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4th ESWC Summer School



Building and using ontologies

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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



FUNDAMENTALS

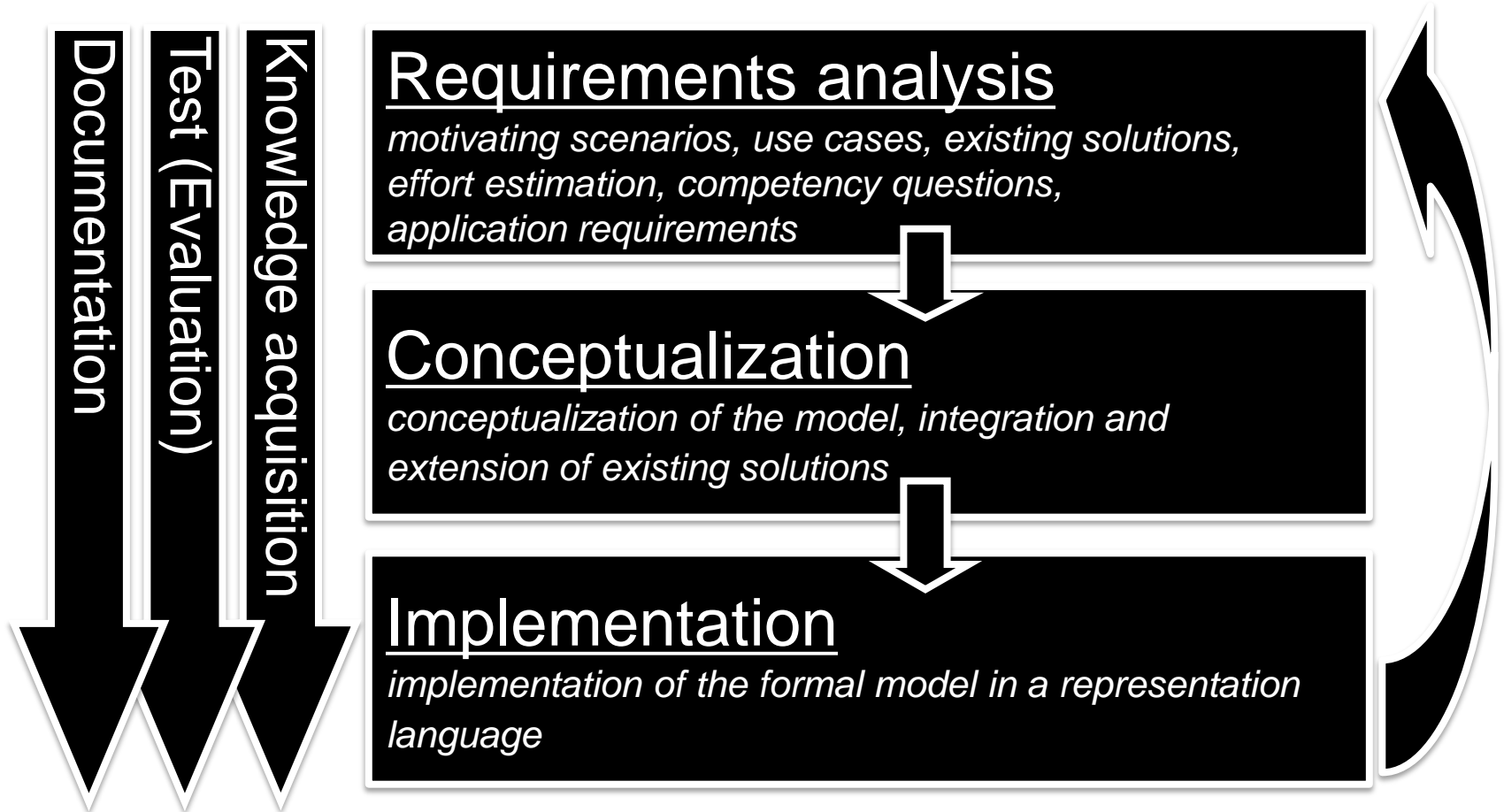
Ontologies in Computer Science

- 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**

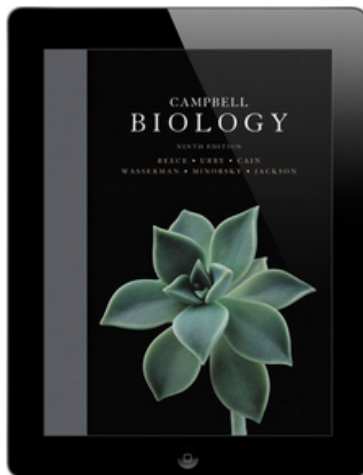
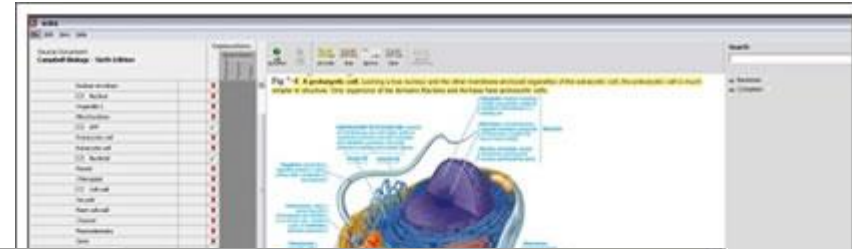
class relationship *entity* type
slot *particular* object *instance*
universal attribute association
individual *property* **role**

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

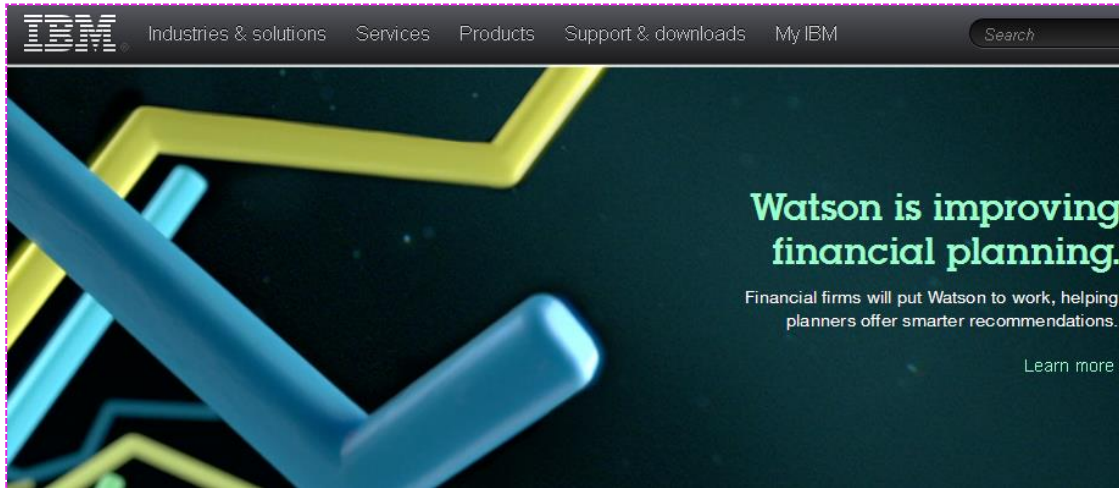


What is the relationship between plant cells and photosynthesis|

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

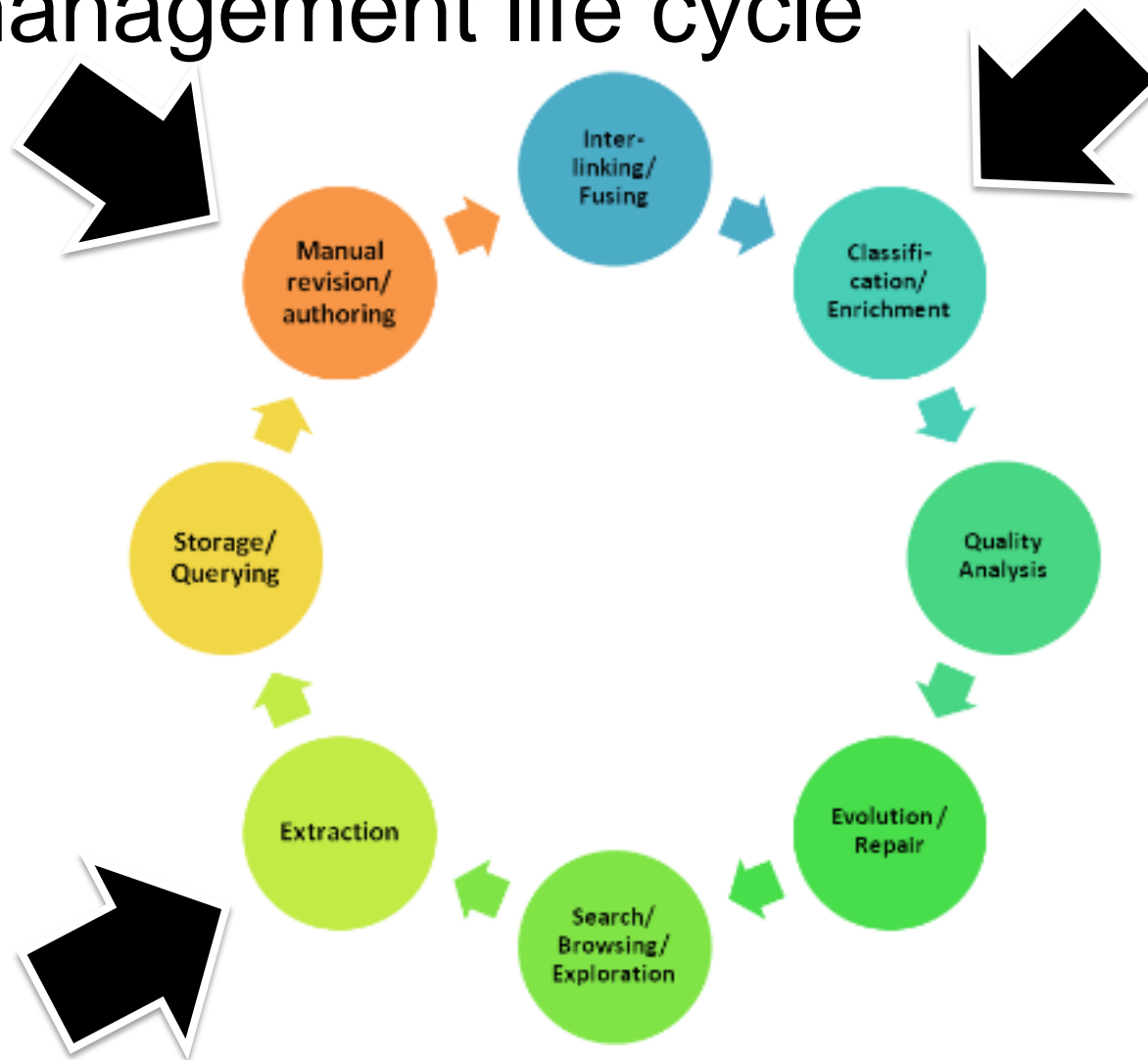
The Linked Data movement has promoted one approach to create and publish semantic data

