Formalisation of Code Lists and their Values

The case of the ISO19152 Land Administration Domain Model

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Overview

- What is code list? and code lists in LADM Edition I
- Land administration and Semantic Web
- Requirements for semantically enriched code list values
- A metamodel for refined code lists and their values

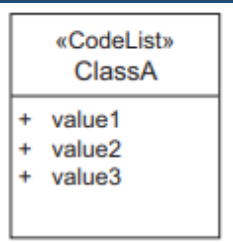
What is code list?

- ISO TC/211 and OGC standards generally uses the class diagram (static view modelling) of the UML.
- **UML class diagram** basically consists of **classes**, **their attributes**, **operations** and **relationships**.
- In this way of modelling, **data types** are assigned to **attributes** in order to specify the allowable characteristics of the attributes.
- One of the options to determine which values an attribute can have is to utilise **code lists**.

ISO 19152:2012 LADM – LA_Party Class

What is code list?

A code list is **a simple list of values without any structure**.



Code lists and their values can be considered as a **supplement** to the classes and associations within a standard and they provides **initial examples** for further structuring of the domain.

When modelling for actual systems to be implemented typically, the half of the efforts are devoted to the creation of the UML class diagrams as backbone of the structure. The other half of the efforts are spent on specifying the actual code list values.

However, the code lists in international standards (e.g. ISO and OGC) are generally just mentioned in the diagrams and present only a simple list of example values **without any definition**, reference to the **source of a definition**, multi-lingual **alternative term support** and **semantic relationships** (e.g. hierarchical, associative) in many cases.

Code list in LADM

This is also true in the case of **ISO 19152:2012 LADM** which specifies a number of code lists (e.g. LA_PartyType, LA_MortgageType, etc.) in the informative annex of the standard (Annex J).

LADM code lists only include example values, and **the specification of code lists is left to 'User communities [who] have to define and manage their own values when implementing' the standard.**

LADM is currently under the **systematic review of ISO** and **adding more content, meaning and structure to its code list values has been considered taking a step forward in development of LADM**.

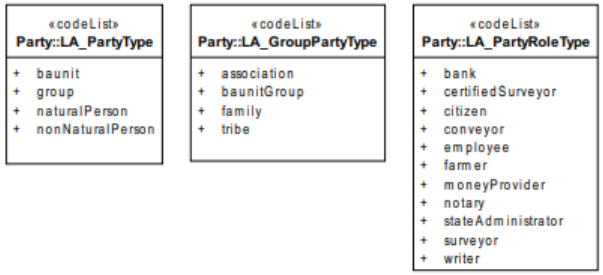


Figure J.1 — Code lists for Party Package

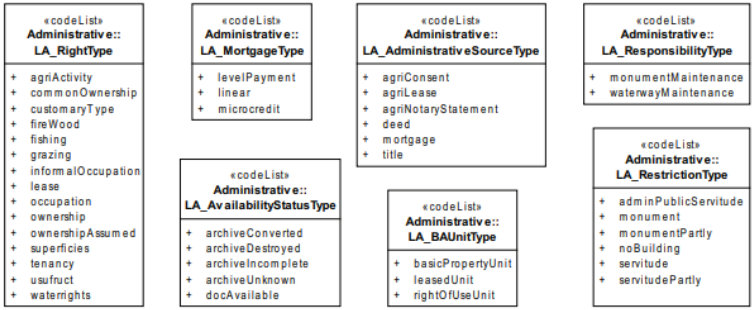


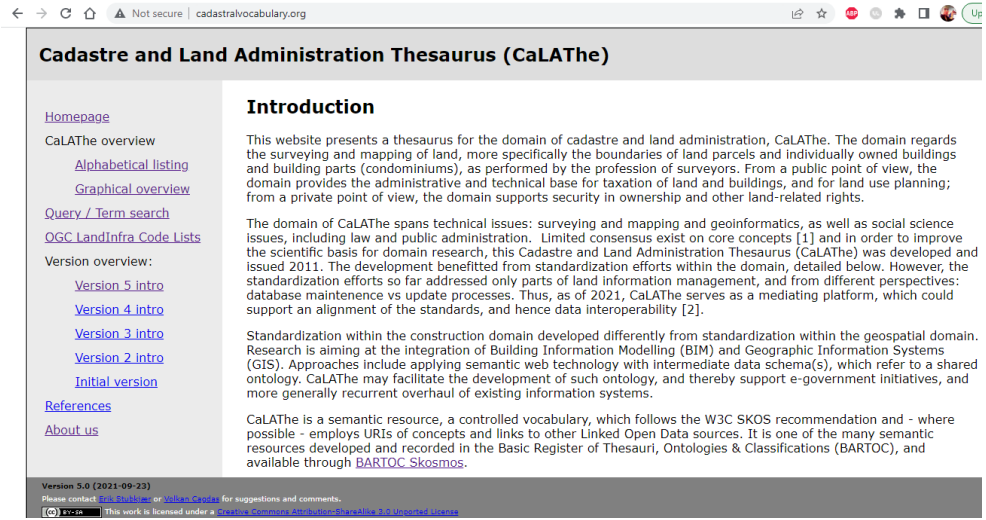
Figure J.2 — Code lists for Administrative Package

