

Terminologies and other Knowledge Organization Systems

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Motivation and Purpose – Knowledge Organization Systems

- In this unit of TSS '11, we focus on the role of terminologies as tools to organize and retrieve knowledge (-> Knowledge Organization Systems, KOS)
- Major types of KOS are:
 - Thesauri (in information science: controlled vocabularies for indexing and information retrieval)
 - Classification systems (hierarchical concept systems, usually domain-specific, sometimes universal in scope)
 - taxonomies, nomenclatures (mostly in natural sciences, systematic arrangements of terms seen as “scientific names”)
 - Ontologies (in IT -> formal conceptual shared specifications, domain ontologies often created by formalizing the previously listed types of KOS)

Knowledge (organization) systems

- Cognitive knowledge systems
- collective knowledge systems, cultural systems, social systems, language and communication systems
- Formal knowledge systems, knowledge representation systems, “semantic systems” (Semantic Web)
- Applications:
 - Knowledge organization as part of knowledge management (Nonaka, Takeuchi, et al)
 - Knowledge organization as daily practice in libraries and information systems (for more than 2000 years)
 - Knowledge organization as formal representations in collective knowledge systems -> Semantic Web applications

What is knowledge organization?

1. A part of information and library science, a part of philosophy of science and of epistemology, but also of knowledge management and knowledge engineering
 - Investigating and representing structures of knowledge
 - Epistemological aspects, cognitive science aspects
 - Linguistic and socio-cultural aspects (e.g. folk taxonomies)
 - Historical aspects (e.g. Leibniz, encyclopedism, administrative categorizations in ancient societies, history of science, etc.)
2. Practical work: creating and using knowledge organization systems (see further down)
3. Knowledge organization is also a crucial process in linguistic action (sprachliches Handeln) – Text organization both in reception and production

Functions of knowledge organization systems

1. Instruments of structuring and archiving the content of large scale collections
2. Structural components of information systems
3. Support of targeted retrieval of information based on conceptual search criteria
4. Search aids, visual navigation, query languages
5. Communication support tools (cross-lingual, cross-disciplinary, cross-cultural)
6. Instruments of corporate knowledge management
7. Learning support, orientation support, didactic tools

Properties of knowledge organization systems

1. Conceptual structures (hierarchical and non-hierarchical structures)
2. Explicitation of conceptual links, definitions (mono- or multilingual)
3. Terminological and linguistic standardization
4. Increasingly formalized and digital (in particular as „ontologies“)
5. Different scales (from small KOS to large ones (more than 200.000 concepts))
6. Increasingly with visualized structures, interactive user interfaces
7. Static or *dynamic* (e.g. ontologies for modelling business processes in companies)

„Ontologies“ as formal knowledge systems

- Computer science: From Ontology as a traditional field of philosophy (theory of being, existence, theory of objects, etc.) to formal, digitally represented concept systems/ knowledge systems
- Concepts are explicitly defined – terms are assigned
- Relations between concepts are explicitated
- Terms are standardized
- Logical application rules and constraints are specified
- Ontologies as knowledge representation systems

Domain-specific knowledge organization systems

- Medicine, health, bio- and life sciences
- Business, trade
- Industry, engineering
- Natural sciences
- Administration, government
- Culture
- Pedagogy
- Linguistics
- Etc.

Thesaurus Example: EUROVOC

- Thesaurus of the European Union
- Using a ppt presentation by Chr. Laaboudi-Spoiden at the 2010 EUROVOC conference:

■ General and multidisciplinary

- 21 fields (domains)
 - Two-digit notation + heading
- 127 microthesauri
 - Four-digit notation + heading

■ Covers both European Union and national point of view

- with emphasis on parliamentary activities

04 POLITICS

- 0406 political framework
- 0411 political party
- 0416 electoral procedure and voting
- 0421 parliament
- 0426 parliamentary proceedings
- 0431 politics and public safety
- 0436 executive power and public service

