

## ATHENS Course: Ontologies and the Semantic Web

# Ontologies: Semantic Web Applications

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<http://www.oeg-upm.net/>

Madrid, November 17th, 2010

## Common features in these domains

- A large amount of information
- Need to harmonize heterogeneous information sources
  - Different formats (documents, databases, etc.)
  - Different terms and structures
- Implicit knowledge hidden inside the application code

# Table of Contents

- Semantic Web Portals: ODESeW
- SEEMP
- Information Retrieval: ReimDoc
- NeOn Use Cases



# Semantic Web Portal: ODESeW

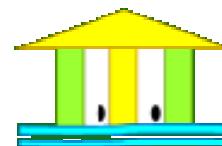


Ontology-based application that automatically generates and manages  
knowledge portals for intranets and extranets

1. Semantic Driven
2. Permission-based
3. User Oriented
4. Interoperate
5. Synchronization with the ontologies



IST-2001-34373  
<http://www.esperonto.net/>



FP6-507482

<http://knowledgeweb.semanticweb.org/>



FP6-511513

<http://www.ontogrid.net/>



FP6-002006

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



<http://kw.dia.fi.upm.es/w3c/>

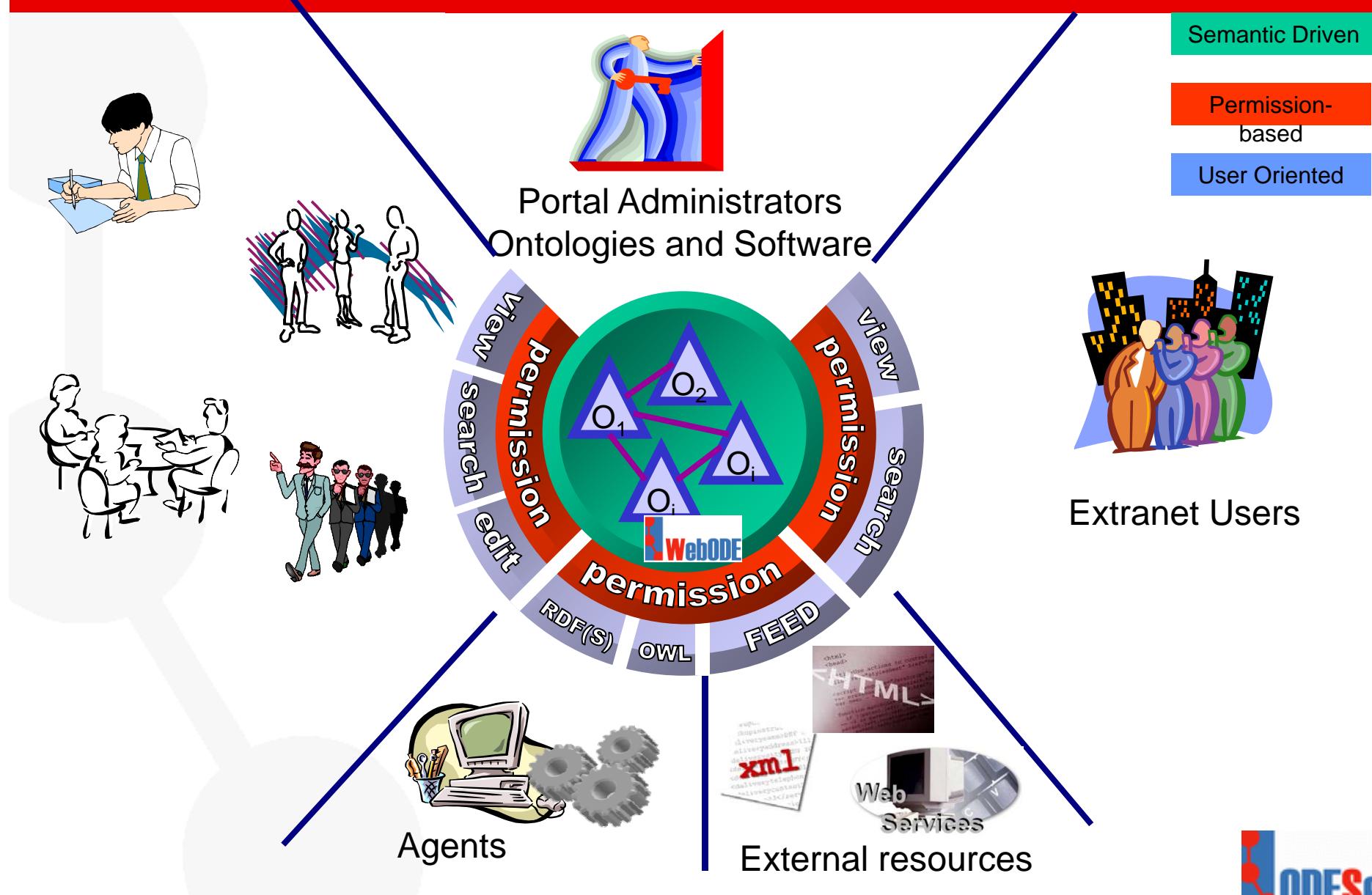


FP6-027595



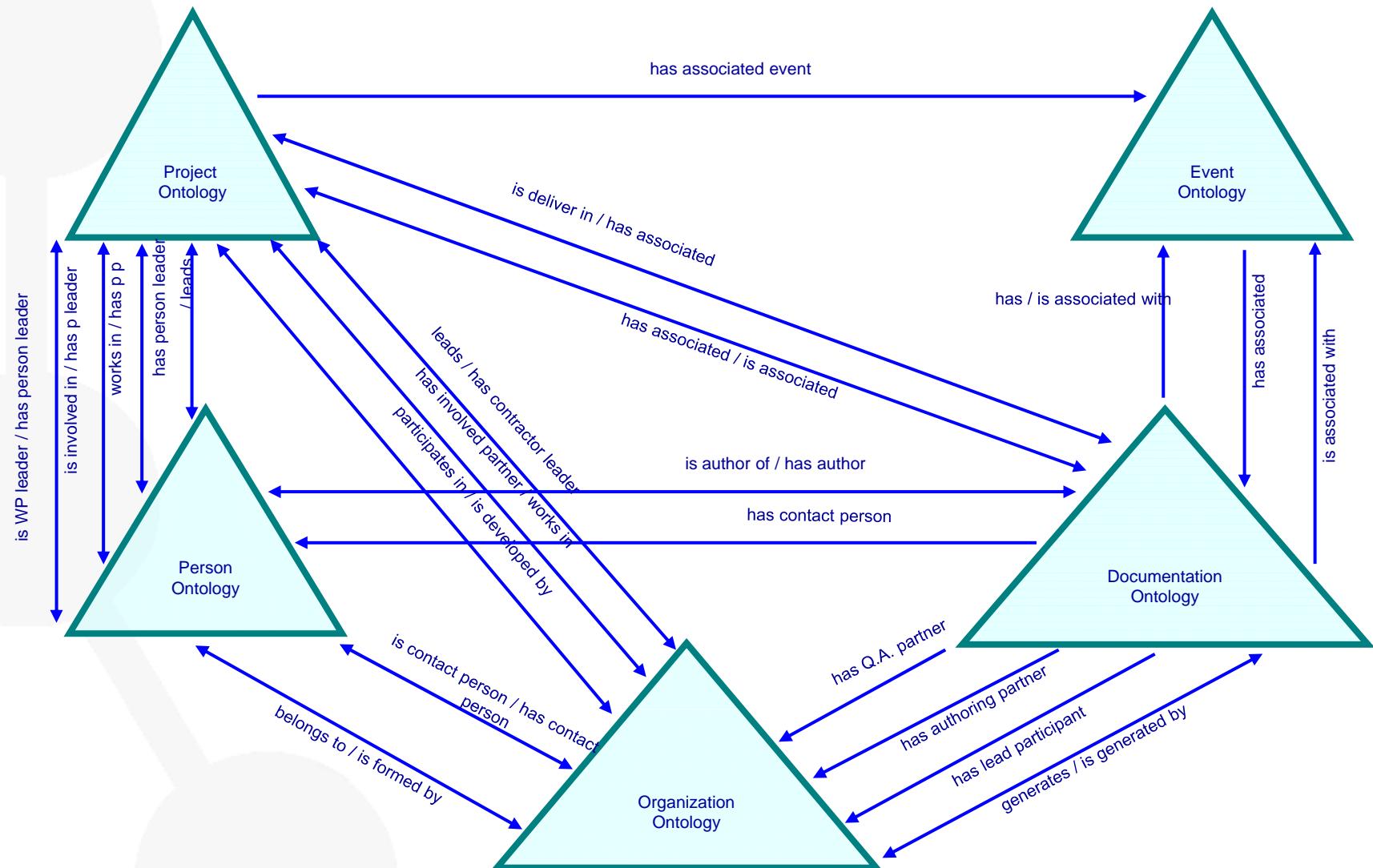
<http://www.oeg-upm.net/>

# Interoperability and management of Semantic portals



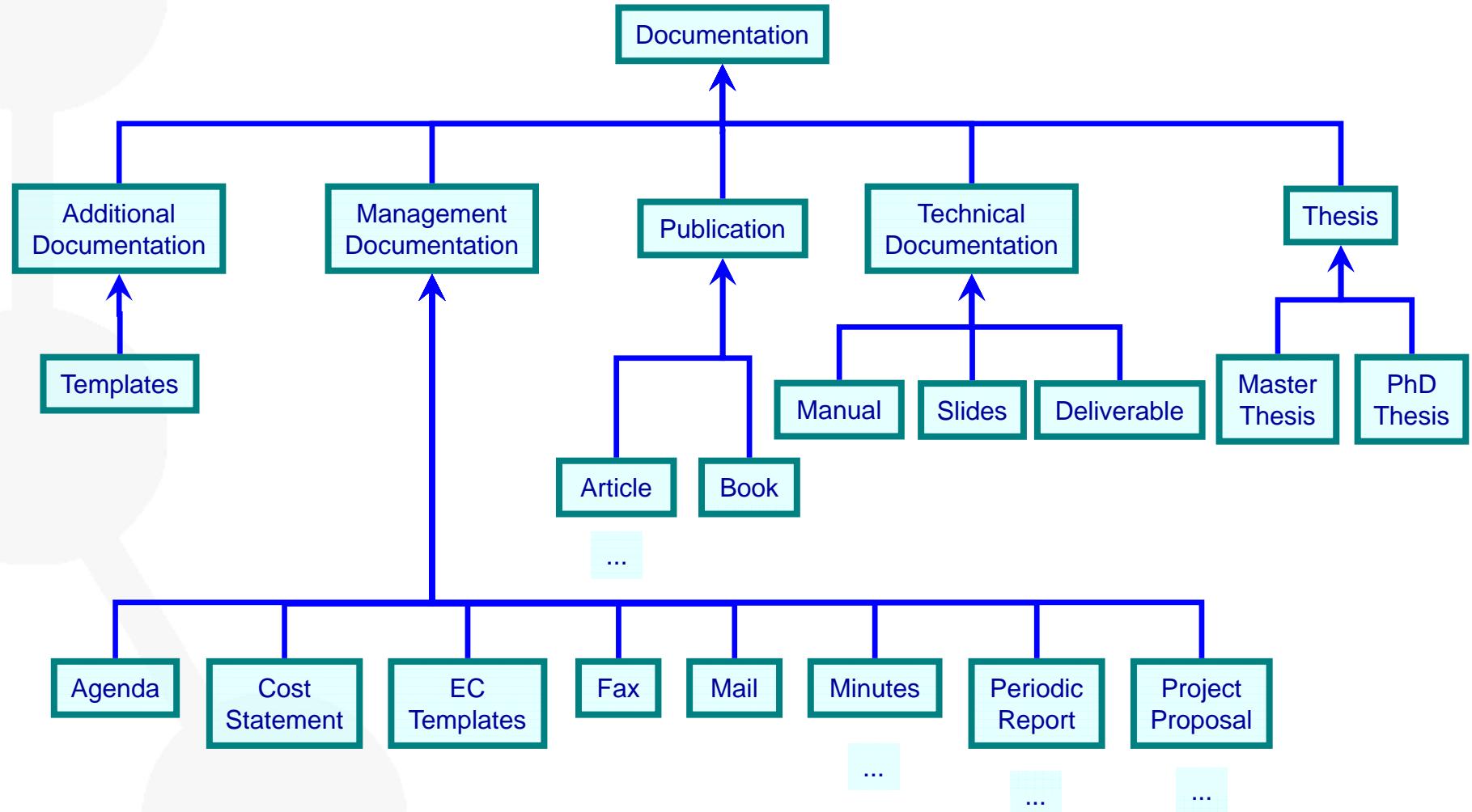


# Ontologies for Managing Projects



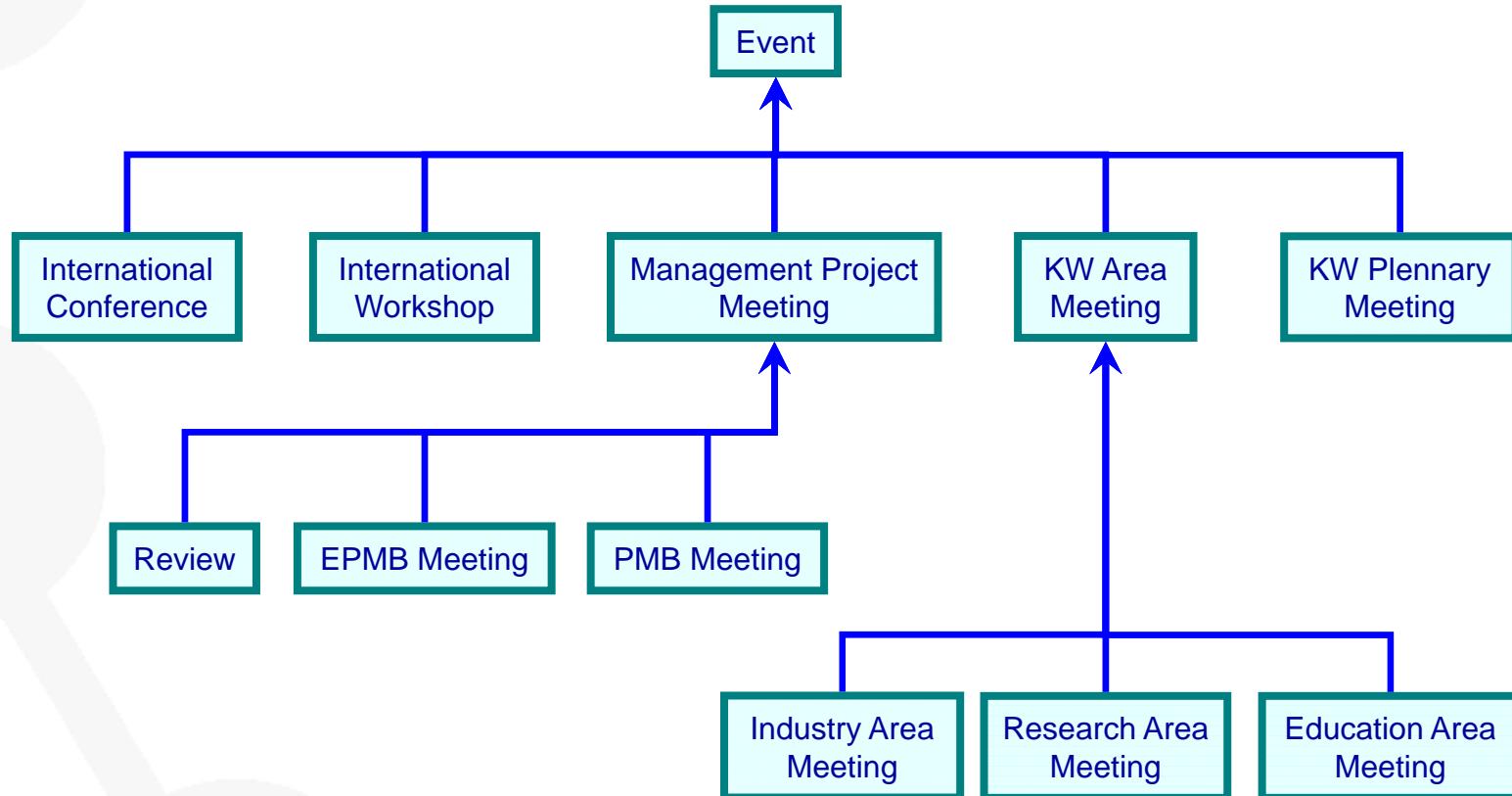


# Document Ontology



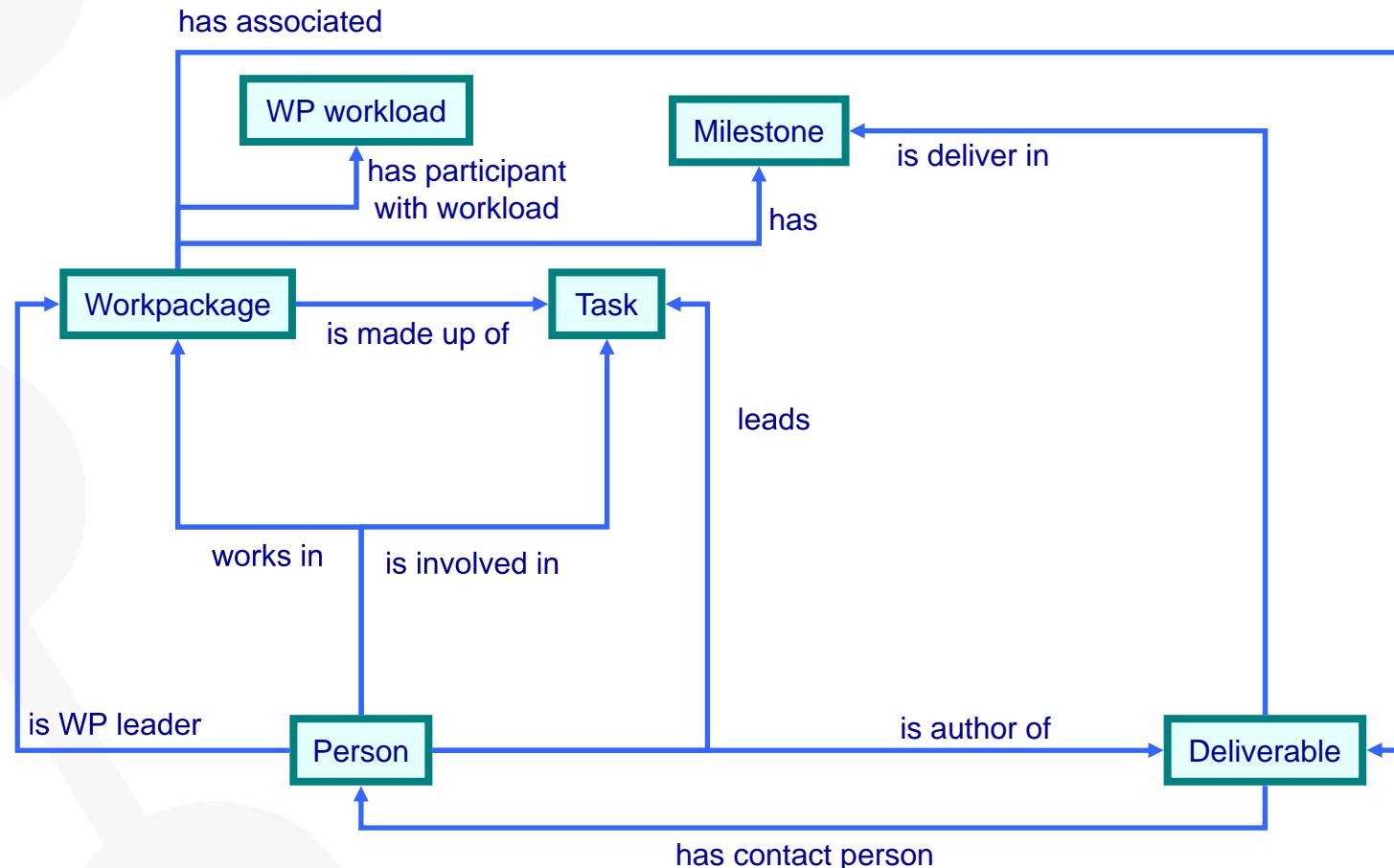


# Event Ontology

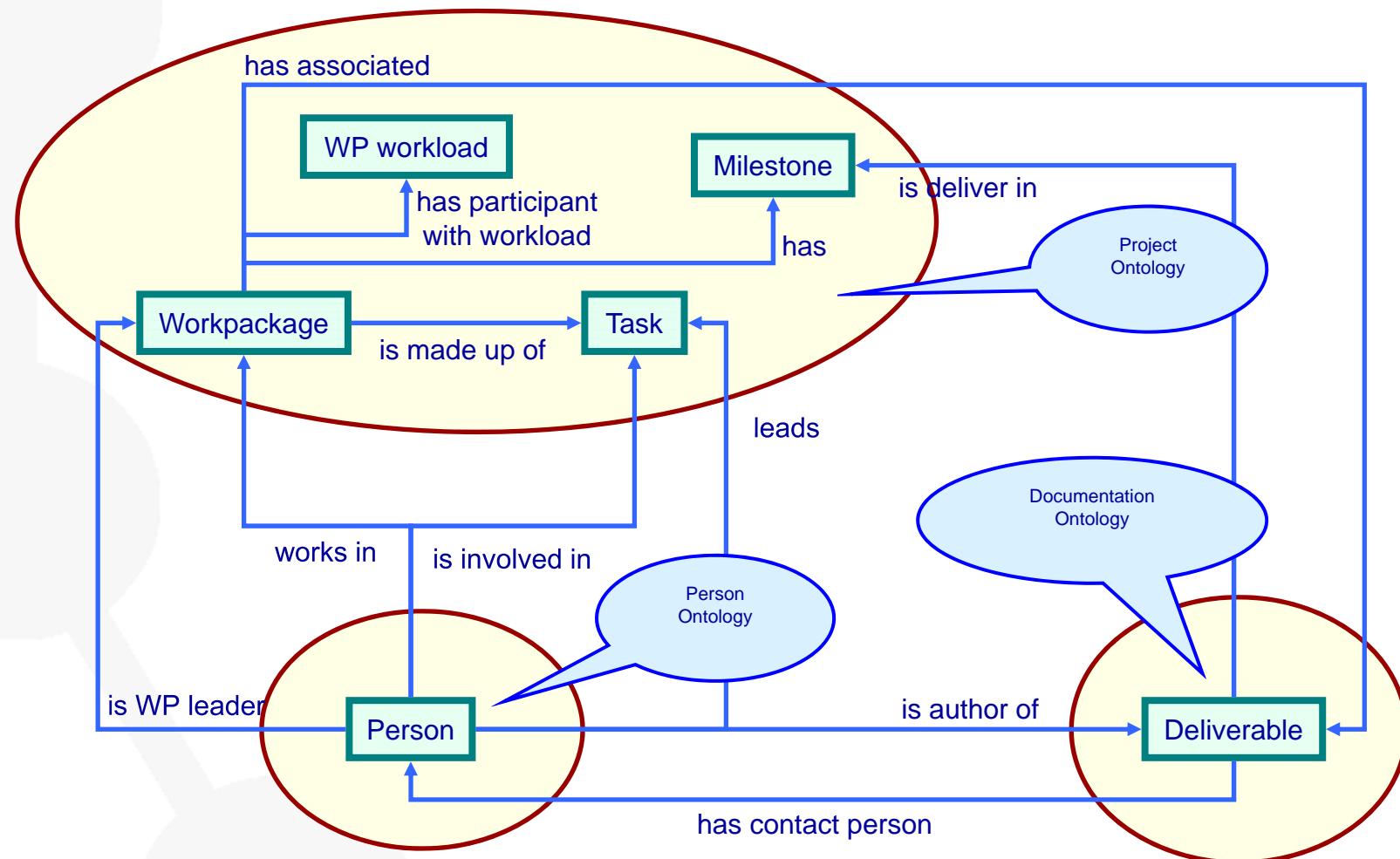




