



Annotation

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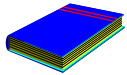
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Main References



Gómez-Pérez, A.; Fernández-López, M.; Corcho, O. **Ontological Engineering**. Springer Verlag. 2003

Chapter 5: Ontology tools



Corcho, O.

Ontology-based document annotation: trends and open research problems

International Journal of Metadata, Semantics and Ontologies 1(1):47-57. 2006



Handschuh S, Staab S (2003)

Annotation for the Semantic Web. IOS Press

Table of Contents

- 1. Ontology-based Annotation**
- 2. Web Page Annotation**
- 3. Database Annotation**
 - 3.1 Approaches for database annotation**
 - 3.2 R2O and ODEMapster**
 - 3.3 Practical Example: NeOn Toolkit**

What is the metadata of this HTML fragment?

Based on Dublin Core

The *contributor* and *creator* is the flight booking service “www.flightbookings.com”.

The *date* would be January 1st, 2003, in case that the HTML page has been generated on that specific date.

The *description* would be something like “flight details for a travel between Madrid and Seattle via Chicago on February 8th, 2004”.

The document *format* is “HTML”.

The document *language* is “en”, which stands for English

Flight details

Outbound

Leaving from **Madrid** - Barajas - Spain
on Saturday 08 February 2003 at **11:50**
Arriving in **Chicago** - O'Hare International - United States of America
same day at **14:10**
Airline: American Airlines
Flight No. AA 7615
Type of aircraft: Airbus Industrie A340 All Series PAX/H

Leaving from **Chicago** - O'Hare International - United States of America
on Saturday 08 February 2003 at **16:48**
Arriving in **Seattle** - Seattle/Tacoma International - United States of America
same day at **19:23**
Airline: American Airlines
Flight No. AA 1605
Type of aircraft: non referenced/B

Based on thesauri

Madrid is a reference to the term with ID 7010413 in the thesaurus, which refers to the city of Madrid in Spain.

Spain is a reference to the term with ID 1000095, which refers to the kingdom of Spain in Europe.

Chicago is a reference to the term with ID 7013596, which refers to the city of Chicago in Illinois, US.

United States of America is a reference to the term “United States” with ID 7012149, which refers to the US nation.

Seattle is a reference to the term with ID 7014494, which refers to the city of Seattle in Washington, US.

Based on ontologies

Concept instances relate a part of the document to one or several concepts in an ontology. For example, “Flight details” may represent an instance of the concept **Flight**, and can be named as **AA7615_Feb08_2003**, although concept instances do not necessarily have a name.

Attribute values relate a concept instance with part of the document, which is the value of one of its attributes. For example, “American Airlines” can be the value of the attribute **companyName**.

Relation instances that relate two concept instances by some domain-specific relation. For example, the flight **AA7615_Feb08_2003** and the location **Madrid** can be connected by the relation **departurePlace**

Annotation

assert facts using terms (*metadata in RDF*)
Represent terms and their relationships (*ontology in RDFS/OWL*)

The screenshot shows the Schizophrenia Research Forum website. Yellow boxes with arrows point to specific features: 'News' points to the 'Research News' section; 'Videocast' points to the 'Live NIH Videocasts' section; 'Grant Application' points to the 'Preparing for Electronic Grant Application' link; 'Research' points to the 'Current Papers—Show Us the Nuggets!' section; 'Events' points to the 'SRF CALENDAR' section; 'Organisation' points to the 'SRF COMMUNITY' section; and 'Gene Database' points to the 'Schizophrenia Gene' logo.

SCHIZOPHRENIA RESEARCH FORUM
A CATALYST FOR CREATIVE THINKING

Home | Your Profile | Become a Member | Contact Us | Get Newsletter

POWERED BY Google

SEARCH SITE
GO
SEARCH PAPERS >
SEARCH INDEX >

WHAT'S NEW
Recent Updates

SRF PAPERS
Current Papers
SRF Recommends
Search All Papers
Search Comments

NEWS
Research News

FORUMS
Current Hypotheses
Idea Lab
Online Discussions
Interviews

RESOURCES
Research Tools
Jobs
Conferences
Journals
General Information

SRF COMMUNITY
Member Directory
R
In
A

Organisation
Mission
History
SRF Team
Advisory Board
Support Us
How to Cite

Research News

November 26, 2006

News

- [New Human Genome Map Shows Extensive Copy Number Variation](#)
23 November 2006. Having more, or fewer, than the normal number of gene copies may be a major factor in human disease ...
- [Playing on Without AKT1: Subtle Cortical Deficits Suggest Vulnerabilities](#)
21 November 2006. The enzyme AKT1 has been implicated in both schizophrenia and bipolar disorder. A new study in the November 7 issue of PNAS finds that...
- [SfN Atlanta: Working Both Sides of the Synapse in Mood Disorders](#)
14 November 2006. In the second of her meeting missives from the Neurosciences 2006 meeting in Atlanta, Susannah F. Locke of the University of Pennsylvania reports on...

GO TO ALL RESEARCH NEWS

Spotlight

Research

- [Current Papers—Show Us the Nuggets!](#)
Our search of PubMed pulled in 72 papers related to schizophrenia or related basic science. But where are the nuggets of new information that will move the field a step forward? Only you can help us identify the important findings in your subspecialty.

Please help us create an online discussion community by picking a paper from the past three, or even six months, that really deserves a comment, and then writing that comment today. If you have time to sketch out your impressions in a few paragraphs, that would be valuable ... If you only have time for the 3 sentence "bottom line," that also transfers knowledge within the community. On to [the papers](#) ...

Live NIH Videocasts

- [NIH Director Advisory Committee](#)
Friday, December 01, 2006, 8:30 AM
- [Orienting Attention in the Human Brain](#)
Monday, December 04, 2006, 12:00 PM
- [Preparing for Electronic Grant Application](#)
Tuesday, December 05, 2006, 9:00 AM

Videocast

Grant Application

Events

SRF CALENDAR
To be announced.

DESPERATELY SEEKING

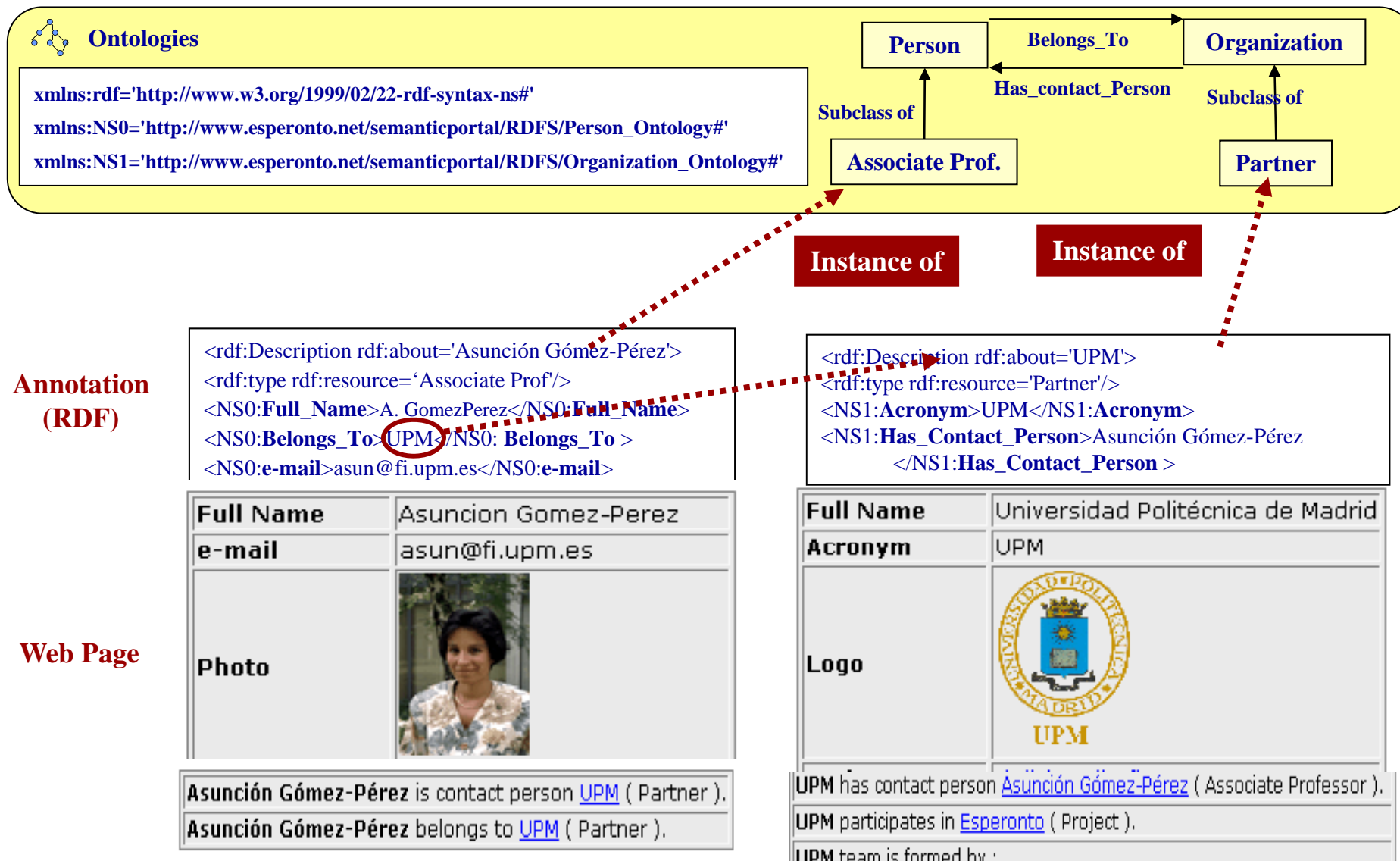
- [Antibodies](#)
- [Collaborators](#)

Gene Database

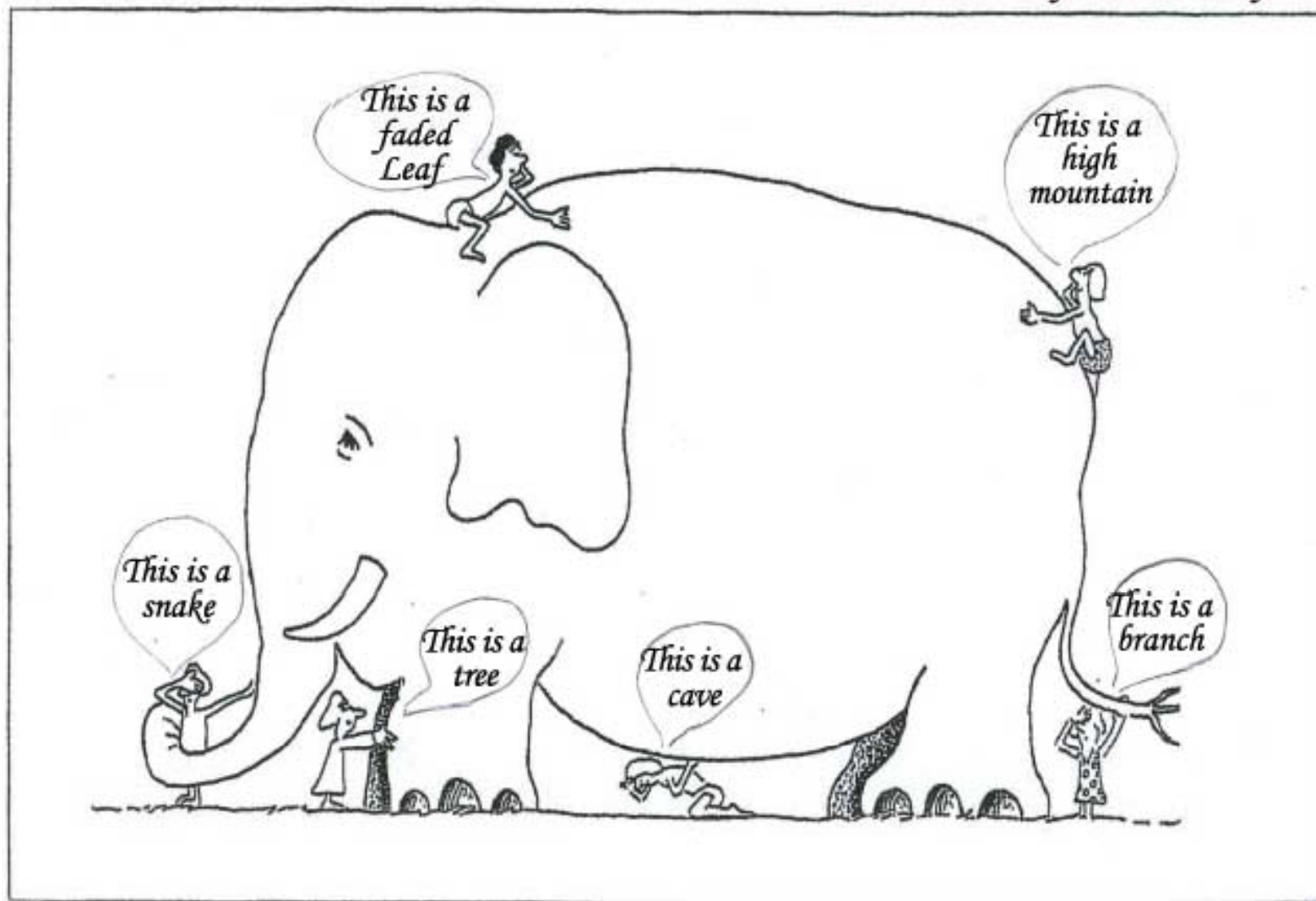
Schizophrenia Gene

O. Corcho, B. Villazón, A. Gómez-Pérez

Ontologies and Metadata



An Indian Tale: Blind Men and an Elephant



The early days of annotation in the Web

- The main objective in the early days was the agreement on how to include **annotations on the Web**

- (KA)²
- SHOE (Simple HTML Ontology Extension)

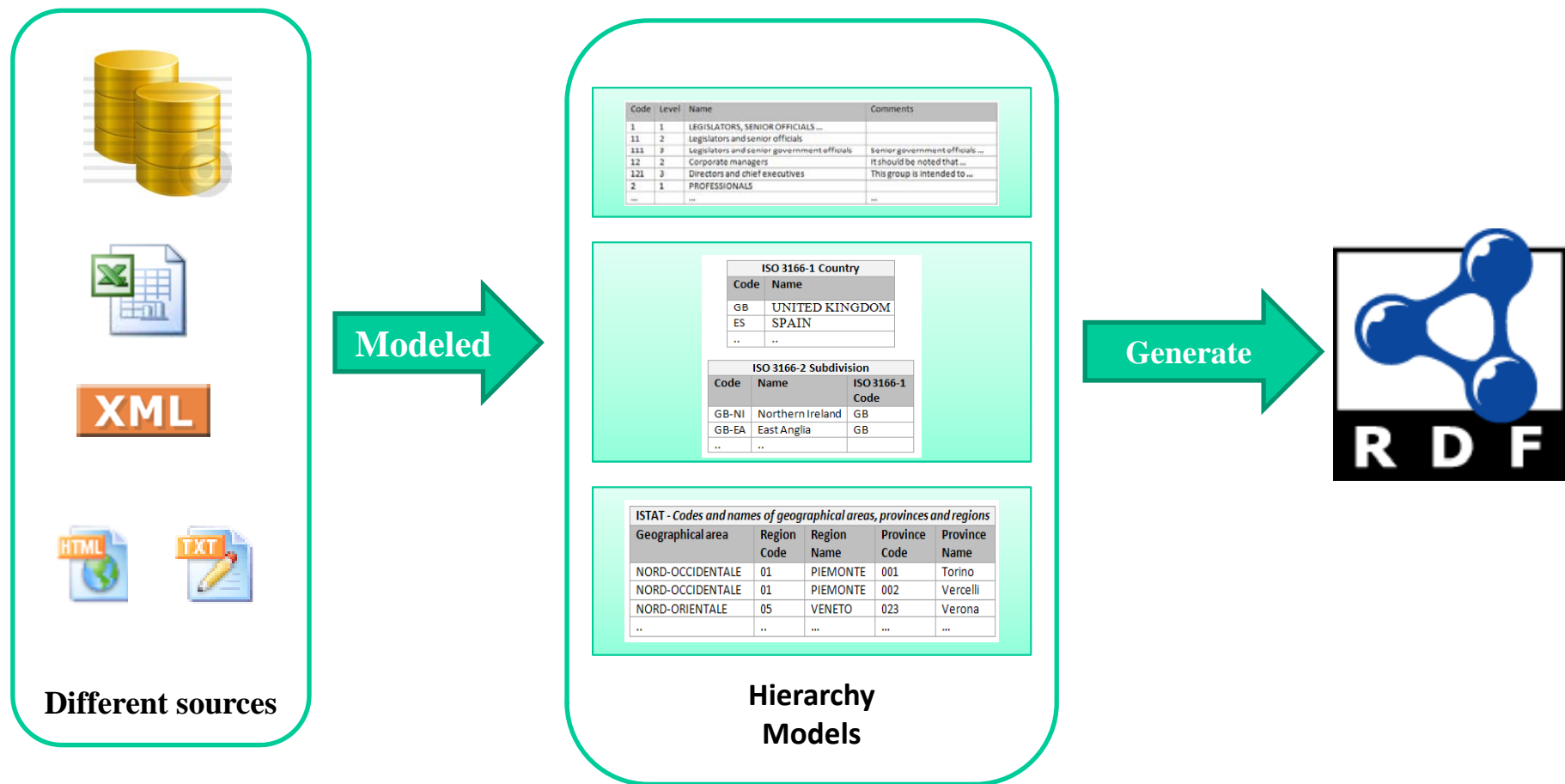
– ...

```
<html>
<head><TITLE> Richard Benjamins </TITLE>
<a ONTO="page:Researcher"> </a>
</head>

<H1> <A HREF="pictures/id-rich.gif">
<IMG align=middle SRC="pictures/richard.gif"></A>
<a ONTO="page[photo=href]"
HREF="http://www.iiia.csic.es/~richard/pictures/richard.gif" ></a>
<a ONTO="page[firstName=body]">Richard</a>
<a ONTO="page[lastName=body]">Benjamins </a>
</h1> <p>

<A ONTO="page[affiliation=body]" HREF="#card">
Artificial Intelligence Research Institute (IIIA)</A> -
<a href="http://www.csic.es/">CSIC</a>, Barcelona, Spain <br>
and <br>
<A ONTO="page[affiliation=body]" HREF="http://www.swi.psy.uva.nl/">
Dept. of Social Science Informatics (SWI)</A>
-
<A HREF="http://www.uva.nl/uva/english/">UvA</A>, Amsterdam, the
Netherlands
```