0421 parliament

composition of parliament

- NT1 bureau of parliament
 - RT Bureau of the EP [1006]
- NT2 Deputy Speaker of Parliament
 - RT Vice-President of the EP [1006]
- NT2 Speaker of Parliament
 - RT President of the EP [1006]
- NT2 treasurer
 - RT Quaestor of the EP [1006]
- NT1 conference of presidents
- NT1 non-attached member
- NT1 parliamentary chamber
 - NT2 bicameral system
 - NT3 directly-elected chamber
 - RT universal suffrage [0416]
 - NT3 federal chamber
 - NT3 Upper House
 - NT2 unicameral system
- NT1 parliamentary committee
 - RT committee report [0426]
 - RT EP Committee [1006]
- NT2 ad hoc committee
- NT2 committee of inquiry
 - RT parliamentary inquiry [0421]
 - RT parliamentary scrutiny [0421]
 - RT power of assessment [0406]
 - RT supervisory power [0406]

EuroVoc - Multilingual content

- 22 official languages
- 2 other languages
 - Croatian and Serbian

Links to EuroVoc in other languages:

- EuroVoc, Europar Batasunaren thesaurus eleaniztuna
Basque
- EuroVoc, el thesaurus multilingüe de la Unió Europea
Catalan
- EuroVoc, многоязычный тезаурус Европейского Союза
Russian

EuroVoc – Language equivalence

■ Set of 6 797 concepts

- Preferred Terms
 - 24 language equivalences
- Non Preferred Terms
 - Language-dependent
- Symmetric equivalence
 - Preferred Terms
 - Relationships (BT/NT, RT)

04 POLITIKA

MT 0421 parlamentas

BT1 parlamento narys

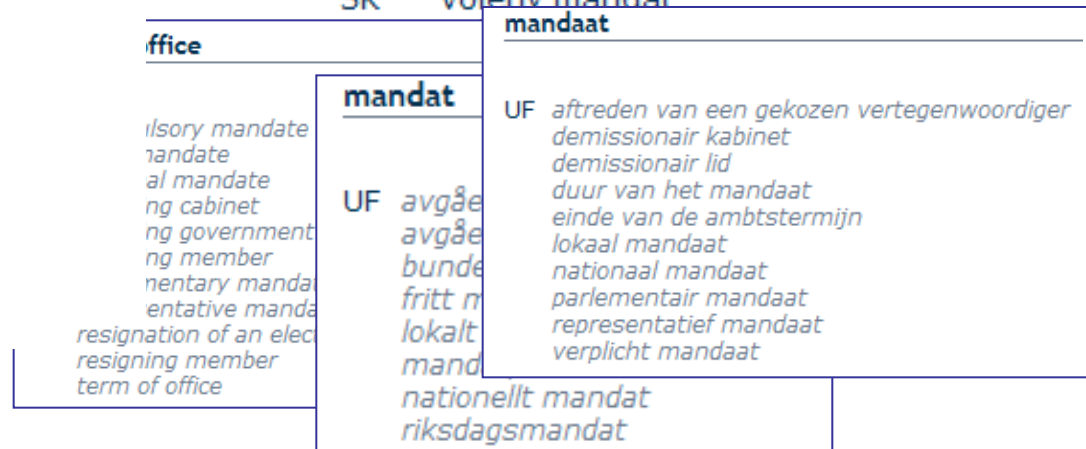
NT1 daugiapareigystė

RT parlamento paleidimas [0431]

rinkimai [0416]

LANGUAGE EQUIVALENTS

BG	избирателен мандат
ES	mandato electoral
CS	poslanecký mandát
DA	mandat
DE	Wahlmandat
ET	valitav ametikoht
EL	αιρετό αξίωμα
EN	elective office
FR	mandat électif
IT	mandato elettivo
LV	vēlēts amats
LT	renkamosios pareigos
HU	képviselői mandátum
MT	mandat elettorali
NL	mandaat
PL	mandat przedstawicielski
PT	mandato electivo
RO	mandat electoral
SK	volený mandát



EuroVoc – Previous Data Model

- One ID number per descriptors
 - 22 language equivalents
 - Standard thesaurus relationships
 - BT/NT (Broader/Narrower)
 - RT (Associative)
- Attributes
 - Non Descriptors
 - Scope Notes
 - Share the descriptor ID
 - “False” equivalence (USE/UF)

Descriptor

```
<RECORD>  
  <DESCRIPTOR_ID>5482</DESCRIPTEUR_ID>  
  <LIBELLE>climate change</LIBELLE>  
</RECORD>
```