# Relationships between People, Project and Documents

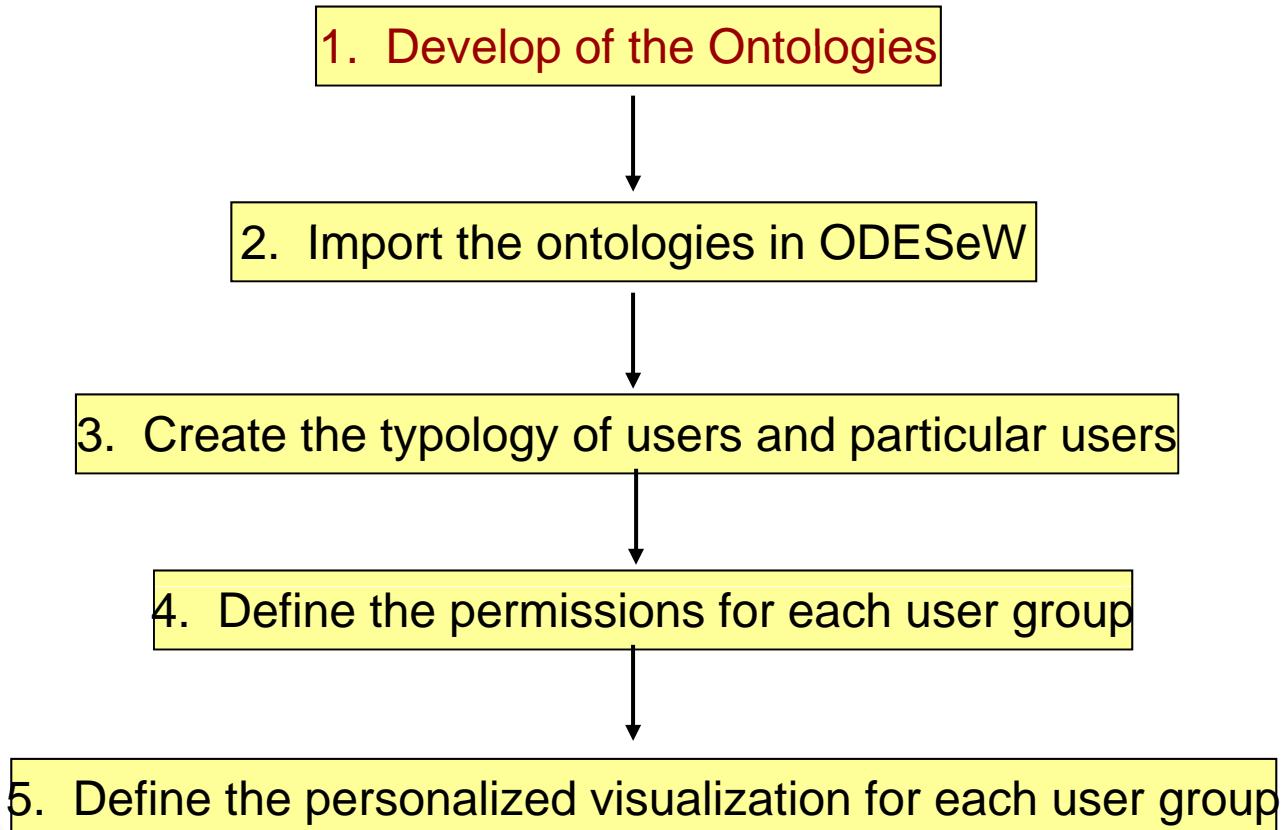


# Relationships between People, Project and Documents





# Process of a Semantic Portal Generation





Knowledge Web

<http://knowledgegeweb.semanticweb.org/>

# KnowledgeWeb Project FP6-507482

Home | Login | Search

## Objectives

The mission of **Knowledge Web** is to strengthen the European industry and service providers in one of the most important areas of current computer technology: **Semantic web** enabled e-work and e-commerce. We will concentrate our efforts around the outreach of this technology to **industry**. Naturally, this includes **education** and **research** efforts to ensure the durability of impact and support of industry.

## Expected results

- Ontology language, tool, and method set that cover all the major tasks in working with ontologies
- Standards to solve the interoperability problem
- Creation of an Ontology Outreach Authority (OOA)
- Establish a Virtual Institute for Semantic Web Education (VISWE)
- Provide up to date learning materials, curricula and, ultimately, new degree programmes
- Dissemination of research results through:
  - Publications
  - Norms
  - Lectures
  - Industry seminars and tutorials
  - KnowledgeWeb semantic portal

## An European IST project

KnowledgeWeb is a project of the Information Society Technologies (IST) Program for Research, Technology Development & Demonstration under the 6th Framework Program of the European Commission.  
The project runs from 2004 to 2007.

