WORKSHOP ON URBAN ONTOLOGIES

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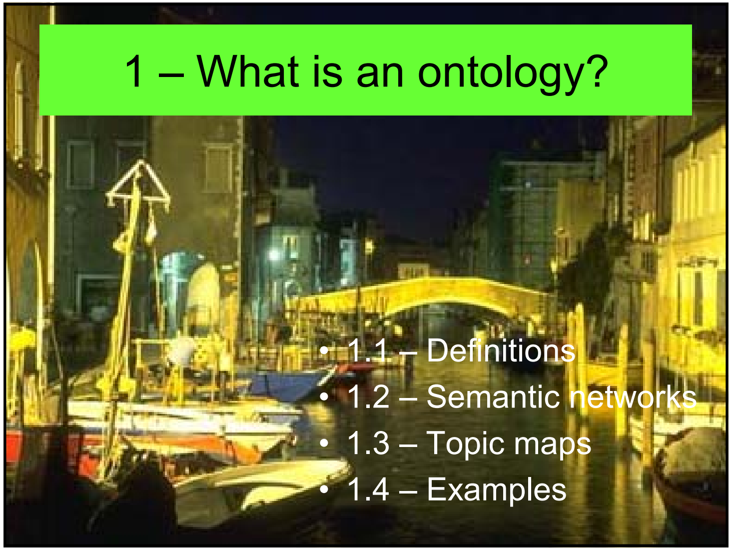
Contents



1 – What is an ontology?

- 1.1 – Definitions
- 1.2 – Semantic networks
- 1.3 – Topic maps
- 1.4 – Examples

1.1 – Definition

- Οντος = Being ; Λογια = discourse
- **Def1**: theory of objects of and their relations
- **Def2**: theory concerning entities, and especially entities in languages
- **Def3**: An ontology is an explicit specification of a conceptualization (Gruber)

Definition

- Ontology (capital "o"):
  - a philosophical discipline.
- An ontology (lowercase "o"):
  - specific artifact designed with the purpose of expressing the intended meaning of a vocabulary

Definition

- **Nicola Guarino** : *"An ontology is an engineering artifact, constituted by a specific vocabulary used to describe a certain reality, plus a set of explicit assumptions regarding the intended meaning of the vocabulary words"* (Guarino, 1998)

What is an ontology?

- A semantic network
- A formal description of a vocabulary
- According to Gruniger et al., ontologies can provide the following:
  - Communication between humans and machines,
  - Structuring and organizing the virtual libraries, and the receptacles of the plans,
  - Reasoning by inference, particularly in very large databases

What an **Ontology** is NOT!!!

- not a collection of facts arising from a specific situation
- not a model of an application domain
- not a database schema
- not a knowledge base
- not a taxonomy
- not a vocabulary or dictionary
- not a semantic net

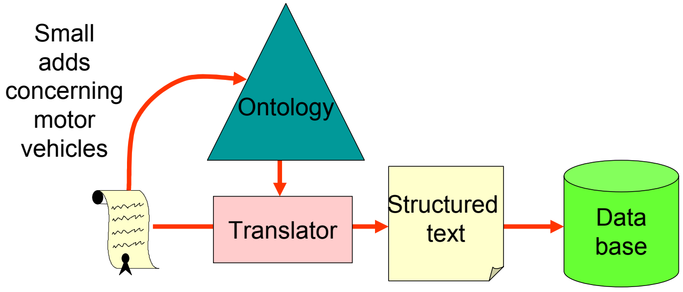
Why ontologies?

- Data integration
  - Semantic integration of n databases
  - without the great “o” would require *n*n* integration attempts
  - with the great “o” would require *n* attempts
- Data annotation
  - full-fledged ontology not required
  - since main purpose is fixed unique reference point in the for of controlled vocabulary

Declarative semantics

- Describe a representation (for instance with first order logics) of an agreed conceptualization of the real world
- Need the agreement of all stakeholders on all aspects (past, current or future) on all observations, facts, rules, etc.
- Assume the existence of confidence and of an authority

Example of using an ontology



Ontology = Conceptualization

- **Basic idea** : Replace the domain of semantic interpretation

  (= conceptualization) by an ontology
- => redefine an ontology as a math object

Ontology = Conceptualization

- Very long description in extension, few rules
- Providing all possible or plausible facts
- Organization by domains, contexts or application
- Where to find a list of terms?
- Is there an authority able to define a "chair"?

Domain or application ontologies

- Building an ontology is similar to data conceptual modelling
- At application/domain level, an ontology can include constraints, rules and derived rules
- No storing problem

Different classifications (Kavouras)

Ontology	Category_type
CORINE Land Cover	Peat bog
	Water course
	Water body
MEGRIN	Bog
	Canal
	Lake/ pond
	Salt marsh
	Salt pan
	Watercourse
WordNet	Body of water
	Bog
	Canal
	Lake
	Pond
	Salt pan
	Watercourse
	Watercourse

Formal Ontological Analysis

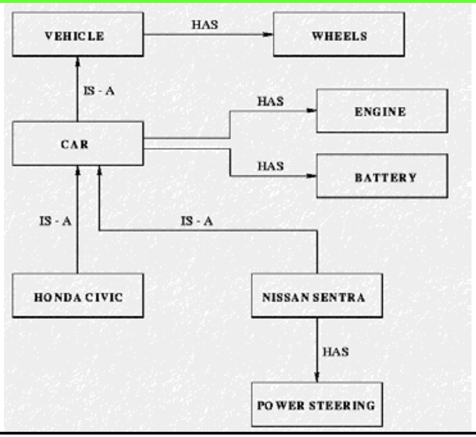
- Theory of Parts
- Theory of Wholes
- Theory of Essence and Identity
- Theory of Dependence
- Theory of Qualities
- Theory of Composition and Constitution
- Theory of Participation
- Theory of Representation

A common ontology vocabulary should be based on these theories!!

1.2 – Semantic networks

- Invented by Sowa
- Example

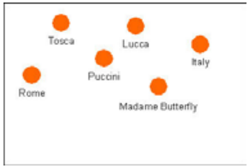
Example with only two relations



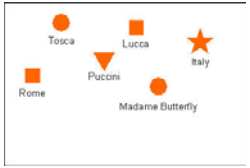
1.3 – Topic maps

- *"Topic maps are used for describing knowledge structures and associating them with information resources. As such they constitute an enabling technology for knowledge management".*
- http://www.ontopia.net/topicmaps/materials/tao.html
- Standard: ISO 13250

