



Building and using ontologies

Elena Simperl, University of Southampton, UK

With contributions from “Linked Data: Survey of Adoption”, Tutorial at the 3rd Asian Semantic Web School ASWS 2011, Incheon, South Korea, July 2011 by Aidan Hogan, DERI, IE



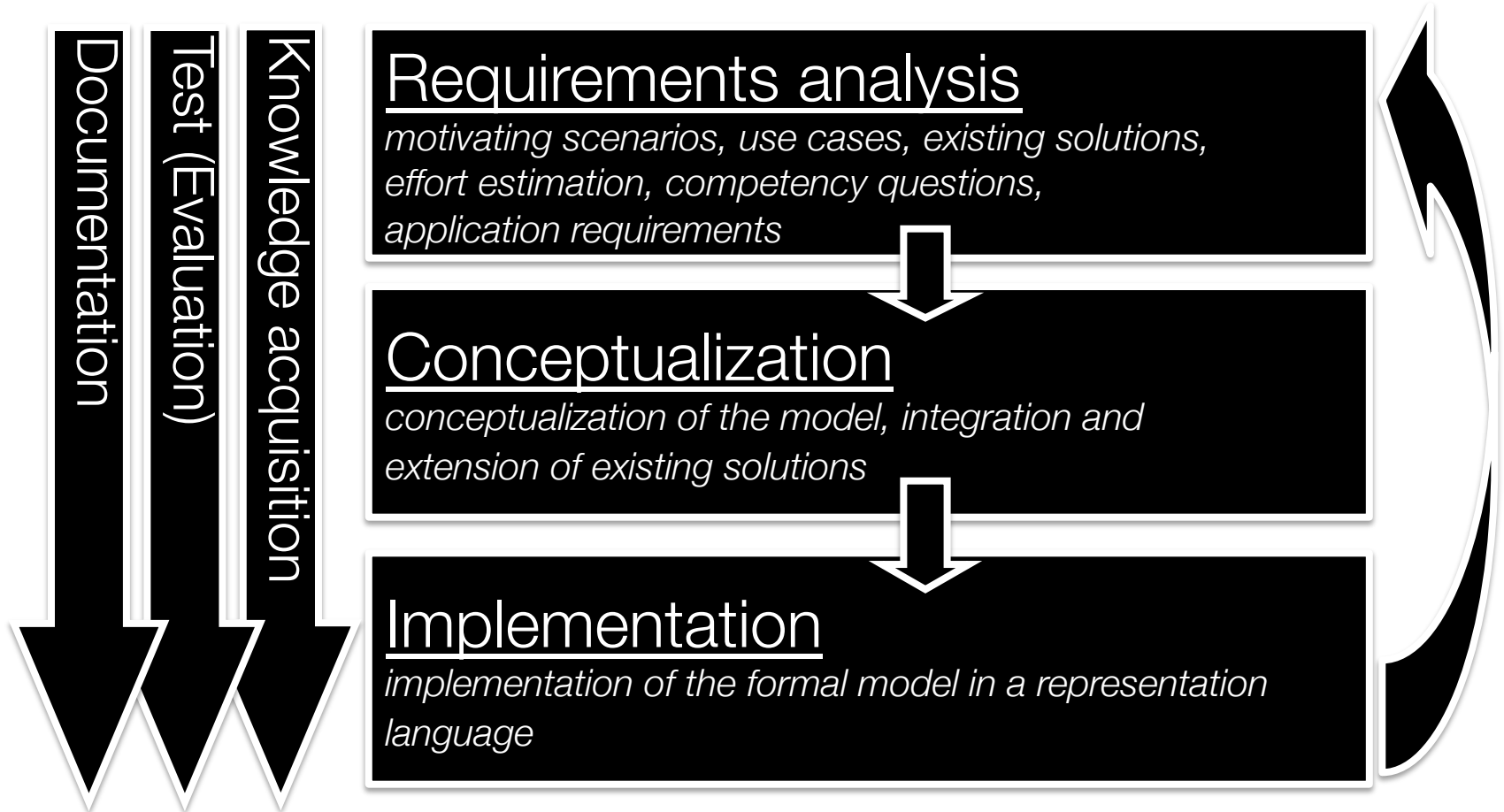
Ontologies in Computer Science

- An ontology defines a domain of interest
 - ... in terms of the **things** you talk about in the domain, their **attributes**, as well as **relationships** between them
- Ontologies are used to
 - Share a **common understanding** about a domain among people and machines
 - Enable **reuse** of domain knowledge

ontology *vocabulary*
microformat *conceptual graph*
topic map *thesaurus*
schema
classification object model
semantic network
glossary *taxonomy*

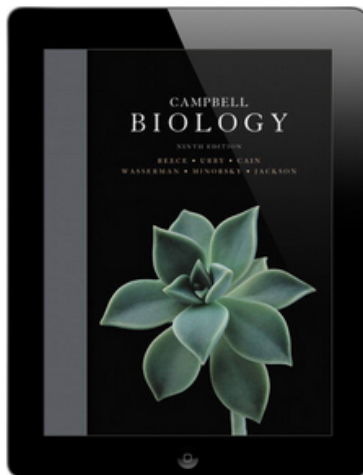
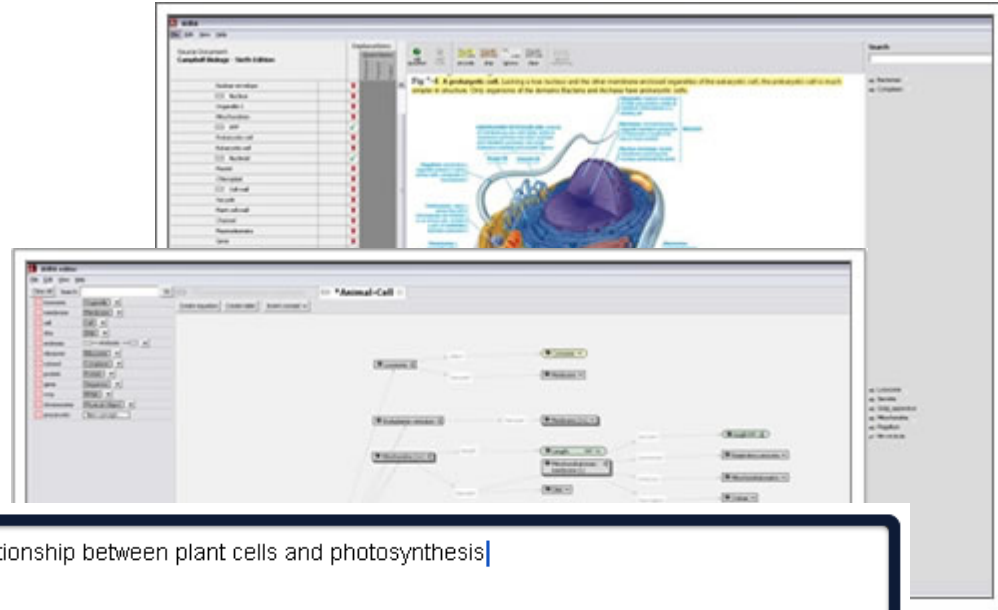
class relationship *entity* type
slot *particular* object *instance*
universal attribute association
individual *property* **role**

Classical ontology engineering process



Example: Project Halo

- Knowledge acquisition from text(books)
- Professional and crowdsourced annotation
- Question analysis and answering through a combination of NLP and reasoning techniques

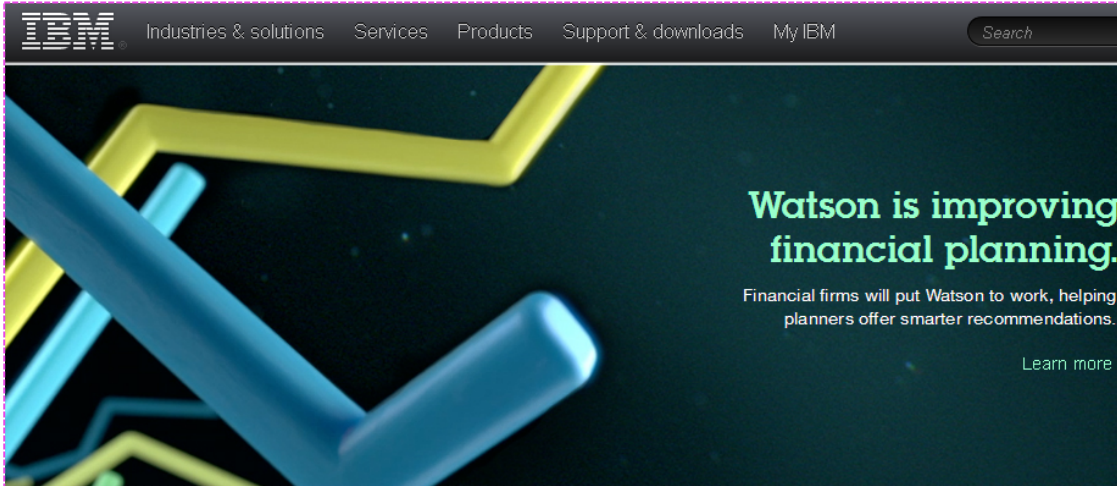


What is the relationship between plant cells and photosynthesis|

define	Define cellular respiration
structure	What is the structure of a chloroplast ?
function	What is the function of a plasma membrane in a eukaryotic cell ?
compare	What are the differences between chloroplasts and mitochondria ?
relate	If the chloroplasts were removed from a plant , what events would be affected?
search	Search book for photosynthesis

