Data Model for Lexicography (DMLex), Version 1.0

Working Draft 01

27 March 2023

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Additional artifacts:
NONE AT THE MOMENT

Related Work:
This specification is related to:

- No related specifications.

Declared namespaces:
This specification declares one or more namespaces. Namespace isn't considered an XML specific feature in this serialization independent specification.

The core namespace

- http://docs.oasis-open.org/lexidma/ns/dmlex-1.0

Key words:
The key words MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT, SHOULD, SHOULD NOT, RECOMMENDED, MAY, and OPTIONAL in this document are to be interpreted as

described in BCP 14 [RFC2119] and [RFC8174] if, and only if, they appear in all capitals, as shown here.

Abstract:

This document defines the 1st version of a data model in support of the high-priority technical goals described in the LEXIDMA TC's charter, including:

- A serialization-independent Data Model for Lexicography (DMLex)
- An XML serialization of DMLex
- A JSON serialization of DMLex
- A relational database implementation of DMLex

Status:

This document was last revised or approved by the LEXIDMA TC on the above date. The level of approval is also listed above. Check the "Latest version" location noted above for possible later revisions of this document. Any other numbered Versions and other technical work produced by the Technical Committee (TC) are listed at https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=lexidma#technical.

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Appendixes

1 Introduction

DMLex is a data model for modelling dictionaries (here called lexicographic resources) in computer applications such as dictionary writing systems.

DMLex is a data model, not an encoding format. DMLex is abstract, independent of any markup language or formalism. At the same time, DMLex has been designed to be easily and straightforwardly implementable in XML, JSON, as a relational database, and as a Semantic Web triplestore.

1.1 Modular structure of DMLex

The DMLex specification is divided into a core with several optional modules.

- DMLex Core allows you to model the basic entries-and-sense structure if a monolingual lexicographic resource.
- DMLex Crosslingual Module extends DMLex Core to model bilingual and multilingual lexicographic resources.
- DMLex Controlled Values Module extends DMLex Core to represent inventories of look-up values to be used as part-of-speech tags, usage label tags and others.
- DMLex Linking Module extends DMLex Core and allows you to model various kinds of relations between entries, senses and other objects, including semantic relations such as synonymy and antonymy and presentational relations such as subentries and subsenses, both within a single lexicographic resource and across multiple lexicographic resources.
- DMLex Annotation Module extends DMLex Core to allow the modelling of inline markup on various objects such as example sentences, including the modelling of collocations and corpus patterns.
- DMLex Etymology Module extends DMLex Core to allow the modelling of etymological information in dictionaries.

1.2 Implementing DMLex

DMLex is an abstract data model which can be implemented in many different programming environments and serialization languages. In this document, we give recommended implementations in XML, in JSON and as a relational database.

- The XML and JSON implementations are intended as serializations for data exchange: for encoding lexicographic data while the data is in transit out of one software system into another. Examples of what the two serializations look like with real-world data are given in Section 9, “Examples”.
- The relational database implementation is intended as a representation for lexicographic data while the data is being edited and maintained inside a software system, such as a Dictionary Writing System (DWS).

2 Conformance

1. *DMLex Instances Conformance*

    a. Conformant DMLex Instances MUST be well formed and valid instances according to one of DMLex Serialization Specifications.

    b. Another Instance conformance clause.

    c. ...

    d. DMLex Instances MAY contain custom extensions, as defined in the Extension Mechanisms section. Extensions MUST be serialized in a way conformant with the pertaining DMLex Serialization Specifications.

2. *Application Conformance*

    a. DMLex Writers MUST create conformant DMLex Instances to be considered DMLex compliant.

    b. Agents processing conformant DMLex Instances that contain custom extensions are not REQUIRED to understand and process non-DMLex objects or attributes. However, conformant applications SHOULD preserve existing custom extensions when processing conformant DMLex Instances, provided that the objects that contain custom extensions are not removed according to DMLex Processing Requirements or the extension's own processing requirements.

    c. All Agents MUST comply with Processing Requirements for otherwise unspecified Agents or without a specifically set target Agent.

    d. Specialized Agents defined in this specification - this is Writer, Modifier, and Enricher Agents - MUST comply with the Processing Requirements targeting their specifically defined type of Agent on top of Processing Requirements targeting all Agents as per point c. above.

    e. DMLex is an object model explicitly designed for exchanging data among various Agents. Thus, a conformant DMLex application MUST be able to accept DMLex Instances Created, Modified, or Enriched by a different application, provided that:

        i. The processed files are conformant DMLex Instances according to the same DMLex Serialization Specification,

        ii. in a state compliant with all relevant Processing Requirements.

3. *Backwards Compatibility*

    a. N/A.

Note

DMLex Instances cannot be conformant to this specification w/o being conformant to a specific serialization.

3 DMLex Core

The DMLex Core provides data types for modelling monolingual dictionaries (called lexicographic resources in DMLex) where headwords, definitions and examples are all in one and the same language. DMLex Core gives you the tools you need to model simple dictionary entries which consist of headwords, part-of-speech labels, senses, definitions and so on.

3.1 `lexicographicResource`

Represents a dictionary. A lexicographic resource is a dataset which can be used, viewed and read by humans as a dictionary and – simultaneously – ingested, processed and understood by software agents as a machine-readable database.

Note

The correct name of this data type in DMLex is lexicographic, not lexical, resource.

Contents

- `title` OPTIONAL (zero or one). Non-empty string. A human-readable title of the lexicographic resource.
- `uri` OPTIONAL (zero or one). The URI of the lexicographic resource, identifying it on the Web.
- `language` REQUIRED (exactly one). The IETF language code of the language that this lexicographic resource describes.
- `entry` OPTIONAL (zero, one or more)

Comments

- `language` identifies the language of headwords, definitions and examples in this dictionary. DMLex is based on the assumption that all headwords in a lexicographic resource are in the same language, and that definitions and examples, if any occur in the lexicographic resource, are in that language too. The `language` child object of `lexicographicResource` informs potential users of the lexicographic resource which language that is.
- The main role of a lexicographic resource is to contain entries (`entry` objects). The other object type that can optionally occur inside a `lexicographicResource`, `tag`, is for lists of look-up values such as part-of-speech labels.
- Ideally, a lexicograpphic resouce should include at least one entry. However, DMLex specifies that `entry` is optional in `lexicographicResouce` to allow for the existence of lexicographic resouces which are not yet complete.
- The `lexicographicResource` data type does not contain fields for detailed metadata about the lexicographic resource, such as author, editor, publisher, copyright status or publication year. Describing these properties of lexicographic resources is outside the scope of DMLex. DMLex is a formalism for modelling the internal structure of a lexicographic resource, not its metadata.

Example 1. XML

```
<lexicographicResource uri="..." language="...">
    <title>...</title>
    <entry.../>
    <tag.../>
</lexicographicResource>
```

Example 2. JSON

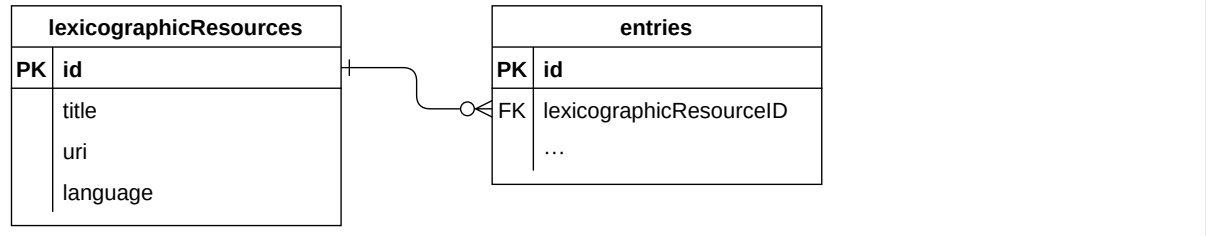
```
{
    "title": "...",
    "language": "...",
    "entries": [...],
    "tags": [...]
}
```

Example 3. RDF

```
@prefix dmlex: <http://www.oasis-open.org/to-be-confirmed/dmlex> .

<#id> a dmlex:LexicographicResource ;
  dmlex:title "..." ;
  dmlex:uri "..." ;
  dmlex:language "..." ;
  dmlex:entry <entry1> , ... ;
  dmlex:tag ... .
```

Example 4. Relational database



3.2 entry

Represents a dictionary entry. An entry contains information about one headword.

Child of

- `lexicographicResource`

Contents

- `id` OPTIONAL (zero or one). An unique identifier of the entry. Entries which have idenfitiers are capable of being involved in relations created with the Linking module.
- `headword` REQUIRED (exactly one). Non-empty string. The entry's headword.
- `homographNumber` OPTIONAL (zero or one). The entry's homograph number, as a guide to distinguish entries with the same headword.
- `partOfSpeech` OPTIONAL (zero, one or more).
- `label` OPTIONAL (zero, one or more).

- `pronunciation` OPTIONAL (zero, one or more).
- `inflectedForm` OPTIONAL (zero, one or more).
- `sense` OPTIONAL (zero, one or more).

Note

DMLex Core does not have a concept of "subentry". To model subentries (ie. entries inside entries) in a lexicographic resource, you should use object types from the Linking Module for that.

Note

The headword can be a single word, a multi-word expression, or any expression in the source language which is being described by the entry.

Note

DMLex allows only one headword per entry. Things like variant headwords and co-headwords do not exist in DMLex. However, the DMLex Linking Module does make it possible to represent the existence of variants by treating them as separate headwords of seperate entries, and linking the entries using a type of link which will cause the entries to be displayed together when shown to human users. See Section 9.16, “Modelling variants” for an example using the English words "colour" and "color".

Note

Entries in DMLex do not have an explicit listing order. An application can imply a listing order from a combination of the headword and the homograph number such that the headword is the primary sorting key and the homograph number (for entries that have) is the secondary sorting key.

Note

Ideally, each entry should have exactly one part-of-speech label. However, DMLex allows more than one `partOfSpeech` in `entry` in order to allow for exceptional cases when the lexicographer multiple part-of-speech readings of a headword in a single entry. Example: English words which denote nationalities ("Czech", "German") and which can function both as nouns and as adjectives.

Example 5. XML

```
<entry id="..." homographNumber="...">
    <headword>...</headword>
    <partOfSpeech.../>
    <label.../>
    <pronunciation.../>
    <inflectedForm.../>
    <sense.../>
</entry>
```

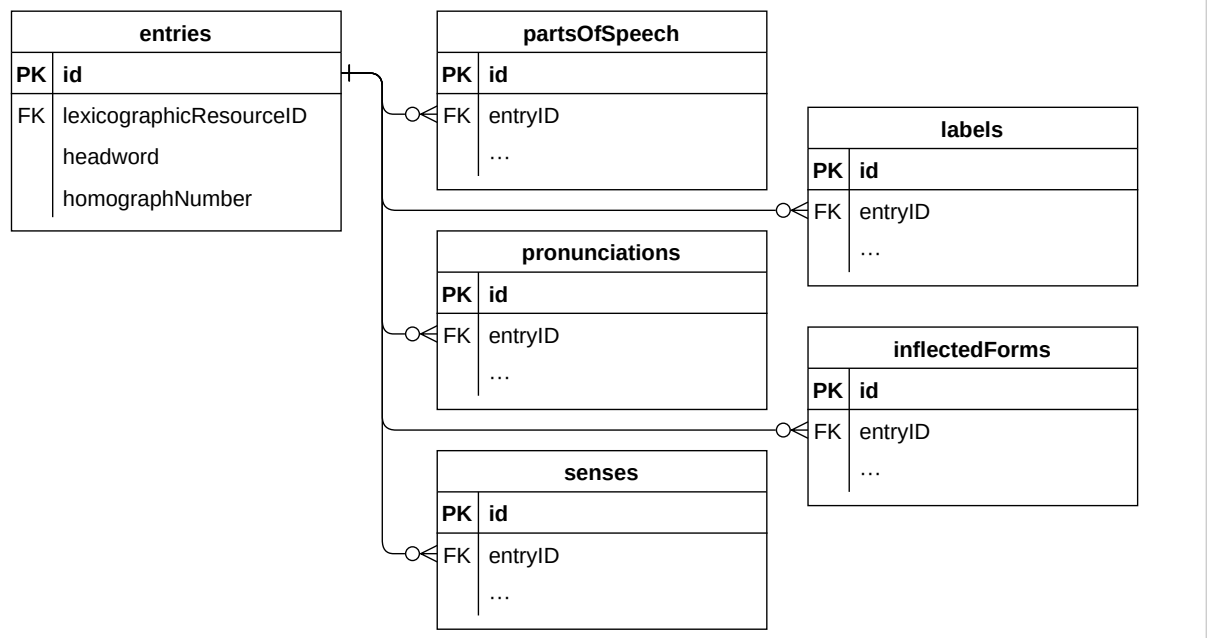
Example 6. JSON

```
{
    "id": "...",
    "headword": "...",
    "homographNumber": "...",
    "partsOfSpeech": [...],
    "labels": [...],
    "pronunciations": [...],
    "inflectedForms": [...],
    "senses": [...]
}
```

Example 7. RDF

```
<id> a dmlex:Entry ;
  dmlex:headword "..." ;
  dmlex:homographNumber ... ;
  dmlex:partOfSpeech ... ;
  dmlex:label ... ;
  dmlex:pronunciation ... ;
  dmlex:inflectedForm ... ;
  dmlex:sense ... .
```

Example 8. Relational database



3.3 partOfSpeech

Represents a part-of-speech label.

Child of

- `entry`

Contents

- `tag` REQUIRED (exactly one). Non-empty string. An abbreviation, a code or some other string of text which identifies the part-of-speech label, for example `n` for noun, `v` for verb, `adj` for adjective. The `partOfSpeechTag` object type can be used to explain the meaning of the part-of-speech tags, to constrain which part-of-speech tags are allowed to occur in the lexicographic resource, and to map them onto external inventories and ontologies.
- `listingOrder` REQUIRED (exactly one). Number. The position of this part-of-speech label among other part-of-speech labels of the same entry. This can be implicit from the serialization.

Comments

- If you want to model other grammatical properties of the headword besides part of speech, such as gender (of nouns) or aspect (of verbs), the way to do that in DMLex is to combine them with the part of speech into a single part-of-speech label, for example `noun-masc` and `noun-fem`, or `v-perf` and `v-imperf`.

Example 9. XML

```
<partOfSpeech tag="..."/>
```

Example 10. JSON

```
"..."
```

Example 11. RDF

```
<entry> dmlex:partOfSpeech [
  a dmlex:PartOfSpeech ;
  dmlex:tag "..." ;
  dmlex:listingOrder 1 ] .
```

Example 12. Relational database

partsOfSpeech	
PK	**id**
FK	entryID
	tag
	listingOrder

3.4 `inflectedForm`

Represents one (of possibly many) inflected forms of the headword. Example: Section 9.2, “How to use `inflectedForm`”.

Child of

- `entry`

Contents

- `tag` OPTIONAL (zero or one). Non-empty string. an abbreviation, a code or some other string of text which identifies the inflected form, for example `pl` for plural, `gs` for genitive singular, `com` for comparative. The `inflectedFormTag` object type can be used to explain the meaning of the inflection tags, to constrain which inflection tags are allowed to occur in the lexicographic resource, and to map them onto external inventories and ontologies.
- `text` REQUIRED (exactly one). Non-empty string. The text of the inflected form.
- `label` OPTIONAL (zero, one or more).
- `pronunciation` OPTIONAL (zero, one or more).
- `listingOrder` REQUIRED (exactly one). Number. The position of this inflected form among other inflected forms of the same entry. This can be implicit from the serialization.

Example 13. XML

```
<inflectedForm tag="...">
    <text>...</text>
    <label.../>
    <pronunciation.../>
</inflectedTag>
```

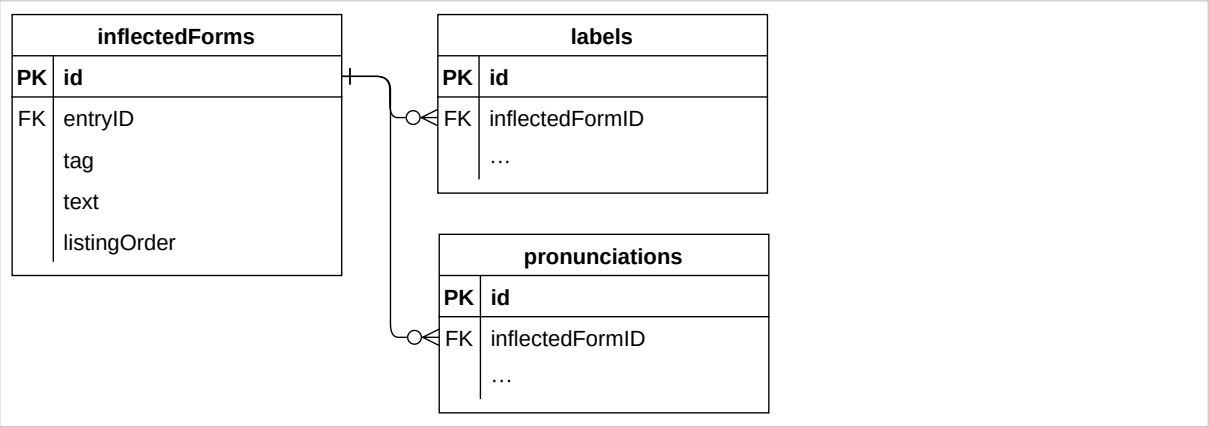
Example 14. JSON

```
{
    "tag": "...",
    "text": "...",
    "labels": [...],
    "pronunciations": [...]
}
```

Example 15. RDF

```
<entry> dmlex:inflectedForm [
  dmlex:text "..." ;
  dmlex:tag "..." ;
  dmlex:listingOrder 1 ;
  dmlex:label ... ;
  dmlex:pronunciation ... .
```

Example 16. Relational database



Comments

- The `inflectedForm` object is intended to model the **inflectional morphology** of a headword. To model derivational morphology, for example feminine forms of maculine nouns, the recommended way to do that in DMLex is to create separate entries for the two words, and link them using the Linking Module.

