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Multiple Vocabulary Facility (MVF)

Version 1.0

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Preface

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1 Scope

This specification defines (1) a metamodel for the MVF vocabulary structures, (2) a set of ontologies corresponding to the metamodel and extensions supporting ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, which provides the semantic basis for the kinds of vocabularies that MVF is designed to support, and (3) an interface for integration of an MVF services with a MOF-based modeling environment.

The ontologies provided in this specification include:

(1) a core ontology corresponding to the MVF metamodel,

(2) an extension representing the subset of the ISO 1087 reference vocabulary used in other ISO standards for vocabulary representation,

(3) an extension that incorporates additional vocabulary from ISO 1087 for terminology science, and

(4) an ontology that maps the core MVF and ISO 1087 terms and definitions ontology to the W3C Simple Knowledge Organization System (SKOS) vocabulary.

MVF also reuses several ontologies from the companion Commons Ontology Library for specific patterns, including designations, collections, and classifiers.

2 Conformance

This specification defines requirements for conformance of the following types of application:

- An extension of a modeling environment to support usage of multiple, alternative vocabularies, associating the terms and definitions in those vocabularies with elements in user models.
- An application for creation and maintenance of vocabularies.
- A service for sharing dictionaries and/or shareable vocabularies.

In addition, there are two conformance points with respect to the ontologies provided herein. These are as follows:

(1) Specification-level conformance with all of the OWL ontologies – which means that the subject application formally imports all of the ontologies (*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 OWL) with no resulting logical inconsistencies;

(2) Linked Data-level conformance – which means that the subject application references one or more of the ontologies but does not formally import them.

For either conformance point, any references to the elements defined in a given ontology must use, or provide a mapping to, the standard OMG URI for that element. Implementations that claim specification-level conformance with the ontologies must support all of them. Users may choose to use or extend any of the MVF ontologies needed to address their individual requirements.

3 References

3.1 Normative References

Reference	*Description*
[API4KP]	APIs for Knowledge Platforms. Available at https://www.omg.org/spec/API4KP/.
[BCP 47]	BCP 47: Tags for Identifying Languages, available at https://tools.ietf.org/search/bcp47
[Commons]	Commons Ontology Library (Commons). Available at https://www.omg.org/spec/COMMONS.
[Dublin Core]	DCMI Metadata Terms, Issued 2020-01-20 by the Dublin Core™ Metadata Initiative. Available at https://www.dublincore.org/specifications/dublin-core/dcmi-terms/.
[ISO 704]	ISO 704:2009 Terminology work – Principles and methods, Third edition, 2009-11-01
[ISO 1087]	ISO 1087:2019 Terminology work – Vocabulary – Theory and Application, Second edition, 2019-09
[ISO 11179-3]	ISO/IEC 11179-3:2013 Information technology – Metadata registries (MDR) – Registry metamodel and basic attributes, Third edition, 2013-02-15
[LCC]	Languages, Countries and Codes (LCC) Specification. Available at https://www.omg.org/spec/LCC/
[MOF]	Meta Object Facility (MOF™) Core. Available at https://www.omg.org/spec/MOF/
[MOF XMI]	MOF 2/XMI (XML Metadata Interchange) Mapping Specification. Available at https://www.omg.org/spec/XMI/
[ODM]	Ontology Definition Metamodel (ODM™). Available at https://www.omg.org/spec/ODM/
[OWL 2]	OWL 2 Web Ontology Language Quick Reference Guide (Second Edition), W3C Recommendation 11 December 2012. Available at https://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 https://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 https://www.w3.org/TR/rdf-schema/.
[RDF Turtle]	RDF 1.1 Turtle. Eric Prud'hommeaux and Gavin Carothers, Editors. W3C Recommendation, 25 February 2014. Available at https://www.w3.org/TR/turtle/.
[RDF XML]	RDF 1.1 XML Syntax. Fabien Gandon and Guus Schreiber, Editors. W3C Recommendation, 25 February 2014. Available at https://www.w3.org/TR/2014/REC-rdf-syntax-grammar-20140225/.
[SKOS]	SKOS Simple Knowledge Organization System Reference, W3C Recommendation

	18 August 2009. Available at https://www.w3.org/TR/2009/REC-skos-reference-20090818/.
[SKOS-XL]	SKOS Simple Knowledge Organization System eXtension for Labels (SKOS-XL), W3C Recommendation 18 August 2009. Available at https://www.w3.org/TR/skos-reference/skos-xl
[SMOF]	MOF Support for Semantic Structures (SMOF™). Available at https://www.omg.org/spec/SMOF/.
[UML]	Unified Modeling Language™ (UML®). Available at https://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 https://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, https://www.ietf.org/rfc/rfc3629.txt
[XML Schema Datatypes]	XML Schema Part 2: Datatypes Second Edition. W3C Recommendation 28 October 2004. Available at https://www.w3.org/TR/xmlschema-2/.

3.2 Non-Normative References

The following informative documents are referenced in this specification:

Reference	*Description*
[DL Handbook]	THE DESCRIPTION LOGIC HANDBOOK: Theory, implementation, and applications. Baader, McGuinness, Nardi, and Patel-Schneider, editors. Cambridge University Press, Cambridge, United Kingdom, 2003.
[OE]	Kendall, Elisa F. and Deborah L. McGuinness. *Ontology Engineering*: Synthesis Lectures on the Semantic Web: Theory and Technology. Morgan & Claypool Publishers. 2019. doi: 10.2200/S00834ED1V01Y201802WBE018
[W3C Datatypes in RDF and OWL]	XML Schema Datatypes in RDF and OWL, W3C Working Group Note 14 March 2006, Available at https://www.w3.org/TR/2006/NOTE-swbp-xsch-datatypes-20060314/.

4 Terms and Definitions

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

Community

A community (aka speech community) is typically a group of people that share a natural language and have a shared set of terms used to express concepts in their domain of interest. We refer to a set of terms that is distinguished from general use of the natural language as a vernacular. The community may be persons that share a profession, are members of the same enterprise or organization or are collaborating on a particular technology. A community may also include applications that use natural language vocabularies and/or nomenclatures.

A user viewing a model chooses a speech community/vocabulary, and the tool (dynamically) presents the model using the terms and definitions in that Vocabulary, by filtering the MVFEntry for each model element to the entry in the chosen Vocabulary.

Concept

A concept is a unit of knowledge created by a unique combination of characteristics [ISO 1087], called an MVFEntry in the context of MVF. An MVFEntry is linked to one or more model elements that represent that concept in the modeling environment.

MVFDictionary

An MVFDictionary is a collection (by reference, or possibly inclusion) of Vocabularies that share a set of MVFEntries. Each Vocabulary is a container for a set of VocabularyEntries that each represent the association of a term in that vocabulary with one of the MVFEntries identified in that dictionary. A modeling environment may include multiple MVFDictionaries, but they must address mutually exclusive concepts. Typically, one MVFDictionary will address concepts of the modeling language metamodel, and at least one additional MVFDictionary will address concepts of user-defined modeling elements.

Model Element

A model element is an element of the modeling language metamodel (*e.g.*, Element in a MOF metamodel or UML model), or an element of the user's model represented in that modeling language. In an interactive modeling environment, each model element is associated with a concept (*i.e.*, MVFEntry) of an active MVFDictionary whose terms are identified in at least one Vocabulary. Note that a model element may be an instance of a modeling language class, attribute or relationship.

Modeling Environment

Software based system allowing a user to create, edit or view models in one or modeling languages. It encompasses "modeling tool".

MVFEntry

An MVFEntry is a unit of knowledge created by a unique combination of characteristics, *i.e.*, a concept. An MVFEntry is contained in exactly one MVFDictionary and may be linked from one or more model elements that represent that concept in models. It may include links from vocabulary entries of alternative vocabularies that express the same concept in a different natural language or vernacular. It is possible that some concepts are not mapped from an entry in any vocabulary, and that not all MVFEntries are associated with model elements in the active model.

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. [OE]

Term

A term is a word or phrase (*i.e.*, a verbal designation, as opposed to a name or symbol) that expresses a specified concept in the natural language or vernacular of a speech community.

Vernacular

A set of terms used by a speech community that is distinguished from general use of the natural language. The community may be persons that share a profession, are members of the same enterprise or organization or are collaborating on a particular technology.

Vocabulary

A Vocabulary is a set of VocabularyEntries (names, terms, other designations such as symbols, and their definitions) for the language of a particular speech community that is based on a specified natural language. A speech community may create a Vocabulary by specializing an existing Vocabulary and overriding selected terms, adding terms for new concepts and incorporating the remaining terms and definitions of the existing Vocabulary. This mechanism may be employed to introduce synonyms as the primary terms of the specializing community. Both Vocabularies should be in the same natural language so that definitions remain meaningful.

VocabularyEntry

A vocabulary entry associates a concept with a definition and designation for that concept in the context of the vocabulary. The definition and designation are expressed in the natural language associated with that vocabulary and the associated user community, and any terms used in a definition should be consistent with their definitions in that vocabulary.

5 Symbols

5.1 Symbols

See clause 6.5, Notation, for a description of the logic symbols used to describe the ontologies covered in this specification.

5.2 Abbreviations

The following abbreviations are used throughout this specification:

API4KP – APIs (Application Programming Interfaces) for Knowlege Platforms

DL – Description Logics

IRI – Internationalized (Uniform) Resource Identifier

ISO – International Organization for Standardization

LCC – Languages, Countries and Codes

MVF – Multiple Vocabulary Facility (this specification)

OWL – Web Ontology Language

ODM – Ontology Definition Metamodel

RDF – Resource Definition Framework

UML – Unified Modeling Language

URI – Uniform Resource Identifier

URL – Uniform Resource Locator

W3C – World Wide Web Consortium

XMI – XML Metadata Interchange

XML – eXtensible Markup Language

6 Additional Information

6.1 Changes to Other OMG Specifications

None.

6.2 Acknowledgments

The following organizations submitted this specification:

- Thematix Partners LLC

The following additional organizations contributed to this specification:

- Agile Enterprise Design
- agnos.ai U.K. Ltd.
- Dassault Systèmes
- Mayo Foundation for Medical Education and Research (MFMER)
- Model Driven Solutions
- Quotewell Insurance Services LLC
- Raytheon Technologies Corporation
- U. S. National Institute of Standards and Technology (NIST)

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

- Auxilium Technology Group
- EDM Council, Inc.
- Rensselaer Polytechnic Institute
- Visumpoint LLC

6.3 Intellectual Property Rights

6.4 Reuse of the Commons Ontology Library and Languages, Countries and Codes (LCC) Ontologies

The Multiple Vocabulary Facility (MVF) ontologies use and extend a number of the ontologies specified in the companion Commons Ontology Library specification. The Commons Ontology Library contains small but fundamental building block ontologies that are essential to MVF. MVF also uses ontologies included in the Languages, Countries and Codes (LCC) specification for the identification of languages and geographic regions associated with vocabulary elements.

6.5 Notation

The ontology 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

Note that these colors are provided for presentation purposes only, and are non-normative.

For the library there is an "about" file, which provides metadata about the library, described below in tabular form. The ontologies themselves are documented as ODM-compliant UML models, aside from the "about" file, annotation vocabulary, and mapping ontology. Every ontology is expressed in RDF/XML-serialized OWL and Turtle-serialized OWL [RDF XML, RDF Turtle].

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]. This notation is a more compact shorthand for the axioms expressed in the ontology, and is used for documentation purposes. The notation used in this specification, representing a subset of OWL 2, is described in Table 6.1, below.

Table 6.1: Description Logic Expressions Notation

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 ∩ D
union	The union of two classes contains every individual which is contained in at least one of these classes.	C ∪ 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).	∀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).	∃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).	∀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).	≤ n R (for unqualified restrictions) ≤ n R.C (for qualified restrictions)
minimum cardinality	Minimum cardinality restrictions restrict the cardinality of possible fillers to at least the number specified (inclusive).	≥ n R (for unqualified restrictions) ≥ n R.C (for qualified restrictions)
Class Axioms		
equivalent classes	Two classes are considered equivalent if they contain exactly the same individuals.	≡ C
disjoint classes	Disjointness means that membership in one class specifically excludes membership in another.	¬ C
Property Axioms		
complex role inclusions	Role inclusions allow [object] properties to be chained together in a sequence that is a subproperty of a higher-level property.	R ○ R

Note 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).

7 MVF Overview

7.1 Business Value

MVF provides two key business benefits: (1) The market for modeling language implementations is expanded for users who are not proficient in the original natural language used for modeling, and (2) user models can be shared with different, international or specialized communities, expressed in the language and terms that are most meaningful to them.

7.2 MVF Operation

This section provides a use case and example operational implementation of MVF.

7.2.1 General Approach

The general concept of MVF is to provide an integrated service to enable modeling tools for MOF-based modeling languages to enable users to apply specific vocabularies to their models, *i.e.* to apply the terminology expressed in an MVF vocabulary to the concepts expressed in the model from a natural language and nomenclature perspective, as appropriate. This means the concepts in the model will be translated to the user's selected vocabulary, including translation of definitions from the user's selected vocabulary. A vocabulary may comprise terms in common use by speakers of a particular natural language or it may be terms based on a natural language but used in a particular community: a profession, an industry, a company, a country, or other. Note that a vocabulary can be based on another vocabulary and only define different terms for selected concepts.

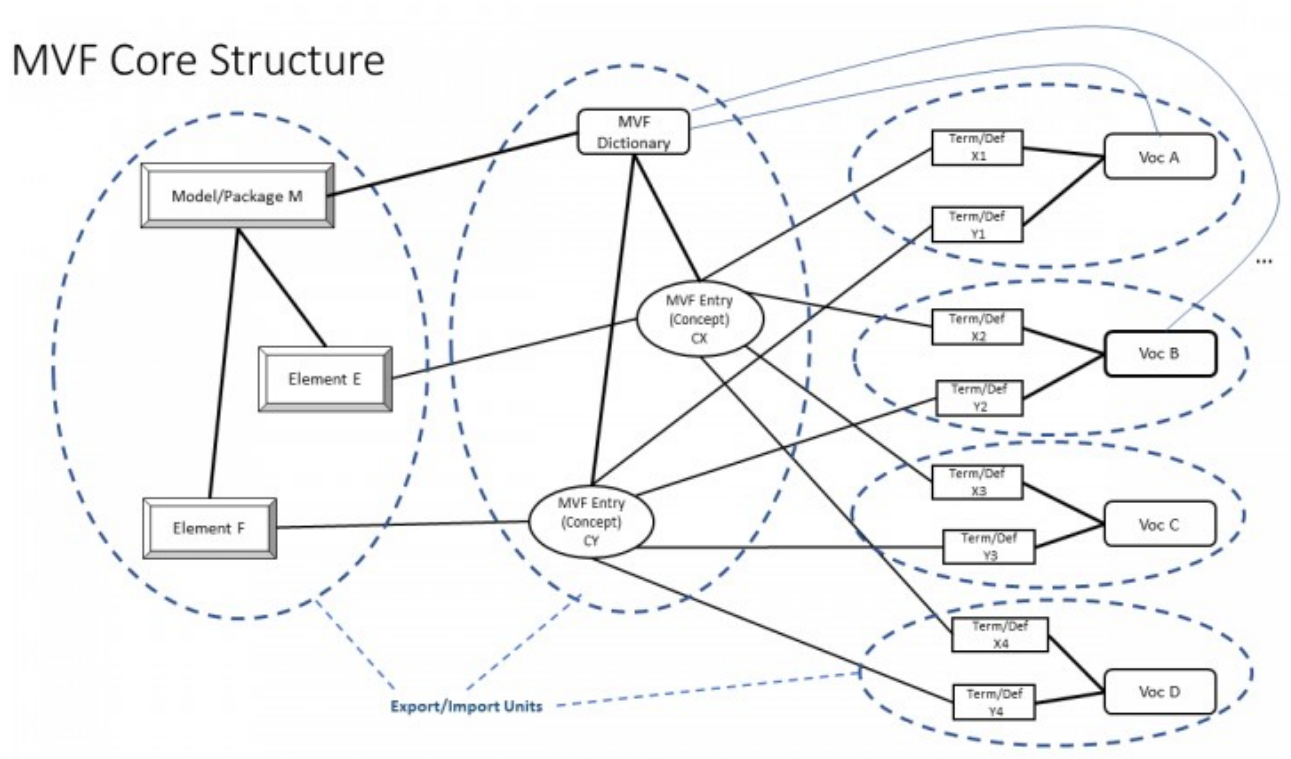

Figure 1: MVF Structural Overview

Figure 1, above, provides a notional example use of MVF. See Annex B for an actual example using the MVF metamodel. On the left are two elements of a model in the modeling environment. Each of these elements is associated

with an MVFEntry in the MVF metamodel. These MVFEntries represent the concepts and relationships expressed in the model. These concepts are contained in an MVFDictionary. The dictionary also links to a set of vocabularies for its concepts. A vocabulary represents a set of terms of a user community and can be selected by a user such that the terms of the vocabulary are applied to the concepts in the model..

