collection	0..*	

skos:Concept

A SKOS concept can be viewed as an idea or notion; a unit of thought. However, what constitutes a unit of thought is subjective, and this definition is meant to be suggestive, rather than restrictive.

The notion of a SKOS concept is useful when describing the conceptual or intellectual structure of a knowledge organization system, and when referring to specific ideas or meanings established within a KOS.

Note that, because SKOS is designed to be a vehicle for representing semi-formal KOS, such as thesauri and classification schemes, a certain amount of flexibility has been built in to the formal definition of this class.

Table 6. Properties

Name	Type	Cardinality	Definition
dct:created	xsd:date	0..1	Date of creation of the resource.
dct:dateAccepted	xsd:date	0..1	Date of acceptance of the resource.
dct:dateSubmitted	xsd:date	0..1	Date of submission of the resource.
dct:modified	xsd:date	0..1	Date of modification of the resource.

Name	Type	Cardinality	Definition
euvoc:endDate	xsd:date	0..1	End of the validity period. If a resource has an end date then it must be marked as deprecated.
euvoc:startDate	xsd:date	0..1	Beginning of the validity period.
lemon:context	rdfs:Resource	0..*	Denotes the pragmatic, discursive or technical context of a concept or a constraint on the concept properties.
owl:deprecated	xsd:boolean	0..1	States whether the resource is current or deprecated. By deprecating a resource, it means that it should not be used in new documents. Deprecation is a feature commonly used in versioning software to indicate that a particular feature is preserved for backward-compatibility purposes, but may be phased out in the future.
owl:versionInfo	rdfs:Literal	0..1	An owl:versionInfo statement generally has as its object a string giving information about this version. This statement does not contribute to the logical meaning of the resource.
skos:inScheme	skos:ConceptScheme	1..*	A concept scheme in which the concept is included. A concept may be a member of more than one concept scheme.
skos:definition	euvoc:XlNote	0..*	A statement or formal explanation of the meaning of a concept.
skos:broadMatch	skos:Concept	0..*	
skos:historyNote	euvoc:XlNote	0..*	A note about the past state/use/meaning of a concept.
skos:narrowMatch	skos:Concept	0..*	
skos:broader	skos:Concept	0..*	A concept that is more general in meaning. Broader concepts are typically rendered as parents in a concept hierarchy (tree).
skos:example	euvoc:XlNote	0..*	An example of the use of a concept.
dct:isReplacedBy	skos:Concept	0..*	A related resource that supplants, displaces, or supersedes the described resource.
skos:exactMatch	skos:Concept	0..*	
skos:closeMatch	skos:Concept	0..*	
skos:relatedMatch	skos:Concept	0..*	
skosxl:altLabel	skosxl:Label	0..*	An alternative lexical label for a resource. Acronyms, abbreviations, spelling variants, and irregular plural/singular forms may be included among the alternative labels for a concept.
skosxl:hiddenLabel	skosxl:Label	0..*	A lexical label for a resource that should be hidden when generating visual displays of the resource, but should still be accessible to free text search operations. Mis-spelled terms are normally included as hidden labels.
skos:topConceptOf	skos:ConceptScheme	0..*	The property skos:hasTopConcept is, by convention, used to link a concept scheme to the SKOS concept(s) which are topmost in the hierarchical relations for that scheme.
skosxl:prefLabel	skosxl:Label	1..*	The preferred lexical label for a resource, in a given language. No two concepts in the same concept scheme may have the same preferred label in a given language.
skos:notation	euvoc:XlNotation	0..*	A notation is a string of characters such as "T58.5" or "303.4833" used to uniquely identify a concept within the scope of a given concept scheme or within a specified context.
skos:related	skos:Concept	0..*	A concept with which there is an associative semantic relationship.
skos:changeNote	euvoc:XlNote	0..*	A note about a modification to a concept.
skos:editorialNote	euvoc:XlNote	0..*	A note for an editor, translator or maintainer of the vocabulary.
skos:scopeNote	euvoc:XlNote	0..*	A note that helps to clarify the meaning of a concept.
skos:broadMatch	skos:Concept	0..*	
skos:narrowMatch	skos:Concept	0..*	
skos:broader	skos:Concept	0..*	A concept that is more general in meaning. Broader concepts are typically rendered as parents in a concept hierarchy (tree).
dct:isReplacedBy	skos:Concept	0..*	A related resource that supplants, displaces, or supersedes the described resource.
skos:exactMatch	skos:Concept	0..*	
skos:closeMatch	skos:Concept	0..*	
skos:relatedMatch	skos:Concept	0..*	
skos:related	skos:Concept	0..*	A concept with which there is an associative semantic relationship.

skos:ConceptScheme

A SKOS concept scheme can be viewed as an aggregation of one or more SKOS concepts. Semantic relationships (links) between those concepts may also be viewed as part of a concept scheme. This definition is, however, meant to be suggestive rather than restrictive, and there is some flexibility in the formal data model stated below.