3.5 sense

Represents one of possibly many meanings (or meaning potentials) of the headword.

Child of

- `entry`

Contents

- `id` OPTIONAL (zero or one). A unique identifier of the sense. Senses which have idenfitiers are capable of being involved in relations created with the Linking module.
- `listingOrder` REQUIRED (exactly one). Number. The position of this sense among other senses of the same entry. Can be implicit from the serialization.
- `indicator` OPTIONAL (zero or one). A short statement, in the same language as the headword, that gives an indication of the meaning of a sense and permits its differentiation from other senses in the entry. Indicators are sometimes used in dictionaries instead of or in addition to definitions.
- `label` OPTIONAL (zero, one or more).
- `definition` OPTIONAL (zero, one or more).
- `example` OPTIONAL (zero, one or more).

Comments

- The contents of **entry** are, apert from `sense`, formal properties of the headword such as orthography, morphology, syntax and pronunciation. A **sense** is a container for statements about the headword's semantics. DMLex deliberately makes it impossible to include morphological information at sense level. If you have an entry where each sense has slightly different morphological properties (eg. a noun has a weak plural in one sense and a strong plural in another) then, in DMLex, you need to treat it as two entries (homographs), and you can use the Linking Module two link the two entries together and to make sure they are always shown together to human users.

Example 17. XML

```
<sense id="...">
    <indicator>...</indicator>
    <label.../>
    <definition.../>
    <example.../>
</sense>
```

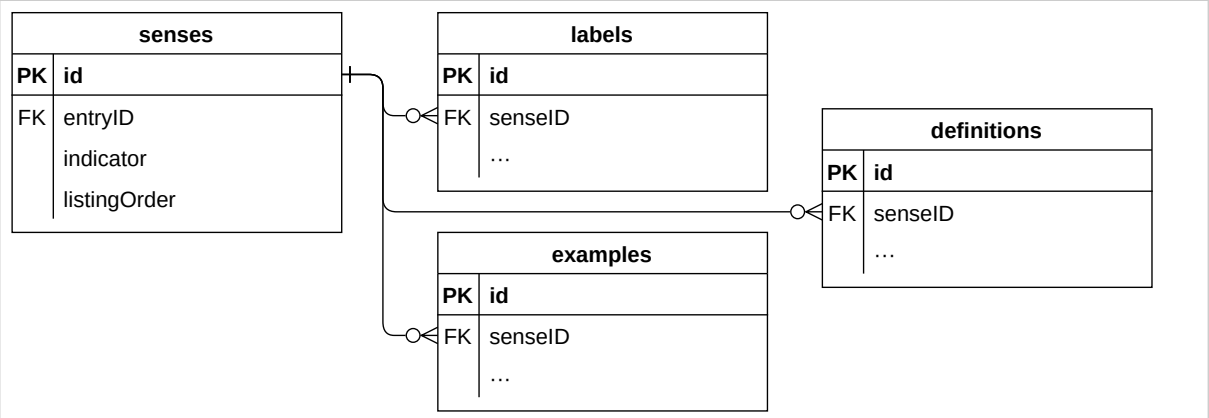
Example 18. JSON

```
{
    "id": "...",
    "indicator": "...",
    "labels": [...],
    "definitions": [...],
    "examples": [...]
}
```

Example 19. RDF

```
<id> a dmlex:Sense ;
  dmlex:listingOrder 1 ;
  dmlex:indicator "..." ;
  dmlex:label ... ;
  dmlex:definition ... ;
  dmlex:example ... .
```

Example 20. Relational database



3.6 definition

Represents one of possibly several definitions of a sense.

Child of

- `sense`

Contents

- `value` REQUIRED (exactly one). Non-empty string. A statement, in the same language as the headword, that describes and/or explains the meaning of a sense. In DMLex, the term definition encompasses not only formal definitions, but also less formal explanations.
- `definitionType` OPTIONAL (zero or one). If a sense contains multiple definitions, indicates the difference between them, for example that they are intended for different audiences. The `definitionTypeTag` object type can be used to constrain and/or explain the definition types that occur in the lexicographic resource.
- `listingOrder` REQUIRED (exactly one). Number. The position of this definition among other definitions of the same sense. This can be implicit from the serialization.

Example 21. XML

```
<definition definitionType="...">...</definition>
```

Example 22. JSON

```
{
    "text": "....",
    "definitionType": "..."
}
```

Example 23. RDF

```
<sense> dmlex:definition [
  a dmlex:Definition ;
  dmlex:text "..." ;
  dmlex:definitionType "..." ;
  dmlex:listingOrder 1 ] .
```

Example 24. Relational database

definitions	
PK	**id**
FK	senseID
	text
	definitionType
	listingOrder

3.7 label

Represents a restriction on its parent such as temporal (old-fashioned, neologism), regional (dialect), register (formal, colloquial), domain (medicine, politics) or grammar (singular-only).

Child of

- entry
- sense
- inflectedForm
- pronunciation
- example

Contents

- tag REQUIRED (exactly one). Non-empty string. An abbreviation, a code or some other string of text which identifies the label, for example neo for neologism, colloq for colloquial, polit for politics. The labelTag object type can be used to explain the meaning of the labels, to constrain which labels are allowed to occur in the lexicographic resource, and to map them onto external inventories and ontologies.
- listingOrder REQUIRED (exactly one). Number. The position of this label among other labels of the same entry. This can be implicit from the serialization.

Comments

- A label applies to the object that it is a child of. When the label is a child of entry, then it applies to the headword in all its senses. When the label is a child of sense, then it applies to the headword in that sense only (**not** including any subsenses linked to it using the Linking Module). When the label is a child of inflectedForm, then it applies only to that inflected form of the headword (in all senses). When the label is a child of pronunciation, then it applies only to that pronuciation of the headword (in all senses).

Example 25. XML

```
<label tag="..."/>
```

Example 26. JSON

```
"..."
```

Example 27. RDF

```
<entry> dmlex:label [
  a dmlex:Label ;
  dmlex:tag "..." ;
  dmlex:listingOrder 1 ] .
```

Example 28. Relational database

labels	
PK	**id**
FK	entryID
FK	senseID
FK	inflectedFormID
FK	pronunciationID
FK	exampleID
	tag
	listingOrder

3.8 pronunciation

Represents the pronunciation of its parent. Examples: Section 9.3, “Pronunciation given as transcription”, Section 9.4, “Pronunciation given as a sound file”, Section 9.5, “Pronunciation given both ways”.

Child of

- `entry`
- `inflectedForm`

Contents

- `soundFile` OPTIONAL (zero or one). A pointer to a file, such as a filename or a URI, containing a sound recording of the pronunciation
- `transcription` OPTIONAL (zero, one or more).
- `listingOrder` REQUIRED (exactly one). Number. The position of this pronuciation object among other pronuciation objects of the same entry. This can be implicit from the serialization.
- `label` OPTIONAL (zero, one or more).

Example 29. XML

```
<pronunciation soundFile="...">
    <transcription.../>
    <label.../>
</pronunciation>
```

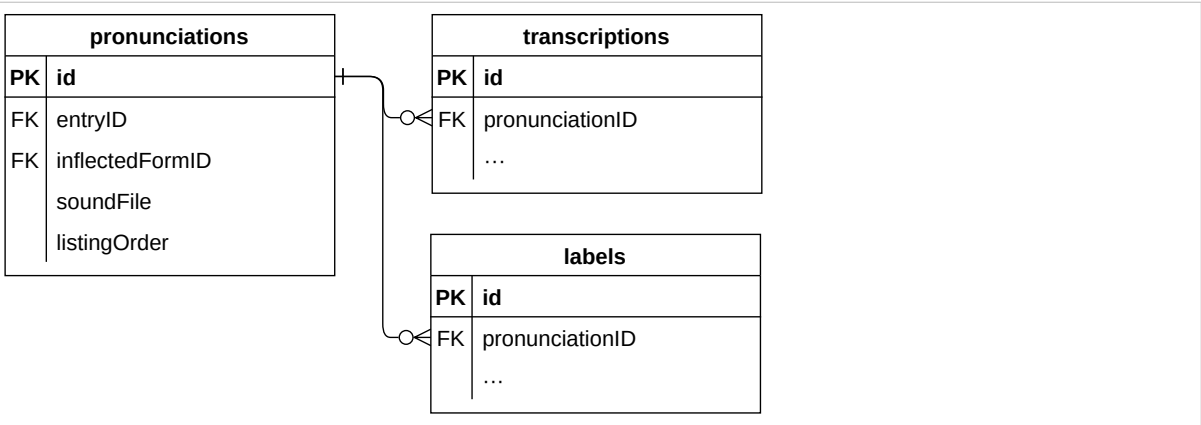
Example 30. JSON

```
{
    "soundFile": "...",
    "transcriptions": [...],
    "labels": [...]
}
```

Example 31. RDF

```
<entry> dmlex:pronunciation [
  a dmlex:Pronunicaton ;
  dmlex:soundFile <...> ;
  dmlex:transcription ... ;
  dmlex:listingOrder 1 ;
  dmlex:label ...  ] .
```

Example 32. Relational database



3.9 transcription

Represents the transcription of a pronunciation in some notation such as IPA.

Child of

- `pronunciation`

Contents

- `text` REQUIRED (exactly one). Non-empty string. The actual transcription.
- `scheme` OPTIONAL (zero or one). IETF language tag. Identifies the transcription scheme used here. Example: `en-fonipa` for English IPA. This can be implicit if the lexicographic resource uses only one transcription scheme throughout.
- `listingOrder` REQUIRED (exactly one). Number. The position of this transcription object among transcriptions of the same pronunciations. This can be implicit from the serialization.

Example 33. XML

```
<transcription scheme="...">...
```

Example 34. JSON

```
{
    "text": "...",
    "scheme": "..."
}
```

Example 35. RDF

```
<pronunciation> dmlex:transcription [
  a dmlex:Transcription ;
  dmlex:scheme "..." ;
  dmlex:listingOrder 1 ] .
```

Example 36. Relational database

transcriptions	
PK	**id**
FK	pronunciationID
	text
	scheme
	listingOrder

3.10 example

Represents a sentence or other text fragment which illustrates the headword being used.

Child of

- sense

Contents

- `text` REQUIRED (exactly one). Non-empty string. The example itself.
- `sourceIdentity` OPTIONAL (zero or one). An abbreviation, a code or some other string of text which identifies the source. The `sourceIdentityTag` object type can be used to explain the meaning of the source identifiers, to constrain which source identifiers are allowed to occur in the lexicographic resource, and to map them onto external inventories and ontologies.
- `sourceElaboration` OPTIONAL (zero or one). Non-empty string. A free-form statement about the source of the example. If `source` is present, then `sourceElaboration` can be used for information where in the source the example can be found: page number, chapter and so on. If `sourceIdentity` is absent then `sourceElaboration` can be used to fully name the source.
- `label` OPTIONAL (zero, one or more).
- `soundFile` OPTIONAL (zero or one). A pointer to a file, such as a filename or a URI, containing a sound recording of the example.

- `listingOrder` REQUIRED (exactly one). Number. The position of this example object among examples of the same sense. This can be implicit from the serialization.

Example 37. XML

```
<example sourceIdentity="..." sourceElaboration="..." soundFile="...">
    <text>...</text>
    <label.../>
</example>
```

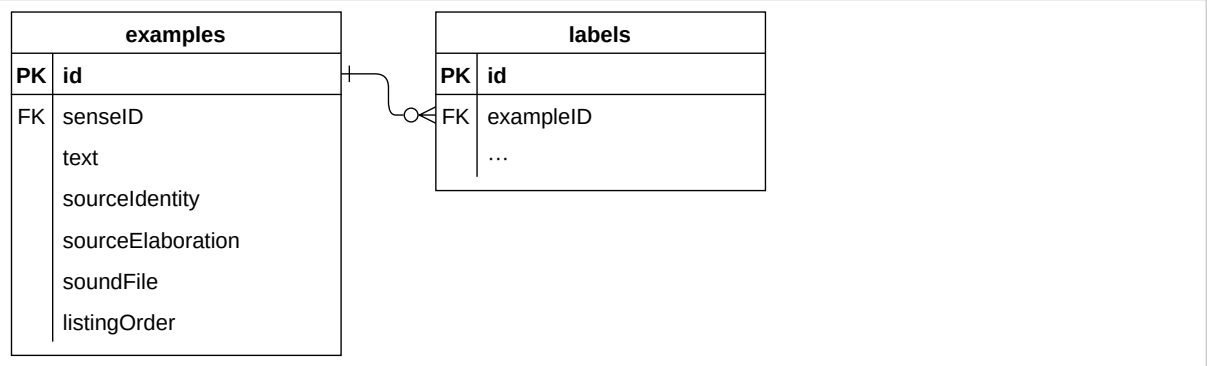
Example 38. JSON

```
{
    "text": "...",
    "sourceIdentity": "...",
    "sourceElaboration": "...",
    "labels": [...],
    "soundFile": "..."
}
```

Example 39. RDF

```
<sense> dmlex:example [
  a dmlex:Example ;
  dmlex:text "..." ;
  dmlex:sourceIdentity "..." ;
  dmlex:sourceElaboration "..." ;
  dmlex:label ... ;
  dmlex:soundFile <...> ;
  dmlex:listingOrder 1 ] .
```

Example 40. Relational database



4 DMLex Crosslingual Module

DMLex's Multilingual Module extends the Core and turns a monolingual lexicographic resource into a bilingual or multilingual one. A bilingual or multilingual lexicographic resource is a lexicographic resource with multiple (two or more) languages: the headwords and the examples are in one language (called the headword language in DMLex) and their translations are in one or more other languages (called the translation languages in DMLex).

4.1 Extensions to `lexicographicResource`

Extends the `lexicographicResource` object type from the Core.

Additional contents

- `translationLanguage` REQUIRED (one or more)

Example 41. XML

```
<lexicographicResource ...>
    ...
    <translationLanguage.../>
</lexicographicResource>
```

Example 42. JSON

```
{
    ...,
    "translationLanguages": [...]
}
```

Example 43. RDF

```
<#lexicographicResource> dmlex:translationLanguage ...
```

4.2 `translationLanguage`

Represents one of the languages in which translations are given in this lexicographic resource. Examples: Section 9.8, “Defining a bilingual lexicographic resource”, Section 9.9, “Defining a multilingual lexicographic resource”.

Child of

- `lexicographicResource`

Contents

- `value` REQUIRED (exactly one). The IETF language code of the language.

- `listingOrder` REQUIRED (exactly one). Number. sets the order in which translations (of headwords and examples) should be shown. It outranks the listing order given in `headwordTranslation`, `headwordExplanation` and `exampleTranslation` objects.

Example 44. XML

```
<translationLanguage langCode=""/>
```

John: shouldn't the XML attribute be value??

Example 45. JSON

```
"..."
```

Example 46. RDF

```
<#lexicographicResource> dmlex:translationLanguage [
  dmlex:value ... ;
  dmlex:listingOrder 0 ] .
```

Example 47. Relational database

translationLanguages	
PK	**langCode**
FK	lexicographicResourceID
	listingOrder

4.3 Extensions to sense

Extends the `sense` object type from the Core.

Additional contents

- `headwordExplanation` OPTIONAL (zero, one or more)
- `headwordTranslation` OPTIONAL (zero, one or more)

Example 48. XML

```
<sense ...>
    ...
    <headwordExplanation.../>
    <headwordTranslation.../>
    ...
</sense>
```

Example 49. JSON

```
{
    ...
    "headwordExplanations": [...],
    "headwordTranslations": [...],
    ...
}
```

Example 50. RDF

<#sense> dmlex:headwordExplanation ... ; dmlex:headwordTranslation ... .

4.4 headwordTranslation

Represents one of possibly multiple translations of a headword. Examples: Section 9.10, “How to use headwordTranslation in a bilingual lexicographic resource”, Section 9.11, “How to use headwordTranslation in a multilingual lexicographic resource”.

Child of

- sense

Contents

- text REQUIRED (exactly one). Non-empty string.
- language OPTIONAL (zero or one) if only one translation language exists in thelexicographic resource, REQUIRED (one or more) otherwise. IETF language tag. Indicates the language of this translation. The translationLanguage datatype can be used to explain the meaning of the language codes that appear here and/or to constrain which language codes are allowed.
- listingOrder REQUIRED (exactly one). Number. The position of this translation among other translations of the same sense in the same language. Can be implicit from the serialization.
- partOfSpeech OPTIONAL (zero, one or more).
- label OPTIONAL (zero, one or more).
- pronunciation OPTIONAL (zero, one or more).
- inflectedForm OPTIONAL (zero, one or more).