Images from <http://www.projecthalo.com> and <http://www.inquireproject.com/>

More examples



- » Computational Sciences
- » Words & Linguistics
- » People & History
- » Culture & Media
- » **Music**
- » Places & Geography
- » Earth Sciences
- » Weather & Meteorology
- » Transportation
- » Units & Measures
- » Dates & Times
- » Money & Finance



Music Acts

get information about a music act

pink floyd

Green Day

Gladys Knight & The Pips

request specific information about a music act

when did the Beatles break up?

compare music acts

evanescence vs bee gees

ABBA, Fleetwood Mac, Lady Antebellum

wikipedia page hits for the Rolling Stones, Bob Dylan, Lady Gaga

Music Albums

get information about a music album

white light/white heat

Images from <http://www.ibm.com/watson>, <http://www.wolframalpha.com/examples/Music.html>, <http://www.apple.com>

Semantic technologies are not **THE** solution to creating intelligent applications, but only one (essential) component

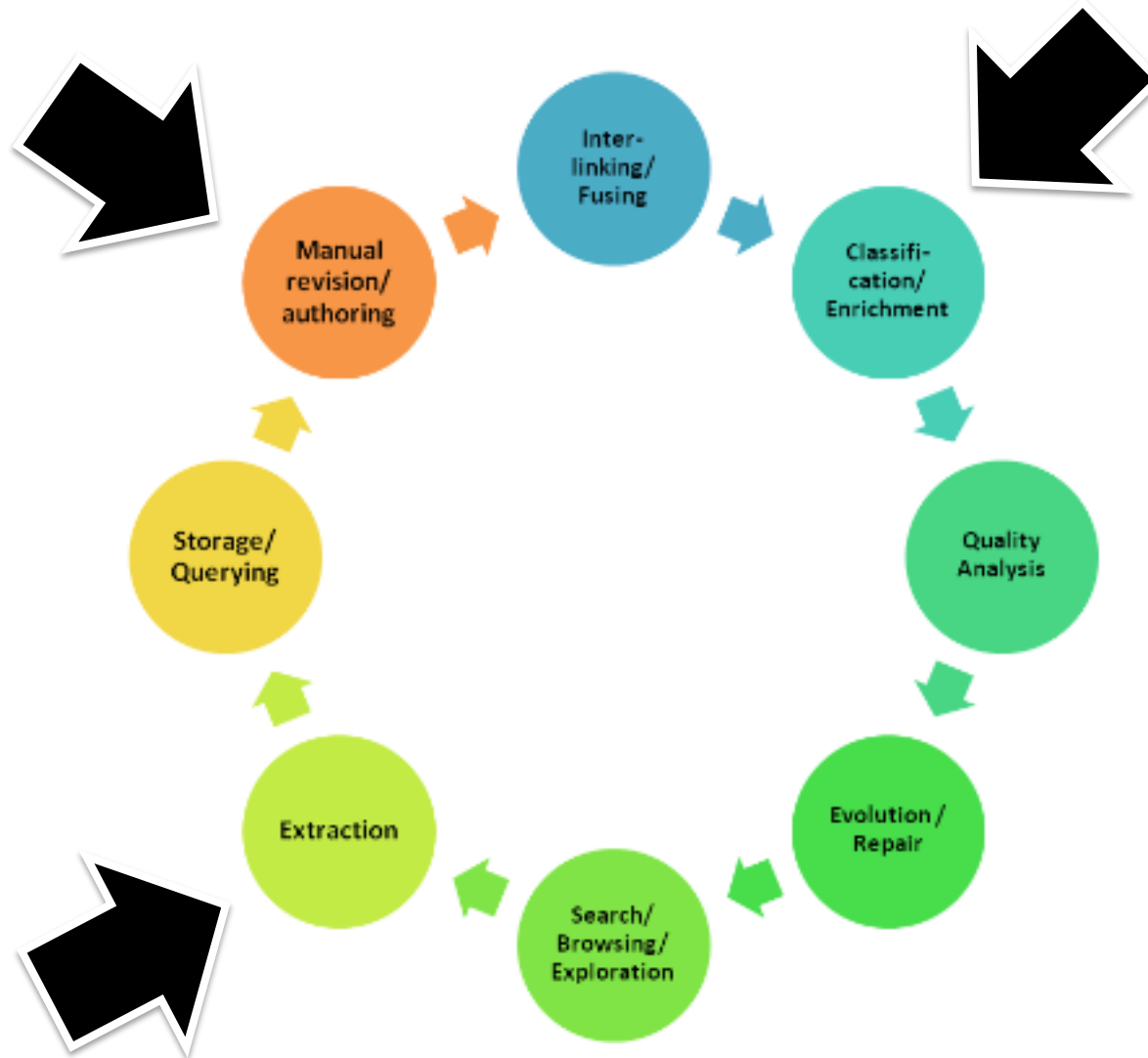
The Linked Data movement has promoted one approach to create and publish semantic data

- They created momentum for the Semantic Web, as well as several useful data sets

Rich knowledge representations do have their value, but are costly to achieve

System	Scope	Input	Result	Core Technology
Inquire intelligent textbook	single textbook	simple English queries	formatted data and relevant textbook content	symbolic AI
Wolfram Alpha computational knowledge engine	curated data from "primary sources"	word phrases with mathematical operators	formatted data	Mathematica
Siri virtual personal assistant	emails, calendar, weather, maps, movies, etc.	voice commands	performs tasks	service integration via speech dialog
Google Search index of world's information	open domain text on the web	keywords and search queries	web documents	statistical AI, PageRank

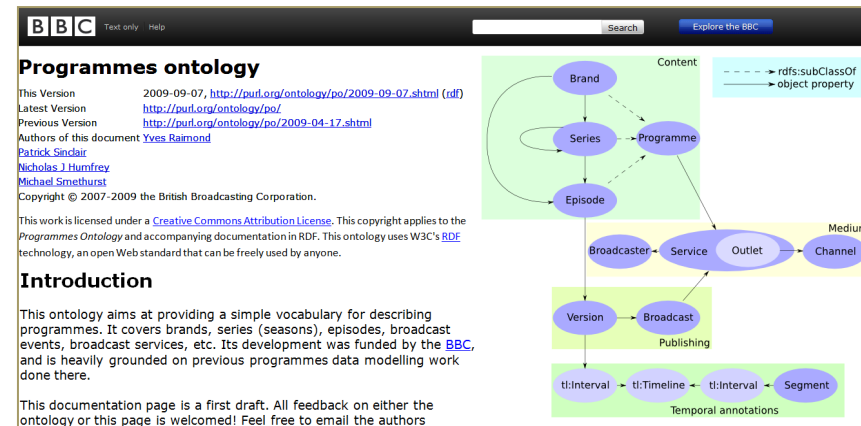
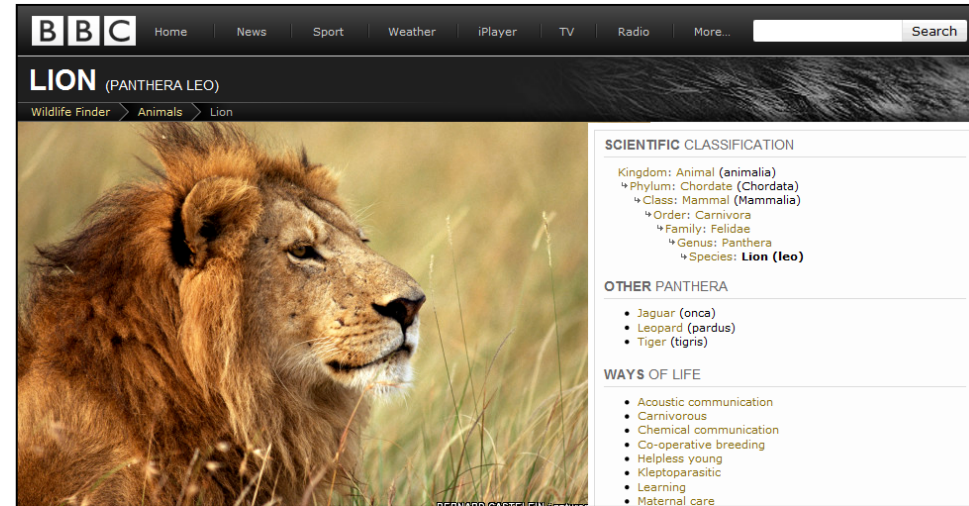
Our scenario



Example: BBC

„Design for a world where Google is your homepage, Wikipedia is your CMS, and humans, software developers and machines are your users“

- Various micro-sites built and maintained manually
- No integration across sites in terms of content and metadata
- Use cases
 - Find and explore content on specific (and related) topics
 - Maintain and re-organize sites
 - Leverage external resources
- Ontology: One page per thing, reusing DBpedia and MusicBrainz IDs, different labels