7.3 “About” the MVF Ontologies

An “about” file for the MVF ontologies provides metadata describing them and acts as a load file for users that want to load all of the ontologies in ontology editors such as Protege[1] at once. This file, which is provided in both RDF/XML and Turtle serializations of the Resource Description Framework (RDF), is designed to (1) describe the machine-readable content of the specification for users that download the ontologies directly and import them into tools that can interpret and display the files, (2) for potential use in tagging the specification document on the OMG site, and (3) to provide a single file that imports the ontologies for ease of use (similar to a *make file* for software), excluding the mapping to the Simple Knowledge Organization System (SKOS), which may or may not be desired.

7.4 Namespace Definitions

The namespaces and prefixes corresponding to external elements required for use in the MVF ontologies are provided in Table 7.1. Table 7.2 provides the namespace declarations required for use of the ontologies themselves. The prefixes provided in Tables 7.1 and 7.2 are normative, and their use is required in any conformant application or extension.

Table 7.1: Prefixes 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#
cmns-av	https://www.omg.org/spec/Commons/AnnotationVocabulary/
cmns-cls	https://www.omg.org/spec/Commons/Classifiers/
cmns-col	https://www.omg.org/spec/Commons/Collections/
cmns-cxtdsg	https://www.omg.org/spec/Commons/ContextualDesignators/
cmns-dsg	https://www.omg.org/spec/Commons/Designators/
cmns-dt	https://www.omg.org/spec/Commons/DatesAndTimes/
cmns-id	https://www.omg.org/spec/Commons/Identifiers/
cmns-txt	https://www.omg.org/spec/Commons/TextDatatype/
dct	http://purl.org/dc/terms/
lcc-cr	https://www.omg.org/spec/LCC/Countries/CountryRepresentation/

[1] https://protege.stanford.edu/

lcc-lr	https://www.omg.org/spec/LCC/Languages/LanguageRepresentation/
skos	http://www.w3.org/2004/02/skos/core#
skos-xl	http://www.w3.org/2008/05/skos-xl#

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

- The standard protocol, authority, and top level specification part of any OMG specification namespace, which is `https://www.omg.org/spec/`
- The abbreviation for the specification: in this case `MVF`
- The ontology name

Note that the URI/IRI strategy for the ontologies included in the library 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 in lower case: `mvf`
- An abbreviation for the ontology name

The namespaces and prefixes for the individual ontologies are summarized in Table 7.2. These are given in alphabetical order, rather than with any intent to show imports relationships. The table includes the namespace definitions for the “about” file that is part of the machine-readable deliverables for the specification, but that is 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: Prefixes and Namespaces for the MVF Ontologies

Namespace Prefix	Namespace
abt-mvf	http://www.omg.org/spec/MVF/AboutMVF/
mvf	https://www.omg.org/spec/MVF/MultipleVocabularyFacility/
mvf-trm	https://www.omg.org/spec/MVF/ISO1087-VocabularyForTermsAndDefinitions/
mvf-tsc	https://www.omg.org/spec/MVF/ISO1087-TerminologyScience/
mvf-skos	https://www.omg.org/spec/MVF/MVFtoSKOSMapping/

8 Multiple Vocabulary Facility (MVF) Metamodel

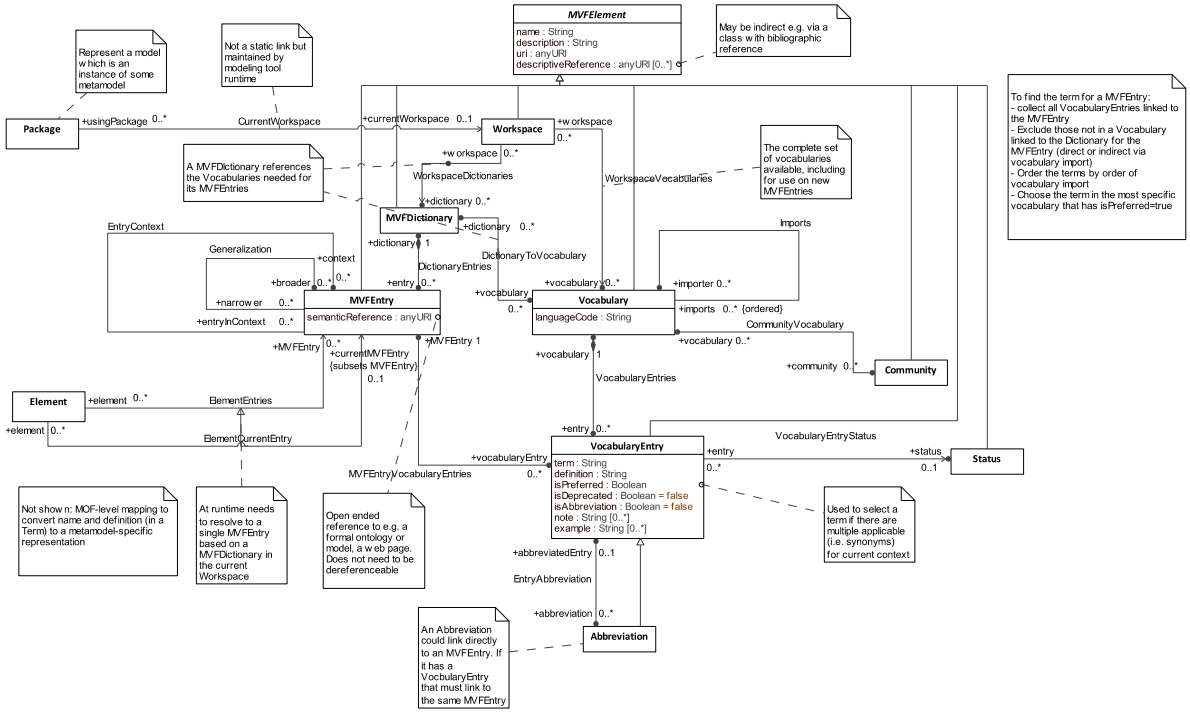

Figure 2: Multiple Vocabulary Facility Metamodel

8.1 Element [Class]

A model element is an element of the user's model represented in a modeling language. In an interactive modeling environment, each Model Element is typically associated with a concept (*i.e.*, MVF Entry) of an active MVF Dictionary whose terms are identified in at least one Vocabulary.

Property	Description
MVFEntry [0..*]	Link to MVFEntries for the Element concept in MVFDictionaries.
currentMVFEntry [0..1]	Link to the MVFEntry for the Element concept in the current MVFDictionary in the Workspace. This is dynamic and will be implicitly updated when the current Workspace is updated.

Note: The above element is part of MOF and is not part of the MVF specification. It is described here to provide context for related properties from the MVF metamodel,

8.2 MVFElement [Class]

MVFElement is an abstract supertype for many of the classes in the MVF metamodel. *i.e.*, a workspace, dictionary, vocabulary, or component of a dictionary or vocabulary.

Property	Description
name:String [1]	Attribute for the name of the instance
description:String [1]	Attribute describing the instance
uri:anyURI [1]	Attribute for the URI identifying the instance
descriptiveReference:anyURI [0..*]	Attribute linking to relevant resources that provide further information about the element

8.3 Workspace [Class]

A workspace is an MVF element that references a consistent set of the MVF dictionaries and vocabularies to be used in in a modeling environment. It's the responsibility of a conformant modeling tool to select the current active Workspace, which is then used to resolve from a Model Element to the most appropriate Vocabulary Entry to provide the term and definition.

Property	Description
dictionary [0..*]	Link to the MVF Dictionaries
vocabulary [0..*]	Link to the MVF Vocabularies

8.3.1 Generalizations

MVFElement

8.4 MVFDictionary [Class]

An MVFDictionary is a collection (by reference) of MVFEntries and the vocabularies that provide terms for them. Each vocabulary is a container of a set of vocabulary entries that each represent the association of a term in that vocabulary with one of the MVFEntries identified in that dictionary.

Property	Description
entry [0..*]	Link to the MVFEntries contained in the dictionary
vocabulary [0..*]	Link to the vocabularies referenced by the dictionary

8.4.1 Generalizations

MVFElement

8.5 MVFEntry [Class]

An MVF Entry is a unit of knowledge created by a unique combination of characteristics, *i.e.*, a concept. An MVF entry is contained in exactly one MVF dictionary and may be linked to by one or more model elements that represent that concept in the modeling environment. It will be linked to by vocabulary entries of alternative vocabularies that express the same concept in a different natural language or vernacular. It is possible that some concepts are not mapped to an entry in any vocabulary, and that not all MVF entries are associated with model elements in the active modeling environment.

Though MVFEntries are not intended to provide a concept modeling capability, two specific associations are available to provide context, in the scenario of mapping a Model Element to an existing MVF Entry. It is the responsibility of conformant tools to make use of these to meet the needs of their users:

- broader: this typically links fo a MVF Entry representing a more general element of the same typo (e.g. a superclass)

- context: this typically references a containing MVF Entry such as that for a Package (for a MVF Entry representing a class) or a Class (for one representing a Property).

Property	Description
dictionary [1]	Link to the MVFDictionary containing the MVFEntry
broader [0..*]	Link to an MVFEntry for a more general concept (has inverse of *narrower*)
context [0..*]	Link to another MVFEntry that provides context for this MVFEntry
semanticReference: any URL	"Attribute for an open ended reference or identifier that provides meaning for the concept or thing represented by the MVFEntry. This could reference an external ontology element, concept specification, model, description, web page, or other resource.

8.5.1 Generalizations

MVFElement

8.6 Vocabulary [Class]

A Vocabulary is a set of representations of concepts (terms and definitions) for the language of a particular speech community that is expressed in a specified natural language. A speech community may create a vocabulary by importing a one or more existing vocabulary and overriding selected terms, adding terms for new concepts and (implicitly) incorporating the remaining terms and definitions of the existing vocabulary. This mechanism may be employed to introduce synonyms as the primary terms of the specializing community. Both vocabularies should be in the same natural language so that definitions remain meaningful.

Property	Description
dictionary [0..*]	Link to associated MVFDictionary(ies) that provide the

	meanings of the terms
languageCode [1]: String	Attribute containing the identifier for the language in which the vocabulary is expressed, as defined in ISO 639
vocabularyEntry [0..*]	Link to the VocabularyEntries contained in this Vocabulary
community [0..*]	Link to the associated speech communities
imports [0..*]	Link to other Vocabularies that are included by reference in this Vocabulary

8.6.1 Generalizations

MVFElement

8.7 VocabularyEntry [Class]

A vocabulary entry associates a definition and term (name, designation, abbreviation) with one concept (MVF Entry) in the context of the vocabulary. The definition and term are expressed in the natural language associated with that vocabulary and the associated user community.

Property	Description
vocabulary [1]	Link to the Vocabulary
MVFEntry [1]	Link to the MVFEntry (concept) for VocabularyEntry
term:String [1]	A textual symbol for an MVFEntry in the language of the Vocabulary
definition:String [1]	Textual definition for an MVFEntry in the language of the Vocabulary, using terms from that vocabulary.
isPreferred:Boolean [1]	If true, indicates that the VocabularyEntry includes the preferred term and definition in this vocabulary, corresponding to the MVFEntry. If false, indicates that the term for this VocabularyEntry is a synonym for the MVFEntry.
isDeprecated:Boolean [1]	If true, indicates that the VocabularyEntry term and/or definition is not to be used in new models or efforts, and is likely to be eliminated in future versions of the Vocabulary.
isAbbreviation:Boolean [1]	If true, indicates that the term in the VocabularyEntry is an abbreviation for some other term in the Vocabulary.
note:String [0..*]	A multivalued text field that can be used to capture a variety of metadata associated with a VocabularyEntry.
example:String [0..*]	A multivalued text field that can be used to capture examples associated with a VocabularyEntry.
status [0..1]	Link to an optional rating established from a predetermined scale and used to evaluate the standing of a

	term (vocabulary entry) in the context of a given vocabulary

8.8 Community [Class]

A community is a group of people that share a natural language and have a shared set of terms used to express concepts in their domain of interest. We refer to a set of terms that is distinguished from general use of the natural language as a vernacular. The community may be persons that share a profession, are members of the same enterprise or organization or are collaborating on a particular technology.

8.8.1 Generalizations

MVFElement

9 Multiple Vocabulary Facility (MVF) UML Profile

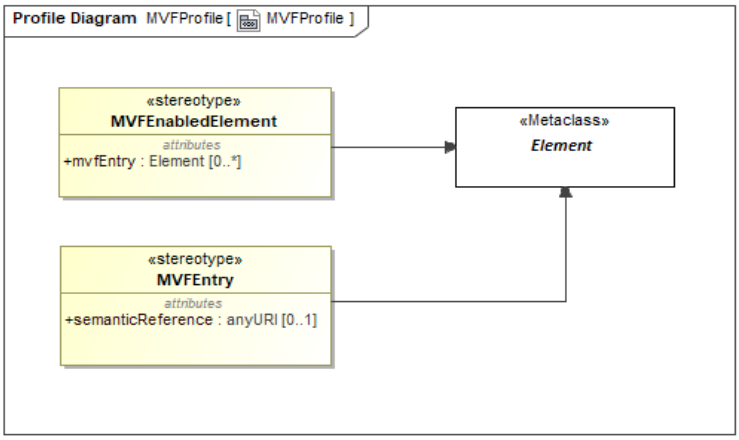

Figure 3: Multiple Vocabulary Facility UML Profile

MVF includes a UML profile that comprises two Stereotypes, MVFEntry and MVFEnabledElement. The stereotypes provide two alternatives to support the association between a mof:Element and an mvf:MVFEntry, for any mof:Element that does not define the association in the first place, and can not be extended / updated to include that association.

