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Languages, Countries, and Codes (LCC)

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http://www.omg.org/spec/LCC/Languages/LanguageRepresentation.rdf
http://www.omg.org/spec/LCC/20151101/Languages/LanguageRepresentation.rdf
http://www.omg.org/spec/LCC/Languages/ISO639-1-LanguageCodes.rdf
http://www.omg.org/spec/LCC/20151101/Languages/ISO639-1-LanguageCodes.rdf
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http://www.omg.org/spec/LCC/20151101/Countries/ISO3166-1-CountryCodes.xmi
http://www.omg.org/spec/LCC/20151101/Countries/ISO3166-2-SubdivisionCodes.xmi

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This OMG document replaces the submission document (ad/2015-11-04, Alpha). It is an OMG Adopted Beta Specification and is currently in the finalization phase. Comments on the content of this document are welcome, and should be directed to *issues@omg.org* by August 5, 2016.

You may view the pending issues for this specification from the OMG revision issues web page *http://www.omg.org/issues/*.

The FTF Recommendation and Report for this specification will be published on December 16, 2016. If you are reading this after that date, please download the available specification from the OMG Specifications Catalog.

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Preface

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- **UML Profile**

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- **CORBAServices**
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All of OMG's formal specifications may be downloaded without charge from our website. (Products implementing OMG specifications are available from individual suppliers.) Copies of specifications, available in PostScript and PDF format, may be obtained from the Specifications Catalog cited above or by contacting the Object Management Group, Inc. at:

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The type styles shown below are used in this document to distinguish programming statements from ordinary English. However, these conventions are not used in tables or headings where no distinction is necessary.

Times/Times New Roman - 10 pt.: Standard body text, table text, bullets

Helvetica/Arial – 9 or **10 pt. Bold:** OMG Interface Definition Language (OMG IDL) and syntax elements.

`Courier new/Courier – 10 pt. Bold`: Programming Languages

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1 Scope

The Languages, Countries, and Codes Specification provides a standard set of ontologies for two ISO standards: (1) ISO 639: Codes for the representation of language names, and (2) ISO 3166: Codes for the representation of country names and their subdivisions. These ontologies are essential for many government, commercial, and academic applications and ontology development activities, ranging from business vocabularies, taxonomies, and nomenclatures, to semantically rich applications, and at OMG, they are required to support the Financial Industry Business Ontology (FIBO) family of standards, among others.

This specification provides ODM-compliant UML reference models for both ISO specifications, including ODM XMI, ODM-compliant UML XMI, and RDF/OWL serialized in both RDF/XML and Turtle, to provide maximum flexibility and coverage for implementers and other users.

This initial version of the specification covers the first two parts of ISO 639 and the first two parts of ISO 3166 (North America only with respect to ISO 3166-2). Future revisions of this specification will extend coverage to other parts of these standards, however, as needed/requested by the OMG community.

1.1 Overview

The Languages, Countries and Codes (LCC) specification includes two modules:

(1) Languages, which includes three ontologies:

- Language Representation, which provides the concepts and relationships that correspond to all six parts of ISO 639 and are derived from ISO 630-4;
- ISO 639-1 Language Codes, which covers the two character digraphs (codes) representing the 180+ languages that are most commonly used in terminology, lexicography, and linguistics, and
- ISO 639-2, which provides the three character trigraphs (codes) for all of the languages specified in ISO 639-1 as well as additional languages and language groups that are relatively commonly used.

(2) Countries, which includes three ontologies:

- Country Representation, which provides the concepts and relationships that correspond to all three parts of ISO 3166;
- ISO 3166-1 Country Codes, which covers the two and three character country codes representing the almost 250 countries, territories, and other entities that are recognized by the United Nations, and
- ISO 3166-2 Subdivision Codes, which provides composite (country + subdivision) codes and subdivision definitions for all of the entities covered by ISO 3166-1.

Note that this initial version of the LCC specification only covers subdivision codes for North America (i.e., states, districts, territories, and provinces of Canada, the United States, and Mexico), based on requirements for other OMG specifications including the Financial Industry Business Ontology (FIBO). Other subdivision codes can be added by implementers as needed until such time as they are incorporated into a revision of the standard. Similarly, coverage of the other parts of ISO 639, including ISO 639-3, which provides comprehensive coverage of every known individual language spoken around the world, including many historical and extinct languages, ISO 639-5, which includes language families and groups, and ISO 639-6, which addresses language variants, may be added as requirements for these codes arise.

1.2 Metadata

Annotations on concepts, properties, and individuals in this specification follow the general policies recommended by the OMG Architecture Board, including the use of (1) the Dublin Core Metadata Terms[1], (2) the Simple Knowledge Organization System (SKOS)[2], and (3) the OMG's Specification Metadata[3]. In general, every element in the

ontologies must have a definition, and in many cases in the Language Representation and Country Representation ontologies, the source section of the relevant standard is referenced.

2 Conformance

The Languages, Countries, and Codes (LCC) specification provides a number of possible conformance points for implementers. These fall into the following categories:

(1) Specification-level conformance with the RDF/OWL ontologies, which means that the subject application formally imports (i.e., through `owl:imports` statements in another ontology or via loading the full set of ontologies for reference in a knowledge base that supports RDF/OWL);

1. Specification-level conformance with the RDF/OWL ontologies, which means that the subject application formally imports (i.e., through `owl:imports` statements in another ontology or via loading the full set of ontologies for reference in a knowledge base that supports RDF/OWL);
2. Ontology-level conformance – which means that the subject application formally imports one or more of the LCC ontologies but may not import all of them;
3. Linked Data-level conformance – which means that the subject application references, but may not formally import, one or more of the LCC ontologies;
4. UML Model-level conformance – which means that the subject application reuses either the ODM XMI or UML XMI models that make up the LCC specification, for example, to use the reference language or country codes in another UML model (including, but not limited to an ODM-compliant model).

These should be considered independent conformance points, although applications providing specification-level conformance will, by definition, also support ontology- and linked data-level conformance. Applications providing ontology-level conformance will, by definition, have linked data-level conformance.

In all four (4) cases, implementers may extend any of the LCC ontologies as necessary, to add language or country codes required between releases, or to add application-specific codes needed to address various requirements. Typically such extensions will entail ontology-level conformance. We encourage implementers to submit any requirements for extension to the relevant LCC task force, as appropriate.

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[1] See http://www.dublincore.org/documents/dcmi-terms/ for more information about the Dublin Core and DCMI

[2] See http://www.w3.org/2004/02/skos/ for more information about the Simple Knowledge Organization System (SKOS)

[3] The AB Recommendation for Specification Metadata is available at http://www.omg.org/techprocess/ab/SpecificationMetadata.rdf.

Note that ontology-level conformance implies that there is a list of LCC ontologies that have been imported into the conforming application, tool, or ontology. Implementers are required to provide that list with their conformance statements, including the appropriate `owl:versionIRI` for each of the LCC ontologies they support.

3 References

3.1 Normative

Note that for the ISO specifications listed herein, in cases where there are registration authorities (RA) for the codes, the latest version as of the `owl:versionIRI` in the ontology metadata has been used for development of this specification. The latest version published by the relevant RA is more recent than what has been published by ISO in all cases. The task force intends that subsequent revisions of this specification should be maintained in such a way as to be current with respect to the codes published by the appropriate RA to the degree possible.

Reference	**Description**
[Dublin Core]	DCMI Metadata Terms, Issued 2013-06-14 by the Dublin Core Metadata Initiative. Available at http://www.dublincore.org/documents/dcmi-terms/.
[ISO 639-1]	ISO 639-1:2002 Codes for the representation of names of languages -- Part 1: Alpha-2 code
[ISO 639-2]	ISO 639-2:1998 Codes for the representation of names of languages -- Part 2: Alpha-3 code
[ISO 639-3]	ISO 639-3:2007 Codes for the representation of names of languages -- Part 3: Alpha-3 code for comprehensive coverage of languages
[ISO 639-4]	ISO 639-4:2010 Codes for the representation of names of languages -- Part 4: General principles of coding of the representation of names of languages and related entities, and application guidelines
[ISO 639-5]	ISO 639-5:2008 Codes for the representation of names of languages -- Part 5: Alpha-3 code for language families and groups
[ISO 639-6]	ISO 639-6:2009 Codes for the representation of names of languages -- Part 6: Alpha-4 code for comprehensive coverage of language variants
[ISO 704]	ISO 704:2000 Terminology Work – Principles and Methods
[ISO 1087]	ISO 1087-1:2000 Terminology — Vocabulary — Part 1: Theory and application
[ISO 3166-1]	ISO 3166-1:2013 Codes for the representation of names of countries and their subdivisions -- Part 1: Country codes

[ISO 3166-2]	ISO 3166-2:2013 Codes for the representation of names of countries and their subdivisions -- Part 2: Country subdivision code
[ISO 3166-3]	ISO 3166-3:2013 Codes for the representation of names of countries and their subdivisions -- Part 3: Code for formerly used names of countries
[MOF Core]	Meta Object Facility (MOF™) Core. Available at http://www.omg.org/spec/MOF/
[MOF XMI]	MOF 2/XMI (XML Metadata Interchange) Mapping Specification. Available at http://www.omg.org/spec/XMI/
[ODM]	Ontology Definition Metamodel (ODM. Available at http://www.omg.org/spec/ODM/
[OMG AB Specification Metadata]	OMG Architecture Board recommendations for specification of ontology metadata, Available at http://www.omg.org/techprocess/ab/SpecificationMetadata.rdf
[OWL 2]	OWL 2 Web Ontology Language Quick Reference Guide (Second Edition), W3C Recommendation 11 December 2012. Available at http://www.w3.org/TR/2012/REC-owl2-quick-reference-20121211/.
[RDF Concepts]	RDF 1.1 Concepts and Abstract Syntax. Richard Cyganiak, David Wood and Markus Lanthaler, Editors. W3C Recommendation, 25 February 2014. Available at http://www.w3.org/TR/rdf11-concepts/
[RDF Schema]	RDF Schema 1.1. Dan Brickley and R.V. Guha, Editors. W3C Recommendation, 25 February 2014. Available at http:// www.w3.org/TR/rdf-schema/.
[SKOS]	SKOS Simple Knowledge Organization System Reference, W3C Recommendation 18 August 2009. Available at http://www.w3.org/TR/2009/REC-skos-reference-20090818/.
[UML2]	Unified Modeling Language™ (UML®). Available at http://www.omg.org/spec/UML/
[Unicode]	*The Unicode Standard, Version 3*, The Unicode Consortium, Addison-Wesley, 2000. ISBN 0-201-61633-5, as updated from time to time by the publication of new versions. (See http:// www.unicode.org/unicode/standard/versions/ for the latest version and additional information on versions of the standard and of the Unicode Character Database).
[UTF-8]	RFC 3629: UTF-8, a transformation format of ISO 10646. F. Yergeau. IETF, November 2003, http://www.ietf.org/rfc/rfc3629.txt
[W3C Datatypes in RDF and OWL]	XML Schema Datatypes in RDF and OWL, W3C Working Group Note 14 March 2006, Available at http://www.w3.org/TR/2006/NOTE-swbp-xsch-datatypes-20060314/.
[XML Schema Datatypes]	XML Schema Part 2: Datatypes. W3C Recommendation 28 October 2004. Available at http://www.w3.org/TR/xmlschema-2/.

3.2 Non-normative

The following informative documents are referenced in this specification:

Reference	Description
[BCP 47]	BCP 47, Tags for Identifying Languages, see http://tools.ietf.org/html/bcp47
[DL Handbook]	THE DESCRIPTION LOGIC HANDBOOK: Theory, implementation, and applications. Baader, McGuinness, Nardi, and Patel-Schneider, editors. Cambridge University Press, Cambridge, United Kingdom, 2003.

4 Terms and Definitions

For the purposes of this specification, the following terms and definitions apply. See sections 8 and 9 in this specification for more detailed definitions of several of the terms listed below.

Country	a geopolitical entity representing a country with references for specific code elements that denote it in the context of ISO 3166
CountryIdentifier	similar to the language identifier specified in ISO 639, a string of letters assigned to a country or other geopolitical entity name specified in ISO 3166-1 for the purpose of uniquely representing it
CountrySubdivision	a unit resulting from the division of a country, dependency, or other area of special geopolitical interest contained in ISO 3166-1
Language	a systematic use of sounds, characters, symbols or signs to communicate meaning
LanguageIdentifier	a string of characters that uniquely identifies a linguistic entity
Ontology	An ontology specifies a rich description of the • Terminology, concepts, nomenclature • Relationships among and between concepts and individuals • Sentences distinguishing concepts, refining definitions and relationships (constraints, restrictions, regular expressions) relevant to a particular domain or area of interest[1].

[1] Kendall, Elisa and McGuinness, Deborah: "Ontology 101: An Introduction to Knowledge Representation & Ontology Development", Tutorial given at Smart Data 2015, August 18th, 2015, San Jose, CA.

5 Symbols and Abbreviations

5.1 Symbols

There are no symbols introduced by this specification.