<http://www.slideshare.net/reduxd/beyond-the-polar-bear>

Core ontology engineering activities in our scenario

- Find ontologies
- Select ontologies
- Extend ontologies
- Popular activities we do not consider
 - Requirements analysis
 - Knowledge representation
 - Ontology learning
 - Ontology alignment
 - ...
- See previous summer schools e.g.,
http://videolectures.net/eswc2012_summer_school/

Finding existing ontologies

- Linked Open Vocabularies: vocabularies used in the LOD cloud
 - <http://lov.okfn.org>
- Protégé Ontologies: several hundreds of ontologies, cross-domain
 - http://protegewiki.stanford.edu/index.php/Protege_Ontology_Library#OWL_ontologies
- Open Ontology Repository: life sciences and other domains
 - <http://ontolog.cim3.net/cgi-bin/wiki.pl?OpenOntologyRepository>
- Tones: 218 ontologies, life sciences and core ontologies.
 - <http://owl.cs.manchester.ac.uk/repository/browser>
- Watson: several tens of thousands of documents, cross-domain
 - <http://watson.kmi.open.ac.uk/Overview.html>
- OBO Foundation Ontologies: hundreds of life sciences ontologies, including mappings
 - <http://www.obofoundry.org/>
- VoCamps
 - http://vocamp.org/wiki/Main_Page

Linked Open Vocabularies

music

Filter by Domain 358 results in 35 vocabularies

- City (6)
- Data & Systems (22)
- Library (98)
- Market (1)
- Media (124)
- Science (1)
- Upper & Meta (28)
- Where & When (72)

Filter by Type

- rdfs:Class (132)
- rdf:Property (210)
 - voaf:Vocabulary (8)
 - Other (33)

Filter by Vocabulary (35)

- mo (105)
- music (69)
- rdarel (29)

music (voaf:Vocabulary) score:0.682	<input type="button" value="»"/>
rdfs:label Music Vocabulary	
dcterms:title Music Vocabulary @en	
rdfs:comment A vocabulary, or music ontology, to describe classical music and performances. C.....es (categories) for musical works, events, in.....sure to distinguish musical works (e.g. Opera.....model to describe a musical work, its repre..... scores, etc) and a musical event to present ...	
dcterms:description A vocabulary, or music ontology, to describe classical music and performances. C.....es (categories) for musical works, events, in.....sure to distinguish musical works (e.g. Opera.....model to describe a musical work, its repre..... scores, etc) and a musical event to present ...	
@en	
vann:preferredNamespacePrefix music	
vann:preferredNamespaceUri .../www.kanzaki.com/ns/ music #	
af:MusicSegment (owl:Class) score:0.568	<input type="button" value="»"/>
rdfs:label Music	
rdfs:comment ...dio segment holding music . This classifier ...	
http://lov.okfn.org/dataset/lov/lov#MUSIC (voaf:VocabularySpace) score:0.568	<input type="button" value="»"/>
dcterms:title Music and Sound @en	
dcterms:description Music , Sound, Audio files @en	
bibo:shortTitle Music @en	
mrel:mus (owl:ObjectProperty) score:0.511	<input type="button" value="»"/>
rdfs:label Musician @en	
skos:prefLabel Musician @en	
mads:authoritativeLabel Musician @en	

See <http://lov.okfn.org>

Linked Open Vocabularies (2)

FOAF - Friend of a Friend vocabulary



Metadata:

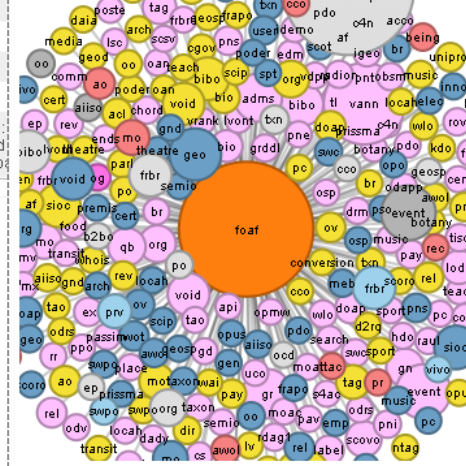
Property	Value
is part of vocabulary space	All > City > People
Vocabulary URI	http://xmlns.com/foaf/0.1/
Prefix	foaf
Namespace URI	http://xmlns.com/foaf/0.1/
Description	FOAF is a project devoted to linking people and information using the Web. Regardless of whether information is people's heads, in physical or digital documents, or in the form of factual data, it can be linked. @en
Last modified	2010-08-09
Creator	Dan Brickley, Libby Miller
Publisher	Dan Brickley
Class number	13
Property number	62
Homepage	http://www.foaf-project.org/
See also	http://stats.lod2.eu/vocabularies/90
Represented by	format-foaf
Has review	(2013-06-04) Bernard Vatant . From the specification mid-2000. There is now a stable core of classes and to their documentation to track implementation feedback

Vocabulary used in 182 datasets (information coming from LOD Stats project)

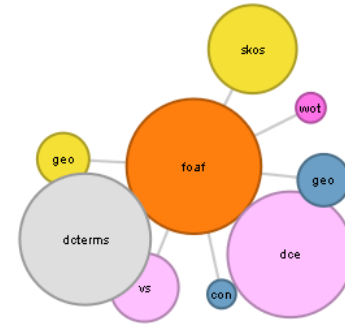
Occurrences	Dataset
20757535	Bibliographica.org BNB export
14673353	B3Kat - Library Union Catalogues of Bavaria, Berlin and Brandenburg
4687220	Ookaboo RDF dump
3586838	Europeana Linked Open Data
2882067	Rådata nå!
See the full list...	

Vocabulary links:

Vocabularies referencing "foaf" (271)



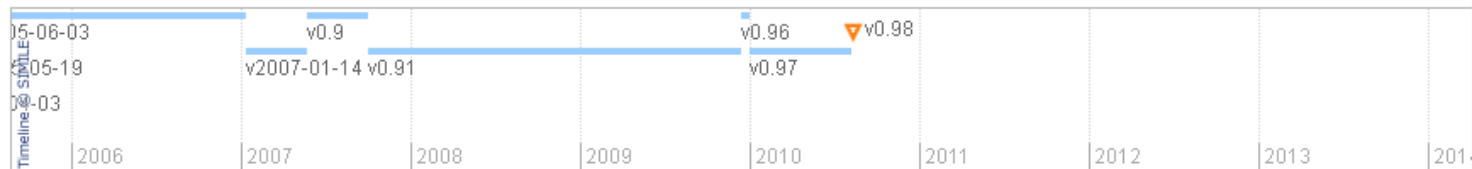
Vocabularies referenced by "foaf" (8)



Link types

- Imports
- Similar to
- Used by
- Relies on
- Metadata vocabulary
- Extends
- Specializes
- Generalizes
- Has equivalences with
- Has disjunctions with

Vocabulary history:



LODStats

499 vocabularies

<u>URI</u>	<u>Overall</u>	<u>Datasets</u>
http://www.w3.org/1999/02/22-rdf-syntax-ns	278,646,233	671
http://www.w3.org/2000/01/rdf-schema	58,329,356	533
http://www.w3.org/2002/07/owl	12,934,565	277
http://purl.org/dc/terms/	127,660,537	225
http://www.w3.org/2004/02/skos/core	45,773,412	174
http://purl.org/dc/terms	60,043,900	153
http://xmlns.com/foaf/0.1/	22,121,715	150
http://purl.org/dc/elements/1.1/	9,342,467	141
http://xmlns.com/foaf/0.1	29,489,527	106
http://purl.org/dc/elements/1.1	20,261,128	90
http://rdfs.org/ns/void	12,664	77
http://www.w3.org/2003/01/geo/wgs84_pos	997,603	61
http://www.aktors.org/ontology/portal	33,286,647	54
http://www.w3.org/2006/time	177,310	54

See <http://stats.lod2.eu/vocabularies>

Dublin Core

Properties in the <i>/terms/</i> namespace	abstract , accessRights , accrualMethod , accrualPeriodicity , accrualPolicy , alternative , audience , available , bibliographicCitation , conformsTo , contributor , coverage , created , creator , date , dateAccepted , dateCopyrighted , dateSubmitted , description , educationLevel , extent , format , hasFormat , hasPart , hasVersion , identifier , instructionalMethod , isFormatOf , isPartOf , isReferencedBy , isReplacedBy , isRequiredBy , issued , isVersionOf , language , license , mediator , medium , modified , provenance , publisher , references , relation , replaces , requires , rights , rightsHolder , source , spatial , subject , tableOfContents , temporal , title , type , valid
Properties in the legacy <i>/elements/1.1/</i> namespace	contributor , coverage , creator , date , description , format , identifier , language , publisher , relation , rights , source , subject , title , type
Vocabulary Encoding Schemes	DCMIType , DDC , IMT , LCC , LCSH , MESH , NLM , TGN , UDC
Syntax Encoding Schemes	Box , ISO3166 , ISO639-2 , ISO639-3 , Period , Point , RFC1766 , RFC3066 , RFC4646 , RFC5646 , URI , W3CDTF
Classes	Agent , AgentClass , BibliographicResource , FileFormat , Frequency , Jurisdiction , LicenseDocument , LinguisticSystem , Location , LocationPeriodOrJurisdiction , MediaType , MediaTypeOrExtent , MethodOfAccrual , MethodOfInstruction , PeriodOfTime , PhysicalMedium , PhysicalResource , Policy , ProvenanceStatement , RightsStatement , SizeOrDuration , Standard