Example 51. XML

```
<headwordTranslation language="...">
    <text>...</text>
    <partOfSpeech.../>
    <label.../>
    <pronunciation.../>
    <inflectedForm.../>
</headwordTranslation>
```

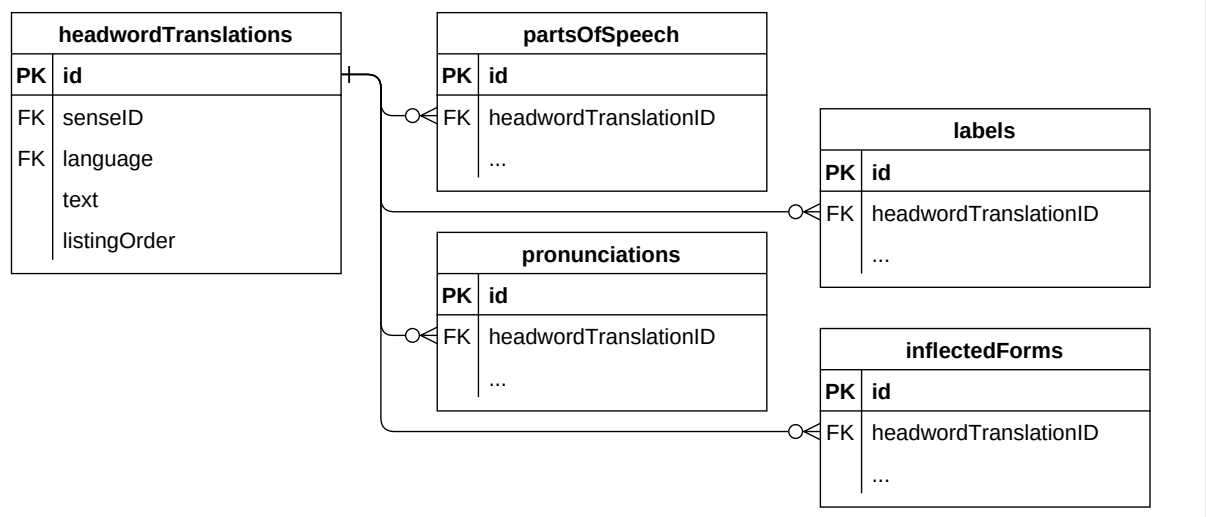
Example 52. JSON

```
{
    "language": "...",
    "text": "...",
    "partsOfSpeech": [...],
    "labels": [...],
    "pronunciations": [...],
    "inflectedForms": [...]
}
```

Example 53. RDF

```
<#sense> dmlex:headwordTranslation [
  dmlex:language "..." ;
  dmlex:text "..." ;
  dmlex:partOfSpeech ... ;
  dmlex:label ... ;
  dmlex:pronunciation ... ;
  dmlex:inflectedForm ... ] .
```

Example 54. Relational database



4.5 headwordExplanation

Represents a statement in the target language which explains (but does not translate) the meaning of the headword. Example: Section 9.12, “How to use headwordExplanation”.

Child of

- sense

Contents

- text REQUIRED (exactly one). Non-empty string.

- `language` OPTIONAL (zero or one) if only one translation language exists in thelexicographic resource, REQUIRED (one or more) otherwise. IETF language tag. Indicates the language in which this explanation is written. The `translationLanguage` datatype can be used to explain the meaning of the language codes that appear here and/or to constrain which language codes are allowed.

Comments

- It is assumed that there will always be a maximum of one `headwordExplanation` per translation language in each sense. For this reason, `headwordExplanation` does not have a `listingOrder`.

Example 55. XML

```
<headwordExplanation language="...">...</headwordExplanation>
```

Example 56. JSON

```
{
    "language": "...",
    "text": "...",
}
```

Example 57. RDF

```
<#sense> dmlex:headwordExplanation [
  dmlex:language "..." ;
  dmlex:text "..." ] .
```

Example 58. Relational database

headwordExplanations	
PK	**id**
FK	senseID
FK	language
	text

4.6 Extensions to `example`

Extends the `example` object type from the Core.

Additional contents

- `exampleTranslation` OPTIONAL (zero, one or more)

Example 59. XML

```
<example ...>
    ...
    <exampleTranslation.../>
</example>
```

Example 60. JSON

```
{
    ...,
    "exampleTranslations": [...]
}
```

Example 61. RDF

```
<#example> dmlex:exampleTranslation ... .
```

4.7 exampleTranslation

Represents the translation of an example.

Child of

- `example`

Contents

- `text` REQUIRED (exactly one). Non-empty string.
- `language` OPTIONAL (zero or one) if only one translation language exists in thelexicographic resource, REQUIRED (one or more) otherwise. IETF language tag. Indicates the language of this translation. The `translationLanguage` datatype can be used to explain the meaning of the language codes that appear here and/or to constrain which language codes are allowed.
- `soundFile` OPTIONAL (zero or one). A pointer to a file, such as a filename or a URI, containing a sound recording of the translation.
- `listingOrder` REQUIRED (exactly one). Number. The position of this translation among other translations of the same example in the same language. Can be implicit from the serialization.

Example 62. XML

```
<exampleTranslation language="..." soundFile="...">
    <text>...</text>
    <label.../>
</exampleTranslation>
```

Example 63. JSON

```
{
    "language": "...",
    "text": "...",
    "labels": [...],
    "soundFile": "..."
}
```

Example 64. RDF

```
<#example> dmlex:exampleTranslation [
  dmlex:language "..." ;
  dmlex:text "..." ;
  dmlex:label ... ;
  dmlex:soundFile "..." ] .
```

Example 65. Relational database

exampleTranslations	
PK	**id**
FK	exampleID
FK	language
	text
	soundFile
	listingOrder

4.8 Extensions to `partOfSpeech`

Extends the `partOfSpeech` object type from the Core.

Can additionally be a child of

- `headwordTranslation`

Example 66. Relational database

partsOfSpeech	
PK	**id**
FK	entryID
FK	headwordTranslationID
	tag
	listingOrder

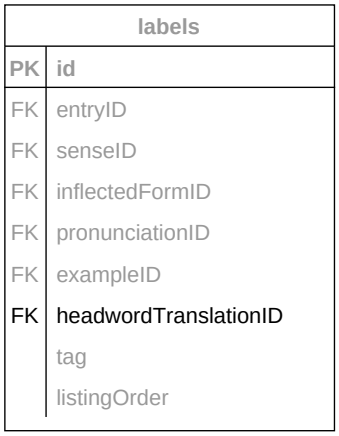
4.9 Extensions to `label`

Extends the `label` object type from the Core.

Can additionally be a child of

- `headwordTranslation`

Example 67. Relational database



labels	
PK	id
FK	entryID
FK	senseID
FK	inflectedFormID
FK	pronunciationID
FK	exampleID
FK	headwordTranslationID
	tag
	listingOrder

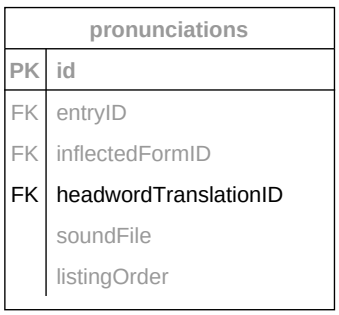
4.10 Extensions to `pronunciation`

Extends the `pronunciation` object type from the Core.

Can additionally be a child of

- `headwordTranslation`

Example 68. Relational database



pronunciations	
PK	id
FK	entryID
FK	inflectedFormID
FK	headwordTranslationID
	soundFile
	listingOrder

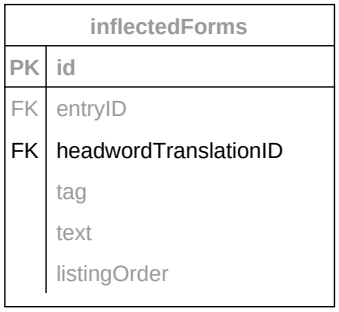
4.11 Extensions to `inflectedForm`

Extends the `inflectedForm` object type from the Core.

Can additionally be a child of

- `headwordTranslation`

Example 69. Relational database



5 DMLex Controlled Values Module

DMLex's Controlled Values Module extends the Core and makes it possible to represent inventories from which the values of various properties come from, such as parts of speech, labels, inlected form tags and others.

Comments

- In a lexicographic resource, `tag` objects can used to define controlled vocabularies (inventories of part-of-speech tags, labels etc.) and constrains on where they are expected to be used (e.g. part-of-speech tags are expected to be used as `value` of `partOfSpeech` objects).

  Enforcing these constraints in an implementation of DMLex, for example as business rules in a dictionary-writing system, is OPTIONAL: an implementation of DMLex is compliant regardless of whether it enforces the constraints defined by `tag` objects or not.

5.1 Extensions to `lexicographicResource`

Extends the `lexicographicResource` object type from the Core.

Additional contents

- `definitionTypeTag` OPTIONAL (zero or more)
- `inflectedFormTag` OPTIONAL (zero or more)
- `labelTag` OPTIONAL (zero or more)
- `partOfSpeechTag` OPTIONAL (zero or more)
- `sourceIdentityTag` OPTIONAL (zero or more)

Example 70. XML

```
<lexicographicResource ...>
    ...
    <definitionTypeTag.../>
    <inflectedFormTag.../>
    <labelTag.../>
    <partOfSpeechTag.../>
    <sourceIdentityTag.../>
</lexicographicResource>
```

Example 71. JSON

```
{
    ...,
    "definitionTypeTags": [...],
    "inflectedFormTags": [...],
    "labelTags": [...],
    "partOfSpeechTags": [...],
    "sourceIdentityTags": [...]
}
```

Example 72. RDF

```
<#lexicographicResource>
  dmlex:definitionTypeTag ...
  dmlex:inflectedFormTag ...
  dmlex:labelTag ...
  dmlex:partOfSpeechTag ...
  dmlex:sourceIdentityTag ...
```

5.2 partOfSpeechTag

Represents one (of many) possible values for `tag` of `partOfSpeech`. Example: Section 9.6, “How to use tag”.

Child of

- `lexicographicResource`

Contents

- `value` REQUIRED (exactly one). Non-empty string. An abbreviation, a code or some other string of text.
- `description` OPTIONAL (zero or one). Non-empty string. A human-readable description of what the tag means.
- `sideConstraint` OPTIONAL (zero or one). If present, indicates whether this tag is intended to be used on the headword side or on the translation side of the lexicographic resource. One of:
  - `headwordSide` This tag is supposed to be used on the headword side of the lexicographic resource: anywhere except inside a `headwordTranslation` object.
  - `translationSide` This tag is supposed to be used on the translation side of the lexicographic resource: inside a `headwordTranslation` object only.
- `translationLanguageConstraint` OPTIONAL (zero, one or more). If present, says that if this tag is being used inside a `headwordTranslation` object, then it is intended to be used only inside a `headwordTranslation` object labelled with this language.
- `sameAs` OPTIONAL (zero, one or more).

Example 73. XML

```
<partOfSpeechTag value="..." sideConstraint="...">
    <description>...</description>
    <translationLanguageConstraint langCode="..."/>
    <sameAs.../>
</tag>
```

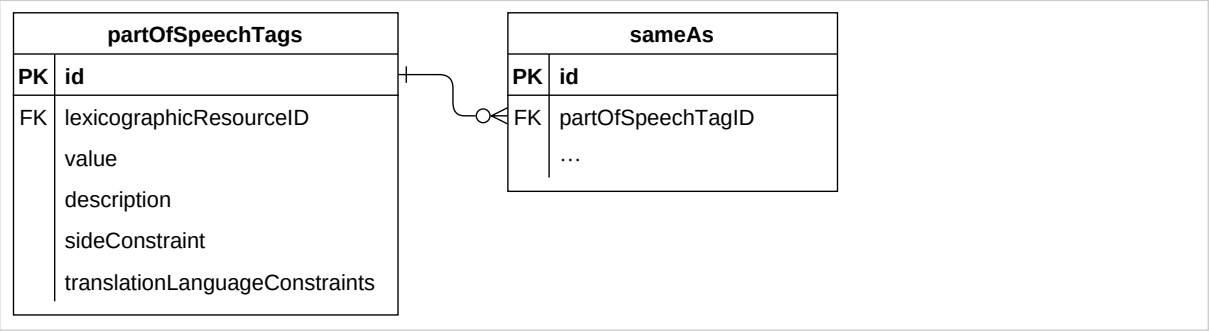
Example 74. JSON

```
{
    "value": "...",
    "description": "...",
    "sideConstraint": "...",
    "translationLanguageConstraint": ["..."]
    "sameAs": [...]
}
```

Example 75. RDF

```
<entry> dmlex:partOfSpeechTag [
  a dmlex:PartOfSpeechTag ;
  dmlex:description "..." ;
  dmlex:sideConstraint "..." ;
  dmlex:translationLanguageConstraint "..." .
  dmlex:sameAs ... ] .
```

Example 76. Relational database



The `translationLanguageConstraints` column is a comma-delimited list of language codes.

5.3 `inflectedFormTag`

Represents one (of many) possible values for `tag` of `inflectedForm`. Example: Section 9.6, “How to use `tag`”.

Child of

- `lexicographicResource`

Contents

- `value` REQUIRED (exactly one). Non-empty string. An abbreviation, a code or some other string of text.
- `description` OPTIONAL (zero or one). Non-empty string. A human-readable description of what the tag means.
- `sideConstraint` OPTIONAL (zero or one). If present, indicates whether this tag is intended to be used on the headword side or on the translation side of the lexicographic resource. One of:

    - `headwordSide` This tag is supposed to be used on the headword side of the lexicographic resource: anywhere except inside a `headwordTranslation` object.
    - `translationSide` This tag is supposed to be used on the translation side of the lexicographic resource: inside a `headwordTranslation` object only.
- `translationLanguageConstraint` OPTIONAL (zero, one or more). If present, says that if this tag is being used inside a `headwordTranslation` object, then it is intended to be used only inside a `headwordTranslation` object labelled with this language.
- `partOfSpeechConstraint` OPTIONAL (zero, one or more). If present, says that:
    - If this tag is used inside a `headwordTranslation`, then it is intended to be used only inside a `headwordTranslation` labelled with this part of speech.
    - If this tag is used outside a `headwordTranslation`, then it is intended to be used only inside entries that are labelled with this part of speech.
- `sameAs` OPTIONAL (zero, one or more).

Example 77. XML

```
<inflectedFormTag value="..." sideConstraint="...">
    <description>...</description>
    <translationLanguageConstraint langCode="..."/>
    <partOfSpeechConstraint value="..."/>
    <sameAs.../>
</tag>
```

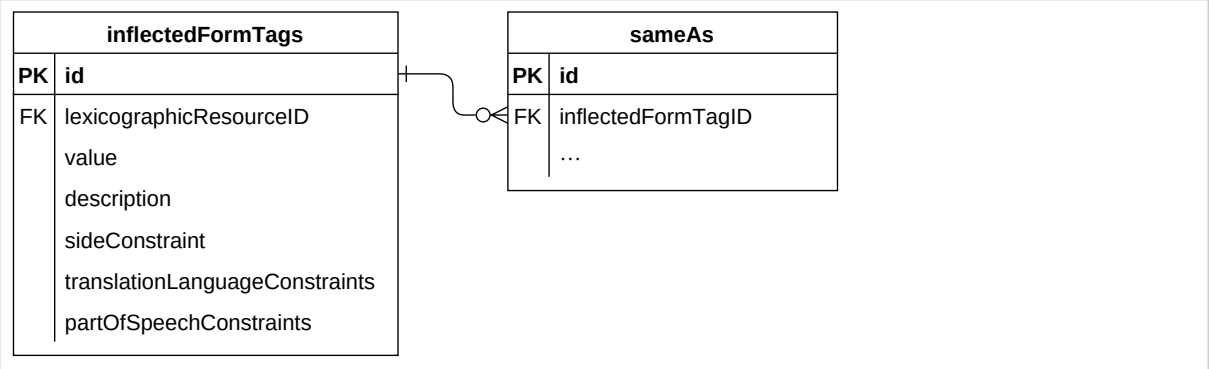
Example 78. JSON

```
{
    "value": "...",
    "description": "...",
    "sideConstraint": "...",
    "translationLanguageConstraint": ["..."]
    "partOfSpeechConstraints": ["..."],
    "sameAs": [...]
}
```

Example 79. RDF

```
<entry> dmlex:inflectedFormTag [
  a dmlex:InflectedFormTag ;
  dmlex:description "..." ;
  dmlex:sideConstraint "..." ;
  dmlex:translationLanguageConstraint "..." .
  dmlex:partOfSpeechConstraint "..." ;
  dmlex:sameAs ... ] .
```

Example 80. Relational database



The `partOfSpeechConstraints` column is a comma-delimited list of part-of-speech labels.

The `translationLanguageConstraints` column is a comma-delimited list of language codes.

5.4 definitionTypeTag

Represents one (of many) possible values for `definitionType` of `definition`.

Child of

- `lexicographicResource`

Contents

- `value` REQUIRED (exactly one). Non-empty string. An abbreviation, a code or some other string of text.
- `description` OPTIONAL (zero or one). Non-empty string. A human-readable description of what the tag means.
- `sameAs` OPTIONAL (zero, one or more).

Example 81. XML

```
<definitionTypeTag value="..."
    <description>...</description>
    <sameAs.../>
</tag>
```

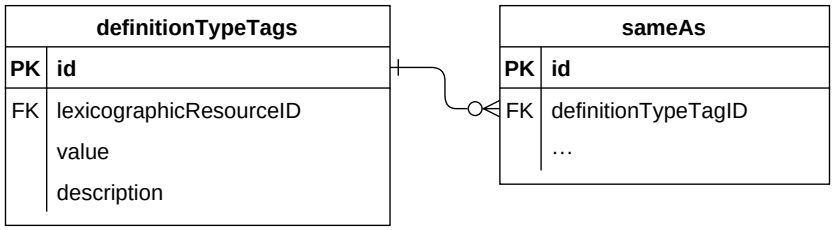
Example 82. JSON

```
{
    "value": "...",
    "description": "...",
    "sameAs": [...]
}
```

Example 83. RDF

```
<entry> dmlex:definitionTypeTag [
  a dmlex:DefinitionTypeTag ;
  dmlex:description "..." ;
  dmlex:sameAs ... ] .
```

Example 84. Relational database



5.5 labelTag

Represents one (of many) possible values for `tag` of `label`.

Child of

- `lexicographicResource`

Contents

- `value` REQUIRED (exactly one). Non-empty string. An abbreviation, a code or some other string of text.
- `description` OPTIONAL (zero or one). Non-empty string. A human-readable description of what the tag means.
- `sideConstraint` OPTIONAL (zero or one). If present, indicates whether this tag is intended to be used on the headword side or on the translation side of the lexicographic resource. One of:
  - `headwordSide` This tag is supposed to be used on the headword side of the lexicographic resource: anywhere except inside a `headwordTranslation` object.
  - `translationSide` This tag is supposed to be used on the translation side of the lexicographic resource: inside a `headwordTranslation` object only.
- `translationLanguageConstraint` OPTIONAL (zero, one or more). If present, says that if this tag is being used inside a `headwordTranslation` object, then it is intended to be used only inside a `headwordTranslation` object labelled with this language.
- `partOfSpeechConstraint` OPTIONAL (zero, one or more). If present, says that:
  - If this tag is used inside a `headwordTranslation`, then it is intended to be used only inside a `headwordTranslation` labelled with this part of speech.
  - If this tag is used outside a `headwordTranslation`, then it is intended to be used only inside entries that are labelled with this part of speech.
- `sameAs` OPTIONAL (zero, one or more).