Non Descriptor

```
<RECORD>  
  <DESCRIPTEUR_ID>5482</DESCRIPTEUR_ID>  
  <UF>  
    <UF_EL>global warming</UF_EL>  
    <UF_EL>climatic change</UF_EL>  
  </UF>  
</RECORD>
```

EuroVoc – Previous Data Model

Déclinaison				español (es)	
Descripteur	climate change			Descripteur	cambio climático
UF	climatic change	Déclinaison		UF	modificación del clima
	global warming	Descripteur	klima	UF	recalentamiento del clima
SN		UF	opvarr		
PERM	change, climate	SN		SN	
	change, climatic	PERM	klima	PERM	clima, modificación del
	warming, global		ændri		clima, recalentamiento del
		Relations			climático, cambio
		MT 5211	naturl		
Relations		BT1	klima	Relations	
MT 5211	natural environment	RT	drivhu	MT 5211	medio natural
BT1	climate		klima	BT1	clima
RT	climatology			RT	climatología
	greenhouse effect				efecto invernadero

© Laaboudi-Spoiden 2010

Standards

- ISO 2788-1986: monolingual (1986)
- ISO 5964-1985: multilingual (1985)

Descriptor - Non Descriptor

Revised by

→ ISO 25964: Thesauri and interoperability with other vocabularies

Preferred Term - Non Preferred Term

New Data Model - Concepts

CLIMATE CHANGE

THESAURUS CONCEPT

Thesaurus Concept
Multilingual

Attributes	
in group	▶ 5216 deterioration of the environment
identifier	5482
preferred term	<ul style="list-style-type: none"> ▶ bg -промяна на климата ▶ es -cambio climático ▶ cs -změna klimatu ▶ da -klimaændring ▶ de -Klimaveränderung ▶ et -kliimamuutus ▶ el -κλιματική αλλαγή ▶ en -climate change ▶ fr -changement climatique ▶ ga -changement climatique ▶ it -cambiamento climatico ▶ lv -klimata maiņa ▶ lt -klimato kaita ▶ hu -éghajlatváltozás ▶ mt -climate change ▶ nl -klimaatsverandering ▶ pl -zmiany klimatyczne ▶ pt -alteração climática ▶ ro -schimbare climatică ▶ sk -zmena podnebia ▶ sl -sprememba podnebja ▶ fi -ilmastonmuutos ▶ sv -klimatförändring ▶ hr -klimatska promjena ▶ sr -промена климе

URI= <http://eurovoc.europa.eu/5482>

climate change

UF *climatic change*
global warming

52 ENVIRONMENT

MT 5211 natural environment

BT1 climate

RT climatology [3606]
greenhouse effect [5216]

LANGUAGE EQUIVALENTS

BG	промяна на климата
ES	cambio climático
CS	změna klimatu
DA	klimaændring
DE	Klimaveränderung
ET	kliimamuutus
EL	κλιματική αλλαγή
EN	climate change
FR	changement climatique
IT	cambiamento climatico
LV	klimata maiņa
LT	klimato kaita
HU	éghajlatváltozás
MT	climate change (<i>under translation</i>)
NL	klimaatsverandering
PL	zmiany klimatyczne
PT	alteração climática
RO	schimbare climatică
SK	zmena podnebia
SL	sprememba podnebja
FI	ilmastonmuutos
SV	klimatförändring
HR	klimatska promjena
SR	промена климе

used term	
▶ es	-modificación del clima
▶ cs	-klimatická změna
▶ en	- climatic change
▶ lv	-klimatiskā izmaiņa
▶ hu	-az éghajlat változása
▶ ro	-schimbări climatice
▶ sk	-klimatická zmena