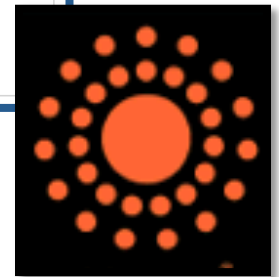


Table from <http://dublincore.org/documents/dcmi-terms/>

Friend Of A Friend

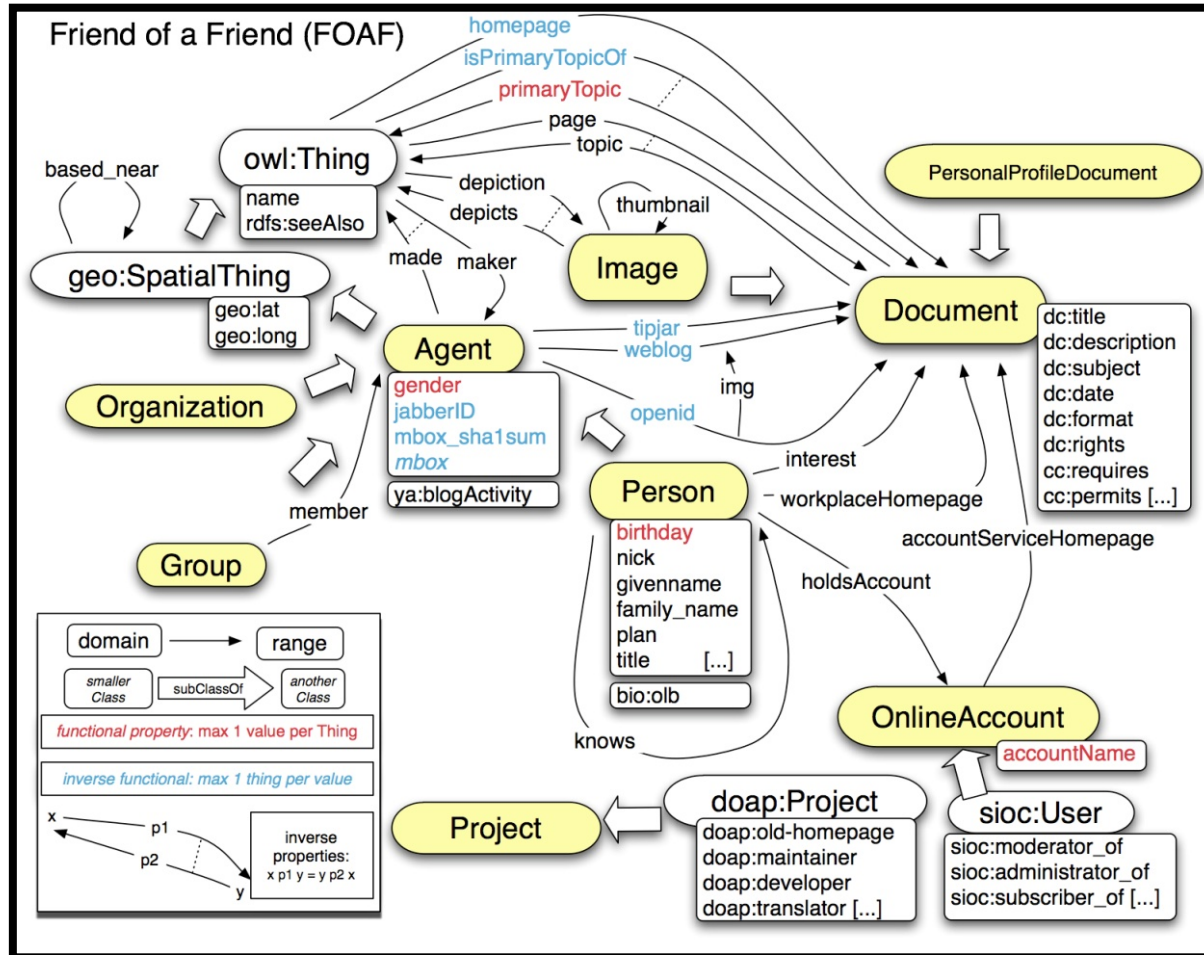


Image from <http://www.deri.ie/fileadmin/images/blog/>: Breslin

DBpedia

- Classes and properties for Wikipedia export (infoboxes), regularly updated

```
{{Infobox Town AT |
name = Innsbruck |
image_coa = InnsbruckWappen.png |
image_map = Karte-tirol-I.png |
state = [[Tyrol]] |
regbzk = [[Statutory city]] |
population = 117,342 |
population_as_of = 2006 |
pop_dens = 1,119 |
area = 104.91 |
elevation = 574 |
lat_deg = 47 |
lat_min = 16 |
lat_hem = N |
lon_deg = 11 |
lon_min = 23 |
lon_hem = E |
postal_code = 6010-6080 |
area_code = 0512 |
licence = I |
mayor = Hilde Zach |
website = [http://innsbruck.at] |
}}
```

Innsbruck	
	
Country	Austria
State	Tyrol
Administrative region	Statutory city
Population	117,342 (2006)
Area	104.91 km²
Population density	1,119 /km²
Elevation	574 m
Coordinates	47°16′N 11°23′E﻿ / ﻿47.267°N 11.383°E﻿ / 47.267; 11.383
Postal code	6010-6080
Area code	0512
Licence plate code	I
Mayor	Hilde Zach
Website	www.innsbruck.at

About: Innsbruck

An Entity of Type : [city](#), from Named Graph : <http://dbpedia.org>, within Data Space : [dbpedia.org](#)



Innsbruck is the capital city of the federal state of Tyrol in western Austria. It is located in the Inn Valley at the junction with the Wipptal, which provides access to the Brenner Pass, some 30 kilometers (19 mi) south of Innsbruck.

Property	Value
dbpedia-owl:PopulatedPlace/populationDensity	1119.0
dbpedia-owl:abstract	<ul style="list-style-type: none">Innsbruck ist die Landeshauptstadt des Bundeslandes Tirol Transit-Strecke Brenner (Auto- und Eisenbahn) nach Südtirol (Brücke über den Inn). Innsbruck ist mit 118.082 (Stand 1.1.2006) und Salzburg die fünfgrößte Stadt Österreichs, im Ballungsräumen dazu kommen ca. 30.000 Studenten und andere Nebenwohner. Innsbruck ist die Landeshauptstadt des Bundeslandes Tirol in w... the junction with the Wipptal, which provides access to the...



See <http://wiki.dbpedia.org/>

Freebase

An entity graph of people, places and things, built by a community that loves open data.

Freebase is joining Google! [Learn more »](#)

Featured Data

- Arts & Entertainment**
- Products & Services**
- Science & Technology**
- Society**
- Special Interests**
- Sports**
- System**
- Time & Space**
- All**

Film
81 members

Location
30 members

People
58 members

Books
47 members

TV
35 members

Music
100+ members

Business
100+ members


Government
29 members

May 31 Jun 28 last week

Facts **Topics** **Top User**

38K last week 3M 340K

27K last week 10M 920K



Gridworks

An open source power tool to fix, discover, experiment, connect and

Type	ID	# of Properties	# of Instances	Description
Musical Director	/theater/musical_director	1	12	A musical director is a person w
Musical Soundtrack	/theater/musical_soundtrack	2	18	A musical soundtrack is a record
Play	/theater/play	10	4,415	A play is a work written to be pe
Theater	/theater/theater	1	1,166	The theater type is for perform
Theater Actor	/theater/theater_actor	1	4,020	People who have performed in a
Theater Character	/theater/theater_character	2	882	This type is for all characters th
Theater Choreographer	/theater/theater_choreographer	1	20	A theater choreographer is some
Theater Company	/theater/theater_company	1	647	A theater company is a group of
Theater Designer	/theater/theater_designer	1	74	A theater designer is someone w
Theater Designer Role	/theater/theater_designer_role	1	27	This type represents possible pd
Theater Director	/theater/theater_director	1	99	A theater director is someone w
Theater Genre	/theater/theater_genre	1	49	This type is for all genres of play
Theater Producer	/theater/theater_producer	1	39	A theater producer is a person w
Theater Production	/theater/theater_production	15	599	A theater production is a product
Theater Production Staff Role	/theater/theater_production_staff_role	1	18	This type represents all positions
Theater Production Staffmember	/theater/theater_production_staff	1	33	This type is for any person who
Theatrical Composer	/theater/theatrical_composer	1	140	A theatrical composer is someone
Theatrical Lyricist	/theater/theatrical_lyricist	1	144	A theatrical lyricist is someone w