Example 85. XML

```
<labelTag value="..." sideConstraint="...">
    <description>...</description>
    <translationLanguageConstraint langCode="..."/>
    <partOfSpeechConstraint value="..."/>
    <sameAs.../>
</tag>
```

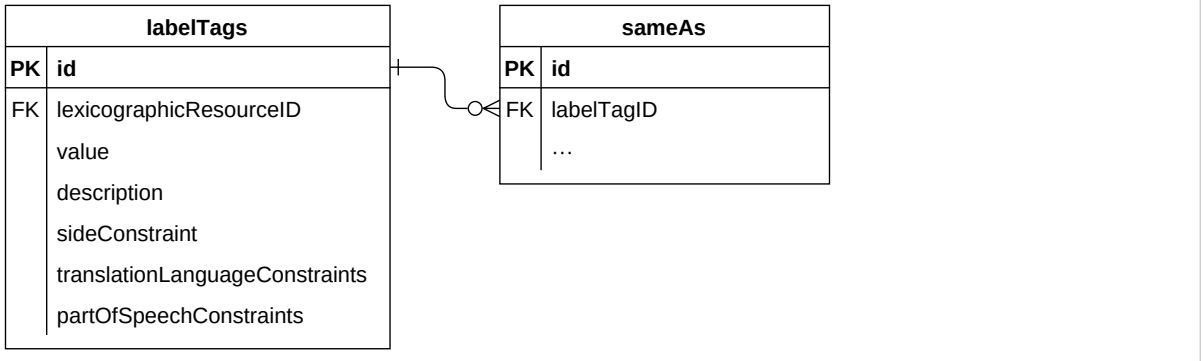
Example 86. JSON

```
{
    "value": "...",
    "description": "...",
    "sideConstraint": "...",
    "translationLanguageConstraint": ["..."]
    "partOfSpeechConstraints": ["..."],
    "sameAs": [...]
}
```

Example 87. RDF

```
<entry> dmlex:labelTag [
  a dmlex:LabelTag ;
  dmlex:description "..." ;
  dmlex:sideConstraint "..." ;
  dmlex:translationLanguageConstraint "..." .
  dmlex:partOfSpeechConstraint "..." ;
  dmlex:sameAs ... ] .
```

Example 88. Relational database



The `partOfSpeechConstraints` column is a comma-delimited list of part-of-speech labels.

The `translationLanguageConstraints` column is a comma-delimited list of language codes.

5.6 sourceIdentityTag

Represents one (of many) possible values for `sourceIndentity` of `example`.

Child of

- `lexicographicResource`

Contents

- `value` REQUIRED (exactly one). Non-empty string. An abbreviation, a code or some other string of text.
- `description` OPTIONAL (zero or one). Non-empty string. A human-readable description of what the tag means.
- `sameAs` OPTIONAL (zero, one or more).

Example 89. XML

```
<sourceIdentityTag value="..."
    <description>...</description>
    <sameAs.../>
</tag>
```

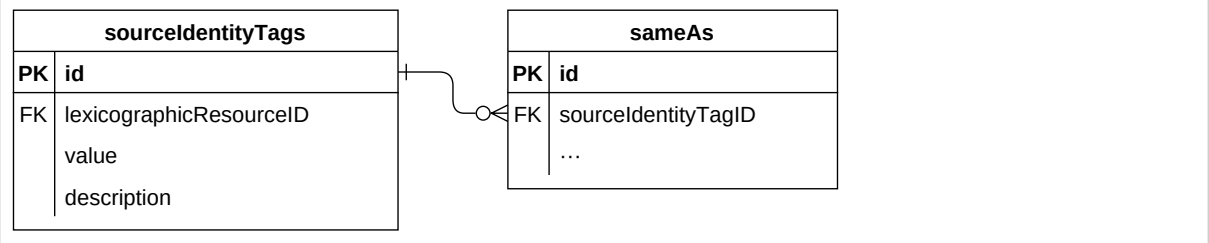
Example 90. JSON

```
{
    "value": "...",
    "description": "...",
    "sameAs": [...]
}
```

Example 91. RDF

```
<entry> dmlex:sourceIdentityTag [
  a dmlex:SourceIdentityTag ;
  dmlex:description "..." ;
  dmlex:sameAs ... ] .
```

Example 92. Relational database



5.7 sameAs

Represents the fact that the parent object is equivalent to an item available from an external authority. Example: Section 9.7, “Mapping tag to external inventories”.

Child of

- definitionTypeTag
- inflectedFormTag
- labelTag
- partOfSpeechTag
- sourceIdentityTag

Contents

- value REQUIRED (exactly one). The URI of an item in an external inventory.

Example 93. XML

```
<sameAs uri="..."/>
```

Example 94. JSON

```
"..."
```

Example 95. Relational database

sameAs	
PK	**id**
FK	definitionTypeTagID
FK	inflectedFormTagID
FK	labelTagID
FK	partOfSpeechTagID
FK	sourceIdentityTagID
	uri

6 DMLex Linking Module

DMLex's Linking Module can be used to construct relations between objects which "break out" of the tree-like parent-and-child hierarchy constructed from datatypes from the Core and from other modules. The Linking Module can be used to create relations between senses which are synonyms or antonyms, between entries whose headwords are homonyms or spelling variants, between senses which represent superordinate and subordinate concepts (eg. hypernyms and hyponyms, holonyms and meronyms), between entries and subentries, between senses and subsenses, and many others.

Each relation is represented in DMLex by an instance of the `relation` datatype. A relation brings two or more members together. The fact that an object (such as a sense or an entry) is a member of a relation is represented in DMLex by an instance of the `member` datatype.

The Linking Module can be used to set up relations between objects inside the same lexicographic resource, or between objects residing in different lexicographic resources.

Relations themselves can be members of other relations.

Examples: Section 9.13, “Modelling parts and wholes”, Section 9.14, “Modelling antonyms”, Section 9.15, “Modelling synonyms”, Section 9.16, “Modelling variants”, Section 9.17, “Modelling subsenses”, Section 9.18, “Modelling subentries (at subsense level)”, Section 9.19, “Modelling subentries (at sense level)”.

6.1 Extensions to `lexicographicResource`

Extends the `lexicographicResource` object type from the Core.

Additional contents

- `relation` OPTIONAL (zero, one or more)
- `relationType` OPTIONAL (zero, one or more)

Example 96. XML

```
<lexicographicResource ...>
    ...
    <relation.../>
    <relationType.../>
</lexicographicResource>
```

Example 97. JSON

```
{
    ...,
    "relations": [...],
    "relationTypes": [...]
}
```

Example 98. RDF

```
<#lexicographicResource>
  dmlex:relation ... ;
  dmlex:relationType ... .
```

6.2 `relation`

Represents the fact that a relation exists between two or more objects.

Child of

- `lexicographicResource`

Contents

- `type` REQUIRED (exactly one). Non-empty string. Specifies what type of relation it is, for example a relation between synonyms or a relation between a sense and a subsense. Optionally, `relationType` objects can be used to explain those types and to constrain which types of relations are allowed to exist in the lexicographic resource.
- `description` OPTIONAL (zero or one). Non-empty string. Is an optional human-readable explanation of this relation.
- `member` REQUIRED (two or more).

Example 99. XML

```
<relation type="...">
    <description>...</description>
    <member.../>
</relation>
```

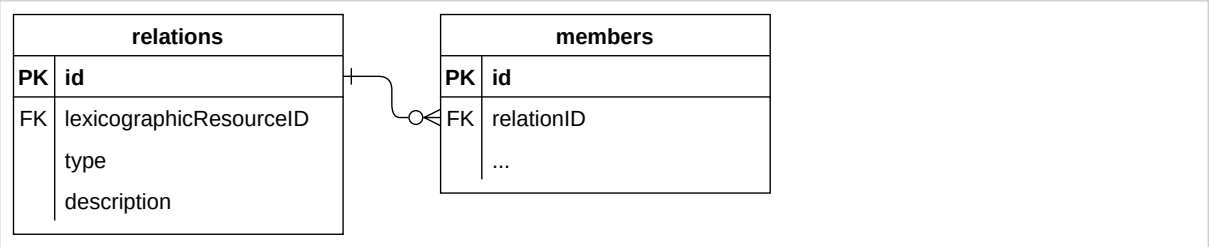
Example 100. JSON

```
{
    "type": "...",
    "description": "...",
    "members": [...]
}
```

Example 101. RDF

```
<#lexicographicResource> dmlex:relation [
  dmlex:type "..." ;
  dmlex:description "..." ;
  dmlex:member ... ] .
```

Example 102. Relational database



6.3 `member`

Represents the fact that an object, such as an entry or a sense, is a member of a relation.

Child of

- `relation`

Contents

- `idref` REQUIRED (exactly one). The ID of an object, such as an entry or a sense.
- `role` OPTIONAL (zero or one). Non-empty string. An indication of the role the member has in this relation: whether it is the hypernym or the hyponym (in a hyperonymy/hyponymy relation), or whether it is one of the synonyms (in a synonymy relation), and so on. You can use `memberRole` objects to explain those roles and to constrain which relations are allowed to contain which roles, what their object types are allowed to be (eg. entries or senses) and how many members with this role each relation is allowed to have.
- `listingOrder` REQUIRED (exactly one). Number. The position of this member among other members of the same relation. When showing members of the relation to human users (for example: when listing the synonyms in a synonymy relation), the members should be listed in this order. This can be implicit from the serialization.
- `obverseListingOrder` REQUIRED (exactly one). Number. The position of this relation among other relations this member is involved in. When an object - such as an entry or a sense - is a member os several relations (for example: when a sense is a member of a synonymy relation and also of a antonymy relation) then, when showing the object (the entry or the sense) to humans users, the relations should be listed in this order (for example: the synonyms first, the antonyms second).

Example 103. XML

```
<member idref="..." role="..." obverseListingOrder="..."/>
```

Example 104. JSON

```
{
    "idref": "...",
    "role": "...",
    "obverseListingOrder": "..."
}
```

Example 105. RDF

```
<#relation> dmlex:member [
  dmlex:idref "..." ;
  dmlex:role "..." ;
  dmlex:listingOrder 0 ;
  dmlex:obverseListingOrder 0 ] .
```

Example 106. Relational database

members	
PK	**id**
FK	relationID
FK	memberEntryID
FK	memberSenseID
	role
	listingOrder
	obverseListingOrder

6.4 `relationType`

Represents one of possible values for the `type` of `relation`.

Child of

- `lexicographicResource`

Contents

- `value` REQUIRED (exactly one). Non-empty string.
- `description` OPTIONAL (zero or one). Non-empty string. A human-readable explanation of this relation type.
- `scope` OPTIONAL (zero or one). Non-empty string. Specifies restrictions on member of relations of this type. The possible values are:
  - `sameEntry`: members must be within of the same `entry`
  - `sameResource`: members must be within the same `lexicographicResource`
  - `any` (default): no restriction
- `memberRole` OPTIONAL (zero or more).
- `sameAs` OPTIONAL (zero or more).

Example 107. XML

```
<relationType value="..." scope="...">
    <description>...</description>
    <memberRole.../>
    <sameAs.../>
</relationType>
```

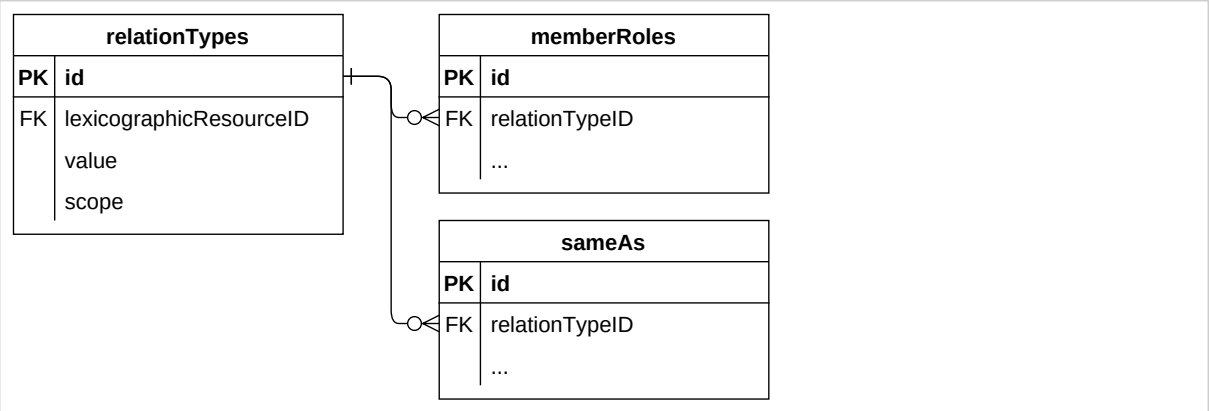
Example 108. JSON

```
{
    "value": "...",
    "scope": "...",
    "memberRoles": [...],
    "sameAs": ["..."]
}
```

Example 109. RDF

```
<#lexicographicResource> dmlex:relationType [
  dmlex:value "..." ;
  dmlex:scope "..." ;
  dmlex:memberRole ... ;
  dmlex:sameAs ... ] .
```

Example 110. Relational database



6.5 `memberRole`

Represents one of possible values for the `role` of `member`, as well as various restrictions on relation member having this role.

Child of

- `relationType`

Contents

- `value` REQUIRED (exactly one). String. If the value is empty, then members having this role do not need to have a `role` property.
- `description` OPTIONAL (zero or one). Non-empty string. A human-readable explanation of this member role.
- `memberType` REQUIRED (exactly one). Non-empty string. A restrictions on the types of objects that can have this role. The possible values are:
  - `sense`: the object that has this role must be a `sense`.
  - `entry`: the object that has this role must be an `entry`.
  - `itemMarker`: the object that has this role must be an `itemMarker` (from the Linking module).
- `min` OPTIONAL (zero or one). Number. Says that relations of this type must have at least this many members with this role. If omitted then there is no lower limit (effectively, zero).
- `max` OPTIONAL (zero or one). Number. Says that relations of this type may have at most this many members with this role. If omitted then there is no upper limit.
- `action` REQUIRED (exactly one). Non-empty string. Gives instructions on what machine agents should do when showing this relation to a human user (either on its own or in the context of one of its members). The possibe values are:
  - `embed`: Members that have this role should be shown in their entirety, i.e. the entire entry or the entire sense. This is suitable for relations between entries and subentries, or senses and subsenses.
  - `navigate`: Members that have this role should not be shown in their entirety. A navigable (e.g. clickable) link should be provided instead. This is suitable for relations between synonyms, antonyms, holonyms/heteronyms and similar.
  - `none`: Members that have this role should not shown.
- `sameAs` OPTIONAL (zero or more).

Example 111. XML

```
<memberRole value="..." memberType="..." min="..." max="..." action="...">
    <description></description>
    <sameAs.../>
</memberRole>
```

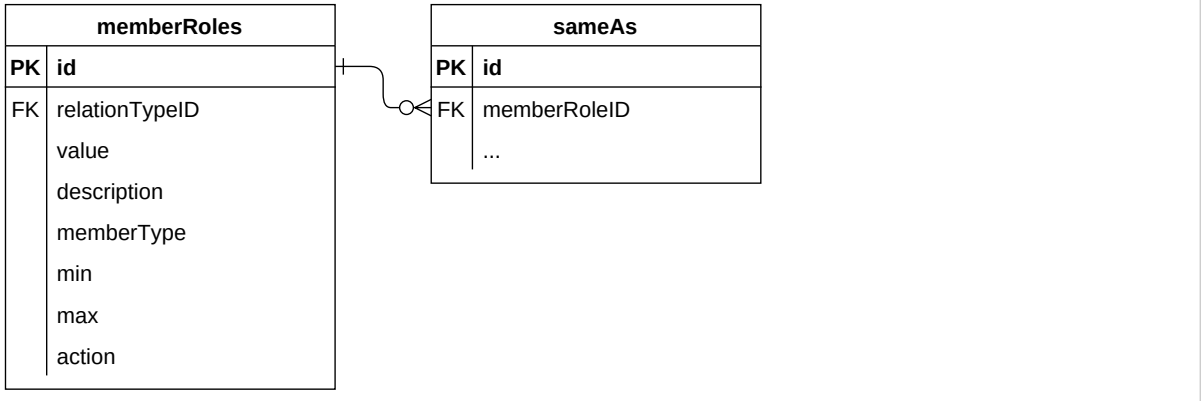
Example 112. JSON

```
{
    "value": "...",
    "description": "...",
    "memberType": "...",
    "min": "...",
    "max": "...",
    "action": "...",
    "sameAs": [...]
}
```

Example 113. RDF

```
<#relationType> dmlex:memberRole [
  dmlex:value "..." ;
  dmlex:description "..." ;
  dmlex:memberType "..." ;
  dmlex:min 0 ;
  dmlex:max 0 ;
  dmlex:action "..." ;
  dmlex:sameAs ... ] .
```

Example 114. Relational database



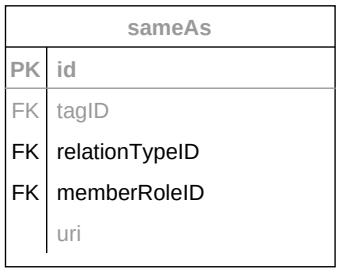
6.6 Extensions to sameAs

Extends the `sameAs` object type from the Controlled Values Module.

Can additionally be a child of

- `relationType`
- `memberRole`

Example 115. Relational database



7 DMLex Annotation Module

This module makes it possible to mark up substrings inside the string values of certain objects and to attach properties to them.