5.2 Abbreviations

The following abbreviations are used throughout this specification:

- IRI – Internationalized (Uniform) Resource Identifier
- LCC – Languages, Countries and Codes
- OWL – Web Ontology Language
- ODM – Ontology Definition Metamodel
- RDF – Resource Definition Framework
- UML – Unified Modeling Language
- URI – Uniform Resource Identifier
- URL – Uniform Resource Locator
- XMI – XML Metadata Interchange
- XML – eXtensible Markup Language

6 Additional Information

6.1 Acknowledgements

The following organization submitted this specification:

- Adaptive, Inc.
- Thematix Partners LLC
- Unisys

The following companies and organizations are strong supporters of this specification:

- EDM Council

6.2 Notation

The diagrams included herein are ODM-compliant UML diagrams, in other words, they conform to the UML Profiles for RDF and OWL specified in the OMG's Ontology Definition Metamodel [ODM] Specification. This includes the set of UML stereotypes and graphical notation used in the diagrams provided.

The color scheme employed in these diagrams includes:

- Basic OWL Classes: white for classes defined within the current (local) ontology, amber for classes defined within an imported (referenced) ontology

- OWL Restriction Classes and other Class Expressions (unions, intersection, complements): green
- OWL Object Properties: blue
- OWL Data Properties: dark gray
- OWL Datatypes: pink
- OWL Individuals: light gray

These colors are provided for clarification purposes only, and are non-normative.

Within the context of this, a module is a group of ontologies, organized as a subdomain with respect to the LCC namespace and as a folder from a file management perspective. Several ontologies are contained in each of the two modules in this specification, which include Languages and Countries. For each module there is an "about" file, which provides metadata about the module, specified herein in tabular form. Each of the primary ontologies in a given module is defined as an ODM-compliant UML model as well as in OWL (aside from the "about" file, which is expressed in RDF/OWL, RDF/XML and Turtle serializations only). The normative ontology is expressed in ODM XMI (*i.e.*, XMI that conforms to the ODM metamodels for RDF and OWL), ODM UML XMI (i.e., that conforms to the UML Profiles for RDF and OWL in the ODM specification), and in RDF/XML serialized OWL 2.

The notation used to represent description logic expressions (*i.e.*, the expressions in the Parent columns in class tables containing ontology details) is consistent with the notation defined in the Description Logic Handbook [DL Handbook]. Some of the basics are described in Table 6-1. Note that this is not intended to be comprehensive, but includes the primary patterns that are used in the LCC specification, for property restrictions in particular.

Table 6.1

Construct	Description	Notation
Boolean Connectives and Enumeration		
intersection	The intersection of two classes consists of exactly those individuals which are instances of both classes.	$C \cap D$
union	The union of two classes contains every individual which is contained in at least one of these classes.	$C \cup D$
enumeration	An enumeration defines a class by enumerating all its instances.	oneOf (i_1, i_2, i_3, … i_n)
Property Restrictions		
universal quantification	Universal quantification is used to specify a class of individuals for which all related individuals must be instances of a given class (i.e., allValuesFrom in OWL).	$\forall$R.C, where R is the relation (property) and C is the class that constrains all values for related individuals
existential quantification	Existential quantification is used to specify a class as the set of all individuals that are connected via a particular property to at least one individual which is an instance of a certain class (i.e., someValuesFrom in OWL).	$\exists$R.C, where R is the relation (property) and C is the class that constrains some values of related individuals
individual value	Individual value restrictions are used to specify classes of individuals that are related to one particular individual (*i.e.*, hasValue in OWL).	$\forall$R.I, where R is the relation (property) and I is the individual

exact cardinality	Cardinality (number) restrictions specify classes by restricting the cardinality on the sets of fillers for roles (relationships, or properties in OWL). Exact cardinality restrictions restrict the cardinality of possible fillers to exactly the number specified.	= n R (for unqualified restrictions) = n R.C (for qualified restrictions, i.e., including onClass or on DataRange)
maximum cardinality	Maximum cardinality restrictions restrict the cardinality of possible fillers to at most the number specified (inclusive).	$\leq$ n R (for unqualified restrictions) $\leq$ n R.C (for qualified restrictions)
minimum cardinality	Minimum cardinality restrictions restrict the cardinality of possible fillers to at least the number specified (inclusive).	$\geq$ n R (for unqualified restrictions) $\geq$ n R.C (for qualified restrictions)
Class Axioms		
equivalent classes	Two classes are considered equivalent if they contain exactly the same individuals.	$\equiv$ C
disjoint classes	Disjointness means that membership in one class specifically excludes membership in another.	$\neg$ C

Within the tabular representation for restrictions in the tables included herein, the identifiers for the restrictions shown in the diagrams are included parenthetically following the logic expressions. These are not part of the logic, but are included for comparison purposes. The identifiers are named based on the precedent set in the FIBO specifications, which includes the namespace prefix for the ontology followed by a unique number, and are unique within the context of an individual ontology only.

Additionally, some restrictions are nested, whereby the content of an embedded (nested) restriction is also included parenthetically. In these cases, all of the identifiers will be included, also parenthetically, following the complete specification of the complex restriction. Note too that in the case of complex restrictions, where there are nested elements in parentheses, the “dot notation” used as a separator between a property and the role filler is replaced with the embedded parenthetical filler definition. A “role” from a description logic perspective is essentially a property in OWL, and the role “filler” is the class or individual that provides the value for that role in a given axiom (i.e., in a restriction or other logic expression).

The majority of the property restrictions specified in LCC are defined as necessary conditions for class membership, rather than sufficient conditions. As a result, the tables assume that necessary conditions is the default and only in cases where a restriction imposes sufficient conditions will that be stated.

7 Architecture

7.1 “About” the LCC Ontologies

The "about" files for LCC provide content describing the specification and each of the modules, complementing the content in this specification and in some cases duplicating it in the form of RDF/OWL metadata. These files are designed to (1) describe the machine-readable content of the specification for people who download that content directly, via content negotiations, and import it into tools that can interpret and display those files, (2) for potential use in tagging the specification document on the OMG site, and (3) to provide a high-level ontology in the case of AboutLCC-1.0.rdf that imports all of the constituent ontologies for ease of use.

7.2 Namespace Definitions

The namespaces and prefixes corresponding to external elements required for use in LCC are provided. Table 7-1 lists the prefixes and namespaces on which LCC depends that are external to LCC. Table 7-2 provides the namespace declarations required for use of LCC itself. The prefixes provided in Tables 7-1 and 7-2 are normative, and their use is required in any conformant extension.

Table 7.1 - Prefix and Namespaces for referenced/external vocabularies

Namespace Prefix	Namespace
rdf	http://www.w3.org/1999/02/22-rdf-syntax-ns#
rdfs	http://www.w3.org/2000/01/rdf-schema#
owl	http://www.w3.org/2002/07/owl#
xsd	http://www.w3.org/2001/XMLSchema#
dct	http://purl.org/dc/terms/
skos	http://www.w3.org/2004/02/skos/core#
sm	http://www.omg.org/techprocess/ab/SpecificationMetadata/

The namespace approach taken for LCC is based on OMG guidelines and is constructed as follows:

- A standard prefix `http://www.omg.org/spec/`
- The abbreviation for the specification: in this case `LCC`
- The ontology name (including the module)

Note that the URI/IRI strategy for the ontologies in LCC takes a “slash” rather than “hash” approach, in order to accommodate server-side applications. Namespace prefixes are constructed as follows with the components separated by “-“:

- The specification abbreviation: `lcc`
- An abbreviation for the ontology name

The namespaces and prefixes corresponding for the Languages, Countries, and Codes ontologies are summarized in Table 7-2. These are given by module, and within a module in alphabetical order, rather than with any intent to show imports relationships. The table includes the namespace definitions for the "about" files that are part of the machine-readable deliverables for the specification, but that are not required for imports closure. Note that these are not versioned, although version IRIs are included in every OWL ontology and are documented in the metadata for each of them.

Table 7.2 - Prefix and Namespaces for Languages, Countries and Codes (LCC)

Namespace Prefix	Namespace
lcc-spc	http://www.omg.org/spec/LCC/AboutLCC/
lcc-spc-1.0	http://www.omg.org/spec/LCC/AboutLCC-1.0/
lcc-lng	http://www.omg.org/spec/LCC/Languages/AboutLanguages/
lcc-lr	http://www.omg.org/spec/LCC/Languages/LanguageRepresentation/
lcc-639-1	http://www.omg.org/spec/LCC/Languages/ISO639-1-LanguageCodes/
lcc-639-2	http://www.omg.org/spec/LCC/Languages/ISO639-2-LanguageCodes/
lcc-cty	http://www.omg.org/spec/LCC/Countries/AboutCountries/
lcc-cr	http://www.omg.org/spec/LCC/Countries/CountryRepresentation/
lcc-3166-1	http://www.omg.org/spec/LCC/Countries/ISO3166-1-CountryCodes/
lcc-3166-2	http://www.omg.org/spec/LCC/Countries/ISO3166-2-SubdivisionCodes/

8 Language Ontologies

8.1 Overview

This section defines the terms, definitions, relationships, and additional logic specified in the ontologies that make up the Languages Module.

8.2 Module: Languages

The Languages module includes three primary ontologies, as well as an "about" file, namely:

- Language Representation, which provides the concepts and relationships that correspond to all six parts of ISO 639 and are derived primarily from ISO 630-4;
- ISO 639-1 Language Codes, which covers the two character digraphs (codes) representing the 180+ languages that are most commonly used in terminology, lexicography, and linguistics, and
- ISO 639-2, which provides the three character trigraphs (codes) for all of the languages specified in ISO 639-1 as well as additional languages and language groups that are relatively commonly used.

Metadata contained in the "about" file that describes the module is given in Table 8.1.

Table 8.1 – Languages Module Metadata

Metadata Term	Value
sm:filename	AboutLanguages.rdf
sm:fileAbbreviation	lcc-lng
OntologyIRI	http://www.omg.org/spec/LCC/Languages/AboutLanguages/
owl:versionIRI	http://www.omg.org/spec/LCC/20151101/Languages/AboutLanguages/
sm:moduleName	Languages
sm:moduleAbbreviation	LCC-LNG
sm:moduleVersion	1.0
sm:moduleAbstract	This module contains ontologies representing languages commonly used in business, including human and machine-interpretable languages. The main body of the module is based on ISO 639 as well as the language element of the Language Tag specified in BCP 47 (RFC 4646, RFC 4647), to provide a systematic description of the vocabulary used for language representation, including natural and artificial languages.

8.3 Ontology: Language Representation

This ontology, based on ISO 639 as well as the language element of the Language Tag specified in BCP 47 (RFC 4646, RFC 4647), provides a systemic description of the vocabulary used for language representation, including natural and artificial languages.

ISO 639 provides two language codes, one as a two-letter code (ISO 639-1) and another as a three-letter code (ISO 639-2, ISO 639-3, ISO 639-5) for the representation of names of languages. ISO 639-1 was devised primarily for use in terminology, lexicography, and linguistics. ISO 639-2 represents all of the languages contained in ISO 639-1, additional languages and language groups, as they may be coded for special purposes when more specificity in coding is needed. The languages listed in ISO 639-1 are a subset of the languages listed in ISO 639-2; every language code element in the two-letter code has a corresponding language code element in the three-letter code, but not necessarily vice versa. ISO 639-4 provides the basis for describing languages, as defined in this ontology, and additional codes are provided in 639-5 and other parts of the standard, again with more details about macrolanguages, other lesser known independent languages, and special language groups.

ISO 639-3 extends the set of three-letter codes provided in 639-2 to cover all of the natural, human languages in use today, along with many well-known ancient, extinct, and historical languages, including written and signed languages. It also identifies the codes found in 639-2 that represent families or groups of languages rather than a single human language, depending on the perspective of the consumer.

The Registration Authority for ISO 639-1 is the International Information Centre for Terminology, ISO 639-1/RA. This organization is responsible for maintenance of Part-1, and more information can be found at http://www.infoterm.info/standardization/iso_639_1_2002.php, although the actual code set is maintained by the US Library of Congress, together with the code set for ISO 639-2.

The Registration Authority for ISO 639-2 is the Library of Congress, ISO 639-2/RA. The Library of Congress is responsible for maintenance of Part-2, at http://www.loc.gov/standards/iso639-2/iso639-2ra.html. Current code sets for ISO 639-1 and ISO 639-2 are available from this site, as mentioned above. In addition to the material covered in the basic standard, the Library of Congress also publishes the German names for all languages, which is reflected in the properties given below. See http://loc.gov/standards/iso639-2/php/code_list.php for the latest release.

The Registration Authority for ISO 639-3 is SIL International, ISO 639-3/RA. SIL International is responsible for maintenance of Part-3, and more information can be found at http://www.sil.org/iso639-3/default.asp.

The codes included herein also correspond to the language element of the Language Tag specified in BCP 47 (RFC 4646, RFC 4647), and can be used for matching or other application development purposes (e.g., use of language identifier literals in applications that build up the RFC 4646 based tags).

This ontology (Language Representation) defines the model for the standard, based in part on ISO 639-4, with individual codes for the other parts of the standard represented in dependent models.