## Upcoming Events

- 12-15th May 2004: [KnowledgeWeb Meeting - Crete](#)
- 19-24th July 2004: [Second European Summer School on Ontological Engineering and the Semantic Web \(SSSW-2004\)](#)
- ...more

## Useful Information

- [How to join Knowledge Web](#)
- [Mailing Lists](#)
- [Procedures & Templates](#)

## Related links

- [OntoWeb project](#)
- [SDK cluster](#)

Project Description

Direct Access to the instances of the most important concepts

Useful Information Links

Network Organization

Managers  
EPMB / PMB / EAB  
WP Leaders

People

Publications

FAQ

Web Master

# External User



**Knowledge Web FP6-507482**

Knowledge Web Portal Industry@KWeb Education@KWeb

Login Search:

**KWeb Flyer KWeb Poster**

**2006**

Jan	Feb	Mar	Apr	May	Jun	
Jul	Aug	Sep	Oct	Nov	Dec	
No	Tu	We	Th	Fr	Sa	Su
27	28	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2

Full year calendar

**Useful Information**

- Template for slides
- Deliverable Review Form
- Quality Management Procedure
- Rules for event support
- Project Fact Sheet
- Detailed Programme of Activities
- Procedures & Templates

**Upcoming Events**

- March 9th - 10th 2006: 2nd KW Review at Innsbruck
- June 15th - 16th 2006: KW Plenary Meeting at Budva
- ...more

**Knowledge Web Annual Public Report 2005**

**Best Practices Questionnaire**

- Visuliazation
  - Project description
    - Objectives
    - Workpackages
    - Task
    - Management Board
  - List of deliverables
    - Description
    - Download the public documents
  - List of partners
  - List of participants
  - List of publications
  - Calendar of events

Ontology  
Engineer  
EngGroup

13

# Semantic-based Visualization

**KnowledgeWeb Project FP6-507482**

Documentation Event Organization Person Project Administration Logout  

**Home**

**Deliverables**

- Industrial Deliverables
- Research Deliverables
- Educational Deliverables
- Management Deliverables

**Events**

- Plenary Meetings
- Management Meetings
- Industrial Events
- Research Events
- Educational Events
- International Conferences
- International Workshops

**Partners**

**Workpackages**

**Network Organization**

- Managers
- EPMB / PMB / EAB
- WP Leaders

**People**

**Publications**

**FAQ**

 Web Master

**WP1.1: Industrial Application Needs**

- » D1.1.v1: Industry board members list, clustering and organizational and operational charter (MoU)
- » D1.1.v2: Board members list, clustering and organizational and operational charter (MoU)
- » D1.1.2: Prototypical business use cases
- » D1.1.3: Typology of ontology-based processing tasks
- » D1.1.4: System requirements and knowledge processing requirements for prototypical applications and b

**WP1.2: Evaluation for technology selection**

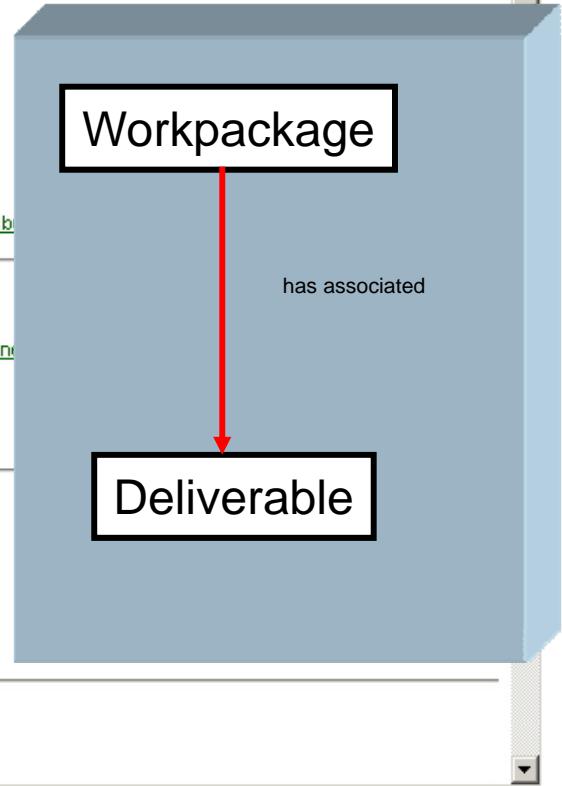
- » D1.2.1: Evaluation of the utility of ontology development tools for different types of industrial application ne
- » D1.2.2: Report on Semantic Web Framework requirements analysis
- » D1.2.3: Methods for ontology evaluation

**WP1.3: Technology Recommendations**

- » D1.3.1: Best practices and guidelines for industry
- » D1.3.2: Identification of standards on metadata for ontologies
- » D1.3.3: Report on requirements of OOA

**WP1.4: Promotion of Ontology Technology**

- » D1.4.1: Presentation of technology roadmap

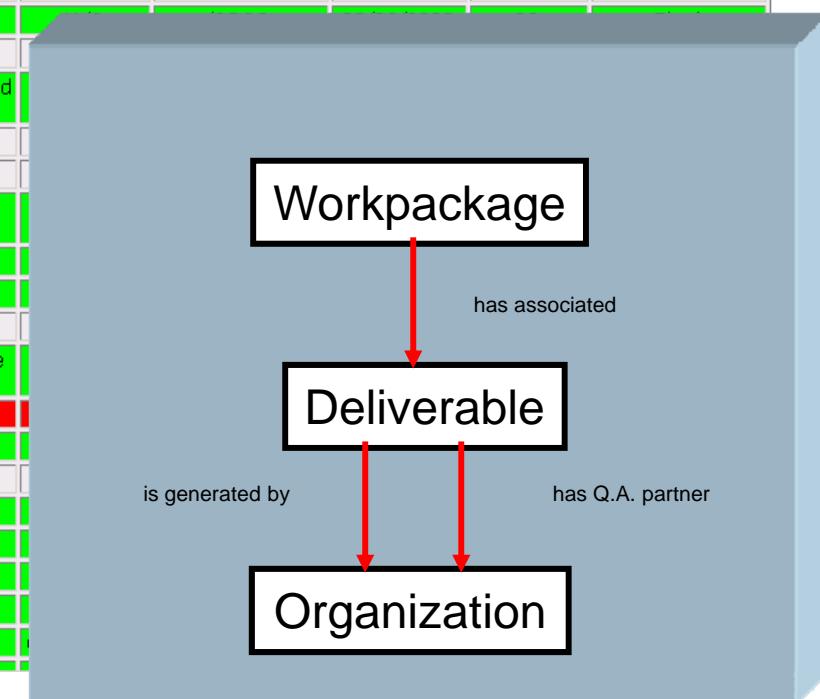


The diagram illustrates a semantic relationship between a Workpackage and a Deliverable. A large blue rectangular box represents the Workpackage. To its right, a smaller blue rectangular box represents the Deliverable. A red arrow points from the bottom of the Workpackage box down to the top of the Deliverable box, with the text "has associated" written above the arrow.

# Semantic-based Visualization

## Status of the Deliverables

Workpackage	Deliverable	Generated By	Q.A. Responsibility	Delivery Date	Project Month	Status
WP1: Ontologies	D1.1: State of the art in ontologies from the SW perspective	UPM	IFI	11/08/2002	2	Final
	D1.2: Kernel Ontology Specification, Knowledge architecture	UPM	UdS	09/24/2003	27	Final
	D1.3: Ontology Workbench Specification	UPM	UniLiv	09/26/2003	27	Final
	D1.4: Ontology Alignment Solution	IFI	UPM	09/12/2003	27	Final
WP2: Window on Semantic Web languages	D2.1: State of the art on Semantic Web languages	IFI	UPM	02/17/2003	2	Final
	D2.2: Report on SW languages evolution	IFI	iSOCO	08/28/2003	30	Final
WP3: Annotation services	D3.1: State of the art on annotation tools and services	iSOCO	UdS	02/28/2003	2	---
	D3.2: Methodology for the development of wrappers and annotation tools	iSOCO	UdS	09/15/2003	10	---
	D3.3: Annotation services for static resources	iSOCO	UPM	---	10	---
	D3.4: Annotation services for dynamic resources	iSOCO	UniLiv	---	23	---
	D3.5: Annotation services for multimedia content					
	D3.6: Annotation services for web services					
WP4: Semantic indexation and routing	D4.1: State of the art on indexation, routing techniques and negotiation techniques					
	D4.2: Semantic Index Solution					
	D4.3: Routing Solution					
WP5: Multilinguality	D5.1: State of the art on multilinguality for ontologies, annotation services and user interfaces					
	D5.2: Multilinguality and ontologies					
	D5.3: Multilingualism and annotation services					
	D5.4: Multilingual user interface					
WP6: User interface and visualisation services	D6.1: State of the art on visualisation technologies feasible for the Semantic Web					
	D6.2: Ontology visualisation core services					
	D6.3: Semantic Web content visualisation services					
	D6.4: Semantic Index and Routing Monitor service					
WP7: Definition and integration	D7.1: System specification					
	D7.2: Cooperation protocol definition					
	D7.3: Application development guidelines					
	D7.4: Integration test plan					
WP8: Test case 1. Fund finder for	D8.1: Test case system specification					
	D8.2: Test case system implementation					



# Instance Visualization

KnowledgeWeb Project FP6-507482

Person > Student > PhD Student : Angel López-Cima

RDFS RDF Metadata

Attribute Names      Atribute Types      Atributes      Relations      Relation Range

**Attribute Types**

Instance Attribute	Type	Value
Full Name	String	Angel Lopez-Cima
Photo	URL	
e-mail	String	lopez@fi.upm.es
Homepage	URL	
Date of Birth	Date	16/10/1976
Role	String	
Country	String	Spain
City	String	Madrid
Zip code	String	28660
Street Address	String	Campus Montegancedo, s/n
Telephone	String	34 91 336 6604
Fax	String	34 91 352 4819

**Relations**

Relation name	Direction	Range	Destination instance
works_in	works_in	Organization	U1.6 Semantic Portal Structure
belongs_to	belongs_to	Organization	Universidad Politécnica de Madrid
is involved in	Task	Task	1.6.1 Semantic portal analysis requirements and design
	Task	Task	1.6.2 Semantic portal ontology prototype development
	Task	Task	1.6.3 Semantic portal prototype development
	Task	Task	1.6.4 Semantic Portal Unit and integration testing
	Task	Task	1.6.5 Content annotation and management
	Task	Task	1.6.6 hosting and running <a href="http://knowledgeweb.semanticweb.org">http://knowledgeweb.semanticweb.org</a>
	Task	Task	1.6.7 hosting and running <a href="http://www.iwsa.org">www.iwsa.org</a>
	Task	Task	1.6.8 Self-assessment
leads	Task	Task	1.6.1 Semantic portal analysis requirements and design
	Task	Task	1.6.2 Semantic portal ontology prototype development
	Task	Task	1.6.3 Semantic portal prototype development
	Task	Task	1.6.4 Semantic Portal Unit and integration testing
	Task	Task	1.6.6 hosting and running <a href="http://knowledgeweb.semanticweb.org">http://knowledgeweb.semanticweb.org</a>
is author of	Documentation	Documentation	1.6.11 Portal requirements analysis and system design

**Attribute Names**

**Relation Names**

**Atributes**

**Relations**

**Relation Range**

# Edition of the portal contents (Atributes)

**KnowledgeWeb Project FP6-507482**

Documentation | Event | Organization | Person | Project | Administration | Logout | [Search](#)

**RDFS**

**Person**

Instance of *PhD Student*: Angel López-Cima

Move instance to: Administrative Staff ▾ Send Continue to relations >>

Instance Attribute	Range	Cardinality	Value
Full Name	String	(1,1)	Angel Lopez-Cima
Photo	URL	(0,1)	Angel.jpg
Homepage	URL	(0,1)	alopez@upm.es
Date of Birth	Date	(1,1)	16/10/1976
Country	String	(1,N)	Spain
City	String	(1,1)	Madrid
Zip code	String	(0,1)	28660
Street Address	String	(1,1)	Campus Montegancedo, s/n
Telephone	String	(0,1)	+34 91 336 6604
Fax	String	(0,1)	+34 91 352 4819

**Upload a file to Angel López-Cima.Photo:**  
Select a file to upload:  Examinar... Enviar consulta

**Select Date, Please. ...**  
October 1976  
Mo Tu We Th Fr Sa Su  
27 28 29 30 1 2 3  
4 5 6 7 8 9 10  
11 12 13 14 15 16 17  
18 19 20 21 22 23 24  
25 26 27 28 29 30 31

Send Continue to relations >>

# Edition of the portal contents (Relations)

**KnowledgeWeb Project FP6-507482**

Documentation Event Organization Person Project Administration Logout

**RDFS**

**Person**

- Person
  - University Staff
    - Researcher
    - Professor
  - Company Staff
    - Project Officer
  - Student

Relation	Range	Cardinality	Value
<a href="#">belongs to</a>	<a href="#">Organization</a>	(0, 1)	<p>Inserted value:</p> <p>Universidad Politécnica de Madrid</p> <p>Centre for Research and Technology Hellas</p>
<a href="#">is contact person of</a>	<a href="#">Organization</a>	(0, 1)	<p>Inserted value:</p> <p>Centre for Research and Technology Hellas</p>
<a href="#">is WP leader in</a>	<a href="#">Workpackage</a>	(0, N)	<p>Inserted values:</p> <p>WP1.1: Industrial Application Needs</p>
<a href="#">works in</a>	<a href="#">Workpackage</a>	(0, N)	<p>Inserted values</p> <p>Potencial values</p> <p>WP1.6: Semantic Portal Structure</p> <p>WP1.1: Industrial Application Needs</p>

**KnowledgeWeb Project FP6-507482**

Documentation Event Organization Person Project

Logout

RDFS Instances of the term Documentation(8s)

1 2 3 4 5 6

RDF Metadelta

**Documentation**

Documentation

- + Additional Documentation
- + Management Documentation
- + Pub
- + Tec
- + The

Concept *Documentation*

```

<?xml version="1.0" encoding="ISO-8859-1" ?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:NS0="http://kweb.dia.fi.upm.es/semanticportal/RDFS/Documentation_Ontology#">
  <rdf:Description rdf:about="D1.6.4:_Portal_contents_releases">
    <rdf:type rdf:resource="Deliverable" />
  </rdf:Description>
  <rdf:Description rdf:about="D1.6.3:_Portal_versions">
    <rdf:type rdf:resource="Deliverable" />
  </rdf:Description>
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  </rdf:Description>
  <rdf:Description rdf:about="D1.3.2:_Identification_of_standards_on_metadata_for_ontologies">
    <rdf:type rdf:resource="Deliverable" />
  </rdf:Description>
  <rdf:Description rdf:about="D1.2.3:_Methods_for_ontology_evaluation">
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  </rdf:Description>
  <rdf:Description rdf:about="http://kw.dia.fi.u...>
    <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class" />
    <rdfs:comment><Imported Term></rdfs:comment>
  </rdf:Description>

```

- Kick-off meeting, Industry Area presentation [EDIT](#)
- Representing and Reasoning with Heterogeneous, Modular and Distributed ontologies [EDIT](#)
- WP 1.1 Kick-off presentation [EDIT](#)
- 1st technical O2I Workshop Report, 5 March 2004, Paris [EDIT](#)

Instances

# Table of Contents

- Semantic Web Portals: ODESeW
- SEEMP
- Information Retrieval: ReimDoc
- NeOn Use Cases