It is up to the implementer to decide how to implement annotations in an implementation of the DMLex Annotation module, whether as inline markup (as XML) or as stand-off annotations (for example through start and end indexes).

7.1 Extensions to `entry`

Extends the `entry` object type from the Core.

Additional contents

- `placeholderMarker` OPTIONAL (zero, one or more)

Example 116. XML

```
<headword>
    ...<placeholderMarker>...</placeholderMarker>...
</headword>
```

Example 117. JSON

```
{
    ...,
    "headword": "...",
    "placeholderMarkers": [...],
    ...
}
```

Example 118. RDF

```
<#entry> dmlex:headword [
  dmlex:value "..." ;
  dmlex:placeholderMarkers ... ] .
```

7.2 Extensions to `headwordTranslation`

Extends the `headwordTranslation` object type from the Crosslingual module.

Additional contents

- `placeholderMarker` OPTIONAL (zero, one or more)

Example 119. XML

```
<headwordTranslation>
    <text>
        ...<placeholderMarker>...</placeholderMarker>...
    </text>
</headwordTranslation>
```

Example 120. JSON

```
{
    "text": "...",
    "headwordMarkers": [...],
    "itemMarkers": [...],
    ...
}
```

Example 121. RDF

```
<#sense> dmlex:headwordTranslation [
  dmlex:headwordMarkers ... ;
  dmlex:itemMarkers ... ] .
```

7.3 `placeholderMarker`

Marks up a substring inside a headword or inside a headword translation which is not part of the expression itself but stands for things that can take its place. An application can use the inline markup to format the placeholders differently from the rest of the text, to ignore the placeholder in full-text search, and so on. Examples: Section 9.20, “Using `placeholderMarker`”, Section 9.21, “Using `placeholderMarker` in a bilingual lexicographic resource”.

Child of

- `entry`
- `headwordTranslation`

Example 122. XML

```
<placeholderMarker>...</placeholderMarker>
```

Example 123. JSON

```
{
    "startIndex": ...,
    "endIndex": ...
}
```

Example 124. RDF

```
<#headword> dmlex:placeholderMarker [
  dmlex:startIndex 0 ;
  dmlex:endIndex 1 ] .
```

Example 125. Relational databases

7.4 Extensions to `definition`

Extends the `definition` object type from the Core.

Additional contents

- `headwordMarker` OPTIONAL (zero, one or more)
- `itemMarker` OPTIONAL (zero, one or more)

Example 126. XML

```
<definition...>
    ...
    <headwordMarker>...</headwordMarker>
    ...
    <itemMarker...>...</itemMarker>
    ...
</definition>
```

Example 127. JSON

```
{
    "text": "...",
    "headwordMarkers": [...],
    "itemMarkers": [...],
    ...
}
```

Example 128. RDF

```
<#sense> dmlex:definition [
  dmlex:text "..." ;
  dmlex:headwordMarker ... ;
  dmlex:itemMarker ... ] .
```

7.5 Extensions to `example`

Extends the `example` object type from the Core.

Additional contents

- `headwordMarker` OPTIONAL (zero, one or more)
- `itemMarker` OPTIONAL (zero, one or more)

Example 129. XML

```
<example>
    <text>
        ...
        <headwordMarker>...</headwordMarker>
        ...
        <itemMarker...>...</itemMarker>
        ...
    </text>
</example>
```

Example 130. JSON

```
{
    "text": "...",
    "headwordMarkers": [...],
    "itemMarkers": [...],
    ...
}
```

Example 131. RDF

```
<#sense> dmlex:example [
  dmlex:text "..." ;
  dmlex:headwordMarker ... ;
  dmlex:itemMarker ... ] .
```

7.6 Extensions to `exampleTranslation`

Extends the `exampleTranslation` object type from the Crosslingual module.

Additional contents

- `headwordMarker` OPTIONAL (zero, one or more)
- `itemMarker` OPTIONAL (zero, one or more)

Example 132. XML

```
<exampleTranslation>
    <text>
        ...
        <headwordMarker>...</headwordMarker>
        ...
        <itemMarker...>...</itemMarker>
        ...
    </text>
</exampleTranslation>
```

Example 133. JSON

```
{
    "text": "...",
    "headwordMarkers": [...],
    "itemMarkers": [...],
    ...
}
```

Example 134. RDF

```
<#example> dmlex:exampleTranslation [
  dmlex:text "..." ;
  dmlex:headwordMarker ... ;
  dmlex:itemMarker ... ] .
```

7.7 `headwordMarker`

Marks up a substring inside an example, inside an example translation or inside a definition which corresponds to the headword (or to a translation of the headword). An application can use the inline markup to highlight the occurence of the headword for human readers through formatting. Example: Section 9.22, “Using `headwordMarker`”.

Child of

- `definition`

- `example`
- `exampleTranslation`

Example 135. XML

```
<headwordMarker>...</headwordMarker>
```

Example 136. JSON

```
{
    "startIndex": ...,
    "endIndex": ...
}
```

Example 137. RDF

```
<#definition> dmlex:headwordMarker [
  dmlex:startIndex 0 ;
  dmlex:endIndex 0 ] .
```

Example 138. Relational databases

7.8 `itemMarker`

Marks up a substring other than the headword inside an example, inside an example translation or inside a definition. An application can use the inline markup to highlight collocates or constituents. Example: Section 9.23, “Using `itemMarker`”.

Child of

- `definition`
- `example`
- `exampleTranslation`

Contents

- `id` OPTIONAL (zero or one). A unique identifier of the marker. Markers which have idenfitiers are capable of being involved in relations created with the Linking module.
- `lemma` OPTIONAL (zero or one). Non-empty string. The lemmatized form of the collocate. An application can use it to provide a clickable link for the user to search for the lemma in the rest of the lexicographic resource or on the web. (If you want to link the collocate explicitly to a specific entry or to a specific sense in your lexicographic resource, or even in an external lexicographic resource, you can use the Linking Module for that.)

- `itemRole` OPTIONAL (zero, one or more). Non-empty string. Can be used to communicate facts about the role of the item in the sentence, for example its syntactic role (subject, direct object etc.), its semantic role (agent, affected etc) or its semantic type (human, institution etc.) The `tag` object type can be used to explain and/or constrain the item types that are allowed to appear in the lexicographic resource.

Example 139. XML

```
<itemMarker id="..." lemma="...">
    ...
    <itemRole value="..."/>
</itemMarker>
```

Example 140. JSON

```
{
    "id": "...",
    "startIndex": ...,
    "endIndex": ...,
    "lemma": "...",
    "itemRoles": ["..."]
}
```

Example 141. RDF

```
<#definition> dmlex:itemMarker [
  dmlex:id "..." ;
  dmlex:startIndex 0 ;
  dmlex:endIndex 0 ;
  dmlex:lemma "..." ;
  dmlex:itemRole ... ] .
```

Example 142. SQL

8 Etymology Module

Extends DMLex Core to support the modelling of etymological information in dictionaries.

8.1 Extensions to `entry`

Additional children:

```
entry: ...
  etymology: (0..n)
```

8.1.1 XML

```
<entry>
  ...
  <etymology>...</etymology>
</entry>
```

8.1.2 JSON

```
{
  "etymology": ...
}
```

8.1.3 RDF

```
<Entry> dmlex:etymology ... .
```

8.2 `etymology`

An `etymology` represents the historical derivation of a word.

```
etymology:
  etymDescription: (0..n)
  etymon: (0..n)
  multiEtymon: (0..n)
```

8.2.1 XML

```
<etymology>
```

```
  <etymDescription>...</etymDescription>
  <etymon>...</etymon>
  <multiEtymon>...</multiEtymon>
</etymology>
```

8.2.2 JSON

```
{
  "etymDescription": ... ,
  "etymon": ... ,
  "multiEtymon": ...
}
```

8.2.3 RDF

```
<entry> dmlex:etymology [
  dmlex:etymDescription "..." ;
  dmlex:etymon ... ,
  dmlex:multiEtymon ... ] .
```

8.3 `etymDescription`

A plain text form of the etymology, which may contain notes about the etymology. This may be used instead or alongside a structured set of `etymon` objects.

```
etymDecscription: <string>
```

8.3.1 XML

```
<etymDescription>...</etymDescription>
```

8.3.2 JSON

```
{
  "value": "..."
}
```

8.3.3 RDF

```
<etymololgy> dmlex:etymDescription [
```

```
  dmlex:value "..." ] .
```

8.4 etymon

Represents a form (typically a word) which is the etymological origin of the entry or another etymologically related form

```
etymon: <id>
  text: (1..1) <string>
  type: (0..1) <string>
  language: (1..1) <string>
  note: (0..1) <string>
  reconstructed: (0..1) <boolean>
  label: (0..1) <string>
  href: (0..1) <url>
  listingOrder: (1..1) <number>
  etymTranslation: (0..n)
  etymDate: (0..1)
```

8.4.1 XML

```
<etymon id="..." href="...">
  <text>...</text>
  <type>...</type>
  <language>...</language>
  <note>...</note>
  <reconstructed>...</reconstructed>
  <label>...</label>
  <etymTranslation>...</etymTranslation>
  <etymDate>...</etymDate>
</etymon>
```

8.4.2 JSON

```
{
  "text": "..." ,
  "type": "..." ,
  "language": "..." ,
  "note": "..." ,
  "reconstructed": true ,
  "label": "..." ,
  "etymTranslation": [...] ,
  "etymDate": ... ,
}
```

8.4.3 RDF

```
<etymon>
```

```
  dmlex:text "..." ;
  dmlex:type "..." ;
  dmlex:language "..." ;
  dmlex:note "..." ;
  dmlex:reconstructed true ;
  dmlex:etymonLabel "..." ;
  dmlex:listingOrder 0 ;
  dmlex:etymTranslation ... ;
  dmlex:etymDate ... .
```

Comments

- Etymons have `id`s to allow etymons to be members of relations
- The `type` of the etymology may have typical values including `derivation`, `cognate` or `borrowing`. Values can be specified using `tag` objects.
- The `language` of the origin form should be specified with a `EtymonLanguage` mapping.
- The `note` conatins extra information about the language, for example the approximate time (e.g., 16th century) or geographical variants
- `reconstructed` indicates that the form is reconstructed and not attested in any corpus
- The `label` indicates the grammatical category of the etymon. Values can be specified using `tag` objects.
- The `href` a reference to a source for this etymology in an external resource
- If this etymon is part of a multietymon (a child of `MultiEtymon`) the `listingOrder` indicates the order of this etymon. If this etymon is not part of a multietymon, then indicates its position among other etymons amd multietymons in the entry. This value may be implicit in some serializations.
- The `etymDate` indicates the time period the etymological word was used in. For multi-etymons there SHOULD be no dates.

8.5 `multiEtymon`

Indicates a combination of multiple historical or borrowed forms that have been combined to make this entry.

```
multiEtymon: <id>
  etymon (2..n)
  type: (0..1) <string>
  language: (1..1) <string>
  note: (0..1) <string>
  reconstructed: (0..1) <boolean>
  label: (0..1) <string>
  href: (0..1) <url>
  listingOrder: (1..1) <number>
  etymTranslation: (0..n)
  etymDate: (0..1)
```

8.5.1 XML

```
<multiEtymon id="..." href="...">
  <etymon>...</etymon>
  <etymon>...</etymon>
  <type>...</type>
  <language>...</language>
  <note>...</note>
```

```
  <reconstructed>...</reconstructed>
  <label>...</label>
  <etymTranslation>...</etymTranslation>
  <etymDate>...</etymDate>
>/multiEtymon<
```

8.5.2 JSON

```
{
  "etymon": [...] ,
  "type": "..." ,
  "language": "..." ,
  "note": "..." ,
  "reconstructed": true ,
  "label": "..." ,
  "etymTranslation": [...] ,
  "etymDate": ... ,
}
```

8.5.3 RDF

```
<multietymon>
  dmlex:etymon ... ;
  dmlex:type "..." ;
  dmlex:language "..." ;
  dmlex:note "..." ;
  dmlex:reconstructed true ;
  dmlex:etymonLabel "..." ;
  dmlex:listingOrder 0 ;
  dmlex:etymTranslation ... ;
  dmlex:etymDate ... .
```

8.6 `etymTranslation`

Gives a translation of a historical or borrowed form in the language of the dictionary

```
etymTranslation: <value>
```

8.6.1 XML

```
<etymTranslation>...</etymTranslation>
```

8.6.2 JSON

```
{
```

```
  "value": "..."
}
```

8.6.3 RDF

```
<etymon> dmlex:etymTranslation [
  dmlex:value "..." ] .
```

8.7 `etymDate`

Gives a period of time for which an etymology was valid

```
etymDate:
  start: (0..1) <string>
  end: (0..1) <string>
```

8.7.1 XML

```
<etymDate start="..." end="..."/>
```

8.7.2 JSON

```
{
  "start": "..."
  "end": "..."
}
```

8.7.3 RDF

```
<etymon> dmlex:etymDate [
  dmlex:start "..." ;
  dmlex:end "..." ].
```

Comments

- `start` and `end` indicate the date of when this etymon was used. This can be a year in the Gregorian calendar or an approximate value.

8.8 Extensions to `tag`

Additional allowed values for the `target` property, allows the specification of values for the `etymonType` and `etymonLabel` properties of `etymon`

```
tag:
  target: etymonType/etymonLabel
```

8.8.1 XML

```
<tag>
  <target value="etymonType"/>
  <target value="etymonLabel"/>
</tag>
```

8.8.2 JSON

```
{
  "targets": ["etymonType", "etymonLabel"]
}
```

8.8.3 RDF

```
<tag> dmlex:target dmlex:etymonType, dmlex:etymonLabel .
```

8.9 Extensions to `lexicographicResource`

Additional children:

```
lexicographicResource ...
  etymonLanguage: (0..n)
```

8.9.1 XML

```
<lexicographicResource>
  <etymonLanguage>...<etymonLanguage/>
</lexicographicResource>
```

8.9.2 JSON

```
{
```

```
  ...
  "etymonLanguage": [...]
}
```

8.9.3 RDF

```
<lexicographicResource> dmlex:etymonLanguage ... .
```

8.10 etymonLanguage

Represents one of several allowed values for the `language` property of `etymon` objects. Note that as etymologies frequently refer to languages that are not covered by ISO standards it is necessary to define codes for all languages used in definitions.

```
etymonLanguage: <value>
  iso639-1: (0..1) <string of 2 lowercase letters>
  iso639-3: (0..1) <string of 3 uppercase letters>
  displayValue: (0..1) <string>
```

8.10.1 XML

```
<etymonLanguage value="...">
  <iso639-1>...</iso639-1>
  <iso639-3>...</iso639-3>
  <displayValue>...<displayValue>
</etymonLanguage>
```

8.10.2 JSON

```
{
  "value": "..." ,
  "iso639-1": "..." ,
  "iso639-3": "..." ,
  "displayValue": "..."
}
```

8.10.3 RDF

```
<etymonLanguage> dmlex:value "..." ;
  dmlex:iso639-1 "..." ;
  dmlex:iso639-3 "..." ;
  dmlex:displayValue "... "  .
```

Comments

- The language may be specified with either `iso639-1` and/or `iso639-3` code in the ISO 639 standard if it exists
- `value` indicates value used by the `language` property of a `etymon` (e.g. `ger`). `displayValue` indicates a natural language name for the language, e.g., “Modern High German”

8.11 Extensions to `memberRole`

This extension makes it possible for etymons to be linked (through `relation` objects from the Linking module) to other entities such as other etymons or entries in other dictionaries.

Additional allowed values for the `memberType` property:

```
memberRole: "etymon"
```

8.11.1 XML

```
<memberRole role="etymon"...>
```

8.11.2 JSON

```
{
  "memberRole": "etymon"
}
```

8.11.3 RDF

```
<relationType> dmlex:memberRole dmlex:etymonRole .
```

9 Examples

This section gives examples which show how to use DMLex to model lexicographic resources. The examples are shown in three formalisms: NVH, XML and JSON.

Each example is shown in NVH first. NVH (Name-Value Hierarchy)[^1] is a concise serialization language designed for lexicographic data. NVH encodes data as a hierarchical list of names, values and children, which corresponds exactly to DMLex's own data model. We use NVH here in order to demonstrate the object model at an abstract level.

After that, each example is shown in XML and JSON, two popular serialization languages. The XML and JSON encoding shown here follows DMLex's own implementation guidance for XML and JSON.

9.1 A basic entry

This is a basic, beginner-level example of how to use DMLex to represent a simple monolingual lexicographic resource consisting of one entry with two senses. It demonstrates some of the basic features of DMLex Core: how to subdivide a entry into senses, how attach various data such as definition, part-of-speech labels to entries and senses, and how to add labels to various objects such as senses and examples.