Semantically Interlinked Online Communities

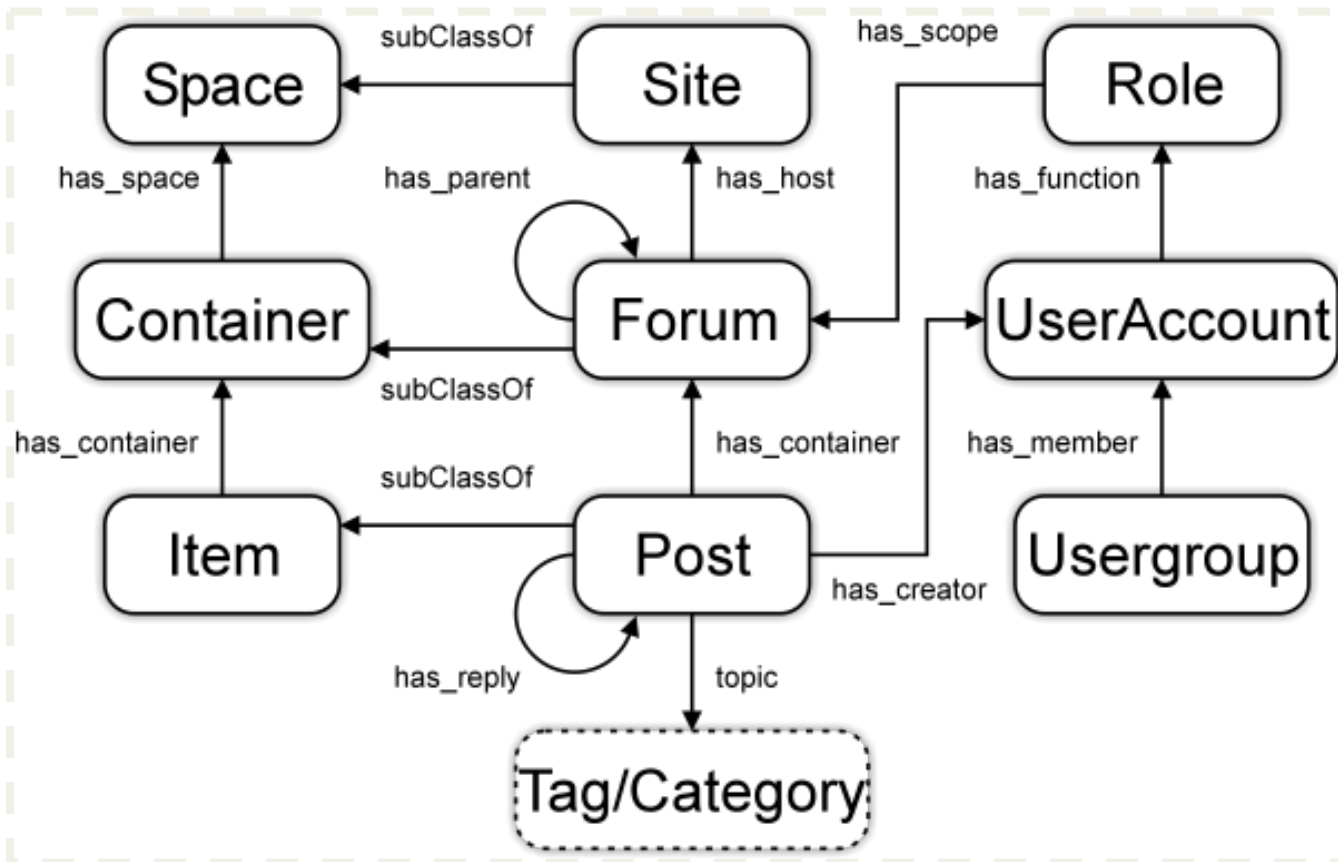


Image from <http://rdfs.org/sioc/spec/>: Bojārs, Breslin et al.