Thesauri, classification schemes, subject heading lists, taxonomies, 'folksonomies', and other types of controlled vocabulary are all examples of concept schemes. Concept schemes are also embedded in glossaries and terminologies.

Table 7. Properties

Name	Type	Cardinality	Definition
dct:created	xsd:date	0..1	Date of creation of the resource.
dct:identifier	rdfs:Literal	0..1	An unambiguous reference to the resource within a given context. Recommended best practice is to identify the resource by means of a string conforming to a formal identification system.
dct:modified	xsd:date	0..1	Date of modification of the resource.
owl:versionInfo	rdfs:Literal	0..1	An owl:versionInfo statement generally has as its object a string giving information about this version. This statement does not contribute to the logical meaning of the resource.
euvoc:domain	skos:Concept	0..1	Indicates the subject of the controlled vocabulary. This property has a similar function as the dct:subject and dcat:theme.
dct:isPartOf	skos:ConceptScheme	0..*	A related resource in which the described resource is physically or logically included.
skosxl:prefLabel	skosxl:Label	1..*	The preferred lexical label for a resource, in a given language. No two concepts in the same concept scheme may have the same preferred label in a given language.
dct:isPartOf	skos:ConceptScheme	0..*	A related resource in which the described resource is physically or logically included.

skosxl:Label

The class skosxl:Label is a special class of lexical entities. An instance of the class skosxl:Label is a resource and may be named with a URI.

An instance of the class skosxl:Label has a single literal form. This literal form is an RDF plain literal (which is a string of UNICODE characters and an optional language tag [https://www.w3.org/TR/rdf-concepts/]). The property skosxl:literalForm is used to give the literal form of an skosxl:Label. If two instances of the class skosxl:Label have the same literal form, they are not necessarily the same resource.

Table 8. Properties

Name	Type	Cardinality	Definition
dct:created	xsd:date	0..1	Date of creation of the resource.
dct:modified	xsd:date	0..1	Date of modification of the resource.
euvoc:endDate	xsd:date	0..1	End of the validity period. If a resource has an end date then it must be marked as deprecated.
euvoc:startDate	xsd:date	0..1	Beginning of the validity period.
lexinfo:animacy	rdfs:Resource	1..1	The characteristic of a word indicating that in a given discourse community, its referent is considered to be alive or to possess a quality of volition or consciousness.
lexinfo:formNumberVariant	rdfs:Resource	1..1	A grammatical category that indicates grammatical variation in numerals. This feature is used in Maltese language.
lexinfo:gender	rdfs:Resource	0..1	A grammatical category that indicates grammatical relationships between words in sentences.
lexinfo:number	rdfs:Resource	0..1	Grammatical category for the variation in form of nouns, pronouns, and any words agreeing with them, depending on how many persons or things are referred to.
owl:deprecated	xsd:boolean	0..1	States whether the resource is current or deprecated. By deprecating a resource, it means that it should not be used in new documents.

Name	Type	Cardinality	Definition
			Deprecation is a feature commonly used in versioning software to indicate that a particular feature is preserved for backward-compatibility purposes, but may be phased out in the future.
owl:versionInfo	rdfs:Literal	0..1	An owl:versionInfo statement generally has as its object a string giving information about this version. This statement does not contribute to the logical meaning of the resource.
skosxl:literalForm	rdfs:Literal	1..1	The literal form of an skosxl:Label. An instance of the class skosxl:Label has one and only one literal form.
dct:type	skos:Concept	0..1	Specify the context where a specified notation is considered unique.

rdfs:Literal

The class rdfs:Literal is the class of literal values such as strings and integers. Property values such as textual strings are examples of RDF literals.

xsd:boolean

The boolean data type is used to specify a true or false value.

xsd:date

The date data type is used to specify a date. The date is specified in the following form "YYYY-MM-DD" where:

- YYYY indicates the year
- MM indicates the month
- DD indicates the day

Note: All components are required!