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

Rich knowledge representations can be extremely valuable, 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

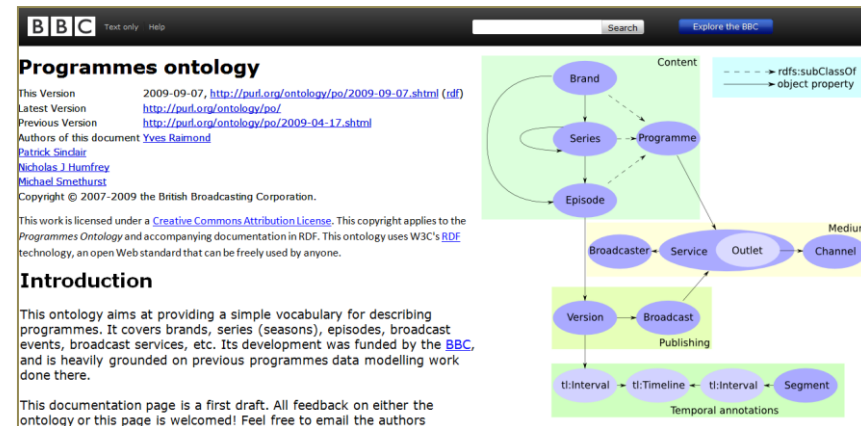
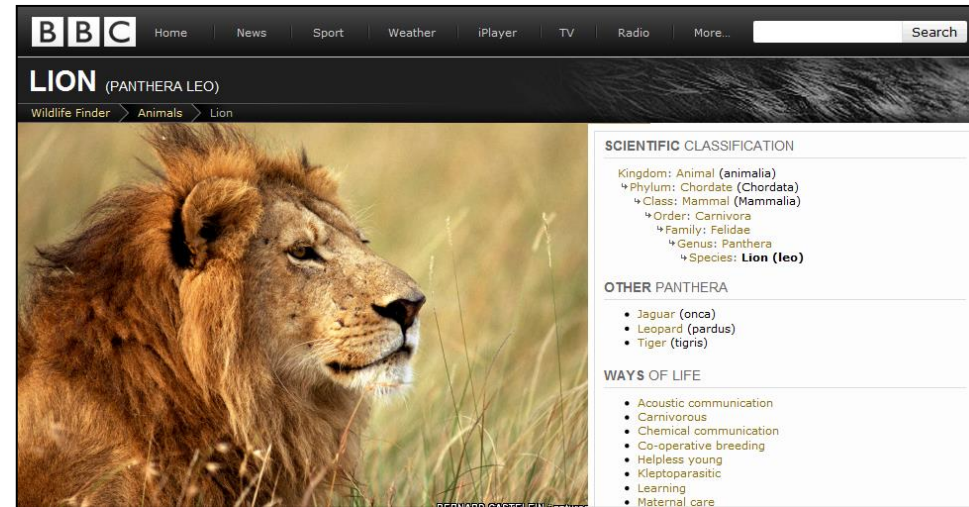
Our scenario: the Linked Data management life cycle



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**
- **Adjust/extend ontologies**
- Popular activities we do **not** consider here
 - Requirements analysis
 - Knowledge representation
 - Ontology learning
 - Ontology alignment
 - ...
- See previous summer schools http://videolectures.net/eswc2012_summer_school/
- This is **not** a tutorial about
 - Ontology engineering tools e.g., **Protégé** (see <http://protege.stanford.edu/>)
 - Ontology languages e.g., RDFS, OWL

FIND ONTOLOGIES

Finding existing ontologies

- Linked Open Vocabularies: over 400 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>
- Dumontier Lab: life sciences ontologies
 - <http://dumontierlab.com/index.php?page=ontologies>
- Tones: ontologies used mainly for testing purposes
 - <http://rpc295.cs.man.ac.uk:8080/repository/>
- OBO Foundation Ontologies: hundreds of life sciences ontologies, including mappings
 - <http://www.obofoundry.org/>
- NCBO Bioportal: hundreds of medical ontologies
 - <http://bioportal.bioontology.org/>
- VoCamps
 - http://vocamp.org/wiki/Main_Page

Linked Open Vocabularies

music Search

380 results in 43 vocabularies

Filter by Domain

- W3C Rec (0)
- City (6)
- Data & Systems (2)
- General (40)
- Library (117)
- Life (123)
- Market (2)
- Media (9)

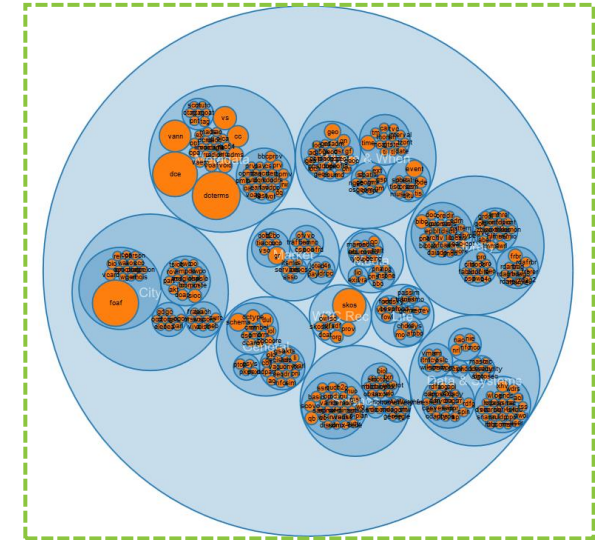
Filter by Type

- rdfs:Class (142)
- rdf.Property (223)
- voaf:Vocabulary (8)
- Other (38)

Filter by Vocabulary (43)

- mo (106)
- music (69)
- rdarel (29)
- rdarole (27)
- rdag1 (21)
- schema (21)
- bf (13)

music (voaf:Vocabulary)	score:0.682
rdfs:label Music Vocabulary	
dcterms:title Music Vocabulary @en	
rdfs:comment A vocabulary, or music ontology, to describe classical music and performances. Categories for musical works, events, instruments to distinguish musical works (e.g. Opera model to describe a musical work, its representation, scores, etc) and a musical event to present ...	>>
dcterms:description A vocabulary, or music ontology, to describe classical music and performances. Categories for musical works, events, instruments to distinguish musical works (e.g. Opera model to describe a musical work, its representation, scores, etc) and a musical event to present ... @en	
vann:preferredNamespacePrefix music	
vann:preferredNamespaceUri http://www.kanzaki.com/ns/music#	
af:MusicSegment (owl:Class)	score:0.568
rdfs:label Music	>>
rdfs:comment ...dio segment holding music. This classifier ...	
http://lov.okfn.org/dataset/lov/lov#MUSIC (voaf:VocabularySpace)	score:0.568
dcterms:title Music and Sound @en	>>
dcterms:description Music, Sound, Audio files @en	
bibo:shortTitle Music @en	
bbc:Music (bbc:Product)	score:0.568
rdfs:label Music @en-gb	>>
rdfs:comment ...Documents from BBC Music. @en-gb	
mrel:mus (owl:ObjectProperty)	score:0.511
rdfs:label Musician @en	>>
skos:prefLabel Musician @en	
mads:authoritativeLabel Musician @en	
schema:musicBy (rdf:Property)	score:0.438
rdfs:label musicBy	>>
mo (voaf:Vocabulary)	score:0.405
dcterms:title Music Ontology @en	



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

Linked Open Vocabularies (2)

Information about mo

Metrics:

Overall score with current parameters	0.405
Best ratio search words in labels	0.357
Nb occurrences in main labels	2
Nb occurrences in secondary labels	2
Nb occurrences in LOD datasets	144239
Nb occurrences in LOV datasets	18
Nb of vocabularies which reference this element	5

Element information:

URI	http://purl.org/ontology/mo/
rdf:type	owl:Thing > owl:Ontology > voaf:Vocabulary
vocabulary	null
is dc:hasPart of	All > Life > Music
dcterms:title	Music Ontology @en
dce:title	The Music Ontology
dcterms:description	The Music Ontology Specification provides main concepts and properties fo describing music (i.e. artists, albums and tracks) on the Semantic Web @en
dce:description	The Music Ontology Specification provides main concepts and properties fo describing music (i.e. artists, albums and tracks) on the Semantic Web.