Motivation



The early days of the Semantic Web

Availability of content

- Including the “Deep Web” and Web Services

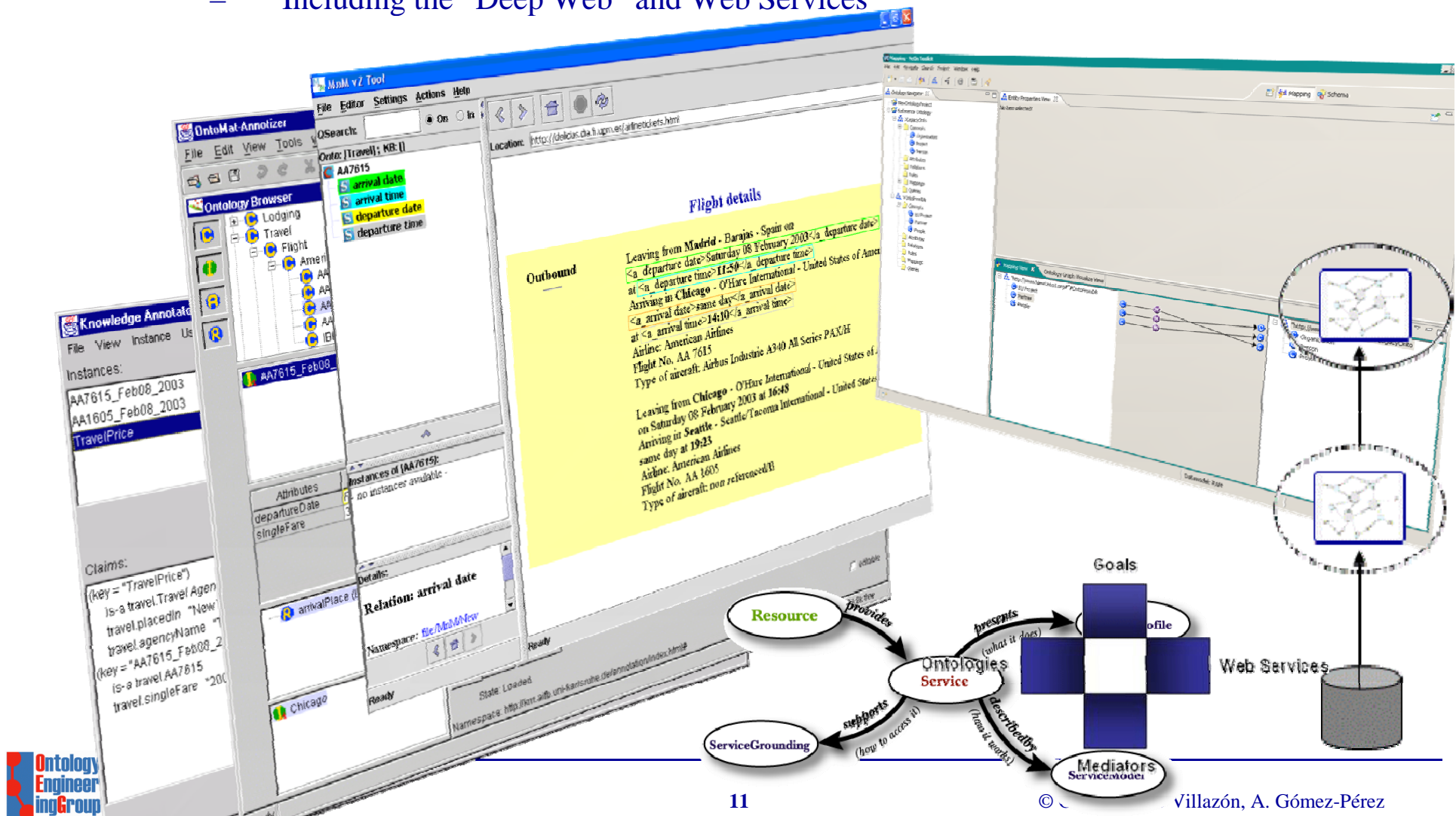


Table of Contents

1. **Ontology-based Annotation**
2. **Web Page Annotation**
3. **Database Annotation**
 - 3.1 **Approaches for database annotation**
 - 3.2 **R2O and ODEMapster**
 - 3.3 **Practical Example: NeOn Toolkit**

Web Page Annotation. Dimensions

- **Sources**

- Source type
 - Text: HTML, XML, PDF, etc.
 - Multimedia: images, video, audio, etc.
 - Web Services
- Origin
 - Static: files
 - Dynamic: databases and forms

- **Used technologies**

- Knowledge extraction
 - NLP, IE, Layout
- Wrapper generation
 - Toolkits, ML, Browsing

- **Annotation Process**

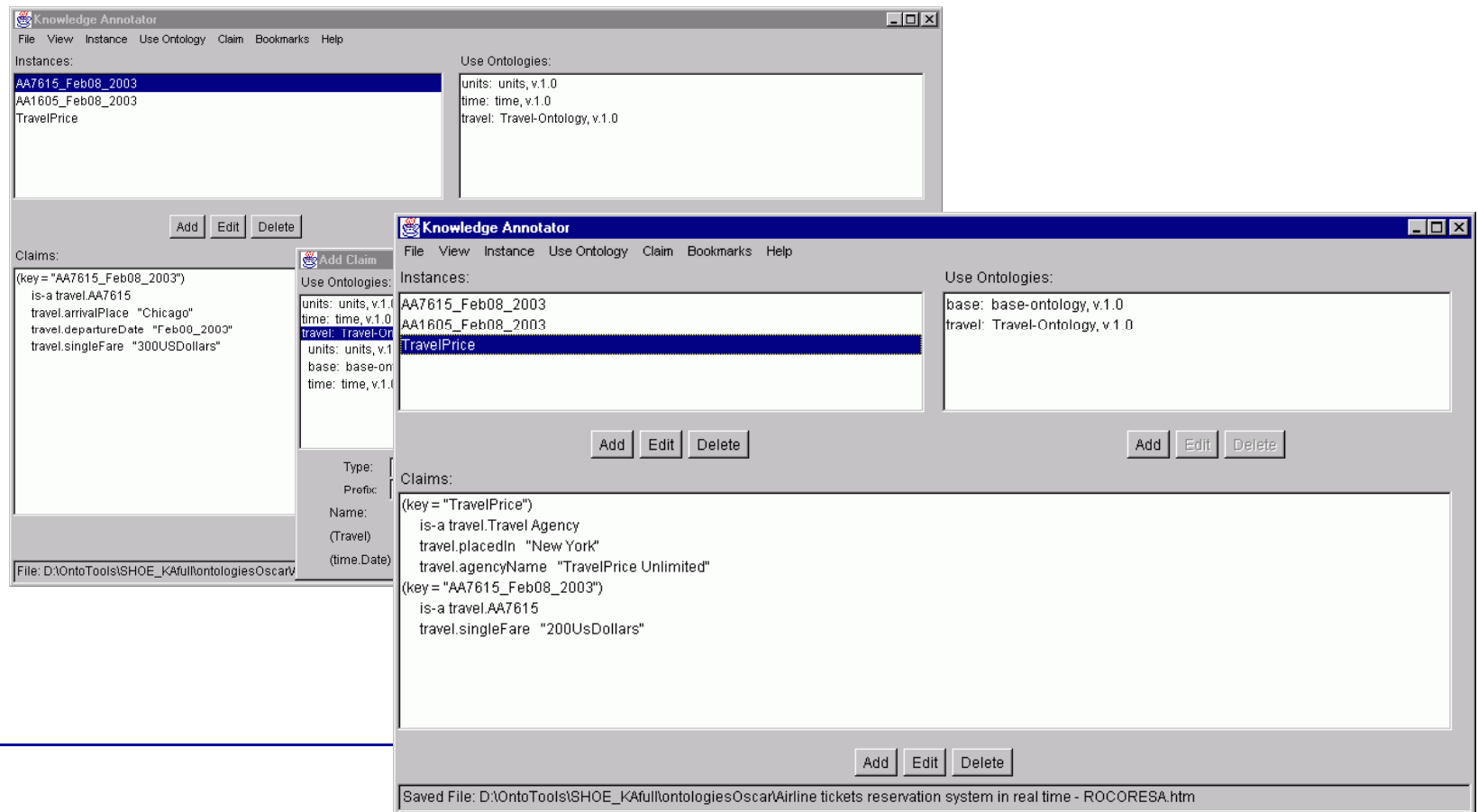
- Maintenance (adaptivity to changes in the sources)
 - Verification
 - Robustness
 - Auto-adaptivity
- Annotation Supervision
 - Manual
 - Supervised (semi-automatic)
 - Unsupervised (automatic)

- **Degree of formality**

- Web 2.0 tagging
- Ontology-based

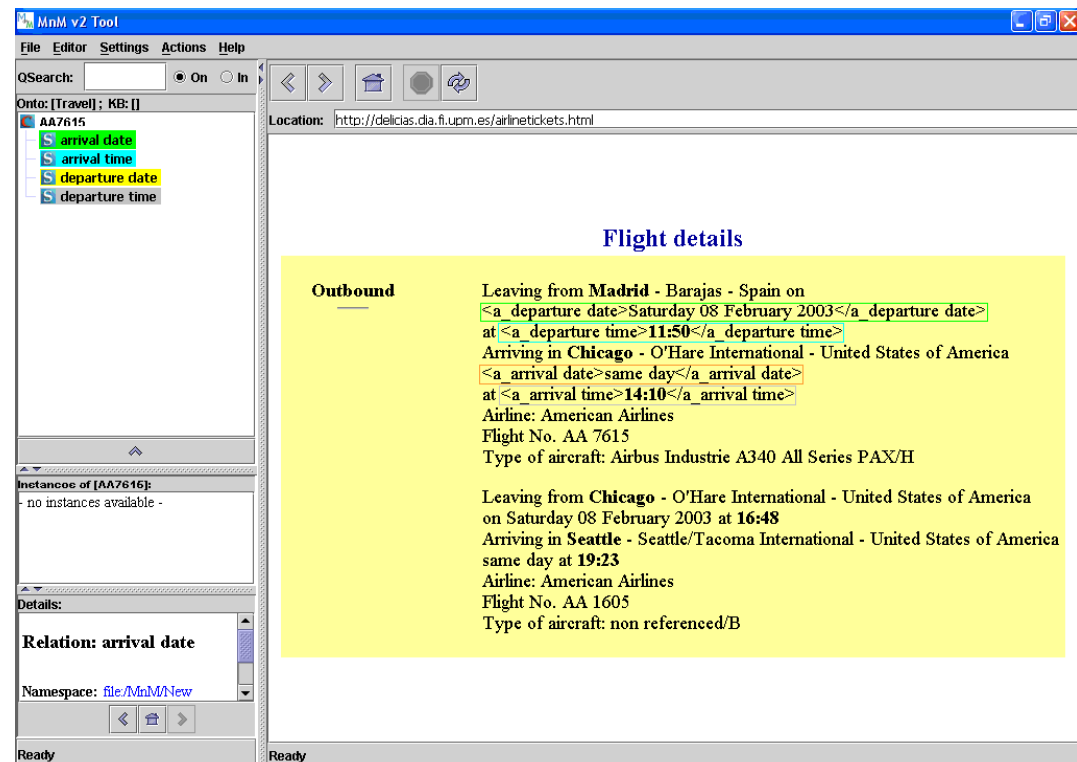
Annotation tools. SHOE Knowledge Annotator

- Standalone application with no Web browser
- Manual annotation
- SHOE



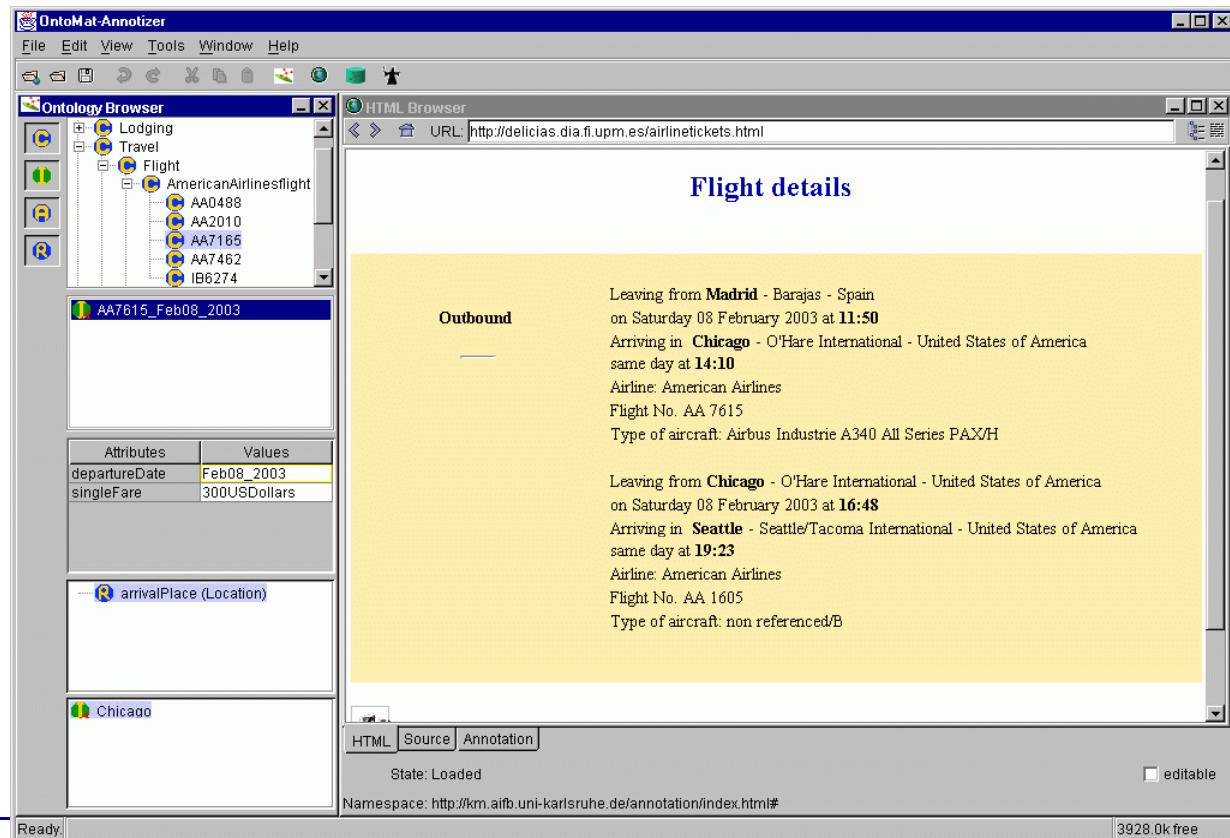
Annotation tools. MnM

- Standalone application
- Manual annotation with drag&drop
- Semi-automatic annotation with information extraction tools (Amilcare)
- OCML, RDF and XML



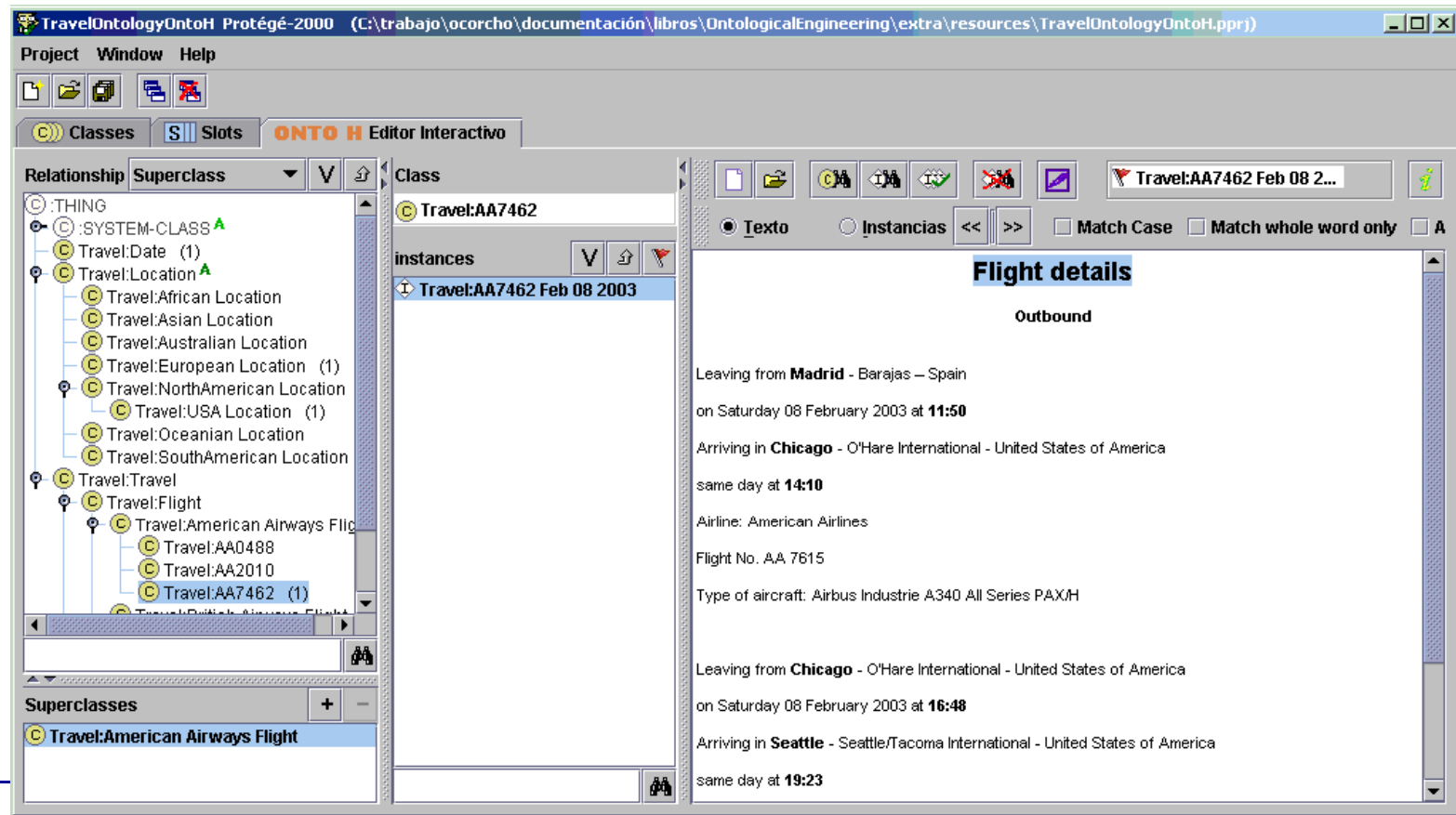
Annotation tools. OntoMat

- Standalone application
- Manual annotation with drag&drop
- RDF and OWL



Annotation tools. ONTO-H

- Protégé plug-in
- Manual annotation with drag&drop
- On cascade annotation, with annotation rules



Annotation tools. AeroSWARM

- Web server for any Web document
- Automatic annotation with predefined ontologies: OpenCyc, SUMO and AeroSWARM
- RDF

LOCKHEED MARTIN

SPACE SYSTEMS > MANAGEMENT & DATA SYSTEMS
DAML UBOT Project

Team Members

Papers



AeroSWARM is a [web service](#) that takes a web page as an input and generates OWL markup. The service analyzes the text of the document and extracts generic information such as: people, places, organization, time, nationality, etc. You can select an ontology for markup from the list of popular ontologies shown below. (This capability will be available as soon as appropriate general purpose OWL ontologies are available.)