7. On concept evolution and versioning

SKOS is a common data model for sharing and linking knowledge organization systems via the Web. It describes means to define concepts and organise them in concept schemes but omits to specify anything about how such organisation should evolve over time. A series of attempts was done to address this issue and a list of references is available on W3C wiki [(6)]

. This section reflects the result of discussions in the MDR team of the Publications Office and addresses a few issues related to evolution of digital assets based on SKOS model. The solutions described below have informative purpose and are not part of the application profile.

Preliminary questions

Discussing the temporal evolution of SKOS assets is not a trivial task. It can be approached as a whole concept scheme or at the level of individual concepts. Regardless of the approach it is difficult to avoid sliding into the classic problems in metaphysics[(7)] related to time[(8)], change[(9)] and identity[(10)]. Although, an alternative and

(6) SKOS/Issues/ConceptEvolution. https://www.w3.org/2001/sw/wiki/SKOS/Issues/ConceptEvolution

(7) van Inwagen, Peter and Sullivan, Meghan, "Metaphysics", The Stanford Encyclopedia of Philosophy (Spring 2018 Edition), Edward N. Zalta (ed.), https://plato.stanford.edu/archives/spr2018/entries/metaphysics/

(8) Markosian, Ned, "Time", The Stanford Encyclopedia of Philosophy (Fall 2016 Edition), Edward N. Zalta (ed.), https://plato.stanford.edu/archives/fall2016/entries/time/.

(9) Gallois, Andre, "Identity Over Time", The Stanford Encyclopedia of Philosophy (Winter 2016 Edition), Edward N. Zalta (ed.), https://plato.stanford.edu/archives/win2016/entries/identity-time/.

perhaps a useful way of escaping the metaphysical distinctions is taking a semiotic[11] standpoint and think about the evolution of signs, "external reality" things and "mental" concepts.

In the course of Next are provided a few competency questions aimed at clarifying the nature of the asset at hand and thus getting one step closer in making a choice in the versioning strategy that will be outlined later.

- What is the level of abstraction of managed concepts? Do the concepts represent entities/individuals or more abstract classes of things?
- What is the nature of the described things and what keeps them together in one asset?
- How to distinguish one concept from another one? What are the criteria of judgement?
- For properties beyond SKOS model (employed in the Application Profile) decide which of them are *transient* (time dependent) and *intransigent* (time invariant).

Versioning strategies

The problem of versioning can be kept outside the SKOS content by simply publishing successive evolved versions of a plain asset marking accordingly each dataset with a new version. Otherwise, if the historicity needs to permeate the SKOS content then there are few approaches to do so.

There is an approach which proposes altering the core SKOS model described by Tennis and Sutton in their paper "Extending the Simple Knowledge Organization System for Concept Management in Vocabulary Development Applications"[12]. This approach suggests describing concepts at two levels: abstract and concrete. It is clean way of distinguishing transient from intransigent aspects of a concept. However, an additional level of complexity is added by this approach making it difficult to employ the model. Also the extension departs from the initially proposed SKOS model and is hardly backwards compatible with the original design. To become practical, a wider adoption of the model is needed along with software support to maintain such descriptions.

Currently, the SKOS model covers the needs of most users and no versioning extensions are employed. This means that any versioning strategy should not alter the meaning of the original model. At the Publications Office three versioning strategies are considered practical: *concept evolution*, *concept succession* and *versioning by concept scheme*. In the case of "*no versioning*" a temporal tracking is still available, but in this case as editions of an evolving dataset, meaning that the content of the dataset is temporally agnostic.

In order to deal with versioning, regardless of the approach, a few properties are deemed useful in order to mark the concept status, mark validity interval of a concept and eventually specify the successor/predecesor of a concept. The next sections describe each of the strategies along with necessary extensions and an example.

Concept evolution

Adopting the *concept evolution* means that the concept description comprises the entire or partial historical account. In this approach the the concept URI remains stable (fixed) in time while the changes in the property values are incrementally recorded on the concept. The properties must be reified and each record has a validity period to it and (eventually) a status distinguishing between the latest valid value and its historical traces. The strength of this approach is that the URI remains persistent over time (even though its description evolves). The downside of such an approach is the high rick of completely redefining the meaning associated with an URI. In practice it becomes more difficult to maintain a dataset which implements this approach and it is also harder to query at least to determine the latest valid description of the concept.