Close

Dublin Core

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

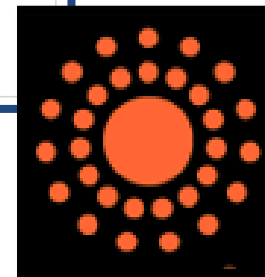


Table from <http://dublincore.org/documents/dcmi-terms/>

Friend Of A Friend

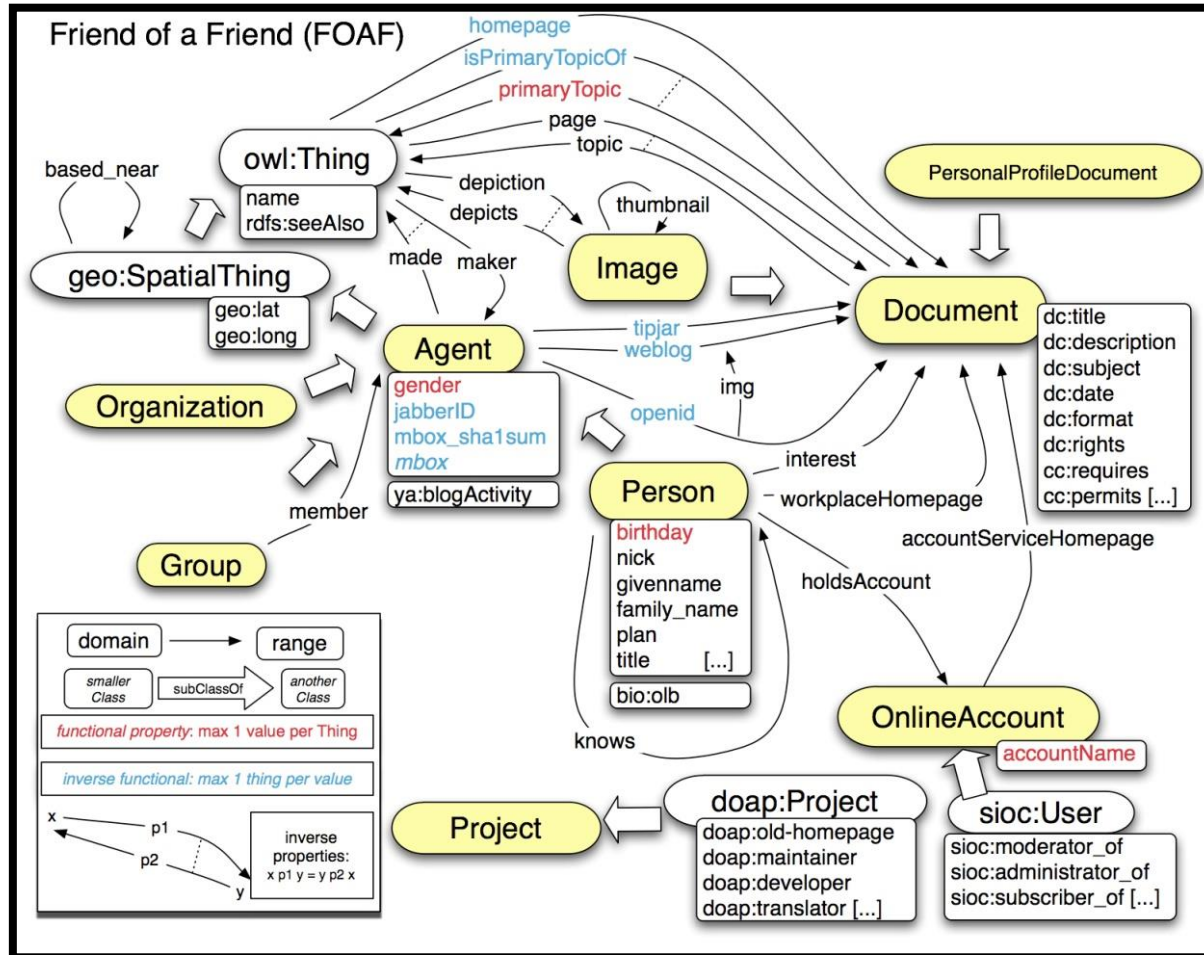


Image (originally found) at <http://www.deri.ie/fileadmin/images/blog/>: Breslin

PROV-O

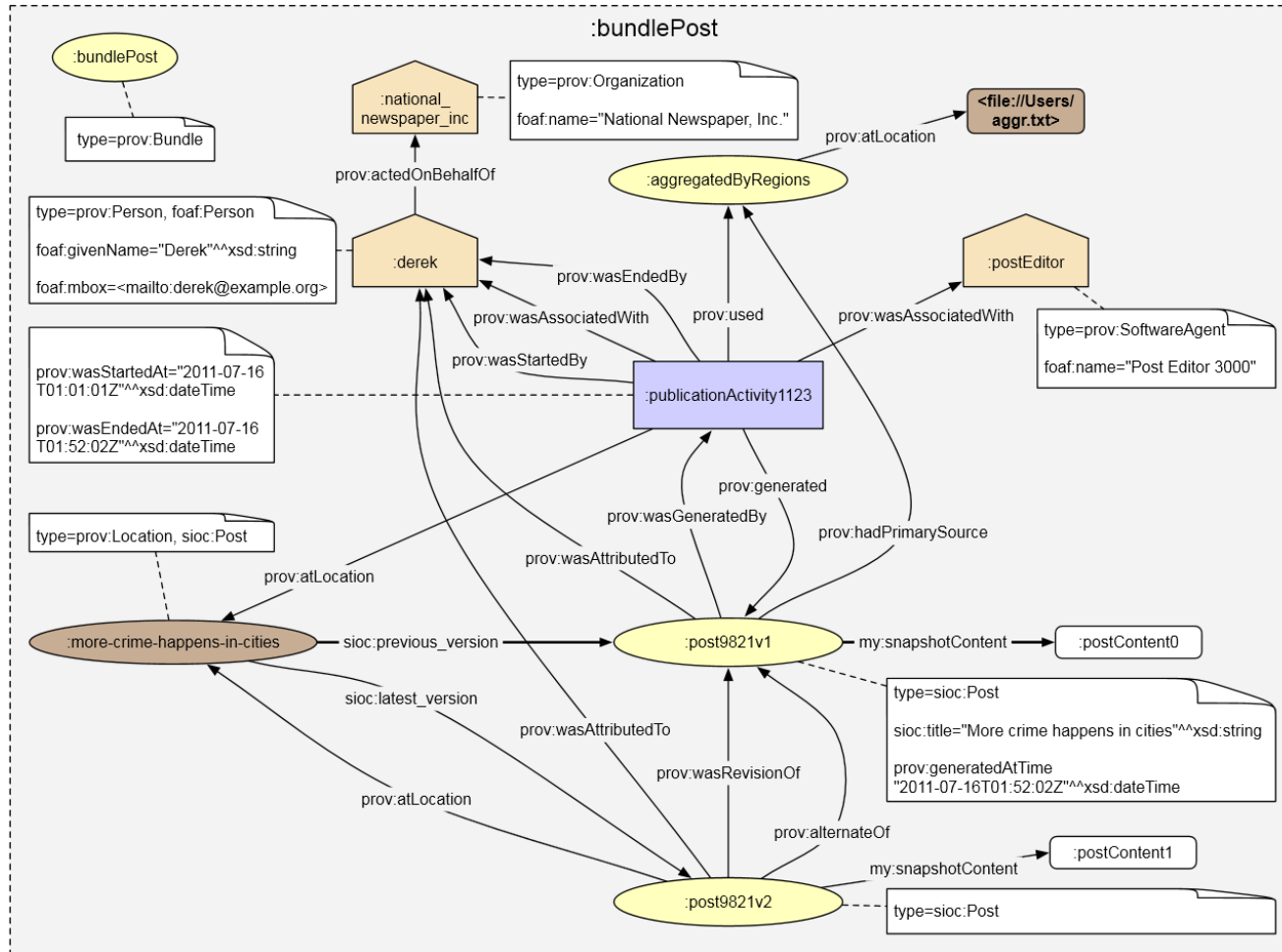


Image from <http://www.w3.org/TR/2012/WD-prov-o-20120724/>

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) die zweitgrößte Stadt Österreichs, im Ballungsraum mit Salzburg die fünftgrößte Stadt Österreichs, im Ballungsraum dazu kommen ca. 30.000 Studenten und andere Nebenwohner, die in der Umgebung von Innsbruck wohnen. Innsbruck ist die Hauptstadt der Bundesländer Tirol und Vorarlberg. Innsbruck ist die Hauptstadt der Bundesländer Tirol 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.



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

Wikidata

Main Page Discussion Read View source View history Search

WIKIDATA

open collaborative linked

multilingual structured

free

Welcome to Wikidata,
the free knowledge base with 15,563,554 data items that anyone can edit

Introduction · Project Chat · Community Portal · Help

Afrikaans · العربية · беларуская · беларуская (тарашкевіца) · Bahasa Banjar · বাংলা · brezhoneg · bosanski · català · کوردی · čeština · cymraeg / galleg · dansk · Deutsch · Zazaki · dolnooserbski · Ελληνικά · English · Esperanto · español · eesti · فارسی · suomi · feroyskt · français · Nordfriisk · gallego · Alemannisch · ગુજરાતી · עברית · hrvatski · hornjoserbsce · magyar · Հայերեն · Bahasa Indonesia · interlingua · iokano · islienska · italiano · 日本語 · ལྷན་རྒྱུ་ཁྱེད་ཀྱི་སྐད་ཀྱི་ཡི་རིན་ · Kurdî · Latina · lietuvių · latviešu · Malagasy · Baso Minangkabau · македонски · മലയാളം · मराठी · Bahasa Melayu · مازرونی · Nedersaksies · नेपाली · Nederlands · norsk bokmål · norsk nynorsk · occitan · འདྲེན་པོ་ལྷན་རྒྱུ་ཁྱེད་ཀྱི་སྐད་ཀྱི་ཡི་རིན་ · Runa Simi · română · русский · Scots · sámegiella · srpskohrvatski / српскохрватски · සිංහල · Simple English · slovenčina · slovenščina · shqip · cрчки / srpski · svenska · šlōnski · தமிழ் · తెలుగు · ལྷན་རྒྱུ་ཁྱེད་ཀྱི་སྐད་ཀྱི་ཡི་རིན་ · Tagalog · Türkçe · українська · اردو · oʻzbekcha · Tiếng Việt · Yorùbá · 中文 (简体) · 中文 (繁體) · 粵語

Tools

- What links here
- Related changes
- Special pages
- Printable version
- Permanent link
- Page information
- Wikidata item

in Wikipedia

- Qatâr af
- Anyosaa
- Achh
- Afrikaans

Welcome!