Topic maps



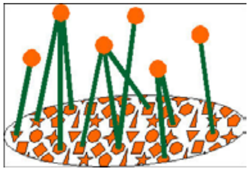
Topics



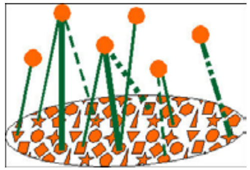
Topic types

http://www.ontopia.net/topicmaps/materials/tao.html

Topic maps

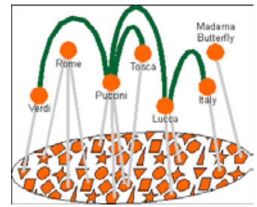


Occurences

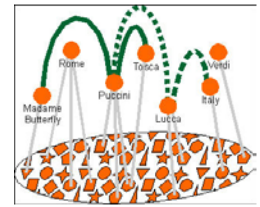


Occurrence types

Topic maps

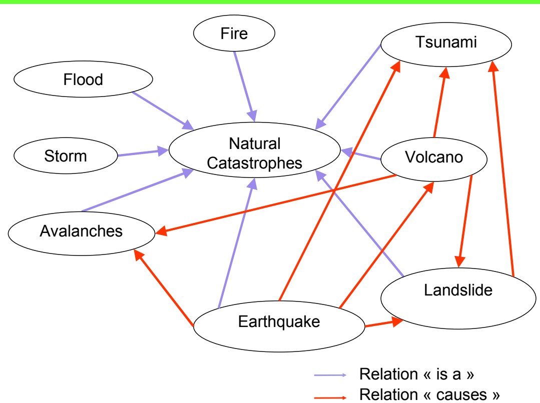


Topic association

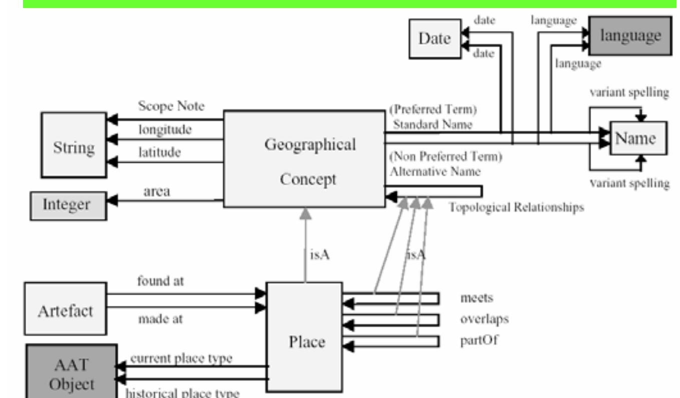


Topic association types

1.4 – Example of ontology

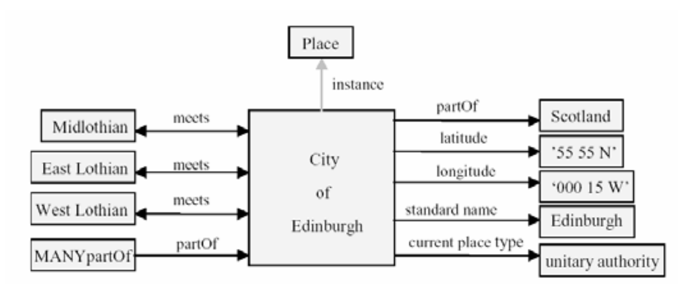


Example "*Place*"



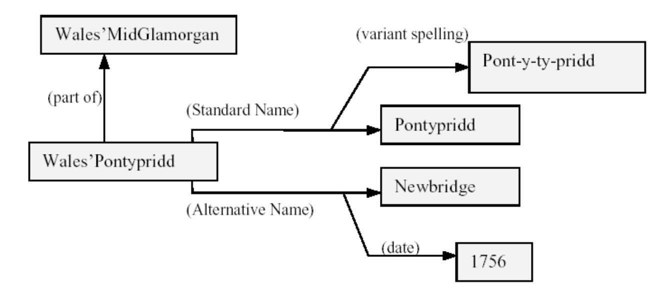
Alani, H. (2001) *Spatial and Thematic Ontology in Cultural Heritage Information Systems.* PhD,. http://eprints.ecs.soton.ac.uk/6147/

City of Edinburgh



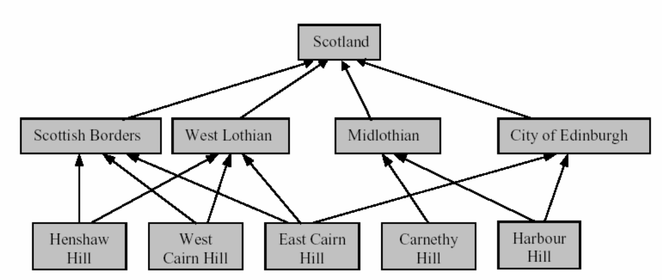
The ontological representation of the City of Edinburgh.

Toponyms (Example)



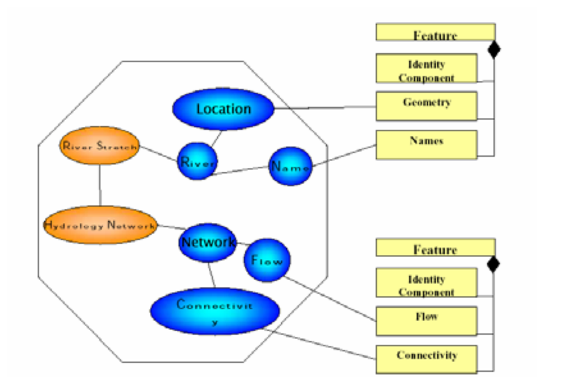
Associating place names with variant spellings and dates.

Toponyms (Example)



A spatial hierarchy of *part of* relationships for a set of hills in Scotland.

Features



2 – Ontology-based interoperability

Ontology-based interoperability

- 2.1 – What is interoperability?
- 2.2 – Sharing an ontology
- 2.3 – Mediation

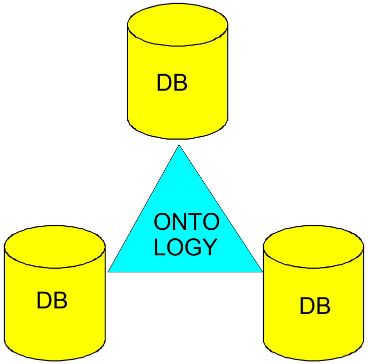
2.1 – What is interoperability?

- *"the ability of two or more systems or components to exchange information and to use the information that has been exchanged" (IEEE)*

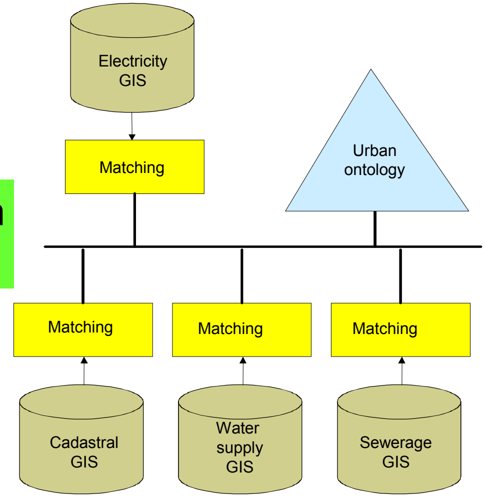
Interoperability between several GIS

- For each database, its own ontology (based on entity-relationship conceptual models)
- Creation of a domain ontology
  - Traffic
  - Electricity supply
  - Etc.

Ontology-based interoperability



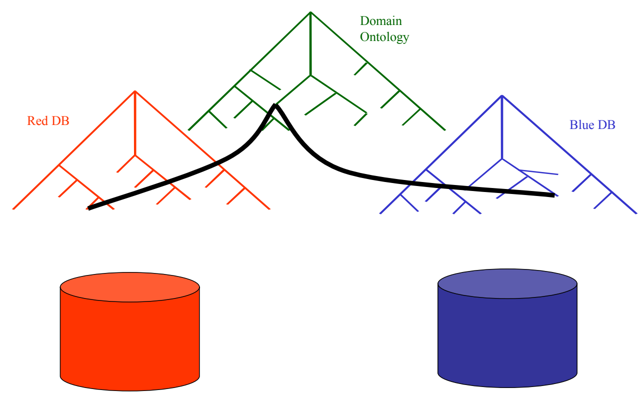
Sharing an ontology



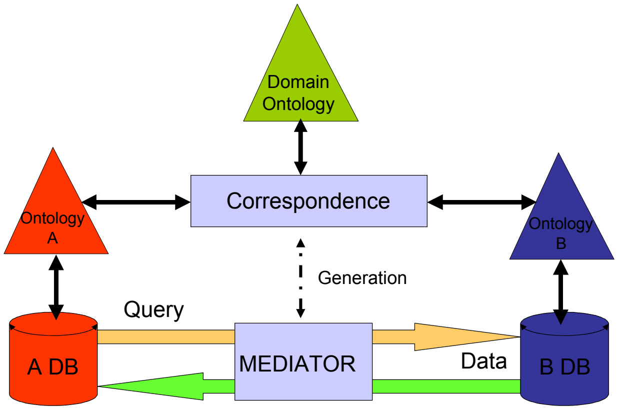
Interoperability

- Discrepancies in data modelling
- Syntactic level
  - Data structures
  - OpenGIS
- Semantic level
  - Discrepancies in representations
  - Linguistic problems
  - Ontology