Land administration and Semantic Web

There is **growing interest in representing terms belonging to a particular domain using Semantic Web technologies** (e.g. RDF, OWL, SKOS, SPARQL) and making them **available on a registry** (e.g. the ISO/TC 211 Multi-Lingual Glossary of Terms –MLGT–, alias Geolexica, OGC Definitions Server, INSPIRE code list register, Basic Register of Thesauri, Ontologies & Classifications -BARTOC-) on the Web. **This interest is also the case in the domain of land administration**.

The Cadastre and Land Administration Thesaurus (CaLAThe)

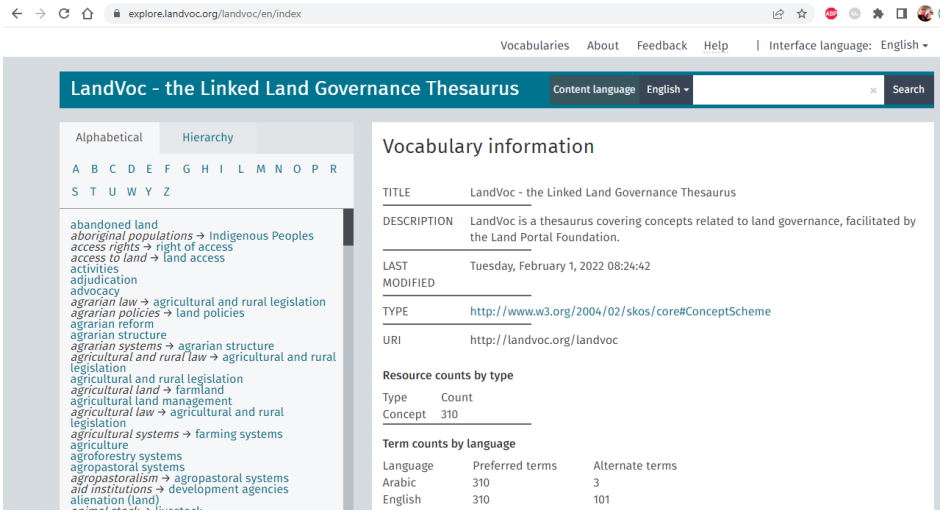
- **Terms from** LADM, OGC LandInfra, and several existing thesauri (e.g. GEMET, AGROVOC, and STW Thesaurus for Economics
- **Encoded with SKOS**
- The last version of CaLAThe includes **code list and values of ISO LADM and OGC LandInfra** that is made available through **BARTOC** and **OGC Definitions Server**



Land administration and Semantic Web

The Linked Land Governance Thesaurus (LandVoc)

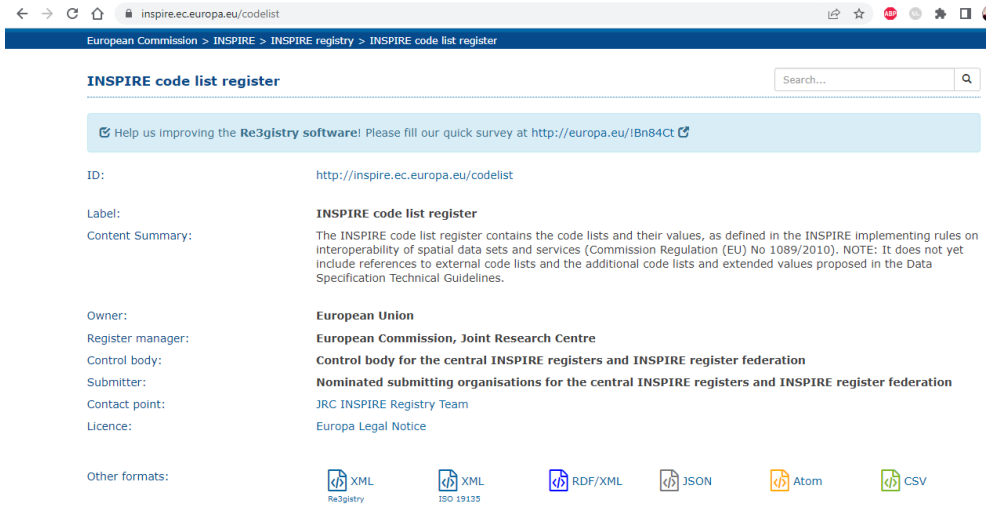
- Includes concepts related to **land governance**. It is designed as a part of **FAO's AGROVOC Linked Open Data set** and is maintained by the **Land Portal Foundation**.
- based on RDF, SKOS and Dublin Core definitions and can be consumed through AGROVOC SPARQL endpoint and RDF format.
- **LandVoc does not provide a specific solution for representing code list values**.