Table 8.2 – Language Representation Ontology Metadata

Metadata Term	Value
sm:filename	LanguageRepresentation.rdf
sm:fileAbbreviation	lcc-lr
OntologyIRI	http://www.omg.org/spec/LCC/Languages/LanguageRepresentation/
owl:versionIRI	http://www.omg.org/spec/LCC/20151101/Languages/LanguageRepresentation/
sm:directSource	ISO 639-1 Codes for the representation of names of languages - Part 1: Alpha-2 code, First edition, 2002-07-15

	ISO 639-2 Codes for the representation of names of languages - Part 2: Alpha-3 code, First edition, 1998-11-01 ISO 639-3 Codes for the representation of names of languages - Part 3: Alpha-3 code for comprehensive coverage of languages, First edition, 2007-02-01 ISO 639-4 Codes for the representation of names of languages - Part 4: General principles of coding of the representation of names of languages and related entities, and application guidelines, First edition, 2010-07-15 ISO 639-5 Codes for the representation of names of languages - Part 5: Alpha-3 code for language families and groups, First edition, 2008-05-15 ISO 639-6 Codes for the representation of names of languages - Part 6: Alpha-4 code for comprehensive coverage of language variants, First edition, 2009-12-01
sm:relatedSpecification	BCP 47, Tags for Identifying Languages, see http://tools.ietf.org/html/bcp47
sm:historyNote	This ontology is ultimately intended to represent all of ISO 639 for reference purposes, and to be sufficiently extensible to accommodate new sections or modifications as they are published. The current version of the ontology (including subordinate modules containing the language names and codes) provides a unique English name (i.e., the reference name from 639-3) for each language, with UTF-8 encoded literals specifying alternates in English, French, and Indigenous languages where present in the standard, and in German corresponding to the names on the LoC web site. 1. Where multiple English names occur in 639-1 and 639-2, we have used the primary name specified in 639-2:1998 superseded by the latest revision posted by the registration authority, or, where multiples are specified by the registration authority, the reference name from ISO 639-3 as the 'named individual name' for a given language. For languages specified in ISO 639-1, there is at least one English name and at least one French name for every language, corresponding to exactly one alpha-2 code. Most languages from ISO 639-1 have at least one indigenous name. Most languages with codes available from the Library of Congress also have at least one German name. The correspondence between the alpha-2 codes and languages are made explicit in the individuals representing the codes themselves, and can be inferred for the languages using an OWL DL reasoner. 2. This release of the ontology covers all languages specified in parts 1 and 2 of the standard, and categorizes the alpha-3 codes from part 2 according to the categorization scheme provided in parts 3 and 4. Subsequent releases of the ontology will address additional languages covered in part 3, as well as additional components of the standard, such as equivalence to standards representing relevant scripts, as they become available, and the language groups covered by ISO 639-5. 3. We have used individuals to represent all alpha-2 and alpha-3 codes, which, in turn, have matching strings (tags) associated with them for use in a variety of applications to facilitate reasoning and mapping. The strings are provided as datatype properties of the individuals to support applications that may require them for RFC 4646-style tagging.

	4. Note that some tools, including certain UML tools, are case insensitive. Thus, in cases where a language name collides with an alpha-2 or alpha-3 code, (i.e., Ga, Ewe, Fon, Ido, Lao, Tiv, Twi, Vai, and Yao), the names for the individual codes have been extended with '_' (e.g., 'ewe_1'). 5. We found a few anomalies in the standards while developing this ontology. These include: (1) Bihari is included in the 2002 version of 639-1, in the 1998 version of 639-2, and in the online codes posted by the Library of Congress in 2007 for parts 1 and 2, with part 1 code of 'bh' and part 2 bibliographic and terminology codes of 'bih'. At that time, there was no discussion stating that Bihari is a collective language, although it was omitted from the downloadable data for 639-3. Since then, the language element has been renamed 'Bihari languages', in both English and French, without change to the corresponding language codes. The latest version of the code sets reflect this modification. Our assumption is that the trigraph for Bihari is a collective language code, which is supported by online research in Eastern Indic languages. (2) Serbo-Croatian was included in the 2002 version of 639-1, with part 1 code 'sh'. It was not mentioned in the 1998 version of 693-2, but appears in 639-3 with a language identifier of 'hbs', without codes for 639-2. As of 2010, Serbo-Croation has been eliminated from ISO 639-1 and 639-2 codes altogether, and the ontology reflects this. (3) Other changes in the latest version of the ontology include elimination of the 639-1 code for Moldavian, merging the language with Romanian, and additional English and French names for some languages, such as Dutch (to include Flemish, flamais), among others. (4) German names for languages in ISO 639-2 were added to the Library of Congress in 2014, and are supported in this version of the ontology.

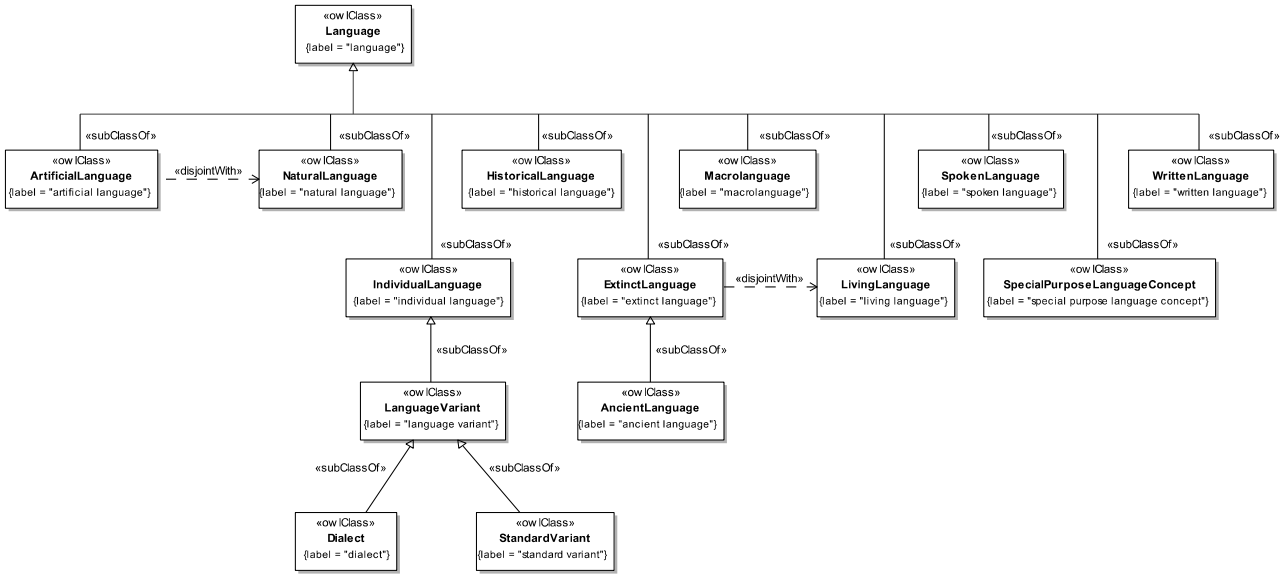

Figure 8.1 - Language Class Hierarchy

Figure 8.1 provides the primary inheritance hierarchy for languages, including the disjoint relationship between extinct and living languages.

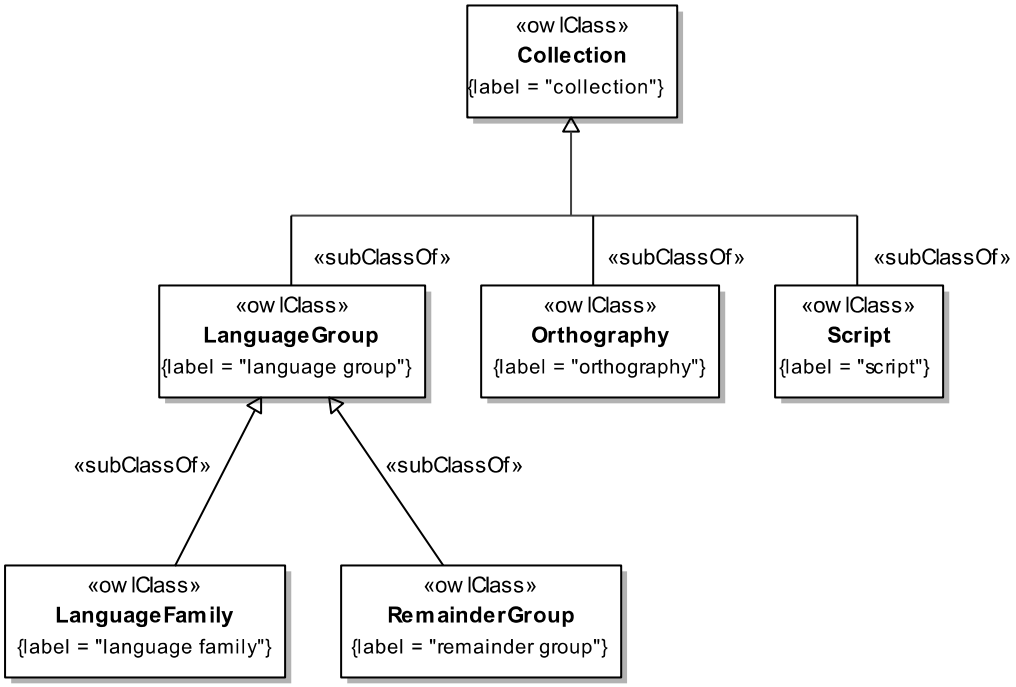

Figure 8.2 - Collection Class Hierarchy

The primary collection concepts are shown in Figure 8.2. These include not only language groups of various sorts but the concept of an orthography for a language and one or more scripts for a language, which are collections of rules and symbols.

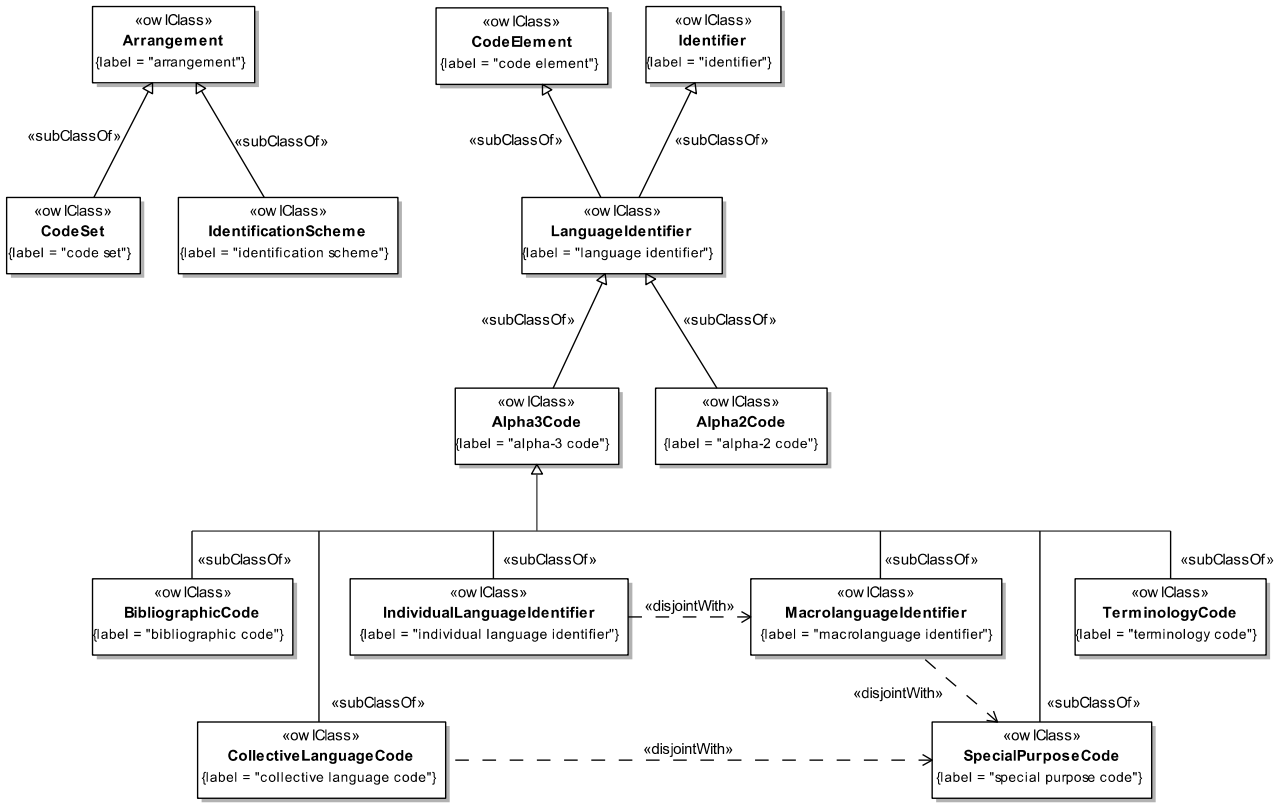

Figure 8.3 - Identifier and Code Class Hierarchy

Figure 8.3 provides a view of the identifier and code concepts in the ontology, including disjoint relationships among the three-character language codes.

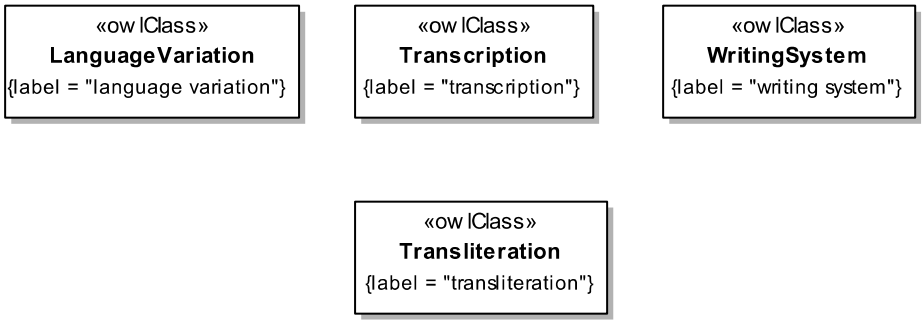

Figure 8.4 - Systems and Processes in Language Analysis

The remaining concepts defined in ISO 639, for several processes and systems related to language, are given in Figure 8.4.