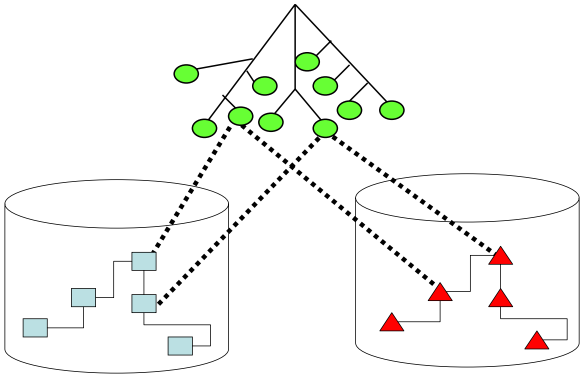
Ontology-based Interoperability



Correspondence with mediators



Example in demography



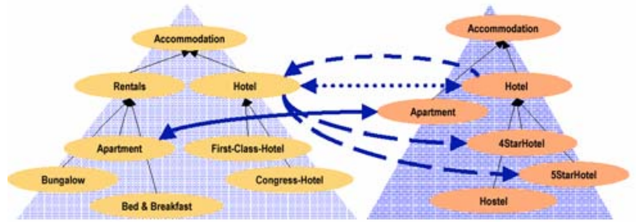
Example of mediator (1)

- DB Content :
  - DB1 : 1 entity « residents »
  - DB2 : 2 entities « men» and « women »
- How to get
  - DB1 : Men and women?
  - DB2 : Residents?

Example of mediator (2)

- Solution: with mediators
- Exact mediators
  - DB2.residents= DB2.men + DB2.women
- Approximate mediators
  - DB1.men = 0.48×DB1.residents
  - DB1.women = 0.52×DB1.residents

Ontology alignment



IAO.APARTMENT	is a synonym of	SAO.apartment
IAO.HOTEL	is a hyponym of	SAO.hotel
IAO.HOTEL	is a hypernym of	SAO.4StarHotel
IAO.HOTEL	is a hypernym of	SAO.5StarsHotel
<IAO.HOTEL,80%>	overlaps	<SAO.Hotel,50%>
IAO.PRICE	is a synonym of	SAO.price

http://www.laser-scan.com/eurosdr/ontologies/pres/A1-euroSDR_stuckensmidt.pdf

3 – XML

Business Week, March 18, 2002

- *"XML is only the first step to ensuring that computers can communicate freely. XML is an alphabet for computers and, as everyone who travels in Europe knows knowing the alphabet doesn't mean you can speak Italian of French"*

3 – XML

- 3.1 – What is XML?
- 3.2 – XML extensions for geodata
- 3.3 – Ontological languages

3.1 – What is XML?

- XML = Extensible Markup Language
- Generalization of HTML distinguishing contents and presentation
- Example:
  - <parcel>
  - <parcel_number> 457 LM 89 </parcel_number>
  - . . . .
  - </parcel>

Goals of XML

- XML shall be straightforwardly usable over the Internet.
- XML shall support a wide variety of applications.
- XML shall be compatible with SGML.
- It shall be easy to write programs which process XML documents.
- The number of optional features in XML is to be kept to the absolute minimum, ideally zero.
- XML documents should be human-legible and reasonably clear.
- The XML design should be prepared quickly.
- The design of XML shall be formal and concise.
- XML documents shall be easy to create.
- Terseness in XML markup is of minimal importance

Advantages

- human-legible contents
- unstructured contents
- mixing data and metadata
- allowing interoperability

Drawbacks

- very long description
- absence of indexing
- difficulties of encoding very large geographic databases.

XML = Simpler SGML

- XML is a meta-language.
  - A meta-language is a language that's used to define other languages. You can use XML for instance to define a language like WML.
  - XML is a smaller version of SGML. It's easy to master and that's a major advantage compared to SGML which is a very complex meta-language.

Define your own tags

- In XML, you define your own tags.
- Examples <TUTORIAL> or <STOCKRATE>,
- This definition is stored in a DTD (Document Type Definition). You can define your own DTD or use an existing one.
- Defining a DTD actually means defining a XML language.
- An alternative for a DTD is Schema.

Tags

- XML tags are created like HTML tags. There's a start tag and a closing tag.
- <TAG>content</TAG>
- The closing tag uses a slash after the opening bracket, just like in HTML.
- The text between the brackets is called an element.

Syntax

- The following rules are used for using XML tags:
- Tags are case sensitive. The tag <TRAVEL> differs from the tags <Travel> and <travel>
- Starting tags always need a closing tag
- All tags must be nested properly
- Comments can be used like in HTML: <!-- Comments -->
- Between the starting tag and the end tag XML expects the content.
- <amount>135</amount> is a valid tag for an element amount that has the content 135

Elements

- Elements and children
- With XML tags you define the type of data. But often data is more complex. It can consist of several parts.
- To describe the element car you can define the tags <car>mercedes</car>. This model might look like this:

```
<car>
   <brand>volvo</brand>
   <type>v40</type>
   <color>green</color>
</car>
```

The XML declaration

- The first line of an XML document is the XML declaration.
- It's a special kind of tag:

  <?xml version="1.0"?>

- The version 1.0 is the actual version of XML.
- The XML declaration makes clear that we're talking XML and also which version is used. The version identification will become important after new versions of XML are used.

Structure of an XML page

```
<?xml version="1.0"?>
<root>
   <element>
        <sub-element>
                content
        </sub-element>
        <sub-element>
                content
        </sub-element>
   </element>
</root>
```

A real XML page

```
<?xml version="1.0"?>
<sales>
  <shop>
    <number>
      100
    </number>
    <manager>
      Ray Bradbury
    </manager>
  </shop>
  <product>
    <name>
      carrots
    </name>
    <totalprice>
      10
    </totalprice>
  </product>
</sales>
```

Attributes

- Elements in XML can use attributes. The syntax is:
  <element attribute-name = "attribute-value">....</element>
- The value of an attribute needs to be quoted, even if it contains only numbers.
- An example
-

<car color = "green">volvo</car>

Rules of well-formed XML doc

- it contains a root element
- all other elements are children of the root element
- all elements are correctly paired
- the element name in a start-tag and an end-tag are exactly the same
- attribute names are used only once within the same element

Defining the language

- To use XML you need a DTD (Document Type Definition).
- A DTD contains the rules for a particular type of XML-documents.
- Actually it's the DD that defines the language.

Defining elements

- A DTD describes elements. It uses the following syntax: The text <! ELEMENT, followed by the name of the element, followed by a description of the element.
- For instance:

<!ELEMENT brand (#PCDATA)>

- This DTD description defines the XML tag <brand>.

Data

- The description (#PCDATA) stands for parsed character data.
- It's the tag that is shown and also will be parsed (interpreted) by the program that reads the XML document.
- You can also define (#CDATA), this stands for character data.
- CDATA will not be parsed or shown.

Sub-elements

- An element that contains sub elements is described thus:

<!ELEMENT car (brand, type) >

<!ELEMENT brand (#PCDATA) >

<!ELEMENT type (#PCDATA) >

- This means that the element car has two subtypes: brand and type. Each subtype can contain characters.