Notably, this includes most UML (meta)models, where classes, datatypes, attributes, associations and other model elements do not have an immediate, or standard, way to be associated to an mvf:MVFEntry.

9.1 MVFEntry [Stereotype]

The MVFEntry stereotype is designed to directly attach mvf:semanticReference tag values to instances of mof:Element.

The primary use case is the creation of semantic (information) models using UML as a modeling language. When UML is used to model information entities, the stereotype-mediated semanticReference allows one to establish an “aboutness” relationship between the information entity and the Thing it represents. Thus the UML element is also playing the role of MVFEntry.

For example, a uml:Class named Person(Record) could be stereotyped with MVFEntry and tagged via its semanticReference to be about *foaf:Person*. Likewise, its attribute name and association friendOf could be associated to the datatype and object properties *foaf:name* and *foaf:knows*, respectively.

This stereotype should be used in models that require the semantic aspects of MVF, but do not need additional terminology support.

9.2 MVFEnabledElement [Stereotype]

The MVFEnabledElement stereotype plays a similar role to its MVFEntry counterpart, but allows one to associate an instance of mof:Element to a mvf:Entry , which includes a semanticReference, but also associations to other mvf:MVFEntries and/or from mvf:MVFVocabularyElements.

As such. the stereotype should be used to bridge MOF (meta)models with MVF models, supporting the full expressivity of MVF. In particular, this stereotype allows to establish a many-many relationship between the Elements of a Model and the VocabularyEntries in one or more Vocabularies, supporting use cases such as the translation or the vernacularization of the terms used in the source model names/labels.

10 MVF Ontologies

10.1 Ontology: Multiple Vocabulary Facility

The MVF ontology consists of three components:

- a core ontology corresponding to the MVF metamodel (this ontology),
- an extension representing the subset of the ISO 1087 reference vocabulary used in other ISO standards for vocabulary representation,
- an extension that incorporates additional vocabulary from ISO 1087 for terminology science.

MVF also reuses several ontologies from the OMG Commons Ontology Library for specific patterns, including designations, collections, and classifiers.

Metadata for the MVF ontology is given in Table 10.1.

Table 10.1: Multiple Vocabulary Facility Ontology Metadata

Metadata Term	Value
OntologyIRI	https://www.omg.org/spec/MVF/MultipleVocabularyFacility/
rdfs:label	Multiple Vocabulary Facility (MVF) Ontology
dct:abstract	The MVF ontology consists of three components: - a core ontology corresponding to the MVF metamodel (this ontology) - an extension representing the subset of the ISO 1087 reference vocabulary used in other ISO standards for vocabulary representation, - an extension that incorporates additional vocabulary from ISO 1087 for terminology science. MVF also reuses several ontologies from the OMG Commons library for specific patterns, including designations, collections, and classifiers.
dct:contributor	Davide Sottara, Mayo Clinic
dct:contributor	Elisa Kendall, Thematix Partners LLC
dct:contributor	Evan Wallace, U.S. National Institute of Standards and Technology (NIST)
dct:contributor	Pete Rivett, agnos.ai U.K. Ltd
cmns-av:copyright	Copyright (c) 2019-2023 Thematix Partners LLC
cmns-av:copyright	Copyright (c) 2019-2023 agnos.ai U.K. Ltd
cmns-av:copyright	Copyright (c) 2020-2023 Mayo Clinic

cmns-av:copyright	Copyright (c) 2022-2023 QuoteWell Insurance Services, LLC
cmns-av:copyright	Copyright (c) 2020-2023 Object Management Group, Inc.
dct:license	http://opensource.org/licenses/MIT
owl:versionIRI	https://www.omg.org/spec/MVF/20230501/MultipleVocabularyFacility/

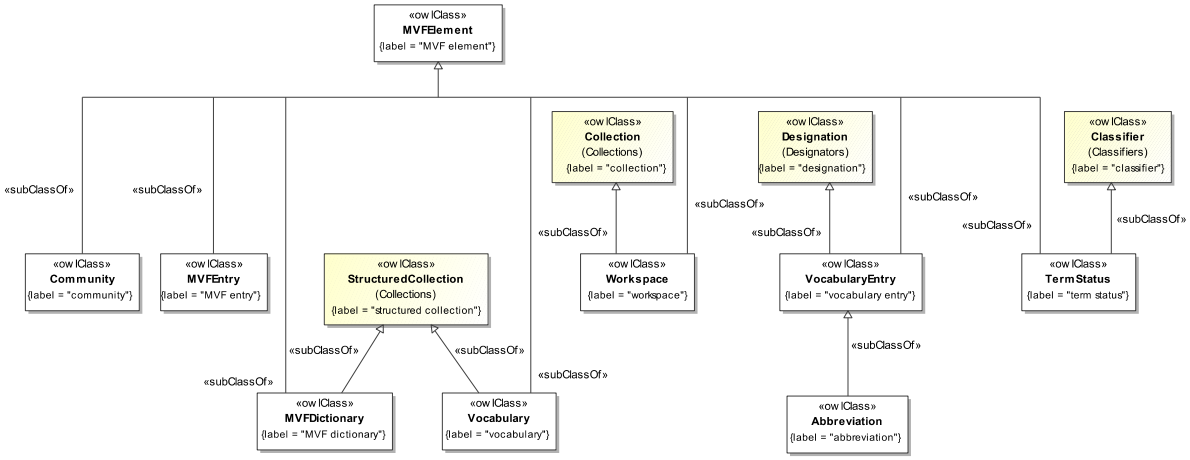

Figure 4: MVF Class Hierarchy

The class hierarchy for the MVF ontology is given in Figure 4, above. It extends classes from the Collections, Classifiers, and Designators ontologies in the Commons Ontology Library, as shown.

The top-most class in the MVF ontology is MVFElement, corresponding to the class of the same name in the metamodel. Figure 5, below, provides an overview of MVFElement and the restrictions on it and all of its subclasses.

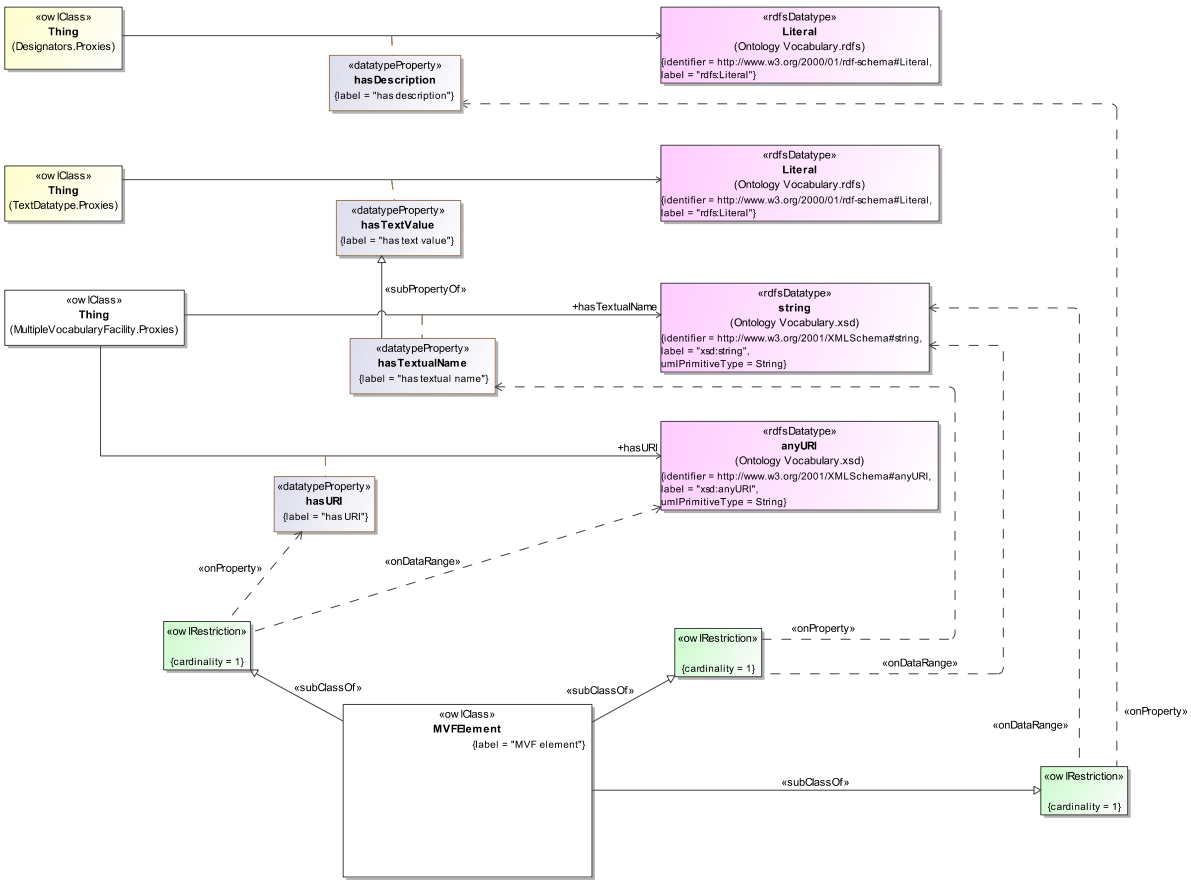

Figure 5: MVF Element Class Diagram

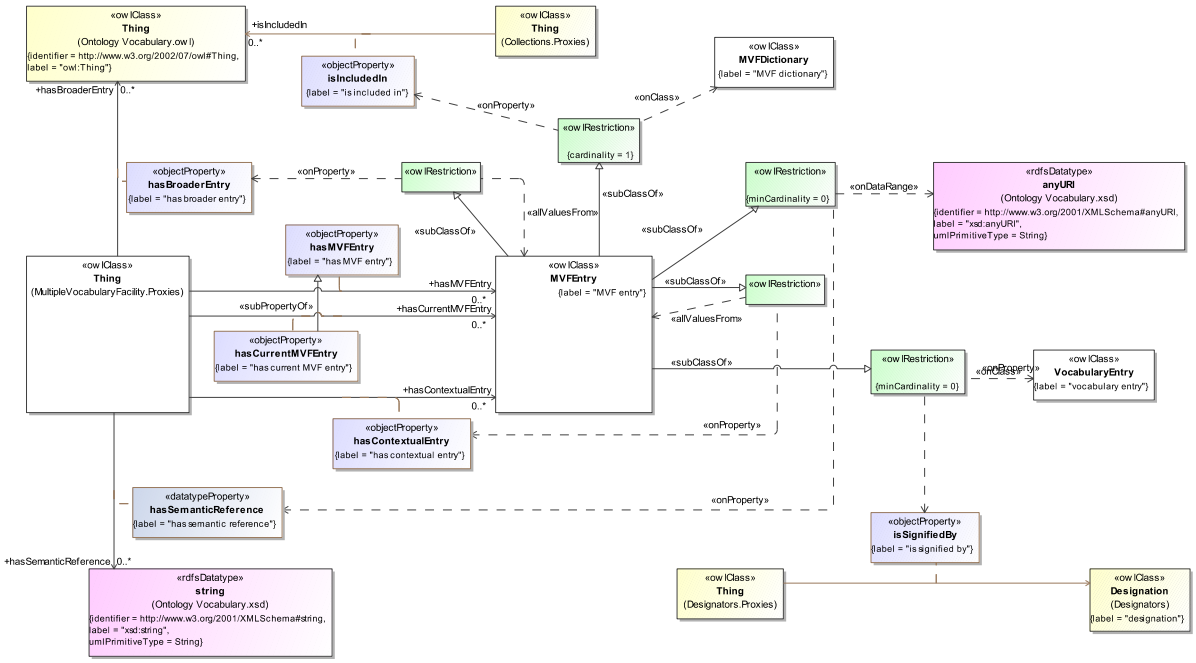

Figure 6: MVF Entry Class Diagram

Each MVF entry (*i.e.*, MVF proxy for concept) is included in an MVF dictionary, and may have vocabulary elements, and external references associated to it, as shown in Figure 6. MVF entries may be associated with other MVF entries as well.

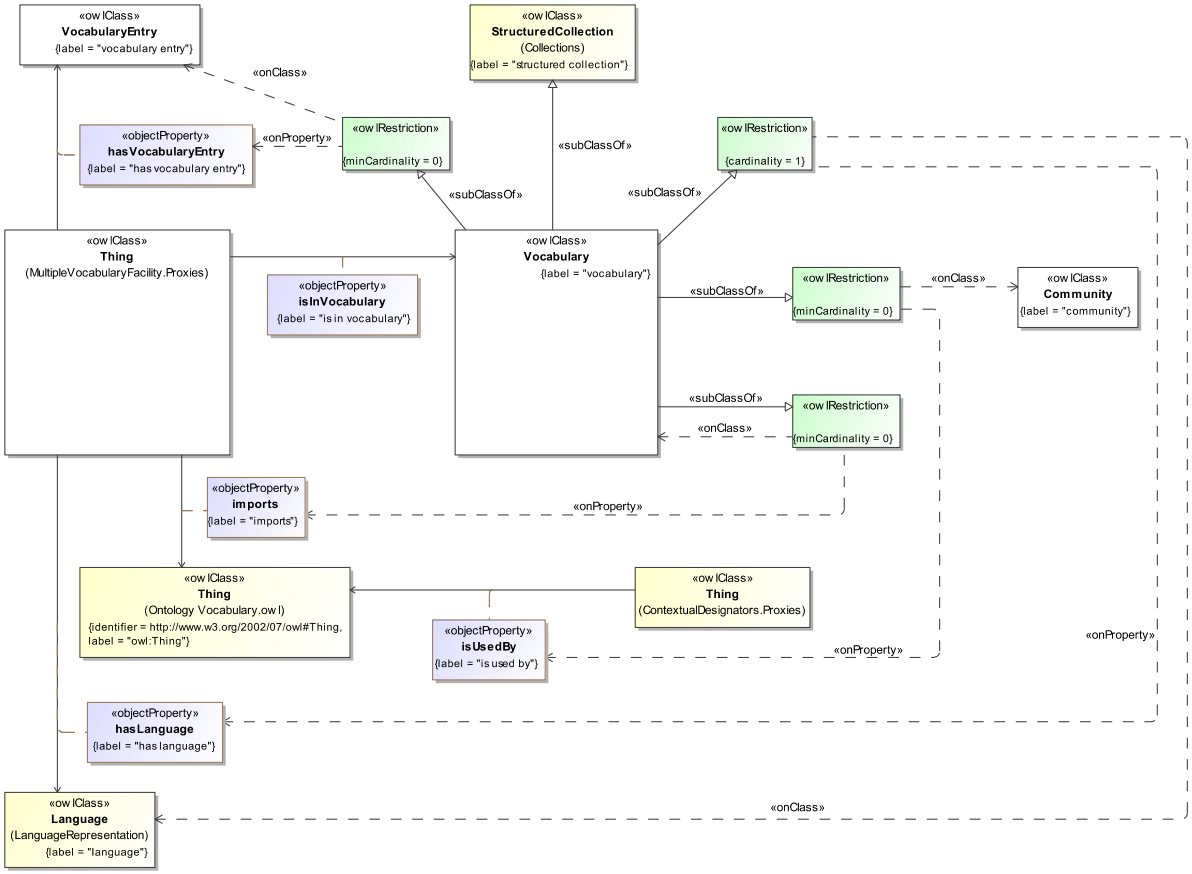

Figure 7: MVF Vocabulary Class Diagram

A vocabulary in MVF terminology is a collection of vocabulary entries, each of which represents a term and its definition in some natural language or vernacular. Vocabulary can import other vocabularies, and be imported by other vocabularies. It may be used by any number of communities, as given in Figure 7, above.