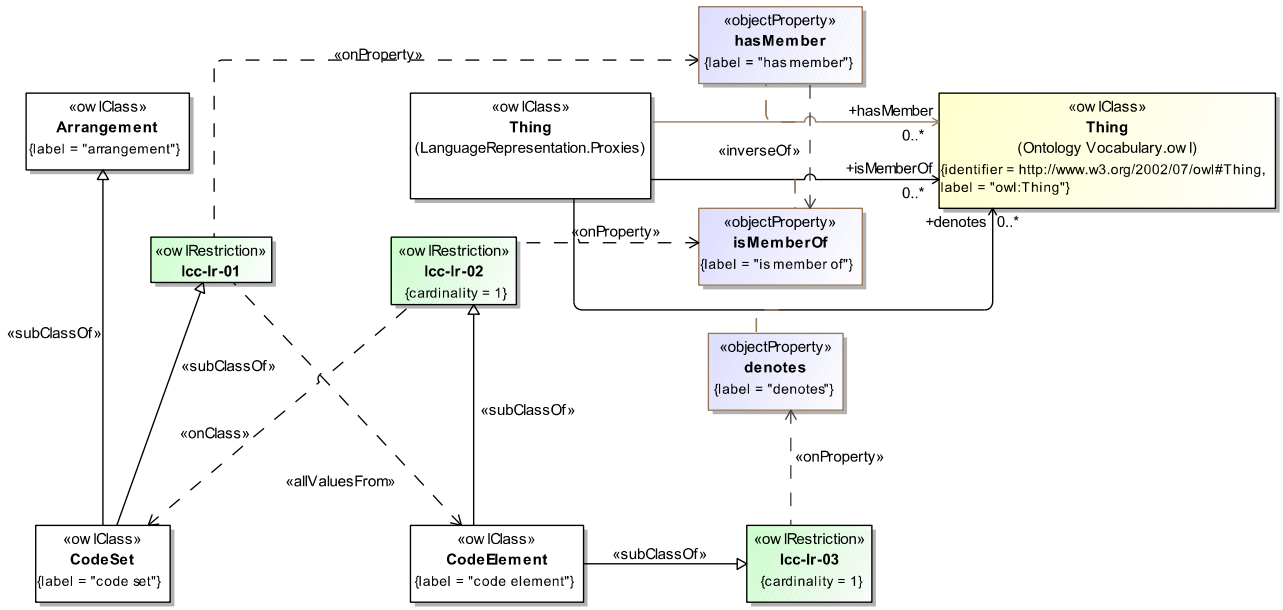

Figure 8.5 - Definition of Code Set and Code Element

Figure 8.5 elaborates the definitions for code sets and code elements, which are fundamental to both ISO 639 and ISO 3166.

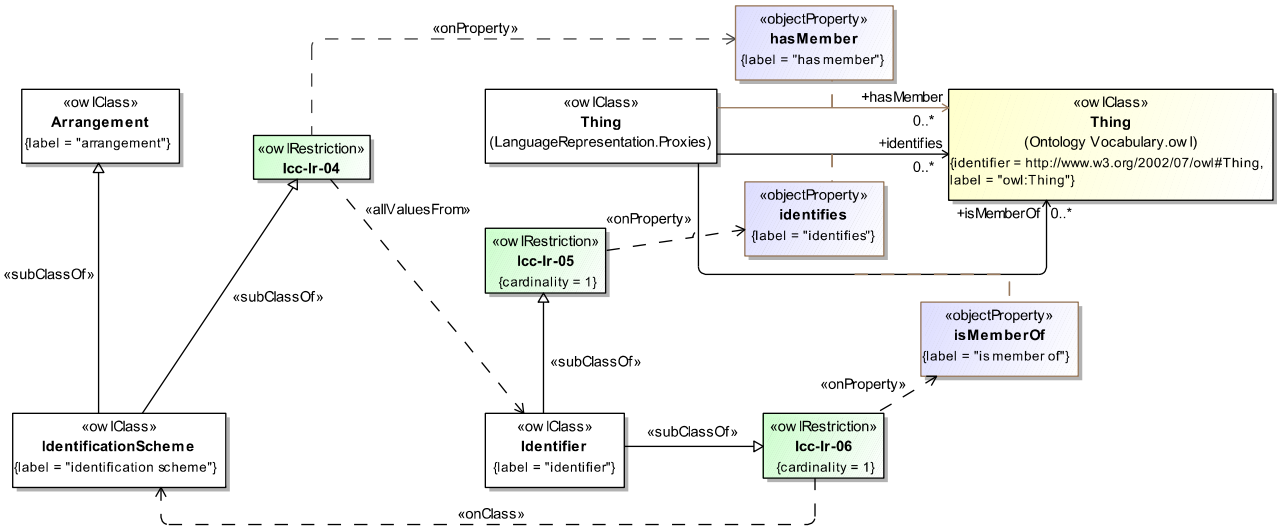

Figure 8.6 - Definition of Identification Schemes and Identifiers

Figure 8.6 defines identification schemes and identifiers, which are also fundamental to both ISO 639 and ISO 3166.

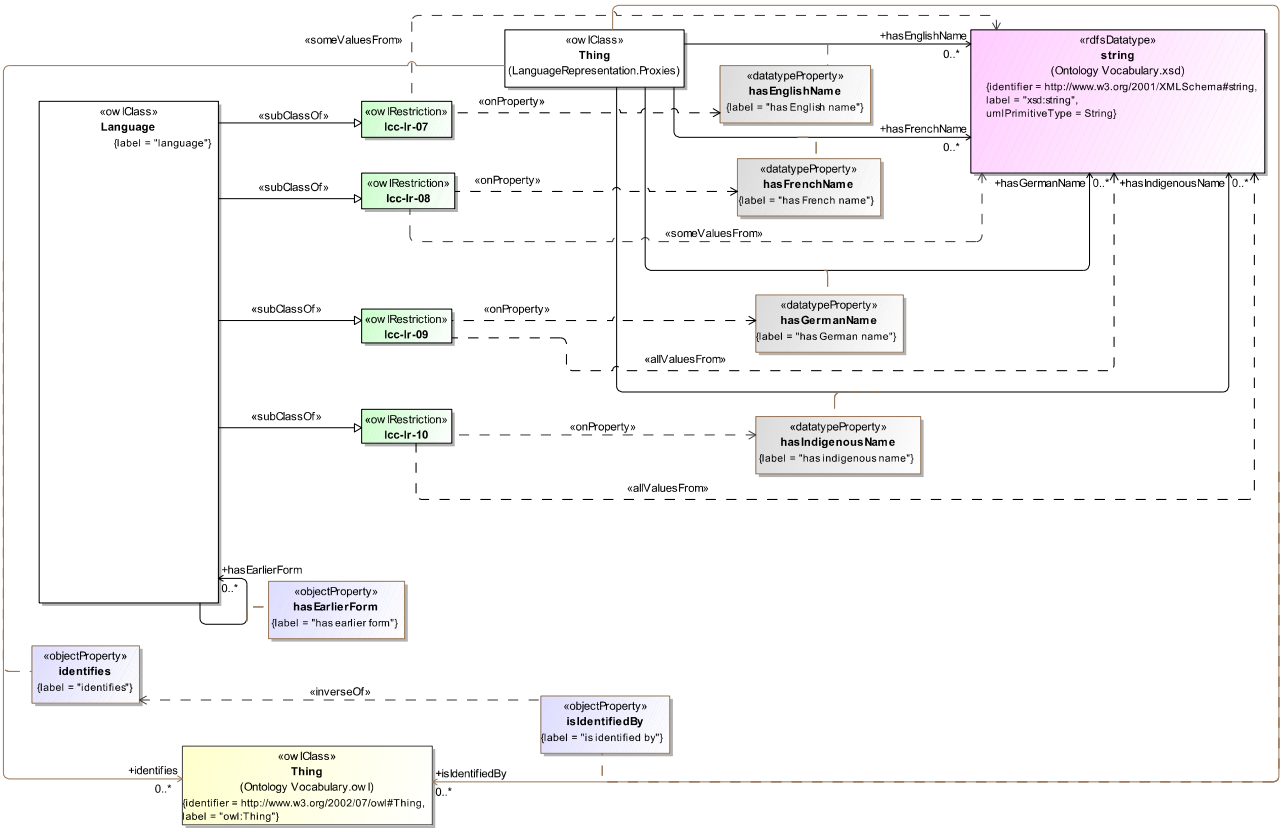

Figure 8.7- Definition of Language

As shown in Figure 8.7, there are a number of potential names associated with a given language as specified in the ISO 639 standard. German names have been added to the standard on the registration authority web sites.

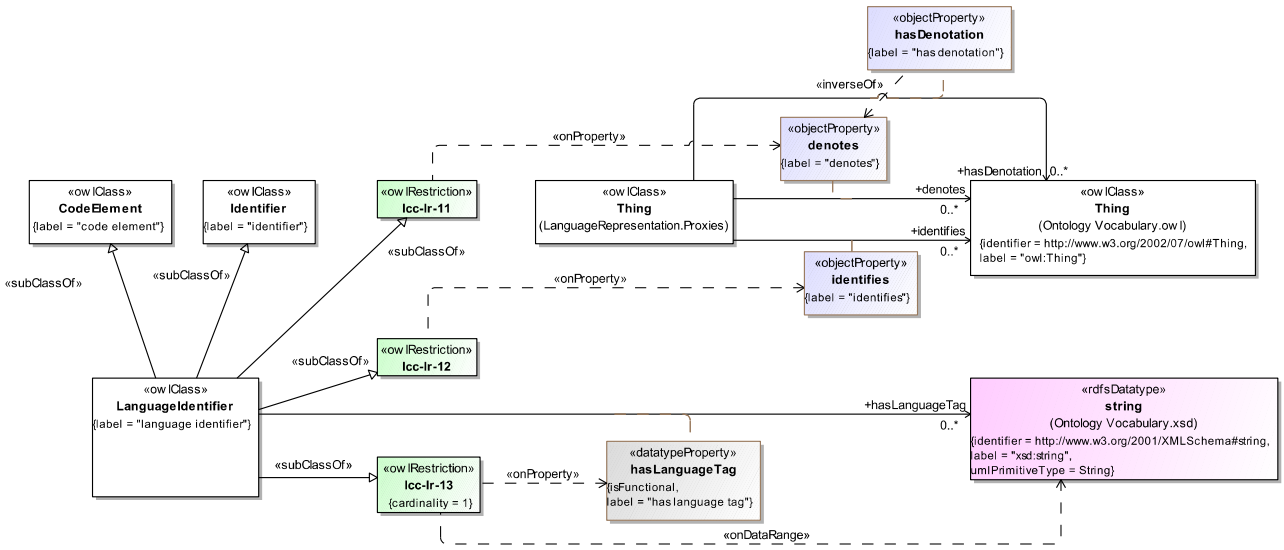

Figure 8.8 - Definition of Language Identifier

Figure 8.8 provides the full definition of a language identifier, which the various kinds of ISO 639 language codes inherit.

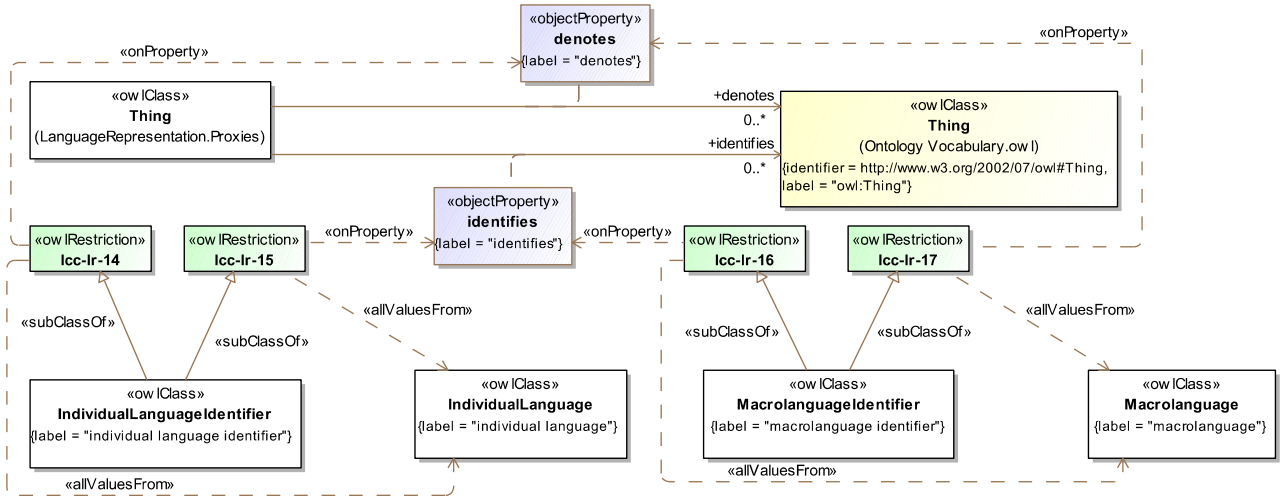

Figure 8.9 - Definition of Individual and Macrolanguage Identifiers

ISO 639 differentiates between individual language and macrolanguages, including between the respective identifiers, where a macrolanguage represents multiple individual languages in some contexts but are treated as a single language in ISO 639-2, as shown in Figure 8.9.