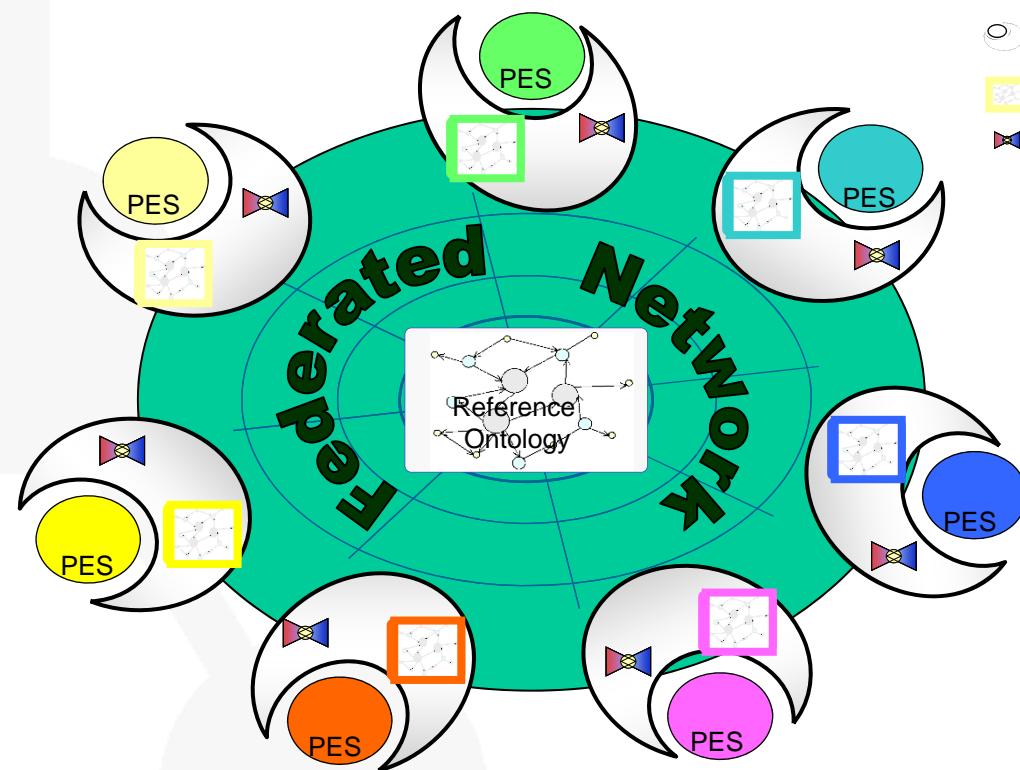


<http://www.seemp.org/>

## SEEMP FP6-027347 SEEMP: Single European Employment Market-Place



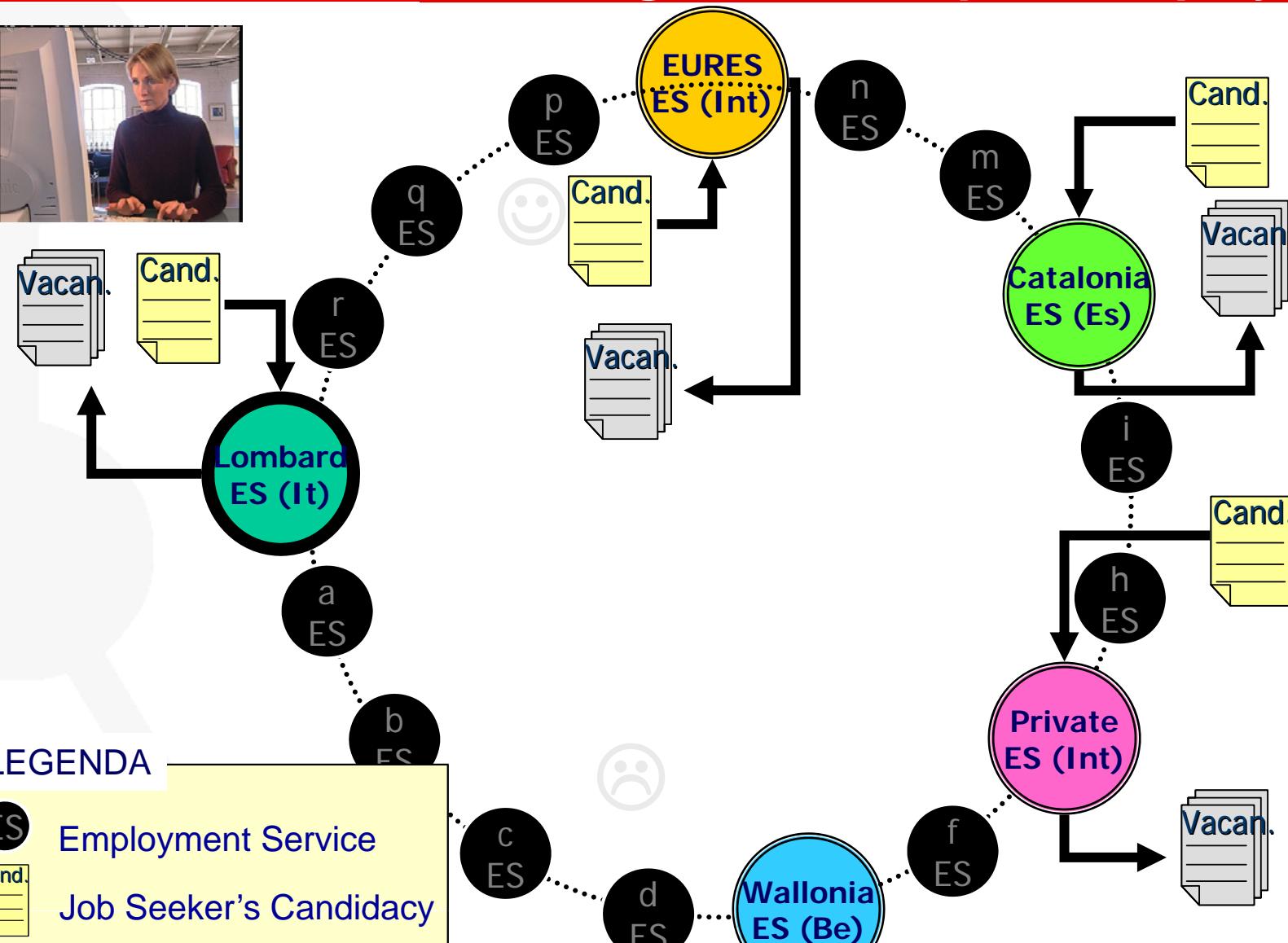
Action Line IST-2005-2.4.9



Global: 4.190.131 €



# Looking for an European Employment



## LEGENDA



Employment Service

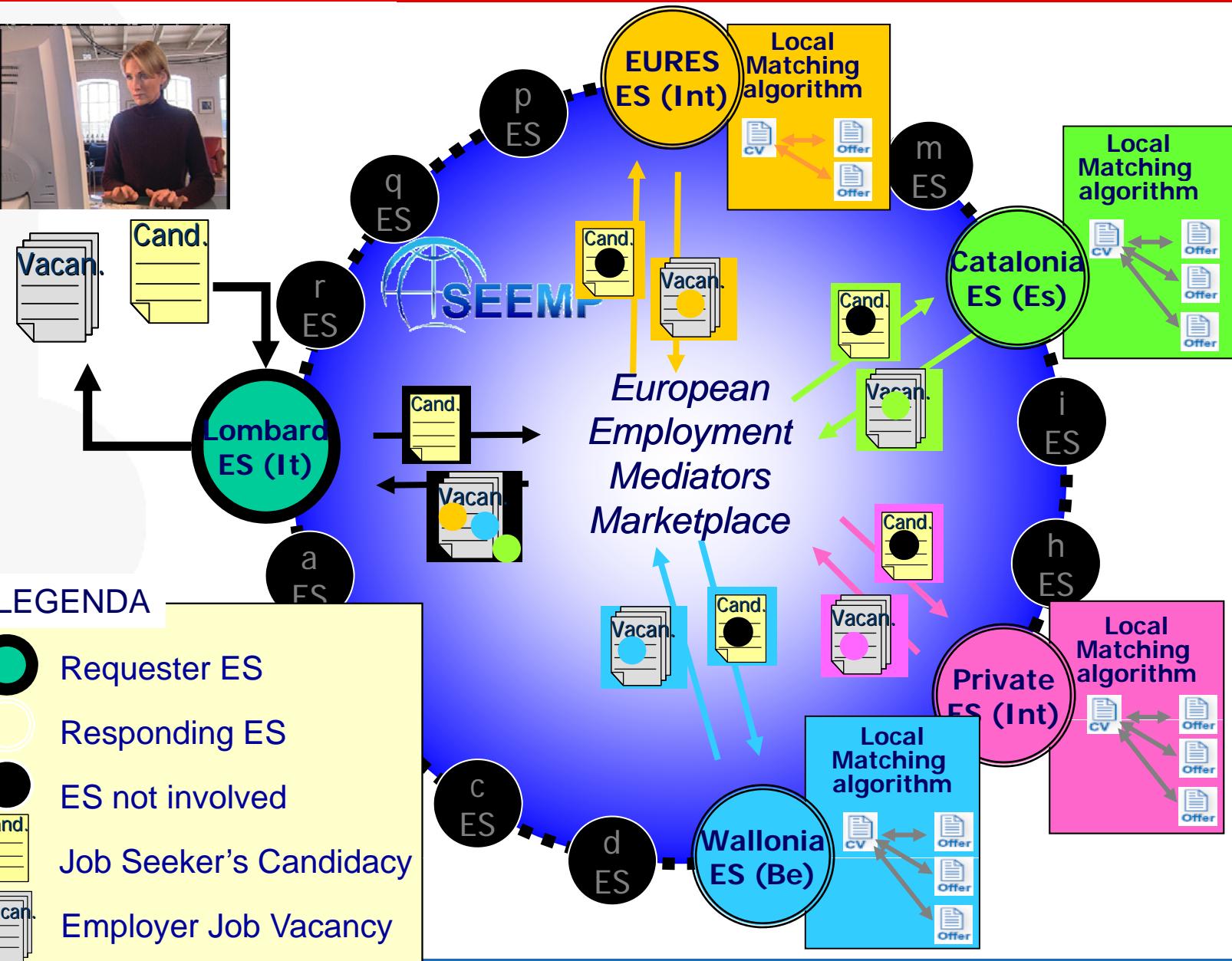


Job Seeker's Candidacy



Employer Job Vacancy

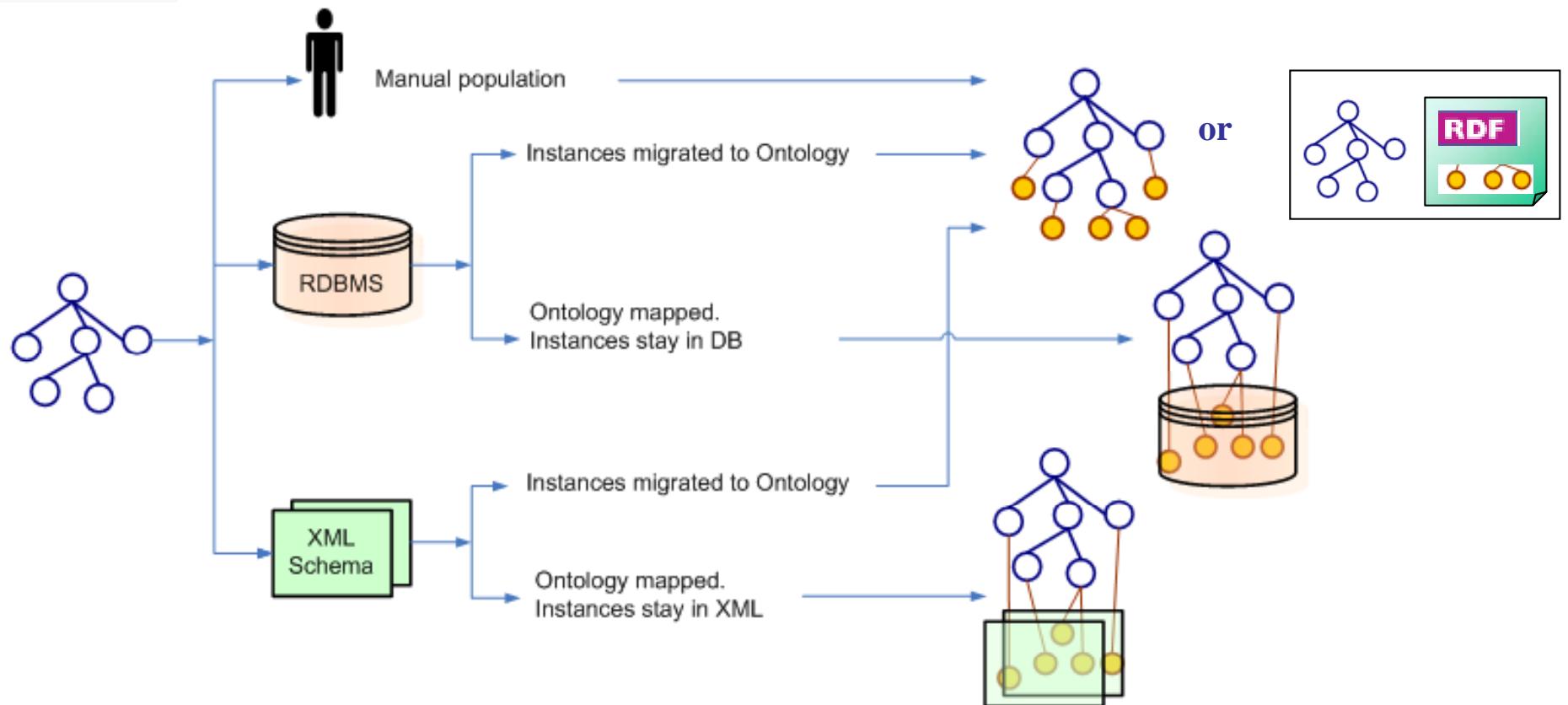
# Helping Job Seekers on their way



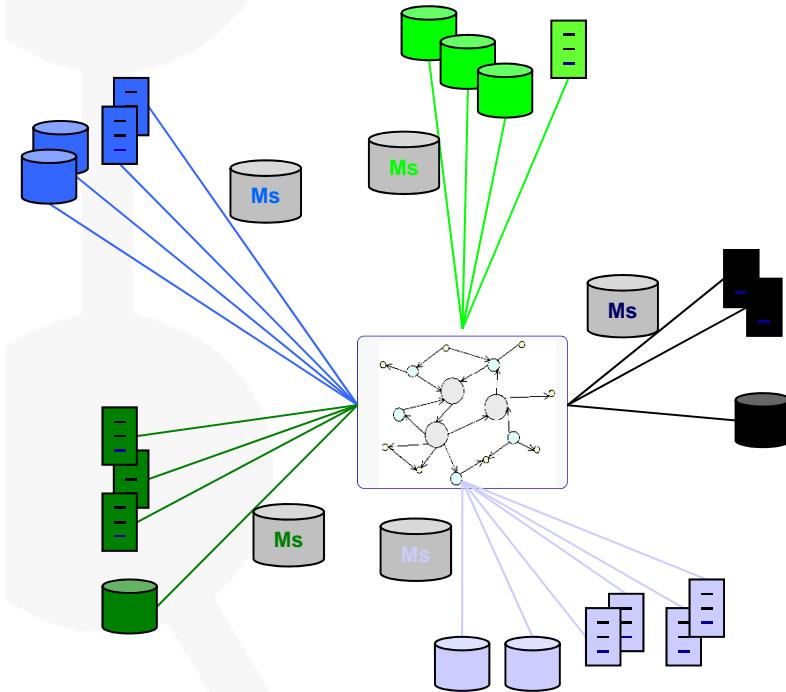
# Key aspects of Ontological Engineering

- **Ontologies**
  - Single versus network of ontologies?
  - Are ontologies built from scratch or reusing knowledge-aware resources?
  - Are mappings used for solving conceptual mismatches?
- **Instances**
  - Where are the data/instances?
    - Instances are in the ontology
    - Instances are in RDF files independently of the ontology
    - Data are kept in the original sources
  - Are instances distributed or centralized?
  - Have instances a very high rate of changes?
  - Heterogeneous provenance of instances
  - Degrees of data quality
  - Permissions