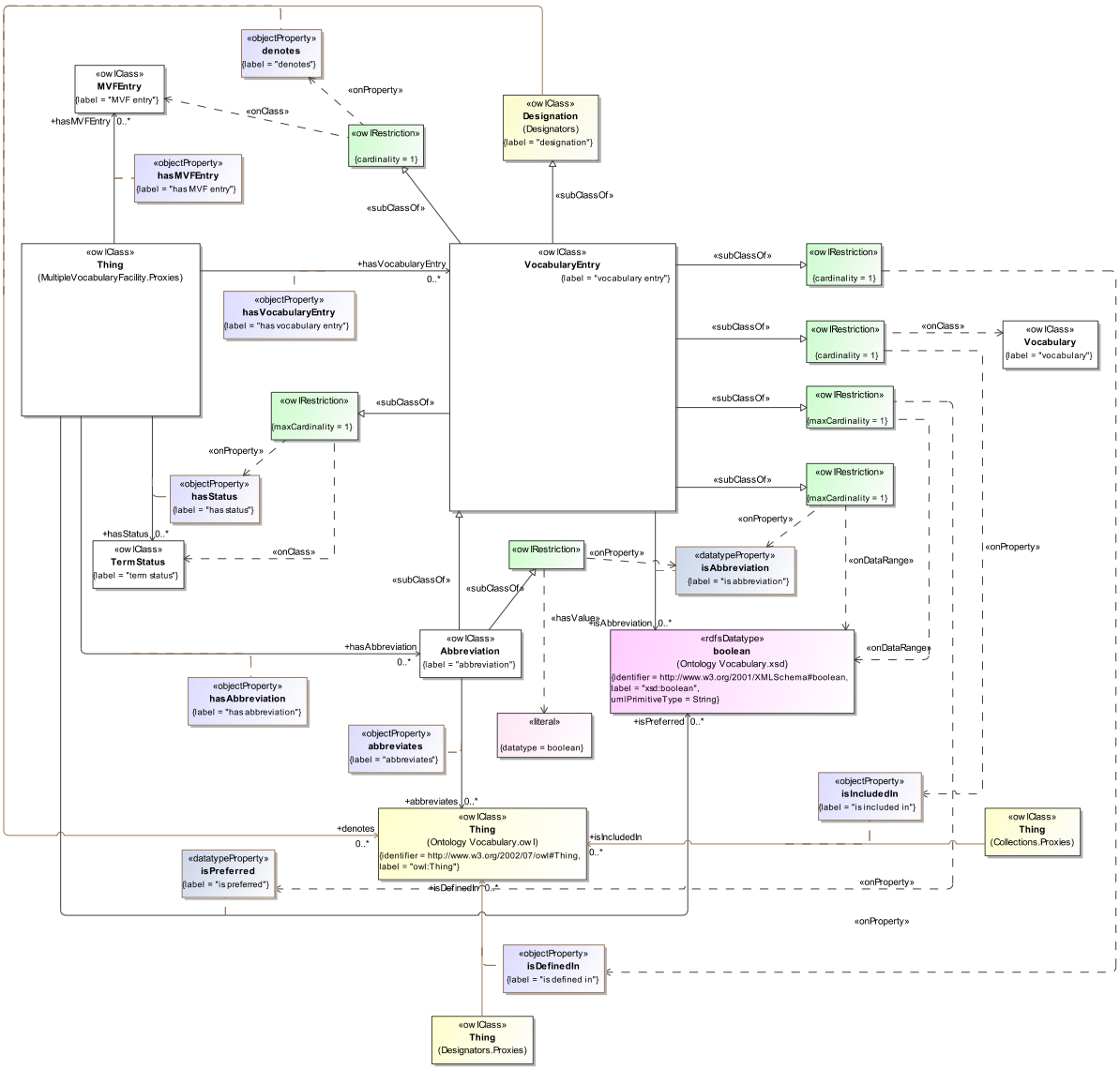

Figure 8: MVF Vocabulary Entry Class Diagram

A vocabulary entry is an element of a vocabulary that associates a concept (the MVFEntry that it references) with a definition and at least one term (name, designation) for that concept in the context of a specific vocabulary, as shown in Figure 8. The entry may or may not be (1) preferred in some context, (2) deprecated, and/or (3) be a synonym or abbreviation for the MVF entry it is associated with.

The detailed annotations and axioms that constitute the Multiple Vocabulary Facility ontology are provided in Table 10.2, below.

Classes

Table 10.2: Multiple Vocabulary Facility Ontology Detail

Name	Annotations	Class Expressions
Abbreviation (abbreviation)	Definition: vocabulary entry formed by omitting parts from the full form of the term and that represents the same concept Note: Abbreviations can be created by removing individual words, or can be acronyms, initialisms, or clipped terms. Note: An abbreviation could link directly to an MVF entry. If it is an abbreviation for a vocabulary entry then it must be linked to the MVF entry for that same vocabulary entry. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.14	Parent Class: VocabularyEntry Property Restriction: ∀ isAbbreviation.true
Community (community)	Definition: group of people that share a natural language and have a shared set of terms used to express concepts in their domain of interest Note: We refer to a set of terms that is distinguished from general use of the natural language as a *vernacular*. The community may be people that share a profession, are members of the same enterprise or organization or are collaborating on a particular technology.	Parent Class: MVFElement Property Restriction: ≥ 0 cmns-cxtdsg:uses.Vocabulary
MVFDictionary (MVF dictionary)	Definition: collection (by reference, or possibly inclusion) of vocabularies that share a set of MVFEntries Note: Each vocabulary is a container for vocabulary entries that each represent the association of a term in that vocabulary with one of the MVFEntries identified in that dictionary. A modeling environment may include multiple dictionaries, but they must address mutually exclusive concepts. Typically, one dictionary will address concepts of the modeling language metamodel, and another dictionary will address concepts of user-defined modeling elements.	Parent Class: cmns-col:StructuredCollection, MVFElement Property Restriction: ≥ 0 cmns-col:hasMember.MVFEntry Property Restriction: ≥ 0 cmns-col:hasMember.Vocabulary
MVFElement MVF element)	Definition: abstract entity in a multiple vocabulary facility model or ontology Explanatory note: An MVF element corresponds roughly to an element in category theory, namely one that can be an object of any category, and to 'entity' in many top level ontologies. Usage note: Use the Dublin Core 'references' annotation for any relevant citations or other references, corresponding to the 'reference' property in the MVF metamodel.	Property Restriction: = 1 hasURI.xsd:anyURI Property Restriction: = 1 cmns-dsg:hasDescription Property Restriction: = 1 hasTextualName.xsd:string

MVFEntry (MVF entry)	Definition: unit of knowledge created by a unique combination of characteristics Note: An MVF entry is linked to by one or more model elements that represent that concept in the modeling environment. Note: From an ISO 1087 perspective, this is the concept 'concept' as used and designated by the term 'concept' in terminology work. It is a very different concept from that designated by other domains such as industrial automation or marketing. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.2.7	Parent Class: MVFElement Property Restriction: = 1 cmns-col:isIncludedIn.MVFDictionary Property Restriction: ∀ mvf;hasBroaderEntry.MVFEntry Property Restriction: ∀ mvf;hasContextualEntry.MVFEntry Property Restriction: ≥ 0 cmns-dsg:isSignifiedBy.mvf:VocabularyEntry Property Restriction: ≥ 0 hasExternalReference.xsd:anyURI
TermStatus (term status)	Definition: classifier for the standing of a term within its vocabulary	Parent Class: cmns-cls:Classifier, MVFElement
Vocabulary (vocabulary)	Definition: set of representations of concepts (terms and definitions) for the language of a particular speech community that is expressed in a specified natural language Editorial note: This representation does not address the ordering of imports, which may require an intervening class that has an attribute that is an ordinal number representing the ordering. Note: A speech community may create a vocabulary by specializing an existing vocabulary and overriding selected terms, adding terms for new concepts and incorporating the remaining terms and definitions of the existing vocabulary. This mechanism may be employed to introduce synonyms as the primary terms of the specializing community. Both vocabularies should be in the same natural language so that definitions remain meaningful.	Parent Class: cmns-col:StructuredCollection, MVFElement Property Restriction: = 1 hasLanguage.lcc-lr;Language Property Restriction: ≥ 0 hasVocabularyEntry.VocabularyEntry Property Restriction: ≥ 0 imports.Vocabulary Property Restriction: ≥ 0 cmns-cxtdsg:isUsedBy.Community
VocabularyEntry (vocabulary entry)	Definition: element of a vocabulary (designation) that denotes exactly one concept (MVF entry) in the context of that vocabulary Note: The definition and term(s) are expressed in the natural language associated with that vocabulary and the associated user community.	Parent Class: cmns-dsg:Designation, MVFElement Property Restriction: = 1 cmns-dsg:denotes.MVFEntry Property Restriction: = 1 cmns-col:isIncludedIn.Vocabulary Property Restriction: = 1 cmns-dsg:isDefinedIn Property Restriction: ≤ 1 hasStatus.TermStatus Property Restriction: ≤ 1 isAbbreviation.xsd:boolean Property Restriction: ≤ 1 isPreferred.xsd:boolean

Workspace (workspace)	Definition: a set of consistent MVF dictionaries and vocabularies which can be activated in a modeling environment	Parent Class: cmns-col:Collection, MVFElement Property Restriction: ≥ 0 cmns-col:comprises.MVFDictionary Property Restriction: ≥ 0 cmns-col:comprises.Vocabulary

Properties

Name	Annotations	Property Axioms
abbreviates (abbreviates)	Definition: is a shortened designation for a term that is used synonymously with that term in the context of a given vocabulary or dictionary	Parent Property: cmns-dsg:denotes Domain: Abbreviation Inverse: hasAbbreviation
hasAbbreviation (has abbreviation)	Definition: has a shortened designation used synonymously in the context of the given vocabulary or dictionary	Parent Property: cmns-dsg:isSignifiedBy Range: Abbreviation Inverse: abbreviates
hasBroaderEntry (has broader entry)	Definition: has a more general MVF entry than the subject	
hasContextualEntry (has contextual entry)	Definition: scopes in the context of	Parent Property: cmns-cxtdsg:isApplicableIn Range: MVFEntry
hasCurrentMVFEntry (has current MVF entry)	Definition: indicates the applicable MVF entry from the active MVF workspace Note: This property will be implicitly updated when the current workspace changes.	Parent Property: hasMVFEntry Range: MVFEntry
hasLanguage (has language)	Definition: has a natural language in which a vocabulary is expressed	Parent Property: cmns-cxtdsg:uses Range: lcc-lr:Language
hasMVFEntry (has MVF entry)	Definition: links a model element to the corresponding MVF entry (concept), providing a name and definition for that model element Alternative label: has multiple vocabulary facility entry Explanatory note: hasMVFEntry is a property used to relate an element in any model to a corresponding MVF entry. It corresponds to the property ElementEntry in the metamodel. That property has a UML Element in its domain, which cannot	Range: MVFEntry

	be modeled in the ontology. Note: There could be many of these in different dictionaries.	
hasNarrowerEntry (has narrower entry)	Definition: has a more specialized MVF entry than the subject	Inverse: hasBroaderEntry
hasSemanticReference (has external reference)	Definition: has a relevant reference that provides meaning but is not explicitly part of the vocabulary (*i.e.*, document, web site, or other resource) Note: This property is string valued as the reference need not be dereferenceable at a URL.	Parent Property: cmns-txt:hasTextValue Range: xsd:string
hasStatus (has status)	Definition: associates a rating with respect to readiness or acceptability for usage with a vocabulary or MVF entry	Parent Property: cmns-cls:classifies Range: TermStatus
hasTextualName (has textual name)	Definition: indicates a text version of something that an MVF element is known by	Parent Property: cmns-txt:hasTextValue Range: xsd:string
hasURI (has URI)	Definition: links something to a unique sequence of characters that identifies a logical or physical resource on a network Synonym: has uniform resource identifier	
hasVocabularyEntry (has vocabulary entry)	Definition: has a designation (term) in this vocabulary	Parent Property: cmns-col;hasMember Range: VocabularyEntry
imports (imports)	Definition: contains as an intrinsic part	Parent Property: cmns-col;hasConstituent
isAbbreviation (is abbreviation)	Definition: whether the term for this vocabulary entry is a shortened form of another	Domain: VocabularyEntry Range: xsd:boolean
isInVocabulary (is in vocabulary)	Definition: has containing vocabulary	Parent Property: cmns-col:isMemberOf Range: Vocabulary Inverse: hasVocabularyEntry
isPreferred (is preferred)	Definition: is the best term to use in the context of the vocabulary for some concept Note: The preferred flag is used to select a term (vocabulary entry) if there are multiple vocabulary entries (i.e., synonyms) available to map to a given model element in the current context.	Range: xsd:boolean

10.2 Ontology: ISO 1087 – Terms and Definitions

This component of the MVF ontology is an extension representing the subset of the ISO 1087 reference vocabulary used in other ISO standards for vocabulary representation.

Metadata for the ISO 1087 – Terms and Definitions ontology is given in Table 10.3.

Table 10.3: ISO 1087 - Terms and Definitions Ontology Metadata

Metadata Term	Value
OntologyIRI	https://www.omg.org/spec/MVF/ISO1087-VocabularyForTermsAndDefinitions/
rdfs:label	Multiple Vocabulary Facility (MVF) Terms and Definitions Ontology
dct:abstract	The MVF ontology consists of three components: - a core ontology corresponding to the MVF metamodel, - an extension representing the subset of the ISO 1087 reference vocabulary used in other ISO standards for vocabulary representation (this ontology), - an extension that incorporates additional vocabulary from ISO 1087 for terminology science. MVF also reuses several ontologies from the OMG Commons library for specific patterns, including designations, collections, and classifiers.
dct:contributor	Ed Barkmeyer, Thematix Partners LLC
dct:contributor	Elisa Kendall, Thematix Partners LLC
dct:contributor	Jim Odell, Thematix Partners LLC
cmns-av:copyright	Copyright (c) 2011-2023 Thematix Partners LLC
cmns-av:copyright	Copyright (c) 2020-2023 Object Management Group, Inc.
dct:license	https://opensource.org/licenses/MIT
owl:versionIRI	https://www.omg.org/spec/MVF/20230501/ISO1087-VocabularyForTermsAndDefinitions/
skos:scopeNote	Note that the set of ontologies provided for MVF do not provide exhaustive coverage of ISO 1087. We have not incorporated the terms related to data validation or natural language processing in the latest version of the standard, and certain classes under the heading of concept relation in the standard are handled as properties herein.