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[10] Deutsch, Harry and Garbacz, Pawel, "Relative Identity", The Stanford Encyclopedia of Philosophy (Fall 2018 Edition), Edward N. Zalta (ed.), https://plato.stanford.edu/archives/fall2018/entries/identity-relative/

[11] Atkin, Albert, "Peirce's Theory of Signs", The Stanford Encyclopedia of Philosophy (Summer 2013 Edition), Edward N. Zalta (ed.), https://plato.stanford.edu/archives/sum2013/entries/peirce-semiotics/.

[12] Tennis, J. T. and Sutton, S. A. (2008), Extending the simple knowledge organization system for concept management in vocabulary development applications. J. Am. Soc. Inf. Sci., 59: 25-37. doi:10.1002/asi.20702

In order to accommodate the concept versioning, the properties for which the historicity is important or necessary, have to be reified is some way. The recommendations are provided in the "RDF Primer"[13] and in the "Defining N-ary Relations on the Semantic Web"[14]. A popular reification example for SKOS properties allowing the qualification of concept labels is provided in the SKOS-XL extension[15]. This extension alone, however is not sufficient to describe the label temporal evolution, and two more properties are necessary: label status and/or label validity interval (start and end date). This approach allows instatiations like the one in the listing below where the concept MARE from CorporateBody authority table has several pref labels out of which only the last one is valid and the first two are deprecated each having a validity period.

```
corporate-body:MARE a skos:Concept ;
  skosxl:prefLabel [
    euvoc:startDate "1977-01-01";
    euvoc:endDate "1999-07-30";
    owl:deprecated "true";
    skoxl:literalValue "DG XIV Fisheries".
  ];
  skoxl:prefLabel [
    euvoc:startDate "1999-10-01";
    euvoc:endDate "2005-01-12";
    owl:deprecated "true";
    skosxl:literalValue "Directorate General for Fisheries".
  ];
  skoxl:prefLabel [
    euvoc:startDate "2005-01-13";
    skosxl:literalValue "Directorate-General for Maritime Affairs and Fisheries".
  ].
```

Concept succession

The *concept succession* differs from the concept evolution. It means that the concept description has no historical account but the concept itself has a validity interval. When the concept description is no longer valid then a new successor concept replaces the current one and the latter becomes deprecated. This implies that the concept URI is maintained stable over time, but when a new concept is created to replace the current one, then the users are encouraged to switch and start using the new URI.

Concept succession requires a slightly different extension. The need for specifying status and validity interval still remains and in addition there needs to be a way to also specify connection between the old and the new superseding concept. In the listing below is provided an example of how concept succession may be instantiated.

```
corporate-body:EEC a skos:Concept ;
  skos:prefLabel "European Economic Community".
  euvoc:startDate "1958-01-01";
  euvoc:endDate "1993-10-31";
  owl:deprecated "true";
  dct:isReplacedBy corporate-body:EURCOM.

corporate-body:EURCOM a skos:Concept ;
  skos:prefLabel "European Economic Community".
  euvoc:startDate "1993-11-01";
  euvoc:endDate "2009-11-30";
  owl:deprecated "true";
  dct:isReplacedBy corporate-body:EURUN.

corporate-body:EURUN a skos:Concept ;
  skos:prefLabel "European Union".
  euvoc:startDate "2009-12-01".
```

[13] Miller, E., & Manola, F. (2004). RDF Primer. https://www.w3.org/TR/rdf-primer/#deification

[14] Rector, A., & Noy, N. (2006). Defining N-ary Relations on the Semantic Web. https://www.w3.org/TR/swbp-n-aryRelations/

[15] Miles, A. & Isaac A. (2008). SKOS Simple Knowledge Organization System eXtension for Labels (XL). http://www.w3.org/2006/07/SWD/SKOS/xl/

Versioning by concept scheme

In *versioning by concept scheme* means that the concept scheme function as version marker and container. This approach resembles slightly the "No versioning" approach where the entire dataset is versioned as a whole. The difference is that all version concept scheme are maintained in a single dataset. This way. a concept may belongs to as many version concept schemes for as long it is current and if it is deprecated then it is simply omitted in the future concept schemes. Each version concept scheme provides a description of the validity interval or publication date.