# Where are the instances?

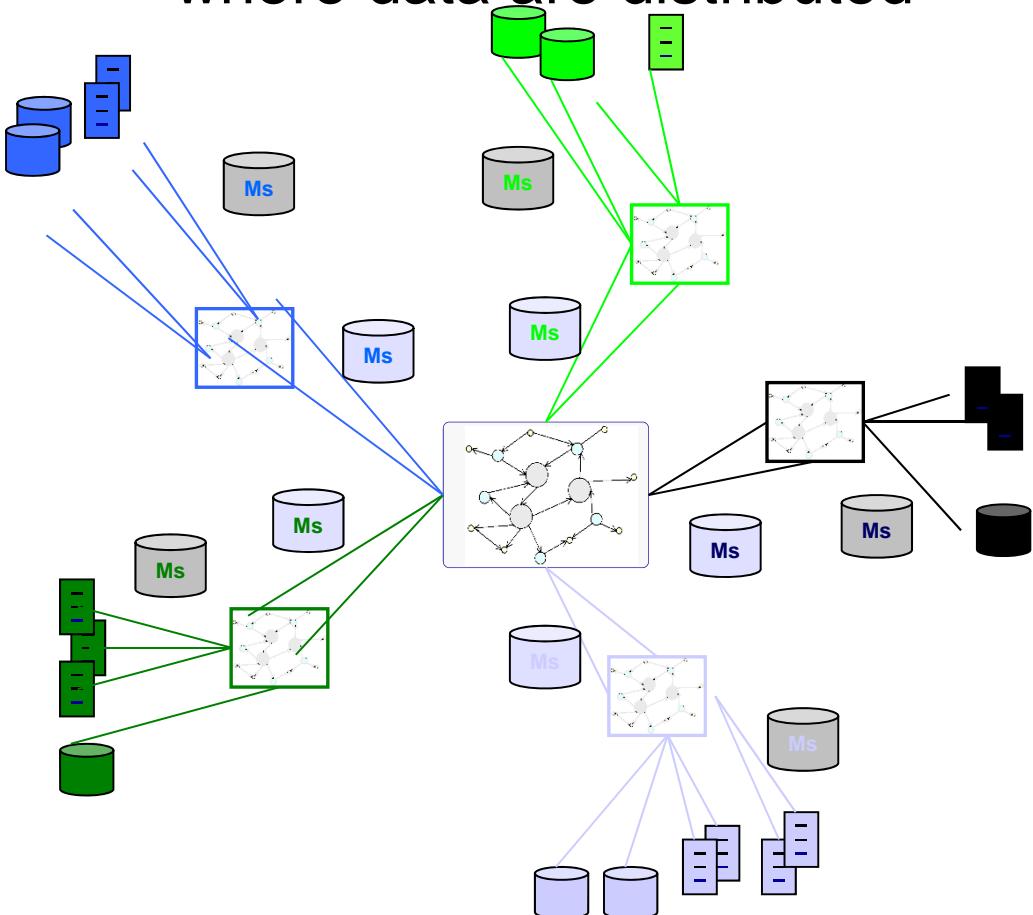


## Centralized network of ontologies where data are distributed

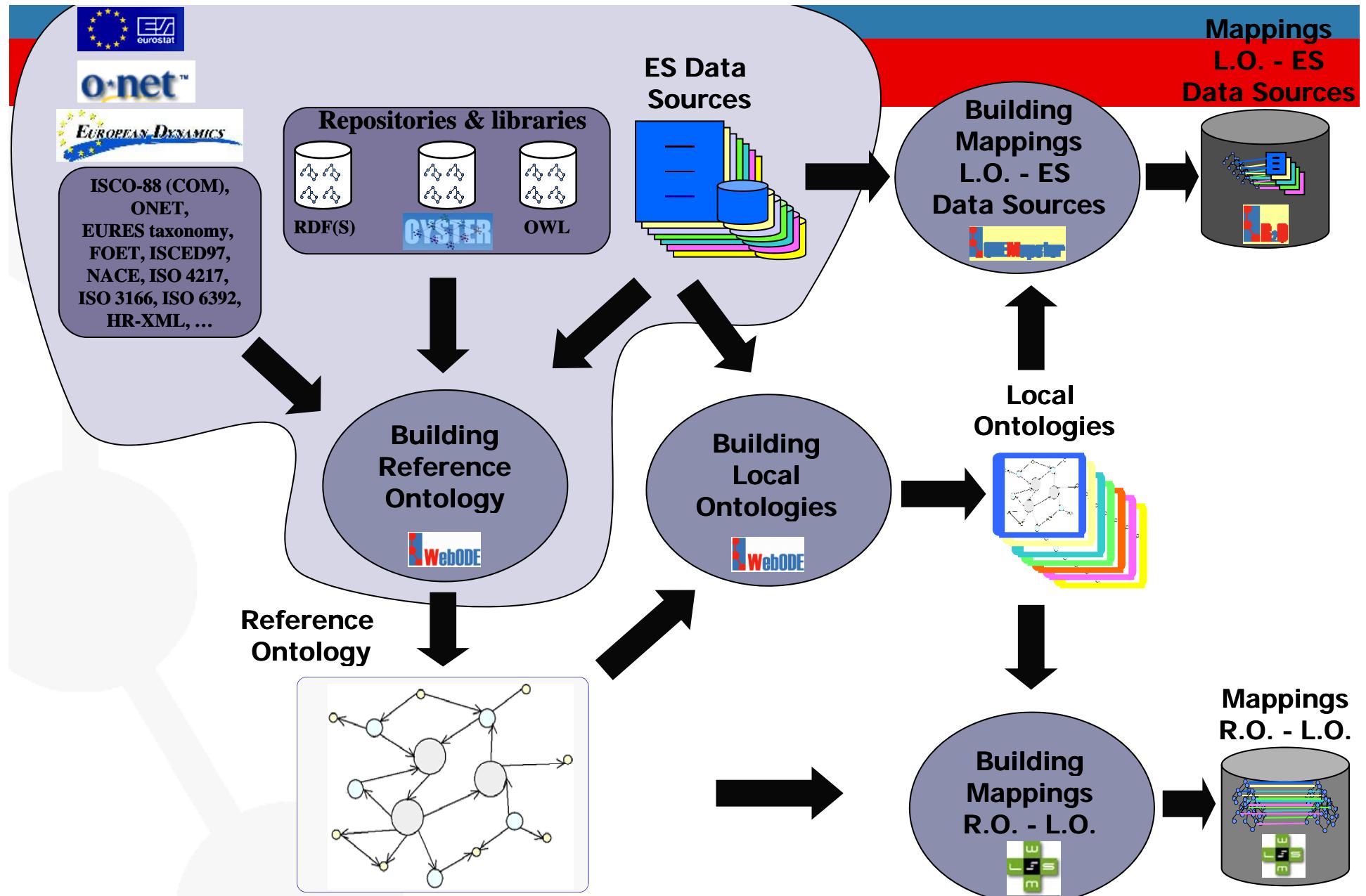


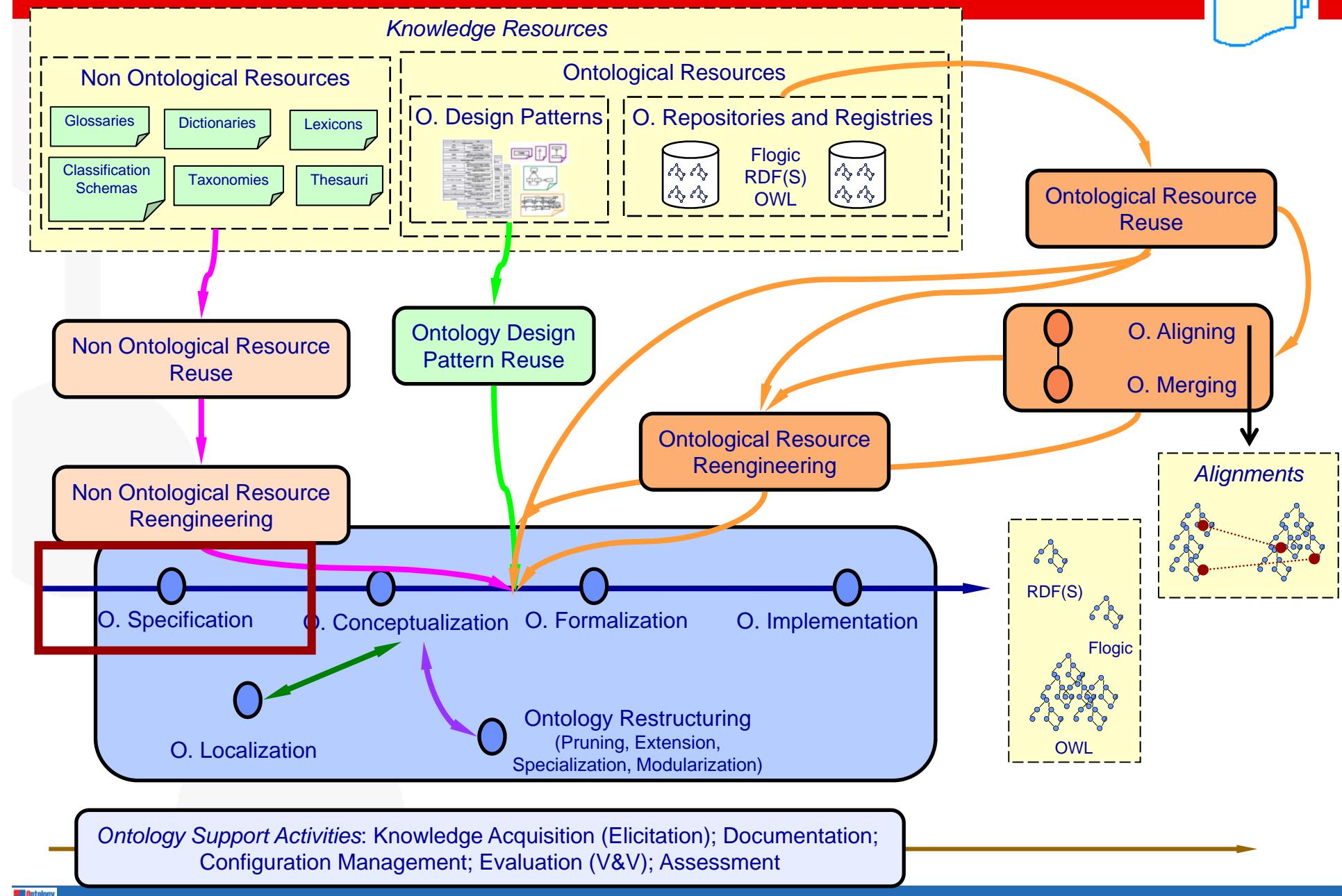
1. Build a reference ontology
2. Build mappings between the reference ontology and the data sources

## Federated network of ontologies where data are distributed



1. Build a reference ontology for the domain
2. Build local ontologies
3. Build mappings between the core and local ontologies
4. Build mappings between the local ontologies and the data sources

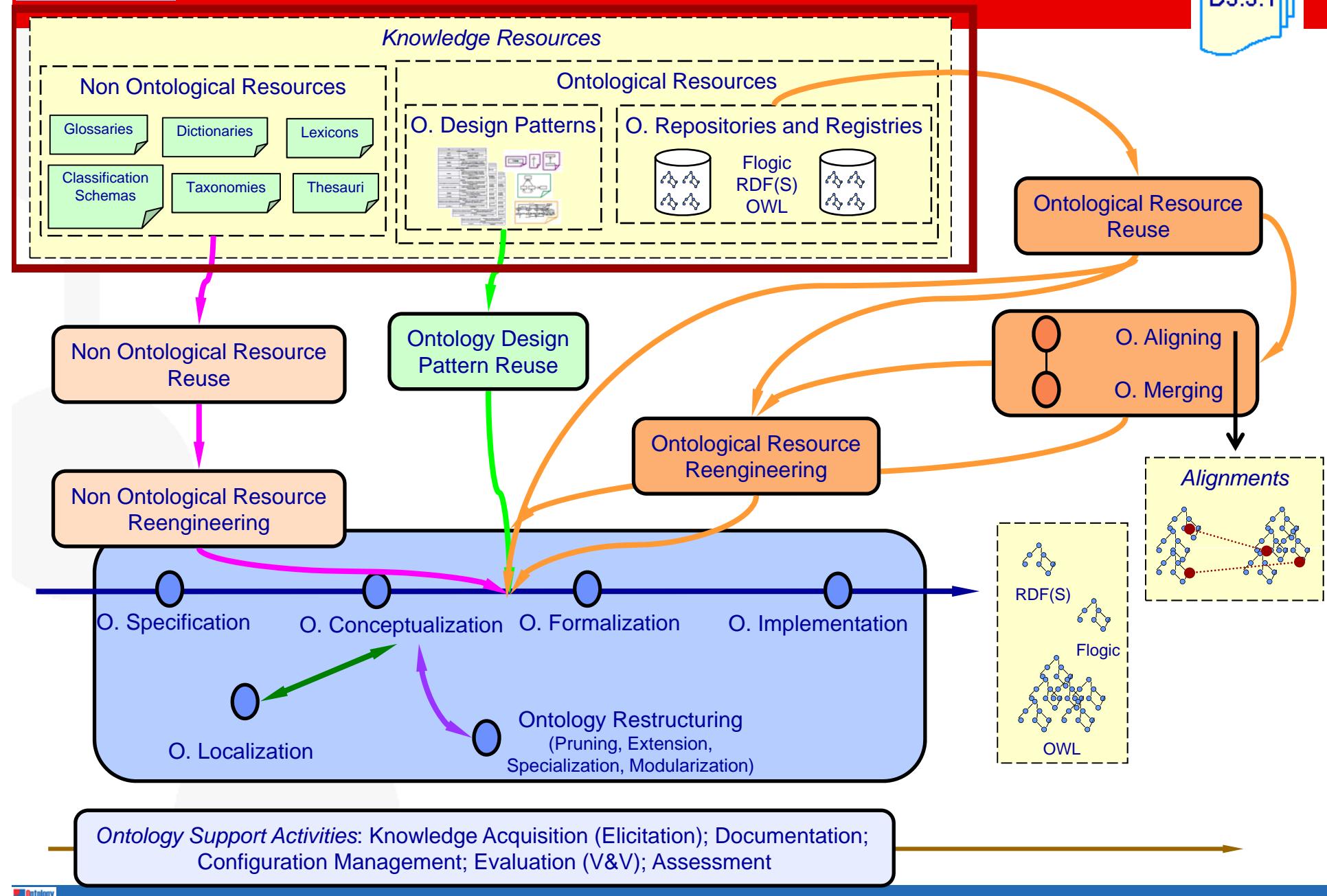




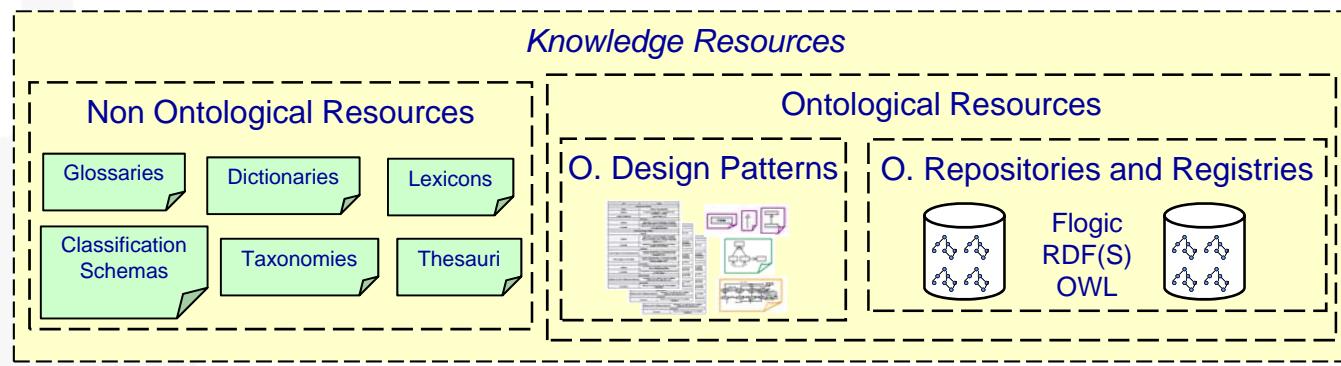


SEEMP Reference Ontology Requirements Specification			
1	Purpose		
	The purpose of building the Reference Ontology is to provide a consensual knowledge model of the employment domain that could be used by public e-Employment services (PES).		
2	Scope		
	The ontology has to focus just on the ICT (Information and Communication Technology) domain. The level of granularity is directly related to the competency questions and terms identified.		
3	Level of Formality		
	The ontology has to be implemented in WSML language		
4	Intended Users		
User 1.	Candidate who is unemployed and searching for a job or searching another occupation for immediate or future purposes		
User 2			
User 3			
5	Intend		
Use 1.			
Use 2.			
Use 3.			
Use 4.			
Use 5.			
7	Pre-Glossary of Terms		
	Terms		
	Frequency		
User 4.	a.	Job Seeker	27
User 5	b.	CV	2
	c.	Personal Information	3
	d.	Name	5
	e.	Gender	1
	f.	Birth date	1
	g.	Address	2
	h.	Nationality	1
	i.	Contact (phone, fax, mail)	4
	j.	Objective	3
	k.	Job Category	6
	l.	Job Offer	27
	m.	Employer Information	1
	n.	Vacancy	1
	o.	Activity Sector	1
	p.	Location	3
	q.	Work Condition	3
	r.	Contract Type	3
	s.	Salary	3
	t.	Education	3
	u.	Work Experience	3