An overview of the class hierarchy for the term-related aspects of the ontology is given in Figure 9.

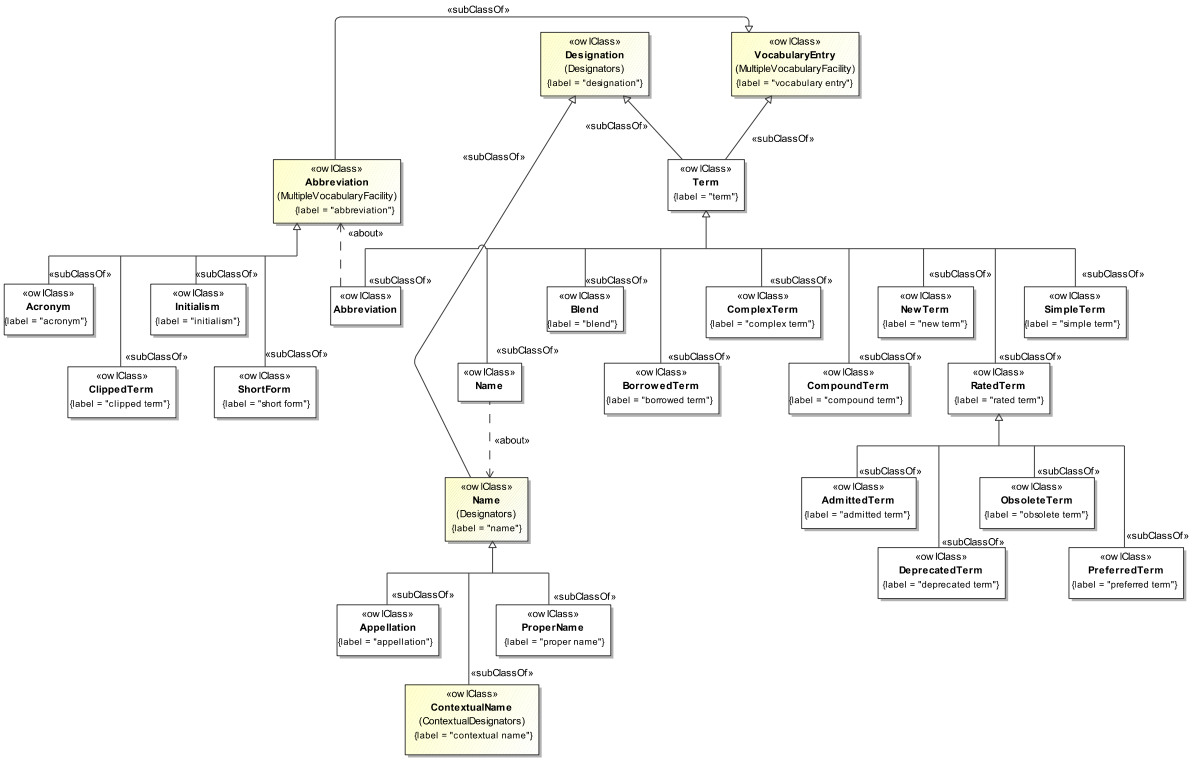

Figure 9: ISO 1087 Term Class Hierarchy

Additional features covering characteristics, definitions, diagrams, language extensions and term ratings are provided in Figure 10, below.

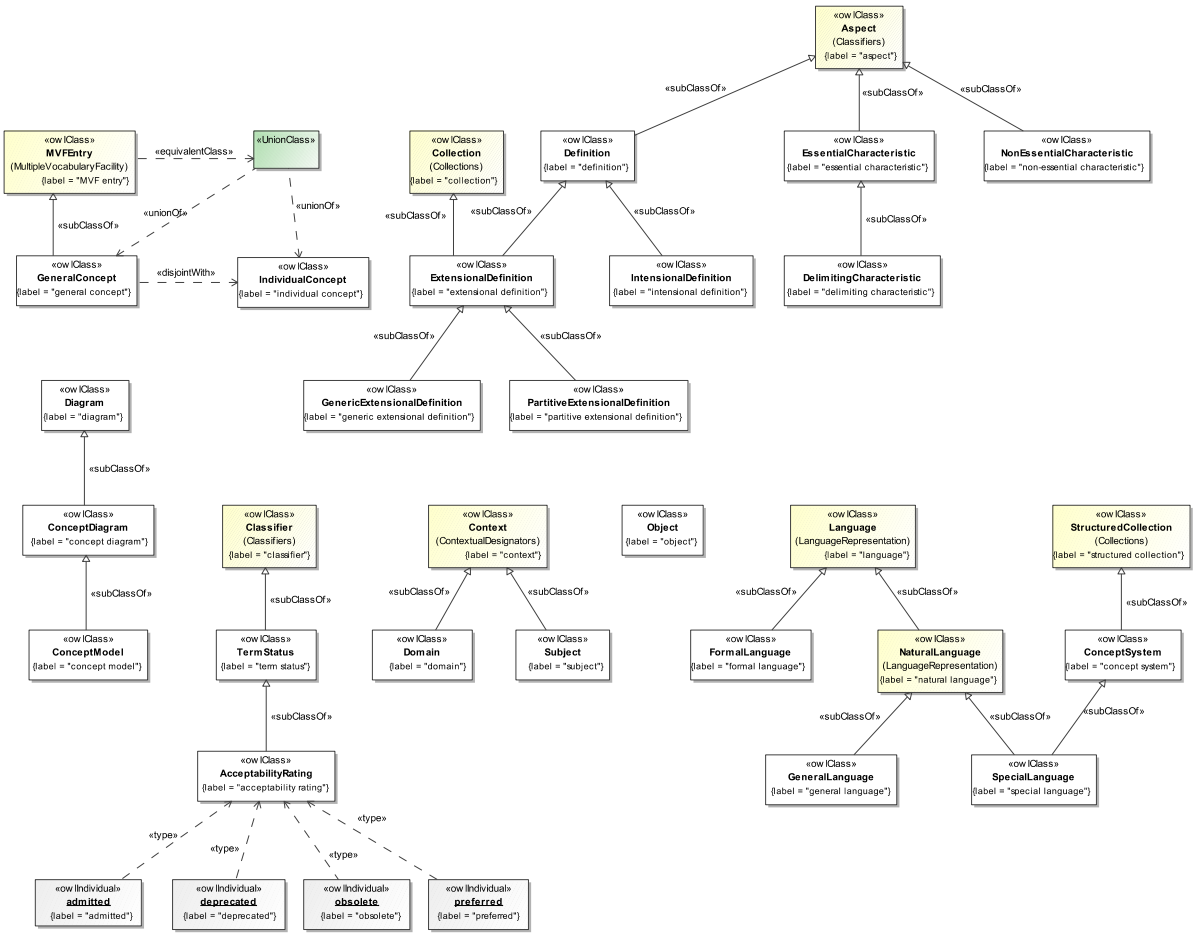

Figure 10: Characteristics, Definitions, Language Extensions, and Term Rating Aspects of the Ontology

The detailed annotations and axioms that comprise the ISO 1087 – Terms and Definitions ontology are provided in Table 10.4, below.

Classes

Table 10.4: ISO 1087 - Terms and Definitions Ontology Details

Name	Annotations	Class Expressions
cmns-cls:Aspect	Example: 'Being made of wood' as a property of a given 'table'; 'Belonging to person A' as a property of a given 'pet'; 'Having been formulated by Einstein' as a property of the equation 'E = mc squared' Note: Characteristics are used for describing concepts. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second	

	edition, 2019-09, clauses 3.1.3, 3.2.1 Synonym: property	
cmns-dsg:Name		Parent Class: Term
lcc-lr:NaturalLanguage	Note: A natural language is a language that is or was in active use in a community of people, and the rules of which are mainly deduced from usage. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.1.7	
AcceptabilityRating (acceptability rating)	Definition: rating that allows for designations to be placed in order of preference as a guide to users Note: The following ratings are common: preferred term, admitted term, deprecated term. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.18	Parent Class: TermStatus
Acronym (acronym)	Definition: abbreviation that is made up of the initial letters of the components of the full form of a term or proper name or from syllables of the full form and that is pronounced syllabically Example: Examples of acronyms are: laser, ISO, GATT, UNESCO, UNICEF Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.15	Parent Class: mvf:Abbreviation
AdmittedTerm (admitted term)	Definition: term that is a synonym for a preferred term, but not rated according to the acceptability rating scale as a preferred term Example: With regard to the concept ‘terminology science’, ‘terminology studies’ is an admitted term, whereas ‘terminology science’ is the preferred term, and ‘terminology’ is a deprecated term. Note: There can be more than one admitted term. By analogy, ‘admitted’ can also apply to appellations, proper names, and symbols.	Parent Class: RatedTerm Property Restriction: hasAcceptabilityRating.admitted
Appellation (appellation)	Definition: term that is applied to a group of objects whose relevant properties are identical Example: Examples of appellations are: ‘Nokia 7 Plus®’ (mobile phone), ‘Adobe® Acrobat® X Pro’ (software), ‘Road King®’	Parent Class: cmns-dsg:Name

	(motorcycle). Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.3	
Blend (blend)	Definition: designation that is formed by clipping and combining two or more words Synonym: blended designation Example: Examples of blends are: infotainment, cyberspace, quasar Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.13	Parent Class: Term
BorrowedTerm (borrowed term)	Definition: term taken from another language or from another domain or subject Example: The term 'virus' was originally used in biology and later transferred to information. The English term 'internet' has been borrowed by many other languages. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.11	Parent Class: Term
ClippedTerm (clipped term)	Definition: abbreviation that is made up of a truncated term Example: vet school (veterinarian school) Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.17	Parent Class: Abbreviation
ComplexTerm (complex term)	Definition: term that consists of more than one word or lexical unit Example: Examples of complex terms are: computer mouse, fault recognition circuit. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.9, 3.4.10	Parent Class: Term
CompoundTerm (compound term)	Definition: simple term that can be split morphologically into separate components Example: Examples of compound terms are: steamship, blackbird, afterbirth. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.8	Parent Class: Term
ConceptDiagram (concept diagram)	Definition: graphic representation of a concept system Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second	Parent Class: Diagram Property Restriction: ∃ cmns-cxtdsg:appliesTo.ConceptSystem

	edition, 2019-09, clause 3.2.29	Property Restriction: ∃ depicts.mvf:MVFEntry
ConceptField (concept field)	Definition: unstructured set of concepts belonging to the same domain or subject Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.2.10	Parent Class: cmns-col:Collection Property Restriction: ∃ cmns-col;comprises.mvf:MVFEntry Property Restriction: ∃ cmns-cxtdsg;isUsedBy (Domain ∪ Subject)
ConceptModel (concept model)	Definition: concept diagram formed by means of a formal language Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.2.30 Source: ISO 24156-1:2014 Graphic notations for concept modelling in terminology work and its relationship with UML - Part 1: Guidelines for using UML notation in terminology work	Parent Class: ConceptDiagram Property Restriction: ∃ cmns-col;compliesWith.FormalLanguage
ConceptSystem (concept system)	Definition: set of concepts structured in one or more related domains according to the concept relations among its concepts Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.2.28	Parent Class: cmns-col;StructuredCollection Property Restriction: ∃ cmns-col:comprises.mvf:MVFEntry Property Restriction: ≥ 0 cmns-cxtdsg:isUsedBy.Domain
Definition (definition)	Definition: representation of a concept by an expression that describes it and differentiates it from related concepts Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.3.1	Parent Class: cmns-cls:Aspect Property Restriction: = 1 cmns-dsg:defines.mvf:MVFEntry
DelimitingCharacteristic (delimiting characteristic)	Definition: essential characteristic used for distinguishing a concept from related concepts Example: The delimiting characteristic ‘support for the back’ may be used for distinguishing the concepts stool and chair. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.2.5	Parent Class: EssentialCharacteristic
DeprecatedTerm (deprecated term)	Definition: term which is a synonym for a preferred term, but rated according to the acceptability rating scale as undesired Example: With regard to the concept ‘terminology science’, ‘terminology’ is a deprecated term, whereas ‘terminology	Parent Class: RatedTerm Property Restriction: hasAcceptabilityRating.deprecated

	science' is the preferred term, and 'terminology studies' is an admitted term. Note: There can be more than one deprecated term. By analogy, 'deprecated' can also apply to appellations, proper names and symbols. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.21	
Diagram (diagram)	Definition: two-dimensional geometric, symbolic representation of information that shows the appearance, structure, or workings of something	Property Restriction: ∃ depicts.owl:Thing
Domain (domain)	Definition: field of special knowledge Scope note: The borderlines and the granularity of a domain are determined from a purpose-related point of view. If a domain is subdivided, the result is again a domain. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09,clause 3.1.4	Parent Class: cmns-cxtdsg:Context Property Restriction: ≥ 0 cmns-cxtdsg:uses.SpecialLanguage
EssentialCharacteristic (essential characteristic)	Definition: characteristic of a concept that is indispensable to understand that concept Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.2.3	Parent Class: cmns-cls;Aspect Property Restriction: ∃ cmns-cls:characterizes.mvf:MVFEntry
ExtensionalDefinition (extensional definition)	Definition: definition that enumerates the objects to which a concept corresponds under one criterion of subdivision Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.1.2, 3.3.3	Parent Class: Definition, cmns-col:Collection Property Restriction: ∃ cmns-col:comprises.Object Property Restriction: ≥ 0 cmns-cls:isCharacterizedBy.cmns-cls:Aspect
FormalLanguage (formal language)	Definition: language whose rules are explicitly established before its use Example: Web Ontology Language (OWL); the structured English informative language that is specified in the Semantics For Business Vocabulary and Rules (SBVR) Specification Note: A formal language is a collection of expressions, following formal rules of well-formedness. See the Distributed Ontology, Model, and Specification Language (DOL) specification for additional criteria and classification, available at https://www.omg.org/spec/DOL/. Scope note: The purpose of formal language is to assure exact communication of	Parent Class: lcc-lr:Language

	information. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.1.10	
GeneralConcept (general concept)	Definition: concept that corresponds to a potentially unlimited number of objects which form a group by reason of shared properties Example: Examples of general concepts are ‘planet’, ‘tower’, ‘Nobel Prize in Physics’, ‘moon’. Note: For a general concept it is essential that a number of corresponding objects greater than 1 can be perceived or conceived of. For example ‘spaceship’ has been a general concept before such a material object existed, at the time when there existed only 1 such object, and later, when there existed several such objects. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.2.9	Parent Class: mvf:MVFEntry Class Axiom: ¬ Individual Concept
GeneralLanguage (general language)	Definition: natural language characterized by the use of linguistic means of expression independent of any specific domain Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.1.8	Parent Class: lcc-lr:NaturalLanguage
GenericExtensionalDefinition (generic extensional definition)	Definition: extensional definition that enumerates all the specific concepts of a generic concept under one criterion of subdivision on the same hierarchical level Example: noble gas - helium, neon, argon, crypton, xenon or radon Note: A generic extensional definition is based on a generic relation, and the enumeration ends with the operator ‘or’; [i.e., a disjoint union of the subordinate concepts]. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.3.4	Parent Class: ExtensionalDefinition
IndividualConcept (individual concept)	Definition: concept that corresponds to a unique object Example: Examples of individual concepts are ‘Saturn’, ‘Eiffel Tower’, ‘Moon’, ‘serial number FRHR603928’, ‘2016 Nobel Prize in Physics’. Note: Individual concepts are represented by proper names. In a UML model or similar	Parent Class: mvf:MVFEntry

	context, an individual concept corresponds to a singleton class. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.2.8	
Initialism (initialism)	Definition: abbreviation that is made up of the initial letters of the components of the full form of a term or proper name or from syllables of the full form and that is pronounced letter by letter Example: Examples of initialisms are: UN, ASTM, IEC, US, EU, DNA Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.16	Parent Class: mvf:Abbreviation
IntentionalDefinition (intentional definition)	Definition: definition that conveys the intension of a concept by stating the immediate generic concept and its characteristics, including any delimiting characteristic(s) Example: mechanical mouse: computer mouse in which movements are detected by rollers and a ball Example: optical mouse: computer mouse in which movements are detected by light sensors Note: Intensional definitions are preferable to other types of definitions because they clearly reveal the characteristics of a concept within a concept system: they should be used whenever possible. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.2.6, 3.3.2	Parent Class: Definition Property Restriction: ∀ hasDelimitingCharacteristic.DelimitingCharacteristic Property Restriction: ∃ cmns-col:comprises.cmns-cls:Aspect
NewTerm (new term)	Definition: term that is specifically coined for a given general concept Example: smartwatch Note: A new term may supersede an older term or may designate a new concept. Synonym: neonym Synonym: neoterm Synonym: terminological neologism Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.12	Parent Class: Term
NonEssentialCharacteristic (non-essential characteristic)	Definition: characteristic of a concept that is not indispensable to understand that concept	Parent Class: cmns-cls:Aspect