Wikidata is a free linked database that can be read and edited by both humans and machines.

Wikidata acts as central storage for the **structured data** of its Wikimedia sister projects including

Learn about data

New to the wonderful world of data? Develop and improve your data literacy through content designed to get you up to speed and feeling comfortable with the fundamentals in no time.

See <http://www.wikidata.org/>

Freebase

The screenshot shows the Freebase website interface. At the top, there is a search bar with the text "Find..." and navigation links for "Browse", "Query", and "Help". Below the search bar, a large dark grey box displays the number "2,771,294,189" and the text "Facts (and counting)". Underneath this, a tagline reads "A community-curated database of well-known people, places, and things". A navigation menu below the tagline includes "Data" (highlighted in orange), "Schema", "Queries", "Apps", "Loads", "Review Tasks", and "Users". The main content area is titled "Explore Freebase Data" and contains a table with the following data:

Domain	ID	Topics	Facts
Music	/music	29M	199M
Books	/book	6M	15M
Media	/media_common	5M	16M
People	/people	3M	19M
Film	/film	2M	21M
TV	/tv	2M	18M
Location	/location	1M	19M
Business	/business	1M	4M
Fictional Universes	/fictional_universe	1M	1M
Organization	/organization	910K	4M
Biology	/biology	649K	4M
Sports	/sports	481K	4M

<http://www.freebase.com>

Semantically Interlinked Online Communities

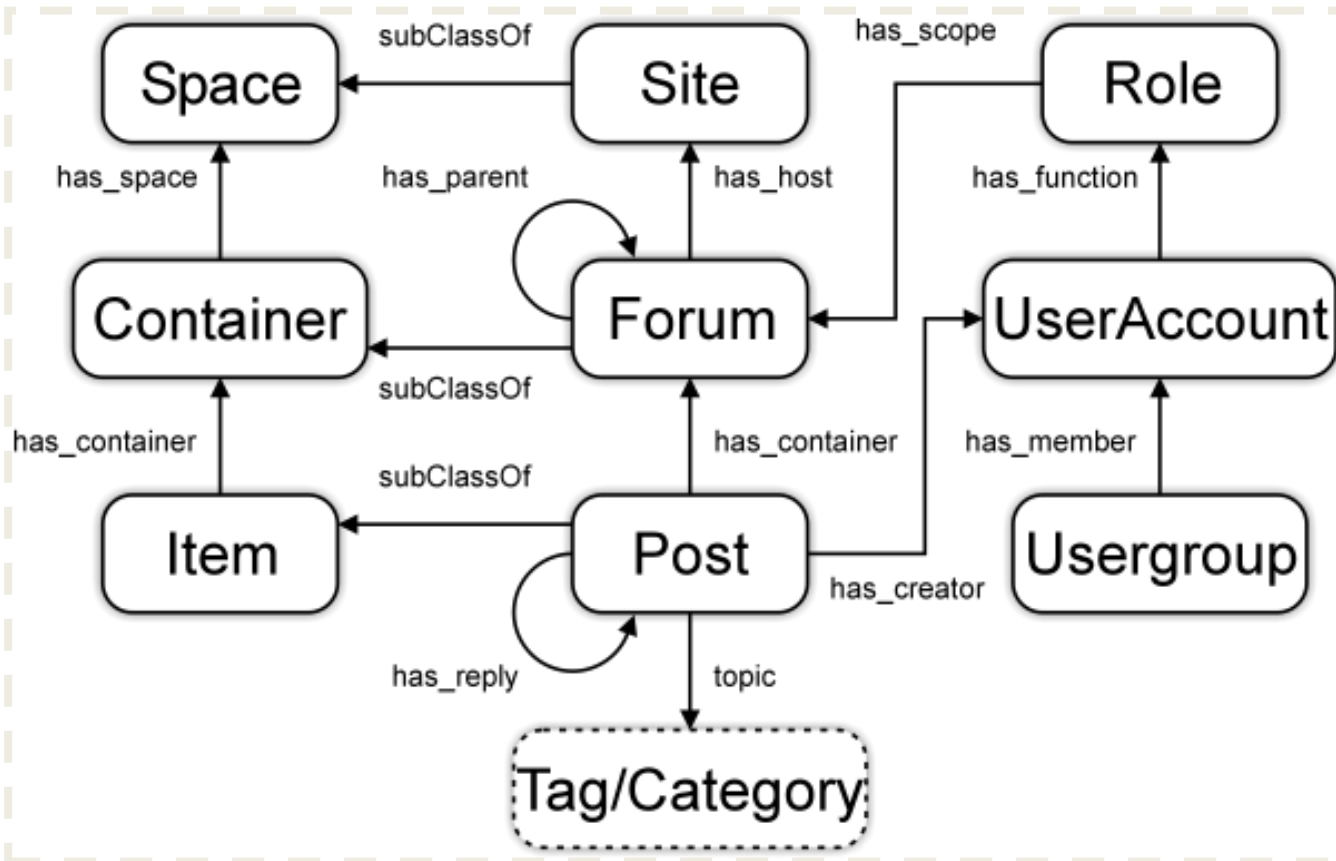


Image from <http://rdfs.org/sioc/spec/>: Bojārs, Breslin et al.