6	Groups of Competency Questions
	<p>CQG1. Job Seeker (16 CQ)</p> <p>CQ1. What is the Job Seeker Name?  CQ2. What is the Job Seeker nationality?  CQ3. When is the Job Seeker birthday?  CQ4. What is the Job Seeker contact information?  CQ5. What is the Job Seeker current job?  CQ6. What is the Job Seeker desired job?  CQ7. What are the Job Seeker desired working conditions?  CQ8. What kind of contract does the Job Seeker want?</p> <p><b>Job Seeker</b></p> <p>CQ9. How much salary does the Job Seeker want to earn?  CQ10. What is the Job Seeker education level?  CQ11. What is the Job Seeker work experience?  CQ12. What is the Job Seeker knowledge?  CQ13. What is the Job Seeker expertise?  CQ14. What are the Job Seeker skills?  CQ15. What publications does the Job Seeker have?  CQ16. What hobbies does the Job Seeker have?</p>
	<p>CQG2. Job Offer (10 CQ)</p> <p>CQ17. What is the employer information?  CQ18. What kind of job does the employer offer?  CQ19. What kind of contract does the employer offer?  CQ20. How much salary does the employer offer?  CQ21. What is the economic activity of the employer?</p> <p><b>Job Offer</b></p> <p>CQ23. What is the work condition of the job offer?  CQ24. What is the required education level for the job offer?  CQ25. What is the required work experience for the job offer?  CQ26. What is the required knowledge for the job offer?</p>
	<p><b>Objects</b></p> <p>CQG3 CQ1</p> <p>4</p> <p>5</p> <p>Objects in the universe of discourse, which are instances of:</p> <ul style="list-style-type: none"> <li>Job Category <ul style="list-style-type: none"> <li>O1. Computer System Designer</li> <li>O2. Computer System Analyst</li> <li>O3. Programmer</li> <li>O4. Computer Engineer</li> <li>O5. Computer Assistant</li> <li>O6. Computer Equipment Operator</li> <li>O7. Industrial Robot Controller</li> <li>O8. Telecommunication Equipment Operator</li> <li>O9. Medical Equipment Operator</li> <li>O10. Electronic Equipment Operator</li> <li>O11. Image Equipment Operator</li> </ul> </li> <li>Nationality <ul style="list-style-type: none"> <li>O12. Austrian</li> <li>O13. Belgian</li> <li>O14. Danish</li> <li>O15. Estonian</li> <li>O16. Finnish</li> <li>O17. French</li> <li>O18. German</li> <li>O19. Greek</li> <li>O20. Italian</li> </ul> </li> <li>Activity Sector <ul style="list-style-type: none"> <li>O21. Telecommunication</li> <li>O22. Justice and Judicial</li> <li>O23. Public Security and law</li> <li>O24. Manufacture of machine tools</li> <li>O25. Research and Development</li> <li>O26. Hardware Consultancy</li> <li>O27. Software Consultancy and Supply</li> <li>O28. Data processing</li> </ul> </li> </ul> <p>• Education</p> <p>O29. Life Science  O30. Mathematics  O31. Computer Science  O32. Computer Use  O33. Statistics  O34. Physics  O35. Network Administration</p> <p>• Languages</p> <p>O36. Swedish  O37. Spanish  O38. Slovenian  O39. Portuguese  O40. English  O41. French  O42. German</p> <p>• Currency</p> <p>O43. Euro  O44. Krone  O45. Great British Pound  O46. Zlote  O47. US Dollar  O48. Franc</p> <p>• Location</p> <p>O49. Austria  O50. Belgium  O51. Denmark  O52. Estonia  O53. Finland  O54. France  O55. Germany  O55. Greece</p>



- Use the terminology from the ORSD
- Find resources covering the terminology



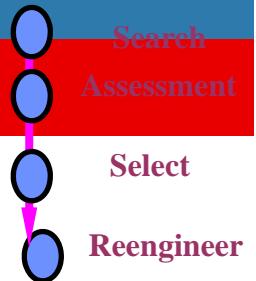
- Where:
  - Internet
  - Standardization bodies (ISO,...)
  - Intranet of the organization
  - Ontology Registries

### Objects

Objects in the universe of discourse, which are instances of:

- Job Category
  - O1. Computer System Designer
  - O2. Computer System Analyst
  - O3. Programmer
  - O4. Computer Engineer
  - O5. Computer Assistant
  - O6. Computer Equipment Operator
  - O7. Industrial Robot Controller
  - O8. Telecommunication Equipment Operator
  - O9. Medical Equipment Operator
  - O10. Electronic Equipment Operator
  - O11. Image Equipment Operator
- Nationality
  - O12. Austrian
  - O13. Belgian
  - O14. Danish
  - O15. Estonian
  - O16. Finnish
  - O17. French
  - O18. German
  - O19. Greek
  - O20. Italian



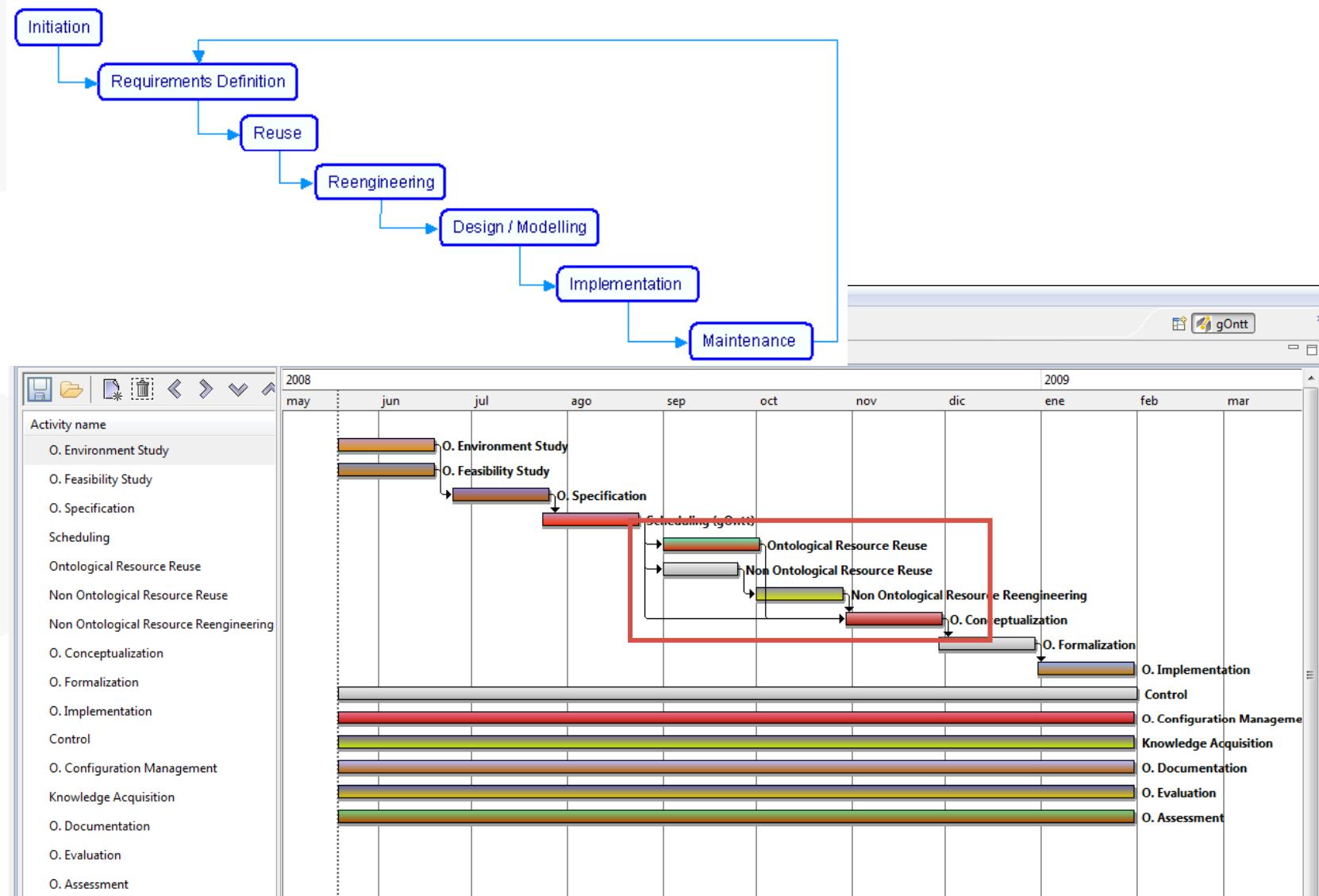


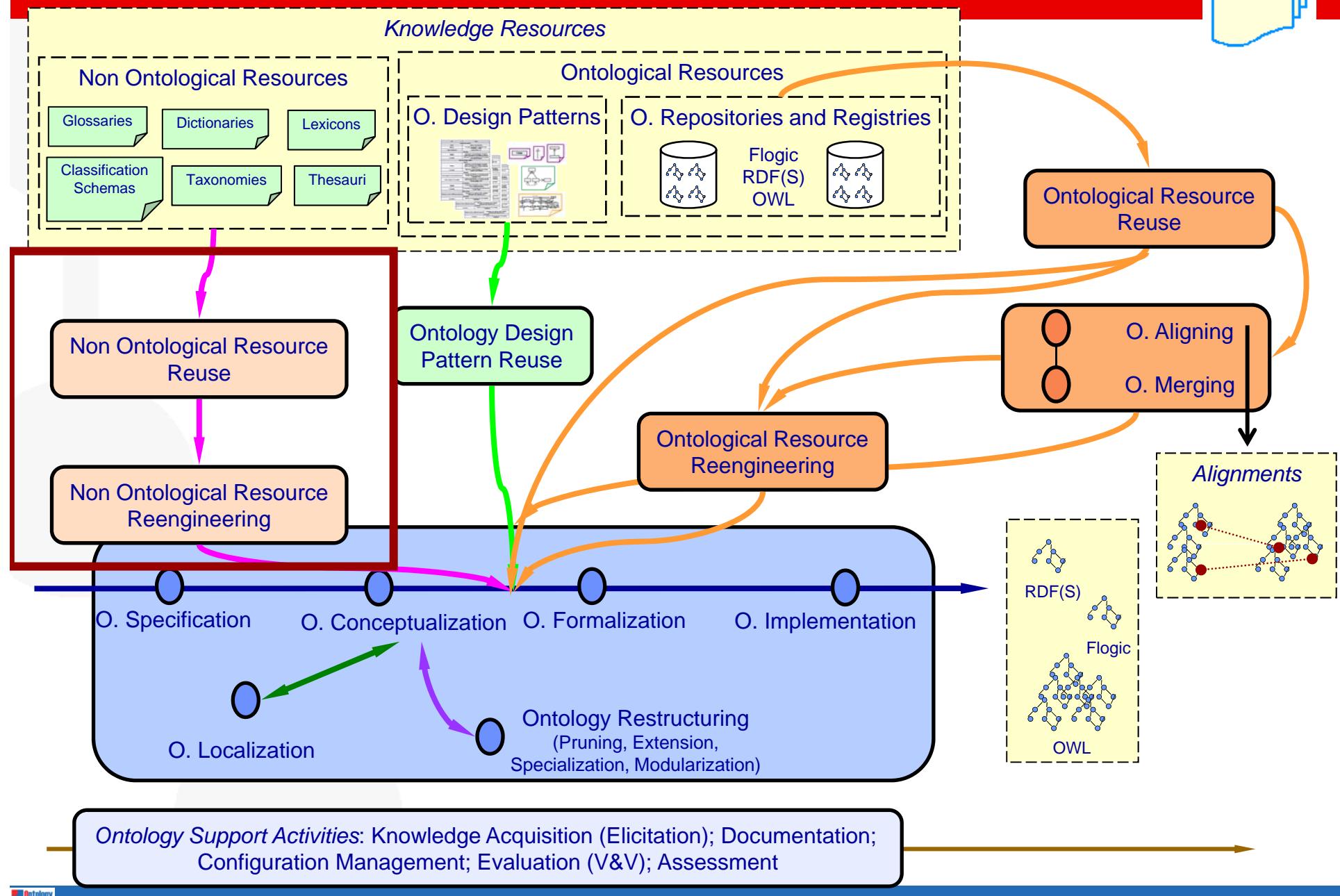
- We select the most appropriate standards and taxonomies for:
  - Occupation Classification  
ISCO-88 (COM), SOC, ISCO-88, ONET, Eures Taxonomy.
  - Classification of Economic Activities  
ISIC Rev. 3.1, NACE Rev. 1.1, NAICS
  - Apprenticeship classifications  
ISCED 97, FOET
  - Currency Classification  
ISO 4217
  - Geography Classification  
ISO 3166, Eures Taxonomy

Language Classification  
 ISO 6392, CEF  
 Driving License Classification  
 European Legislation  
 Skill Classification  
 Eures Taxonomy  
 Contract Types Classification  
 LE FOREM, Eures and BLL Classification  
 Work Condition Classification  
 LE FOREM, Eures and BLL Classification