	Example: For defining the concept ‘traffic light’, the color ‘red’, ‘green’ or ‘amber’ is an essential characteristic, while for defining the concept ‘computer mouse’, the color (e.g. ‘ivory’, ‘blue’ or ‘red’) is a non-essential characteristic. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09,claue 3.2.4	
Object (object)	Definition: anything perceivable or conceivable Note: Objects may be material (*e.g.* an engine, a sheet of paper, a diamond), immaterial (*e.g.* conversion ratio, a project plan) or imagined (*e.g.* a unicorn). Objects correspond to individuals in an ontology, instances in many programming languages. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.1.1	Property Restriction: ≥ 0 cmns-cls:isCharacterizedBy.cmns-cls:Aspect
ObsoleteTerm (obsolete term)	Definition: term which is no longer in common use Note: By analogy, ‘obsolete’ can also apply to appellations, proper names and symbols. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.22	Parent Class: RatedTerm Property Restriction: hasAcceptabilityRating.obsolete
PartitiveExtensionalDefinition (partitive extensional definition)	Definition: extensional definition that enumerates all the partitive concepts of a comprehensive concept on the same hierarchical level Example: Family 18 in the Periodic Table: helium, neon, argon, krypton, xenon and radon. Note: A partitive extensional definition is based on a partitive relation, and the enumeration ends with the operator ‘and’; [*i.e.*, a union that is disjoint and covering of all parts of the whole]. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.3.5	Parent Class: ExtensionalDefinition
PreferredTerm (preferred term)	Definition: term rated according to the acceptability rating as the primary term for a given concept Example: With regard to the concept ‘terminology science’, the preferred term is ‘terminology science’, whereas ‘terminology studies’ is an admitted term, and	Parent Class: RatedTerm Property Restriction: hasAcceptabilityRating.preferred

	‘terminology’ is a deprecated term. Note: By analogy, ‘preferred’ can also apply to appellations, proper names and symbols. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.19	
ProperName (proper name)	Definition: designation that represents an individual concept Example: ‘International Organization for Standardization’, ‘IBM®’, ‘British Isles’, ‘United Nations’ Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.4	Parent Class: cmns-dsg:Name
RatedTerm (rated term)	Definition: term rated according to an acceptability rating scale that allows for designations to be placed in order of preference as a guide to users Note: The following ratings are common: preferred term, admitted term, deprecated term.	Parent Class: Term Property Restriction: = 1 hasAcceptabilityRating
ShortForm (short form)	Definition: abbreviatiated form for a very long complex term or appellation, using fewer words to designate the same concept	Parent Class: mvf:Abbreviation
SimpleTerm (simple term)	Definition: term that consists of a single word or lexical unit Example: Examples of simple terms are: sound, light, barrier, accessory, accessorize, virus, viral. Synonym: single word term Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.6, 3.4.7	Parent Class: Term
SpecialLanguage (special language)	Definition: natural language used in communication between experts in a domain and characterized by the use of specific linguistic means of expression Scope note: The specific linguistic means of expression always include domain-specific terminology and phraseology and also can cover stylistic or syntactic features. Synonym: LSP Synonym: language for special purposes Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.1.9	Parent Class: lcc-lr:NaturalLanguage, ConceptSystem Property Restriction: ∃ cmns-cxtdsg;isUsedBy (Domain ∪ Subject)

Subject (subject)	Definition: area of interest or expertise Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.1.5	Parent Class: cmns-cxtdsg:Context
Symbol (symbol)	Definition: designation that represents a concept by non-linguistic means Note: From section 7.5, ISO 704, symbols are an important aid to international communication because their visual representation of concepts functions independently of any given language. They can communicate information directly under difficult circumstances (*e.g.*, traffic signs). Iconic symbols should bear some visual resemblance to the concept they represent. Generally their meaning should be directly apparent without explanation. In some cases, however, the visual resemblance of the symbol is less pronounced or completely lost. Its meaning may be no longer directly recognizable and may be supported only by general agreement. Terms using the letters of the alphabet as iconic symbols to communicate the shape of the letter itself rather than its sound shall not be considered a symbol. Characters that replace words or parts of words, such as mathematical symbols or currency symbols, are considered symbols. Note: There are several types of symbols such as graphical symbols (ISO 3864, all parts) and letter symbols (ISO 80000, all parts). Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.5	Parent Class: mvf:VocabularyEntry
Term (term)	Definition: verbal designation of a general concept in a specific subject field Note: A term may contain symbols and can have variants, e.g. different forms of spelling. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.2	Parent Class: mvf:VocabularyEntry
mvf:Abbreviation	Synonym: abbreviated form	Parent Class: Term
mvf:MVFEntry	Synonym: concept	Property Restriction: ≥ 0 cmns-cls:isCharacterizedBy.cmns-cls:Aspect Property Restriction: ≥ 0 cmns-

		dsg:isDefinedIn.Definition Class Axiom: ≡ (GeneralConcept ∪ Individual Concept)
mvf:VocabularyEntry		Property Restriction: ≥ 0 cmns-dsg:isDefinedIn.Definition Property Restriction: ≥ 0 cmns-dsg:denotes.mvf;MVFEntry

Properties

Name	Annotations	Property Axioms
associates (associates)	Definition: relates two concepts having a non-hierarchical, thematic connection by virtue of experience Example: An associative relation exists between the concepts education and teaching, baking and oven. Note: Associative relations are evidence that the terms are semantically or conceptually associated to the degree that it is important to make the connection explicit, on the grounds that it may suggest additional terms for use in indexing or retrieval. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.2.23	
causes (causes)	**Definition**: makes something happen or gives rise to some action, condition, or phenomenon as a consequence Example: A causal relation exists between the concepts action and reaction, nuclear explosion and fall-out. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.2.27	Parent Property: associates
depicts (depicts)	Definition: illustrates via an image	Parent Property: cmns-dsg:describes
extends (extends)	Definition: supplements or augments	
hasAcceptabilityRating (has acceptability rating)	Definition: relates to a rating indicating its status with respect to the vocabulary	Parent Property: cmns-dsg:sDescribedBy
hasAntonym (has antonym)	Definition: relates a designation to another representing a coordinate concept viewed as its logical complement or opposite Example: Antonymy exists between the terms encoding and decoding, positive and negative. Note: Designations in the relation of antonymy are called 'antonyms'. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.25	Type: owl:SymmetricProperty Parent Property: associates

hasDelimitingCharacteristic (has delimiting characteristic)	Definition: indicates a defining feature of Note: A delimiting characteristic is a necessary condition for class membership.	Parent Property: cmns-cls:isCharacterizedBy
hasExtension (has extension)	Definition: specifies something that supplements this entity	Inverse: extends
hasHomonym (has homonym)	Definition: relates a designation to another that has common spelling and pronunciation but represents a different concept, *i.e.*, has different meaning and origin Example: The term 'bark' represents three unrelated concepts: 1) the concept 'bark' corresponding to certain vocal repertoires of dogs; 2) the concept 'bark' corresponding to the outside coverings of stems of woody plants; 3) the concept 'bark' corresponding to some sailing vessels. **Note**: Designations in the relation of homonymy are called 'homonyms'. **Source**: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.29	Type: owl:SymmetricProperty Parent Property: associates
hasIntension (has intension)	Definition: specifies something that explains the entity in terms of meaning	
hasMononym (has mononym)	Definition: has as its singular (only) designation Note: Mononymic relations between a concept and a term (designation, vocabulary entry) in a given language are those in which a given concept has only one designation. Designations in the relation of mononymy are called ‘mononyms’. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.26	Parent Property: associates, cmns-dsg:isSignifiedBy
hasSuperordinateConcept (has superordinate concept)	Definition: indicates a broader, ancestral concept Synonym: is narrower transitive than	Type: owl:TransitiveProperty Parent Property: mvf:hasBroaderEntry
hasSynonym (has synonym)	Definition: relates a vocabulary entry (designation) to another in a given natural language representing the same concept Example: Synonymy exists between 'deuterium' and 'heavy hydrogen', between 'United Nations' and 'UN'. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.23	Type: owl:SymmetricProperty Parent Property: associates
isCausedBy (is caused by)	Definition: is a consequence of	Parent Property: associates Inverse: causes
isCoordinateWith (is coordinate with)	Definition: indicates a concept that results from the same criterion of subdivision as another subordinate concept with the same immediate superordinate [parent] concept Example: Applying 'layer of clothing' as a criterion of subdivision to 'clothing' yields 'outerwear' and 'underwear' as	

	specific concepts. These concepts are coordinate concepts in relation to their generic concept 'clothing'. Example: For the concept system 'computer mouse' according to ISO 704:2009, 5.5.2.2.1, Example 4 the type of characteristic 'computer connection' is used as a criterion of subdivision to divide the generic concept 'computer mouse into specific concepts such as 'cord mouse' and 'cordless mouse'. Example: For the concept system 'computer' the type of characteristic 'function' is used as a criterion of subdivision to divide the comprehensive concept 'computer' into partitive concepts such as 'main board', 'display adapter', 'power supply', 'storage device' and 'input device'. Example: For the concept system 'safety sign' according to ISO 3864-1:2011, 5, Table 1, the type of characteristic 'geometric shape' is used as a criterion of subdivision to divide the generic concept 'safety sign' into specific concepts such as 'mandatory action sign' and 'safe condition sign'. Note: A criterion of subdivision is a type of characteristic [aspect] according to which a superordinate concept is divided into subordinate concepts. Synonym: is a sibling of Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.2.17, 3.2.18	
isDepictionOf (is depiction of)	Definition: is an illustration of	Parent Property: cmns-dsg:isDescribedBy Inverse: depicts
isManagedBy (is managed by)	Definition: indicates an entity that administers, oversees, and potentially maintains or operates it	
isMonosemeFor (is monoseme for)	Definition: is the sole designation for Note: Designations in the relation of monosemy are called 'monosemes'. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.27	Parent Property: cmns-dsg:denotes, associates
isPolysemeFor (is polyseme for)	Definition: relates a designation to more than one concept for which it has a different sense (meaning) Example: The term 'bridge' represents three concepts that are related in form and/or function: 1) the concept 'bridge' corresponding to structures to carry traffic over a gap; 2) the concept 'bridge' corresponding to certain wooden parts of string instruments; 3) the concept 'bridge' corresponding to dental plates. Note: Designations in the relation of polysemy are called 'polysemes'. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.28	Parent Property: cmns-dsg:denotes, associates
manages (manages)	Definition: administers, oversees and possibly maintains and/or	

	operates	Inverse: isManagedBy

10.3 Ontology: ISO 1087 – Terminology Science

This component of the MVF ontology consists of an extension that incorporates additional vocabulary from ISO 1087 for terminology science. MVF also reuses several ontologies from the OMG Commons Ontology Library for specific patterns, including designations, collections, and classifiers.

Metadata for the ISO 1087 – Terminology Science ontology is given in Table 10.5.

Table 10.5: ISO 1087 - Terminology Science Ontology Metadata

Metadata Term	Value
OntologyIRI	https://www.omg.org/spec/MVF/ISO1087-TerminologyScience/
rdfs:label	Multiple Vocabulary Facility (MVF) Terminologies Ontology
dct:abstract	The MVF ontology consists of three components: - a core ontology corresponding to the MVF metamodel, - an extension representing the subset of the ISO 1087 reference vocabulary used in other ISO standards for vocabulary representation, - an extension that incorporates additional vocabulary from ISO 1087 for terminology science. MVF also reuses several ontologies from the OMG Commons library for specific patterns, including designations, collections, and classifiers (this ontology).
dct:contributor	Ed Barkmeyer, Thematix Partners LLC
dct:contributor	Elisa Kendall, Thematix Partners LLC
cmns-av:copyright	Copyright (c) 2011-2023 Thematix Partners LLC
cmns-av:copyright	Copyright (c) 2020-2023 Object Management Group, Inc.
dct:license	https://opensource.org/licenses/MIT
owl:versionIRI	https://www.omg.org/spec/MVF/20230501/ISO1087-TerminologyScience/
skos:note	Note that the set of ontologies provided for MVF do not provide exhaustive coverage of ISO 1087. We have not incorporated the terms related to data validation or natural language processing in the latest version of the standard, and certain classes under the heading of concept relation in the standard are handled as properties herein.

Figure 11, below, covers the terminology resource class hierarchy for the terminology science ontology as well as various arrangements specifying how the contents of a terminology resource might be organized.

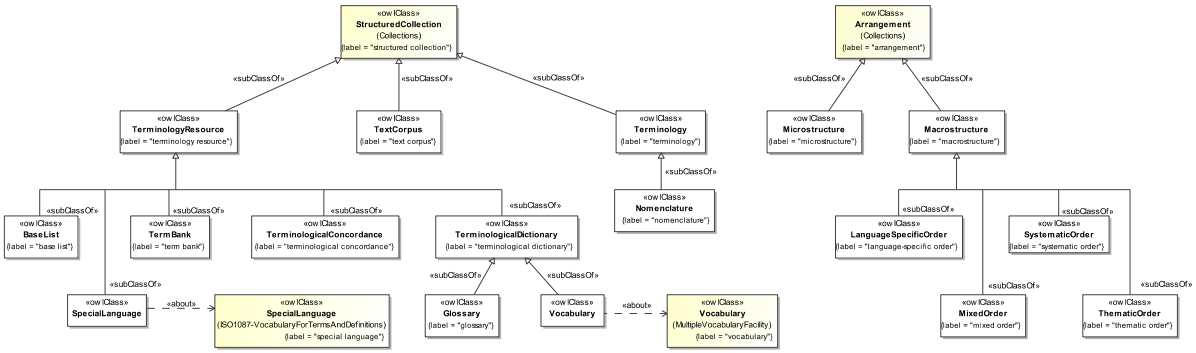

Figure 11: ISO 1087 Terminology Resource Class Hierarchy

Figure 12 provides an overview of other elements related to terminology science.