If you wish to use an ontology for markup other than the ontologies listed below, this [utility](#) can help you create a translation ontology that maps the terms from one ontology to another. The [AeroSWARM Markup Converter](#) takes a pre-existing markup and the translation ontology that you created by the ontology mapping utility and converts it to your preferred ontology.

Try generating your own OWL markup with AeroSWARM!

Enter the URL: [view sample webpage](#)

Multi-page option ([What is this?](#))

☒ Mark up only this webpage [View AeroSWARM Markup](#)

☐ Mark up this page and linked pages [View Consolidated Entries](#)

☐ Mark up this page and all linked pages

☐ Check consistency of markup ([W](#))

Ontology selection:

☐ custom

☒ [OpenCyc Ontology](#)

☐ [Sumo Ontology](#)

☐ [AeroSWARM Ontology](#)

Persons:

[PAX](#)

Organizations:

[HareInternational](#)

[TacomaInternational](#)

[AirbusIndustrie](#)

[AmericanAirlines](#)

Time Values:

[08February2003](#)

[1605](#)

[Saturday](#)

[14:10](#)

[16:48](#)

[19:23](#)

[11:50](#)

Organization: HareInternational

Also Known As: [Hare International \(source\)](#)

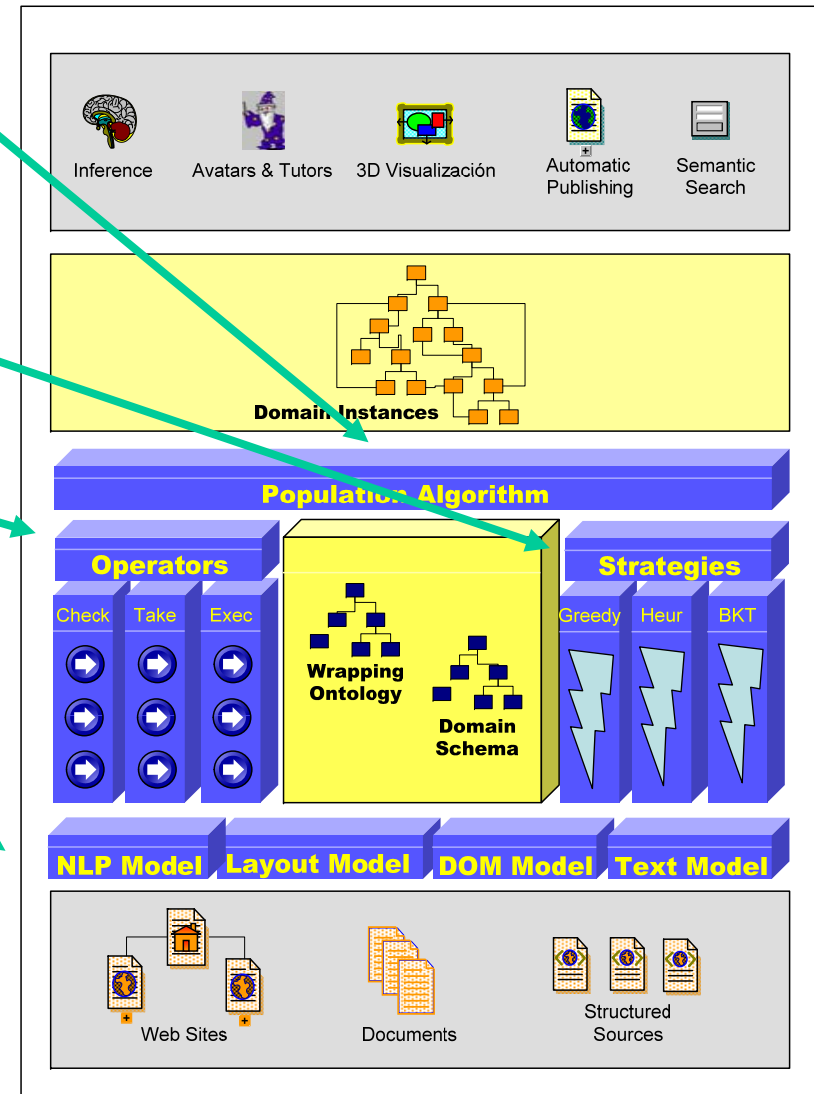
Located In: [UnitedStatesofAmerica \(source\)](#)

Flight details

Outbound	
	Leaving from Madrid - Barajas - Spain on Saturday 08 February 2003 at 11:50 Arriving in Chicago - O'Hare International - United States of America same day at 14:10 Airline: American Airlines Flight No. AA 7615 Type of aircraft: Airbus Industrie A340 All Series PAX/H
	Leaving from Chicago - O'Hare International - United States of America on Saturday 08 February 2003 at 16:48 Arriving in Seattle - Seattle/Tacoma International - United States of America same day at 19:23

Annotation tools. Knowledge Parser

- **Semantic-based population**
 - Explicit wrapping knowledge
 - Bootstrapping
- **Strategies**
 - Heuristic
 - Backtracking
 - etc.
- **Operators**
 - In-Row
 - Is-Proper-Name
 - Is-Integer-Greater-Than, etc.
- **Pre-processing**
 - Natural language
 - Layout
 - XML/DOM
 - Plain text





4.2.1) Documentación administrativa:

- a) Original o fotocopia compulsada del documento acreditativo de la personalidad de la entidad solicitante.
- b) Poder notarial bastante del representante de dicha entidad, o documentación acreditativa de dicha cualidad.
- c) **Fotocopia compulsada de la tarjeta de identificación fiscal de la Entidad.**
- d) Original o copia con el carácter de auténtica o fotocopia compulsada de los Estatutos debidamente legalizados.
- e) **Original o fotocopia compulsada de la siguiente documentación acreditativa del cumplimiento de Obligaciones Tributarias y de Seguridad Social:**

Recibo del año anterior a la convocatoria del Impuesto sobre actividades económicas, o en su caso, exención concedida por el órgano competente. Certificaciones administrativas expedidas por las Administraciones correspondientes de la Administración Tributaria y de la Tesorería Territorial de la Seguridad Social, de conformidad con lo establecido en el artículo 81 de la Ley General Presupuestaria y en su caso, exenciones del Impuesto del Valor Añadido y del Impuesto de Sociedades.

```

- <Funding_Opportu:DocumentationItem
  rdf:about="http://protege.stanford.edu/tmp_namespace#tmp_Instance_10032" rdfs:label="BOE">
  <tmp_namespace:Description>Fotocopia compulsada de la tarjeta de identificación fiscal de la
  Entidad.</tmp_namespace:Description>
  <Funding_Opportu:isNeededToApplyFor
    rdf:resource="http://protege.stanford.edu/tmp_namespace#tmp_Instance_10004" />
</Funding_Opportu:DocumentationItem>
- <Funding_Opportu:DocumentationItem
  rdf:about="http://protege.stanford.edu/tmp_namespace#tmp_Instance_10033" rdfs:label="BOE">
  <tmp_namespace:Description>Original o copia con el carácter de auténtica o fotocopia compulsada de
  los Estatutos debidamente legalizados.</tmp_namespace:Description>
  <Funding_Opportu:isNeededToApplyFor
    rdf:resource="http://protege.stanford.edu/tmp_namespace#tmp_Instance_10004" />
</Funding_Opportu:DocumentationItem>
- <Funding_Opportu:DocumentationItem
  rdf:about="http://protege.stanford.edu/tmp_namespace#tmp_Instance_10034" rdfs:label="BOE">
  <tmp_namespace:Description>Original o fotocopia compulsada de la siguiente documentación
  acreditativa del cumplimiento de Obligaciones Tributarias y de Seguridad Social: Recibo del año
  anterior a la convocatoria del Impuesto sobre actividades económicas, o en su caso, exención
  concedida por el órgano competente. Certificaciones administrativas expedidas por las Administraciones correspondientes de la Agencia Estatal de Administración
  Tributaria y de la Tesorería Territorial de la Seguridad Social, de conformidad con lo establecido en
  el artículo 81 de la Ley General Presupuestaria y en su caso, exenciones del Impuesto del Valor
  Añadido y del Impuesto de Sociedades.</tmp_namespace:Description>

```

Semantic wikis

RDF presentation
Rhizome
HTML + RDF page edition
IkeWiki
SemanticMediaWiki
SemPerWiki
SweetWiki
WikSAR
Ontology-based population
OntoWiki
COW
Non-ontology based attribute-value annotation
DiamondWiki

The screenshot shows the SemanticMediaWiki interface for the user 'Oscar Corcho'. The page layout includes a navigation menu on the left with links like 'Main Page', 'People', 'Events', 'Help', 'RDF Export', 'Recent changes', and 'SearchTriple'. Below the navigation menu is a search bar and a toolbox with options like 'What links here', 'Related changes', 'Upload file', 'Special pages', 'Printable version', and 'Permanent link'. The main content area displays a profile for Oscar Corcho, including his affiliation (University of Manchester), homepage, and participation in conferences like ESWC2006 and ISWC2006. The page is categorized as 'Person' and includes a footer with modification date and access statistics.



Semantic Wikipedia

Semantic desktop (including semantic e-mail)

Haystack
Gnowsif
D-Bin
OpenIris
NEPOMUK

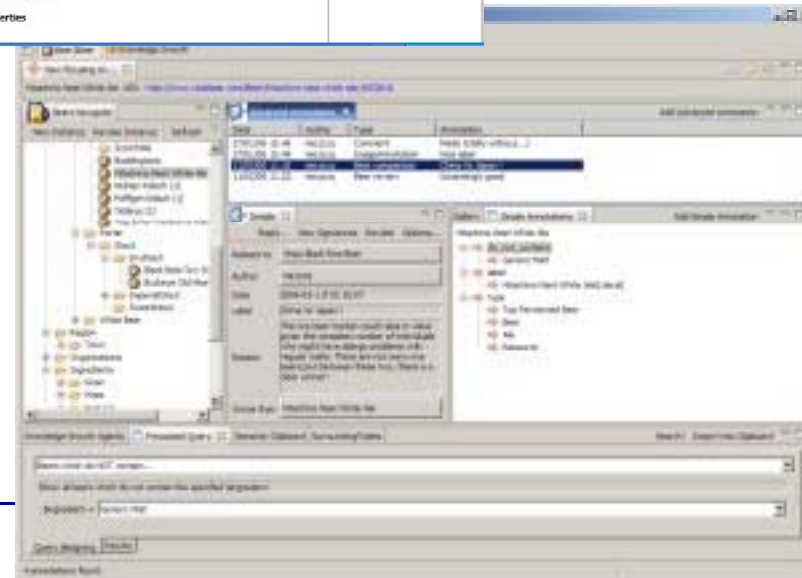
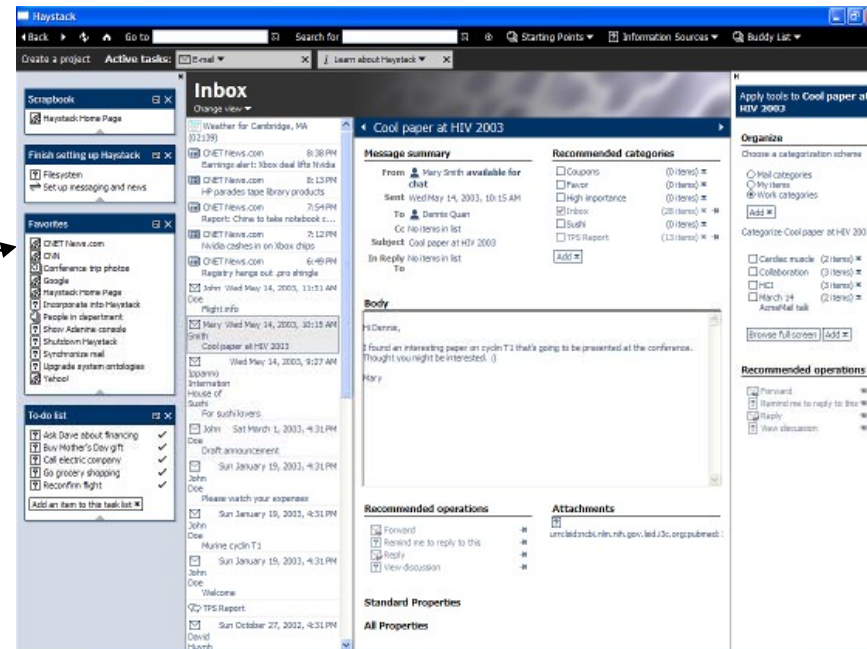
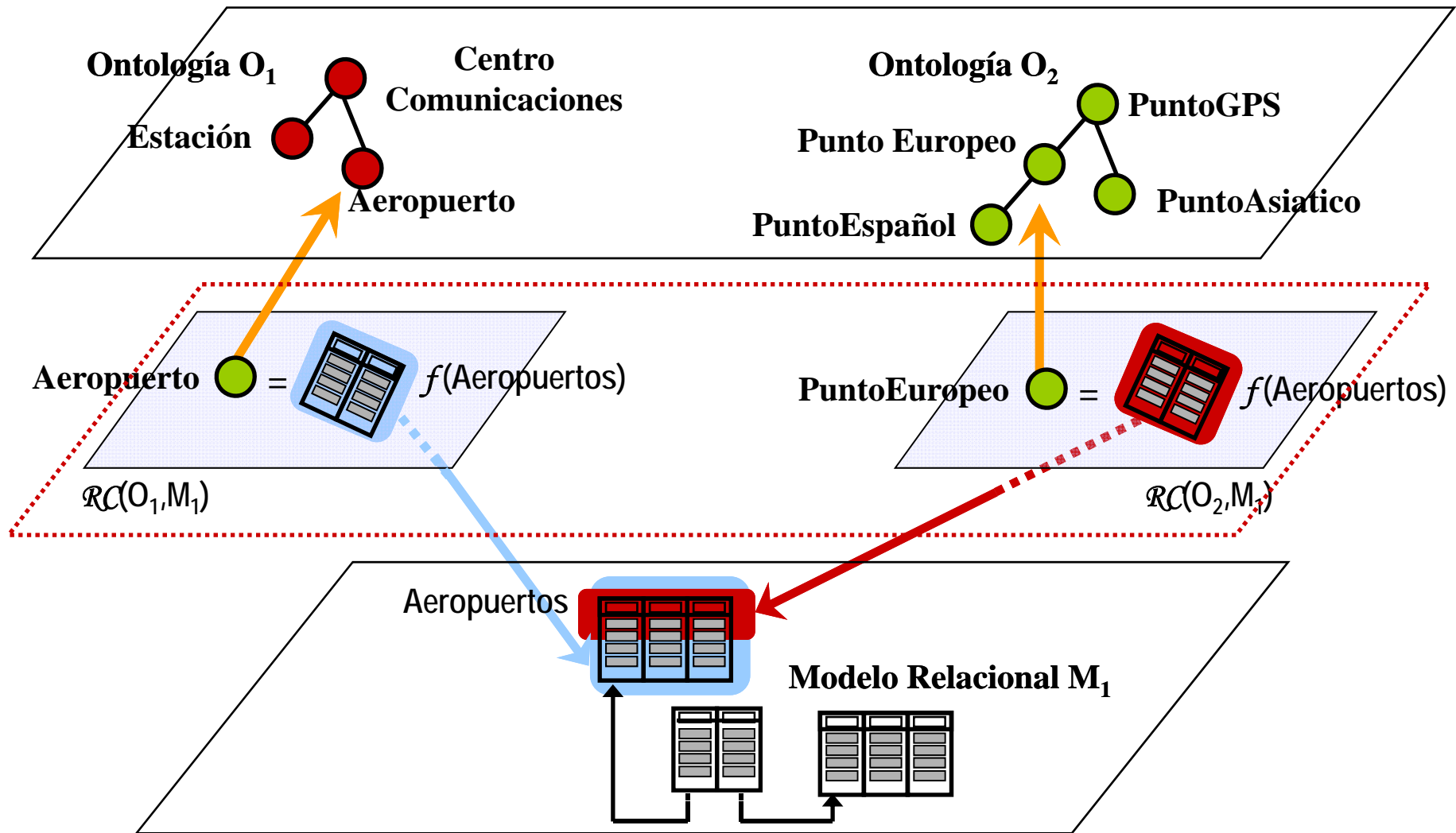