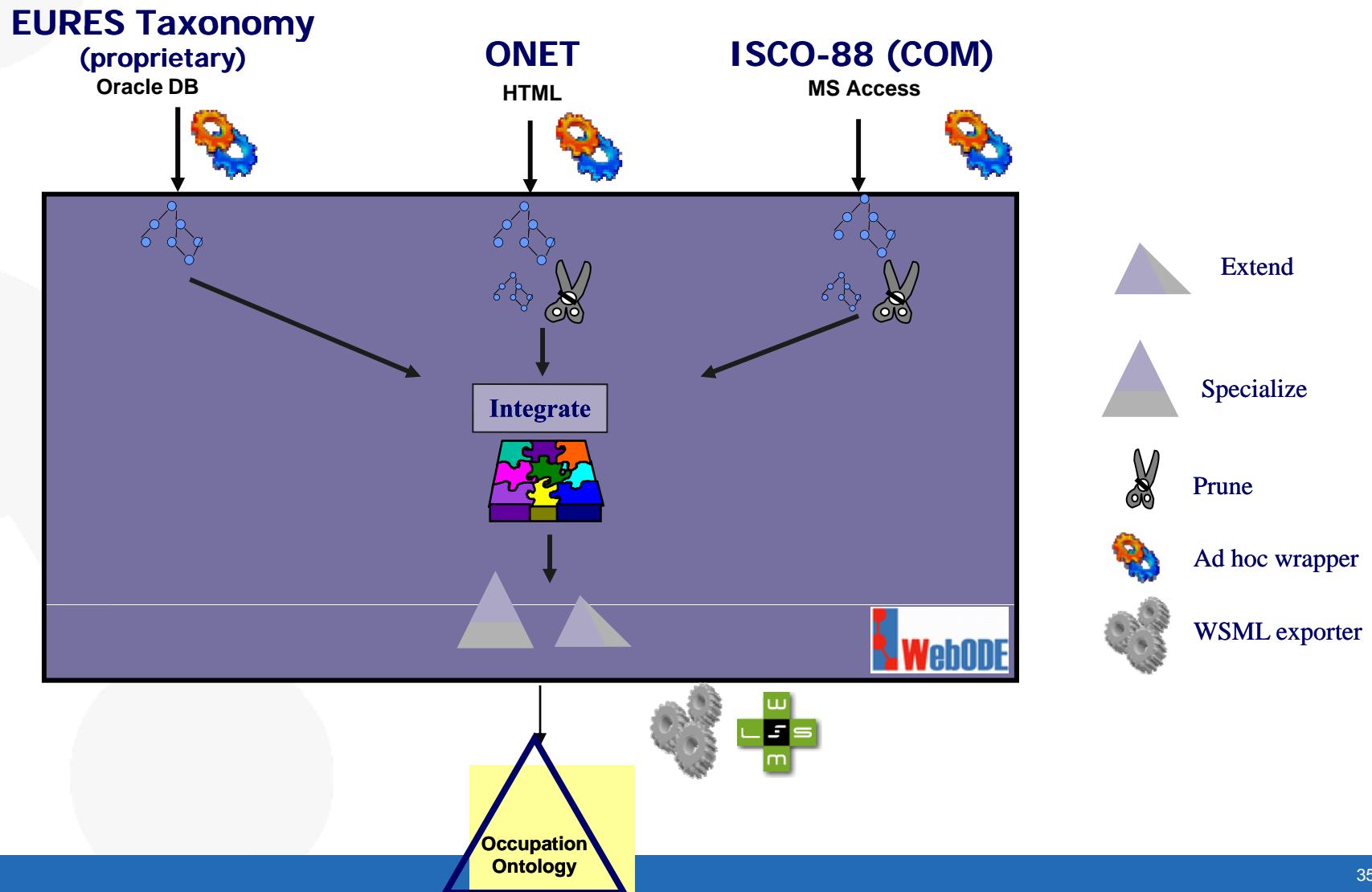
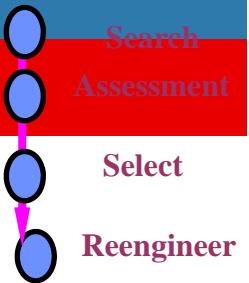
**Assessment activity: Matching terminology  
from Competency Questions against the Standards**