Simple Knowledge Organization System

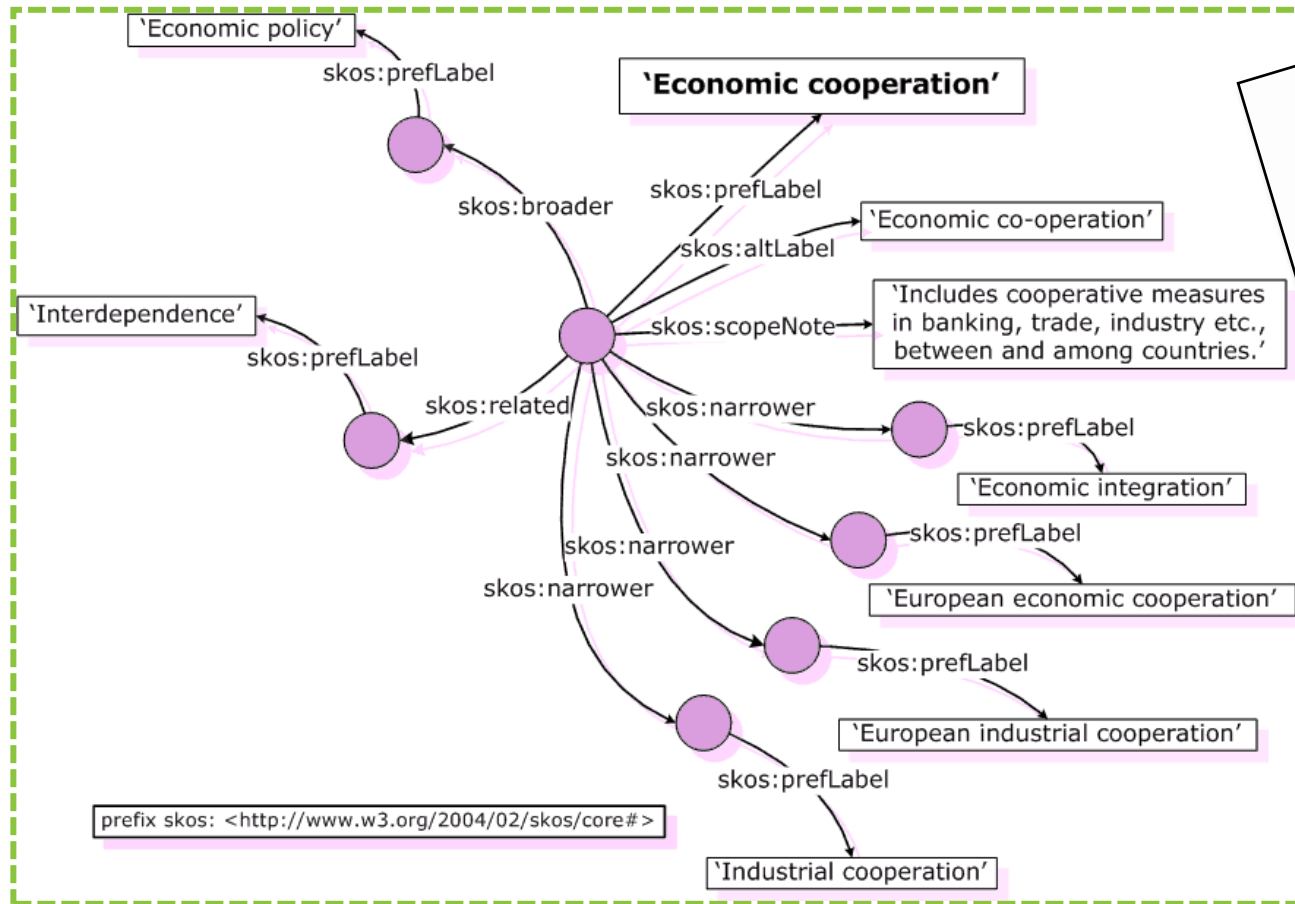


Image from <http://www.w3.org/TR/swbp-skos-core-guide>: Miles, Brickley

Description Of A Project

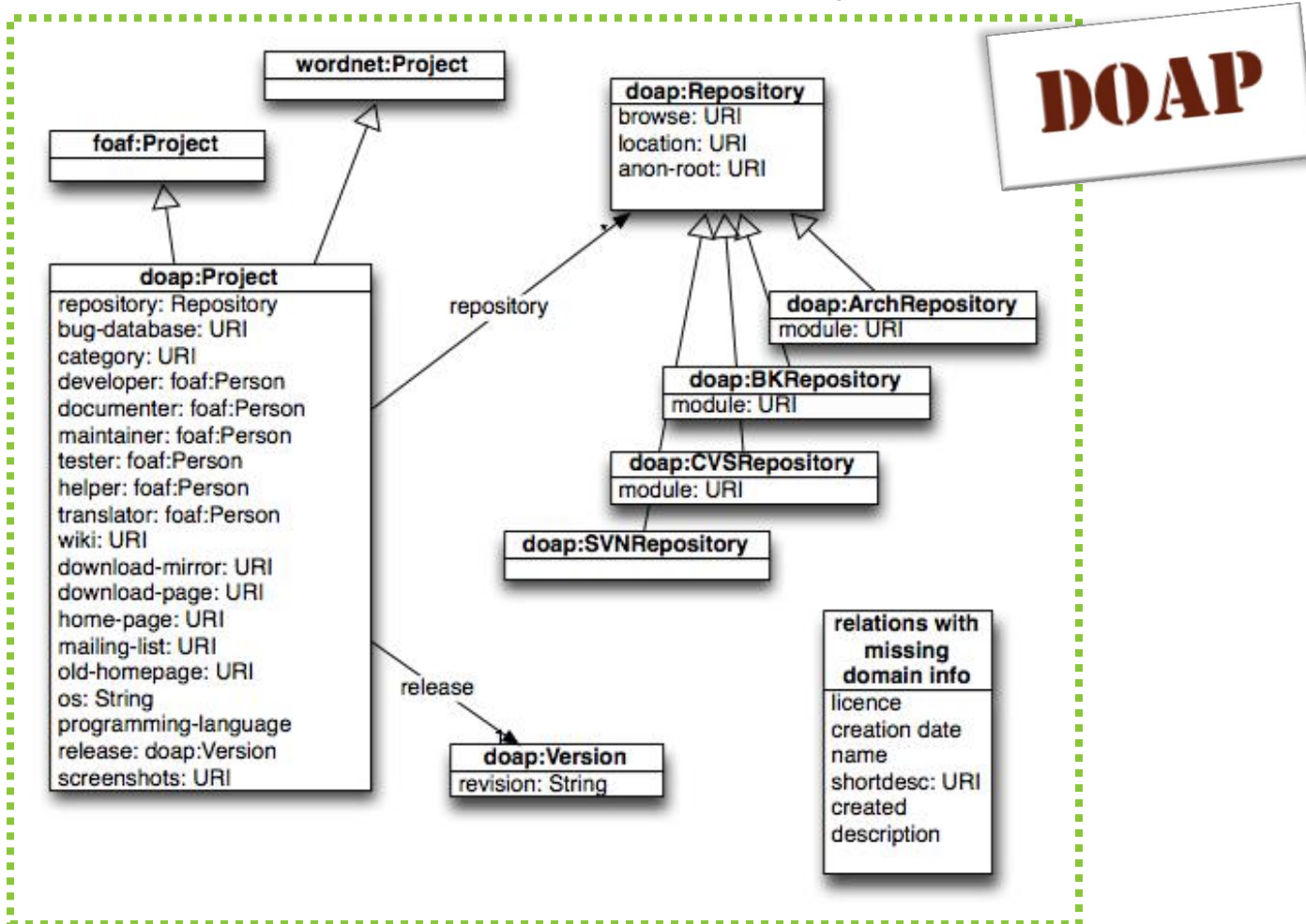


Image from <http://code.google.com/p/baetle/wiki/DoapOntology>: Breslin

Music Ontology

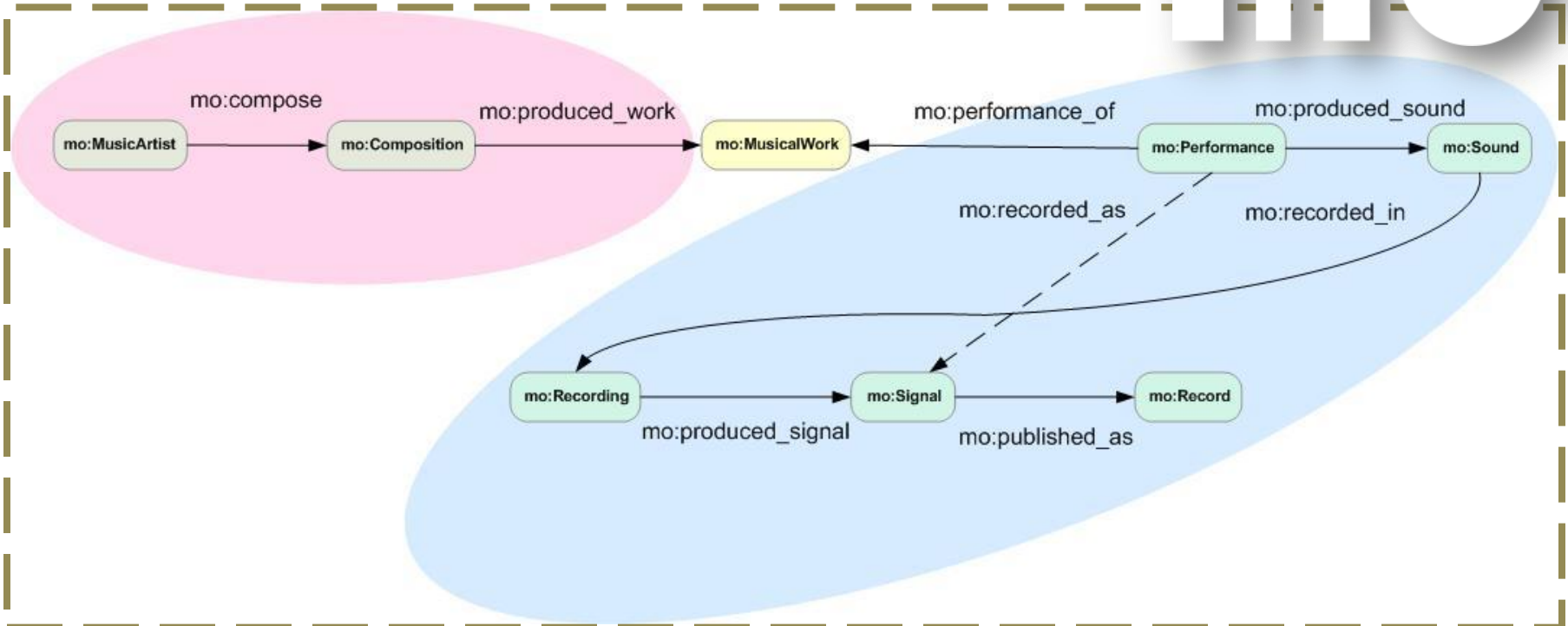


Image from <http://musicontology.com/>:Raimond, Giasson

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 WordN

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

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 system is provided through an ontology language (OWL), showing that ontological reasoning can be scaled to sizes of standard IR system

OWL Representation of the WordNet Ontology

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

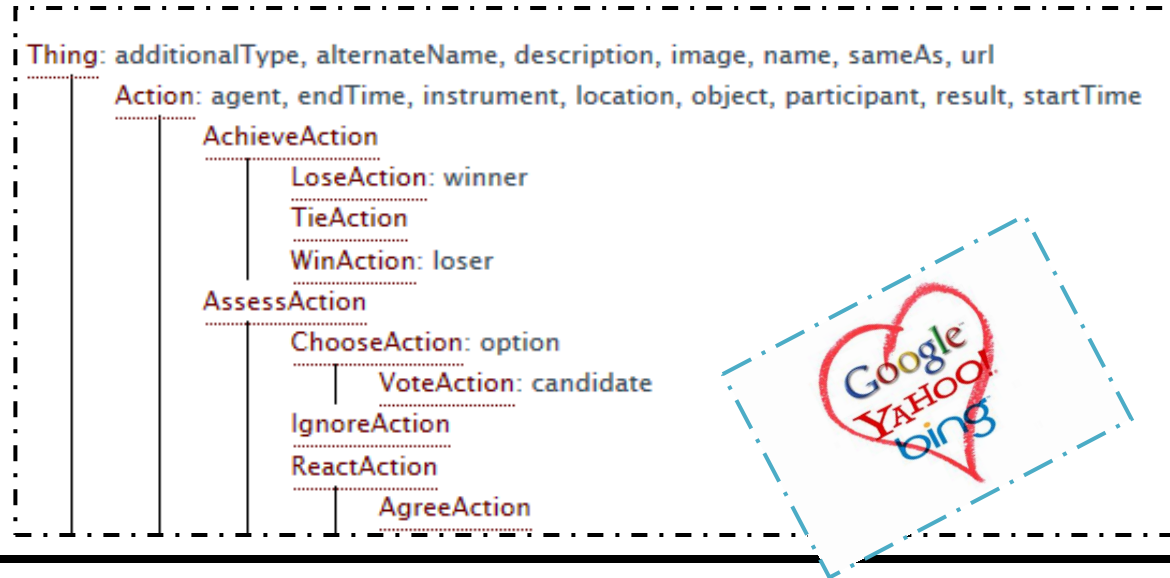
WordNet171.OWL contains both the ontology [schema](#) and the instances.

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

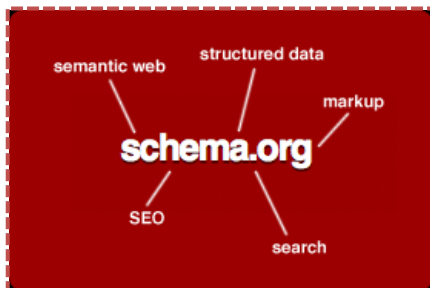
Download: [wordnet171.owl.gz](#) (approx. 8.5Mb).

schema.org

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



Note: as of 2014-04-04 this tree is not entirely up to date. Additional types have been added: see [EmailMessage](#), [Reservation](#), [Question](#) and [Answer](#), added in version 1.1. Version 1.2 added the Potential Actions vocabulary, see [potentialAction](#), [EntryPoint](#), [target](#), [actionStatus](#), [ActionStatusType](#), [ActiveActionStatus](#), [CompletedActionStatus](#), [PotentialActionStatus](#).