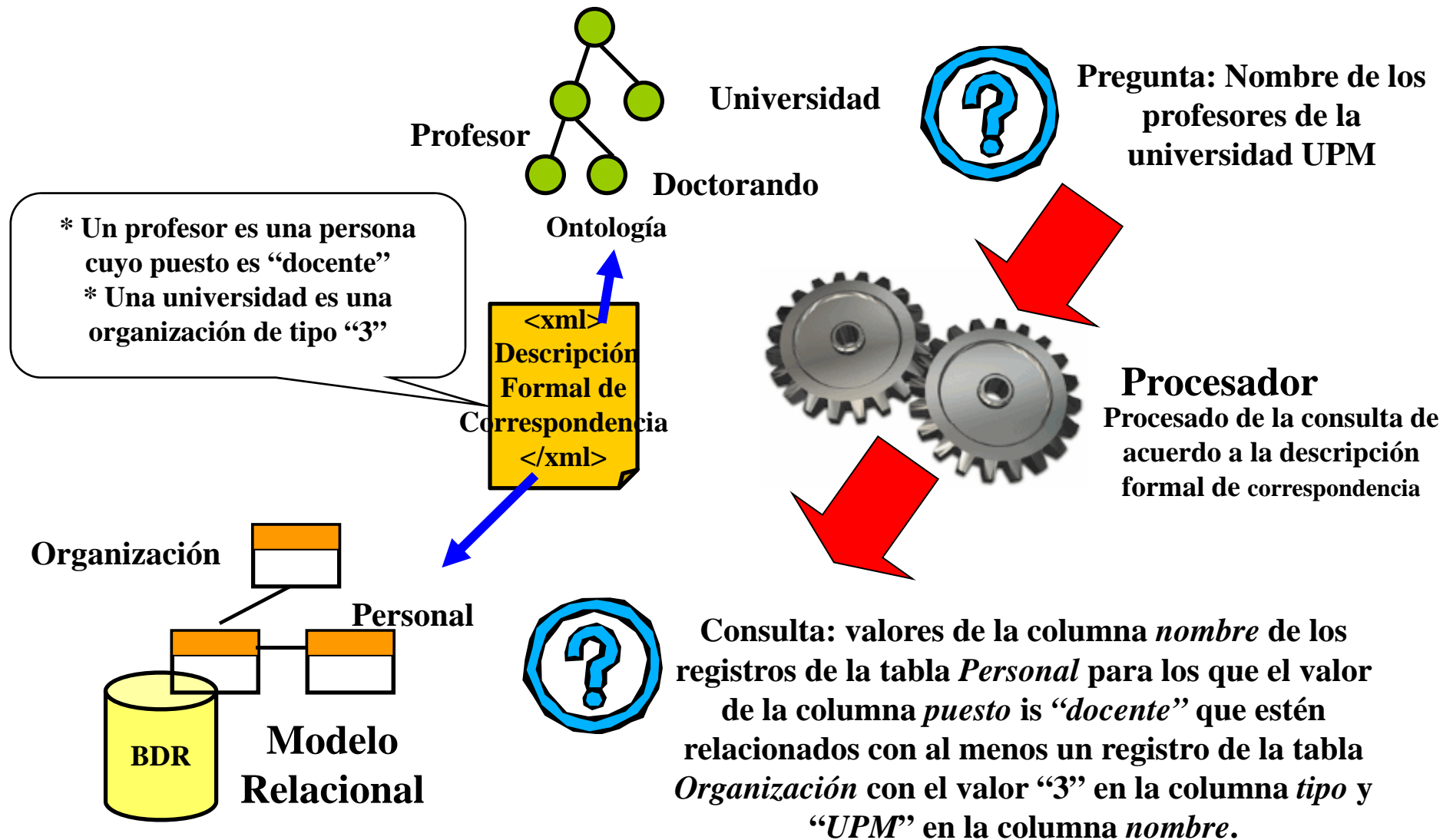
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3. **Database Annotation**
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Ontology-based view over a relational model (I)

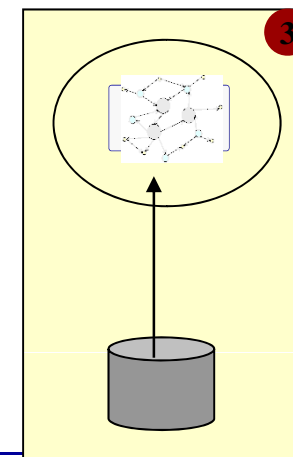
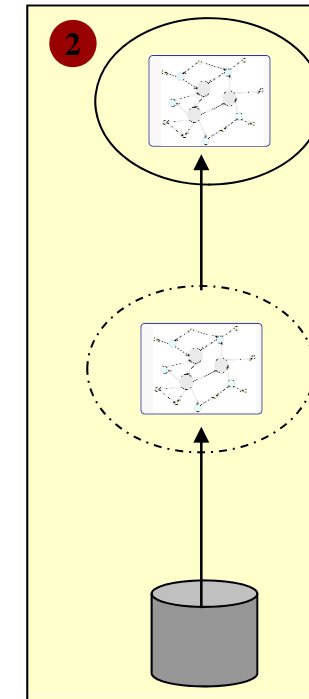
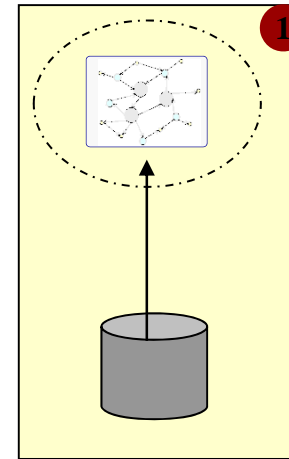




Ontology-based view over a relational model (II)



Existing approaches

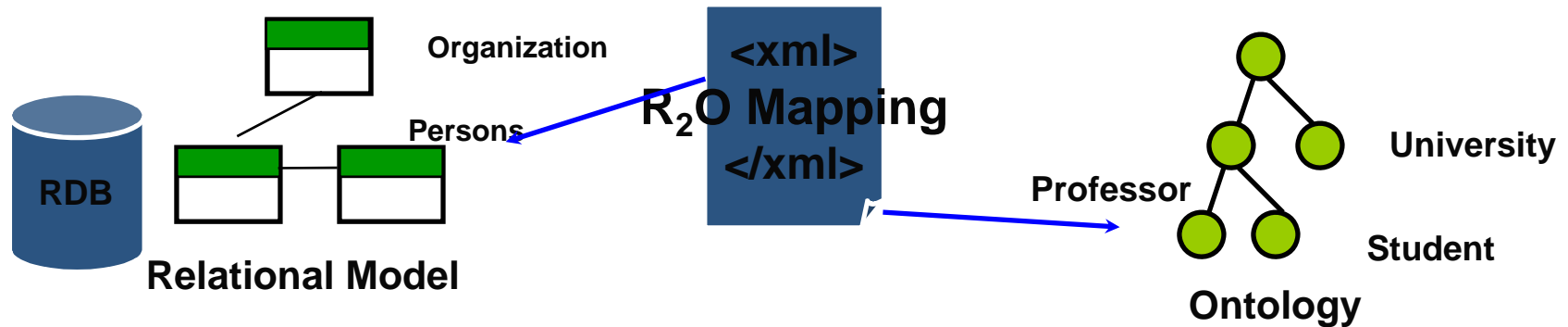
1. To build a **new ontology** from a database schema and content (OntoStudio, KaOn Reverse)
2. To map the ontology created in approach (1) to a **legacy ontology** (NeOn toolkit UKARL)
3. To map an existing DB to a **legacy ontology** (NeOn Toolkit UPM)



 new ontology
 existing ontology

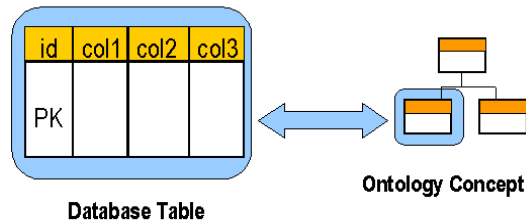
R₂O

- **R₂O** is an extensible, fully declarative language to describe mappings between relational database schemas and ontologies.

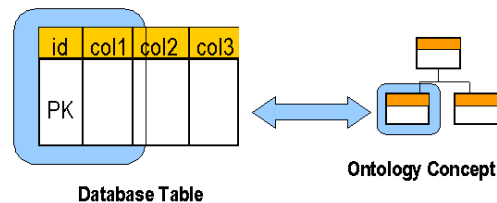


R2O (Relational-to-Ontology) Language

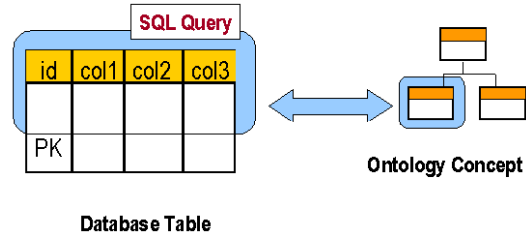
For concepts...



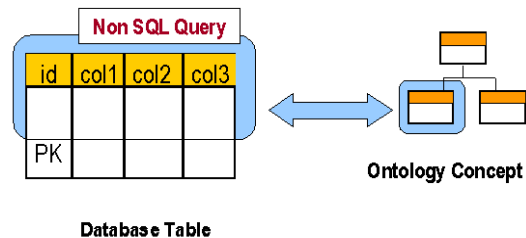
A view maps exactly one concept in the ontology.



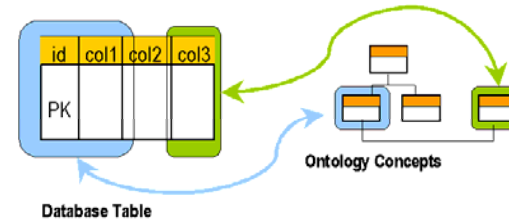
A subset of the columns in the view map a concept in the ontology.



A subset (selection) of the records of a database view map a concept in the ontology.

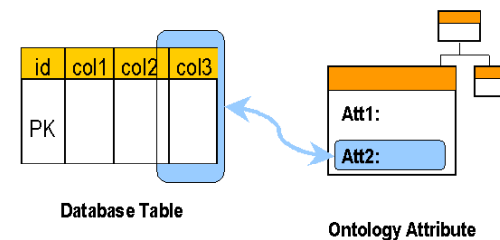


A subset of the records of a database view map a concept in the onto. but the selection cannot be made using SQL.

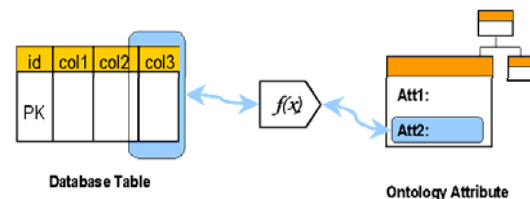


One or more concepts can be extracted from a single data field (not in 1NF).

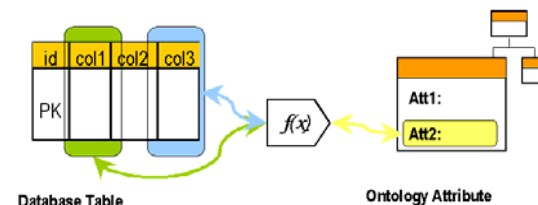
For attributes...



A column in a database view maps directly an attribute or a relation.

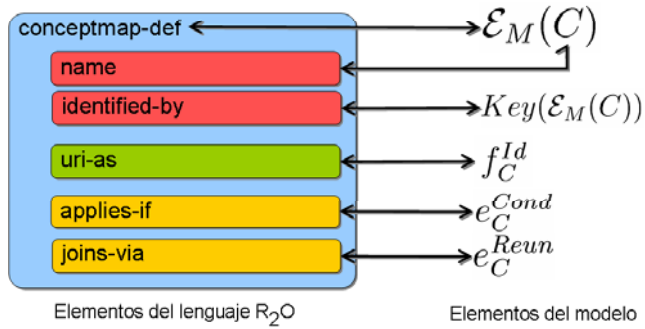


A column in a database view maps an attribute or a relation after some transformation.

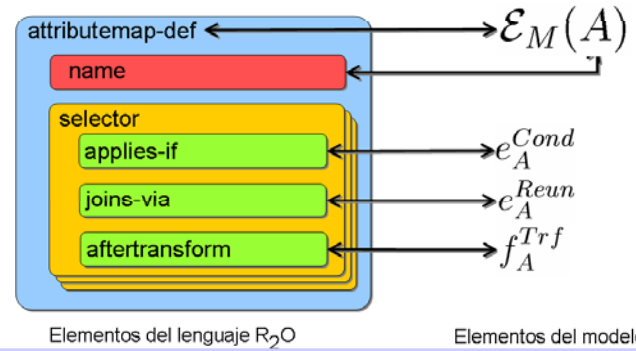


A set of columns in a database view map an attribute or a relation.

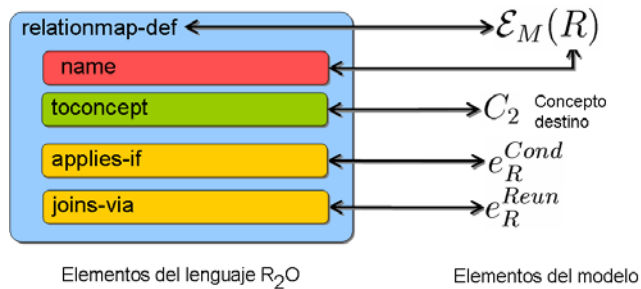
R₂O Basic Syntax



```
<conceptmap-def name="Customer">
  <identified-by> Table key </identified-by>
  <uri-as> operation </uri-as>
  <applies-if> condition </applies-if>
  <joins-via> expression </joins-via>
  <documentation>description ...</documentation>
  <described-by>attributes,relations</described-by>
</conceptmap-def>
```



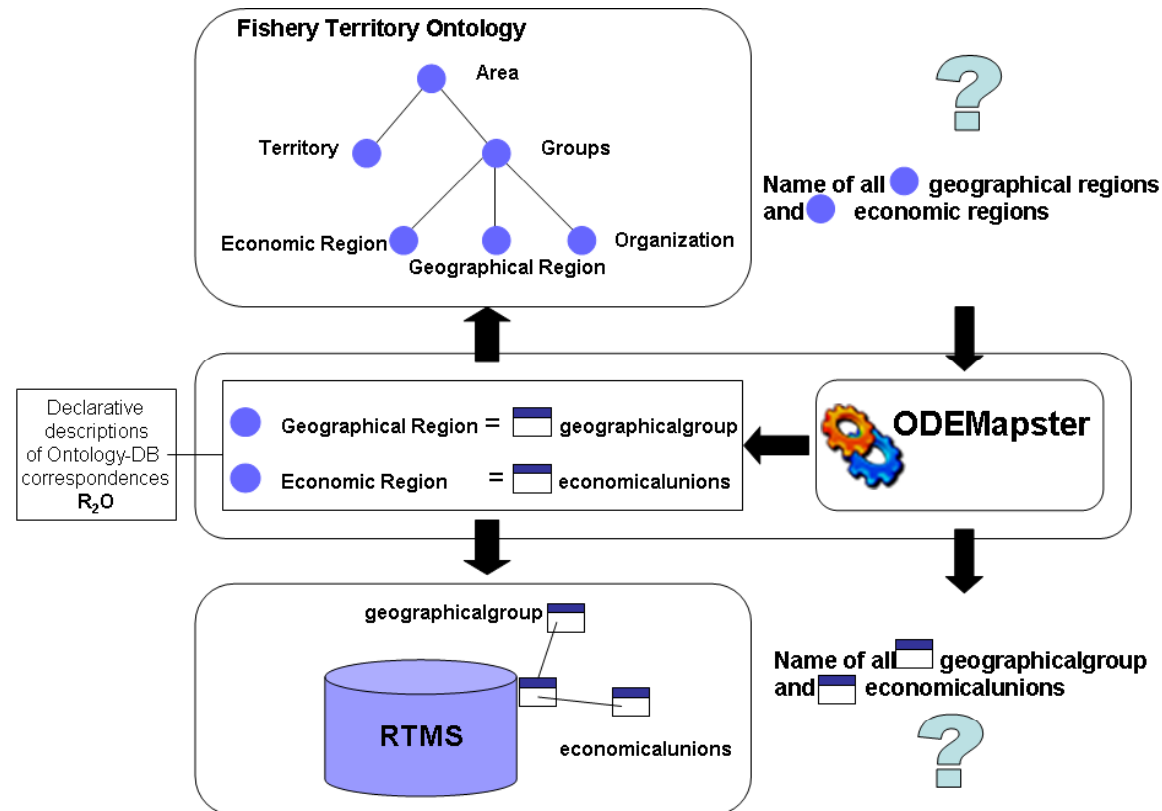
```
<attributemap-def name="http://esperonto/ff#Title">
  <aftertransform>
    <operation oper-id="constant">
      <arg-restriction on-param="const-val">
        <has-column>fsb_ajut.titol</has-column>
      </arg-restriction>
    </operation>
  </aftertransform>
</attributemap-def>
```