Number of sub elements

- If you use <!ELEMENT car (brand, type) >, the sub elements brand and type can occur once inside the element car. To change the number of possible occurrences the following indications can be used:
- + must occur at least one time but may occur more often
- * may occur more often but may also be omitted
- ? may occur once or not at all
- The indications are used behind the sub element name. For instance:
- <!ELEMENT animal (color+) >

Empty tags

- Besides a starting tag and a closing tag, you can use an empty tag. An empty tag does not have a closing tag.
- The syntax differs from HTML:
- <TAG/>

Showing the results

- Often it's not necessary to display the data in a XML document. It's for instance possible to store the data in a database right away.
- If you want to show the data, you can. XML itself is not capable of doing so.
- But XML documents can be made visible with the aid of a language that defines the presentation.
- XSL (eXtensible Stylesheet Language) is created for this purpose. But the presentation can also be defined with CSS (Cascading Style Sheets).

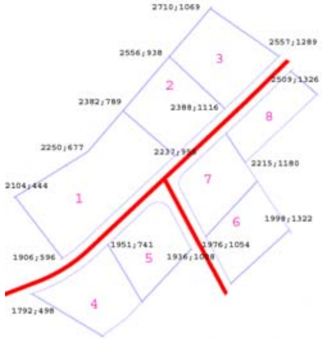
XML: What it can do?

- With XML you can :
  - Define data structures
  - Make these structures platform independent
  - Process XML defined data automatically
  - Define your own tags
- With XML you cannot
  - Define how your data is shown. To show data, you need other techniques.

3.2 – XML and geodata

- SVG
  - Scalable Vector Graphics (SVG)
  - Only 2D data
  - Animation is possible
- GML
  - Geographic Markup Language
  - OpenGIS
- LandXML
  - Cadasters, engineering and land surveys works

Example of encoding



Example with GML

```
<desc>Parcel Lot #4</desc>
  <g>
     <polyline points="741,-1951 700,-1913"/>
     <polyline points="528,-1804 498,-1792"/>
     <polyline points="498,-1792 724,-1657"/>
     <polyline points="724,-1657 799,-1712"/>
     <polyline points="7994,-1712 850,-1767"/>
     <polyline points="850,-1767 741,-1951"/>
  </g>
```

Example with LandXML

```
<Parcel name="Lot #4" area="49292.93" >
    <Center>1793.64 698.59</Center>
    <CoordGeom>
        <Line length="55.85" dir="223.38" >
            <Start>1951.79 741.45</Start>   <End>1913.43 700.86</End>
        </Line>
        <Curve rot="cw" radius="530" length="205.35" crvType="arc" chord="204.06" tangent="103.98"
            delta="22.19" dirStart="133.38" dirEnd="291.18" >
            <Start>1913.43 700.86</Start> <Center>2298.59 336.79</Center>
            <End>1804.42 528.36</End>
        </Curve>
        <Line length="31.89" dir="201.18" >
            <Start>1804.42 528.36</Start> <End>1792.89 498.62</End>
        </Line>
        <Line length="263.07" dir="328.96" >
            <Start>1792.89 498.62</Start> <End>1657.24 724.02</End>
        </Line>
        <Line length="94.09" dir="36.20" >
            <Start>1657.24 724.02</Start> <End>1712.83 799.94</End>
        </Line>
        <Line length="74.24" dir="47.09" >
            <Start>1712.83 799.94</Start>  <End>1767.21 850.48</End>
        </Line>
        <Line length="214.38" dir="120.56" >
            <Start>1767.21 850.48</Start>  <End>1951.79 741.45</End>
        </Line>
    </CoordGeom>
</Parcel>
```

3.3 – Ontological languages

- KIF
- Extensions of XML
  - SHOE
  - XOL
  - RDF e RDF(S)
  - OIL
  - DAML+OIL
  - **OWL**

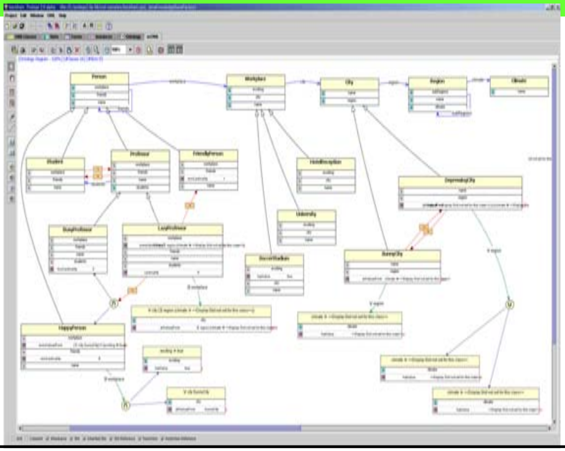
MicroKosmos

Ontological Languages

	KIF/OKBC/ CG/CycL	UML	Topic Maps / XTM	RDF(S)	DAML + OIL	OWL
Description	Legacy KR Languages	Universal Modeling Language	Topic Maps/XML Topic Maps	Resource Description Framework	DARPA ML + Ontology Inference	Web Ontology Language
Governance	ANSI American National Standards Institute /Other	OMG	ISO	W3C	DARPA	W3C
Years since proposed	>5	>5	>5	>3	3 or less	3 or less
Commercial Support (as a KRL)	☐	☐	☐☐	☐☐☐☐	☐☐☐	☐
Open Source Support	Yes	Yes	Yes	Yes	Yes	Coming

☐ 2 or less vendors ☐☐☐ 10 or less vendors
☐☐ 5 or less vendors ☐☐☐☐ > 10 vendors

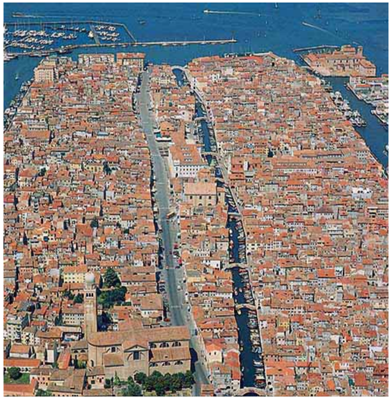
Ontology with OWL



Example with OWL

```
<owl:Class rdf:ID="Church">
     <rdfs:subClassOf rdf:resource="#Building"/>
     <rdfs:subClassOf>
           <owl:Restriction>
               <owl:onProperty rdf:resource="#hasFunction"/>
               <owl:hasValue rdf:resource="#Religion"/>
           </owl:Restriction>
     </rdfs:subClassOf>
  </owl:Class>

  <owl:Class rdf:ID="Cathedral">
        <rdfs:subClassOf rdf:resource="#Church"/>
  </owl:Class>
```