New Data Model – Thesaurus Terms

CLIMATE CHANGE

THESAURUS CONCEPT

Attributes	
in group	▶ 5216 deterioration of the environment
identifier	5482
preferred term	<ul style="list-style-type: none"> ▶ bg -промяна на климата ▶ es -cambio climático ▶ cs -změna klimatu ▶ da -klimaændring ▶ de -Klimaveränderung ▶ et -kliimamuutus ▶ el -κλιματική αλλαγή ▶ en -climate change ▶ fr -changement climatique ▶ ga -changement climatique ▶ it -cambiamento climatico ▶ lv -klimata maiņa ▶ lt -klimato kaita ▶ hu -éghajlatváltozás ▶ mt -climate change ▶ nl -klimaatsverandering ▶ pl -zmiany klimatyczne ▶ pt -alteração climática ▶ ro -schimbare climatică ▶ sk -zmena podnebia ▶ sl -sprememba podnebja ▶ fi -ilmastonmuutos ▶ sv -klimatförändring ▶ hr -klimatska promjena ▶ sr -промена климе
used term	<ul style="list-style-type: none"> ▶ es -modificación del clima ▶ cs -klimatická změna ▶ en -climatic change ▶ lv -klimatiskā izmaiņa ▶ hu -az éghajlat változás ▶ ro -schimbări climatice ▶ sk -klimatická zmena

Thesaurus Concept
Multilingual

URI= <http://eurovoc.europa.eu/5482>

Thesaurus Terms
[language specific]

URI= <http://eurovoc.europa.eu/125206>

CAMBIO CLIMÁTICO

PREFERRED TERM

Attributes	
permuted lexical form	climático, cambio
language	▶ Spanish
released with version	n/a
concept	▶ climate change
used term	▶ es -modificación del clima

New Data Model – Thesaurus Terms

URI= <http://eurovoc.europa.eu/125206>

CAMBIO CLIMÁTICO

PREFERRED TERM

Attributes

permutated lexical form climático, cambio

language ► Spanish

released with version n/a

concept ► climate change

used term ► **es** modificación del clima

cambio climático

UF *modificación del clima*
recalentamiento del clima

52 MEDIO AMBIENTE

MT 5211 medio natural

BT1 clima

RT climatología [3606]
efecto invernadero [5216]

LANGUAGE EQUIVALENTS

BG	промяна на климата
ES	cambio climático
CS	změna klimatu
DA	klimaændring
DE	Klimaveränderung
ET	kliimamuutus
EL	κλιματική αλλαγή
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HU	éghajlatváltozás
MT	climate change <i>(under translation)</i>
NL	klimaatsverandering
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PT	alteração climática
RO	schimbare climatică
SK	zmena podnebia
SL	sprememba podnebja
FI	ilmastonmuutos
SV	klimatförändring
HR	klimatska promjena
SR	промена климе

MODIFICACIÓN DEL CLIMA

SIMPLE NON PREFERRED TERM

Attributes

permutated lexical form clima, modificación del

language ► Spanish

released with version n/a

concept ► climate change

preferred term ► **es** cambio climático

modificación del clima

USE cambio climático

URI= <http://eurovoc.europa.eu/125207>

Data Model – Summary

- Concept (multilingual)
 - Concept – Terms relation
 - Standard relationships (BT/NT, RT)
 - Relations to the Microthesaurus
 - Group of concepts

climate change		LANGUAGE EQUIVALENTS
UF	<i>climatic change</i> <i>global warming</i>	
S2 ENVIRONMENT		
MT	5211 natural environment	
BT1	climate	
RT	climatology [3606] greenhouse effect [5216]	
BG		промяна на климата
ES		cambio climático
CS		změna klimatu
DA		klimaændring
DE		Klimaveränderung
ET		kliimamuutus
EL		κλιματική αλλαγή
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SL		sprememba podnebja
FI		ilmastonmuutos
SV		klimatförändring
HR		klimatska promjena
SR		промена климе

- Thesaurus terms (language-dependent)
 - Lexical representation of a concept in a given language
 - 2 types of term
 - Preferred term (PT)
 - Non preferred term (NPT)
 - Equivalence relation between PT/NPT (USE/UF)


climatic change
USE climate change

climate change
UF *climatic change*

- What's new ?
 - One **URI** by concept, term

EuroVoc Website

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Content language:

(fr) Français

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- Alphabetical index
- SKOS/XML

Your proposals

- Contribute
- New approved concepts

EuroVoc, the EU's multilingual thesaurus

EuroVoc is a multilingual, multidisciplinary thesaurus covering the activities of the EU, the European Parliament in particular. It contains terms in 22 EU languages (Bulgarian, Czech, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Hungarian, Italian, Latvian, Lithuanian, Maltese, Polish, Portuguese, Romanian, Slovak, Slovenian, Spanish and Swedish), plus Croatian and Serbian.