See also <http://schema.org/docs/full.html>

GoodRelations

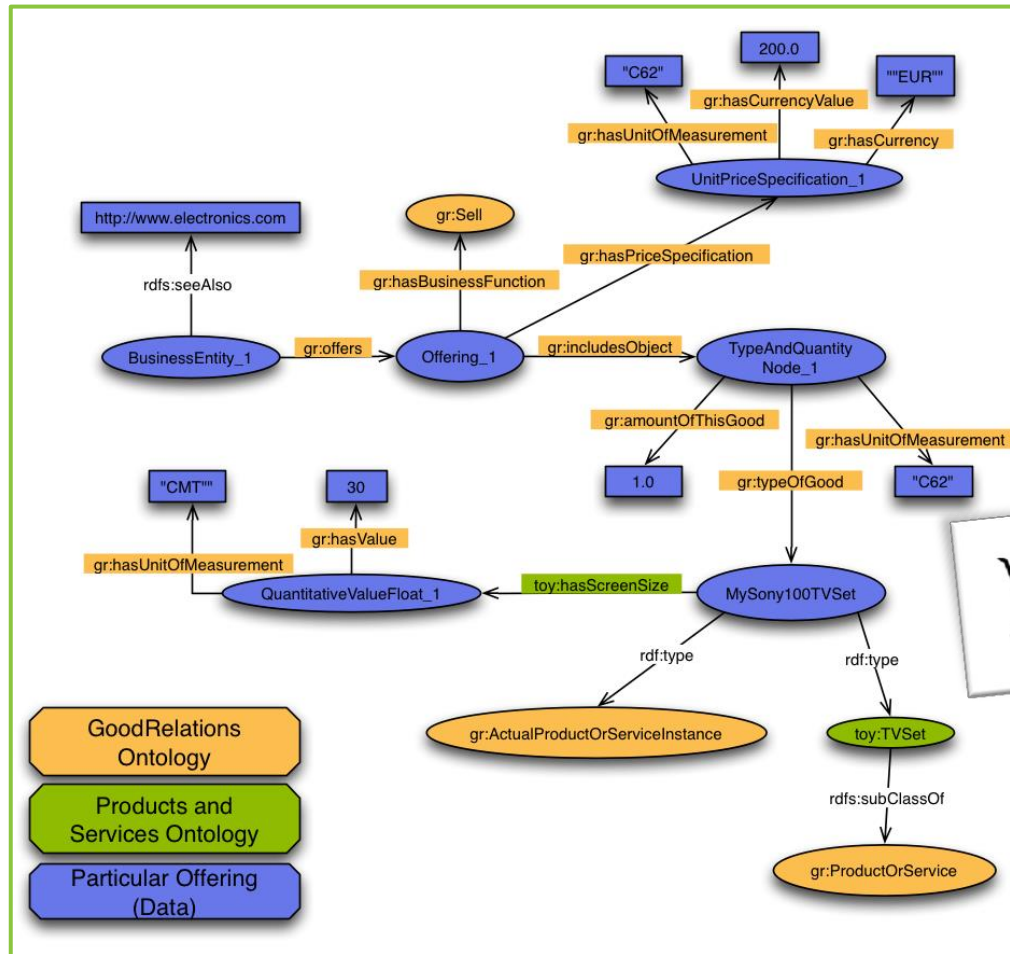


Image from <http://www.heppnetz.de/projects/goodrelations/primer/>: Hepp

Life sciences and healthcare




The Open Biological and Biomedical Ontologies

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[Ontologies](#)
[Resources](#)
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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



Title	Domain	Prefix	File	Last changed
Biological process	biological process	GO	go.obo 	
Cellular component	anatomy	GO	go.obo 	
Chemical entities of biological interest	biochemistry	CHEBI	chebi.obo 	
Molecular function	biological function	GO	go.obo 	
Ontology for biomedical investigations	experiments	OBI	obi.owl 	
Phenotypic quality	phenotype	PATO	quality.obo 	
Plant Ontology	anatomy and development	PO	plant_ontology.obo?view=co 	
Protein Ontology (PRO)	proteins	PR	pro.obo 	
Xenopus anatomy and development	anatomy	XAO	xenopus_anatomy.obo 	
Zebrafish anatomy and development	anatomy	ZFA	zfa.obo 	

OBO Foundry candidate ontologies and other ontologies of interest

Quick Links

-  [Mappings between ontologies](#)
-  [Download alternate formats](#)
-  [About the OBO Foundry](#)
-  [Current events](#)
-  [How to join](#)
-  [OBO Foundry paper](#) in *Nature Biotechnology*, November 2007

Other Ontology Lists

-  [OntoBee](#)
-  [Ontology Lookup Service \(OLS\)](#) (OBO Foundry term lookup)

<http://www.obofoundry.org/>

Getty vocabularies

The screenshot shows the Getty Research Institute website. The main heading is 'The Getty Research Institute'. Below it is a navigation bar with links for Events, Special Collections, Library, Search Tools & Databases, Scholars & Projects, Publications, and About the GRI. The page title is 'Getty Vocabularies as Linked Open Data'. The main text explains that the Getty vocabularies are constructed to allow their use in linked data and that a project to publish AAT, TGN, ULAN, and CONA to the LOD (Linked Open Data) cloud is underway. A logo for 'Linked Open data GETTY VOCABULARIES' is displayed. A list of links includes 'News and Status of the Project', 'What Is LOD?', 'Introduction to Getty Vocabularies as LOD (PDF, 3.8 MB, 46pp)', 'Linked Open Data Flier (PDF, 1 MB, 1pp)', and 'List of External Advisors (PDF, 88KB, 7pp)'. A note states that AAT and TGN are now available as LOD under the ODC-By 1.0 license. A bolded section states: 'Developers and programmers, technical documentation to help you explore the AAT and TGN data is available at the SPARQL endpoint at vocab.getty.edu'. A sidebar on the left contains a navigation menu under 'Explore the Getty' with categories like Visit, Museum, Research Institute, Conservation Institute, Foundation, Publications, and About the Getty. The 'About the Getty' section is expanded to show 'Getty Vocabularies' with sub-links for Art & Architecture Thesaurus (AAT), Cultural Objects Name Authority (CONA), Getty Thesaurus of Geographic Names (TGN), and Union List of Artist Names (ULAN).

<http://www.getty.edu/research/tools/vocabularies/lod/index.html>

SELECT ONTOLOGIES

Selecting relevant ontologies

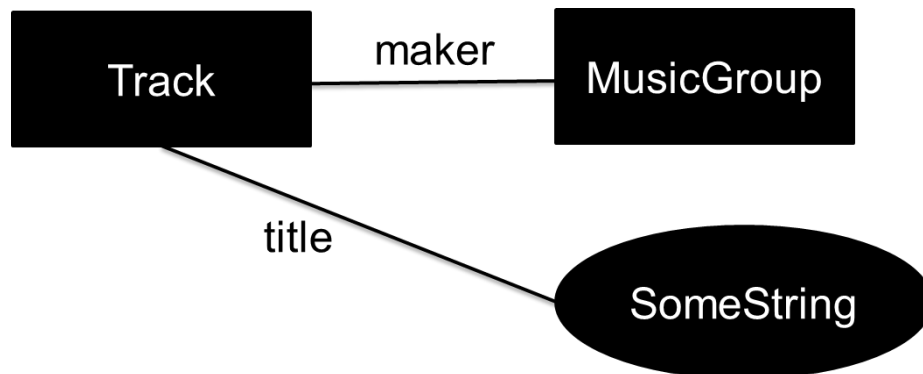
- Key: domain and usage
 - There are many different points of view upon a domain
 - Use popular ontologies
- You might need to adjust/expand an existing ontology to
 - Lexicalization
 - Implementation language (e.g., RDFS, OWL, frames, SKOS)
 - Level of granularity
 - Level of expressivity
 - Instance data
- Be aware of/that
 - Imports: transitive dependency between ontologies
 - Changes in imported ontologies can result in inconsistencies and changes of meanings and interpretations, as well as computational aspects

Brief introduction to ontology conceptualization

ADJUST/EXPAND

Basics

- Ontological primitives in this tutorial
- Classes
- Instances
- Attributes
- Relationships
- Literals



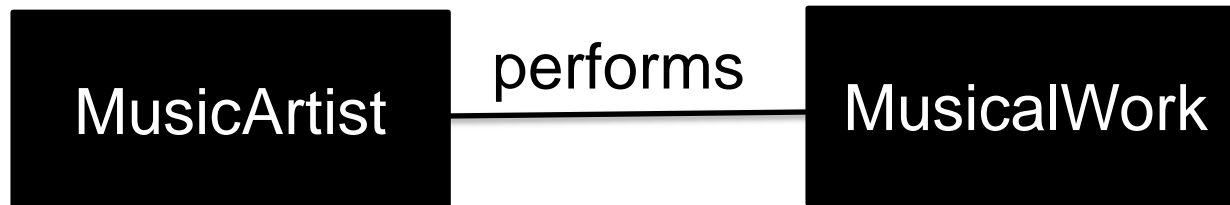
- In real applications
 - Ontology languages with different degrees of formality and support for
 - Different types of nodes
 - Different types of edges
 - Built-in features of nodes and edges
 - Nodes and edges may come from different ontologies
 - (Ideally) provenance metadata attached to nodes and edges

Example: OWL

- Classes
- Instances
 - Set of classes is not always disjunct from set of instances
- Datatype properties
- Object properties
- Constraints
 - Cardinality
 - Range constraints (all values, some values etc.)
- Others
 - Imports
 - Annotations
 - ...