4 – Spatial ontologies

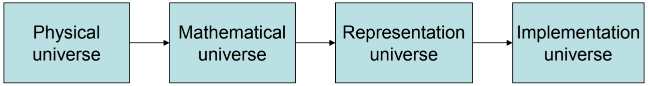


4 – Spatial ontologies

- 4.1 – Theoretical bases
- 4.2 – Examples of alignment

4.1 – Theoretical bases

- http://www.spatial.maine.edu/~max/Using Ontologies.pdf



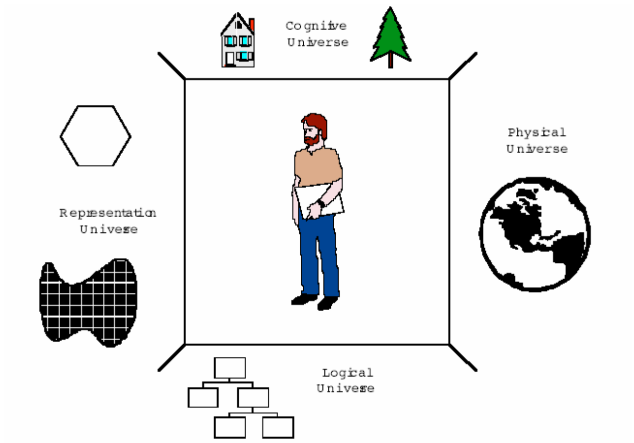


Figure 2 - The human perspective of the four-universes-paradigm

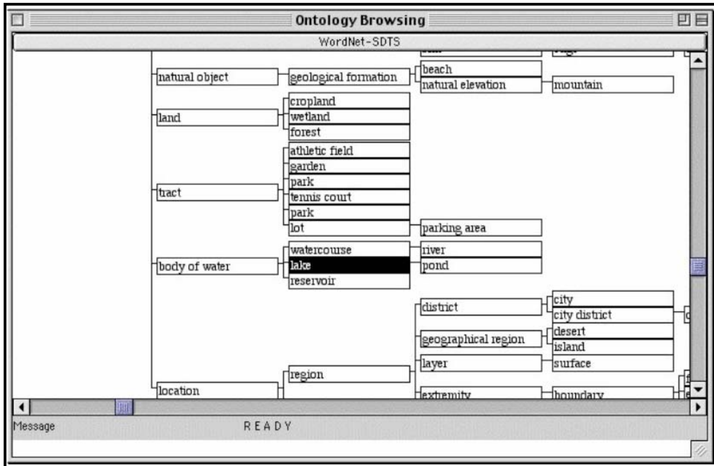
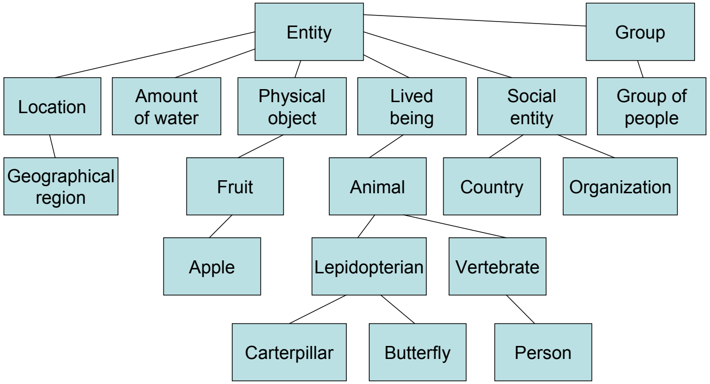


Figure 6 – The class lake in WordNet-SDTS ontology

Top-level ontology from Guarino



Important relations between concepts

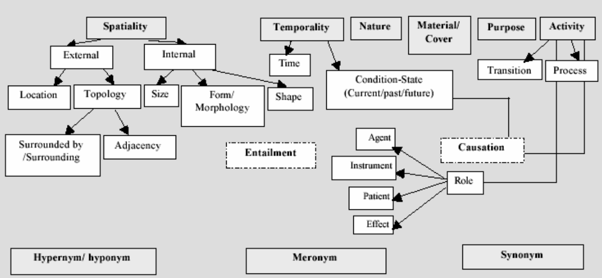
- Semantic properties/relations

1.	Hypernym	6.	Form/morphology
2.	Nature	7.	Location
3.	Use/purpose	8.	Condition/state
4.	Material/cover	9.	Time
5.	Has parts/is part of	10.	Surrounded by

- Semantic properties/relations

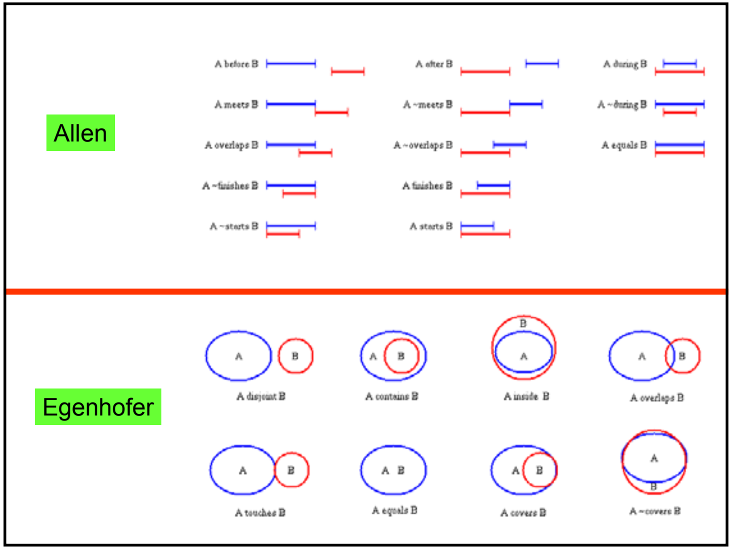
Relations between relations

- Relations among Relations

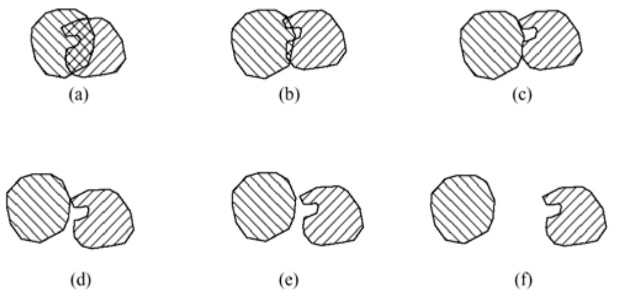


Theoretical basis of spatial ontologies

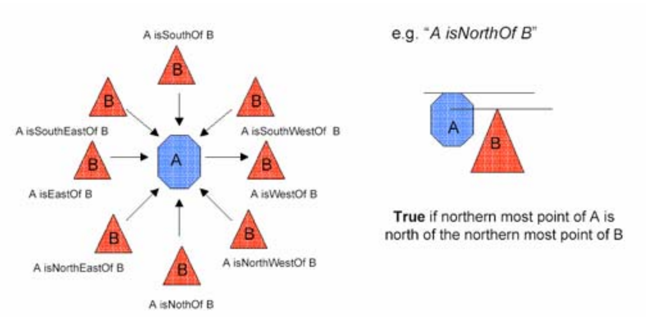
- Spatial objects
  - classes
  - description
- Spatial Relations
  - topological
  - directional
  - distance
  - mereological



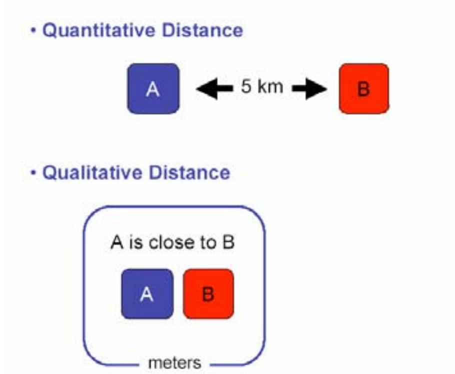
Example of topological relations



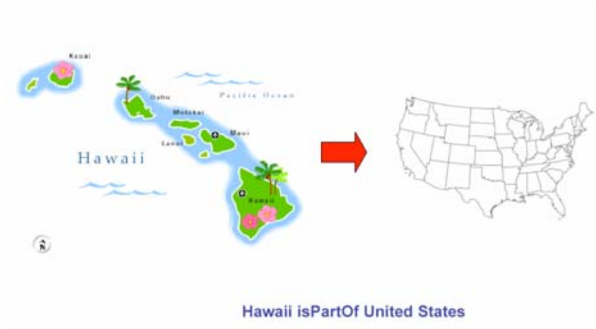
Directional relations



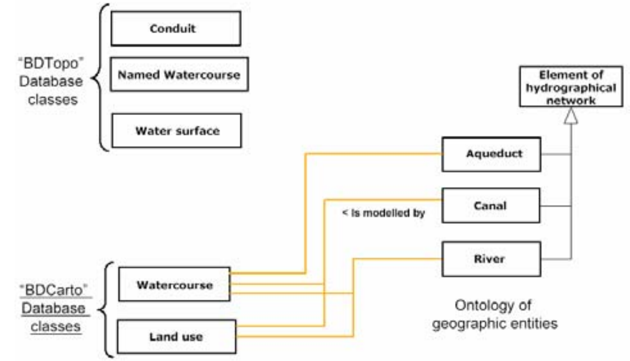
Distance relations



Mereological relations

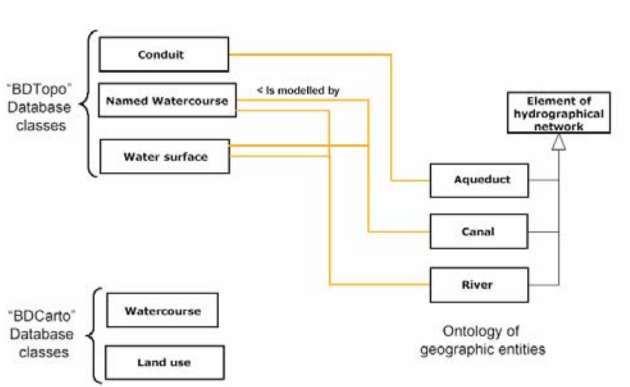


4.2 – Example of alignment (1/3)