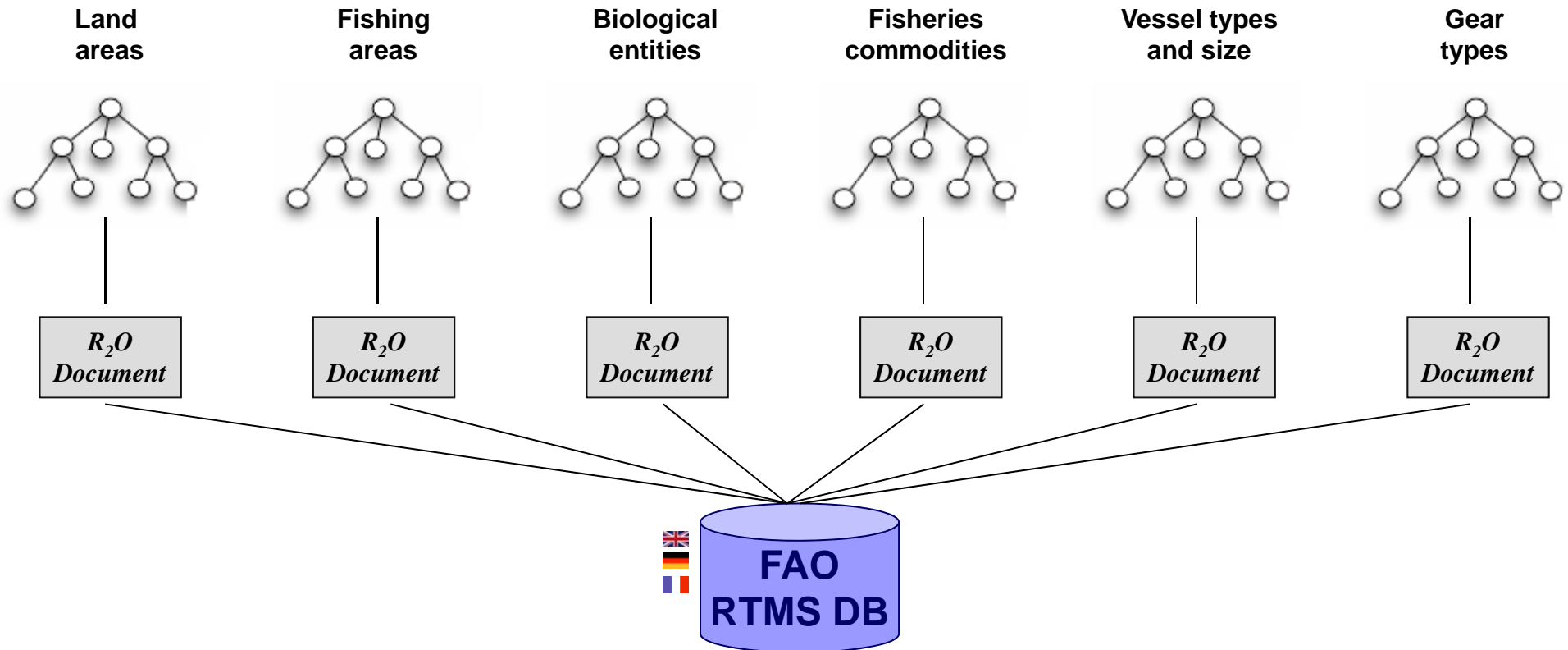
```
<relationmap-def name="http://esperonto/ff#isCandidateFor">
  <to-concept name="http://esperonto/ff#FundOpp">
    <joins-via>
      <operation oper-id="equals">
        <arg-restriction on-param="value1">
          <has-column>fsb_ajut.id</has-column>
        </arg-restriction>
        <arg-restriction on-param="value2">
          <has-column>fsb_candidate.forFund</has-column>
        </arg-restriction>
      </operation>
    </joins-via>
  </to-concept>
</relationmap-def>
```

ODEMapster

- The ODEMapster processor generates Semantic Web instances from relational instances based on the mapping description expressed in the R₂O document
 - Batch process: DB records migrated to the ontology
 - On demand: Querying the DB in terms of ontological terms



FAO Use Case



Land areas	
Concepts	4
Properties	25
Instances	289

Fishing areas	
Concepts	5
Properties	14
Instances	134

Biological entities	
Concepts	5
Properties	21
Instances	11571

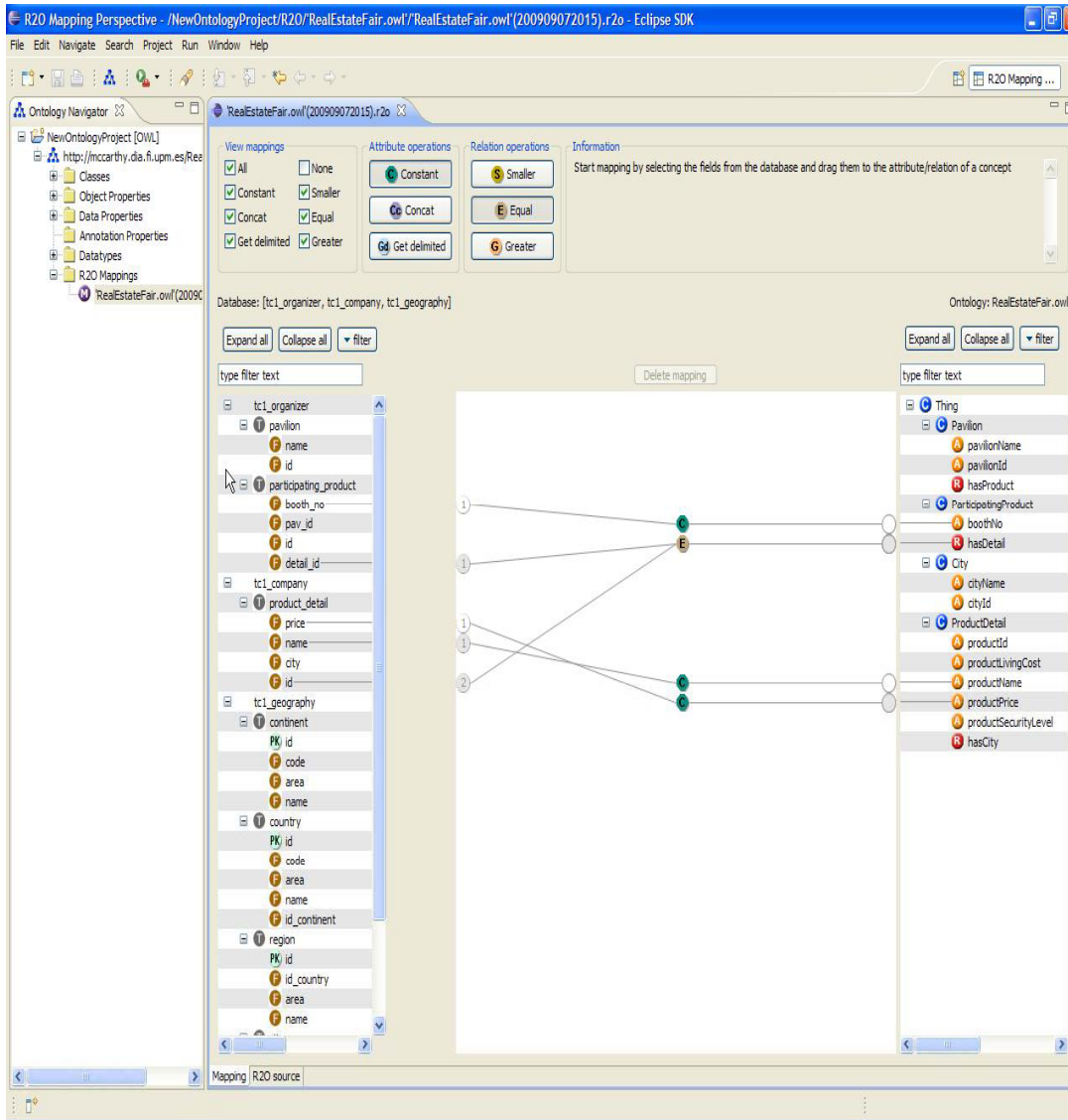
Fisheries commodity	
Concepts	5
Properties	14
Instances	1380

Vessel types and size	
Concepts	5
Properties	20
Instances	120

Gear types	
Concepts	4
Properties	14
Instances	0



Mapping Design



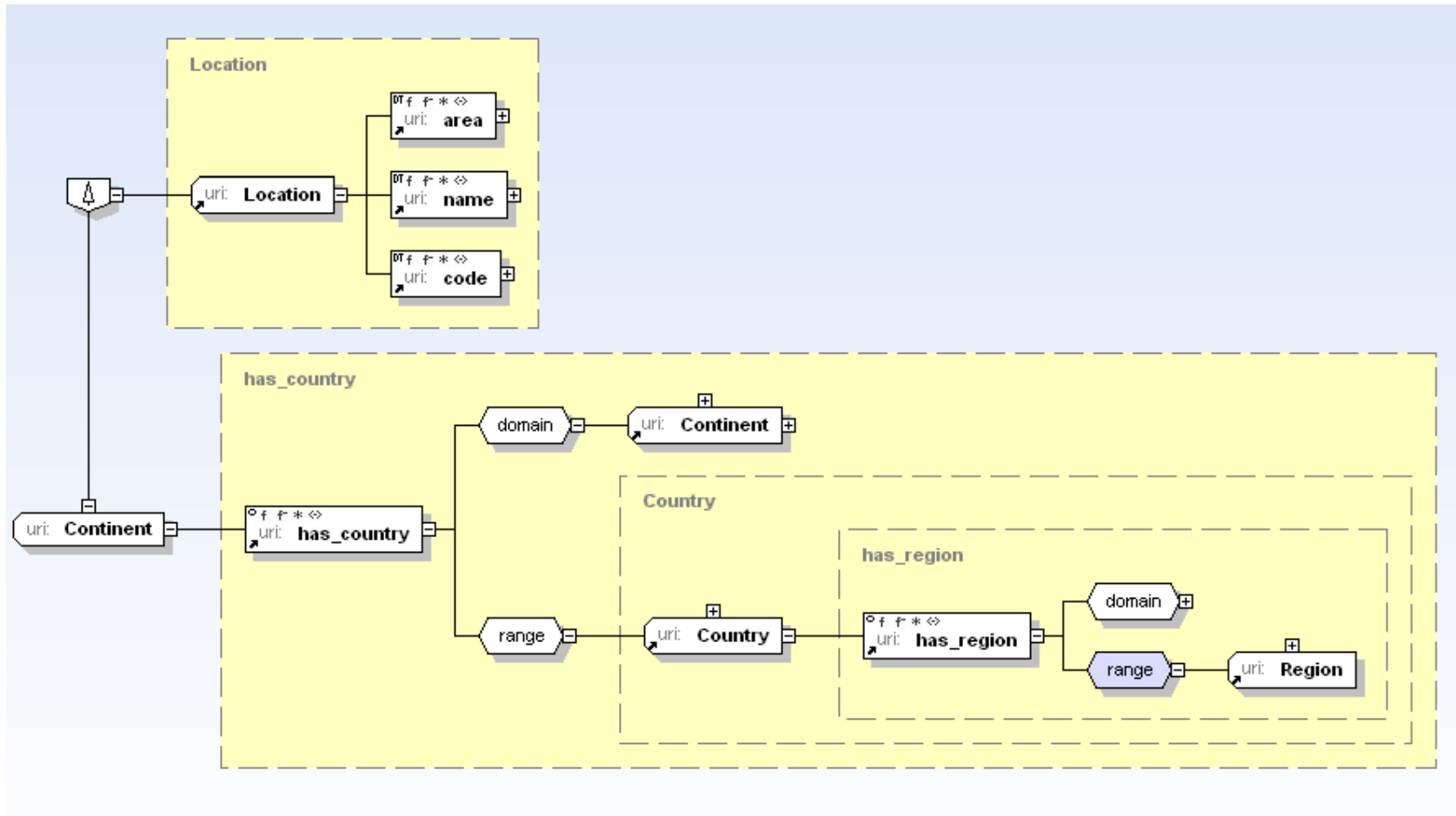
3 Mapping Creation Steps

- Load Ontology
- Load Database(s)
- Create mapping

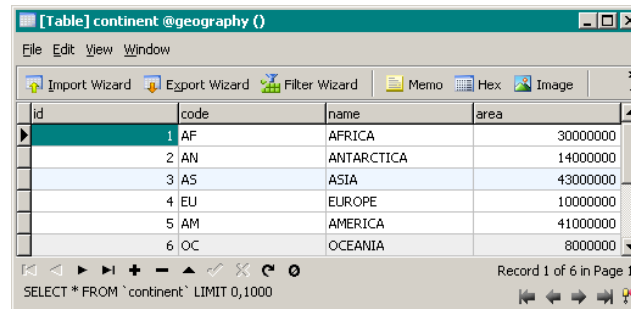
2 Usage Modes

- Online mode (run time query execution)
- Offline mode (materialized RDF dump)

Example: Geography Ontology



Geography Database

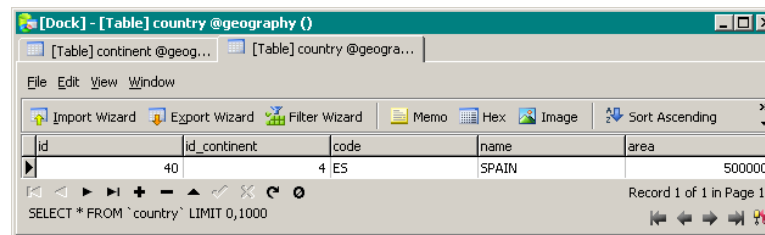


The screenshot shows a database application window titled "[Table] continent @geography ()". It contains a table with the following data:

id	code	name	area
1	AF	AFRICA	30000000
2	AN	ANTARCTICA	14000000
3	AS	ASIA	43000000
4	EU	EUROPE	10000000
5	AM	AMERICA	41000000
6	OC	OCEANIA	8000000

The application interface includes a menu bar (File, Edit, View, Window), a toolbar with icons for Import Wizard, Export Wizard, Filter Wizard, Memo, Hex, and Image, and a status bar at the bottom showing the SQL query "SELECT * FROM `continent` LIMIT 0,1000" and "Record 1 of 6 in Page 1".

Continent Table

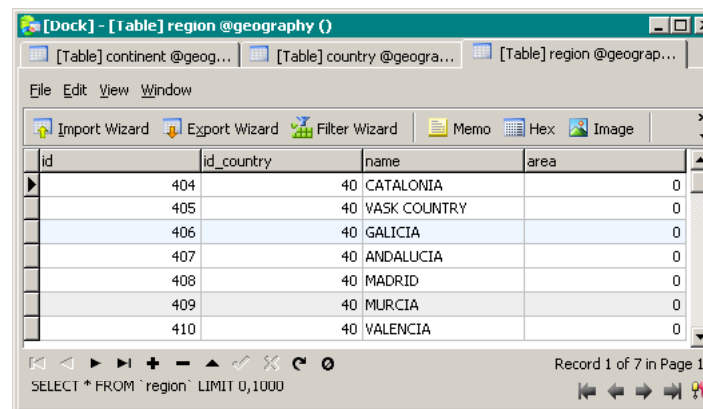


The screenshot shows a database application window titled "[Dock] - [Table] country @geography ()". It contains a table with the following data:

id	id_continent	code	name	area
40	4	ES	SPAIN	500000

The application interface includes a menu bar (File, Edit, View, Window), a toolbar with icons for Import Wizard, Export Wizard, Filter Wizard, Memo, Hex, Image, and Sort Ascending, and a status bar at the bottom showing the SQL query "SELECT * FROM `country` LIMIT 0,1000" and "Record 1 of 1 in Page 1".

Country Table



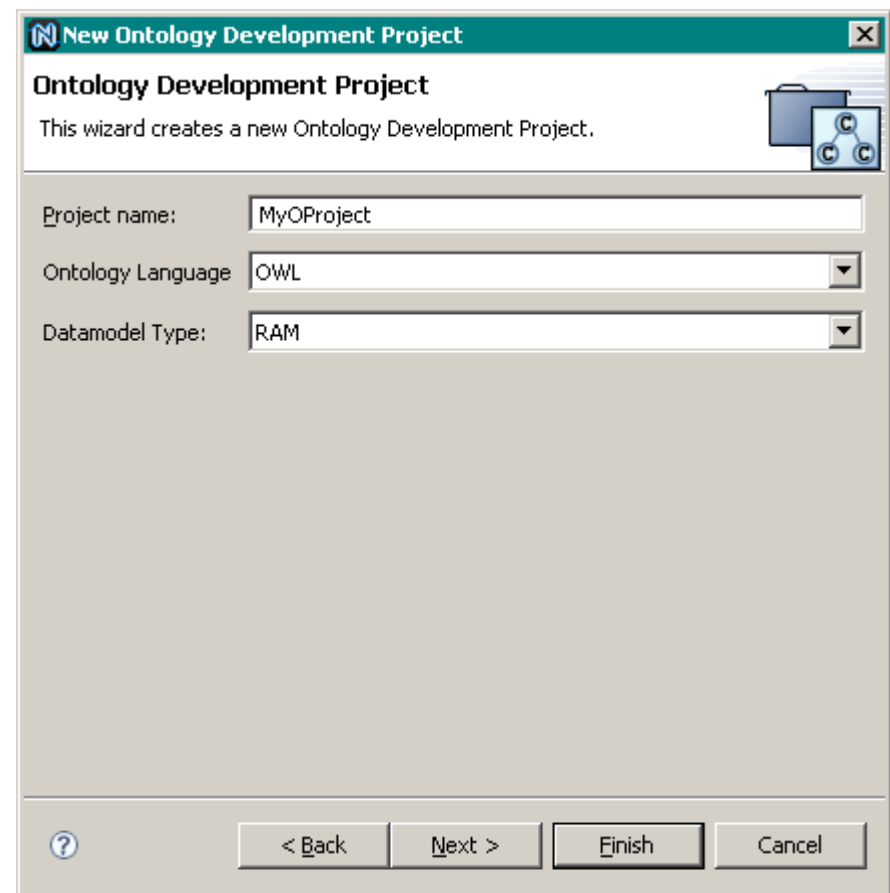
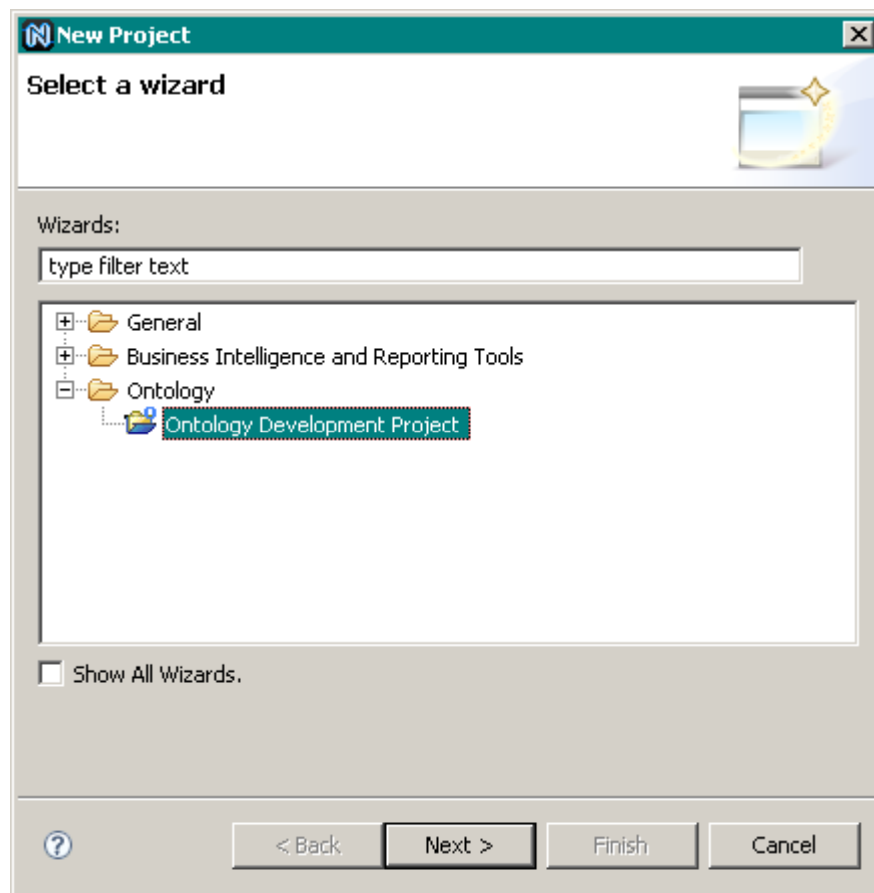
The screenshot shows a database application window titled "[Dock] - [Table] region @geography ()". It contains a table with the following data:

id	id_country	name	area
404	40	CATALONIA	0
405	40	VASK COUNTRY	0
406	40	GALICIA	0
407	40	ANDALUCIA	0
408	40	MADRID	0
409	40	MURCIA	0
410	40	VALENCIA	0