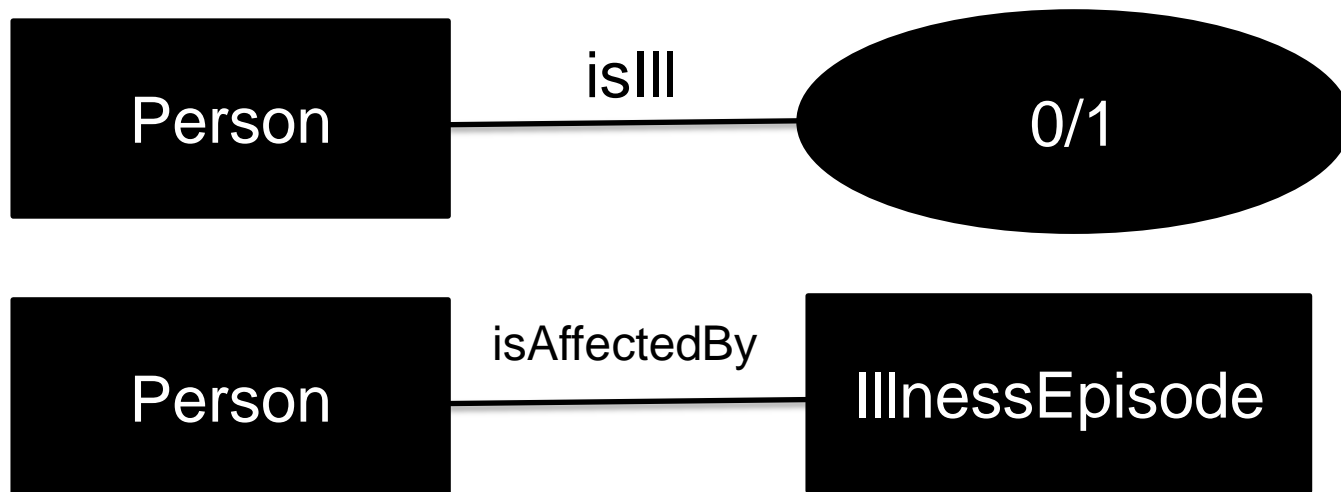
Classes

- A class represents a set of instances
- A class should be cohesive, meaningfully named, and relevant
- Classes represent domain concepts and not the words that denote these concepts
 - Synonyms for the same concept do not represent different classes



Classes (2)

- 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
 - No pronouns



Cohesiveness

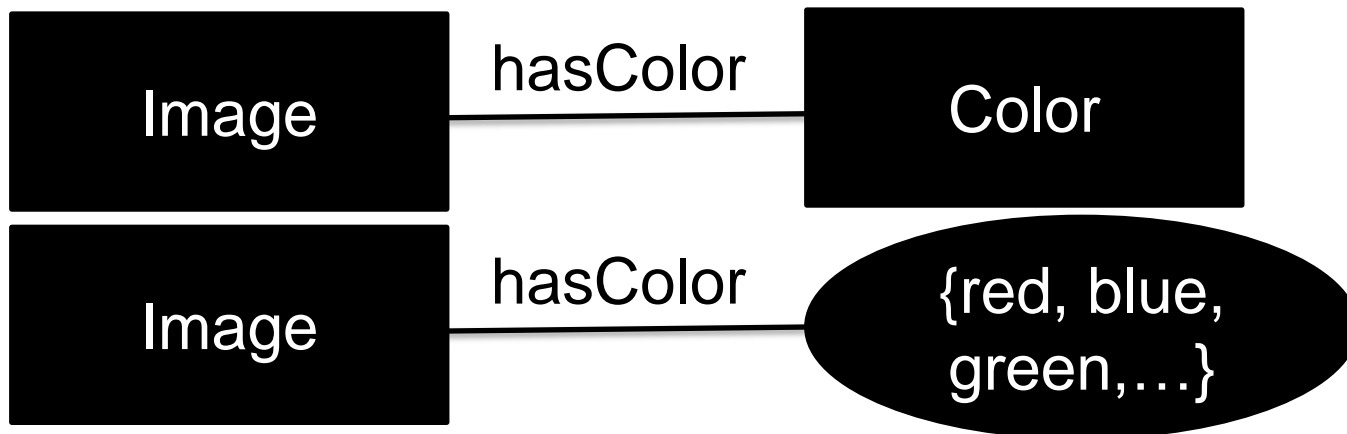
- A class should represent one thing, all of that thing and nothing but that thing
 - Why: Reusability, maintenance, see also OO design
- You can prove cohesion by giving the class a representative name, typically nouns
 - No plural form, e.g, Albums
 - No others, utilities etc.
- On a related note: avoid ambiguous terms
 - Manager, handler, processor, list, information, item, data etc.

Instances

- Entities of a certain type
 - Abstract entities (e.g., Jazz music) are allowed
- Issues
 - Distinction between classes and instances
 - Example: Stradivarius
 - Choice of the most appropriate class
 - Example: Violetta Valery
- Identity vs individuality: entities may change values, but remain members of the same class
 - Example: Age of child vs person

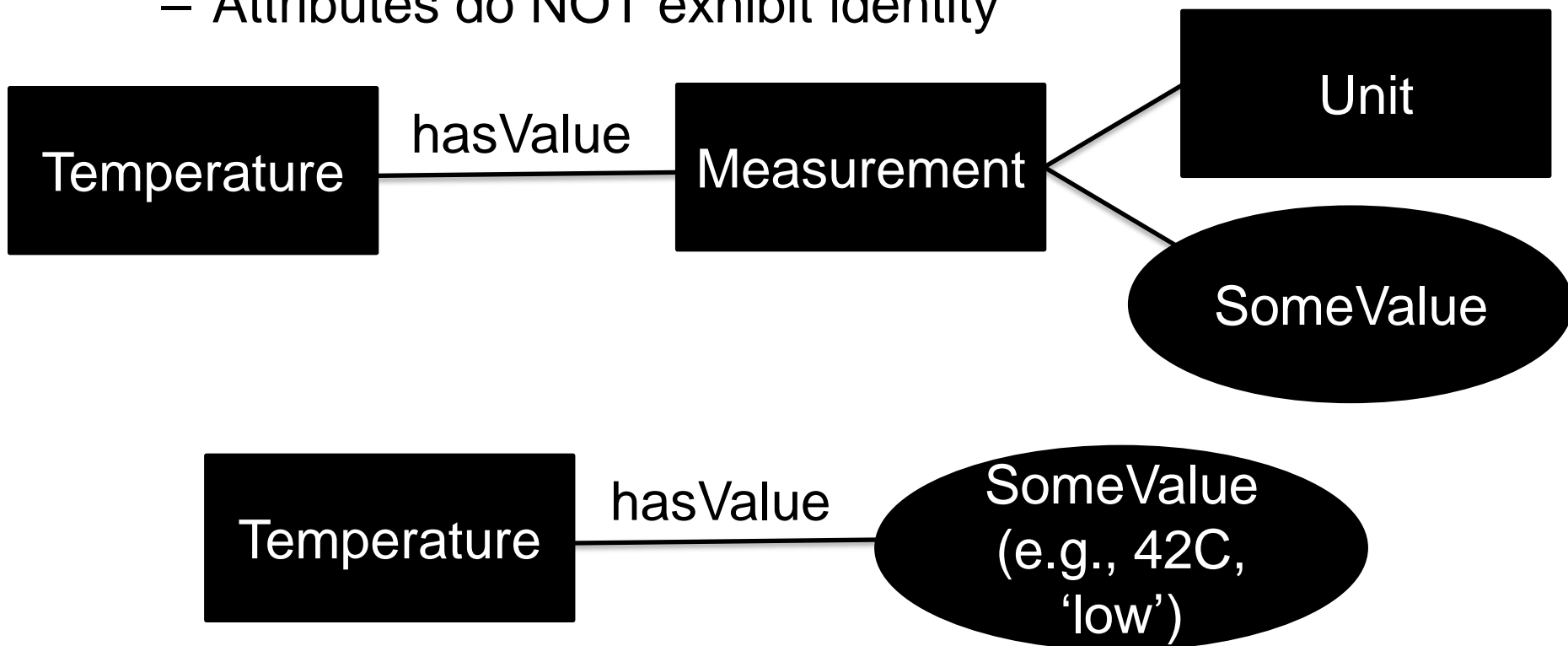
Characterizing classes

- Two types of principal characteristics
 - ‚Measurable‘ properties of a class: attributes
 - Inter-entity connections: relationships associations