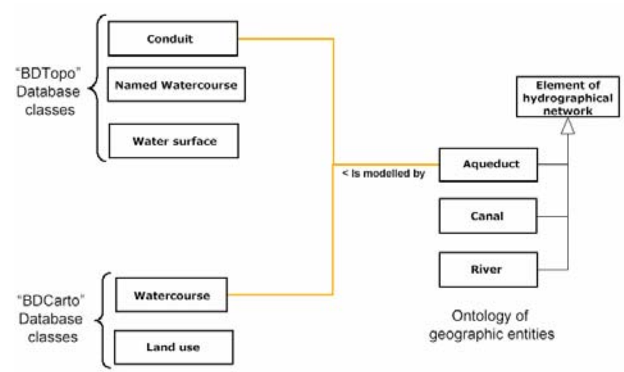


http://www.laser-scan.com/eurosdr/ontologies/pres/B4-Cogit_Presentation.pdf

Example of alignment (2/3)



Example of alignment (3/3)



5 – Ontological engineering

Ontological engineering

- How to build an ontology?
- Possible approaches
  - Top-down
  - Bottom-up
  - Dictionaries
  - Etc.
- How to find a consensus between actors?
- How to verify?

Collaborative design

- Using ontologies
  - Interoperability
  - Information retrieval
  - Knowledge reasoning
- **Ontology = vocabulary**
- **= semantic network**

Ontological engineering

- 5.1 – Approaches
- 5.2 – Methodologies
- 5.3 – Comparison of some ontological engineering tools

Top-down approach

- Define high level concepts
- Build the semantic network from the top
- Add specific concepts from more generic ones
- Sometimes, difficulties to include real object

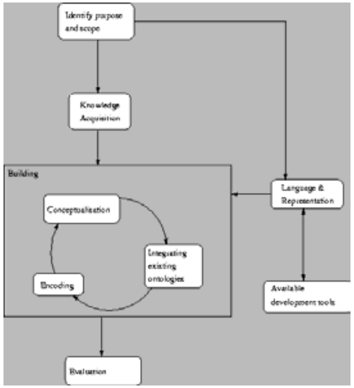
Bottom-up approach

- Start from real existing objects
- Aggregate into more generic objects
- Finally arrive to the top level concepts

Consensus

- Two actors have two visions of the worlds
- « *Ad ognuno la sua verità* »
- Solve conflicts
- When we have several definitions of the same concepts
  - – Define different concepts
  - – Keep all definitions until consensus

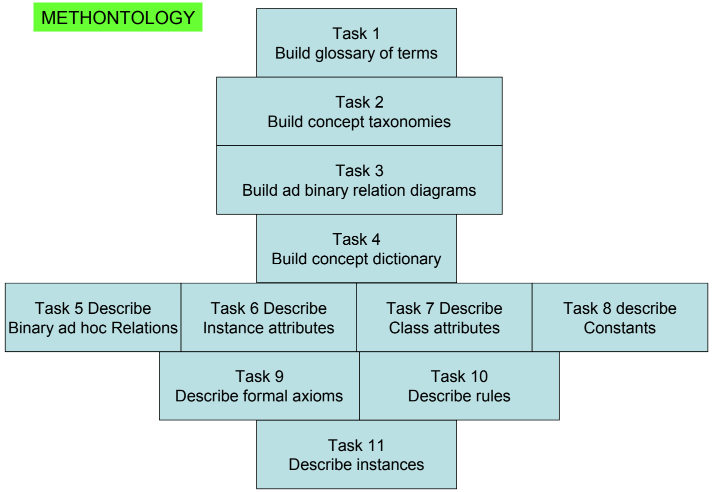
5.2 – Methodologies

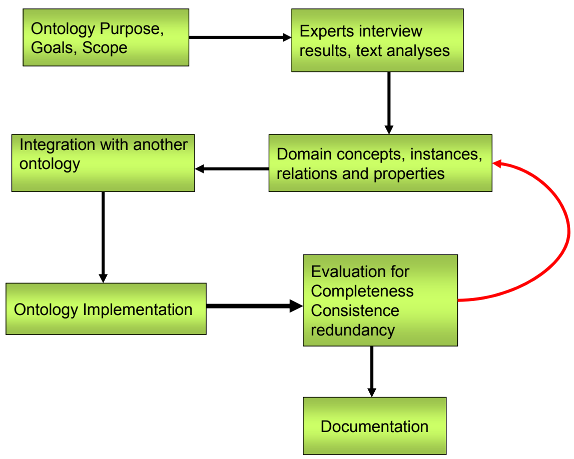


METHONTOLOGY

- Specification
- Knowledge acquisition
- Conceptualization
- Integration
- Implementation
- Evaluation
- Documentation

METHONTOLOGY





5.3 – Comparison of some ontological engineering tools

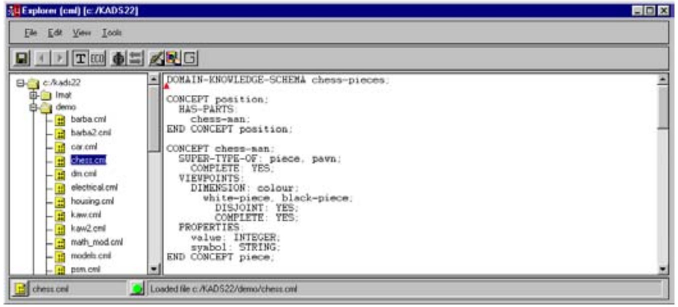
For details see http://www.swi.psy.uva.nl/wondertools/html/paper.htm

WonderTools? A comparative study of ontological engineering tools

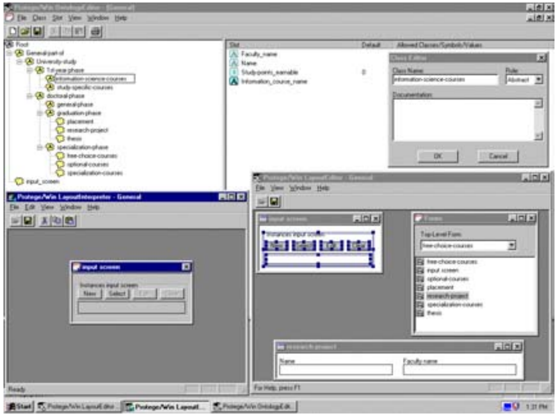
A. J. Duineveld, R. Stoter, M. R. Weiden, B. Kenepa and V. R. Benjamins
Dept. of Social Science Informatics
University of Amsterdam
e-mail: {duinevel, stoter, weiden, kenepa, richard}@swi.psy.uva.nl

- **Ontolingua,** a web-based tool for making ontologies http://www.ksl.stanford.edu/software/ontolingua/
- **WebOnto,** also a web-based tool, but completely graphical http://kmi.open.ac.uk/projects/webonto/
- **ProtégéWin,** a Windows-based tool, also graphical http://www.smi.stanford.edu/projects/prot-nt/documentation/
- **OntoSaurus,** a web-based tool, looks much like Ontolingua, but uses the Loom language http://www.isi.edu/natural-language/projects/SENSUS-demo.html
- **ODE,** a Windows-based tool, a combination of a graphical and text-based tool http://delicias.dia.fi.upm.es/webODE/
- **KADS22**, a graphical and text-based tool for building ontologies and reasoning strategies http://www.swi.psy.uva.nl/projects/kads22/help/intro/intro.htm