9.1.1 NVH

```
lexicographicResource: my-dictionary
    entry: abandon-verb
        headword: abandon
        partOfSpeech: verb
        sense: abandon-verb-1
            definition: to suddenly leave a place or a person
            example: I'm sorry I abandoned you like that.
            example: Abandon ship!
                label: idiom
        sense: abandon-verb-2
            label: mostly-passive
            definition: to stop supporting an idea
            example: That theory has been abandoned.
```

9.1.2 XML

```
<lexicographicResource id="my-dictionary">
    <entry id="abandon-verb">
        <headword>abandon</headword>
        <partOfSpeech value="verb"/>
        <sense id="abandon-verb-1">
            <definition>to suddenly leave a place or a person</definition>
            <example>
                <text>I'm sorry I abandoned you like that.</text>
            </example>
            <example>
                <text>Abandon ship!</text>
                <label value="idiom"/>
```

```
            </example>
        <sense id="abandon-verb-2">
            <label value="mostly-passive"/>
            <definition>to stop supporting an idea</definition>
            <example>
                <text>That theory has been abandoned.</text>
            </example>
        </sense>
    </entry>
<lexicographicResource>
```

9.1.3 JSON

```
{
    "id": "my-dictionary",
    "entry": {
        "id": "abandon-verb",
        "headword": "abandon",
        "partsOfSpeech": ["verb"],
        "senses": [{
            "id": "abandon-verb-1",
            "definitions": [{
                "text": "to suddenly leave a place or a person"
            }],
            "examples": [{
                "text": "I'm sorry I abandoned you like that."
            }, {
                "text": "Abandon ship!",
                "labels": ["idiom"]
            }]
        }, {
            "id": "abandon-verb-2",
            "labels": ["mostly-passive"],
            "definitions": ["to stop supporting an idea"],
            "examples": [{
                "text": "That theory has been abandoned."
            }]
        }]
    }
}
```

Example 143. RDF

```
<#my-dictionary> dmlex:entry <#abandon-verb> .

<abandon-verb> dmlex:headword "abandon" ;
  dmlex:partOfSpeech "verb" ;
  dmlex:sense <#abandon-verb-1"> , <#abandon-verb-2> .

<#abandon-verb-1< dmlex:definition [
     dmlex:text "to suddenly leave a place or a person" ] ;
   dmlex:example [
     dmlex:text "I'm sorry I abandoned you like that."
   ] , [
     dmlex:text "Abandon ship!" ;
     dmlex:labels "idiom" ] .


<#abandon-verb-2">
  dmlex:label "mostly-passive" ;
  dmlex:definition [
    dmlex:text "to stop supporting an idea" ] ;
  dmlex:example [
    dmlex:text "That theory has been abandoned." ] .
```

9.2 How to use `inflectedForm`

This is an entry from a hypothetical Irish dictionary for the headword "folúsghlantóir" ("vacuum cleaner") which gives its two inflected forms, the singular genitive and the plural.

9.2.1 NVH

```
entry: folúsghlantóir-n
    headword: folúsghlantóir
    partOfSpeech: n-masc
    inflectedForm: folúsghlantóra
        inflectedTag: sg-gen
    inflectedForm: folúsghlantóirí
        inflectedTag: pl
    sense: ...
```

9.2.2 XML

```
<entry id="folúsghlantóir-n">
    <headword>folúsghlantóir</headword>
    <partOfSpeech value="n-masc"/>
    <inflectedForm inflectedTag="sg-gen">folúsghlantóra</inflectedForm>
    <inflectedForm inflectedTag="pl">folúsghlantóirí</inflectedForm>
    <sense>...</sense>
</entry>
```

9.2.3 JSON

```
{
    "id": "folúsghlantóir-n",
    "headword": "folúsghlantóir",
    "partsOfSpeech": ["n-masc"],
    "inflectedForms": [{
        "text": "folúsghlantóra",
        "inflectedTag": "sg-gen",
    }, {
        "text": "folúsghlantóirí",
        "inflectedTag": "pl",
    }],
    "senses": [...]
}
```

9.3 Pronunciation given as transcription

9.3.1 NVH

```
entry: aardvark-noun
    headword: aardvark
    pronunciation:
        transcription: a:rdva:rk
    sense: ...
```

9.3.2 XML

```
<entry id="aardvark-noun">
    <headword>aardvark</headword>
    <pronunciation>
        <transcription>a:rdva:rk</transcription>
    </pronunciation>
    <sense>...</sense>
</entry>
```

9.3.3 JSON

```
{
    "id": "aardvark-noun",
    "headword": "aardvark",
    "pronunciations": [{
        "transcriptions": [{"text": "a:rdva:rk"}]
    }],
    "senses": [...]
}
```

9.4 Pronunciation given as a sound file

9.4.1 NVH

```
entry: aardvark-noun
    headword: aardvark
    pronunciation:
        soundFile: aardvark.mp3
    sense: ...
```

9.4.2 XML

```
<entry id="aardvark-noun">
    <headword>aardvark</headword>
    <pronunciation soundFile="aardvark.mp3"/>
    <sense>...</sense>
</entry>
```

9.4.3 JSON

```
{
    "id": "aardvark-noun",
    "headword": "aardvark",
    "pronunciations": [{
        "soundFile": "aardvark.mp3"
    }],
    "senses": [...]
}
```

9.5 Pronunciation given both ways

9.5.1 NVH

```
entry: aardvark-noun
    headword: aardvark
    pronunciation:
        transcription: a:rdva:rk
        soundFile: aardvark.mp3
    sense: ...
```

9.5.2 XML

```
<entry id="aardvark-noun">
    <headword>aardvark</headword>
    <pronunciation soundFile="aardvark.mp3">
        <transcription>a:rdva:rk</transcription>
    </pronunciation>
```

```
    <sense>...</sense>
</entry>
```

9.5.3 JSON

```
{
    "id": "aardvark-noun",
    "headword": "aardvark",
    "pronunciations": [{
        "soundFile": "aardvark.mp3",
        "transcriptions": [{"text": "a:rdva:rk"}]
    }],
    "senses": [...]
}
```

9.6 How to use `tag`

This is an entry from a hypothetical Irish dictionary for the headword "folúsghlantóir" ("vacuum cleaner"). The meaning of the various tags used in this entry is explained in the `tag` objects.

9.6.1 NVH

```
lexicographicResource: my-irish-dictionary
    language: ga
    entry: folúsghlantóir-n
        headword: folúsghlantóir
        partOfSpeech: n-masc
        inflectedForm: folúsghlantóra
            inflectedTag: sg-gen
        inflectedForm: folúsghlantóirí
            inflectedTag: pl
        sense: ...
    tag: n-masc
        description: noun, masculine
        target: partOfSpeech
    tag: n-fem
        description: noun, feminine
        target: partOfSpeech
    tag: sg-gen
        description: singular genitive
        target: inflectedTag
        partOfSpeechConstraint: n-masc
        partOfSpeechConstraint: n-fem
    tag: pl
        description: plural
        target: inflectedTag
        partOfSpeechConstraint: n-masc
        partOfSpeechConstraint: n-fem
```

9.6.2 XML

```

```

```
<lexicographicResource id="my-irish-dictionary" language="ga">
    <entry id="folúsghlantóir-n">
        <headword>folúsghlantóir</headword>
        <partOfSpeech value="n-masc"/>
        <inflectedForm inflectedTag="sg-gen">folúsghlantóra</inflectedForm>
        <inflectedForm inflectedTag="pl">folúsghlantóirí</inflectedForm>
        <sense>...</sense>
    </entry>
    <tag value="n-masc">
        <description>noun, masculine</description>
        <target value="partOfSPeech"/>
    </tag>
    <tag value="n-fem">
        <description>noun, feminine</description>
        <target value="partOfSPeech"/>
    </tag>
    <tag value="sg-gen">
        <description>singular genitive</description>
        <target value="inflectedTag"/>
        <partOfSpeechConstraint value="n-masc"/>
        <partOfSpeechConstraint value="n-fem"/>
    </tag>
    <tag value="pl">
        <description>plural</description>
        <target value="inflectedTag"/>
        <partOfSpeechConstraint value="n-masc"/>
        <partOfSpeechConstraint value="n-fem"/>
    </tag>
</lexicographicResource>
```

9.6.3 JSON

```
{
    "id": "my-irish-dictionary",
    "language": "ga",
    "entries": [{
        "id": "folúsghlantóir-n",
        "headword": "folúsghlantóir",
        "partsOfSpeech": ["n-masc"],
        "inflectedForms": [{
            "text": "folúsghlantóra",
            "inflectedTag": "sg-gen",
        }, {
            "text": "folúsghlantóirí",
            "inflectedTag": "pl",
        }],
        "senses": [...]
    }],
    "tags": [{
        "value": "n-masc",
        "description": "noun, masculine",
        "targets": ["partOfSpeech"]
    }, {
        "value": "n-fem",
        "description": "noun, feminine",
        "targets": ["partOfSpeech"]
```

```
    }, {
        "value": "sg-gen",
        "description": "singular genitive",
        "targets": ["inflectedTag"],
        "partOfSpeechConstraints": ["n-masc", "n-fem"]
    }, {
        "value": "pl",
        "description": "plural",
        "targets": ["inflectedTag"],
        "partOfSpeechConstraints": ["n-masc", "n-fem"]
    }]
}
```

9.7 Mapping `tag` to external inventories

This shows how to map the value of a tag such as `n-masc` and `n-fem` to items in an external inventory such as LexInfo.

9.7.1 NVH

```
tag: n-masc
    description: noun, masculine
    target: partOfSpeech
    sameAs: http://www.lexinfo.net/ontology/3.0/lexinfo#noun
    sameAs: http://www.lexinfo.net/ontology/3.0/lexinfo#masculine
tag: n-fem
    description: noun, feminine
    target: partOfSpeech
    sameAs: http://www.lexinfo.net/ontology/3.0/lexinfo#noun
    sameAs: http://www.lexinfo.net/ontology/3.0/lexinfo#feminine
```

9.7.2 XML

```
<tag value="n-masc">
    <description>noun, masculine</description>
    <target value="partOfSPeech"/>
    <sameAs uri="http://www.lexinfo.net/ontology/3.0/lexinfo#noun"/>
    <sameAs uri="http://www.lexinfo.net/ontology/3.0/lexinfo#masculine"/>
</tag>
<tag value="n-fem">
    <description>noun, feminine</description>
    <target value="partOfSPeech"/>
    <sameAs uri="http://www.lexinfo.net/ontology/3.0/lexinfo#noun"/>
    <sameAs uri="http://www.lexinfo.net/ontology/3.0/lexinfo#feminine"/>
</tag>
```

9.7.3 JSON

```
{
    "tags": [{
        "value": "n-masc",
        "description": "noun, masculine",
```

```
        "targets": ["partOfSpeech"],
        "sameAs": [
            "http://www.lexinfo.net/ontology/3.0/lexinfo#noun",
            "http://www.lexinfo.net/ontology/3.0/lexinfo#masculine"
        ]
    }, {
        "value": "n-fem",
        "description": "noun, feminine",
        "targets": ["partOfSpeech"],
        "sameAs": [
            "http://www.lexinfo.net/ontology/3.0/lexinfo#noun",
            "http://www.lexinfo.net/ontology/3.0/lexinfo#feminine"
        ]
    }]
}
```

9.8 Defining a bilingual lexicographic resource

This defines a lexicographic resource where the source language is German and the translation language is English and the English translations are going to come with pronunciation transcriptions in English IPA.

9.8.1 NVH

```
lexicographicResource: deueng
    title: My German-English Dictionary
    language: de
    translationLanguage: en
```

9.8.2 XML

```
<lexicographicResource id="deueng" language="de">
    <title>My German-English Dictionary</title>
    <translationLanguage langCode="en"/>
    ...
</lexicographicResource>
```

9.8.3 JSON

```
{
    "id": "deueng",
    "title": "My German-English Dictionary",
    "language": "de",
    "translationLanguages": ["en"],
    ...
}
```

9.9 Defining a multilingual lexicographic resource

This defines a lexicographic resource where the source language is Irish and the translation languages are English, German and Czech.

9.9.1 NVH

```
lexicographicResource: irish-multilingual
    description: My Irish-Multilingual Dictionary
    language: ga
    translationLanguage: en
    translationLanguage: de
    translationLanguage: cs
```

9.9.2 XML

```
<lexicographicResource id="irish-multilingual" language="ga">
    <title>My Irish-Multilingual Dictionary</title>
    <translationLanguage langCode="en"/>
    <translationLanguage langCode="de"/>
    <translationLanguage langCode="cs"/>
    ...
</lexicographicResource>
```

9.9.3 JSON

```
{
    "id": "irish-multilingual",
    "title": "My Irish-Multilingual Dictionary",
    "language": "ga",
    "translationLanguages": ["en", "de", "cs"],
    ...
}
```

9.10 How to use `headwordTranslation` in a bilingual lexicographic resource

This is an entry from a hypothetical English-German dictionary for English-speaking learners of German.

9.10.1 NVH

```
entry: doctor-n
    headword: doctor
    sense: doctor-n-1
        indicator: medical doctor
        headwordTranslation: Arzt
            partOfSpeech: n-masc
        headwordTranslation: Ärztin
            partOfSpeech: n-fem
    sense: doctor-n-2
        indicator: academic title
        headwordTranslation: Doktor
            partOfSpeech: n-masc
        headwordTranslation: Doktorin
```

```
            partOfSpeech: n-fem
            label: rare
```

9.10.2 XML

```
<entry id="doctor-n">
    <headword>doctor</headword>
    <sense id="doctor-n-1">
        <indicator>medical doctor</indicator>
        <headwordTranslation>
            <text>Arzt</text>
            <partOfSpeech value="n-masc"/>
        </headwordTranslation>
        <headwordTranslation>
            <text>Ärztin</text>
            <partOfSpeech value="n-fem"/>
        </headwordTranslation>
    </sense>
    <sense id="doctor-n-2">
        <indicator>academic title</indicator>
        <headwordTranslation>
            <text>Doktor</text>
            <partOfSpeech value="n-masc"/>
        </headwordTranslation>
        <headwordTranslation>
            <text>Doktorin</text>
            <partOfSpeech value="n-fem"/>
        </headwordTranslation>
    </sense>
</entry>
```

9.10.3 JSON

```
{
    "id": "doctor-n",
    "headword": "doctor",
    "senses": [{
        "id": "doctor-n-1",
        "indicator": "medical doctor",
        "headwordTranslations": [{
            "text": "Arzt",
            "partsOfSpeech": ["n-masc"]
        }, {
            "text": "Ärztin",
            "partsOfSpeech": ["n-fem"]
        }]
    }, {
        "id": "doctor-n-2",
        "indicator": "academic title",
        "headwordTranslations": [{
            "text": "Doktor",
            "partsOfSpeech": ["n-masc"]
        }, {
            "text": "Doktorin",
```

```
            "partsOfSpeech": ["n-fem"]
        }]
    }]
}
```

9.11 How to use `headwordTranslation` in a multilingual lexicographic resource

This is an entry from a hypothetical Irish-multilingual dictionary.

9.11.1 NVH

```
entry: fómhar-n
    headword: fómhar
    sense: fómhar-n-1
        headwordTranslation: autumn
            language: en
        headwordTranslation: fall
            language: en
        headwordTranslation: Herbst
            language: de
        headwordTranslation: podzim
            language: cs
    sense: fómhar-n-2
        headwordTranslation: harvest
            language: en
        headwordTranslation: Ernte
            language: de
        headwordTranslation: sklize#
            language: cs
```

9.11.2 XML

```
<entry id="fómhar-n">
    <headword>fómhar</headword>
    <sense id="fómhar-n-1">
        <headwordTranslation language="en">
            <text>autumn</text>
        </headwordTranslation>
        <headwordTranslation language="en">
            <text>fall</text>
        </headwordTranslation>
        <headwordTranslation language="de">
            <text>Herbst</text>
        </headwordTranslation>
        <headwordTranslation language="cs">
            <text>podzim</text>
        </headwordTranslation>
    </sense>
    <sense id="fómhar-n-2">
        <headwordTranslation language="en">
            <text>harvest</text>
        </headwordTranslation>
```

```
        <headwordTranslation language="de">
            <text>Ernte</text>
        </headwordTranslation>
        <headwordTranslation language="cs">
            <text>sklize#</text>
        </headwordTranslation>
    </sense>
</entry>
```

9.11.3 JSON

```
{
    "id": "fómhar-n",
    "headword": "fómhar",
    "senses": [{
        "id": "fómhar-n-1",
        "headwordTranslations": [{
            "language": "en",
            "text": "autumn"
        }, {
            "language": "en",
            "text": "fall"
        }, {
            "language": "de",
            "text": "Herbst"
        }, {
            "language": "cs",
            "text": "podzim"
        }]
    }, {
        "id": "fómhar-n-2",
        "headwordTranslations": [{
            "language": "en",
            "text": "harvest"
        }, {
            "language": "de",
            "text": "Ernte"
        }, {
            "language": "cs",
            "text": "sklize#"
        }]
    },]
}
```

9.12 How to use `headwordExplanation`

9.12.1 NVH

```
entry: treppenwitz
    headword: Treppenwitz
    partOfSpeech: n-masc
    sense: treppenwitz-1
        headwordExplanation: belated realisation of what one could have said
        headwordTranslation: staircase wit
```

9.12.2 XML

```
<entry id="treppenwitz">
    <headword>Treppenwitz</headword>
    <partOfSpeech value="n-masc"/>
    <sense id="treppenwitz-1">
        <headwordExplanation>
            belated realisation of what one could have said
        </headwordExplanation>
        <headwordTranslation>
            <text>staircase wit</text>
        </headwordTranslation>
    </sense>
```

9.12.3 JSON

```
{
    "id": "treppenwitz",
    "headword": "Treppenwitz",
    "partsOfSpeech": ["n-masc"],
    "senses": [{
        "id": "treppenwitz-1",
        "headwordExplanations": [{
            "text": "belated realisation of what one could have said"
        }],
        "headwordTranslations": [{
            "text": "staircase wit"
        }]
    }]
}
```

9.13 Modelling parts and wholes

We have three entries with one sense each: "glasses", "microscope" and "lens". We want to represent the fact that "lens" is a meronym of both "glasses" and "microscope", and simultanously that "glasses" and "microscope" are both holonyms of "lens".