Finally, Figure 8.10 provides the definitions for the identifiers specific to language groups and special purpose concepts, as used in ISO 639.

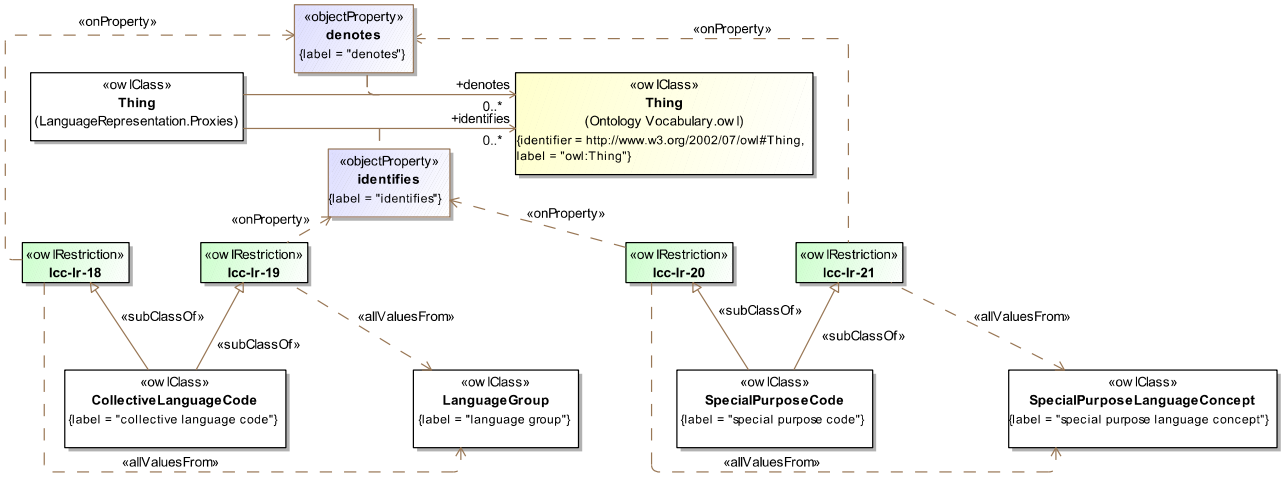

Figure 8.10 - Definitions of Identifiers for Language Groups and Special Purpose Concepts

The detailed annotations and axioms that comprise the ontology are provided in Table 8-3.

Table 8.3 - Language Representation Ontology Details

Classes

Name	Annotations	Class Expressions
Alpha2Code (alpha-2 code)	Definition: a language identifier for a human language as defined by ISO 639-1, that is, a two-letter combination of characters used to represent a language or languages Note: In the ISO 639-1 language code, each language identifier is composed of two letters (lower case letters from the Latin alphabet, corresponding to characters 97 through 122 of the UTF-8 encoding), without diacritical marks or other encodings of any kind. Scope note: The identifiers are not abbreviations for the languages they identify. They are derived in some way from the indiginous language name or from preferences of the relevant speech community.. Source: Section 4.1, ISO 639-1 See also: https://en.wikipedia.org/wiki/UTF-8	Parent Class: LanguageIdentifier
Alpha3Code (alpha-3 code)	Definition: a language identifier for a human language as defined by ISO 639, that is, a three-letter combination of characters used to represent a language or languages Note: In the ISO 639-2 language code, each language identifier is composed of three letters (lower case letters from the Latin alphabet, corresponding to characters 97 through 122 of the UTF-8 encoding), without diacritical marks or other encodings of any kind. Note: Two code sets are provided in ISO 639-2, one for bibliographic applications and one for terminology applications. Some of these are considered collective language codes, referring to a family of languages, and there are a few special purpose codes for use in various applications. ISO 639-3 provides a single, three character code for each individual language or macrolanguage. Additional codes for language families and groups are specified in other parts of the standard. Source: Section 3.2, ISO 639-2 See also: https://en.wikipedia.org/wiki/UTF-8	Parent Class: LanguageIdentifier
AncientLanguage (ancient language)	Definition: an extinct language that has an attested literature and is recognized as having special status in the academic community Note: Ancient languages may have either individual or collective language codes. See section 4.1.5, ISO 639-2, for an explanation of the latter case.	Parent Class: ExtinctLanguage

	Source: Section 3.25 and 4.7, ISO 639-4	
Arrangement (arrangement)	Definition: a structure or means of organizing information such as a schema, numbering system, organization scheme, measurement system, taxonomy, or language for organizing information	
ArtificialLanguage (artificial language)	Definition: a language for human communication that has been artificially devised Note: Artificial languages do not include reconstructed languages or computer programming languages. Source: Section 3.28 and 4.8, ISO 639-4	Parent Class: Language Class Axiom: ¬ NaturalLanguage
BibliographicCode (bibliographic code)	Definition: an alpha-3 code that is a member of the set of bibliographic codes in ISO 639-2	Parent Class: Alpha3Code
CodeElement (code element)	Definition: a sequence of characters denoting something that it is associated with for some purpose, within a specified context, according to some rule set Source: ISO/IEC 11179-3 Information technology - Metadata registries (MDR) - Part 3: Registry metamodel and basic attributes, Third edition, 2013-02-15	Property Restriction: = 1 **isMemberOf.CodeSet** (lcc-lr-02) Property Restriction: = 1 **denotes** (lcc-lr-03)
CodeSet (code set, coding scheme)	Definition: a system of alpha-numeric symbols, or combinations of symbols, that stand for specified values in some context Source: ISO/IEC 11179-3 Information technology - Metadata registries (MDR) - Part 3: Registry metamodel and basic attributes, Third edition, 2013-02-15	Parent Class: Arrangement Property Restriction: ∀ **hasMember.CodeElement** (lcc-lr-01)
Collection (collection)	Definition: a grouping of some variable number of things (may be zero) that have some shared significance	
CollectiveLanguageCode (collective language code)	Definition: a language identifier or code used to represent a group of languages Note: See section 4.1.1, ISO 639-2, for an explanation of the usage of such codes, and section 4.1.3 to gain understanding of the distinction between collective language and macrolanguage codes. Source: Sections 3.3 and 4.1.1, and 4.1.3, ISO 639-2; Section 4.6, ISO 639-4	Parent Class: Alpha3Code Class Axiom: ¬ SpecialPurposeCode Property Restriction: ∀ **denotes.LanguageGroup** (lcc-lr-18) Property Restriction: ∀ **identifies.LanguageGroup** (lcc-lr-19)
Dialect (dialect)	Definition: a language variant that is specific to a geographical region or speech community Note: Dialects are typically represented via the same language code as the code for the primary language, with a few exceptions for well-known dialects. See sections 4.1.3 and 4.1.4, ISO 639-2	Parent Class: LanguageVariant

	for additional details on the treatment of dialects in the standard. Source: Sections 3.8, 4.2, and 4.5, ISO 639-4; Sections 4.1.3 and 4.1.4, ISO 639-2	
ExtinctLanguage (extinct language)	Definition: an individual language or variant that is no longer in use and has no current descendant Source: Section 3.24 and 4.7, ISO 639-4	Parent Class: Language Class Axiom: ¬ LivingLanguage
HistoricalLanguage (historical language)	Definition: a well-known prior version of a living or extinct language Source: Section 3.26 and 4.7, ISO 639-4	Parent Class: Language
IdentificationScheme (identification scheme)	Definition: a system for allocating identifiers to objects Source: ISO/IEC 11179-3 Information technology - Metadata registries (MDR) - Part 3: Registry metamodel and basic attributes, Third edition, 2013-02-15	Parent Class: Arrangement Property Restriction: ∀ **hasMember**.**Identifier** (lcc-lr-04)
Identifier (identifier)	Definition: a sequence of characters uniquely identifying something that it is associated with for some purpose and within a specified context Source: ISO/IEC 11179-3 Information technology - Metadata registries (MDR) - Part 3: Registry metamodel and basic attributes, Third edition, 2013-02-15	Property Restriction: = 1 **isMemberOf**.**IdentificationScheme** (lcc-lr-06) Property Restriction: = 1 **identifies** (lcc-lr-05)
IndividualLanguage (individual language)	Definition: a language that can be distinguished from another language by some set of rules Note: Identifiers in Parts 1, 2, and 3 of ISO 639 are assumed to denote distinct individual languages, unless the language name explicitly refers to a language group. See section 4.2 in ISO 639-4 for a detailed explanation of the definition of individual language in the context of the ISO 639 standard. Source: Section 3.7, ISO 639-4	Parent Class: Language
IndividualLanguageIdentifier (individual language identifier)	Definition: a language identifier with a scope representing an individual (distinct) language Source: Section 3.7, ISO 639-3	Parent Class: Alpha3Code Class Axiom: ¬ MacrolanguageIdentifier Property Restriction: ∀ **denotes**.**IndividualLanguage** (lcc-lr-14) Property Restriction: ∀ **identifies**.**IndividualLanguage** (lcc-lr-15)
Language (language)	Definition: a systematic use of sounds, characters, symbols or signs to communicate meaning Source: Section 3.6, ISO 639-4	Property Restriction: ≥ 1 **hasEnglishName**.**string** (lcc-lr-07) Property Restriction: ≥ 1 **hasFrenchName**.**string**

		(lcc-lr-08) Property Restriction: ∀ **hasGermanName**.**string** (lcc-lr-9) Property Restriction: ∀ **hasIndigenousName**.**string** (lcc-lr-10)
LanguageFamily (language family)	Definition: a group of individual languages related to each other through common ancestry Source: Section 3.11, ISO 639-4	Parent Class: LanguageGroup
LanguageGroup (language group)	Definition: a collection of two or more individual languages, treated as a group for some purpose Note: See section 4.6 in ISO 639-4 for additional explanatory material for language groups. Direct source: Section 3.10, ISO 639-4	Parent Class: Collection
LanguageIdentifier (language identifier, language symbol)	Definition: a string of characters that uniquely identifies a linguistic entity Scope note: In the language codes of Parts 1, 2, 3, and 5 of ISO 639, each language identifier is composed of two or three letters. Source: Section 3.5, ISO 639-4	Parent Class: CodeElement Parent Class: Identifier Property Restriction: = 1 **hasLanguageTag**.**string** (lcc-lr-13) Property Restriction: ∀ **denotes**.**Language** (lcc-lr-11) Property Restriction: ∀ **identifies.Language** (lcc-lr-12)
LanguageVariant (language variant)	Definition: a variation of an individual language that is sufficiently unique that it can be identified and named Source: Section 3.14, ISO 639-4	Parent Class: IndividualLanguage
LanguageVariation (language variation)	Definition: continuous variation within and between individual languages Note: Language variation may include change over time, space, cultural affiliation, etc. Source: Section 3.13, ISO 639-4	
LivingLanguage (living language)	Definition: an individual language or variant in use today by some speech community Source: Section 3.23, ISO 639-4	Parent Class: Language
Macrolanguage (macrolanguage)	Definition: a language that may be viewed in some circumstances as an individual language, but actually represents two or more individual languages Note: See sections 4.1 and 4.3 of ISO 639-4 for an extensive description of macrolanguages and how	Parent Class: Language

	they are different from language groups. Source: Section 3.9, ISO 639-4	
MacrolanguageIdentifier (macrolanguage identifier)	Definition: a language identifier whose scope is that of a macrolanguage Source: Section 3.7, ISO 639-3	Parent Class: Alpha3Code Class Axiom: ¬ SpecialPurposeCode Property Restriction: ∀ **denotes**.**Macrolanguage** (lcc-lr-17) Property Restriction: ∀ **identifies.Macrolanguage** (lcc-lr-16)
NaturalLanguage (natural language)	Definition: a language used in human communications that is not artificial in nature Source: Section 3.27, ISO 639-4	Parent Class: Language
Orthography (orthography)	Definition: a set of conventions and rules for representing language in written form Note: The orthographic rules for a given language may include rules of spelling, hyphenation, capitalization, word breaks, emphasis, and punctuation. Languages that have multiple writing systems may have distinct orthographies and scripts. Source: Section 3.27, ISO 639-4	Parent Class: Collection
RemainderGroup (remainder group)	Definition: a group of languages that explicitly excludes certain individual languages Source: Section 3.12, ISO 639-4	Parent Class: LanguageGroup
Script (script)	Definition: a set of graphic characters used to represent one or more languages in writing Note: Use of multiple writing systems does not mean that multiple language identifiers are necessary for a language. ISO 639 language identifiers may be combined with script identifiers from ISO 15924 (e.g., BCP 47). Source: Section 3.17, ISO 639-4	Parent Class: Collection
SpecialPurposeCode (special purpose code)	Definition: a language identifier whose scope is that of a special purpose language construct Source: Section 3.7, ISO 639-3	Parent Class: Alpha3Code Property Restriction: ∀ **denotes**.**SpecialPurposeLanguageConcept** (lcc-lr-21) Property Restriction: ∀ **identifies.SpecialPurposeLanguageConcept** (lcc-lr-20)
SpecialPurposeLanguage Concept (special purpose language concept)	Definition: a language concept introduced in ISO 639-3 to satisfy special-purpose requirements, typically to support application constraints	Parent Class: Language