Versioning by concept scheme does not require any SKOS extensions, at least not for concept descriptions. It is recommended however to describe evolution of concept schemes using similar means as described above for concepts, i.e. employing validity interval, a status and successorship relations. In the listing below is provided an example how versioning by concept scheme may be instantiated.

```
nuts-scheme:2010 a skos:ConceptScheme;
  skos:prefLabel "Nomenclature of territorial units for statistics";
  owl:versionInfo "version 2010";
  dct:isReplacedBy nuts-scheme:2013.

nuts-scheme:2013 a skos:ConceptScheme;
  skos:prefLabel "Nomenclature of territorial units for statistics";
  owl:versionInfo "version 2013".

nuts-code:UKK42 a skosConcept;
  skos:prefLabel "Torbay";
  skos:inScheme nuts-scheme2010;
  skos:inScheme nuts-scheme2013.

nuts-code:UKD37 a skosConcept;
  skos:prefLabel "Greater Manchester North East";
  skos:inScheme nuts-scheme2013.
```

This section presented three strategies to version the SKOS content. Each of these approaches is supported by this application profile and it is up to the dataset authors to decide how the content evolves in time and is historicity maintained.

8. Requirements for controlled vocabularies

The following is a list of requirements for the controlled vocabularies that are used in this application profile as controlled list of values.

Controlled vocabularies should:

- Be published under an open licence.
- Be operated and/or maintained by an institution of the European Union, by a recognised standards organisation or another trusted organisation.
- Be properly documented.
- Have labels in multiple languages, ideally in all official languages of the European Union.
- Have terms that are identified by dereferenceable[(16)] URIs with each URI resolving to descriptions about the term.
- Have associated persistence and versioning policies.

These criteria have been applied to select controlled vocabularies used in this application profile.

[(16)] Dereferencing HTTP URIs. https://www.w3.org/2001/tag/doc/httpRange-14/2007-05-31/HttpRange-14

9. Conformance statement

Provider requirements

In order to conform to this application profile an application must be able to provide data assets that:

- comprise statements using at least the mandatory classes and properties.
- in addition, any of the recommended and optional properties and classes may be provided.
- employ values from the specified controlled vocabularies on properties with restricted value ranges. Additional controlled vocabularies may be used on properties with unrestricted value ranges.

Receiver requirements

In order to conform to this application profile an application that receives a compliant data asset must be able to:

- process information for all mandatory classes and optionally for recommended and optional classes.
- process information for all mandatory properties and optionally for recommended and optional properties.
- process information for all controlled vocabularies.

"processing" means that receivers must accept incoming data and transparently provide these data to applications and services. It does neither imply nor prescribe what applications and services finally do with the data (parse, convert, store, make searchable, display to users, etc.).

10. Multilingual aspects

Multilingual aspects related to this Application Profile concern all properties whose contents are expressed as strings with human-readable text. Wherever such properties are used, the string values are of one of two types:

- The string is free text. Examples are descriptions and labels. Such text may be translated into several languages.
- The string is an appellation of a "named entity". Examples are names of organisations or persons. These names may have parallel versions in other languages but those versions don't need to be literal translations.

Wherever values of properties are expressed with either type of string, the property can be repeated with translations in the case of free text and with parallel versions in case of named entities. For free text, the language tag is mandatory. For named entities, the language tag is optional and should only be provided if the parallel version of the name is strictly associated with a particular language. For example, the name "European Union" has parallel versions in all official languages of the union, while a name like "W3C" is not associated with a particular language and has no parallel versions.

How multilingual information is handled by the receiver applications, for example in indexing and user interfaces, is outside of the scope of this Application Profile.

11. Publishing linked data

This Application Profile is intended for use in a *Linked Data*[17] environment. Therefore data providers should consider publishing the data assets following the recommendations in the W3C Notes "Best Practice Recipes for Publishing RDF Vocabularies"[18] , "Best Practices for Publishing Linked Data"[19] and the ISA report "10 Rules for Persistent URIs"[20] .

[17] W3C. Linked Data. http://www.w3.org/standards/semanticweb/data

[18] W3C. Best Practice Recipes for Publishing RDF Vocabularies. http://www.w3.org/TR/swbp-vocab-pub/

(19) W3C. Best Practices for Publishing Linked Data. https://dvcs.w3.org/hg/gld/raw-file/default/bp/index.html

(20) European Commission. Joinup. 10 Rules for Persistent URIs. https://joinup.ec.europa.eu/community/semic/document/10-rules-persistent-uris