9.13.1 NVH

```
lexicographicResource: my-dictionary
    language: en
    entry: glasses
        headword: glasses
        sense: glasses-1
            definition: an optical seeing aid
    entry: microscope
        headword: microscope
        sense: microscope-1
            definition: equipment for looking at very small things
    entry: lens
        headword: lens
        sense: lens-1
```

```
            definition: curved glass that makes things seem bigger
    relation: meronymy
        member: glasses-1
            role: whole
        member: lens-1
            role: part
    relation: meronymy
        member: microscrope-1
            role: whole
        member: lens-1
            role: part
    relationType: meronomy
        description: used for modelling part-whole relationships
        memberRole: whole
            description: the whole
            memberType: sense
            min: 1
            max: 1
            action: navigate
        memberRole: part
            description: the part
            memberType: sense
            min: 1
            max: 1
            action: navigate
```

9.13.2 XML

```
<lexicographicResource id="my-dictionary" language="en">
    <entry id="glasses">
        <headword>glasses</headword>
        <sense id="glasses-1">
            <definition>an optical seeing aid</definition>
        </sense>
    </entry>
    <entry id="microscope">
        <headword>microscope</headword>
        <sense id="microscope-1">
            <definition>equipment for looking at very small things</definition>
        </sense>
    </entry>
    <entry id="lens">
        <headword>lens</headword>
        <sense id="lens-1">
            <definition>curved glass that makes things seem bigger</definition>
        </sense>
    </entry>
    <relation type="meronymy">
        <member idref="glasses-1" role="whole"/>
        <member idref="lens-1" role="part"/>
    </relation>
    <relation type="meronymy">
        <member idref="microscrope-1" role="whole"/>
        <member idref="lens-1" role="part"/>
    </relation>
    <relationType type="meronomy">
```

```
        <description>used for modelling part-whole relationships</description>
        <memberRole role="whole" memberType="sense"  min="1" max="1" action="navigate">
            <description>the whole</description>
        </memberRole>
        <memberRole role="part" memberType="sense" min="1" max="1" action="navigate">
            <description>the part</description>
        </memberRole>
    </relationType>
</lexicographicResource>
```

9.13.3 JSON

```
{
    "id": "my-dictionary",
    "language": "en",
    "entries": [{
        "id": "glasses",
        "headword": "glasses",
        "senses": [{
            "id": "glasses-1",
            "definition": "an optical seeing aid"
        }, {
        "id": "microscope",
        "headword": "microscope",
        "senses": [{
            "id": "microscope-1",
            "definition": "equipment for looking at very small things"
        }, {
        "id": "lens",
        "headword": "lens",
        "senses": [{
            "id": "lens-1",
            "definition": "curved glass that makes things seem bigger"
        }]
    }],
    "relations": [{
        "type": "meronymy",
        "members": [{
            "idref": "glasses-1",
            "role": "whole"
        }, {
            "idref": "lens-1",
            "role": "part"
        }]
    }, {
        "type": "meronymy",
        "members": [{
            "idref": "microscope-1",
            "role": "whole"
        }, {
            "idref": "lens-1",
            "role": "part"
        }]
    }],
    "relationTypes": [{
        "type": "meronymy",
```

```
        "description": "used for modelling part-whole relationships",
        "memberRoles": [{
            "role": "whole",
            "description": "the whole",
            "memberType": "sense",
            "min": 1,
            "max": 1,
            "action": "navigate"
        }, {
            "role": "part",
            "description": "the part",
            "memberType": "sense",
            "min": 1,
            "max": 1,
            "action": "navigate"
        }]
    }]
}
```

9.13.4 Suggested rendering for human users

lens

- curved glass that makes things seem bigger things that contain lens: **glasses**, **microscope**

9.14 Modelling antonyms

We have two entries for the verbs "buy" and "sell" with one sense each. We want to express the fact that the senses are antonyms.

9.14.1 NVH

```
lexicographicResource: my-dictionary
    language: en
    entry: buy
        headword: buy
        sense: buy-1
            definition: get something by paying money for it
    entry: sell
        headword: sell
        sense: sell-1
            definition: exchange something for money
    relation: ants
        member: buy-1
        member: sell-1
    relationType: ants
        description: antonyms
        memberRole:
            memberType: sense
            min: 2
            max: 2
            action: navigate
```

9.14.2 XML

```
<lexicographicResource id="my-dictionary" language="en">
    <entry id="buy">
        <headword>buy</headword>
        <sense id="buy-1">
            <definition>get something by paying money for it</definition>
        </sense>
    </entry>
    <entry id="sell">
        <headword>sell</headword>
        <sense id="sell-1">
            <definition>exchange something for money</definition>
        </sense>
    </entry>
    <relation type="ants">
        <member idref="buy-1"/>
        <member idref="sell-1"/>
    </relation>
    <relationType type="ants">
        <description>antonyms</description>
        <memberRole memberType="sense" min="2" max="2" action="navigate"/>
    </relationType>
</lexicographicResource>
```

9.14.3 JSON

```
{
    "id": "my-dictionary",
    "language": "en",
    "entries": [{
        "id": "buy",
        "headword": "buy",
        "senses": [{
            "id": "buy-1",
            "definition": "get something by paying money for it"
        }, {
        "id": "sell",
        "headword": "sell",
        "senses": [{
            "id": "sell-1",
            "definition": "exchange something for money"
        }]
    }],
    "relations": [{
        "type": "ants",
        "members": [
            {"idref": "buy-1"},
            {"idref": "sell-1"}
        ]
    }],
    "relationTypes": [{
        "type": "ants",
        "description": "antonyms",
        "memberRoles": [{
            "memberType": "sense",
            "min": 2,
```

```
            "max": 2,
            "action": "navigate"
        }]
    }]
}
```

9.14.4 Suggested rendering for human users

buy

- get something by paying money for it opposite meaning: **sell**

9.15 Modelling synonyms

We have three German entries with one sense each, two which mean "sea" and one which means "ocean". We want to set up a relation which brings these three sense together as near-synonyms.

9.15.1 NVH

```
lexicographicResource: my-dictionary
    language: de
    translationLanguage: en
    entry: die-see
        headword: See
        partOfSpeech: n-fem
        sense: die-see-1
            headwordTranslation: sea
    entry: das-meer
        headword: Meer
        partOfSpeech: n-neut
        sense: das-meer-1
            headwordTranslation: sea
    entry: der-ozean
        headword: Ozean
        partOfSpeech: n-masc
        sense: der-ozean-1
            translation: ocean
    relation: syns
        description: words that mean sea and ocean
        member: die-see-1
        member: das-meer-1
        member: der-ozean-1
    relationType: syns
        description: synonyms and near synonyms
        memberRole:
            memberType: sense
            min: 2
            action: navigate
```

9.15.2 XML

```
<lexicographicResource id="my-dictionary" language="en">
    <translationLanguage langCode="de"/>
```

```
    <entry id="die-see">
        <headword>See</headword>
        <partOfSpeech value="n-fem"/>
        <sense id="die-see-1">
            <headwordTranslation><text>sea</text></headwordTranslation>
        </sense>
    </entry>
    <entry id="das-meer">
        <headword>Meer</headword>
        <partOfSpeech value="n-neut"/>
        <sense id="das-meer-1">
            <headwordTranslation><text>sea</text></headwordTranslation>
        </sense>
    </entry>
    <entry id="der-ozean">
        <headword>Ozean</headword>
        <partOfSpeech value="n-masc"/>
        <sense id="der-ozean-1">
            <headwordTranslation><text>ocean</text></headwordTranslation>
        </sense>
    </entry>
    <relation type="syns">
        <description>words that mean sea and ocean</description>
        <member idref="die-see-1"/>
        <member idref="das-meer-1"/>
        <member idref="der-ozean-1"/>
    </relation>
    <relationType type="syns">
        <description>synonyms and near synonyms</description>
        <memberRole memberType="sense" min="2" action="navigate"/>
    </relationType>
</lexicographicResource>
```

9.15.3 JSON

```
{
    "id": "my-dictionary",
    "language": "de",
    "translationLanguages": ["en"],
    "entries": [{
        "id": "die-see",
        "headword": "See",
        "partsOfSpeech": ["n-fem"],
        "senses": [{
            "id": "die-see-1",
            "headwordTranslations": [{"text": "sea"}]
        }]
    }, {
        "id": "das-meer",
        "headword": "Meer",
        "partsOfSpeech": ["n-neut"],
        "senses": [{
            "id": "das-meer-1",
            "headwordTranslations": [{"text": "sea"}]
        }]
    }, {
```

```
        "id": "der-ozean",
        "headword": "OZean",
        "partsOfSpeech": ["n-masc"],
        "senses": [{
            "id": "der-ozean-1",
            "headwordTranslations": [{"text": "ocean"}]
        }]
    }],
    "relations": [{
        "type": "syns",
        "description": "words that mean sea and ocean",
        "members": [
          {"idref": "die-see-1"},
          {"idref": "das-meer-1"},
          {"idref": "der-ozean-1"}
        ]
    }],
    "relationTypes": [{
        "type": "syns",
        "description": "synonyms and near synonyms",
        "memberRoles": [{
            "memberType": "sense",
            "min": 2,
            "action": "navigate"
        }]
    }]
}
```

9.15.4 Suggested rendering for human users

See feminine noun

- sea same or similar meaning: **Meer**, **Ozean**

9.16 Modelling variants

We have two entries in our lexicographic resource, one for the headword "colour" and one for the headword "color". We want to create a relation to represent the fact that these are spelling variants. One of the entries is fully fleshed-out (has a sense with a definition, an example etc) while the other one os only skeletal: its only purpose is to serve as the origin of a navigable link to the other entry.

9.16.1 NVH

```
lexicographicResource: my-dictionary
    language: en
    entry: colour
        headword: colour
        partOfSpeech: n
        label: europeanSpelling
        sense: colour-1
            definition: red, blue, yellow etc.
            example: What is your favourite colour?
    entry: color
        headword: color
        partOfSpeech: n
        label: americanSpelling
```

```
    relation: vars
        member: colour
        member: color
    relationType: vars
        description: variants, words which differ only in spelling
        memberRole:
            memberType: entry
            min: 2
            action: navigate
```

9.16.2 XML

```
<lexicographicResource id="my-dictionary" language="en">
    <entry id="colour">
        <headword>colour</headword>
        <partOfSpeech value="n"/>
        <label value="europeanSpelling"/>
        <sense id="colour-1">
            <definition>red, blue, yellow etc.</definition>
            <example><text>What is your favourite colour?</text></example>
        </sense>
    </entry>
    <entry id="color">
        <headword>color</headword>
        <partOfSpeech value="n"/>
        <label value="americanSpelling"/>
    </entry>
    <relation type="vars">
        <member idref="colour"/>
        <member idref="color"/>
    </relation>
    <relationType type="vars">
        <description>variants, words which differ only in spelling</description>
        <memberRole memberType="entry" min="2" action="navigate"/>
    </relationType>
</lexicographicResource>
```

9.16.3 JSON

```
{
    "id": "my-dictionary",
    "language": "en",
    "entries": [{
        "id": "colour",
        "headword": "colour",
        "partsOfSpeech": ["n"],
        "labels": ["europeanSpelling"],
        "senses": [{
            "id": "colour-1",
            "definitions": [{"text": "red, blue, yellow etc."}],
            "examples": [{"text": "What is your favourite colour?"}]
        }]
    }, {
        "id": "color",
```

```
        "headword": "color",
        "partsOfSpeech": ["n"],
        "labels": ["americanSpelling"]
    }],
    "relations": [{
        "type": "vars",
        "members": [
          {"idref": "colour"},
          {"idref": "color"}
        ]
    }],
    "relationTypes": [{
        "type": "vars",
        "description": "variants, words which differ only in spelling",
        "memberRoles": [{
            "memberType": "entry",
            "min": 2,
            "action": "navigate"
        }]
    }]
}
```

9.16.4 Suggested rendering for human users

colour noun, European spelling

- red, blue, yellow etc. What is your favourite colour?

see also: color

9.17 Modelling subsenses

We have an entry for the noun "colour" with four senses. We want to express the fact that senses number two and three are subsenses of sense number one, and should be displayed as such to human users.

9.17.1 NVH

```
lexicographicResource: my-dictionary
    language: en
    entry: colour
        headword: colour
            sense: colour-1
                definition: red, blue, yellow etc.
                example: What is your favourite colour?
            sense: colour-2
                definition: not being black and white
                example: Back then owning a colour TV meant you were rich.
            sense: colour-3
                definition: a sign of a person's race
                example: We welcome people of all creeds and colours.
            sense: colour-4
                definition: interest or excitement
                example: Examples add colour to your writing.
    relation: subsensing
        member: colour-1
            role: supersense
```

```
        member: colour-2
            role: subsense
    relation: subsensing
        member: colour-1
            role: supersense
        member: colour-3
            role: subsense
    relationType: subsensing
        description: expresses the fact that a sense is a subsense of another sense
        scope: sameEntry
        memberRole: supersense
            memberType: sense
            min: 1
            max: 1
            action: none
        memberRole: subsense
            memberType: sense
            min: 1
            max: 1
            action: embed
```

9.17.2 XML

```
<lexicographicResource id="my-dictionary" language="en">
    <entry id="colour">
        <headword>colour</headword>
        <sense id="colour-1">
            <definition>red, blue, yellow etc.</definition>
            <example><text>What is your favourite colour?</text></example>
        </sense>
        <sense id="colour-2">
            <definition>not being black and white</definition>
            <example><text>Back then owning a colour TV meant you were rich.</text></exa
        </sense>
        <sense id="colour-3">
            <definition>a sign of a person's race</definition>
            <example><text>We welcome people of all creeds and colours.</text></example>
        </sense>
        <sense id="colour-4">
            <definition>interest or excitement</definition>
            <example><text>Examples add colour to your writing.</text></example>
        </sense>
    </entry>
    <relation type="subsensing">
        <member idref="colour-1" role="supersense"/>
        <member idref="colour-2" role="subsense"/>
    </relation>
    <relation type="subsensing">
        <member idref="colour-1" role="supersense"/>
        <member idref="colour-3" role="subsense"/>
    </relation>
    <relationType type="subsensing" scope="sameEntry">
        <description>
            expresses the fact that a sense is a subsense of another sense
        </description>
        <memberRole role="supersense" memberType="sense" min="1" max="1"
```

```
                    action="none"/>
        <memberRole role="subsense" memberType="sense" min="1" max="1"
                    action="embed"/>
    </relationType>
</lexicographicResource>
```

9.17.3 JSON

```
{
    "id": "my-dictionary",
    "language": "en",
    "entries": [{
        "id": "colour",
        "headword": "colour",
        "senses": [{
            "id": "colour-1",
            "definitions": [{"text": "red, blue, yellow etc."}],
            "examples": [{"text": "What is your favourite colour?"}]
        }, {
            "id": "colour-2",
            "definitions": [{"text": "not being black and white"}],
            "examples": [{"text": "Back then owning a colour TV meant you were rich."}]
        }, {
            "id": "colour-3",
            "definitions": [{"text": "a sign of a person's race"}],
            "examples": [{"text": "We welcome people of all creeds and colours."}]
        }, {
            "id": "colour-4",
            "definitions": [{"text": "interest or excitement"}],
            "examples": [{"text": "Examples add colour to your writing."}]
        }]
    }],
    "relations": [{
        "type": "subsensing",
        "members": [
          {"role": "supersense", "idref": "colour-1"},
          {"role": "subsense", "idref": "colour-2"}
        ]
    }, {
        "type": "subsensing",
        "members": [
          {"role": "supersense", "idref": "colour-1"},
          {"role": "subsense", "idref": "colour-3"}
        ]
    }],
    "relationTypes": [{
        "type": "subsensing",
        "description": "expresses the fact that a sense is a subsense of another sense",
        "scope": "sameEntry",
        "memberRoles": [{
            "role": "supersense",
            "memberType": "sense",
            "min": 1,
            "max": 1,
            "action": "none"
        }, {
```

```
            "role": "subsense",
            "memberType": "sense",
            "min": 1,
            "max": 1,
            "action": "embed"
        }]
    }]
}
```

9.17.4 Suggested rendering for human users

colour

1. red, blue, yellow etc.What is your favourite colour?
    a. not being black and white Back then owning a colour TV meant you were rich.
    b. a sign of a person's race We welcome people of all creeds and colours.
2. interest or excitement Examples add colour to your writing.

9.18 Modelling subentries (at subsense level)

We have an entry for the adjective "safe" with two senses, and an entry for the multi-word expression "better safe than sorry" with one sense. We want to express the fact that the multi-word entry should appear under the first sense of "safe" as a subentry.

9.18.1 NVH

```
lexicographicResource: my-dictionary
    language: en
    entry: safe
        headword: safe
        sense: safe-1
            indicator: protected from harm
            example: It isn't safe to park here.
        sense: safe-2
            indicator: not likely to cause harm
            example: Is the ride safe for a small child?
    entry: better-safe
        headword: better safe than sorry
        sense: better-safe-1
            definition: you should be careful even if it seems unnecessary
    relation: subentrying
        membership: safe-1
            role: container
        membership: better-safe
            role: subentry
    relationType: subentrying
        scope: sameResource
        memberRole: container
            memberType: sense
            min: 1
            max: 1
            action: navigate
        memberRole: subentry
```

```
            memberType: entry
            min: 1
            max: 1
            action: embed
```

9.18.2 XML

```
<lexicographicResource id="my-dictionary" language="en">
    <entry id="safe">
        <headword>safe</headword>
        <sense id="safe-1">
            <indicator>protected from harm</indicator>
            <example><text>It isn't safe to park here.</text></example>
        </sense>
        <sense id="safe-2">
            <indicator>not likely to cause harm</indicator>
            <example><text>Is the ride safe for a small child?</text></example>
        </sense>
    </entry>
    <entry id="better-safe">
        <headword>better safe than sorry</headword>
        <sense id="better-safe-1">
            <definition>
                <text>you should be careful even if it seems unnecessary</text>
            </definition>
        </sense>
    </entry>
    <relation type="subentrying">
        <member idref="safe-1" role="container"/>
        <member idref="better-safe" role="subentry"/>
    </relation>
    <relationType type="subentrying" scope="sameResource">
        <memberRole role="container" memberType="sense" min="1" max="1"
                    action="navigate"/>
        <memberRole role="subentry" memberType="entry" min="1" max="1"
                    action="embed"/>
    </relationType>
</lexicographicResource>
```

9.18.3 JSON

```
{
    "id": "my-dictionary",
    "language": "en",
    "entries": [{
        "id": "safe",
        "headword": "safe",
        "senses": [{
            "id": "safe-1",
            "indicator": "protected from harm",
            "examples": [{"text": "It isn't safe to park here."}]
        }, {
            "id": "safe-2",
            "indicator": "not likely to cause harm",
```

```
            "examples": [{"text": "Is the ride safe for a small child?"}]
        }]
    }, {
        "id": "better-safe",
        "headword": "better safe than sorry",
        "senses": [{
            "id": "better-safe-1",
            "definitions": [{
                "text": "you should be careful even if it seems unnecessary"
            }]
        }]
    }],
    "relations": [{
        "type": "subentrying",
        "members": [
          {"role": "container", "idref": "safe-1"},
          {"role": "subentry", "idref": "better-safe"}
        ]
    }],
    "relationTypes": [{
        "type": "subentrying",
        "scope": "sameResource",
        "memberRoles": [{
            "role": "container",
            "memberType": "sense",
            "min": 1,
            "max": 1,
            "action": "navigate"
        }, {
            "role": "subentry",
            "memberType": "entry",
            "min": 1,
            "max": 1,
            "action": "embed"
        }]
    }]
}
```

9.18.4 Suggested rendering for human users

safe

- protected from harm: It isn't safe to park here.
    - **better safe than sorry** you should be careful even if it seems unnecessary
- not likely to cause harm: Is the ride safe for a small child?

better safe than sorry

- you should be careful even if it seems unnecessary

see also: safe

9.19 Modelling subentries (at sense level)

We have an entry for the word "bible" and another entry for the expression "the Bible". We want to make sure that, when a human user is viewing the entry for "bible", the entry for "the Bible" is shown as a subentry of it, as if it were its first sense.