Land administration and Semantic Web

INSPIRE Code List Register

- **The code list values defined in INSPIRE data themes** (e.g. cadastral parcel) were structured in RDF format and made available through the **INSPIRE code list register**.
- The RDF representation of INSPIRE code list values **does not include hierarchical relationships between the code list values** and **references to external code list values**.



Problem and Aim

Problem: adding more meaning and content to code list values Semantic Web Technologies can be used, however code list values can be structured in a number of ways within the framework of the Semantic Web using **various formalisms (format, vocabulary, registry)**.

To overcome this issue, **a joint understanding in structuring, extending and maintaining code list values** is required that may be achieved through an **agreed metamodel**.

Aim: creating a **metamodel for structuring, extending, and maintaining semantically enriched code list values** and **implementing of the proposed framework**.

To achieve this aim the **requirements for semantically refined code list values** should be firstly collected and/or determined.

Requirements for a semantically enriched code list values

When developing a new model, it is important to **reuse existing standards** as a foundation.

ISO 19150-2:2015 – Rules for developing ontologies in the Web Ontology Language (OWL) standard, which 'defines the conversion of the UML static view modeling elements used in the ISO geographic information standards into OWL'

This standard proposes the use of SKOS for code lists.

- '*SKOS has been broadly adopted for vocabulary formalization. SKOS supports the codelist requirements of membership and extensibility*.'

ISO 19150-2:2015 sets a number of requirements for the conversion from UML code lists to SKOS:

- *'A CODELIST shall correspond to a Class , a ConceptScheme , and a Collection*.'
- '*The Class shall be a subclass of skos:Concept*.'
- The use of skos:broader, skos:narrower, and skos:related properties in order to specify the hierarchical relationships between values.
- The utilisation of skos:broadMatch, skos:closeMatch, skos:exactMatch, skos:narrowMatch and skos:relatedMatch properties are suggested to record the relationships between values of a code list.

Requirements for a semantically enriched code list values

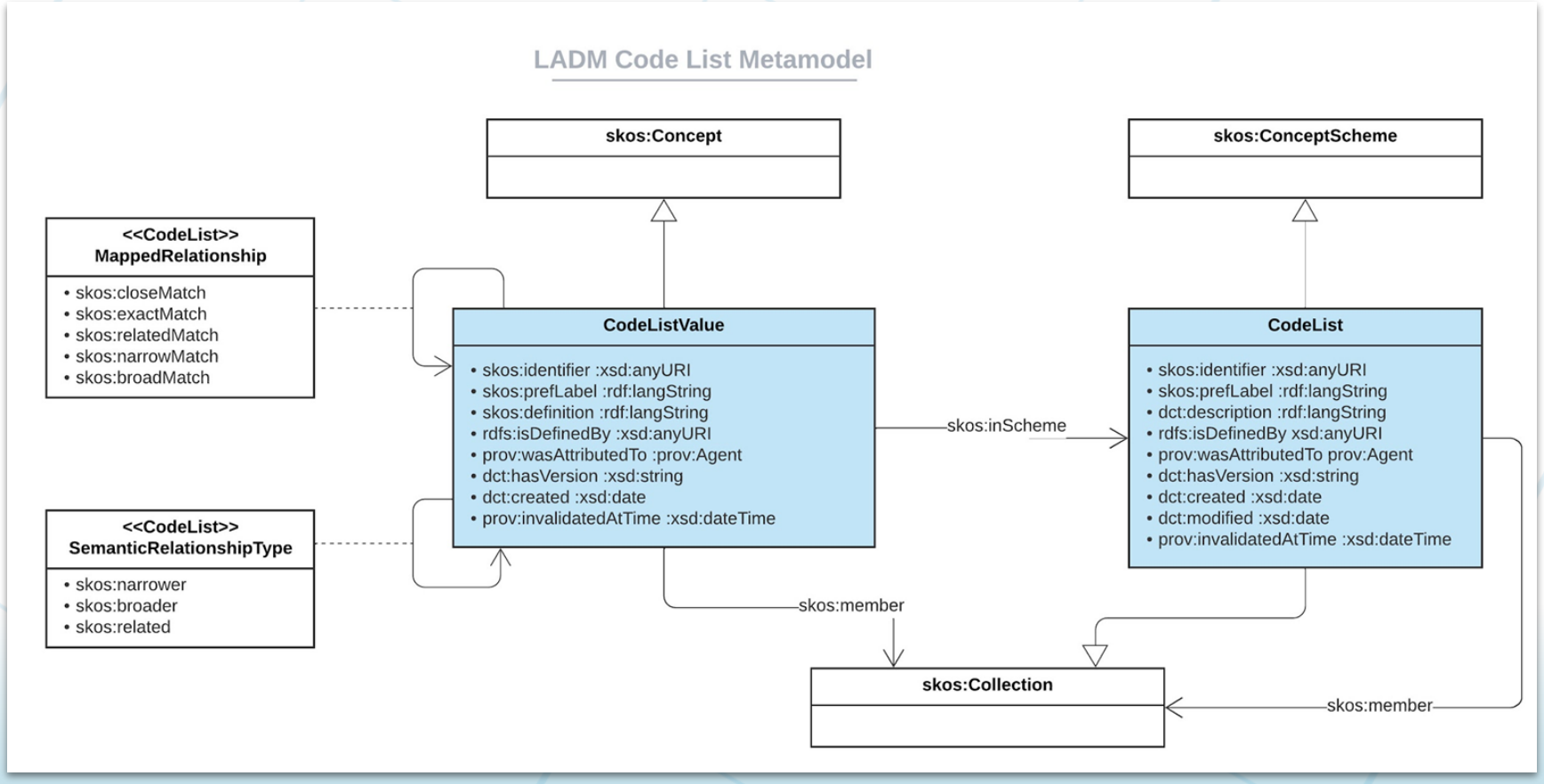
ISO 19150-2 only focuses on conversion from UML code list values to SKOS but **it does not specify requirements** for structuring semantically enriched code list values, such as **versioning**, **localisation (i.e. country profile)**, **alternative values** and **maintenance**.