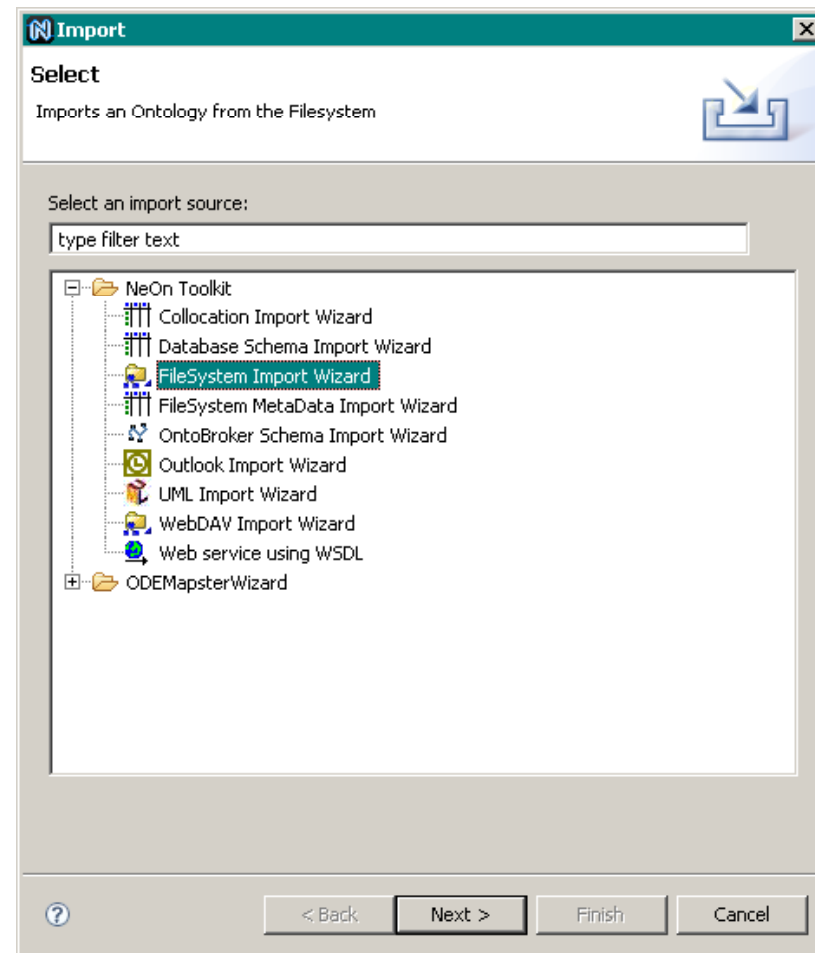
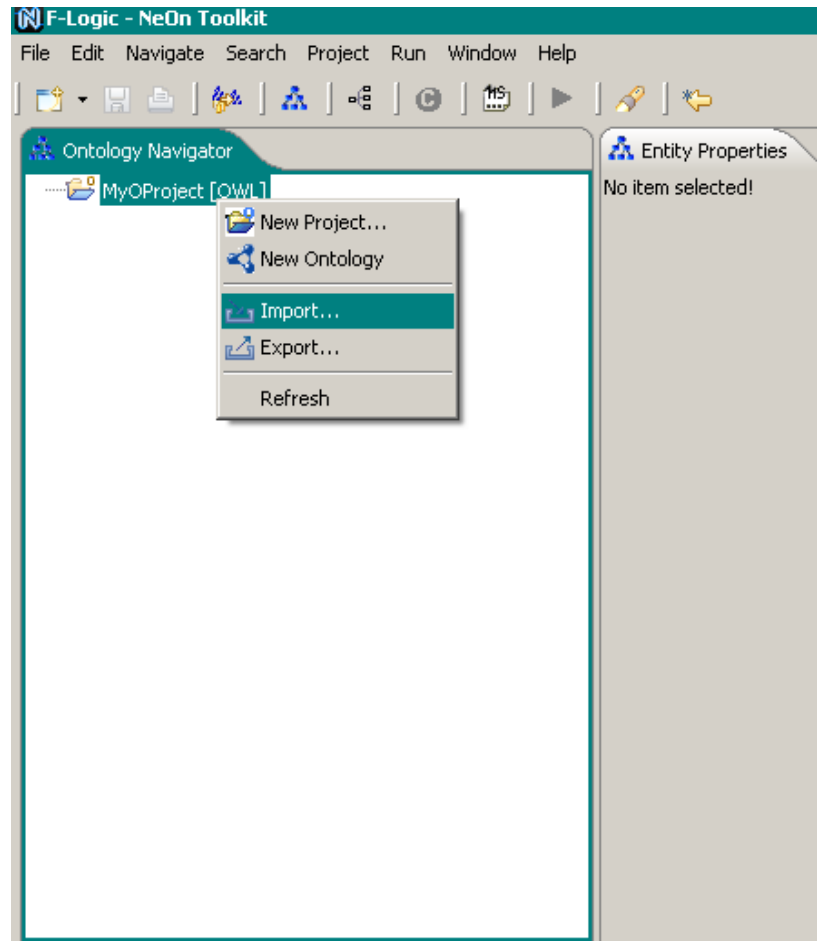
The application interface includes a menu bar (File, Edit, View, Window), a toolbar with icons for Import Wizard, Export Wizard, Filter Wizard, Memo, Hex, Image, and Sort Ascending, and a status bar at the bottom showing the SQL query "SELECT * FROM `region` LIMIT 0,1000" and "Record 1 of 7 in Page 1".

Region Table

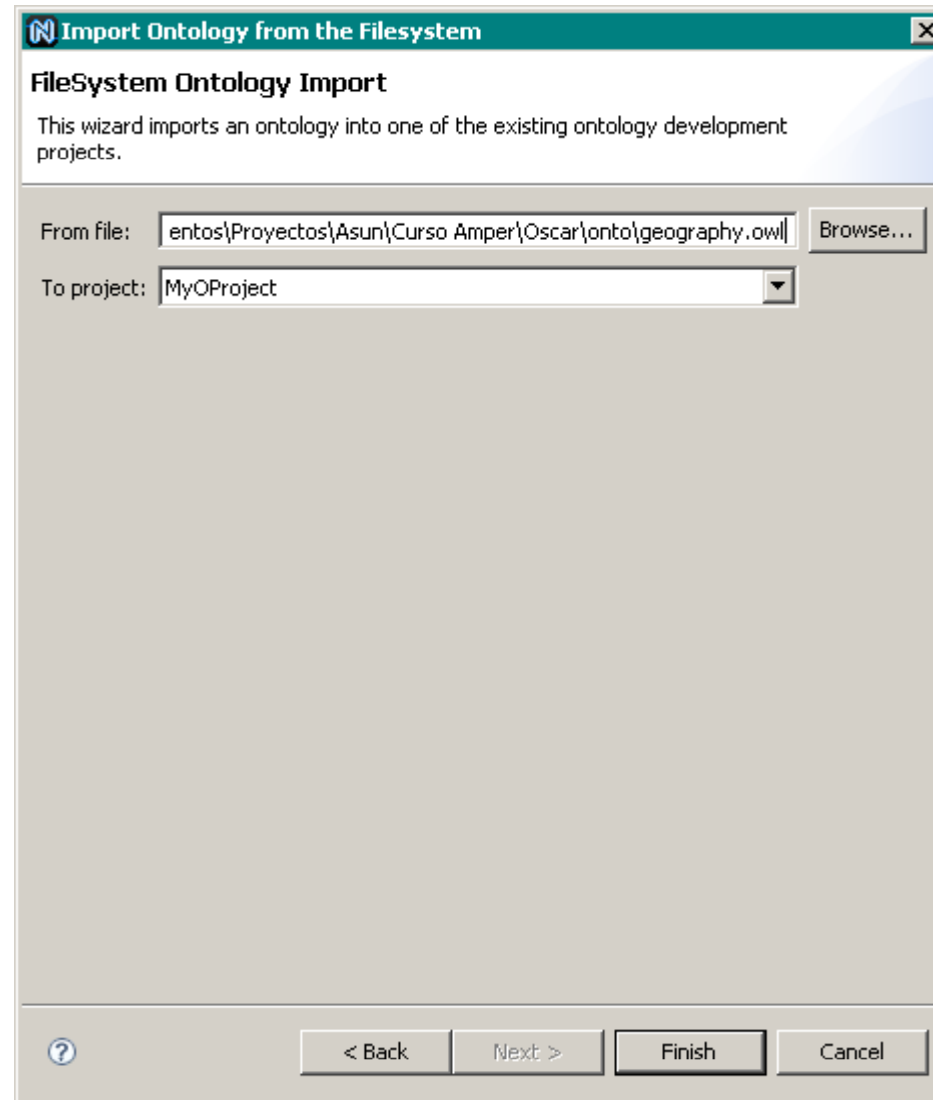
NeOn Toolkit – New Ontology Project



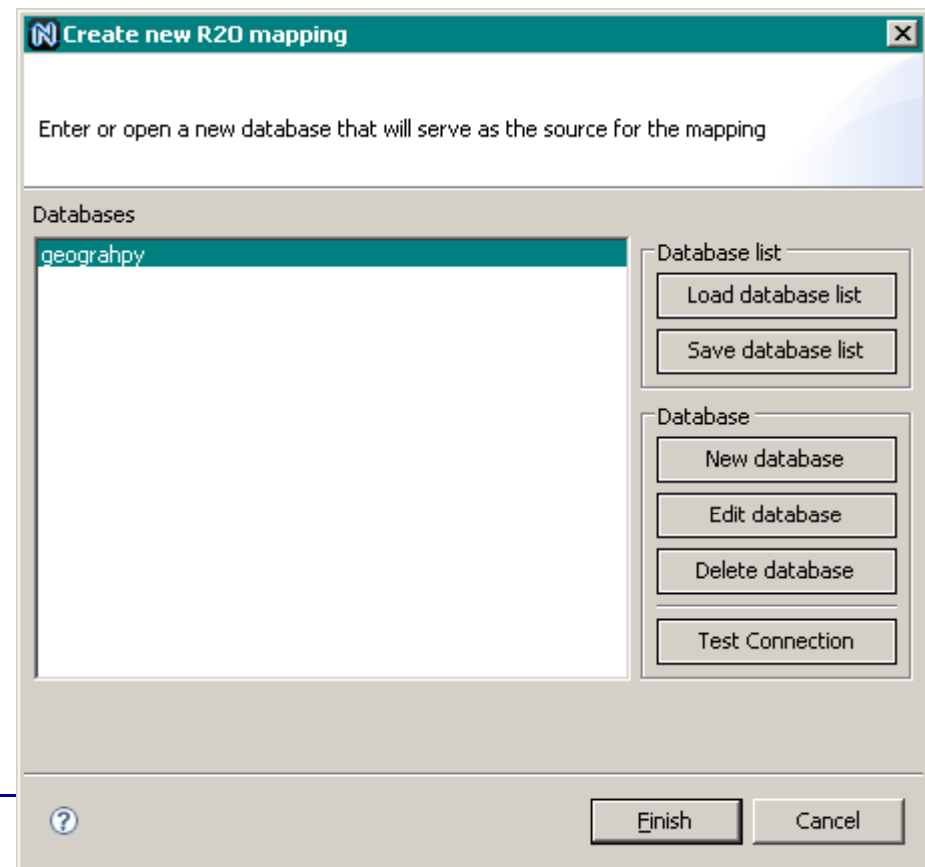
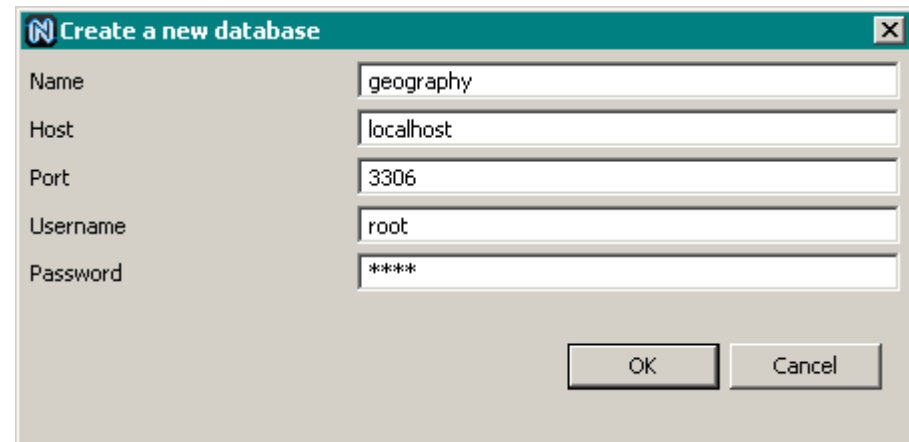
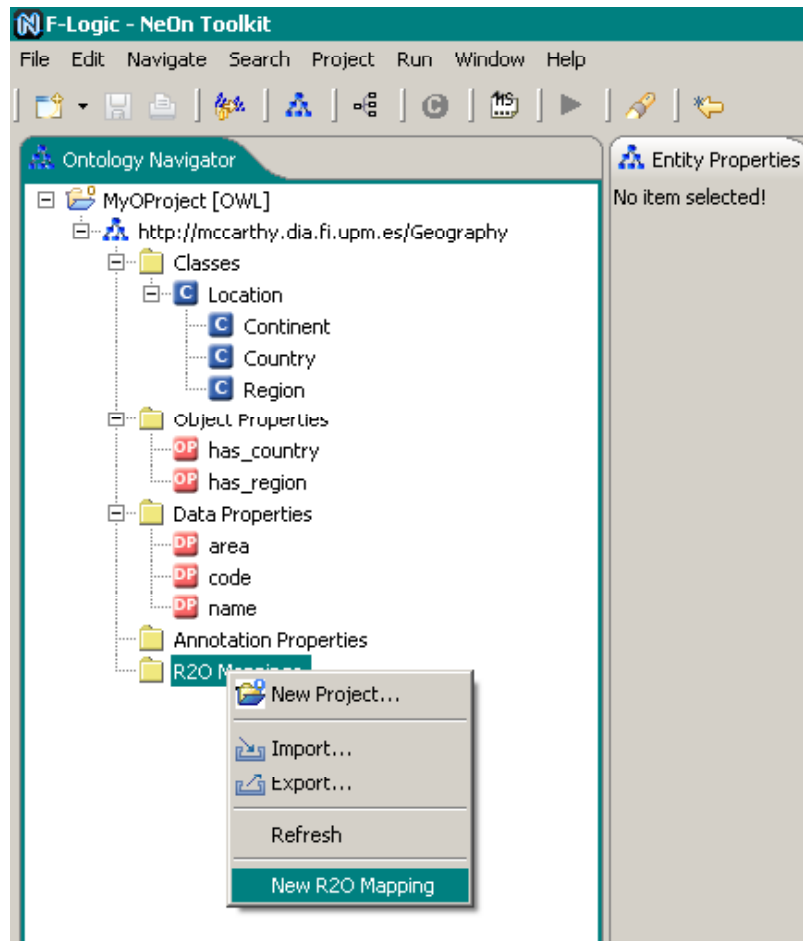
Import Ontology