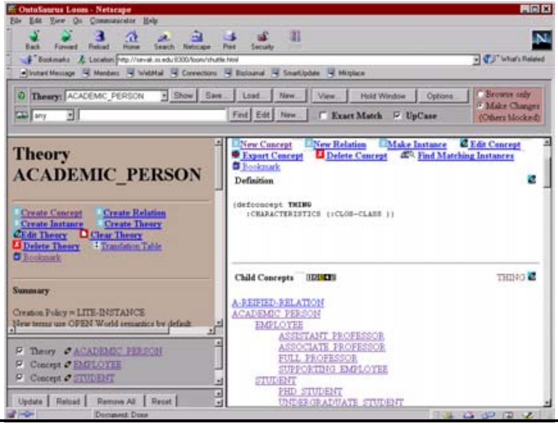
KDS22

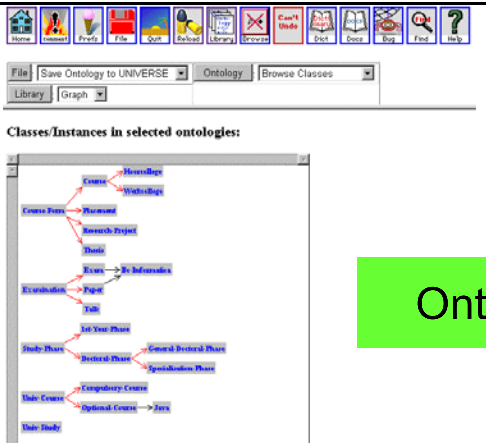


Example: ProtégéWin

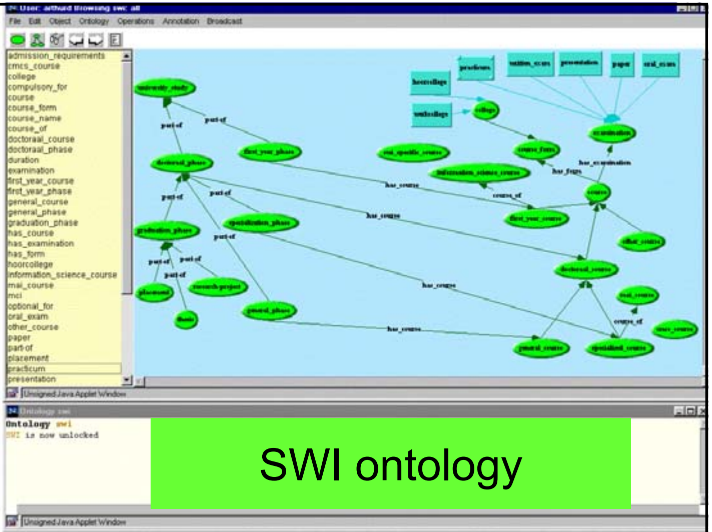


Ontosaurus



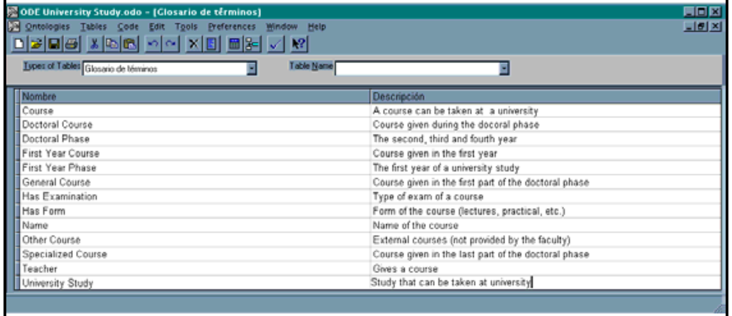


Ontolingua



SWI ontology

Terminology in ODE



Nombre	Descripción
Course	A course can be taken at a university
Doctoral Course	Course given during the docoral phase
Doctoral Phase	The second, third and fourth year
First Year Course	Course given in the first year
First Year Phase	The first year of a university study
General Course	Course given in the first part of the doctoral phase
Has Examination	Type of exam of a course
Has Form	Form of the course (lectures, practical, etc.)
Name	Name of the course
Other Course	External courses (not provided by the faculty)
Specialized Course	Course given in the last part of the doctoral phase
Teacher	Gives a course
University Study	Study that can be taken at university

Evaluation result

Criteria	Ontolingua	WebOnto	ProtégéWin	OntoSaurus	ODE
1. General					
1.1 interface clarity	-	+	+	-	-
1.2 interface consistency	+	+	+	+	+
1.3 speed of updating	-	0	+	-	+
1.4 overview	0	+	+	-	-
1.5 meaning of commands	+	+	+	+	0
1.6 identifiability of changes	0	0	0	0	0
1.7 stability	+	+	+	+	-
1.8 local installation	No	No	Yes	Yes/no	Yes
1.9 help-system	+	-	+	+	-
2. Ontology					
2.1 multiple inheritance	Yes	Yes	Yes	Yes	Yes
2.2 decomposition types	+	+	-	+	+
2.3.1 consistency checking	+	+	+	+	+
2.3.2 level of checking	7	0	0	7	+
2.4 example ontologies	+	+	0	+	0
2.5 reusable ontologies	+	+	-	+	-
2.6 high-level primitives	+	+	-	+	+
2.7 ontological help	-	-	-	-	+
3. Cooperation					
3.1 synchronous editing	+	+	-	+	-
3.2 ontology locking	+	+	-	+	-
3.3 browsing when locked	+	+	NA	+	NA
3.4 change recognition	-	-	-	-	-
3.5 export facilities	+	-	-	+	0
3.6 import facilities	+	-	-	+	+

6 – TOWNTOLOGY project

TOWNTOLOGY project

- 6.1 – Advocacy for urban ontologies
- 6.2 – Principles of the Towntology project
- 6.3 – Visual interfaces
- 6.4 – COST project C21

6.1 – Advocacy for urban ontologies

- Vocabulary difficulties between actors in urban applications

- Creation of an ontology for cities and for urban planning
- Initial objective: 1000 terms

6.2 – Principles of the Towntology project

- Creating an ontology for urban planning
- First steps in Lyon (2002-2003)
  - Street planning (French language)
  - Starting from existing dictionaries
  - ≅ 800 concepts
- Second step (2003-2004)
  - Setting a COST network
  - Extension to other languages
  - Public space description

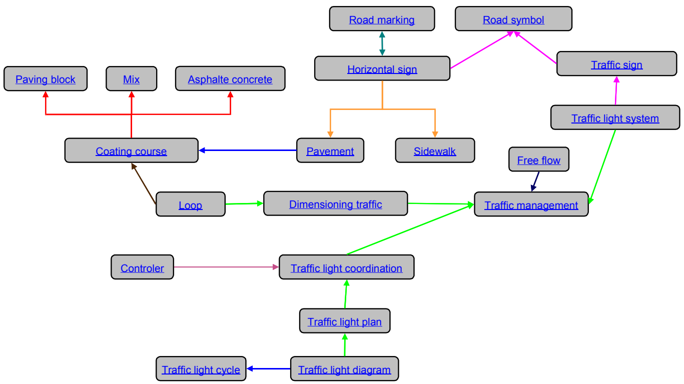
Towntology principles

- Visual presentation
- Semantic network
- Hypertext structure
- Multiple definitions
- Origin and lineage of definitions
- Possibility of updating
- Photos and drawings

Towntology relations

- 9 relations:
  - *is made of*
  - *is composed of*
  - *is located in*
  - *is used for*
  - *is located on*
  - *is a*
  - *is a subset of*
  - *depends on*
  - *is a tool for*

Excerpt of the ontology



MIX
Aggregates gravel, sand...) of variable size, mixedwith lime and closely bound by a called bitumen binder bituminizes. The bituminous mix is used mainly in carriageway surfacing. One distinguishes two main categories of bituminous mix :
• Hot-mix, used in courses and underlayers of coating in the structures of roadway. These products are implemented and compacted at a temperature varying between 135 and 160°C.
• Cold-mix generally used to stop the "potholes" or provisional repair of the trenches.