Simple Knowledge Organization System

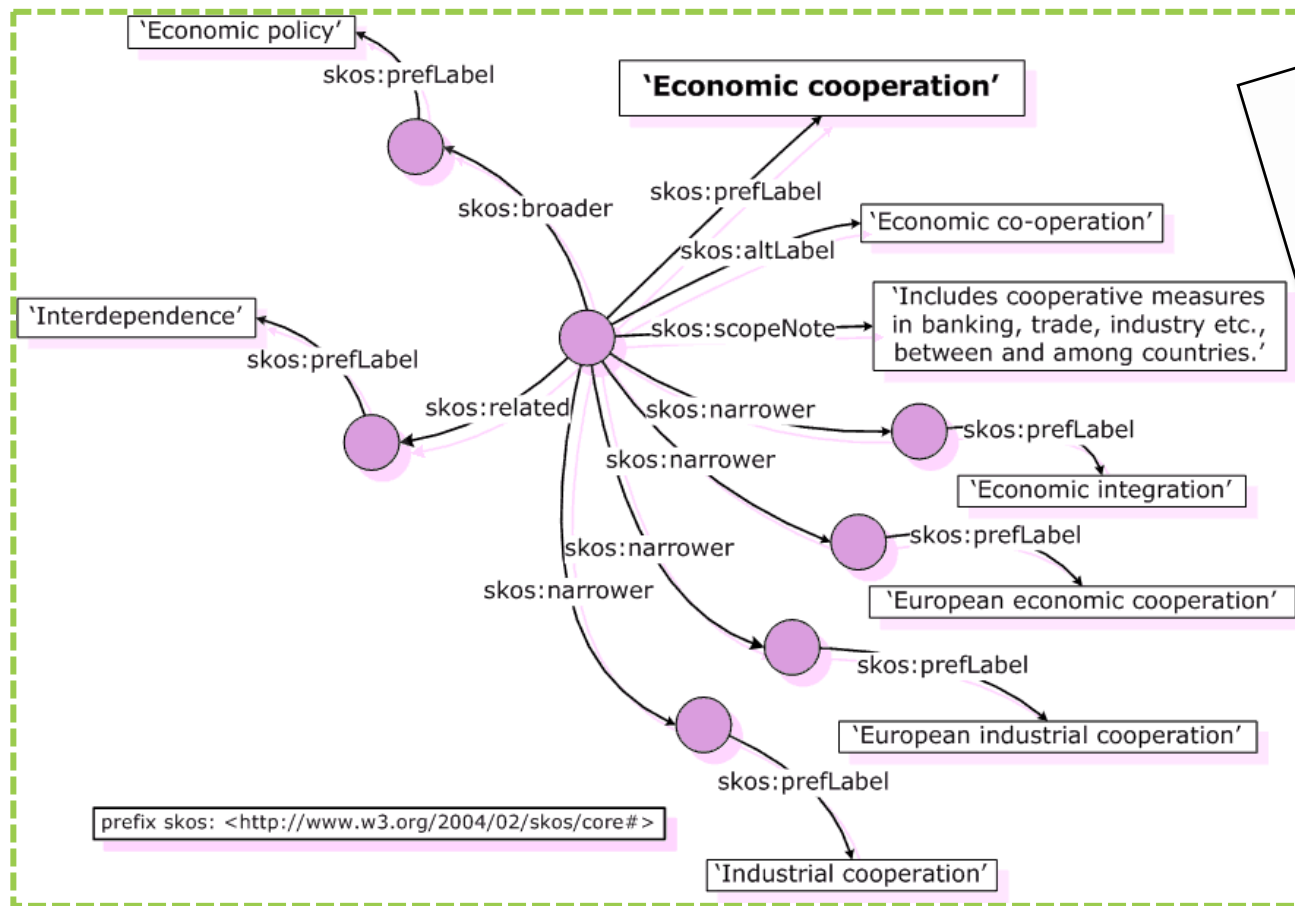


Image from <http://www.w3.org/TR/swbp-skos-core-guide>: Miles, Brickley

Description Of A Project

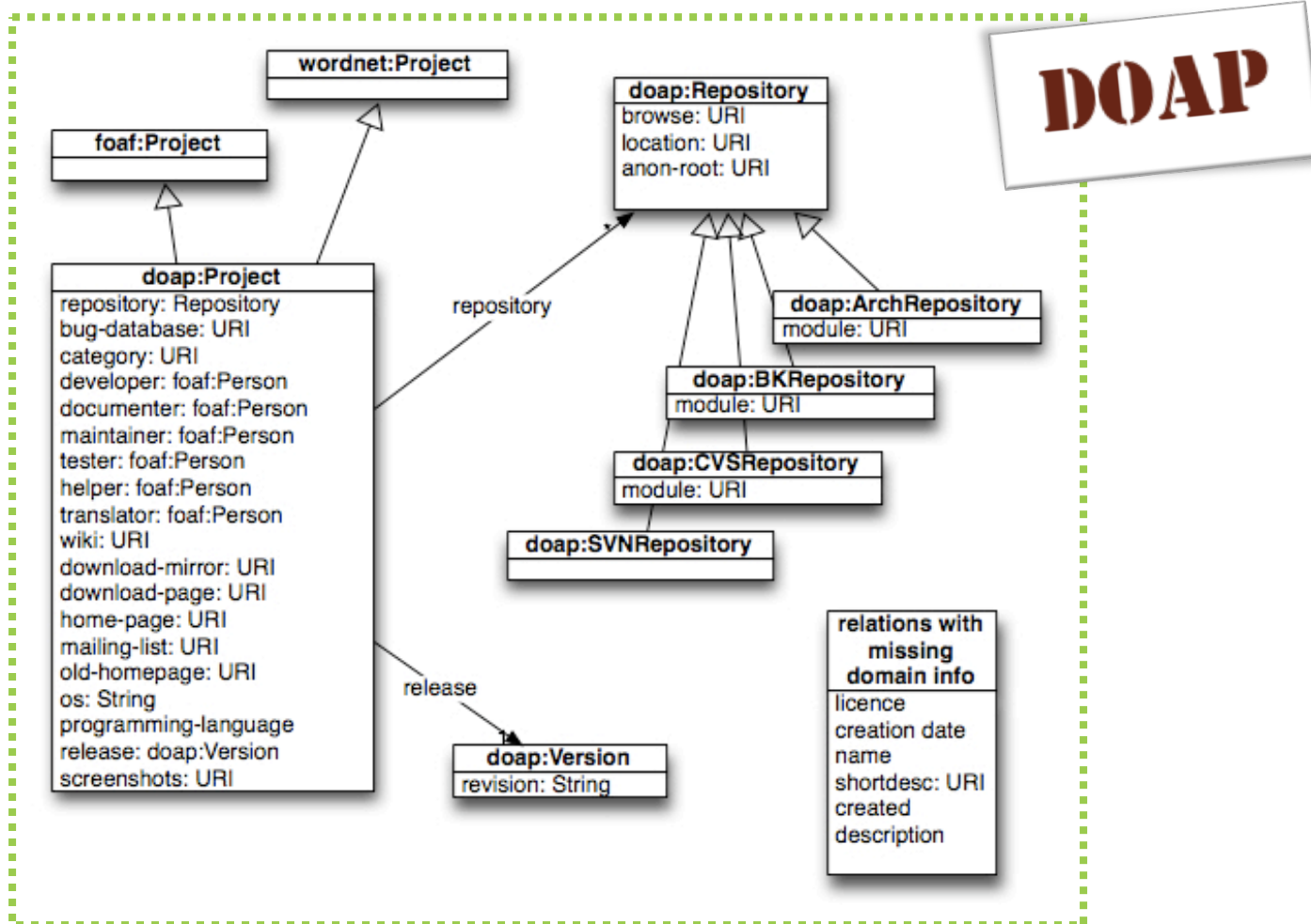


Image from <http://code.google.com/p/baetle/wiki/DoapOntology>: Breslin

Music Ontology

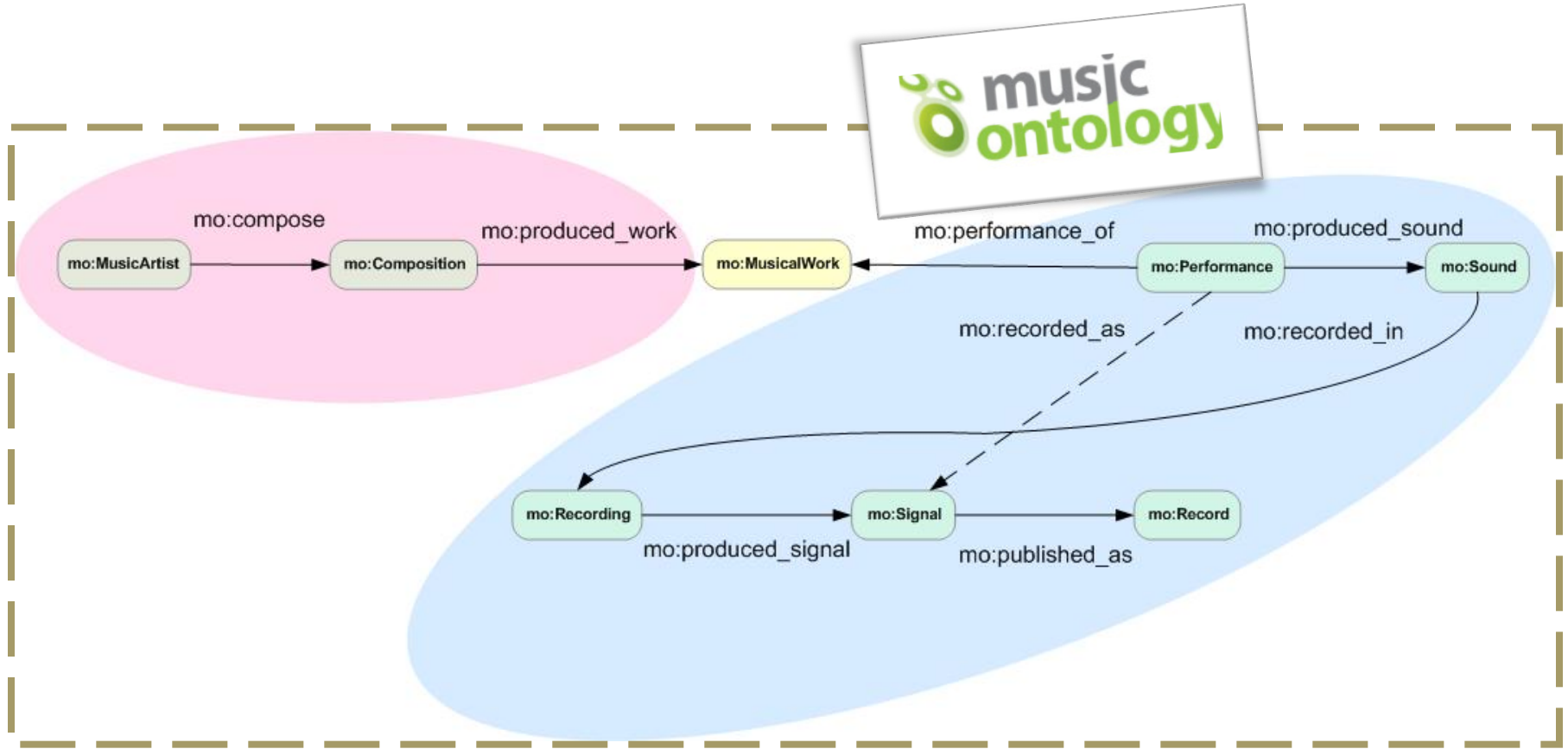


Image from <http://musicontology.com/>:Raimond, Giasson

Life sciences and healthcare



The Open Biological and Biomedical Ontologies

Ontologies


Resources

Participate

About

The OBO Foundry is a collaborative experiment involving developers of science-based ontologies who are establishing a set of principles for ontology development with the goal of creating a suite of orthogonal interoperable reference ontologies in the biomedical domain. The groups developing ontologies who have expressed an interest in this goal are listed below, followed by other relevant efforts in this domain.

In addition to a listing of OBO ontologies, this site also provides a statement of the OBO Foundry principles, discussion fora, technical infrastructure, and other services to facilitate ontology development. We welcome feedback and encourage participation.

Click any column header to sort the table by that column. The  link to the term request trackers for the listed ontologies.

OBO Foundry ontologies

<u>Title</u>	<u>Domain</u>	<u>Prefix</u>	<u>File</u>	<u>Last changed</u>
Biological process	biological process	GO	gene_ontology_edit.obo 	2010/07/26
Cellular component	anatomy	GO	gene_ontology_edit.obo 	2010/07/26
Chemical entities of biological interest	biochemistry	CHEBI	chebi.obo 	2010/07/07
Molecular function	biological function	GO	gene_ontology_edit.obo 	2010/07/26
Phenotypic quality	phenotype	PATO	quality.obo 	2010/07/25
PROtein Ontology (PRO)	proteins	PRO	pro.obo 	2010/07/24
Xenopus anatomy and development	anatomy	XAO	xenopus_anatomy.obo	2009/12/02
Zebrafish anatomy and development	anatomy	ZFA	zebrafish_anatomy.obo 	2010/06/14

WordNet

WordNet

WordNet

Apache Tomcat



WNWS
WordNet Web Service
for Apache Tomcat server

Bernard Bou
bbou@ac-toulouse.fr

This **Java** Web service produces XML output to word queries of the WordNet database. The release is in the form of a web archive (jar or zip format) which is ready to deploy but also contains both the sources and Intel native support needed for deployment (other platforms may refer to <http://wnjn.sf.net>). This application is under the GPL license agreement.

1. **excel**
quality: "made an excellent speech"; "the school has excellent teachers"; "a first-class mind")

```
(TOP (S (NP (JJ excellent) )  
(VP (VBZ is)  
(NP (NP (NN something) )  
(PP (IN of)  
(NP (DT the) (JJS highest) (NN quality) ) ) ) )  
(. )))
```

excellent:JJ(x1) -> **of**:IN(x1, x2) **highest**:JJ(x1)
quality:NN(x1)

```
<wf pos="IN" >of</wf>  
<wf pos="DT" >the</wf>  
<wf pos="JJS" lemma="high" quality="silver" wnsn="1"
```

extended WordNet

The goal of this project is to develop a tool that takes as input the current or future versions of WordNet and automatically generates an eXtended WordNet that provides... intended to... of WordNet.

In the eX... glosses a... transform... words are

University of Neuchâtel **unine** [home] Search

5 faculties UniNE > Information Management Institute > projects > directory sitemap localisation

ini Information Management Institute

- presentation
- projects
 - Zenodotus
 - knOWLer
 - ICDBrowser
 - IKARO
 - SplitTrees
 - HTS Classifier
- publications
- teaching

knOWLer

knOWLer is an ontology-based information management system targeting semantic integration into large-scale information systems is provided through an ontology language (OWL), showing that ontological reasoning can be scaled to sizes of standard IR systems.