	Source: Section 4.2.6, ISO 639-3	
SpokenLanguage (spoken language)	Definition: an individual language or language variant that is articulated through speech (oral or vocal) sounds Source: Section 3.22, ISO 639-4	Parent Class: Language
StandardVariant (standard variant)	Definition: a language variant with a high degree of status and normalization, typically used in public discourse, centers of government and commerce Source: Section 3.15, ISO 639-4	Parent Class: LanguageVariant
TerminologyCode (terminology code)	Definition: a language identifier whose scope is that of terminological codes Source: Section 3.7, ISO 639-3	Parent Class: Alpha3Code
Transcription (transcription)	Definition: the representation of speech or signing in written form Note: The resulting text is also referred to as a transcription. Source: Section 3.19, ISO 639-4	
Transliteration (transliteration)	Definition: the conversion of text from one script to another without loss of information Note: The resulting text is also referred to as a transliteration. Source: Section 3.20, ISO 639-4	
WritingSystem (writing system)	Definition: a system for writing a language, including the requisite script and character set Source: Section 3.16, ISO 639-4	
WrittenLanguage (written language)	Definition: the representation of a language via a writing system, with a relatively normalized orthography Source: Section 3.21, ISO 639-4	Parent Class: Language

Properties

Name	Annotations	Property Axioms
denotes (denotes)	Definition: represents, signifies, or symbolizes	
has (has)	Definition: indicates that someone (or something) possesses something, as a characteristic, attribute, feature, capability, and so forth	
hasDenotation (has denotation)	Definition: has meaning, representation, signifier, or symbol	Parent Property: has

		Inverse*:* denotes
HasEarlierForm (has earlier form)	Definition: relates a language to an earlier form (historically significant) of that same language	Parent Property*:* has Domain*:* Language Range: Language
hasMember (has member)	Definition: relates something, typically a collection, group or organization, to some discrete thing identified as a member of it	Inverse*:* isMemberOf
identifies (identifies)	Definition: recognizes or establishes within some context	
isIdentifiedBy (is identified by)	Definition: has an indicator or label, that is unique within some context	Inverse*:* identifies
isMemberOf (is member of)	Definition: belongs, either individually or collectively, to a group	
hasName (has name)	Definition: associates a name, reference name, or appellation with an individual concept Source: Section 3.4, ISO 639-3	Range*:* string
hasEnglishName (has English name)	Definition: associates a name in English with an individual concept Source: Section 3.4, ISO 639-3	Parent Property: hasName Range*:* string
hasFrenchName (has French name)	Definition: associates a name in French with an individual concept Source: Section 3.4, ISO 639-3	Parent Property: hasName Range*:* string
hasGermanName (has German name)	Definition: associates a name in German with an individual concept	Parent Property: hasName Range*:* string
hasIndigenousName (has indigenous name)	Definition: associates a local regional or cultural name with an individual concept Source: Section 3.4, ISO 639-3	Parent Property: hasName Range*:* string
hasLanguageTag (has language tag)	Definition: a unique combination of alphanumeric characters corresponding to the language identifier Source: Section 3.4, ISO 639-3	Domain: LanguageIdentifier Range*:* string Property axiom: Functional

8.4 Ontology: ISO 639-1 Language Codes

This ontology represents the subset of the ISO 639 standard that provides the language names and actual codes for ISO 639-1, updated to reflect changes identified on the Library of Congress site as of the date of the versionIRI.

Table 8.4 – ISO 639-1 Language Codes Ontology Metadata

Metadata Term	Value
sm:filename	ISO639-1-LanguageCodes.rdf
sm:fileAbbreviation	lcc-639-1
OntologyIRI	http://www.omg.org/spec/LCC/Languages/ISO639-1-LanguageCodes/
owl:versionIRI	http://www.omg.org/spec/LCC/20151101/Languages/ISO639-1-LanguageCodes/
sm:dependsOn	http://www.omg.org/spec/LCC/Languages/LanguageRepresentation/

Note that this ontology consists entirely of individuals representing the ISO 639-1 code set, language, and language codes, and therefore is not modeled herein. The contents of this ontology are considered normative, however, and are provided in machine-readable form.

8.5 Ontology: ISO 639-2 Language Codes

This ontology represents the subset of the ISO 639 standard that provides the language names and actual codes for ISO 639-2, updated to reflect changes identified on the Library of Congress site as of the date of the versionIRI.

Table 8.5 – Registration Authorities Ontology Metadata

Metadata Term	Value
sm:filename	ISO639-2-LanguageCodes.rdf
sm:fileAbbreviation	lcc-639-2
OntologyIRI	http://www.omg.org/spec/LCC/Languages/ISO639-2-LanguageCodes/
owl:versionIRI	http://www.omg.org/spec/LCC/20151101/Languages/ISO639-2-LanguageCodes/
sm:dependsOn	http://www.omg.org/spec/LCC/Languages/LanguageRepresentation/ http://www.omg.org/spec/LCC/Languages/ISO639-1-LanguageCodes/

Note that this ontology consists entirely of individuals representing the ISO 639-2 code set, language, and language codes, and therefore is not modeled herein. The contents of this ontology are considered normative, however, and are provided in machine-readable form.

9 Country Ontologies

9.1 Overview

This section defines the terms, definitions, relationships, and additional logic specified in the ontologies that make up the Countries Module.

9.2 Module: Countries

Table 9.1 - Countries Module Metadata

Metadata Term	Value
sm:filename	AboutCountries.rdf
sm:fileAbbreviation	lcc-cty
OntologyIRI	http://www.omg.org/spec/LCC/Countries/AboutCountries/
owl:versionIRI	http://www.omg.org/spec/LCC/20151101/Countries/AboutCountries/
sm:moduleName	Countries
sm:moduleAbbreviation	LCC-CTY
sm:moduleVersion	1.0
sm:moduleAbstract	This module contains ontologies representing countries, territories, subdivisions, and other geopolitical entities commonly used in business, scientific, and government systems and applications. The main body of the module is based on ISO 3166 as well as the country element of the Language Tag specified in BCP 47 (RFC 4646, RFC 4647). It is intended to provide a systematic description of the vocabulary used for country representation in applications requiring geophysical and geopolitical concepts derived from, or in compliance with ISO 3166, including but not limited to web-based applications. It is also compatible with the GeoNames ontology, but represents only a small fraction of the material in GeoNames.

9.3 Ontology: Country Representation

The purpose of the Country Representation ontology, based on ISO 3166 and other representations of countries, such as the ISO Online Browsing Platform, SWIFT registry, UN FAO and CIA World Factbook, and GeoNames, is to provide a systematic description of the vocabulary used for country and geopolitical entity representation (based strictly on requirements for business applications, not broader geographic or political uses). A few additional properties to support geophysical coordinates, identified in the UN FAO and CIA World Factbook as well as from the well-known GeoNames ontology, have been added, but extensions to support other coding systems, such as the FAOSTAT code, have not been included.ISO 3166 provides universally applicable coded representations of names of countries, dependencies, and other areas of particular geopolitical interest and their subdivisions.

- ISO 3166-1 (Country codes) establishes codes that represent the current names of countries, dependencies, and other areas of particular geopolitical interest, on the basis of lists of country names obtained from the United Nations.
- ISO 3166-2 (Country subdivision code) establishes a code that represents the names of the principal administrative divisions, or similar areas, of the countries, etc. included in the ISO 3166-1.
- ISO 3166-3 (Code for formerly used names of countries) establishes a code that represents non-current country names, i.e., the country names deleted from ISO 3166 since its first publication in 1974.

This ontology reflects the first two parts of ISO 3166, revised to reflect the latest modifications made by the relevant registrars via the sources mentioned above. It has been partitioned into 3 components: (1) the essential concept system describing the standard (this ontology), (2) lcc-3166-1 contains all of the individuals specified in ISO 3166-1, and (3) lcc-3166-2 contains the individuals specified in ISO 3166-2. A fourth ontology, supporting ISO 3166-3, may be added if requirements from the OMG community arise.

Table 9.2 - Country Representation Ontology Metadata

Metadata Term	Value
sm:filename	CountryRepresentation.rdf
sm:fileAbbreviation	lcc-cr
OntologyIRI	http://www.omg.org/spec/LCC/Countries/CountryRepresentation/
owl:versionIRI	http://www.omg.org/spec/LCC/20151101/Countries/CountryRepresentation/
sm:directSource	ISO 3166-1 Codes for the representation of names of countries and their subdivisions- Part 1: Country codes, Second edition, 2006-11-15 ISO 3166-2 Codes for the representation of names of countries and their subdivisions- Part 2: Country subdivision code, First edition, 1998-12-15 ISO 3166-3 Codes for the representation of names of countries and their subdivisions- Part 3: Code for formerly used names of countries, First edition, 1998-03-01
sm:relatedSpecification	Food and Agriculture Organization of the United Nations, see http://www.fao.org/countryprofiles/en/ Society for Worldwide Interbank Financial Telecommunication (SWIFT) Online Directories, see http://www.swift.com/bsl/index.faces CIA World Factbook, see https://www.cia.gov/library/publications/the-world-factbook/
sm:historyNote	(1) The present version of the ontology covers the English sections of the standard only, and (2) UTF-8 character encodings are employed in names to support the broadest number of tools.
sm:dependsOn	http://www.omg.org/spec/LCC/Languages/LanguageRepresentation/

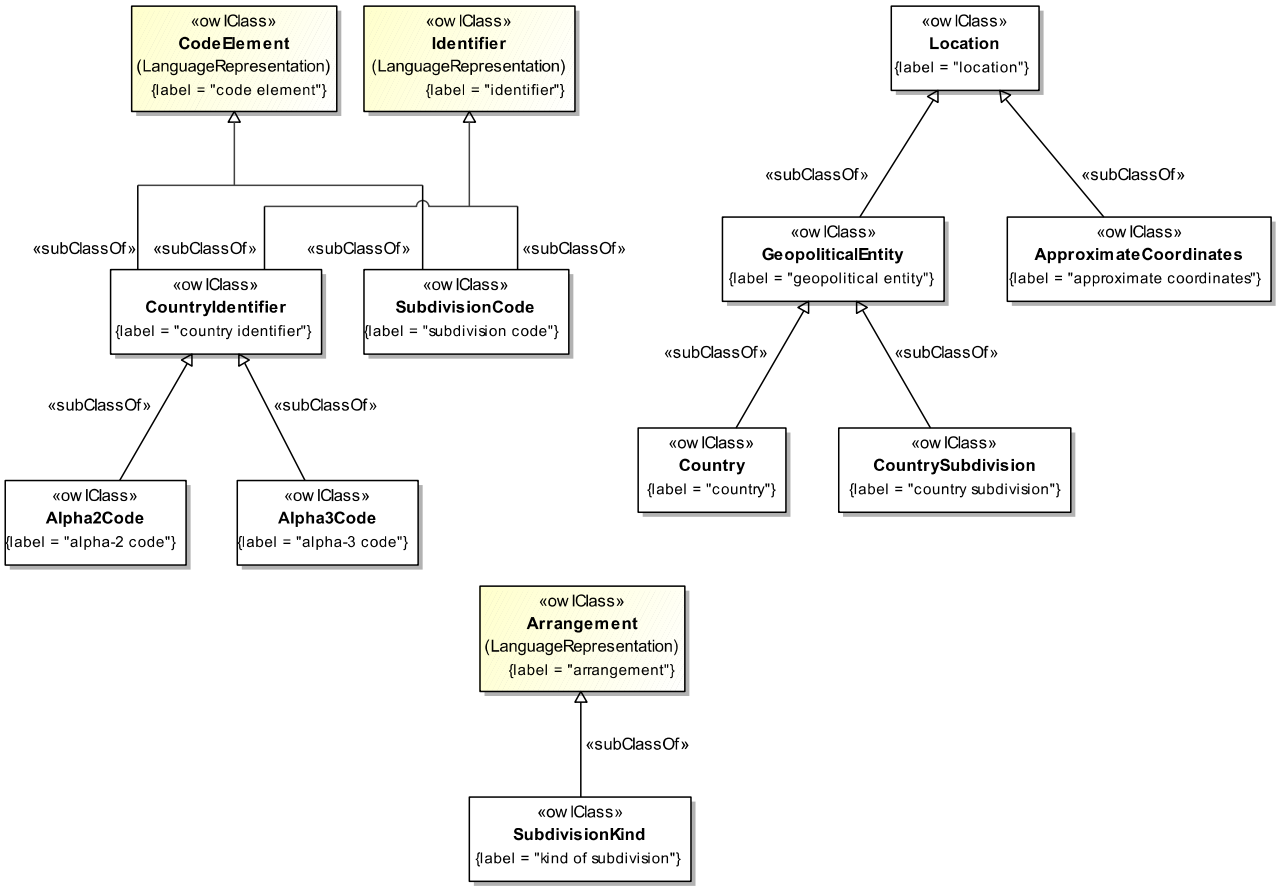

Figure 9.1 - Country Representation Class Hierarchy

Figure 9.1 provides an overview of the concepts in the Country Representation ontology, including the primary inheritance relationships.