EuroVoc is managed by the Publications Office, which moved forward to ontology-based thesaurus management and semantic web technologies conformant to W3C recommendations as well as latest trends in thesaurus standards.

EuroVoc users include the European Parliament, the Publications Office, national and regional parliaments in Europe, plus national governments and private users around the world.

Links to EuroVoc in other languages:

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Basque
- EuroVoc, el tesaurus multilingüe de la Unió Europea
Catalan
- EuroVoc, многоязычный тезаурус Европейского Союза
Russian

Editorial content



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European Union law
Official Journal of the EU

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A common gateway to national law

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 Ted

Public procurement within the European Union

 CORDIS

The gateway to European research and development

 Whoiswho

The official directory of the European Union

Left menu

EuroVoc - Architecture

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Interface language: (en) English

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Content language: (fr) Français

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OWL



Ontology - Data model

XML
RDFTerminologies
Concept & Terms
[URI]

Workflow



SKOS/RDF

Partial SKOS

EuroVoc content
XHTML

PDF



XML/SKOS



XLS

Drupal (Web Content Management)

Oracle Text (Search engine)

EuroVoc Web site

ITM (Intelligent Topic Manager)

EuroVoc website – Browse the subject-oriented version

Domains

COLLAPSE ALL

☐ 04 POLITICS

- 0406 political framework
- 0411 political party
- 0416 electoral procedure and voting
- 0421 parliament
- 0426 parliamentary proceedings
- 0431 politics and public safety
- 0436 executive power and public service

☐ 08 INTERNATIONAL RELATIONS

- 0806 international affairs
- 0811 cooperation policy
- 0816 international balance
- 0821 defence

☐ 10 EUROPEAN COMMUNITIES

- 1006 Community institutions and European civil service
- 1011 European Union law
- 1016 European construction
- 1021 Community finance


☐ 12 LAW

- 1206 sources and branches of the law
- 1211 civil law
- 1216 criminal law
- 1221 justice
- 1226 organisation of the legal system
- 1231 international law
- 1236 rights and freedoms

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- Browse the subject-oriented version

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Interface language: (en) English

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cambiamento climatico

Content language:

(en) English

Simple search

Advanced search

Browse

Browse the subject-oriented version

Download

- By domain
- Permuted alphabetical
- Multilingual list
- Alphabetical index
- SKOS/XML

Your proposals

- Contribute
- New approved concepts

UF *riscaldamento del clima*

52 AMBIENTE

MT 5211 ambiente naturale

BT1 clima

RT climatologia [3606]

effetto serra atmosferico [5216]

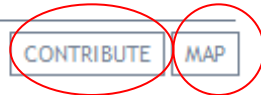
LANGUAGE EQUIVALENTS

BG	промяна на климата
ES	cambio climático
CS	změna klimatu
DA	klimaændring
DE	Klimaveränderung
ET	kliimamuutus
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SK	zmena podnebia
SL	sprememba podnebja
FI	ilmastonmuutos
SV	klimatförändring
HR	klimatska promjena
SR	промена климе
ru	климатска промена
sr	промена климе

EuroVoc website – Term details

- Preferred Term

national law



UF *domestic law*
internal law

legislation of the Member States

national legal system

national legislation

national regulations

12 LAW

MT 1206 sources and branches of the law

BT1 legislation

BT2 source of law

RT approximation of laws [1011]

LANGUAGE EQUIVALENTS

BG национално право

ES Derecho nacional

CS národní právo

DA national ret

DE nationales Recht

ET riigisisene õigus

EL εθνικό δίκαιο

EN national law

FR droit national

IT diritto nazionale

LV valsts tiesību akti

LT šalies teisė

HU nemzeti jog

MT national law (*under translation*)