9.19.1 NVH

```
lexicographicResource: my-dictionary
    language: en
    entry: the-bible
        headword: the Bible
        Sense: the-bible-1
            definition: the book considered holy by Christians
    entry: bible
        headword: bible
        sense: bible-1
        sense: bible-2
            definition: a book considered important for a subject
    relation: subentrying
        member: bible-1
            role: container
        member: the-bible
            role: subentry
    relationType: subentrying
        scope: sameResource
        memberRole: container
            memberType: sense
            min: 1
            max: 1
            action: navigate
        memberRole: subentry
            memberType: entry
            min: 1
            max: 1
            action: embed
```

9.19.2 XML

```
<lexicographicResource id="my-dictionary" language="en">
    <entry id="the-bible">
        <headword>the Bible</headword>
        <sense id="the-bible-1">
            <definition>
                <text>the book considered holy by Christians</text>
            </definition>
        </sense>
    </entry>
    <entry id="bible">
        <headword>bible</headword>
        <sense id="bible-1"/>
        <sense id="bible-2">
            <definition>
                <text>a book considered important for a subject</text>
            </definition>
        </sense>
    </entry>
    <relation type="subentrying">
        <member idref="bible-1" role="container"/>
        <member idref="the-bible" role="subentry"/>
```

```
    </relation>
    <relationType type="subentrying" scope="sameResource">
        <memberRole role="container" memberType="sense" min="1" max="1"
                    action="navigate"/>
        <memberRole role="subentry" memberType="entry" min="1" max="1"
                    action="embed"/>
    </relationType>
</lexicographicResource>
```

9.19.3 JSON

```
{
    "id": "my-dictionary",
    "language": "en",
    "entries": [{
        "id": "the-bible",
        "headword": "the Bible",
        "senses": [{
            "id": "the-bible-1",
            "definitions": [{"text": "the book considered holy by Christians"}]
        }]
    }, {
        "id": "bible",
        "headword": "bible",
        "senses": [{
            "id": "bible-1"
        }, {
            "id": "bible-2",
            "definitions": [{"text": "a book considered important for a subject"}]
        }]
    }],
    "relations": [{
        "type": "subentrying",
        "members": [
          {"role": "container", "idref": "bible-1"},
          {"role": "subentry", "idref": "the-bible"}
        ]
    }],
    "relationTypes": [{
        "type": "subentrying",
        "scope": "sameResource",
        "memberRoles": [{
            "role": "container",
            "memberType": "sense",
            "min": 1,
            "max": 1,
            "action": "navigate"
        }, {
            "role": "subentry",
            "memberType": "entry",
            "min": 1,
            "max": 1,
            "action": "embed"
        }]
    }]
}
```

9.19.4 Suggested rendering for human users

bible

1. **the Bible** the book considered holy by Christians
2. a book considered important for a subject

Suggeted rendering of the entry "the Bible" for human users:

the Bible

- the book considered holy by Christians

see also: bible

9.20 Using `placeholderMarker`

9.20.1 NVH

```
entry: continue-studies
    headword: continue your studies
        placeholderMarker: your
    sense: ...
```

9.20.2 XML

```
<entry id="continue-studies">
    <headword>
        continue <placeholderMarker>your</placeholderMarker> studies
    </headword>
    <sense.../>
</entry>
```

9.20.3 JSON

```
{
  "id": "continue-studies",
  "headword": "continue your studies",
  "placeholderMarkers": [
     {"startIndex": 9, "endIndex": 13}
  ],
  "senses": [...]
}
```

9.21 Using `placeholderMarker` in a bilingual lexicographic resource

9.21.1 NVH

```
entry: beat-up
    headword: beat sb. up
        placeholderMarker: sb.
    sense: beat-up-1
        headwordTranslation: jemanden verprügeln
            placeholderMarker: jemanden
```

9.21.2 XML

```
<entry id="beat-up">
    <headword>
        beat <placeholderMarker>sb.</placeholderMarker> up
    </headword>
    <sense id="beat-up-1">
      <headwordTranslation>
        <text>
            <placeholderMarker>jemanden</placeholderMarker> verprügeln
        </text>
      </headwordTranslation>
    </sense>
</entry>
```

9.21.3 JSON

```
{
  "id": "beat-up",
  "headword": "beat sb. up",
  "placeholderMarkers": [
      {"startIndex": 5, "endIndex": 8}
  ],
  "senses": [{
    "id": "beat-up-1",
    "headwordTranslations": [{
      "text": "jemanden verprügeln",
      "placeholderMarkers": [
          {"startIndex": 0, "endIndex": 8}
      ],
    }]
  }]
}
```

9.22 Using `headwordMarker`

9.22.1 NVH

```
entry: autopsy
    headword: autopsy
    sense: autopsy-1
        headwordTranslation: pitva
        example: The coroner performed an autopsy.
```

```
            headwordMarker: autopsy
            exampleTranslation: Koroner provedl pitvu.
                headwordMarker: pitvu
```

9.22.2 XML

```
<entry id="autopsy">
    <headword>autopsy</headword>
    <sense id="autopsy-1">
        <headwordTranslation><text>pitva</text></headwordTranslation>
        <example>
            <text>
                The coroner performed an <headwordMarker>autopsy</headwordMarker>.
            </text>
            <exampleTranslation>
                <text>
                    Koroner provedl <headwordMarker>pitvu</headwordMarker>.
                </text>
            </exampleTranslation>
        </example>
    </sense>
</entry>
```

9.22.3 JSON

```
{
  "id": "autopsy",
  "headword": "autopsy",
  "senses": [{
    "id": "autopsy-1",
    "headwordTranslations": [{"text": "pitva"}],
    "examples": [{
      "text": "The coroner performed an autopsy.",
      "headwordMarkers": [
        {"startIndex": 25, "endIndex": 32}
      ],
      "exampleTranslations": [{
        "text": "Koroner provedl pitvu.",
        "headwordMarkers": [
          {"startIndex": 16, "endIndex": 21}
        ]
      }]
    }]
  }]
}
```

9.23 Using `itemMarker`

9.23.1 NVH

```
entry: autopsy
```

```
    headword: autopsy
    sense: autopsy-1
        headwordTranslation: pitva
        example: The coroner performed an autopsy.
            headwordMarker: autopsy
            itemMarker: performed
                lemma: perform
            exampleTranslation: Koroner provedl pitvu.
                headwordMarker: pitvu
                itemMarker: provedl
                    lemma: provést
```

9.23.2 XML

```
<entry id="autopsy">
    <headword>autopsy</headword>
    <sense id="autopsy-1">
        <headwordTranslation><text>pitva</text></headwordTranslation>
        <example>
            <text>
                The coroner <itemMarker lemma="perform">performed</itemMarker>
                an <headwordMarker>autopsy</headwordMarker>.
            </text>
            <exampleTranslation>
                <text>
                    Koroner <itemMarker lemma="provést">provedl</itemMarker>
                    <headwordMarker>pitvu</headwordMarker>.
                </text>
            </exampleTranslation>
        </example>
    </sense>
</entry>
```

9.23.3 JSON

```
{
  "id": "autopsy",
  "headword": "autopsy",
  "senses": [{
    "id": "autopsy-1",
    "headwordTranslations": [{"text": "pitva"}],
    "examples": [{
      "text": "The coroner performed an autopsy.",
      "headwordMarkers": [
        {"startIndex": 25, "endIndex": 32}
      ],
      "itemMarkers": [
        {"startIndex": 12, "endIndex": 21, "lemma": "perform"}
      ],
      "exampleTranslations": [{
        "text": "Koroner provedl pitvu.",
        "headwordMarkers": [
          {"startIndex": 16, "endIndex": 21}
        ],
```

```
        "itemMarkers": [
          {"startIndex": 8, "endIndex": 15, "lemma": "provést"}
        ],
      }]
    }]
  }]
}
```

10 DMLex XML serialization

10.1 Design principles

The XML serialization of DMLex shown in this document follows these priciples:

- The top-level `lexicographicResource` object is implemented as an XML element.
- All other objects are implemented as XML attributes of their parents, unless:
  - the object has an arity other than `(0..1)` and `(1..1)`
  - or the object can have child objects
  - or the object's value is human-readable text, such as a headword or a definition.

  In such cases the object is implemented as a child XML element of its parent.

10.2 DMLex namespaces and validation artifacts for its XML serialization

TBD...

10.3 Element: `<lexicographicResource>`

Implements the lexicographicResource data type.

Attributes:

- `@id` REQUIRED
- `@title` OPTIONAL
- `@uri` OPTIONAL
- `@language` REQUIRED

Child elements

- `<entry>` zero or more
- `<tag>` zero or more

Child elements if implementing the Crosslingual Module

- `<translationLanguage>` one or more

Child elements if implementing the Linking Module

- `<relation>` zero or more
- `<relationType>` zero or more

10.4 Element: `<entry>`

Implements the entry data type.

Attributes:

- `@id` REQUIRED
- `@homographNumber` OPTIONAL

Child elements

- `<headword>` REQUIRED
- `<partOfSpeech>` zero or more
- `<label>` zero or more
- `<pronunciation>` zero or more
- `<inflectedForm>` zero or more
- `<sense>` zero or more

Child elements if implementing the Etymology Module

- `<etymology>` zero or more

11 DMLex JSON serialization

11.1 Design principles

The JSON serialization of DMLex shown in this document follows these priciples:

- The top-level `lexicographicResource` object is implemented as a JSON object: `{...}`.
- All other objects are implemented as JSON name-value pairs inside their parent JSON object: `{"name": ...}`.
- The values of objects are implemented:
  - If the object has an arity of `(0..1)` or `(1..1)`:
    - If the object cannot have any child objects: as a string or number.
    - If the object can have child objects: as a JSON object.
  - If the object has any other arity:
    - If the object cannot have any child objects: as an array of strings or numbers.
    - If the object can have child objects: as an array of JSON objects.

11.2 Class: `lexicographicResource`

Implements the lexicographicResource data type.

Type

JSON object: `{...}`

Members

- `"id"` string REQUIRED
- `"title"` string OPTIONAL
- `"uri"` string OPTIONAL
- `"language"` string REQUIRED
- `"entries"` array of zero or more `entry` objects, OPTIONAL
- `"tags"` array of zero or more `tag` objects, OPTIONAL

Members if implementing the Crosslingual Module

- `"translationLanguages"` array of one or more `translationLanguage` objects, REQUIRED

Members if implementing the Linking Module

- `"relations"` array of zero or more `relation` objects, OPTIONAL
- `"relationTypes"` array of zero or more `relationType` objects, OPTIONAL

11.3 Class: `entry`

Implements the entry data type.

Type

JSON object: `{...}`

Members

- `"id"` string REQUIRED
- `"headword"` (string) REQUIRED
- `"homographNumber"` string OPTIONAL
- `"partsOfSpeech"` array of zero or more `partOfSpeech` objects, OPTIONAL
- `"labels"` array of zero or more `label` objects, OPTIONAL
- `"pronunciations"` array of zero or more `pronunciation` objects, OPTIONAL
- `"inflectedForms"` array of zero or more `inflectedForm` objects, OPTIONAL
- `"senses"` array of zero or more `sense` objects, OPTIONAL

Members if implementing the Etymology Module

- `"etymologies"` array of zero or more `etymology` objects, OPTIONAL

12 DMLex RDF serialization

12.1 Design principles

The RDF serialization used in this document follows the following principles

- The `lexicographicResource` object is an individual of type `dmlex:LexicographicResource`
- All other objects are implemented as individuals
- Each other object type is associated with a property (with a lowercase intiial letter) and a class (with an uppercase initial letter. In all case the range of this property is the class
- Arity of properties is implemented by means of OWL class restrictions.
- Listing order can be specified with the property `dmlex:listingOrder` with values starting from 1 and ascending
- The implementation is not aware of which modules are in use, to enable publishing on the web. As such cardinality constraints that are only required in a module are not implemented.

12.2 Interoperability with OntoLex-lemon

The ontology provides rules to infer an OntoLex-lemon model from DMLex data. This is achieved by means of subclass and subproperty axioms and so conversion can be performed by an OWL reasoner.

13 DMLex relational database serialization

13.1 Design principles

The relational database serialization of DMLex shown in this document follows these priciples:

- The `lexicographicResource` object is implemented as table. (Alternatively, it can left unimplemented if the database is going to contain only one lexicographic resource.)
- Other objects with an arity other than `(0..1)` and `(1..1)` are implemented as tables.
- The values of objects, and objects with an arity of `(0..1)` or `(1..1)` are implemented as columns in those tables.
- The parent-child relation is implemented as a one-to-many relation between tables.

13.2 Table: `lexicographicResources`

Implements the lexicographicResource data type.

Columns

- `id int primary key`
- `title varchar(255)`
- `uri varchar(255)`
- `language varchar(10)`

Processing Requiremnts

- If the implementation contains only one lexicographic resource, then the lexicographicResource table is not REQUIRED to be unimplemented.

13.3 Table: `entries`

Implements the entry data type.

Columns

- `lexicographicResourceID int foreign key references lexicographicResource(id)`
- `id int`, primary key
- `headword varchar(255)`
- `homographNumber int`

Comment

If the implementation contains only one lexicographic resource, then the column `lexicographicResourceID` MAY remain unimplemented.

Appendix A References

This appendix contains the normative and informative references that are used in this document. Normative references are specific (identified by date of publication and/or edition number or Version number) and Informative references are either specific or non-specific.

While any hyperlinks included in this appendix were valid at the time of publication, OASIS cannot guarantee their long-term validity.

A.1 Normative references

[**BCP 14**] is a concatenation of [RFC 2119] and [RFC 8174]

[**RFC 2119**] S. Bradner, *Key words for use in RFCs to Indicate Requirement Levels*, *https://www.ietf.org/rfc/rfc2119.txt* IETF (Internet Engineering Task Force) RFC 2119, March 1997.

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[**RFC 7303**] H. Thompson and C. Lilley, *XML Media Types*, *https://www.tools.ietf.org/html/rfc7303 [https://www.tools.ietf.org/html/rfc7303]* IETF (Internet Engineering Task Force) RFC 7303, July 2014.

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[**XML namespace**] W3C, *Schema document for namespace http://www.w3.org/XML/1998/namespace* *http://www.w3.org/2001/xml.xsd* [http://www.w3.org/2009/01/xml.xsd]. at http://docs.oasis-open.org/lexidma/dmlex/v1.0/wd01/schemas/informativeCopiesOf3rdPartySchemas/w3c/xml.xsd in this distribution

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[**XML Schema Structures**] W3C, *XML Schema Part 1: Structures*, *https://www.w3.org/TR/xmlschema-1/* (Second Edition) W3C Recommendation 28 October 2004.

A.2 Informative references (Informative)

[**LDML**] *Unicode Locale Data Markup Language* *http://unicode.org/reports/tr35/*

[**UAX #29**] M. Davis, *UNICODE TEXT SEGMENTATION*, *http://www.unicode.org/reports/tr29/* Unicode text Segmentation.

Appendix B Machine Readable Validation Artifacts (Informative)

CURRENTLY NO VALIDATION ARTIFACTS FORESEEN FOR THE OM.. JUST FOR SERIALIZATIONS

MAY LIST CONFORMANT ARTIFACTS FOR SPECIFIC SERILIZATIONS AT A LATER STAGE

Appendix C Security and privacy considerations

Note

OASIS strongly recommends that Technical Committees consider issues that might affect safety, security, privacy, and/or data protection in implementations of their work products and document these for implementers and adopters. For some purposes, you may find it required, e.g. if you apply for IANA registration.

While it may not be immediately obvious how your work product might make systems vulnerable to attack, most work products, because they involve communications between systems, message formats, or system settings, open potential channels for exploit. For example, IETF [RFC 3552] lists “eavesdropping, replay, message insertion, deletion, modification, and man-in-the-middle” as well as potential denial of service attacks as threats that must be considered and, if appropriate, addressed in IETF RFCs.

In addition to considering and describing foreseeable risks, this section should include guidance on how implementers and adopters can protect against these risks.

We encourage editors and TC members concerned with this subject to read Guidelines for Writing RFC Text on Security Considerations, IETF [RFC 3552], for more information.

Appendix D Specification Change Tracking (Informative)

This appendix will contain tracked changes after the csprd01 phase will have been reached.

Appendix E Acknowledgements (Informative)

The following individuals have participated in the creation of this specification and are gratefully acknowledged:

- Erjavec, Tomaž - JSI
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