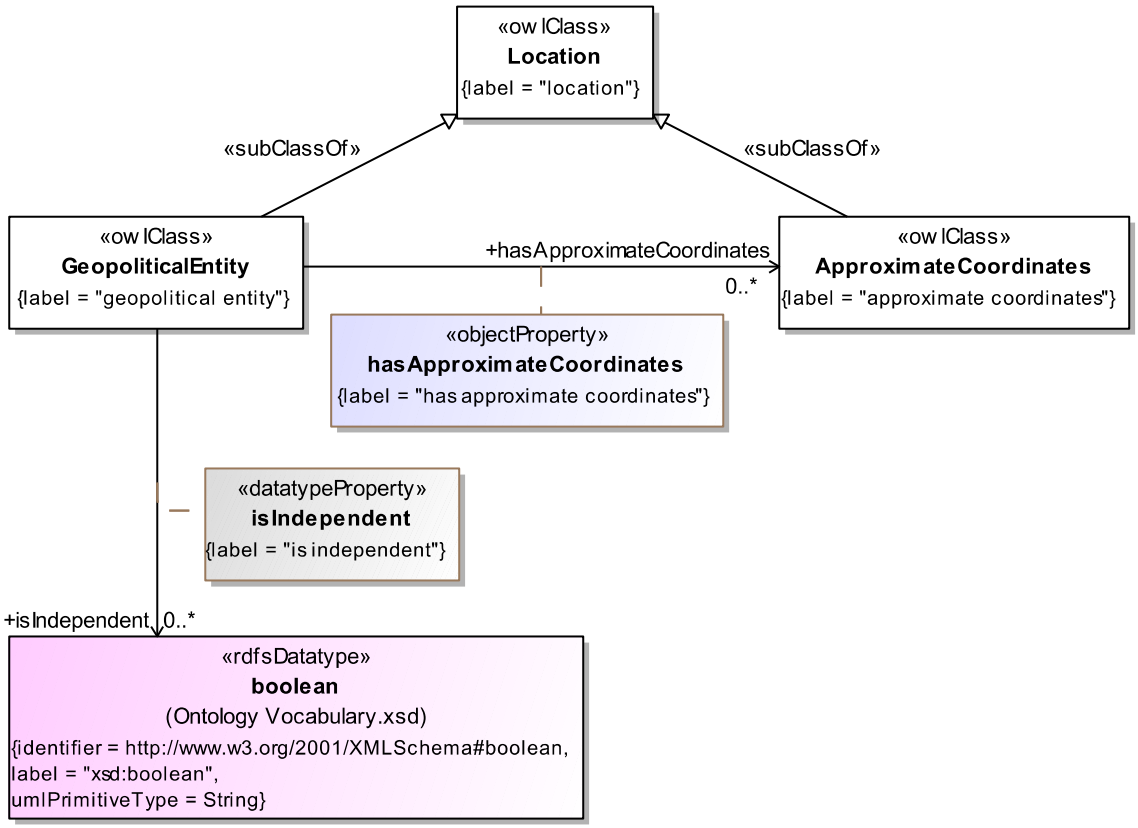

Figure 9.2 - Definitions of Location, Geopolitical Entity, and Approximate Coordinates

Figure 9.2 defines concepts including locations, geopolitical entities, and approximate coordinates. Note that approximate coordinates is underspecified in order to facilitate mappings to various coordinate systems, as required by specific applications or situations.

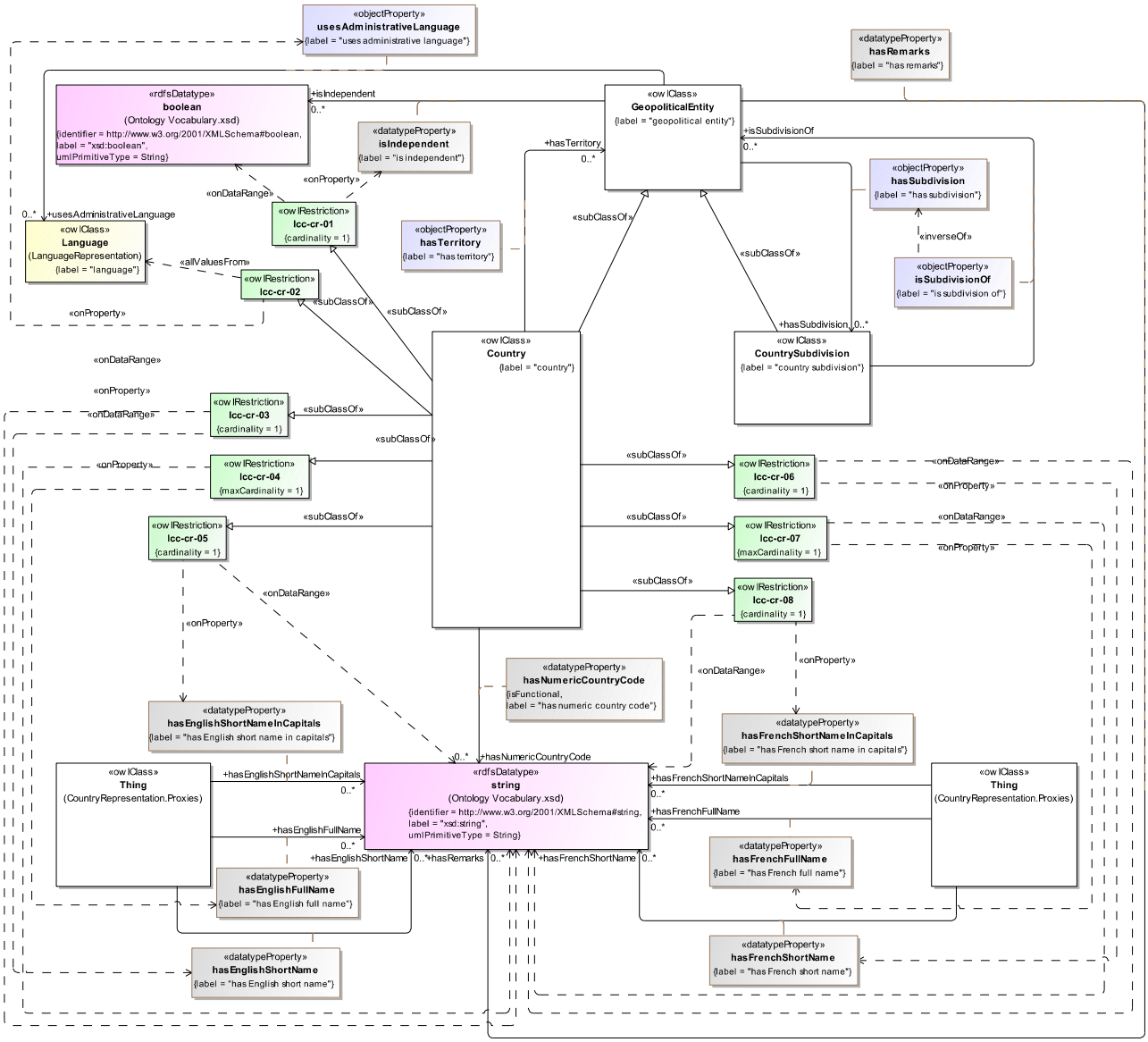

Figure 9.3 - Definition of Country

Figure 9.3 expands on the definition of a country, including constraints indicating that the some of the English and French names are required in the ISO 3166 specification.

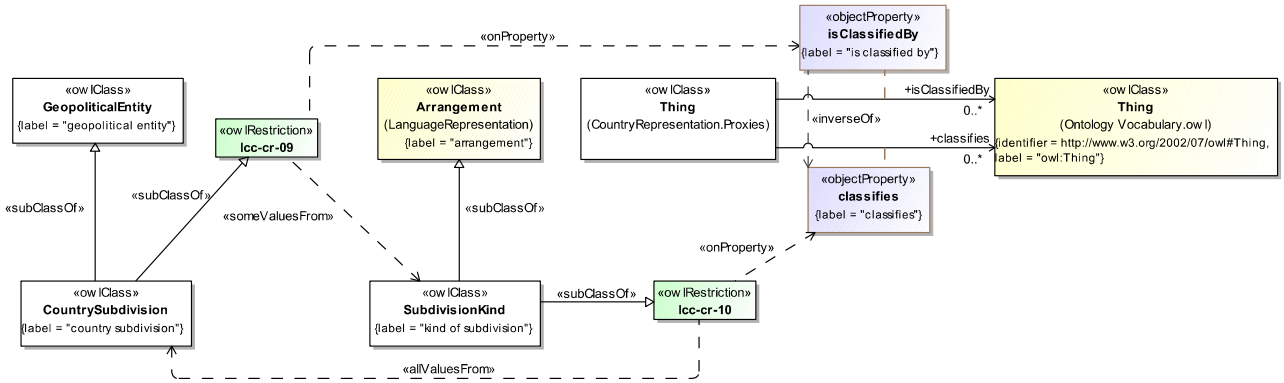

Figure 9.4 - Definition of Country Subdivision

Figure 9.4 elaborates the definition of a country subdivision and on subdivision kind, which is a classification scheme for subdivisions in ISO 3166-2.

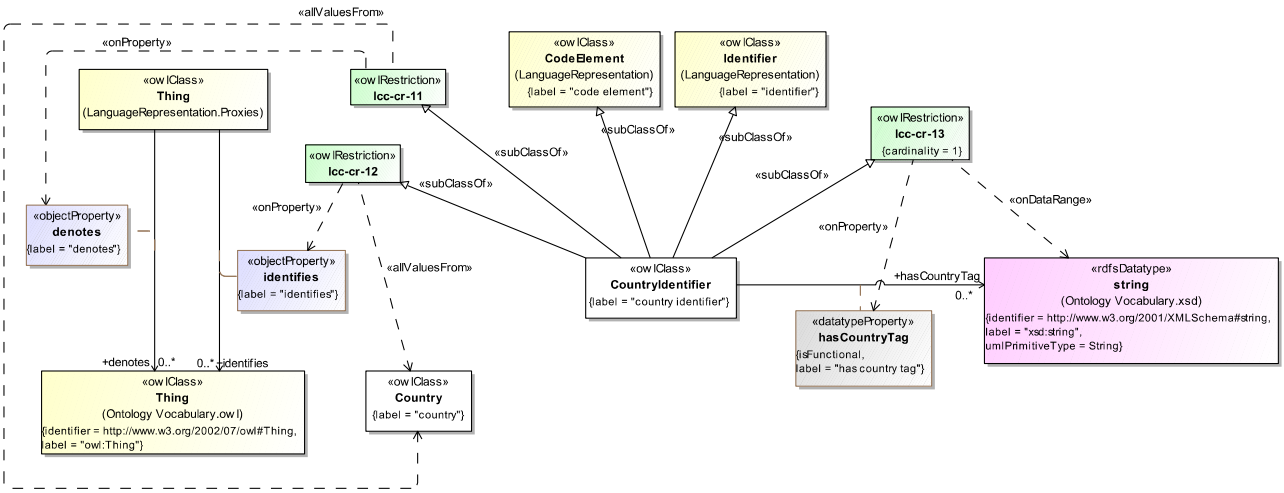

Figure 9.5 - Definition of Country Identifier

Figure 9.5 shows the definition of a country identifier, and Figure 9.6, below, provides the definition of a country subdivision code.

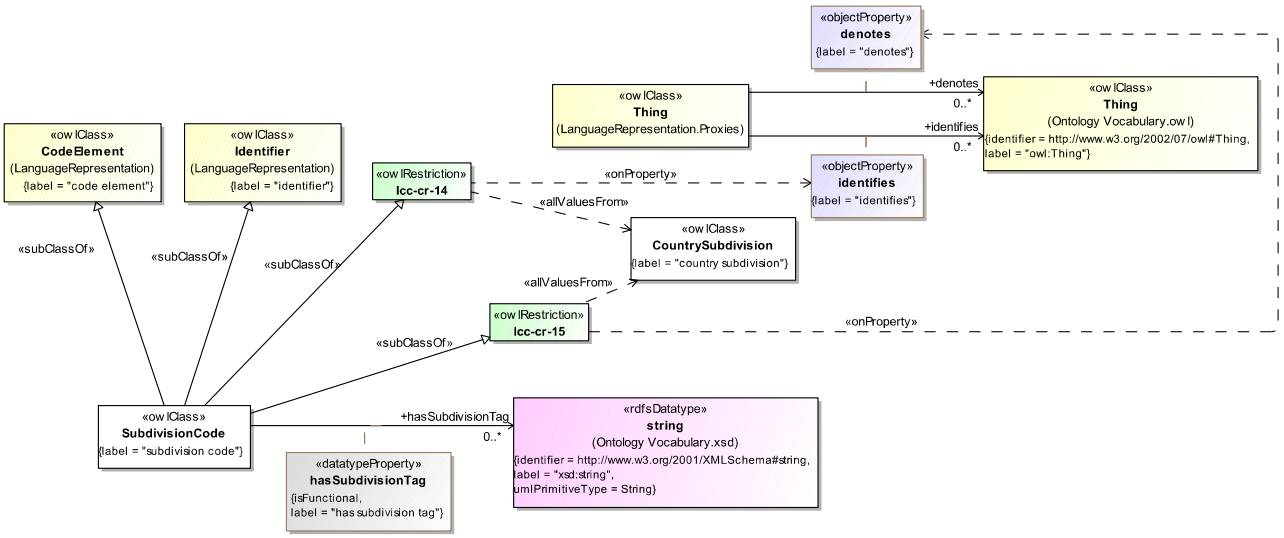

Figure 9.6 - Definition of Subdivision Code

The detailed annotations and axioms that comprise the ontology are provided in Table 9-3.