NL nationaal recht

PL prawo krajowe

PT direito nacional

RO drept național

SK národné právo

SL nacionalno pravo

FI kansallinen oikeus

SV nationell rätt

HR nacionalno pravo

SR право државе чланице

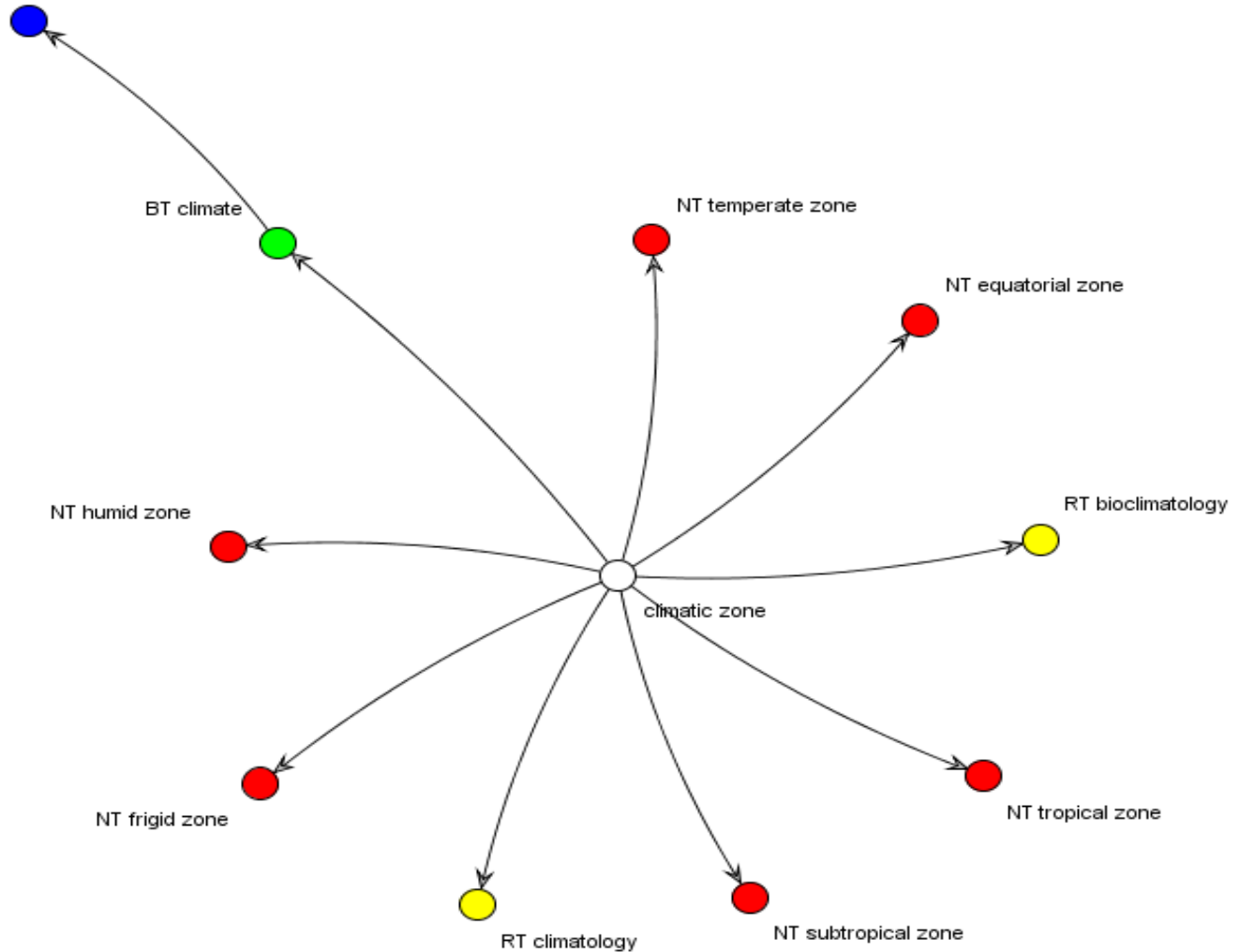
- Non Preferred Term

legislation of the Member States

USE national law

EuroVoc website – Map

MT 5211 natural environment



EuroVoc 4.4

- Lisbon Treaty
 - EC → EU
 - European Community → European Union

powers of the EC Institutions
powers of the EU Institutions
EC competition
EU competition

- Source of the proposals
 - The European Parliament (15%)
 - The national parliament libraries (SE, RO and SK)
 - Terminologists from EC DGT
 - EuroVoc users
 - The Publications Office

delegated decision
non-legislative act
legislative act
implementing regulation
special legislative procedure