- To identify the requirements for semantically enriched code list values **several experts (from Kadaster, Geonovum, Universities) meeting were held**.
- After several meetings with experts, **thirteen requirements are identified**. **The selected thesauri and registries are evaluated against the identified requirements**.

Requirements for a semantically enriched code list values

Requirements \ Solutions	S1. CaLAThe	S2. LandVoc	S3. INSPIRE code list register	S4. Geolexica	S5. OGC Definitions Server
R1. Selection of code list values	OGC LandInfra, LADM, …	FAO's Land Tenure Thesaurus, LADM, …	INSPIRE Data Theme	ISO standards	Terms defined by OGC or communities
R2. Identifier for code lists and their values	skos:ConceptScheme, skos:Concept, rdf:about	rdf:Description, rdf:about	rdf:Description, rdf:about	Yes	Yes
R3. Label (preferred and alternative) for code list values	skos:prefLabel, skos:altlabel	skos:prefLabel, skosxl:prefLabel, skos:altlabel, skosxl:altlabel	skos:prefLabel, skos:altLabel	Yes	Yes
R4. Definition of code list values (and source of definition)	skos:definition	rdf:Description rdf:value	skos:definition	Yes	Yes
R5. Determining the values that belong to a code list	skos:inScheme, skos:broader	No	skos:inScheme	-	-
R6. Hierarchical and associative relationships between code list values	skos:broader, skos:narrower, skos:related	skos:narrower, skos:broader, skos:related	No	Yes	Yes
R.7 Mapping relationships across different code list values	skos:exactMatch skos:closeMatch	skos:exactMatch skos:closeMatch skos:broadMatch	No	Yes	Yes
R8. Versioning of code lists and their values (and concurrent versioning)	Partly yes	No	No	Partly yes	Partly yes
R9. Procedures for updating code list values (e.g. new, changed, deleted)	No	No	No	No	No
R10. Semantic web view of code lists	SKOS RDF/XML	SKOS RDF/XML, SPARQL Endpoint	RDF/XML	Yes	Yes
R11. Support for multiple languages (alphabets)	Yes, with labels	Yes, labels and skosxl:literalForm	Yes	Yes	Yes
R12. Support for national extension	Partly yes	Partly yes	Partly yes	-	-
R13. Selecting possible registries to publish and maintain code list values	Yes, through OGC Definitions Server, SKOMOS	AGROVOC	-	-	-

Proposed Metamodel for LADM Code Lists



Implementation and Demo Environment Links

To follow along in the overview of this metamodel and to see the demonstration version live (or to attend to interact with the model yourself) please make use of the following data stories:

- Summary implementation document (developed for the purpose of LADM Workshop): https://data.labs.kadaster.nl/lexi-rowland/-/stories/summary-ladm-code-list
- Demonstration environment: https://data.labs.kadaster.nl/experiment/-/stories/ladm-metamodel-Demo