Table 9.3 - Country Representation Ontology Details

Classes

Name	Annotations	Class Expressions
Alpha2Code (alpha-2 code)	Definition: the digraph representing the country name Note: This part of IS0 3166 establishes an alphabetic 2-character (alpha-2) code which is generally recommended to represent country names and which is the basis for the codes laid down in ISO 3166-2 and ISO 3166-3 and for other international standards and recommendations. The alpha-2 code uses combinations, in upper case, of two letters of the 26-character Roman alphabet (ignoring diacritic signs) from the range AA to ZZ.	Parent Class: CountryIdentifier
Alpha3Code (alpha-3 code)	Definition: the trigraph representing the country name Note: This part of IS0 3166 also provides an alphabetic 3-character (alpha-3) code, based on the alpha-2 code, and using combinations, in upper case, of three letters of the 26-character Roman alphabet (ignoring diacritic signs) from the range AAA to ZZZ, for use in cases where a specific need has been identified. Attention is drawn to the fact that other 3-letter codes for some country names are used in other contexts (e.g., US MARC standard).	Parent Class: CountryIdentifier
ApproximateCoordinates	Definition: approximate latitude and longitude	Parent Class: Location

(approximate coordinates)	coordinates (approximate rectangle) corresponding to the location of the geopolitical entity according to the UN	
Country (country)	Definition: a geopolitical entity representing a country or dependent territory according to the United Nations Note: Countries are named using the English short country names officially used by the ISO. The ISO uses country names from United Nations sources and hence, names such as Palestinian Territory, Occupied and Taiwan, Province of China reflect political status within the UN.	Parent Class: GeopoliticalEntity Property Restriction: = 1 **hasEnglishShortName**.**string** (lcc-cr-03) Property Restriction: ≤ 1 **hasEnglishFullName**.**string** (lcc-cr-04) Property Restriction: = 1 **hasEnglishShortNameInCapitals**.**string** (lcc-cr-05) Property Restriction: = 1 **hasFrenchShortName**.**string** (lcc-cr-06) Property Restriction: ≤ 1 **hasFrenchFullName**.**string** (lcc-cr-07) Property Restriction: = 1 **hasFrenchShortNameInCapitals**.**string** (lcc-cr-08) Property Restriction: ∀ **usesAdministrativeLanguage**.**Language** (lcc-cr-02) Property Restriction: = 1 **isIndependent**.**boolean** (lcc-cr-01)
CountryIdentifier (country identifier)	Definition: similar to the language identifier specified in ISO 639, a string of letters assigned to a country or other geopolitical entity name specified in ISO 3166-1 for the purpose of uniquely representing it	Parent Class: CodeElement Parent Class: Identifier Property Restriction: = 1 **hasCountryTag**.**string** (lcc-cr-13) Property Restriction: ∀ **denotes**.**Country** (lcc-cr-11) Property Restriction: ∀ **identifies.Country** (lcc-cr-12)
CountrySubdivision (country subdivision)	Definition: a geopolitical entity, typically a division of a country, dependency, or other area of special geopolitical interest related to a country or other geopolitical entity referenced in ISO 3166-1	Parent Class: GeopoliticalEntity Property Restriction: ∃ **isClassifiedBy**.**SubdivisionKind** (lcc-cr-09)
GeopoliticalEntity (geopolitical entity)	Definition: any country, federal province, city or other administrative unit that represents a geophysical location and has some political identity	Parent Class: Location
Location (location)	Definition: a named geographic place	

SubdivisionCode (subdivision code)	Definition: similar to the language identifier specified in ISO 639, a string of letters assigned to a country subdivision for the purpose of uniquely representing it	Parent Class: CodeElement Parent Class: Identifier Property Restriction: ∀ **denotes**.**CountrySubdivision** (lcc-cr-15) Property Restriction: ∀ **identifies.CountrySubdivision** (lcc-cr-14)
SubdivisionKind (subdivision kind)	Definition: a classification scheme for subdivisions of a geopolitical entity, as defined in ISO 3166-2 (noting that there may be more than one kind for a given country or other entity)	Parent Class: Arrangement Property Restriction: ∀ **classifies.CountrySubdivision** (lcc-cr-10)

Properties

Name	Annotations	Property Axioms
Classifies (classifies)	Definition: arranges in categories according to shared characteristics	
hasApproximateCoordinates (has approximate coordinatess)	Definition: relates a country to its approximate coordinates Direct source: http://www.fao.org/countryprofiles/geoinfo/en/	Parent Property: has Domain: GeopoliticalEntity Range: ApproximateCoordinates
hasPart (has part)	Definition: indicates any portion of something, regardless of whether the portion itself is attached to the remainder or detached; cognitively salient or arbitrarily demarcated; self-connected or disconnected; homogeneous or gerrymandered; material or immaterial; extended or unextended; spatial or temporal Direct source: Stanford Encyclopedia of Philosophy at http://plato.stanford.edu/entries/mereology/	
hasSubdivision (has subdivision)	Definition: relates a geopolitical entity to another geopolitical entity that is a subdivision of it	Parent Property: hasPart Domain: GeopoliticalEntity Range: CountrySubdivision
hasTerritory (has territory)	Definition: relates a country to another geopolitical entity in ISO 3166 that is a territory of that country Note: The isIndependent flag indicates whether or not a 'country' is in fact independent, but does not indicate whether or not it is self-governing. The UN FAO ontology distinguishes between these two cases, which can be added as an extension if required in a subsequent version of this specification. Direct source: http://www.fao.org/countryprofiles/geoinfo/en/	Parent Property: hasPart Domain: Country Range: GeopoliticalEntity
isClassifiedBy (is classified by)	Definition: indicates the classifier used to characterize something	Inverse: classifies
isPartOf (is a part of)	Definition: relates something to another thing that it is some component or portion of, regardless of how	Property axiom: Transitive

	that whole-part relationship is manifested, i.e., attached to the remainder or detached; cognitively salient or arbitrarily demarcated; self-connected or disconnected; homogeneous or gerrymandered; material or immaterial; extended or unextended; spatial or temporal; the most generic part relation, reflexive, asymmetric, and transitive Direct source: Stanford Encyclopedia of Philosophy at http://plato.stanford.edu/entries/mereology/	Inverse: hasPart
isSubdivisionOf (is subdivision of)	Definition: relates a country subdivision to geopolitical entity that it is a part of	Parent Property: isPartOf Domain: CountrySubdivision Range: GeopoliticalEntity Inverse: hasSubdivision
isUsedBy (is used by)	Definition: is employed by in the process of accomplishing something	
uses (uses)	Definition: employs as a means of accomplishing some task or achieving some result	Inverse: isUsedBy
usesAdministrativeLanguage uses administrative language)	Definition: relates a country or geopolitical entity to the administrative language(s) that entity uses for international communications	Parent Property: uses Domain: Country Range: Language
hasCountryTag (has country tag)	Definition: a unique combination of alphanumeric characters corresponding to the country identifier	Domain: CountryIdentifier Range: string Property axiom: Functional
HasEnglishFullName (has English full name)	Definition: the full name, if different from the short form of the country name, in lower case; the formal title as notified by the country concerned to the UN Secretary General	Parent Property: hasEnglishName Range: string
hasEnglishShortName (has English short name)	Definition: the short form of the country name, in English	Parent Property: hasEnglishName Range: string
hasEnglishShortNameInCapitals (has English short name in capitals)	Definition: the short form of the country name, in English (capitals)	Parent Property: hasEnglishName Range: string
hasFrenchFullName (has French full name)	Definition: the full name, if different from the short form of the country name, in lower case; the formal title as notified by the country concerned to the UN Secretary General	Parent Property: hasFrenchName Range: string
hasFrenchShortName (has French short name)	Definition: the short form of the country name, in French	Parent Property: hasFrenchName Range: string
hasFrenchShortNameInCapitals (has French short name in captials)	Definition: the short form of the country name, in French (capitals)	Parent Property: hasFrenchName Range: string

hasLocalShortName (has local short name)	Definition: the local regional or cultural short form of the country name	Parent Property: hasName Range: string
hasNumericCountryCode (has numeric country code)	Definition: Also called numeric-3 code in the specification, the three-digit numeric code representing the country name. Recognizing that a numeric code for country names is of advantage (e.g. to provide language independence), a three-digit numeric (numeric-3) code from the range 000 to 899 is also provided in this part of IS0 3166. It is made available by the United Nations Statistics Division.	Domain: Country Range: string Property axiom: Functional
hasRemarks (has remarks)	Definition: Remarks, such as other widely-used country names and names of geographically separated territories covered by the main entry in the list(the latter are indexed in Annex A)	Domain: GeopoliticalEntity Range: string
hasSubdivisionTag (has subdivision tag)	Definition: a unique combination of alphanumeric characters corresponding to the country subdivision code	Domain: SubdivisionCode Range: string Property axiom: Functional
isIndependent (is independent)	Definition: indicates whether a geopolitical entity stands alone or is part of another country from an international political perspective	Domain: GeopoliticalEntity Range: boolean

9.4 Ontology: ISO 3166-1 Country Codes

This ontology represents the subset of the ISO 3166 standard that include the actual ISO 3166-1 country codes, with the ontology and codes for the other parts of the standard represented in dependent models.

Table 9.4 - ISO 3166-1 Country Codes Ontology Metadata

Metadata Term	Value
`sm:filename`	`ISO3166-1-CountryCodes.rdf`
`sm:fileAbbreviation`	`lcc-3166-1`
`OntologyIRI`	`http://www.omg.org/spec/LCC/Countries/ISO3166-1-CountryCodes/`
`owl:versionIRI`	`http://www.omg.org/spec/LCC/20151101/Countries/ISO3166-1-CountryCodes/`

`sm:dependsOn`	`http://www.omg.org/spec/LCC/Languages/LanguageRepresentation/`
	`http://www.omg.org/spec/LCC/Languages/ISO639-1-LanguageCodes/`
	`http://www.omg.org/spec/LCC/Countries/CountryRepresentation/`

Note that this ontology consists entirely of individuals representing the ISO 3166-1 code set, countries, and country codes, and therefore is not modeled herein. The contents of this ontology are considered normative, however, and are provided in machine-readable form.

9.5 Ontology: ISO 3166-2 Subdivision Codes

This ontology represents the subset of the ISO 3166 standard that include the actual ISO 3166-2 subdivision codes, with the ontology and codes for the other parts of the standard represented in models that this ontology depends on.

Scope note: This initial release of the ontology covers North America only. Implementers should consider this as a guide for extension – to add more subdivisions and codes for other parts of the world as required for their applications, and to make requests via the OMG issues list for additional subdivisions for specific geopolitical areas.

Table 9.5 - ISO 3166-2 Subdivision Codes Ontology Metadata

Metadata Term	Value
sm:filename	ISO3166-2-SubdivisionCodes.rdf
sm:fileAbbreviation	lcc-3166-2
OntologyIRI	http://www.omg.org/spec/LCC/Countries/ISO3166-2-SubdivisionCodes/
owl:versionIRI	http://www.omg.org/spec/LCC/20151101/Countries/ISO3166-2-SubdivisionCodes/
sm:dependsOn	http://www.omg.org/spec/LCC/Languages/LanguageRepresentation/ http://www.omg.org/spec/LCC/Languages/ISO639-1-LanguageCodes/ http://www.omg.org/spec/LCC/Countries/CountryRepresentation/ http://www.omg.org/spec/LCC/Countries/ISO3166-1-CountryCodes/

Note that this ontology consists entirely of individuals representing the ISO 3166-2 code set, subdivisions, and subdivision codes, and therefore is not modeled herein. The contents of this ontology are considered normative, however, and are provided in machine-readable form.

Annex A: Deliverables

(normative)

The LCC ontologies are delivered as (1) RDF/XML serialized OWL (normative and definitive), (2) UML XMI, serialized from UML with the ODM profiles for RDF and OWL applied (normative), (3) ODM XMI, serialized based on the ODM MOF metamodels for RDF and OWL (normative), and (4) Visual Ontology Modeler (VOM) model files, based on the VOM plug-in to MagicDraw (ancillary). If there are differences between the OWL files, ODM XMI, and UML XMI, the OWL files take precedence, followed by the UML XMI, and finally the ODM XMI.

Regardless of their form, each of the ontologies included in Languages, Countries and Codes (LCC) makes normative reference to the DCMI Dublin Core Metadata Terms[1], W3C Simple Knowledge Organization System (SKOS) Recommendation[2], and the OMG Architecture Board's Specification Metadata Recommendation[3], which are not part of this specification.

The individual RDF/XML files are organized by module (directory), and within a given module, alphabetically by name, as shown in the URI structure for each individual OWL file. These files are UTF-8 conformant XML Schema files that are also OWL 2 compliant, and may be examined using any text editor, XML editor, or RDF or OWL editor. They have been verified for syntactic correctness via the W3C RDF Validator and University of Manchester OWL 2 Validator. They have also been checked for logical consistency using the Pellet OWL 2 reasoner from Complexible (formerly Clark & Parsia) as well as the HermiT OWL 2 reasoner from Oxford University. It is anticipated that the OWL ontologies will be dereference-able, together with technical documentation (HTML) from the OMG site.

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[1] http://www.dublincore.org/documents/dcmi-terms/

[2] http://www.w3.org/TR/2009/REC-skos-reference-20090818/

[3] http://www.omg.org/techprocess/ab/SpecificationMetadata/