- Online publication: first semester 2011

Your proposals

- Contribute
- New approved concepts

Ongoing and future developments of EUROVOC

- Available in SKOS
- Visualization
- Online version
- Thesaurus mapping and alignment – software support
- Update of content

Other major thesauri

- GEMET – General European Multilingual Environmental Thesaurus
- UNESCO Thesaurus
- CEDEFOP Thesaurus (vocational training)
- AAT – Art and Architecture Thesaurus
- AGROVOC Thesaurus (FAO)

- General trends:
 - Preparing for Semantic web applications
 - RDF, SKOS, Linked Data, ontologies
 - Networking/mapping/interoperability

http://protege.stanford.edu/ protege ontology editor

Datei Bearbeiten Ansicht Favoriten Extras ?

Favoriten Observatoire de linguistique... APA Style Essentials e-learning glossary. Instruc... xml-intl - Home Asia Online - The World Spe...

The Protégé Ontology Editor and Knowledge Acquisiti...



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welcome to protégé

news

25 April 2011
Protege 3.4.6 released!
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Protégé is a **free, open source** ontology editor and knowledge-base framework.

The Protégé platform supports two main ways of modeling ontologies via the **Protégé-Frames** and **Protégé-OWL** editors. Protégé ontologies can be exported into a variety of formats including RDF(S), OWL, and XML Schema. [\(more\)](#)

Protégé is based on Java, is extensible, and provides a plug-and-play environment that makes it a flexible base for rapid prototyping and application development. [\(more\)](#)

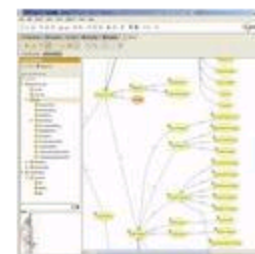
Protégé is supported by a **strong community** of developers and academic, government and corporate users, who are using Protégé for knowledge solutions in areas as diverse as biomedicine, intelligence gathering, and corporate modeling.

community

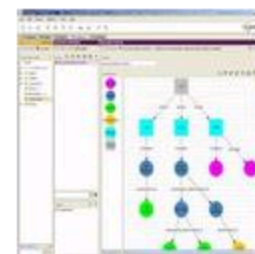
Registered Users	176,656
protege-users list members	17,307
protege-discussion list members	2,646
protege-owl list members	2,295

399

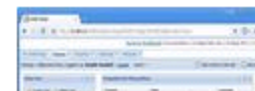
Gefällt mir



[go to protégé-owl](#)



[go to protégé-frames](#)





Welcome to the Protege Ontology Library!

This page is organized into the following groupings:

- [OWL ontologies](#)
- [Frame-based ontologies](#)
- [Ontologies in other formats \(e.g., DAML+OIL, RDF Schema, etc.\)](#)

If your ontology is available in multiple formats, please feel free to link to it from multiple sections.

Please make insertions in alphabetical order. Thank you !!!

navigation

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- [All Properties](#)
- [All Templates](#)
- [All Forms](#)
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search

toolbox

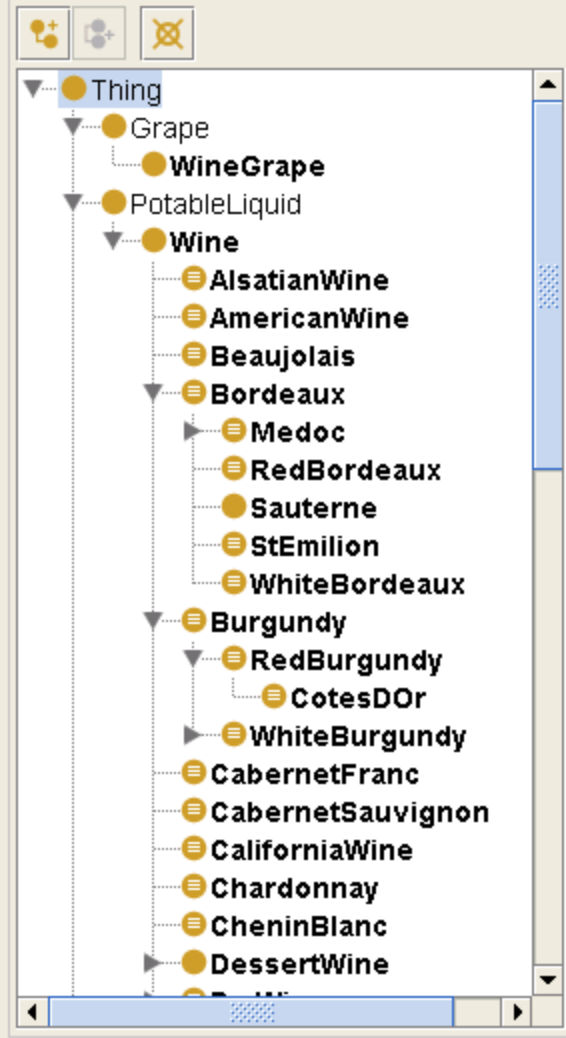
- [What links here](#)
- [Related changes](#)
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- [Printable version](#)
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OWL ontologies