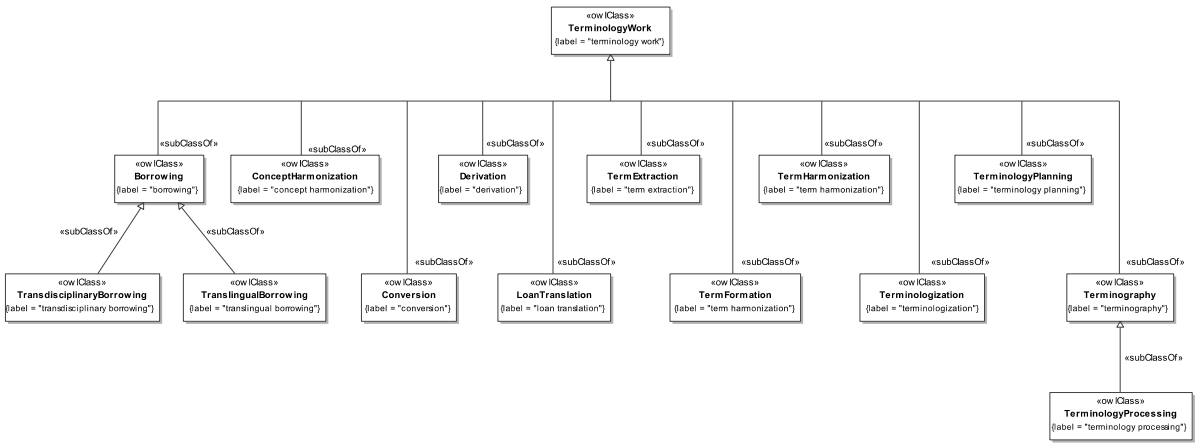

Figure 12: ISO 1087 Terminology Work Class Hierarchy

The detailed annotations and axioms that comprise the ISO 1087 – Terminology Science ontology are provided in Table 10.6, below.

Classes

Table 10.6: ISO 1087 - Terminology Science Ontology Details

Name	Annotations	Class Expressions
cmns-col:StructuredCollection	Example: collection of artifacts, books, periodicals, artwork, terms, or other objects that form the core basis for a vocabulary, exhibit, library, or other organization	Property Restriction: ≥ 0 cmns-col:hasArrangement.Macrostructure

BaseList (base list)	Definition: list of designations resulting from term extraction Note: A base list usually gives rise to further terminology work. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.5.7	Parent Class: TerminologyResource Property Restriction: ∃ cmns-col:comprises cmns-dsg:Designation
Borrowing (borrowing)	Definition: method for the formation of designations in which a designation is adopted from another natural language or another domain or subject Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.32	Parent Class: TerminologyWork
ConceptHarmonization (concept harmonization)	Definition: terminology work aimed at the establishment of a correspondence between two or more closely related or overlapping concepts to eliminate or reduce minor differences between them Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.5.4	Parent Class: TerminologyWork
Conversion (conversion)	Definition: method for the formation of designations in which the syntactic category of an existing word or lexical unit is changed Example: The conversion of 'constant' as an adjective to 'constant' as a noun in the domain of mathematics; the conversion of 'output' as a noun to 'output' as a verb in the domain of economics. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.39	Parent Class: TerminologyWork
DataCategory (data category)	Definition: specification of a type of terminological data that is used for structuring terminological entries or terminology resources Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.6.3	Parent Class: cmns-cls:Classifier
Derivation (derivation)	Definition: method for the formation of designations in which a designation is formed by adding one or more morphological elements to a word or lexical unit Example: Terms formed by derivation: 'printer' (print | -er), 'disassembly' (assemble | dis- | -y), 'hormonal' (hormon | -al). Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.38	Parent Class: TerminologyWork

Glossary (glossary)	Definition: terminological dictionary that contains designations from one or more domains or subjects together with equivalents in one or more natural languages Note: In English common language usage, glossary can refer to a monolingual list of designations and definitions in a domain or subject. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.7.6	Parent Class: TerminologicalDictionary
LanguageSpecificOrder (language-specific order)	Definition: macrostructure in which the terminological entries reflect the ordering conventions specific to a given natural language or script Note: Alphabetical order in a monolingual terminology resource. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.7.12	Parent Class: Macrostructure
LoanTranslation (loan translation)	Definition: method for the formation of designations in which the elements of a designation in another natural language are translated literally into the recipient language Example: Loan translations in English are 'flea market' (from French marché aux puces), 'loan translation' (from German Lehnübersetzung). Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.35	Parent Class: TerminologyWork
Macrostructure (macrostructure)	Definition: selection and arrangement of terminological entries in a collection Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.7.8	Parent Class: cmns-col:Arrangement
Microstructure (microstructure)	Definition: selection and arrangement of terminological data in each terminological entry of a collection Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.7.9	Parent Class: cmns-col:Arrangement
MixedOrder (mixed order)	Definition: macrostructure which is a combination of systematic order, thematic order, and language-specific order Synonym: mixed arrangement Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second	Parent Class: Macrostructure

	edition, 2019-09, clause 3.7.13	
Nomenclature (nomenclature)	Definition: terminology structured systematically according to pre-established naming rules Example: International Code of Virus Classification and Nomenclature Note: Nomenclatures have been elaborated in various domains (3.1.4), such as biology, medicine, and chemistry. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.7.7	Parent Class: Terminology Property Restriction: ∃ cmns-col:hasArrangement.SystematicOrder
SystematicOrder (systematic order)	Definition: macrostructure in which the terminological entries reflect the underlying concept system Synonym: systematic arrangement Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.7.10	Parent Class: Macrostructure
TermBank (term bank)	Definition: collection of terminology databases including the organizational framework for recording, processing and disseminating terminological data Synonym: terminological data bank Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.7.3	Parent Class: TerminologyResource Property Restriction: ∃ cmns-col:comprises.TerminologicalDatabase
TermExtraction (term extraction)	Definition: terminology work that involves the identification and excerption of terminological data by searching through a text corpus Note: Term extraction is often supported by dedicated software tools. Note: Terminological data of primary interest are typically designations, definitions and contexts. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.5.6	Parent Class: TerminologyWork Property Restriction: ∃ produces.BaseList Property Restriction: ∃ produces.TerminologicalConcordance Property Restriction: ∃ reflects.TextCorpus
TermFormation (term formation)	Definition: terminology work aimed at creating new terms using one or more of a variety of methods Note: By analogy, 'term formation' can apply also to appellations, proper names and symbols. Note: Methods of term formation may among others include transdisciplinary borrowing, translingual borrowing, loan translation, transliteration, transcription, derivation, or conversion, the creation of abbreviations or	Parent Class: TerminologyWork

	blends. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.4.31	
TermHarmonization (term harmonization)	Definition: terminology work leading to the selection of designations for harmonized concepts either in different natural languages or within the same natural language Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.5.5	Parent Class: TerminologyWork
Terminography (terminography)	Definition: terminology work aimed at creating and maintaining terminology resources Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.5.5	Parent Class: TerminologyWork
TerminologicalConcordance (terminological concordance)	Definition: list of designations extracted from a text corpus together with a context and a source reference Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.5.8	Parent Class: TerminologyResource Property Restriction: ≥ 0 cmns-cxtdsg:isApplicableIn.cmns-cxtdsg:Context Property Restriction: ∃ cmns-col:comprises.cmns-dsg;Designation Property Restriction: ∃ reflects.TextCorpus
TerminologicalDatabase (terminological database)	Definition: database comprising a terminology resource Synonym: termbase Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.7.2	Parent Class: cmns-col;StructuredCollection Property Restriction: ∀ mvf-trm;isManagedBy.TermBank Property Restriction: ∀ cmns-col:comprises.TerminologyResource
TerminologicalDictionary (terminological dictionary)	Definition: terminology resource that is designed to be used as a reference work Abbreviation: LSP dictionary Synonym: special-language dictionary Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.7.4	Parent Class: TerminologyResource Property Restriction: ∃ cmns-col:comprises.mvf:VocabularyEntry Property Restriction: ∃ cmns-col:hasArrangement.Macrostructure Property Restriction: ∃ cmns-cxtdsg:uses.mvf-trm;SpecialLanguage
Terminologization (terminologization)	Definition: process by which a general language word or lexical unit is being used more and more as a term in a specific domain or subject Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.30	Parent Class: TerminologyWork Property Restriction: ∃ produces.mvf-trm:Term
Terminology (terminology)	Definition: set of designations and concepts belonging to one domain or subject	Parent Class: cmns-col;StructuredCollection

	Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.1.11	Property Restriction: = 1 cmns-cxtdsg;isUsedBy (mvf-trm:Domain ∪ mvf-trm:Subject) Property Restriction: ∃ cmns-col:comprises.cmns-dsg;Designation Property Restriction: ∃ cmns-col:comprises.mvf;MVFEntry
TerminologyPlanning (terminology planning)	Definition: terminology work aimed at developing, improving, implementing and disseminating the terminology of a domain or subject Note: Terminology planning involves all aspects of terminology work and has among other objectives the objective of achieving vocabulary control through such normative documents as thesauri and terminology standards. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.5.3	Parent Class: TerminologyWork
TerminologyProcessing (terminology processing)	Definition: part of terminography concerned with computer aspects of database creation, maintenance and extraction of terminology from texts Source: ISO 1087-1, paragraph 3.6.3	Parent Class: Terminography
TerminologyResource (terminology resource)	Definition: collection of terminological entries Note: Terminology resources may be in paper or electronic format, e.g. paper dictionaries or glossaries, CDs, DVDs, databases or term banks. Abbreviation: TDC Synonym: terminological data collection Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.7.1	Parent Class: cmns-col;StructuredCollection Property Restriction: ∃ cmns-col:comprises.mvf:VocabularyEntry
TerminologyScience (terminology science)	Definition: science studying terminologies, aspects of terminology work, the resulting terminology resources, and terminological data Synonym: terminology studies Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.1.12	Parent Class: mvf-trm;Domain
TerminologyWork (terminology work)	Definition: work concerned with the systematic collection, description, processing and presentation of concepts and their designations Note: Terminology work often aims at creating and maintaining terminology resources. Note: Terminology work often aims at	

	terminology planning and can involve all of concept harmonization, term harmonization, and term formation. Synonym: terminology management Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.5.1	
TextCorpus (text corpus)	Definition: collection of natural language data Synonym: corpus Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.6.4	Parent Class: cmns-col:StructuredCollection
ThematicOrder (thematic order)	Definition: macrostructure in which the terminological entries are grouped in accordance with a relational theme Note: In a human resource vocabulary, one group of terminological entries relates to recruitment processes, while another group relates to employee assessment. Synonym: thematic arrangement Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.7.11	Parent Class: Macrostructure
TransdisciplinaryBorrowing (transdisciplinary borrowing)	Definition: borrowing from another domain or subject Example: The term 'virus' was originally used in biology and later transferred to information technology. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.33	Parent Class: Borrowing
TranslingualBorrowing (translingual borrowing)	Definition: borrowing from another natural language Example: An example of a direct borrowing into English is the French term 'calque'. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.34	Parent Class: Borrowing
mvf-trm;SpecialLanguage		**Parent Class**: TerminologyResource
mvf;Vocabulary	Note: A vocabulary is a terminological dictionary that contains designations and definitions from one or more domains or subjects. Note: A vocabulary may be monolingual, bilingual or multilingual. A vocabulary is a terminological dictionary that contains	**Parent Class**: TerminologicalDictionary Property Restriction: ≥ 0 cmns-id:isIdentifiedBy.lcc-cr:GeographicRegionIdentifier

	designations (vocabulary entries) and definitions from one or more specific subject fields. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.7.5	
mvf;VocabularyEntry	Note: A terminological entry prepared in accordance with the principles and methods given in ISO 704 follows the same structural principles whether it is monolingual or multilingual. Note: From a terminology perspective, a vocabulary entry is a collection of terminological data related to only one concept. Explanatory note: Notes on vocabulary entries can be represented using the skos:note annotation or any of its subproperties or other annotations as appropriate. Synonym: terminological entry Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clause 3.6.2	Property Restriction: ≥ 0 cmns-col:hasArrangement.Microstructure Property Restriction: ≥ 0 cmns-cxtdsg:isApplicableIn.mvf-trm;Subject

Properties

Name	Annotations	Property Axioms
excerpts (excerpts)	Definition: selects for quoting (from a passage), extracts	
informs (informs)	Definition: gives character or essence to, communicates knowledge to	Parent Property: cmns-cls:characterizes
makesTransparent (makes transparent)	Definition: expresses one or more characteristics of Note: Designations in the relation of transparency are called 'transparent' designations or 'motivated' designations. Designations lacking transparency are called 'unmotivated' designations. Source: ISO 1087 Terminology work and terminology science - Vocabulary, Second edition, 2019-09, clauses 3.4.40	Parent Property: informs
produces (produces)	Definition: causes something to exist, makes something available, manufactures	Parent Property: mvf-trm;associates
reflects (reflects)	Definition: makes manifest or apparent, shows	
studies (studies)	Definition: application of the mental faculties to the acquisition of knowledge - such application in a particular field or to a specific subject - careful or extended consideration - a careful examination or analysis of a phenomenon, development, or question	

10.4 Ontology: MVF to SKOS-XL Mapping Ontology

This ontology provides a mapping from the concepts defined in MVF to the Simple Knowledge Organization System (SKOS-XL) W3C Recommendation.

Metadata for the MVF to SKOS Mapping ontology is given in Table 10.7.

Table 10.7: MVF to SKOS Mapping Ontology Metadata

Metadata Term	Value
OntologyIRI	https://www.omg.org/spec/MVF/MVFtoSKOSMapping/
rdfs:label	Multiple Vocabulary Facility (MVF) MVF to SKOS Ontology
dct:abstract	This ontology provides a mapping from the concepts defined in MVF to the Simple Knowledge Organization System (SKOS) W3C Recommendation
cmns-av:copyright	Copyright (c) 2019-2023 Thematix Partners LLC
cmns-av:copyright	Copyright (c) 2020-2023 Object Management Group, Inc.
dct:license	https://opensource.org/licenses/MIT
owl:versionIRI	https://www.omg.org/spec/MVF/20230501/MVFtoSKOSMapping/

The detailed annotations and axioms that comprise the MVF to SKOS Mapping ontology are provided in Table 10.8, below.

Classes

Table 10.8: MVF to SKOS Mapping Ontology Details

Name	Annotations	Class Expressions
skos:Collection		Parent Class: cmns-col:Collection
skos-xl:Label		Parent Class: cmns-dsg:Name
mvf:MVFEntry		Equivalent Class: skos:Concept
mvf-trm:ConceptSystem		Equivalent Class: skos:ConceptScheme

Properties

Name	Annotations	Property Axioms
skos-xl:literalForm		Parent Property: mvf:hasTerm
mvf:isBroaderThan		Equivalent Property: skos:broader
mvf:isNarrowerThan		Equivalent Property: skos:narrower
mvf-trm:hasSuperordinateConcept		Equivalent Property: skos:broaderTransitive

10. MVF Vocabulary Services

Conceptually, MVF works with “concepts” (mvf:MVFEntry), organized into Dictionaries (mvf:MVFDictionary) and related “terms” (mvf:VocabularyEntry), organized into “vocabularies” (mvf:Vocabulary). APIs to construct, publish and query knowledge bases of this kind are typically managed by Terminology Services. OMG’s Common Terminology Services (CTS-2)[2] specification and HL7’s FHIR Terminology[3] specification are both well-established candidates in this space. Note that despite the domain focus, the FHIR terminology specification is not healthcare specific.