OWL Representation of the WordNet Ontology

WordNet.OWL is an OWL-ontology based on [WordNet 1.7.1](#) lexical database.

WordNet171.OWL contains both the ontology [schema](#) and the instances.

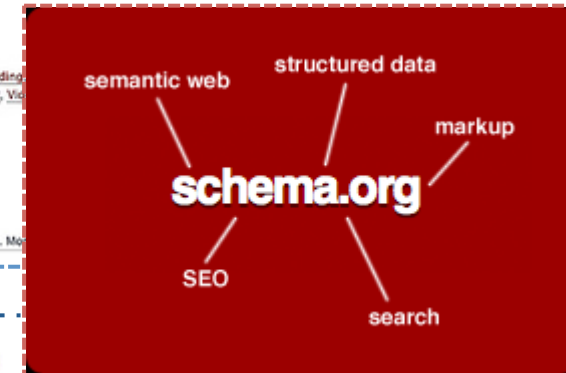
This OWL representation of the WordNet ontology can be freely used provided that proper references [1] are mentioned. For more information, consider the [WordNet licence](#) in case of commercial use of this ontology.

Download: [wordnet171.owl.gz](#) (approx. 8.5Mb).

schema.org

- Collection of schemas to mark-up structured content in HTML pages

The screenshot shows the schema.org website with a search bar and navigation links for Home, Schemas, and Documentation. The main heading is "Organization of Schemas". Below it, a paragraph explains that schemas are a set of 'types' with associated properties, arranged in a hierarchy. It offers two ways to browse: by full hierarchy (one page per type or full list on one page) or by jumping directly to commonly used types. A list of these types includes Creative works, Embedded non-text objects, Event, Organization, Person, Place, Product, Offer, and Review. A note at the bottom mentions a small set of primitive data types.



This screenshot shows a list of schema types and their associated properties:

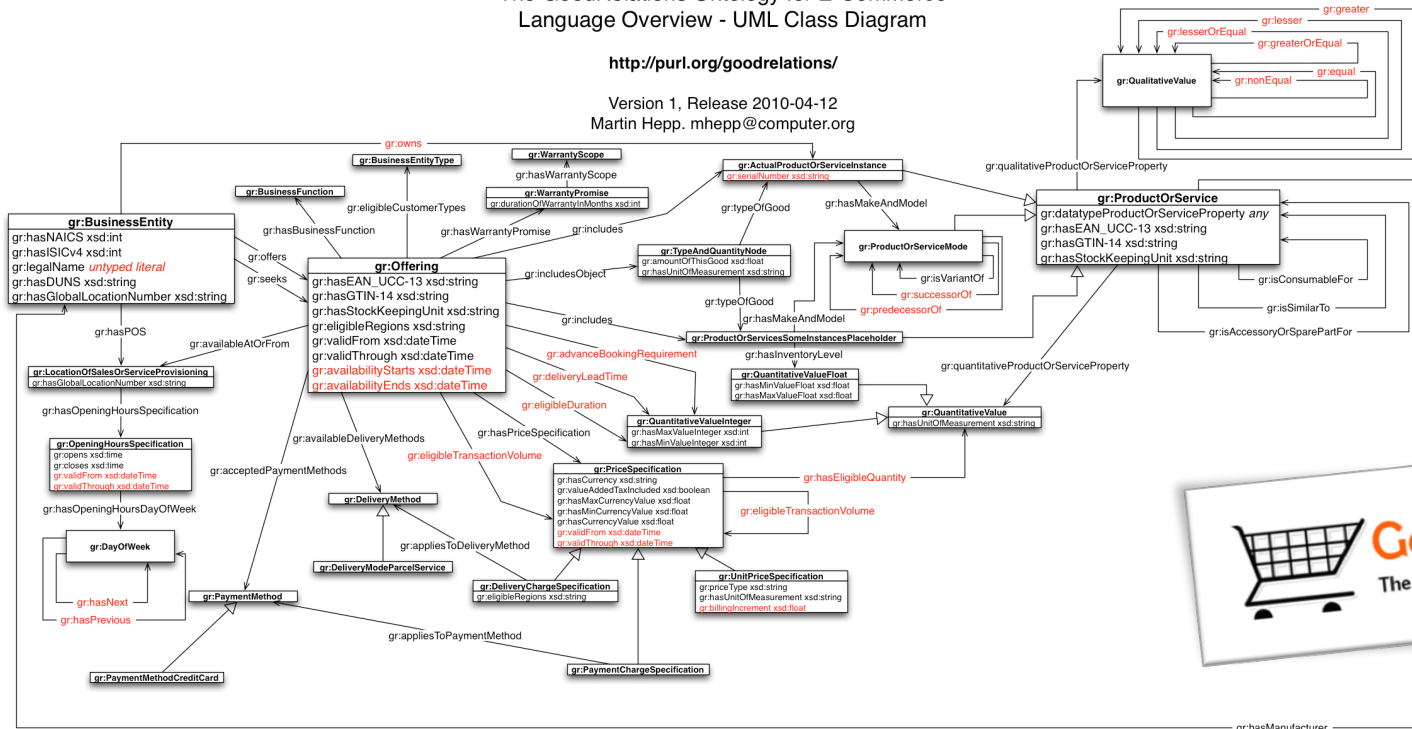
- Thing:** name, url, image, description
- CreativeWork:** encodings, headline, keywords, about, datePublished, author, contentRating, inLanguage, audio, video, genre, editor, awards, publisher, isFamilyFriendly, contentLocation, interactionCount, aggregateRating, offers, reviews
- Article:** articleSection, articleBody
 - BlogPosting
 - NewsArticle
 - ScholarlyArticle
- Blog:** blogPosts
- Book:** illustrator, bookEdition, bookFormat, numberOfPages, isbn
- ItemList:** itemListElement
- Map**
- MediaObject:** encodesCreativeWork, width, height, regionsAllowed, embedURL, bitrate, encodingFormat, playerType, duration, expires, contentURL, requiresSubscription, uploadDate, contentSize, interactionCount, offers

GoodRelations

The GoodRelations Ontology for E-Commerce Language Overview - UML Class Diagram

<http://purl.org/goodrelations/>

Version 1, Release 2010-04-12
Martin Hepp. mhepp@computer.org



Notes:

- The following GoodRelations elements are not shown in this diagram because they are only shortcuts for simpler annotation or querying. See the documentation at <http://purl.org/goodrelations/> for details:
 - gr:hasMinValue (shortcut for querying hasMinValueFloat and hasMinValueInteger properties in one turn)
 - gr:hasMaxValue (shortcut for querying hasMaxValueFloat and hasMaxValueInteger properties in one turn)
 - gr:hasValueFloat (shortcut for setting both hasMinValueFloat and hasMaxValueFloat properties to the same value in one turn)
 - gr:hasValueInteger (shortcut for setting both hasMinValueInteger and hasMaxValueInteger properties to the same value in one turn)

- The class gr:N-Ary-Relations is not shown, because it is just a helper class to collate all classes that represent n-ary relations that OWL cannot handle otherwise.
- For the recommended cardinality of attributes, see the GoodRelations Language Reference at <http://purl.org/goodrelations/> v1.html.

Red highlighting indicates elements added or changed in this release.



Image from <http://www.heppnetz.de/projects/goodrelations/primer/>; Hepp

Additional resources

- <http://vocamp.org/wiki/>
Where to find vocabularies

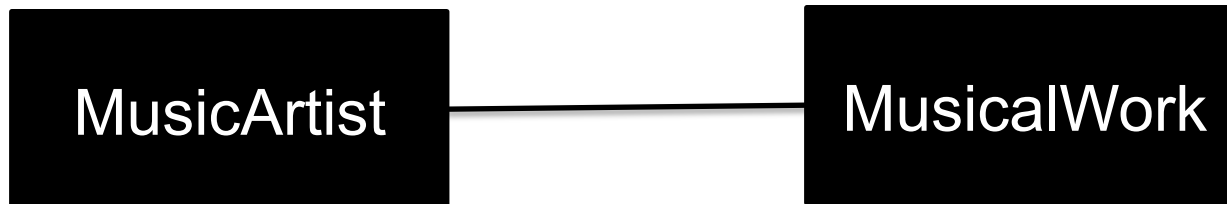
The screenshot displays the Taxonomy Warehouse website. At the top, there is a navigation bar for 'The Getty' with links for Home, Visit, Museum, Research Institute, and Conservation Institute. Below this is a secondary navigation bar with links for Exhibitions, Conducting Research, Scholarly Activities, and About the Research. The main content area features a search bar with a dropdown menu set to 'All Taxonomy Warehouse' and a 'GO' button. To the left, there is a sidebar with a 'Browse' section containing links for 'Browse vocabularies', 'Browse publishers', 'Browse categories', and 'Browse A-Z index'. The main content area is titled 'Your Gateway to Maximizing Information Assets' and includes a paragraph about the site's purpose. Below this, there is a section for 'Taxonomy Warehouse' with a list of benefits. To the right, there is a 'Become a Partner' section with a 'Join Taxonomy Warehouse' link, and a 'Partners' section listing GALE CENGAGE Learning, wand, and cycorp. On the far right, there is a section for 'Getty Vocabularies' with a heading 'Conducting Research' and a sub-heading 'Learn about the Getty Vocabularies'. This section includes text about the vocabularies being produced and maintained by the Getty Vocabulary Program, and lists several vocabularies: Architecture Thesaurus (AAT), Union List of Artist Names (ULAN), and Thesaurus of Geographic Names (TGN).