Roadway dictionnary

From : http://www.lequotidienauto.com

Example of textual and visual description

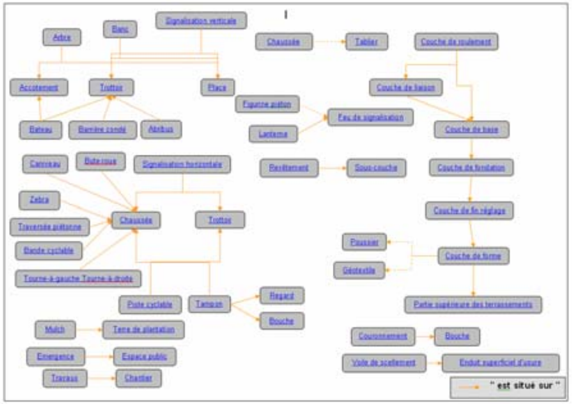
Beginning of the urban ontology


```
<ONTOLOGY>
  <HEAD>
    <TITLE>Transports</TITLE>
    <LANGUAGE>français</LANGUAGE>
    <CUSTODIAN>Christophe BERTHET</CUSTODIAN>
    <LAST_MODIF_DATE>2004/6/25</LAST_MODIF_DATE>
  </HEAD>
  <BODY>
   <RELATION_TYPES>
    <RELATION_TYPE ID="100001" ORIGINATOR="Christophe BERTHET" INSERTION_DATE="2004/06/21">
      <RELATION_NAME>dépend de</RELATION_NAME>
      <TERMS />
      <RELATION_DEF />
      <RELATION_PROPERTIES SYMMETRIC="false" TRANSITIVE="false" MAYBEOPTIONAL="false" />
    </RELATION_TYPE>

      .........

   </BODY>
 </ONTOLOGY>
```


Description of a concept


```
  <CONCEPT_NAME>Accident de la route </CONCEPT_NAME>
  <TERMS />
  <CONCEPT_DOMAIN ID="200001" />
  <CONCEPT_DEFS>
    <CONCEPT_DEF ORIGINATOR="Christophe BERTHET" INSERTION_DATE="2004/06/21">
      <CONCEPT_DEF_SOURCE>
        <AUTHORS />
        <REF>Glossaires – Promotion Of Results in Transport Research and Learning</REF>
      </CONCEPT_DEF_SOURCE>
      <CONCEPT_DEF_TEXT>Définition utilisée pour les statistiques dans la plupart des pays : il
        s'agit d'une collision ayant lieu sur la voie publique et qui implique au moins un véhicule
        roulant. Sont considérés comme accidents de la route les accidents provoquant
        uniquement des dégâts matériels et les accidents occasionnant des
        blessures.</CONCEPT_DEF_TEXT>
    </CONCEPT_DEF>
  </CONCEPT_DEFS>
  <MULTIMEDIA />
</CONCEPT>
```


Ontological graph

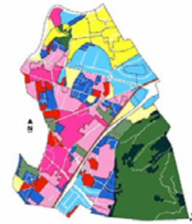


Example: Land use plan

PLAN D'OCCUPATION DES SOLS (P.O.S.)

Document d'urbanisme opposable aux tiers qui fixe les règles générales et les servitudes d'utilisation des sols. Composé de documents graphiques qui localisent des zones, d'un règlement qui fixe le droit des sols applicable à chaque zone et d'annexes techniques.

Dictionnaire de la voirie



Source : http://www.ville-st-martin-dheres.fr/images/photos/pos.gif

Biking track

PISTE CYCLABLE
Aménagement en site propre séparé de la circulation générale automobile. Elle peut être située sur un trottoir, sur une chaussée toutefois séparée physiquement de la circulation automobile par une bordure, une bande de stationnement V.P., ...
La largeur de l'aménagement est de 1,50 mètre pour une piste unidirectionnelle, et de 3,00 mètres pour une piste bidirectionnelle. Le revêtement peut être un enrobé, un asphalte, un béton désactivé ou un sable stabilisé.
Ce type d'aménagement s'adresse à un usage ludique ou familial et permet aux usagers de se rendre vers des zones de loisirs. Il est recommandé d'aménager les pistes cyclables le long des voies où il y a peu d'intersections, les voies à vitesse élevée et à grand débit, les anciennes voies ferrées, les chemins de halage.

Dictionnaire de la voirie

Source : Dictionnaire de la voirie

Source : [illegible]

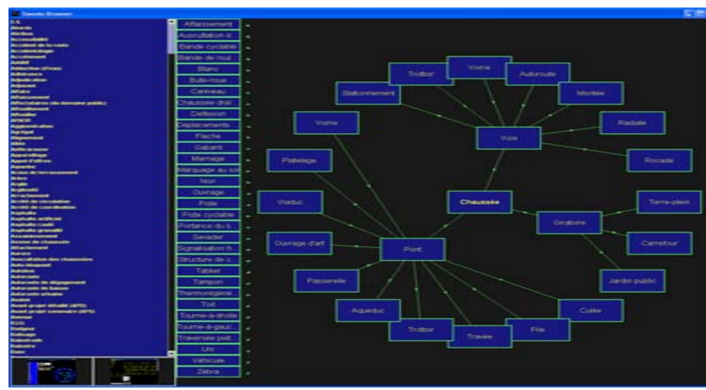
Source : [illegible]

6.3 – Visual interfaces

- Portal for navigating and querying
- Portal for updating
- Portal for photo-based access

Portal

Visual interface (browser)



Content visualization

6.4 – COST working group C21

- University of Liege (key responsible)
- INSA de Lyon
- University of Basilicata
- Queen's University of Belfast
- University of Madrid
- University of Coimbra
- etc.

7 – Conclusions

Conclusions

- Importance of ontologies for
  - interoperability
  - language clarification
  - cooperation between actors
  - cooperation between computers
  - information retrieval
- Necessity of creating urban ontologies
- Usage of XML

Bibliography

- Gómez-Pérez A., Fernandez-Lopez M., Corcho O. (2004) "*Ontological Engineering*", Springer Verlag 2004, 403 p.
- Laurini R. (2001) "*Information Systems for Urban Planning, A Hypermedia Co-operative Approach*", Taylor and Francis, Londres, 308 p. Janvier 2001

Recent conferences

- FOIS-2004 "*International Conference on Formal Ontology in Information Systems*" November 4-6, 2004, Torino (Italy) http://fois2004.di.unito.it/
- International Conference on the Ontology of Spacetime, 11-14th May, 2004, Concordia University, Montreal, Quebec http://alcor.concordia.ca/~scol/seminars/conference/

- Workshop on FUNDAMENTAL ISSUES IN SPATIAL AND GEOGRAPHIC ONTOLOGIES 23rd September 2003, COSIT, 24-28 September 2003, Ittingen, Switzerland, http://www.comp.leeds.ac.uk/brandon/cosit03ontology/
- Workshop on Geo-Ontology Sponsored by Ordnance Survey 16th & 17th September 2002 Ilkley, West Yorkshire, UK, http://www.comp.leeds.ac.uk/brandon/geo-ontology/

- Joint EuroSDR/EuroGraphics workshop on Ontologies and Schema Translation SErvives. Paris, April 15-16, 2004 http://www.laser-scan.com/eurosdr/ontologies/index.htm


Thanks for your attention!
http://lisi.insa-lyon.fr/~laurini