Architecturally, a component that implements a terminology API could either be embedded in a modeling tool, or could be specified as an independent service for a modeling tool to interface with.

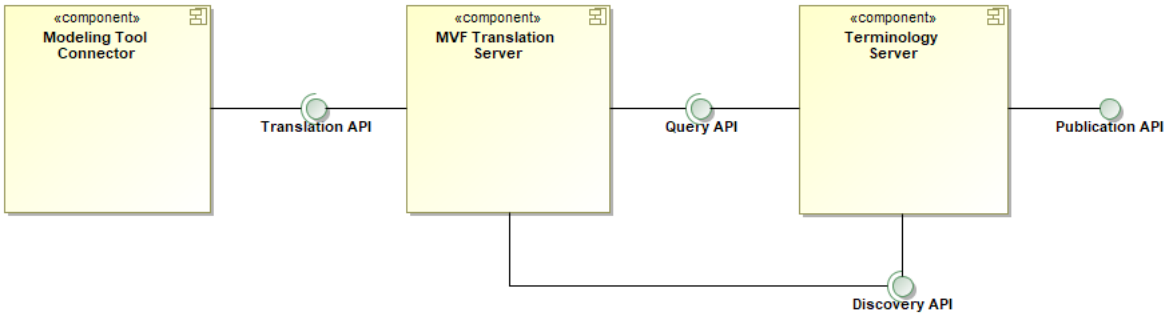

Figure 13: Notional Component / Interface Integration

Most terminology APIs can be decomposed into publication APIs, which support CRUD (-like) operations to publish, update/version or retire content; discovery APIs which allow users to determine what content is available, returning some form of metadata in the process; and query APIs that provide access to the content itself.

An MVF Translation Server is a prospective client of the terminology discovery and query API, as described in Clause 11, below. In turn, a modeling tool is a prospective client of the MVF Translation API, implemented by an MVF Translation Server. The modeling tool itself may be a client of the terminology server Discovery API, for example, to offer users the ability to discover which translations would be supported given the available vocabularies. The modeling tool itself may leverage the Query API to gather detailed information to be presented to its users.

[2] https://www.omg.org/cts2/

[3] https://hl7.org/fhir/terminology-service.html

11. MVF Translation Interfaces

The primary MVF use case consists in the substitution of the terms used in a model's elements with other terms, based on the Vocabularies referenced by the currently active Workspace, that are iso-semantic (in some context), based on co-reference to a common concept designated by an mvf:MVFEntry.

This Translation Service API is a specialization of the API for Knowledge Platform (API4KP) "Translation" API, in the following sense.

Relationship to API4KP

An M1 Model that is an instance of a (M3) MOF-based M2 MetaModel can be considered an M1 Expression in a Language M2[4], whose formal grammar is grounded in M3. More specifically, API4KP operations process (Knowledge) Artifacts, each of which is the digital manifestation of an Expression, such as the binary content carried by a file or a memory device. The distinction between Artifact and Expression is secondary to this discussion.

An api4kp:Translation is an operation that preserves the interpretation of the Artifact (api4kp:Knowledge Asset), but modifies at least one of the components of the Expression, which include the syntax, the notation, and/or the terminology. In particular, an mvf:Translation is an api4kp:Translation which is restricted to a change in Vocabulary but not in (modeling) Language.

MVF:translate as a profile of API4KP:translate

The specification of the behavior of an mvf:Translation service can also be defined in terms of API4KP micro-operations.

Figure 14: MVF Translation API

Given the signatures:

```
mvf:translate( Model source, Code targetLang, Identifier communityID ) : Model

api4kp:translate(
  KnowledgeCarrier source, Representation targetRep, String context) : KnowledgeCarrier
```

[4] The API4KP definition is also compatible with the Distributed Ontology Language (DOL) Definition of "Ontology, Model or Specification" (dol:OMS), even if API4KP requires the language to have a formal Grammar, but does not require the language to have formal semantics.

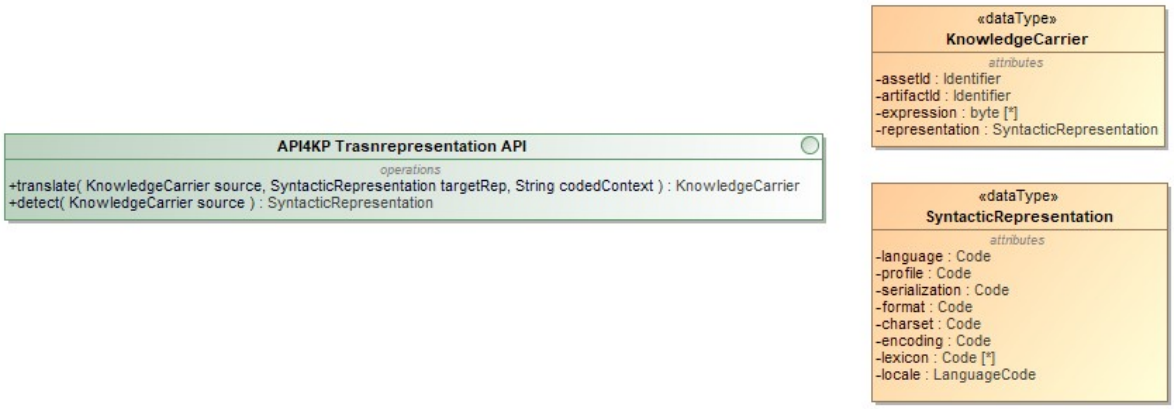

Figure 15: API4KP Translation API

• KnowledgeCarrier is a structured object that wraps the encoded serialization of a Model, its Identifier(s) and its Syntactic Representation

• A Syntactic Representation lists the syntactic elements Language (Syntax), Profile, Serialization, Format, CharacterSet, Encoding, Lexicon and Localization

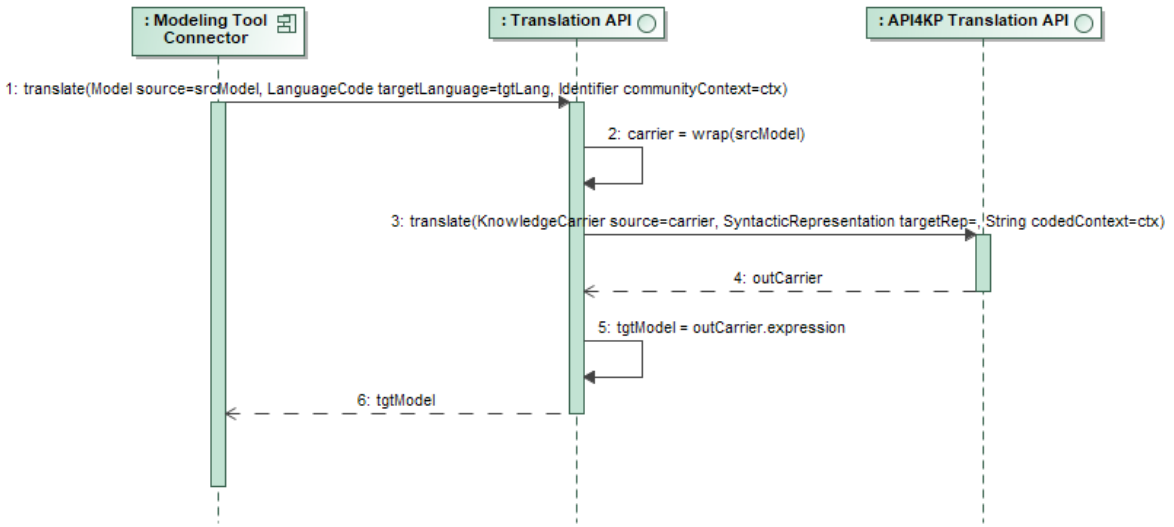

Figure 16: MVF to API4KP Delegation

The implementation of the MVF Translation API is responsible for the construction of the KnowledgeCarrier wrapper, using the source model, on the assumption the component would have enough information to infer the source model's SyntacticRepresentation, or implement the api4kp:detect operation for this purpose.

mvf:translate Specification

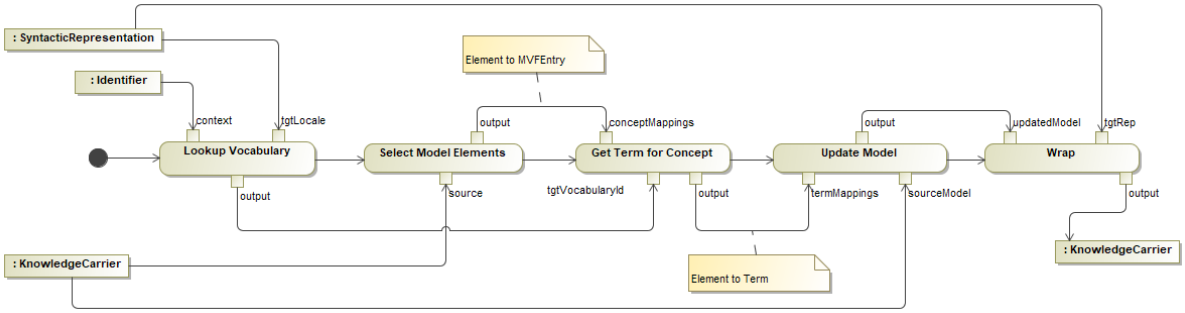

Figure 17: API4KP-based Specification of the MVF-profiled api4kp:translate operation

The implementation of the api4kp:translate operation can be decomposed as follows:

- Coherently with the MVF metamodel, the Locale language of the target SyntacticRepresentation should be used to lookup the (Identifier of the) target Vocabulary. This operation should be implemented by delegation to the underlying Terminology API. The community context designator could be used to filter/refine the search
- The source Model should be introspected, coherently with the semantics of the api4kp:select API, to extract all the Model elements that are associated to any MVF entry.
  The SyntacticRepresentation of the source KnowledgeCarrier contains the information necessary to parse the Model itself, constructing an Abstract Syntax Tree that can be traversed for processing.
  In the notable case of MOF-based models, one could assume an XMI Serialization, which implies the use of the XML meta-format. An implementation of the MOF conceptual APIs could be used to implement the api4kp:select operation. Alternative implementations could leverage technologies such as XPath or other traversal languages.
- Given the mapping between model elements and MVFEntries, for each entry, the corresponding VocabularyEntry (term) is looked up in the resolved target Vocabulary. This operation should also be delegated to the underlying terminology API
- The resulting VocabularyEntries are used to update the Model elements. In MOF based models, the MOF APIs could be used to update the ‘name’ of each Element.
- Finally, the updated model is serialized and wrapped according to the client’s requested target SyntacticRepresentation

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Annex A: Deliverables

(normative)

The MVF ontologies are delivered as (1) RDF/XML serialized OWL (normative and definitive), and (2) Turtle serialized OWL (normative and definitive).

The ontologies included in MVF makes normative reference to the Commons Ontology Library [Commons], the Languages, Countries and Codes (LCC) [LCC] ontologies, the DCMI Dublin Core Metadata Terms [Dublin Core] and W3C Simple Knowledge Organization System (SKOS) Recommendation [SKOS], which are not part of this specification.

The individual RDF/XML files are UTF-8 conformant XML 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. They have also been checked for logical consistency using the Pellet OWL 2 reasoner from Stardog Union (formerly Complexible, and prior to that, 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.

Annex B: Example

(informative)

Figure 18 below provides an example that shows how multiple vocabulary elements in a notional financial model can be applied to the concepts in that model.

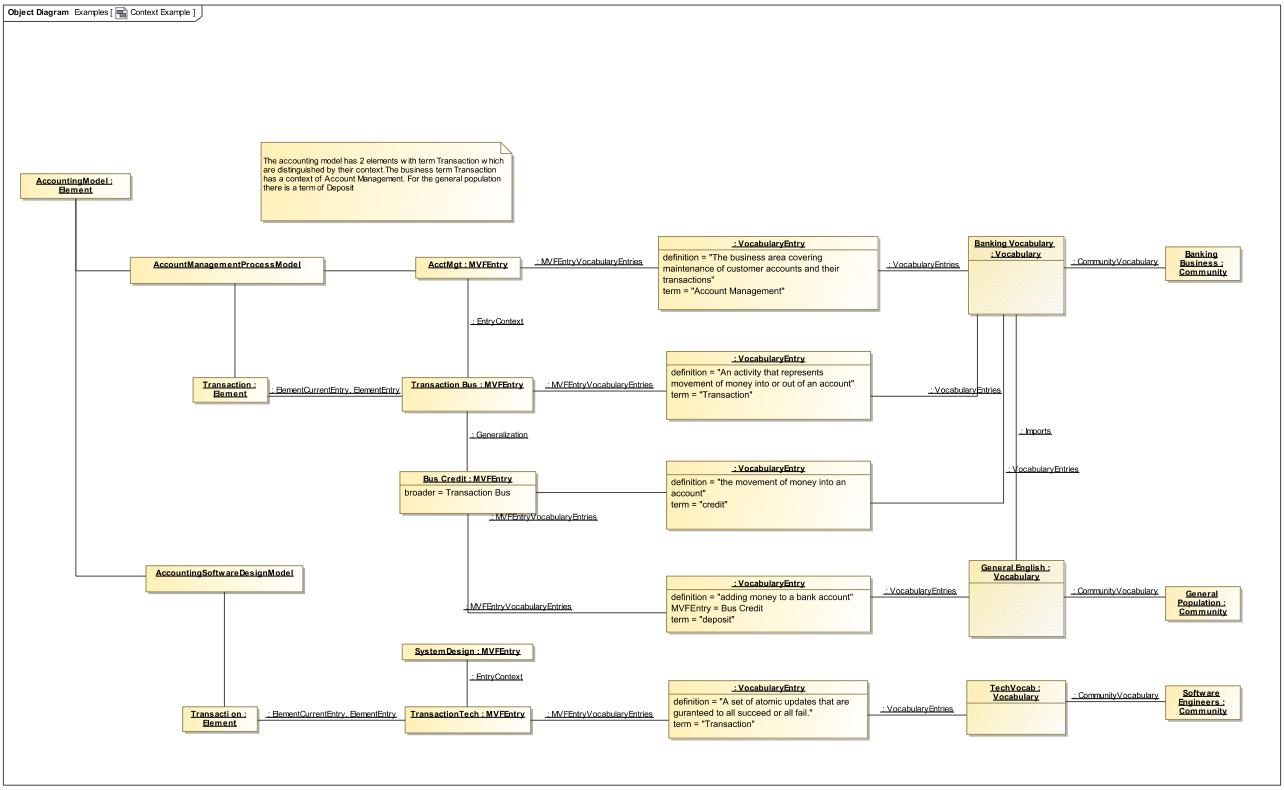

Figure 18: Example showing a mapping from multiple vocabulary elements to the same concept