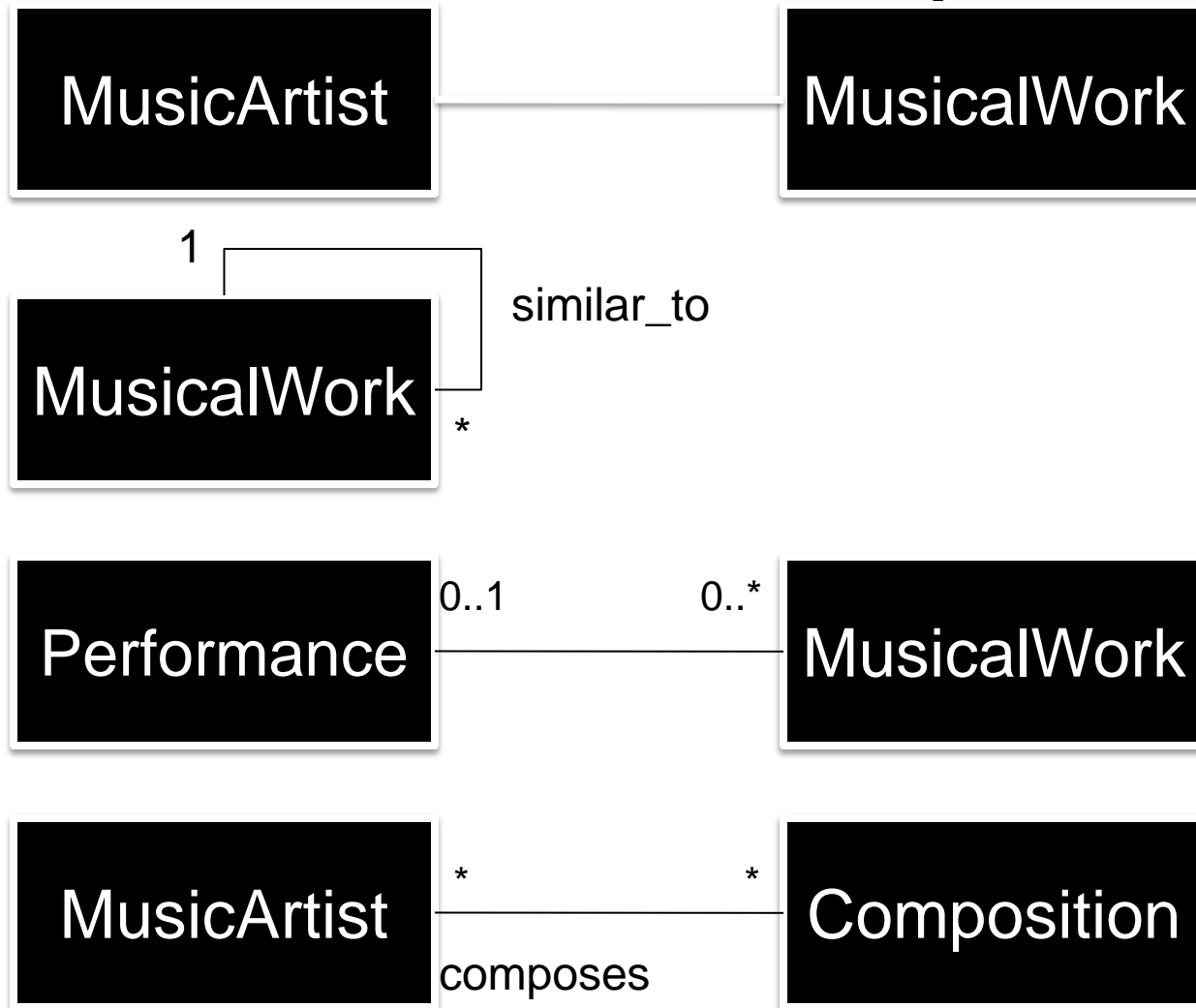


Attributes

- An attribute is a measurable property of a class
 - Scalar values: choice from a range of possibilities
 - Attributes do NOT exhibit identity



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
- A subclass has
 - Additional properties
 - Restrictions different from those of the superclass, or
 - Participates in different relationships than the superclasses
- Multiple inheritance may be possible

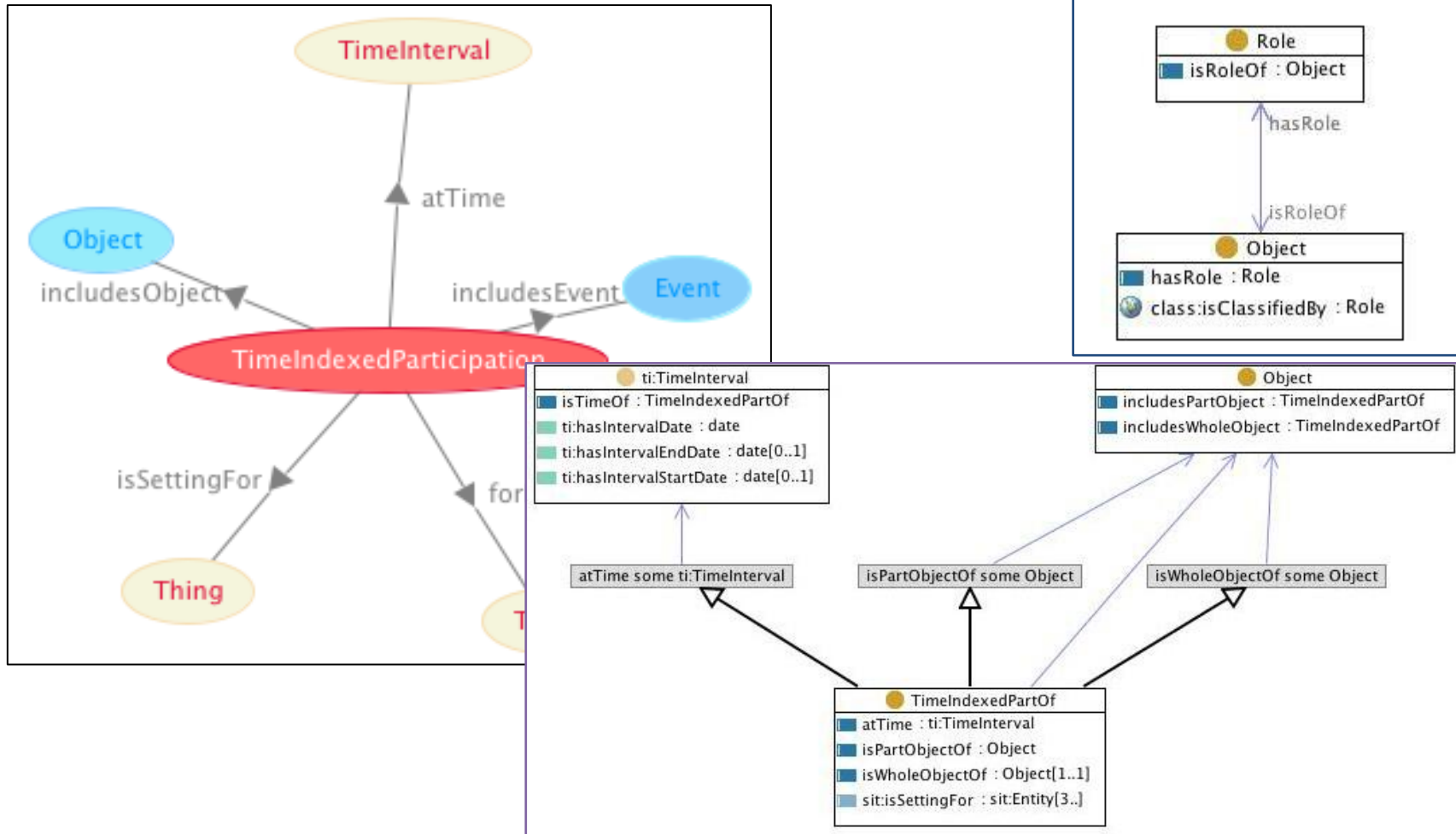
Class hierarchy (2)

- 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 might be necessary
- Roles are not subclasses
- Application dependent or subjective
 - Example: Artist and person
 - Example: Rectangle and square

Formal properties of ontologies

- Identity
 - Example: triangle as three edges of the same length vs edge length and angle
 - Example: the same clay vs the same statue
 - See also primary keys in ER modeling
- Types and roles
 - Roles hold because an instance happens to participate in some relationship with another instance (at some point in time), and not because they are essential to identify these instances
 - Example: Person vs student vs employee
- Dependence
 - Existence depends on other instance
 - Example: Student and university
- Concreteness
 - Has physical location (not necessarily real)
 - Example: Violetta Valery
- Unity
 - Is identified by the sum of its parts
 - Example: Piece of stone vs person vs pile of stones
- These properties are inherited along by subclasses and instances
- Used to
 - Test ontological consistency
 - Avoid unintended inferences
 - Improve extendibility
 - Improve reusability
- See also
 - OntoClean (<http://en.wikipedia.org/wiki/OntoClean>)

Ontology design patterns



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

Assignments

(in your free time)

Modeling: Unstructured to structured

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.

Modeling: different encodings

- Encode using the notation introduced in the tutorial

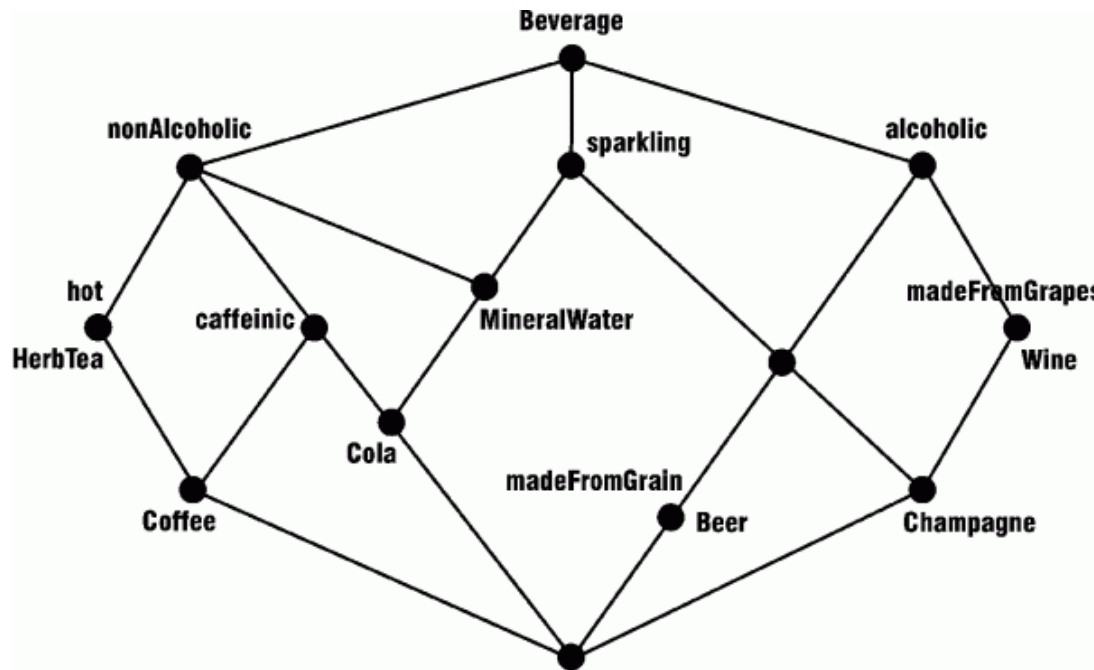


Image from <http://www.jfsowa.com/ontology/>



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