Import Ontology



New R₂O Mapping – Database



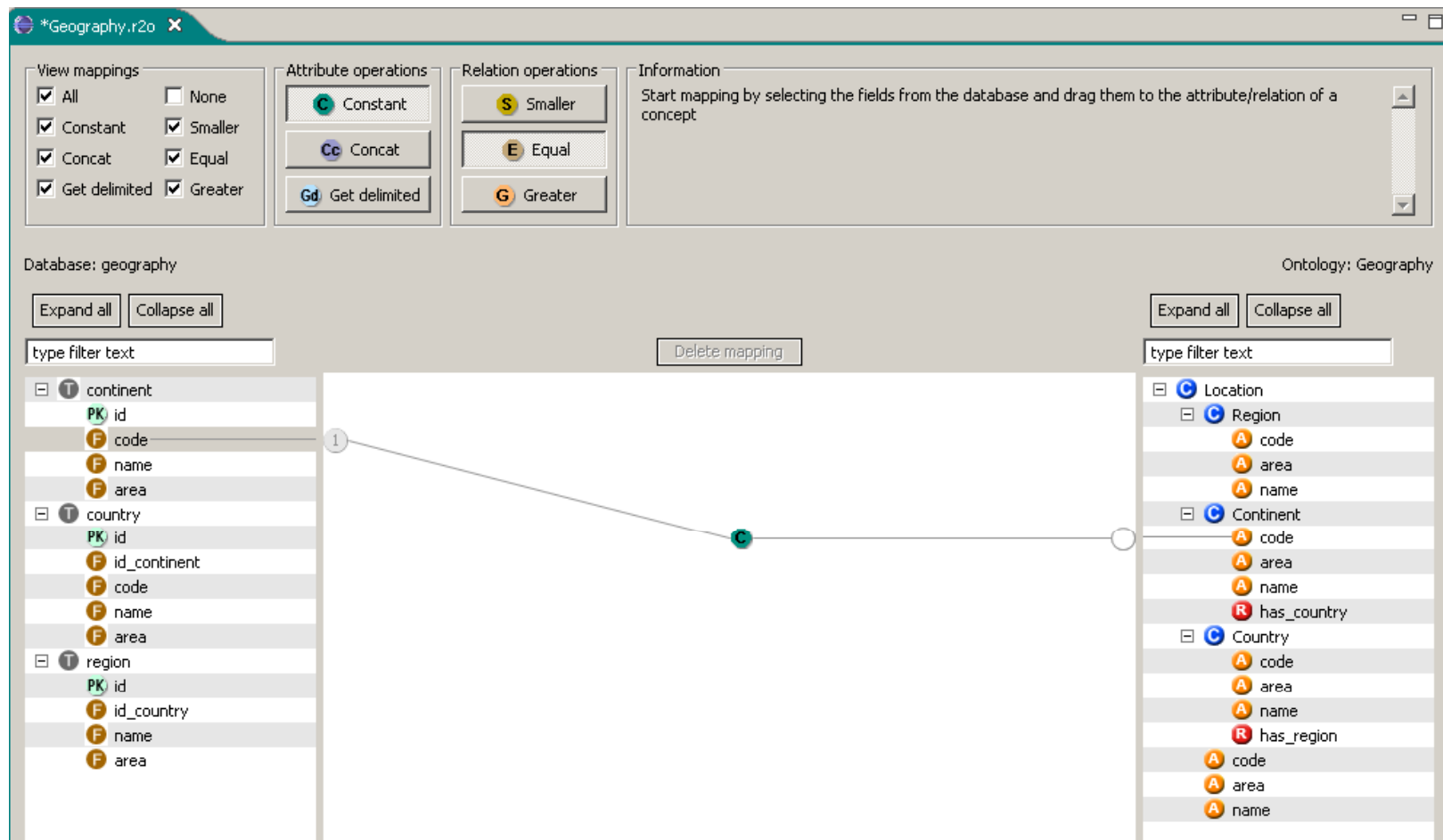
R₂O Mapping Perspective

The screenshot displays the R2O Mapping Perspective - Geography.r2o - NeOn Toolkit interface. The main window is divided into several panels:

- Ontology Navigator (Left):** Shows a hierarchical tree of the 'Geography' ontology. It includes classes like 'Location', 'Continent', 'Country', and 'Region', along with object properties ('has_country', 'has_region'), data properties ('area', 'code', 'name'), and annotation properties.
- Geography.r2o (Top Center):** Contains configuration options for 'View mappings' (All, Constant, Concat, Get delimited, None, Smaller, Equal, Greater), 'Attribute operations' (Constant, Concat, Get delimited), and 'Relation operations' (Smaller, Equal, Greater). It also includes an 'Information' section with instructions on how to start mapping.
- Database: geography (Bottom Left):** Lists database tables and their attributes. For example, 'continent' has attributes 'id' (PK), 'code', 'name', and 'area'. 'country' has 'id' (PK), 'id_continent', 'code', 'name', and 'area'. 'region' has 'id' (PK), 'id_country', 'name', and 'area'.
- Ontology: Geography (Bottom Right):** Lists ontology classes and their attributes. For example, 'Location' has 'Region' as a subclass, and 'Region' has attributes 'code', 'area', and 'name'. 'Continent' has 'code', 'area', and 'name'. 'Country' has 'code', 'area', 'name', and 'has_region'.

The central area is a large workspace for creating and editing mappings between the database attributes and ontology classes.

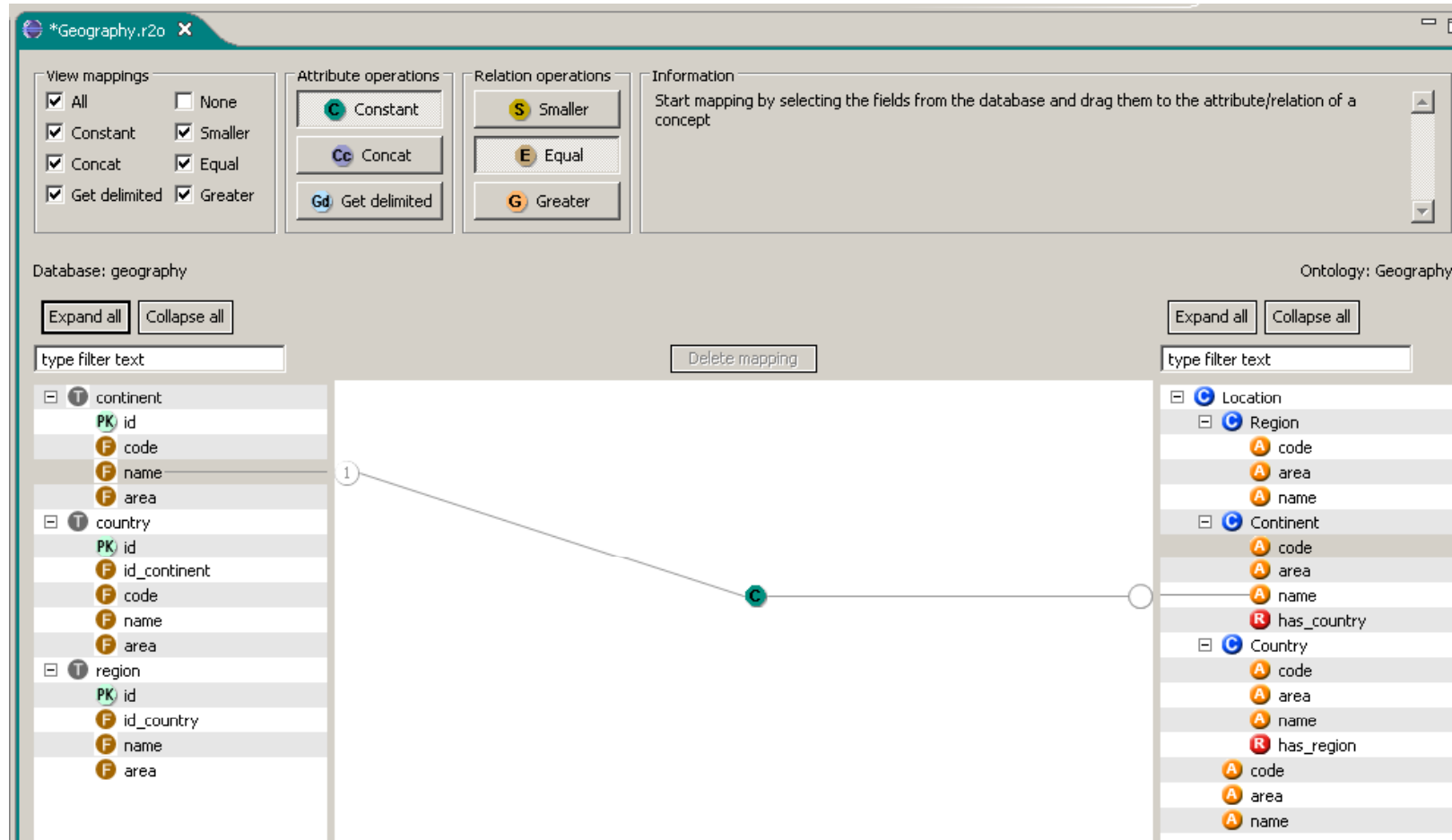
An attribute mapping example



An attribute mapping example – R₂O Code

```
<attributemap-def name="http://mccarthy.dia.fi.upm.es/Geography#code">
  <selector>
    <aftertransform>
      <operation oper-id="constant">
        <arg-restriction on-param="const-val">
          <has-column>continent.code</has-column>
        </arg-restriction>
      </operation>
    </aftertransform>
  </selector>
</attributemap-def>
```


An attribute mapping example



An attribute mapping example – R₂O Code

```
<attributemap-def name="http://mccarthy.dia.fi.upm.es/Geography#name">
  <selector>
    <aftertransform>
      <operation oper-id="constant">
        <arg-restriction on-param="const-val">
          <has-column>continent.name</has-column>
        </arg-restriction>
      </operation>
    </aftertransform>
  </selector>
</attributemap-def>
```

An attribute mapping example

The screenshot displays the *Geography.r2o application window. At the top, there are three main sections: 'View mappings' with checkboxes for 'All', 'None', 'Constant', 'Smaller', 'Concat', 'Equal', 'Get delimited', and 'Greater'; 'Attribute operations' with buttons for 'Constant', 'Concat', and 'Get delimited'; and 'Relation operations' with buttons for 'Smaller', 'Equal', and 'Greater'. An 'Information' box on the right provides instructions: 'Start mapping by selecting the fields from the database and drag them to the attribute/relation of a concept'.

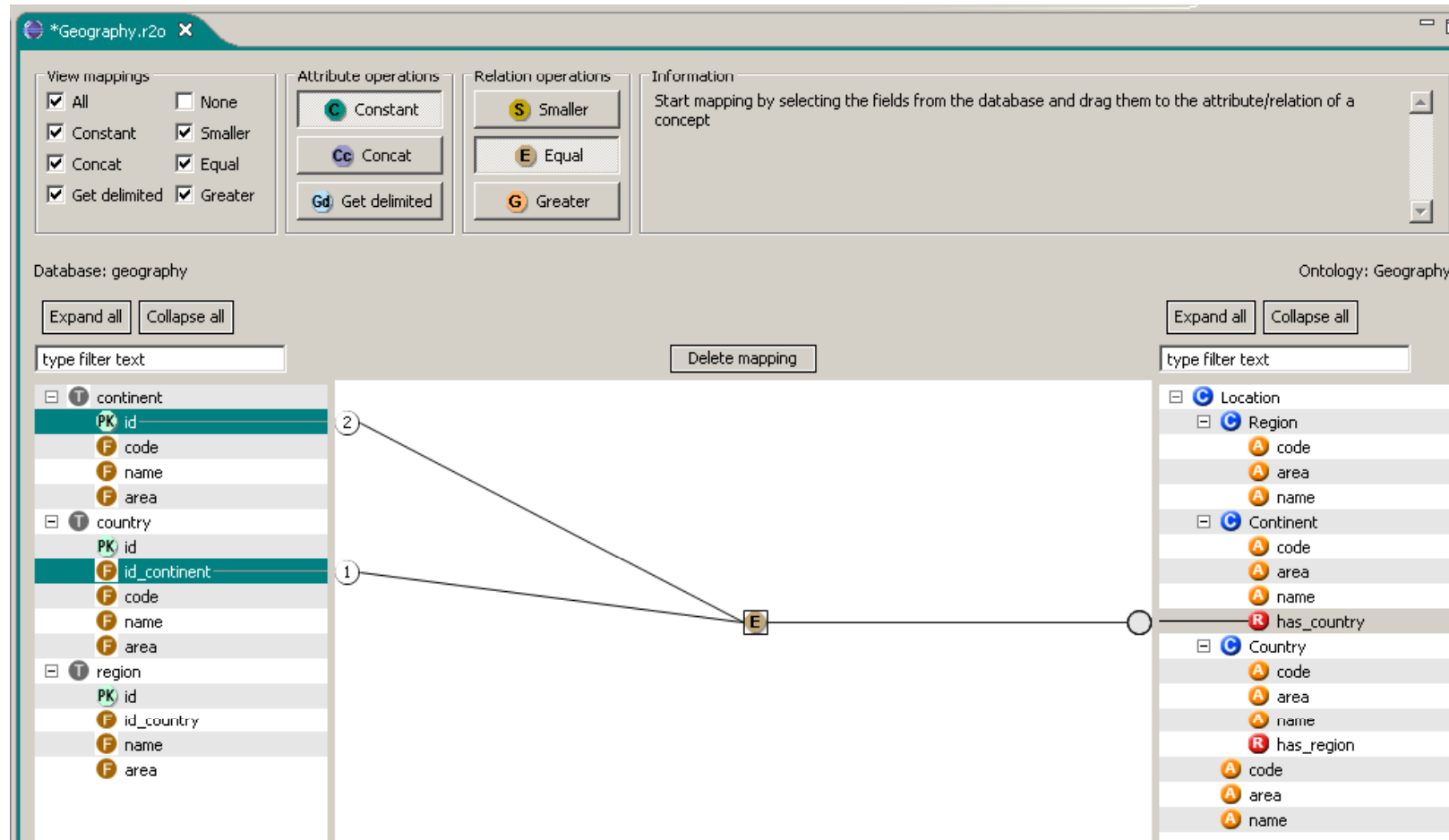
Below these sections, the 'Database: geography' and 'Ontology: Geography' are listed. Each has 'Expand all' and 'Collapse all' buttons. A 'type filter text' input field is present for both. A 'Delete mapping' button is located in the center of the workspace.

The workspace shows a mapping diagram. On the left, under 'Database: geography', the 'continent' table is expanded, showing attributes: 'id' (PK), 'code', 'name', and 'area'. The 'area' attribute is selected and connected to a green circle labeled 'C' in the workspace. On the right, under 'Ontology: Geography', the 'Location' concept is expanded, showing 'Region' and 'Continent' as sub-concepts. The 'Continent' concept is further expanded, showing attributes: 'code', 'area', 'name', and 'has_country'. The 'has_country' relation is selected and connected to the same green circle 'C' in the workspace.

An attribute mapping example – R₂O Code

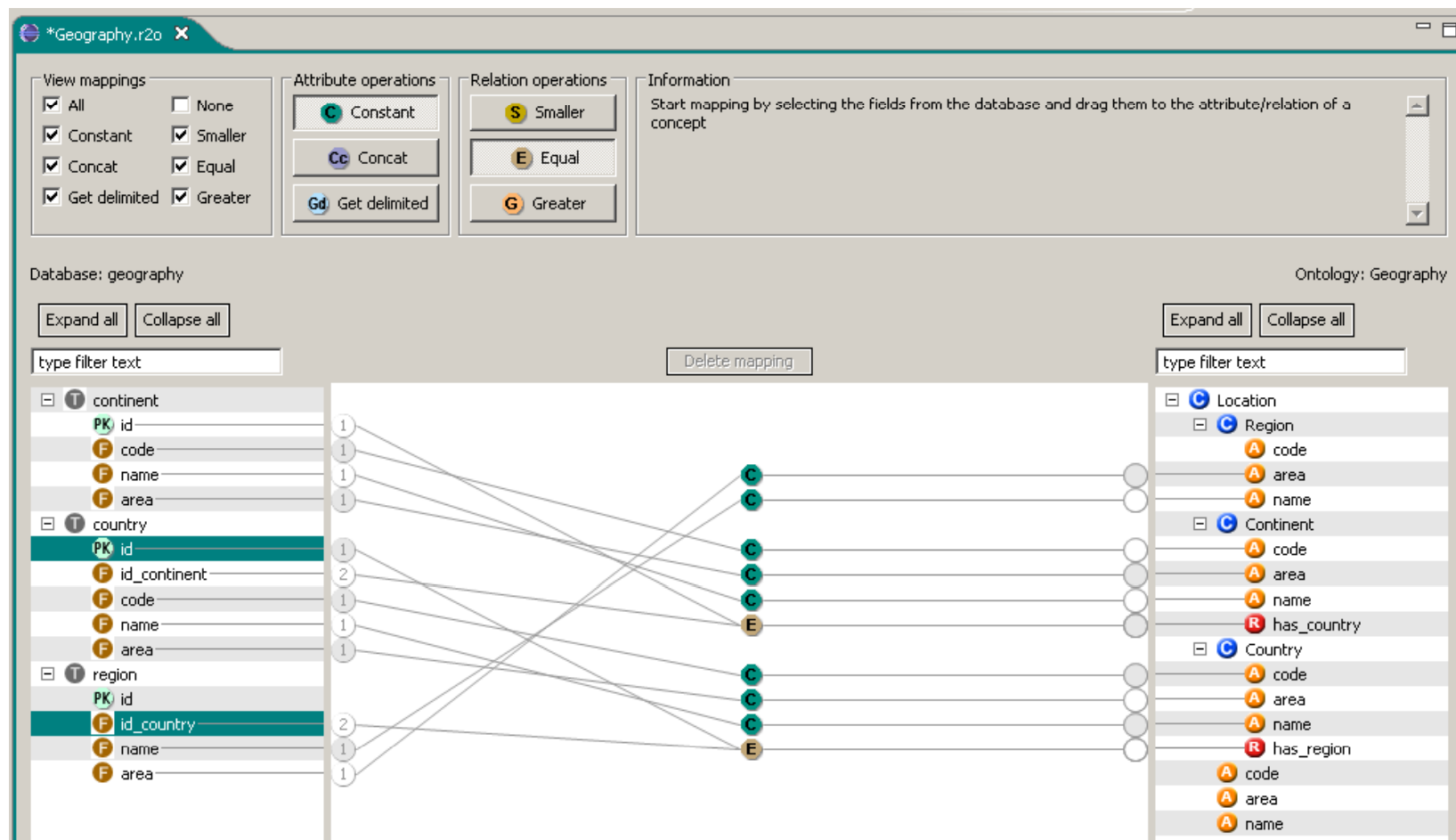
```
<attributemap-def name="http://mccarthy.dia.fi.upm.es/Geography#area">
  <selector>
    <aftertransform>
      <operation oper-id="constant">
        <arg-restriction on-param="const-val">
          <has-column>continent.area</has-column>
        </arg-restriction>
      </operation>
    </aftertransform>
  </selector>
</attributemap-def>
```