Selecting relevant ontologies

- What will the ontology be used for?
 - Does it need a natural language interface and if yes in which language?
 - Do you have any knowledge representation constraints (language, reasoning)?
 - What level of expressivity is required?
 - What level of granularity is required?
- What will you reuse from it?
 - Vocabulary++
- How will you reuse it?
 - Imports: transitive dependency between ontologies
 - Changes in imported ontologies can result in inconsistencies and changes of meanings and interpretations, as well as computational aspects

Classes

- A class represents a set of instances
- A class should be highly cohesive, precisely nameable, relevant
- A class should have a strong identity



Classes

- Classes represent **concepts** in the domain and **not** the **words** that denote these concepts
 - Synonyms for the same concept do not represent different classes
- Typically nouns and nominal phrases, but not restricted to them
 - **Verbs** can be modeled as classes, if the emphasis is on the process as a whole rather than the actual execution



- Events: „Being ill“ → „Illness episode“
- No pronouns

Cohesion and identity

- A class should represent one thing, all of that thing and nothing but that thing
- You can prove cohesion by
 - Giving the class a representative name
 - Noun (+ modifier, sometimes however also captured as attribute value)
 - Examples: Jazz music, classical music
 - Albums is not cohesive
- Avoid ambiguous terms
 - Manager, handler, processor, list, information, item, data...
- Identity ~ individuality: entities change values, but remain members of the same class
 - Examples: Child/Adult: age

Instances

- Entities of a certain type
 - Abstract entities are allowed
- Issues
 - Distinction between classes and instances
 - Examples: **Jazz** as music genre
 - Choice of the most appropriate class
 - Examples: **Violetta Valery**, **Stradivarius**
- Instances adopt attributes and properties of their classes
 - Examples: **rectangles** and **squares**

Characterizing classes

- Two types of principal characteristics
 - Measurable properties: attributes
 - Inter-entity connections: relationships, associations

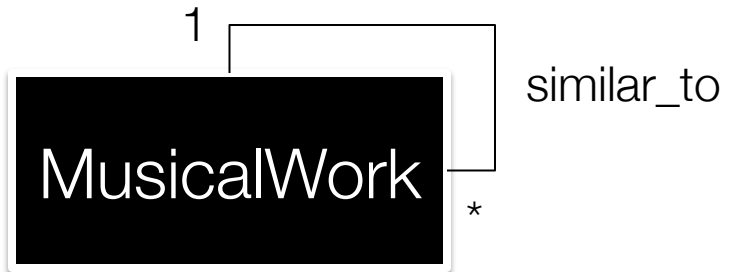


- Color of an image as attribute vs. class

Attributes

- An attribute is a measurable property of a class
 - Scalar values: choice from a range of possibilities
 - An attribute is NOT a data structure. It is not complicated to measure
 - Attributes do NOT exhibit identity
- Typically nouns in „-ness“
 - Velocity-ness, job-ness, arrested-ness...
- „How much, how many“ test.
 - If you evaluate this, then it is probably an attribute
 - If you enumerate these, it is probably a class

Relationships



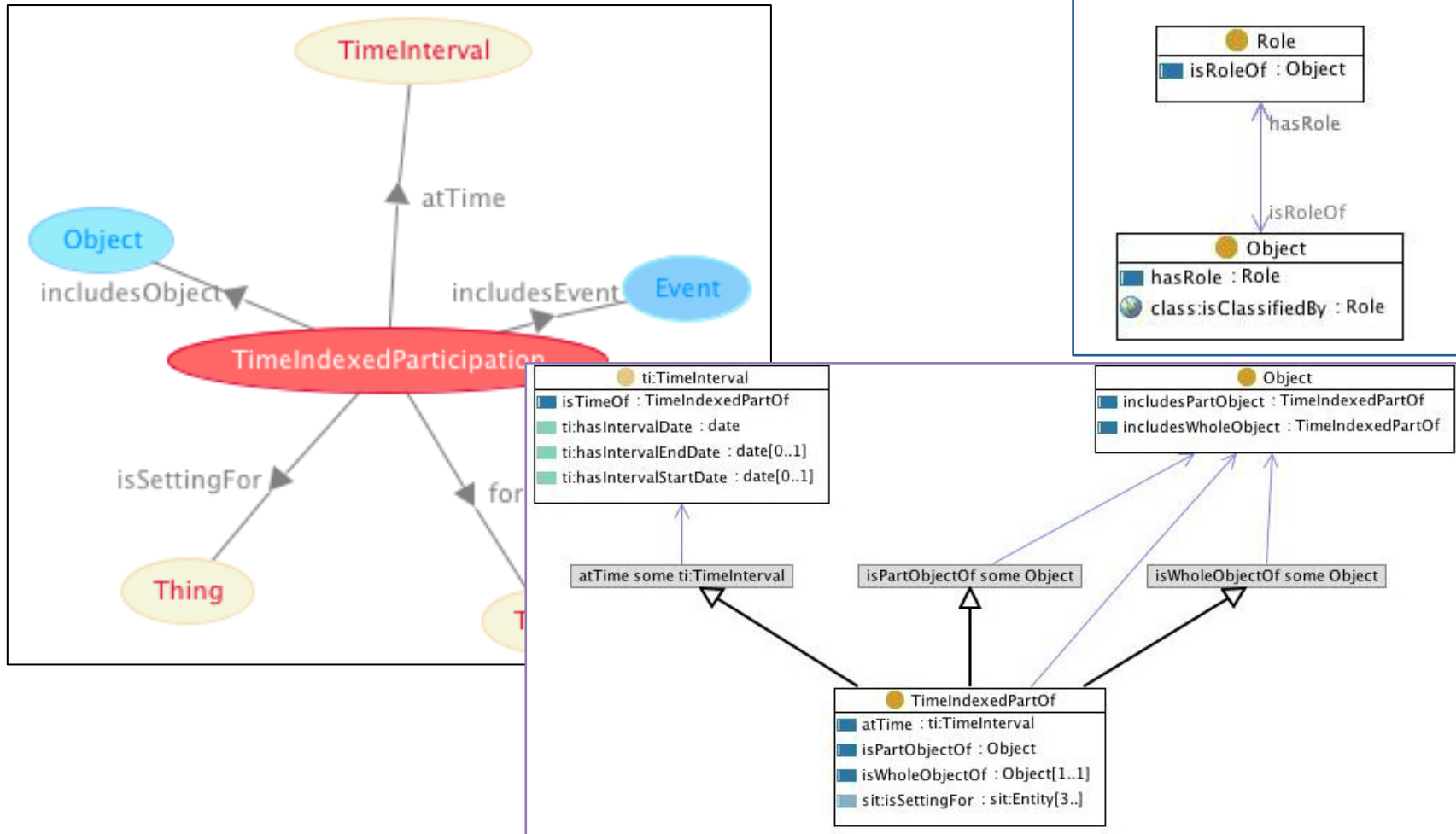
Some instances of a class hold a relationship with some instances of another class.



Class hierarchy

- A subclass of a class represents a concept that is a “kind of” the concept that the superclass represents
- It has
 - Additional properties
 - Restrictions different from those of the superclass, or
 - Participates in different relationships than the superclasses
- All the siblings in the hierarchy (except for the ones at the root) must be at the same level of generality
- If a class has only one direct subclass there may be a modeling problem or the ontology is not complete
- If there are more than a dozen subclasses for a given class then additional intermediate categories may be necessary
- **Roles are not subclasses**
 - Application dependent or subjective
 - Examples: Artist and Person

Ontology Design Patterns



Content from <http://ontologydesignpatterns.org/>

Assignment

Assignment: Modeling

The current configuration of the “Red Hot Chili Peppers” are: Anthony Kiedis (vocals), Flea (bass, trumpet, keyboards, and vocals), John Frusciante (guitar), and Chad Smith (drums). The line-up has changed a few times during they years, Frusciante replaced Hillel Slovak in 1988, and when Jack Irons left the band he was briefly replaced by D.H. Peligo until the band found Chad Smith. In addition to playing guitars for Red hot Chili Peppers Frusciante also contributed to the band “The Mars Volta” as a vocalist for some time.

From September 2004, the Red Hot Chili Peppers started recording the album “Stadium Arcadium”. The album contains 28 tracks and was released on May 5 2006. It includes a track of the song “Hump de Bump”, which was composed in January 26, 2004. The critic Crian Hiatt defined the album as "the most ambitious work in his twenty-three-year career". On August 11 (2006) the band gave a live performance in Portland, Oregon (US), featuring songs from Stadium Arcadium and other albums.



<http://www.euclid-project.eu>

eBook



amazonkindle



ePUB



iBooks

Course



iTunes U

Other channels



@euclid_project



euclidproject



euclidproject