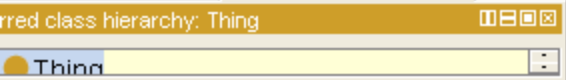
Information on how to open OWL files from the [Protege-OWL editor](#) is available on the main Protege Web site. See the [Creating and Loading Projects](#) section of the [Getting Started with Protege-OWL](#) Web page. Other ways to search for OWL ontologies include using Google: <http://www.google.com/search?q=filetype:owl+owl>, or the SemanticWeb search engine [Swoogle](#).

- [AIM@SHAPE Ontologies](#): Ontologies pertaining to digital shapes. Source: [AIM@SHAPE NoE](#) - Advanced and Innovative Models And Tools for the development of Semantio-based systems for Handling, Acquiring, and Processing knowledge Embedded in multidimensional digital objects.
- [amino-acid.owl](#): A small OWL ontology of amino acids and their properties. Source: [Amino Acid Ontology Web site](#).
- [Basic Formal Ontology \(BFO\)](#)
- [bhakti.owl](#): An OWL ontology for the transcendental states of consciousness experienced by practitioners of bhakti-yoga, a form of Vedic consciousness engineering.
- [Biochemical Ontologies](#): Over 30 ontologies for knowledge representation and reasoning across scientific domains. Ontologies are normalized into non-disjoint primitive skeletons and complex class expressions for DL reasoning. Ontologies describe atoms, bonds, molecules, macromolecules and the processes they participate in.
- [BioPAX](#): An OWL ontology for biological pathways, which is primarily used to exchange data between pathway resources.
- [BIRNLex](#): An ontology created by and for the [Biomedical Informatics Research Network \(BIRN\)](#) in order to provide a shared semantic framework in which to annotate BIRN data related to multi-resolucional, cross-species studies of neurodegenerative disease. BIRNLex follows the OBO Foundry best practices and makes use of other OWL-based OBO ontologies.
- [Black Pepper Ontology](#): A black pepper ontology created for [DataIndia.ORG](#) to provide support for farm automation and agro-processing. Joint project between [AMAL JYOTHI College of Engineering](#) and [Dr. M.G.R. University](#).
- [BreastCancerOntology](#): An OWL ontology for describing some features of Breast Cancer; Basic model is stable, but still being fleshed out.

Asserted Class Hierarchy: Thing



Inferred class hierarchy



Class Annotations Class Usage RDF/XML Rendering

Class Usage: Thing

Usage for: Thing

- Beaujolais**
 - Beaujolais **subClassOf** madeFromGrape **max** 1 Thing
- CabernetFranc**
 - CabernetFranc **equivalentTo** Wine
 - and** madeFromGrape **value** CabernetFrancGrape
 - and** madeFromGrape **max** 1 Thing
- CabernetFrancGrape**
 - CabernetFrancGrape **types** Thing
- CabernetSauvignon**
 - CabernetSauvignon **equivalentTo** Wine
 - and** madeFromGrape **value** CabernetSauvignonGrape
 - and** madeFromGrape **max** 1 Thing
- CabernetSauvignonGrape**
 - CabernetSauvignonGrape **types** Thing
- Chardonnay**
 - Chardonnay **equivalentTo** Wine

Class description Navigation view

Class Description: Thing

Equivalent classes +

For more information on ontologies, knowledge organization systems, on our projects mentioned above, on further reading, related tools, etc.

Please contact

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