A relation mapping example



A relation mapping example – R₂O Code

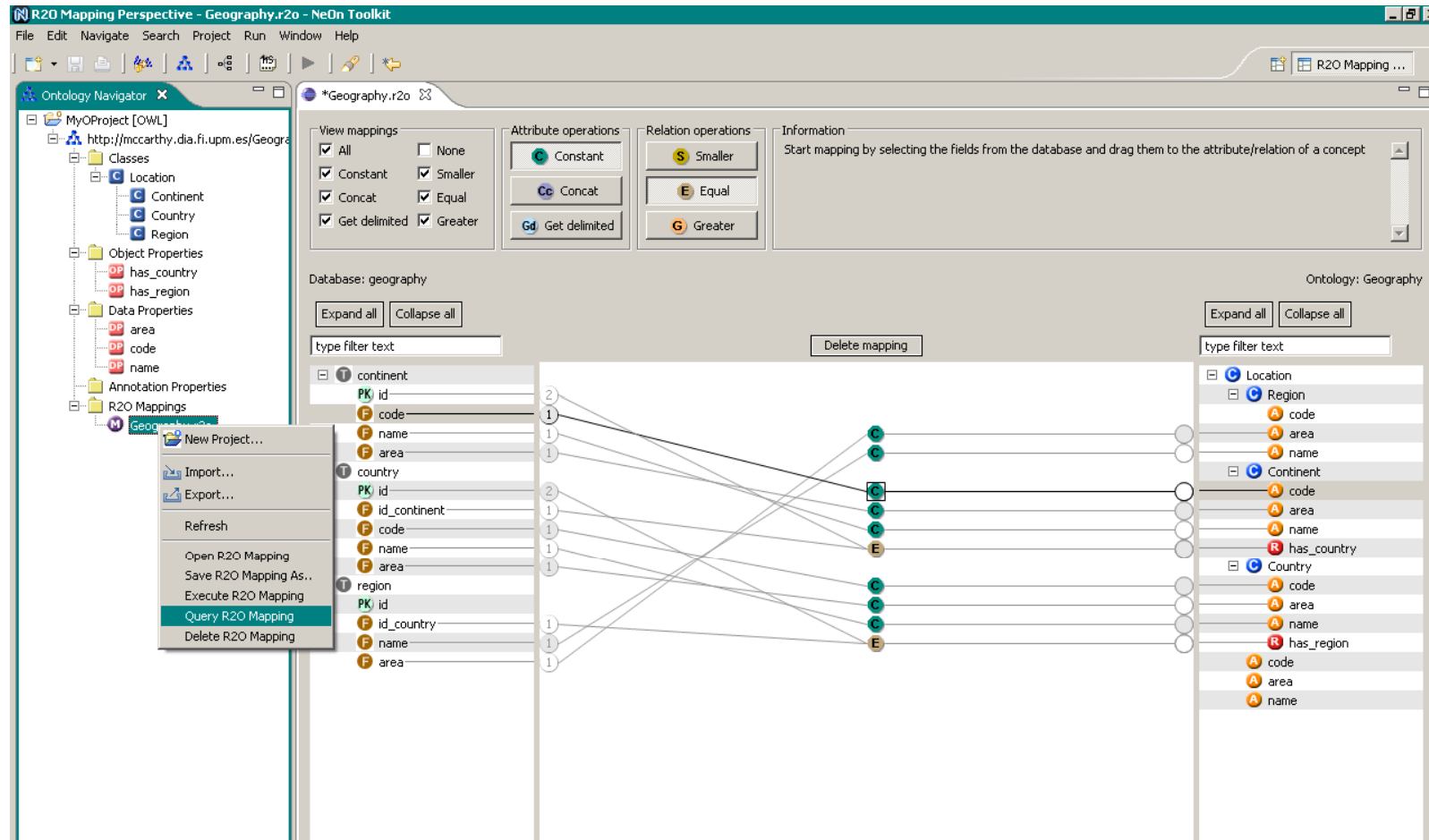
```
<dbrelationmap-def name="http://mccarthy.dia.fi.upm.es/Geography#has_country" toConcept="http://mccarthy.dia.fi.upm.es/Geography#Country">
  <joins-via>
    <condition oper-id="equals">
      <arg-restriction on-param="value1">
        <has-column>continent.id</has-column>
      </arg-restriction>
      <arg-restriction on-param="value2">
        <has-column>country.id_continent</has-column>
      </arg-restriction>
    </condition>
  </joins-via>
</dbrelationmap-def>
```



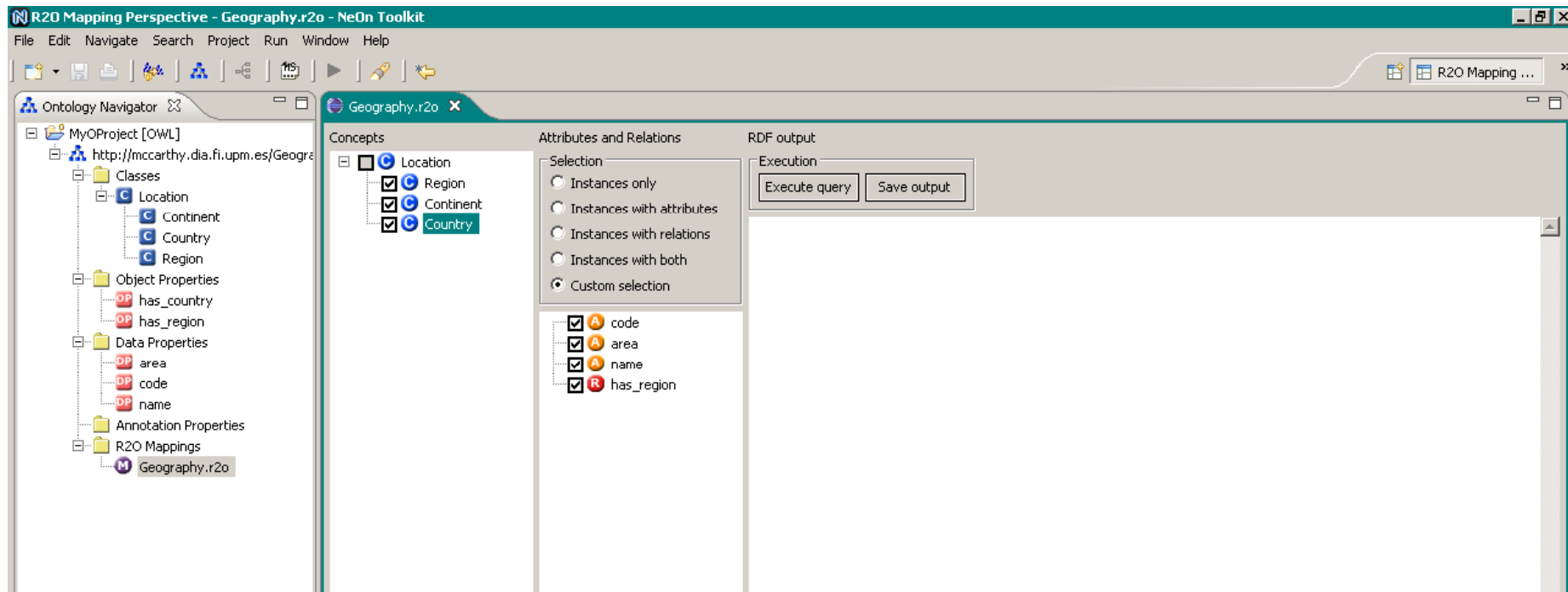
Concept mapping example – uri-as

```
<conceptmap-def name="http://mccarthy.dia.fi.upm.es/Geography#Region">
  <uri-as>
    <operation oper-id="concat">
      <arg-restriction on-param="string1">
        <has-value>http://mccarthy.dia.fi.upm.es/Geography#Region</has-value>
      </arg-restriction>
      <arg-restriction on-param="string2">
        <has-column>region.id</has-column>
      </arg-restriction>
    </operation>
  </uri-as>
  <described-by>
</conceptmap-def>
```


Querying the Ontology Instances



Querying the Ontology Instances



Querying the Ontology Instances – ODQML code

```
<onConcept conceptUri="http://mccarthy.dia.fi.upm.es/Geography#Country">
  <attSelect>
    | <onAtt attName="http://mccarthy.dia.fi.upm.es/Geography#code"/>
  </attSelect>
  <attSelect>
    | <onAtt attName="http://mccarthy.dia.fi.upm.es/Geography#area"/>
  </attSelect>
  <attSelect>
    | <onAtt attName="http://mccarthy.dia.fi.upm.es/Geography#name"/>
  </attSelect>
  <relSelect>
    | <onRel relName="http://mccarthy.dia.fi.upm.es/Geography#has_region"/>
  </relSelect>
</onConcept>
```

Retrieving the instances

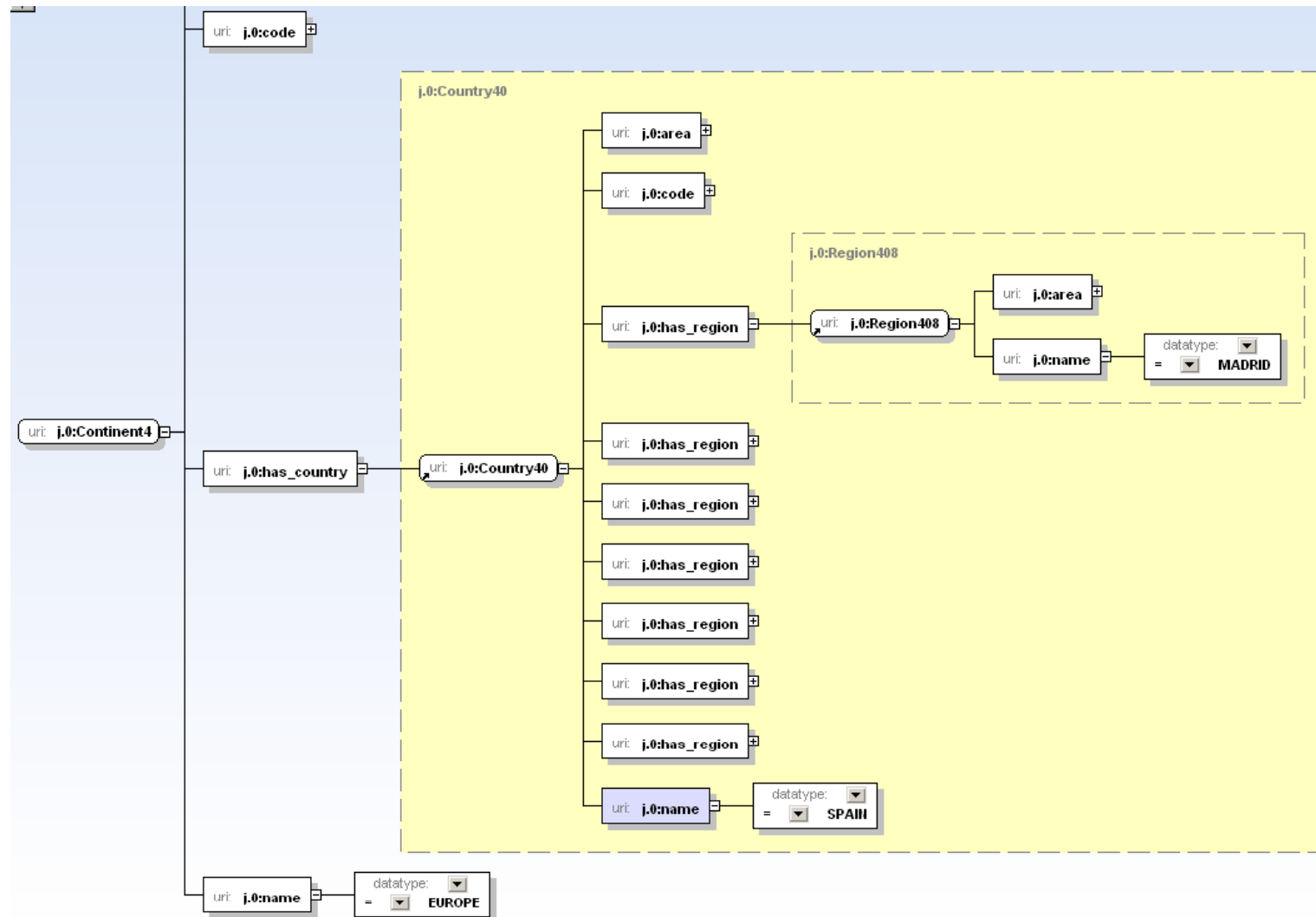
The screenshot displays the Geography.r2o application interface, which is used for querying and retrieving instances from an ontology. The interface is divided into three main panels: Concepts, Attributes and Relations, and RDF output.

Concepts: A tree view showing the hierarchy of concepts. The 'Location' concept is selected, and its sub-concepts 'Region', 'Continent', and 'Country' are also selected.

Attributes and Relations: A section for selecting attributes and relations. The 'Selection' radio buttons are set to 'Instances only'. The 'Attributes' section shows 'code', 'area', and 'name' selected. The 'Relations' section shows 'has_region' selected.

RDF output: A text area displaying the RDF output of the query. The output is a list of RDF triples, including information about regions, continents, and countries, such as 'ANTARCTICA', 'MURCIA', 'AMERICA', 'EUROPE', 'GALICIA', 'ANDALUCIA', and 'SPAIN'.

Instance example



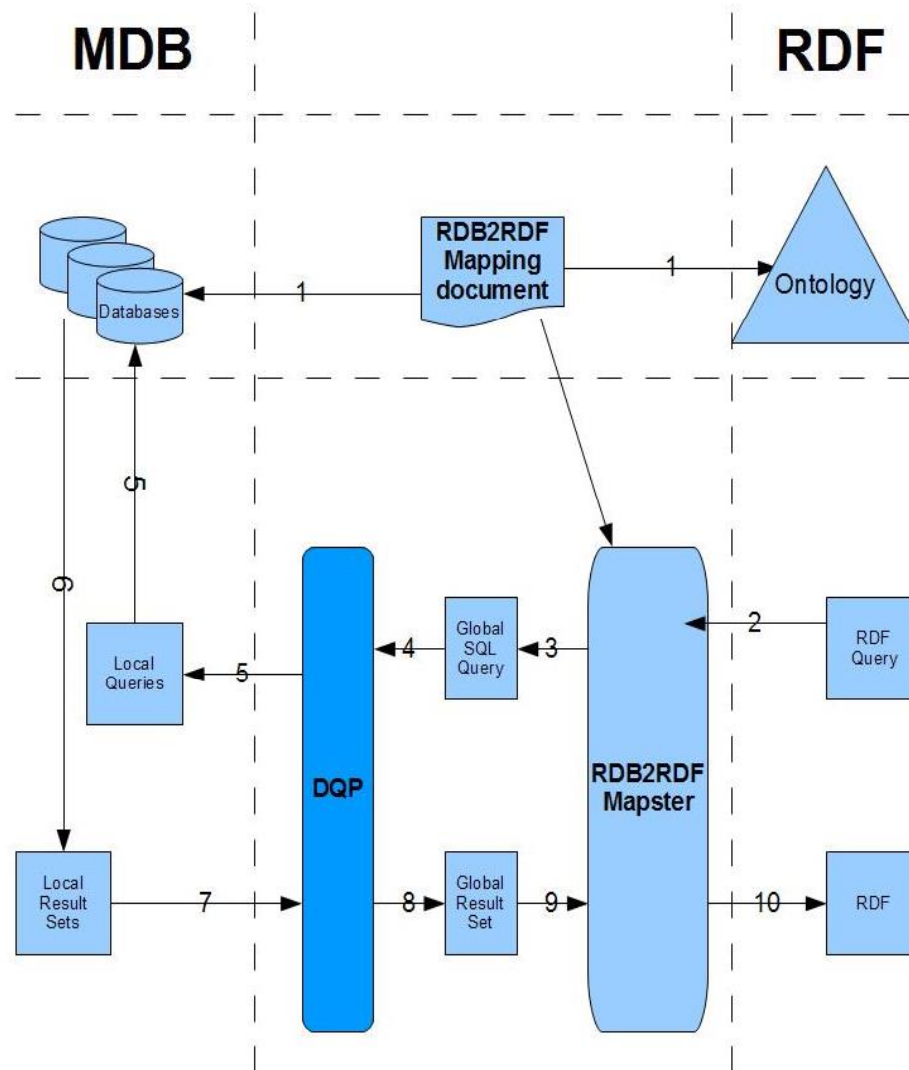
How to embed the ODEMapster Processor

```
public void testFunction() throws Exception
{
    Properties props = new Properties();

    props.setProperty(MapsterConnector.DATABASE_DRIVER, "com.mysql.jdbc.Driver");
    props.setProperty(MapsterConnector.DATABASE_URL, "jdbc:mysql://rtms_figis");
    props.setProperty(MapsterConnector.DATABASE_USER, "root");
    props.setProperty(MapsterConnector.DATABASE_PWD, "root");
    props.setProperty(MapsterConnector.OUTPUT_FILE_PATH, "c:/develop/space/mapster/examples/jan/output.rdf");
    props.setProperty(MapsterConnector.ONTO_FILE_PATH, "c:/develop/space/mapster/examples/jan/onto.owl");
    props.setProperty(MapsterConnector.R2O_FILE_PATH, "c:/develop/space/mapster/examples/jan/f1.r2o");
    props.setProperty(MapsterConnector.QUERY_FILE_PATH, "c:/develop/space/mapster/examples/jan/fq1.xml");

    MapsterConnector mp = new MapsterConnector();
    mp.setProperties(props);
    mp.process();
}
```

MDB2RDF



- Mapping defined
- RDF Query Posed
- RDF Query to Global Query
- Global query is sent to DQP
- DQP distributes global queries into local queries and evaluate them
- Databases return local results
- Local results sent to DQP
- DQP integrates the results into global result
- Global result is sent to be transformed into RDF
- RDF documents containing RDF instances

Other topics not covered today

- **Blog annotation tools**
 - E.g., Zemanta
- **Linguistic-based data annotation**
 - E.g., GATE-based tools
- **RDF data publishing**
 - RDFa
 - Linked Data
- **Ontology-based data integration techniques**