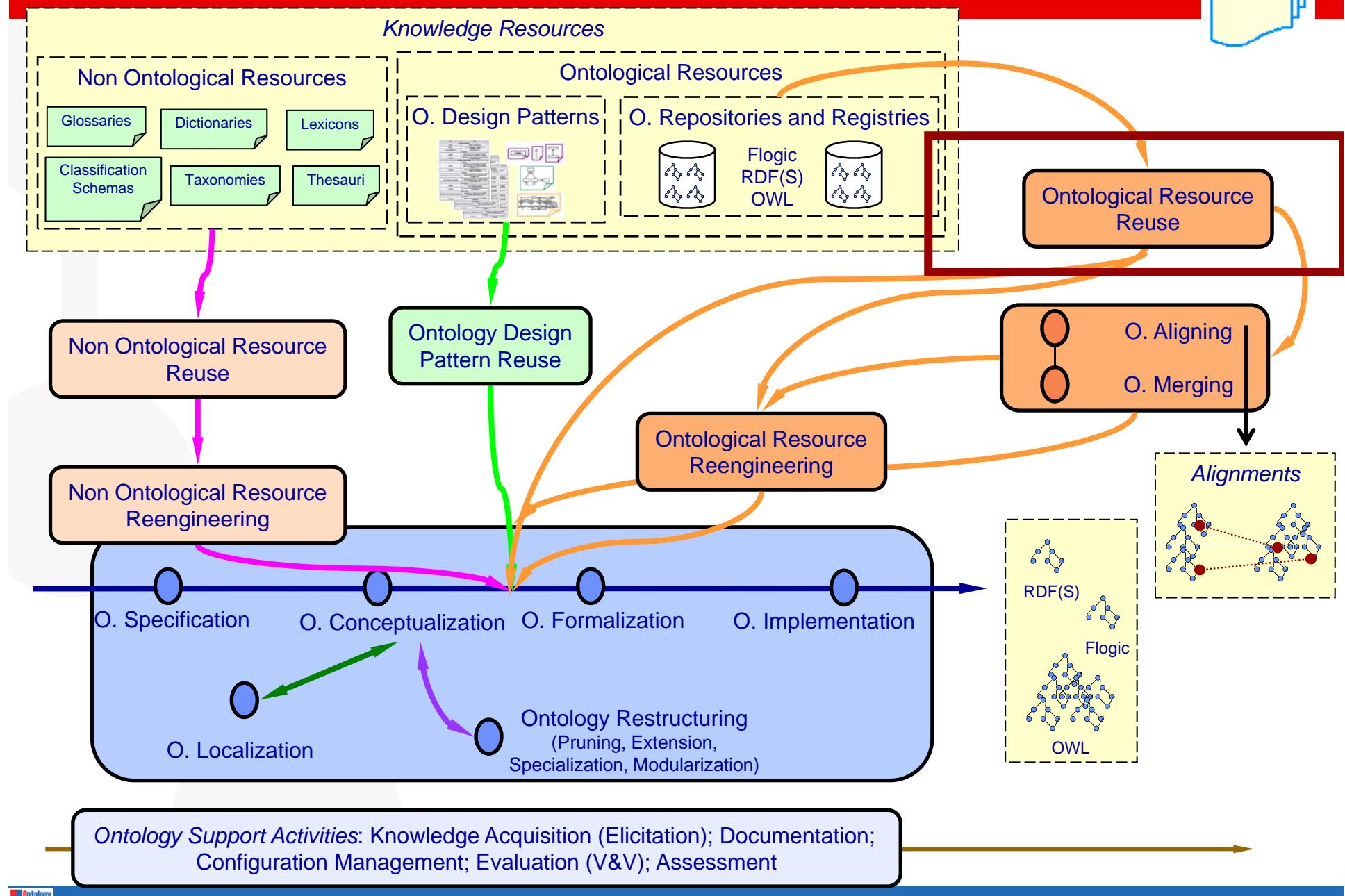
## Reuse and Reengineering + Waterfall



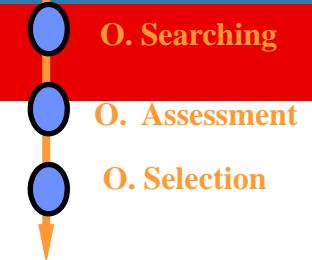


# Reengineering resources

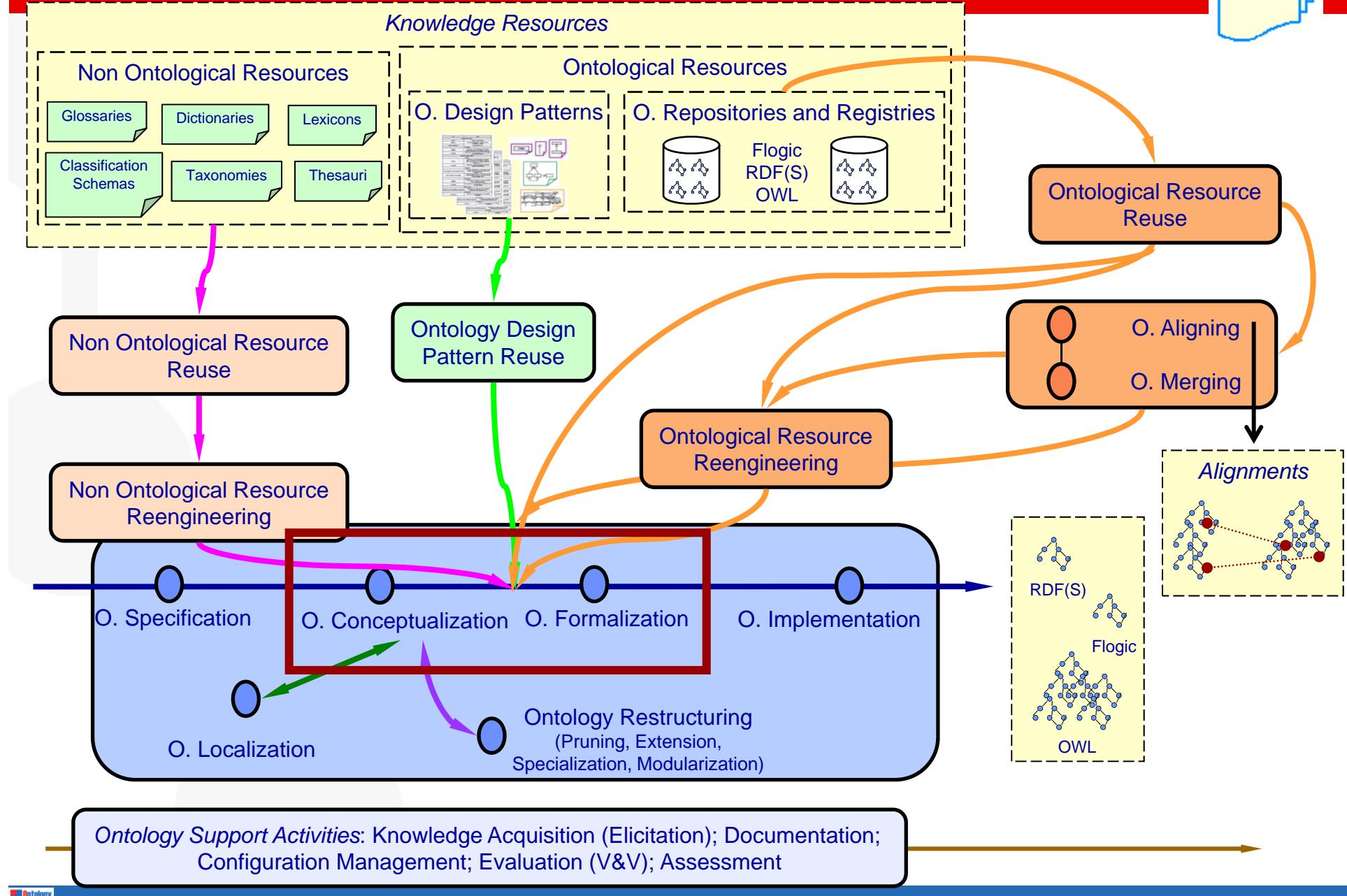




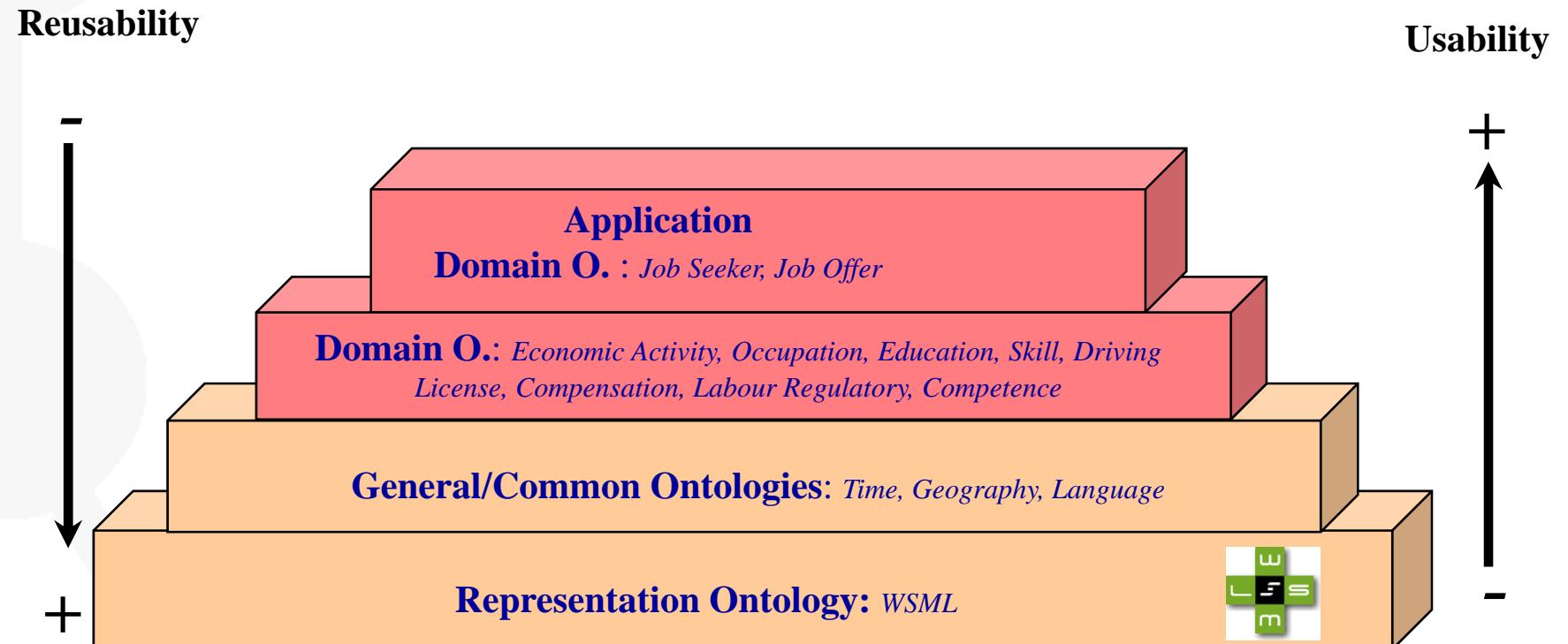
# The Time Ontology Selection



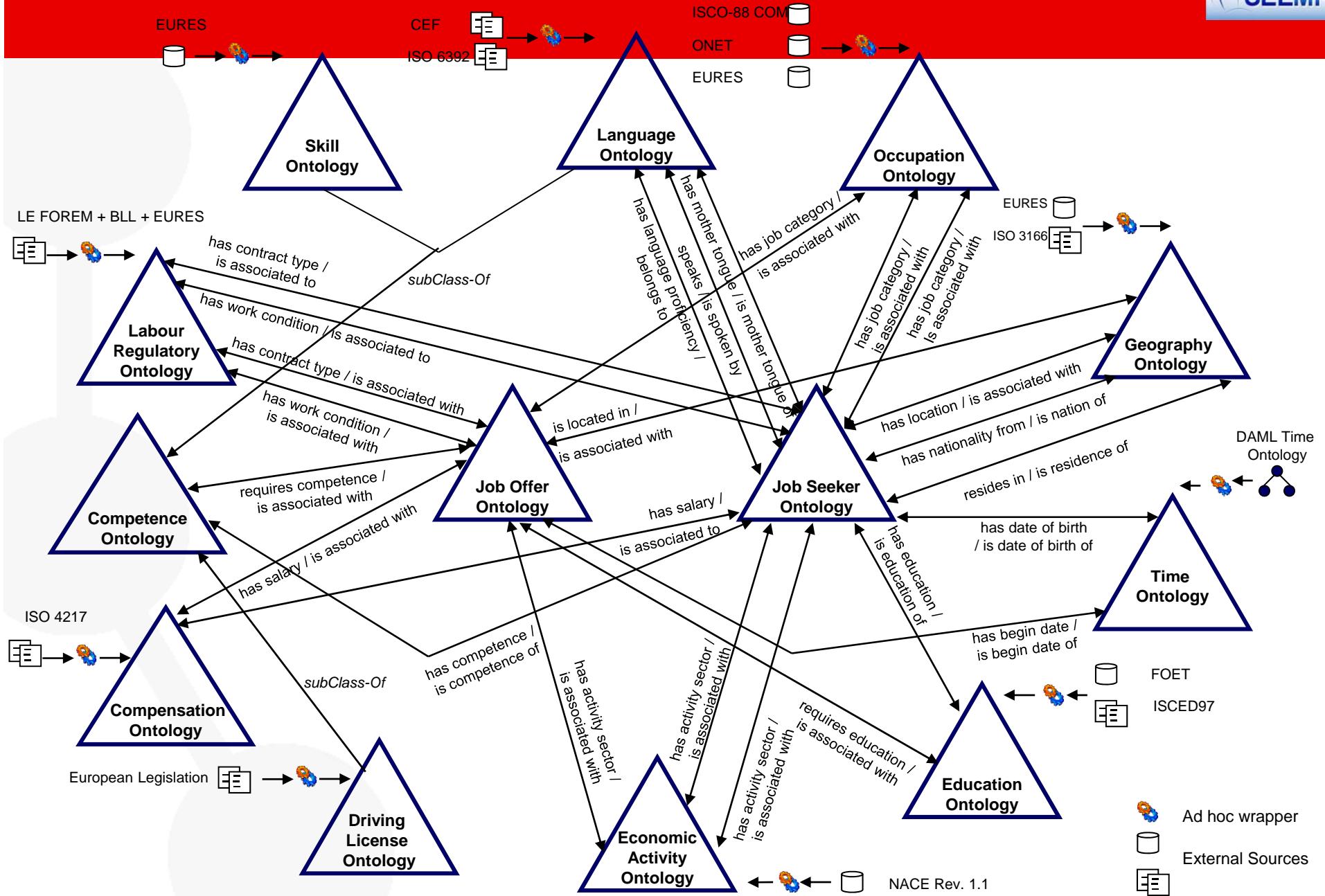
	Cyc's Upper Ontology	Unrestricted Time Ontology	Simple Time Ontology	Reusable Time Ontology	Kestrel Time Ontology	SRI's Time Ontology	SUMO Time Ontology	DAML Time Ontology	AKT Time Ontology
Time Points	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time Interval	✓			✓	✓	✓	✓	✓	✓
Absolute and Relative Time	✓					✓	✓	✓	✓
Relations between time intervals	✓			✓				✓	✓
Convex and non convex intervals	✓			✓			✓	✓	✓
Distinction between open and close intervals	✓			✓			✓		✓
Explicit modeling of proper intervals								✓	✓
Concatenation of intervals	✓					✓	✓	✓	✓
Different temporal granularities		✓	✓	✓		✓	✓	✓	✓
Provides axioms	✓						✓	✓	



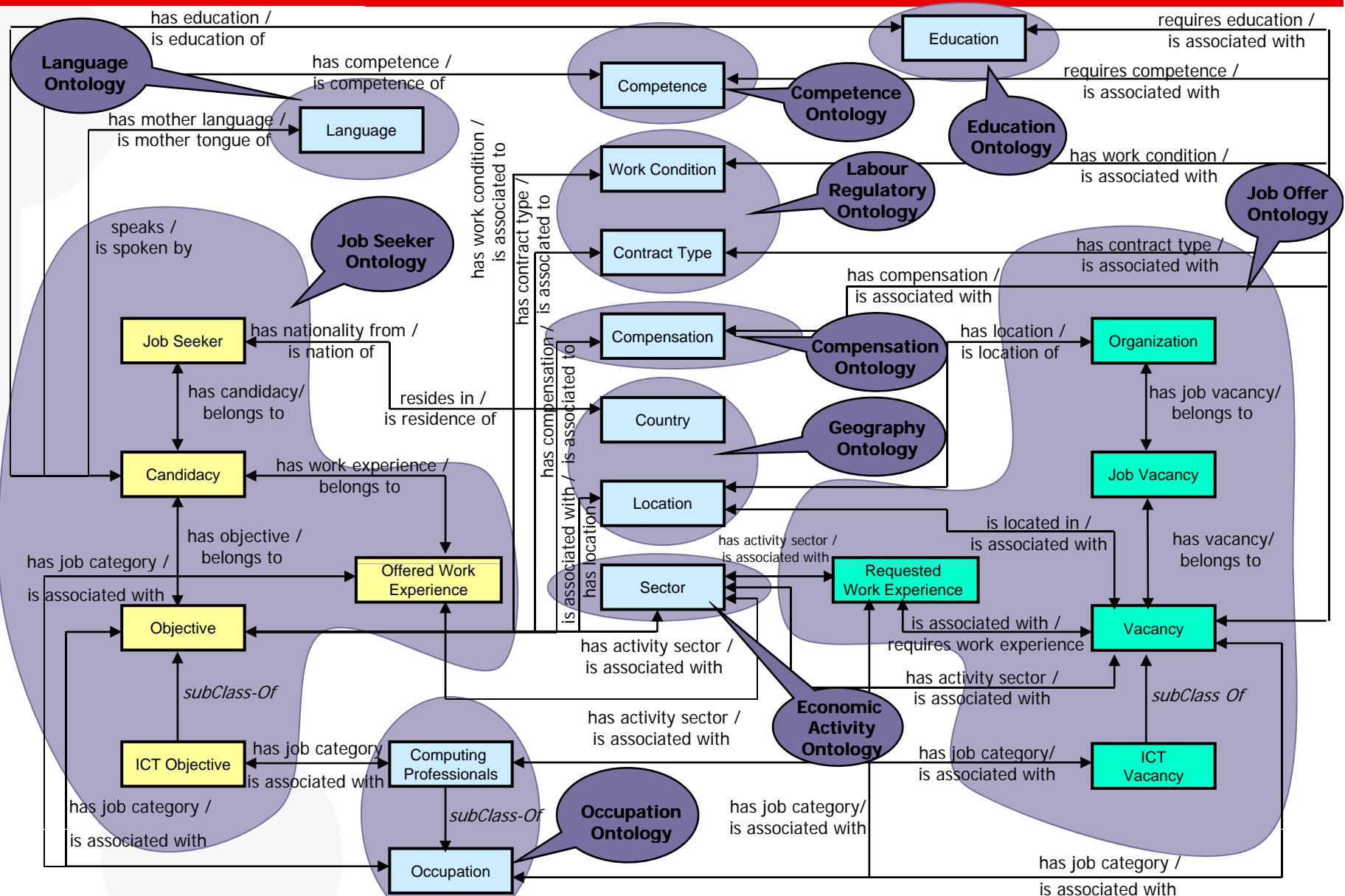
# Conceptualization: Modular approach for ontology construction

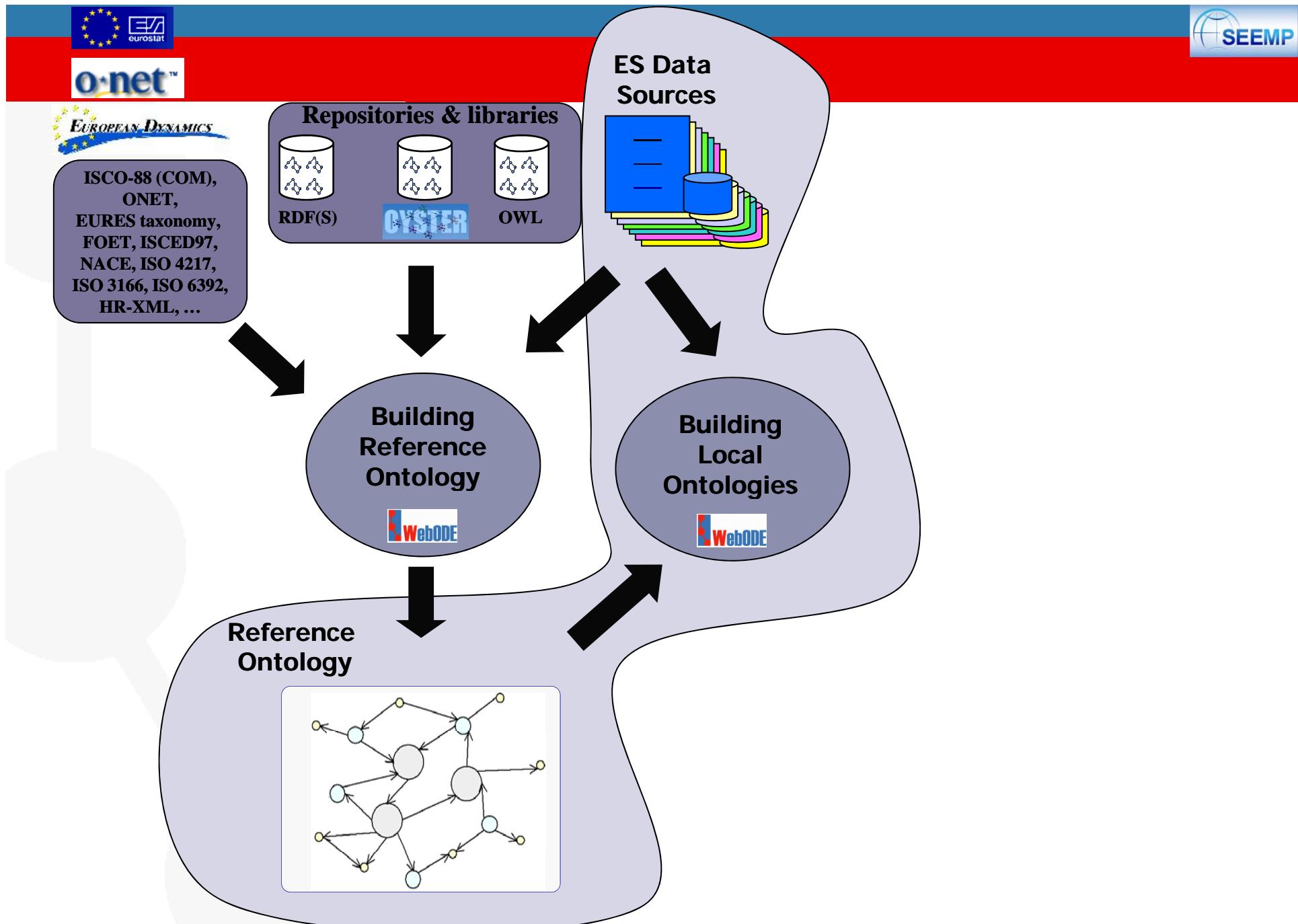


# Reference Ontology



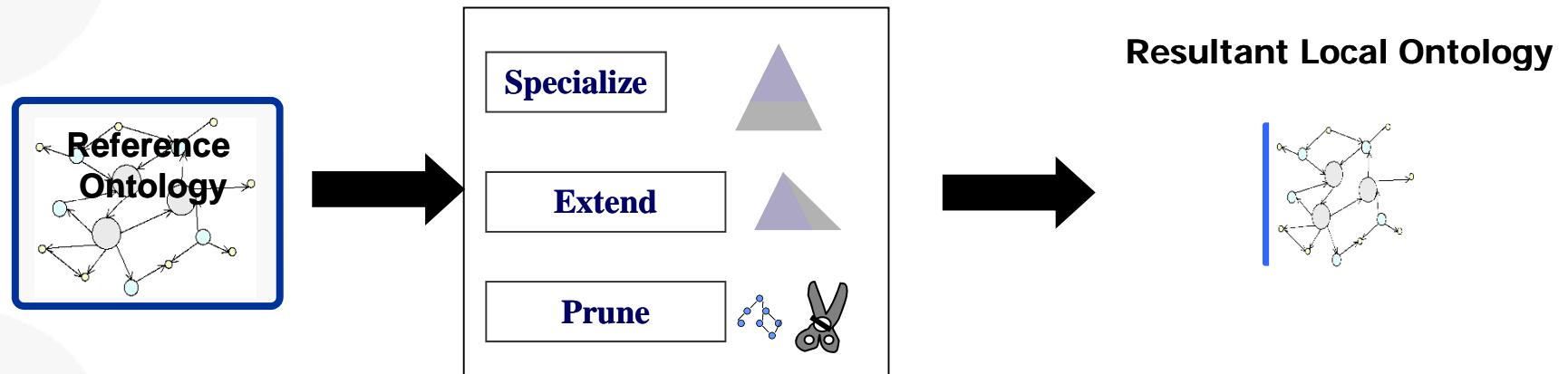
# Details of the ontology



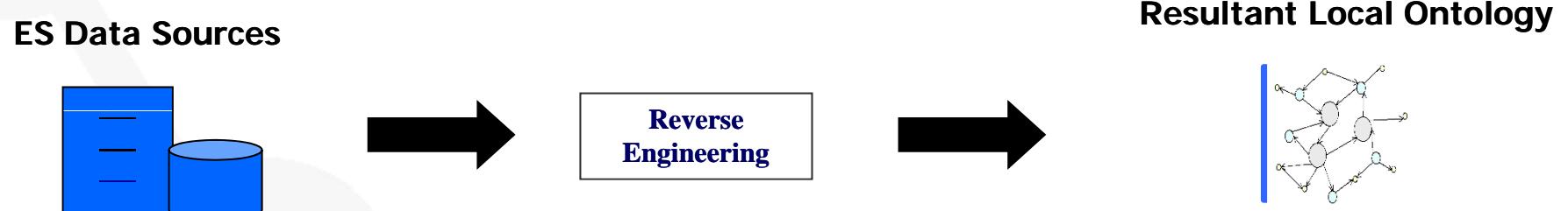


# Local Ontologies Building Process

- Option 1: *Building Local Ontologies from the Reference Ontology.*



- Option 2: *Building Local Ontologies as a reverse engineering process from ES Data Sources.*



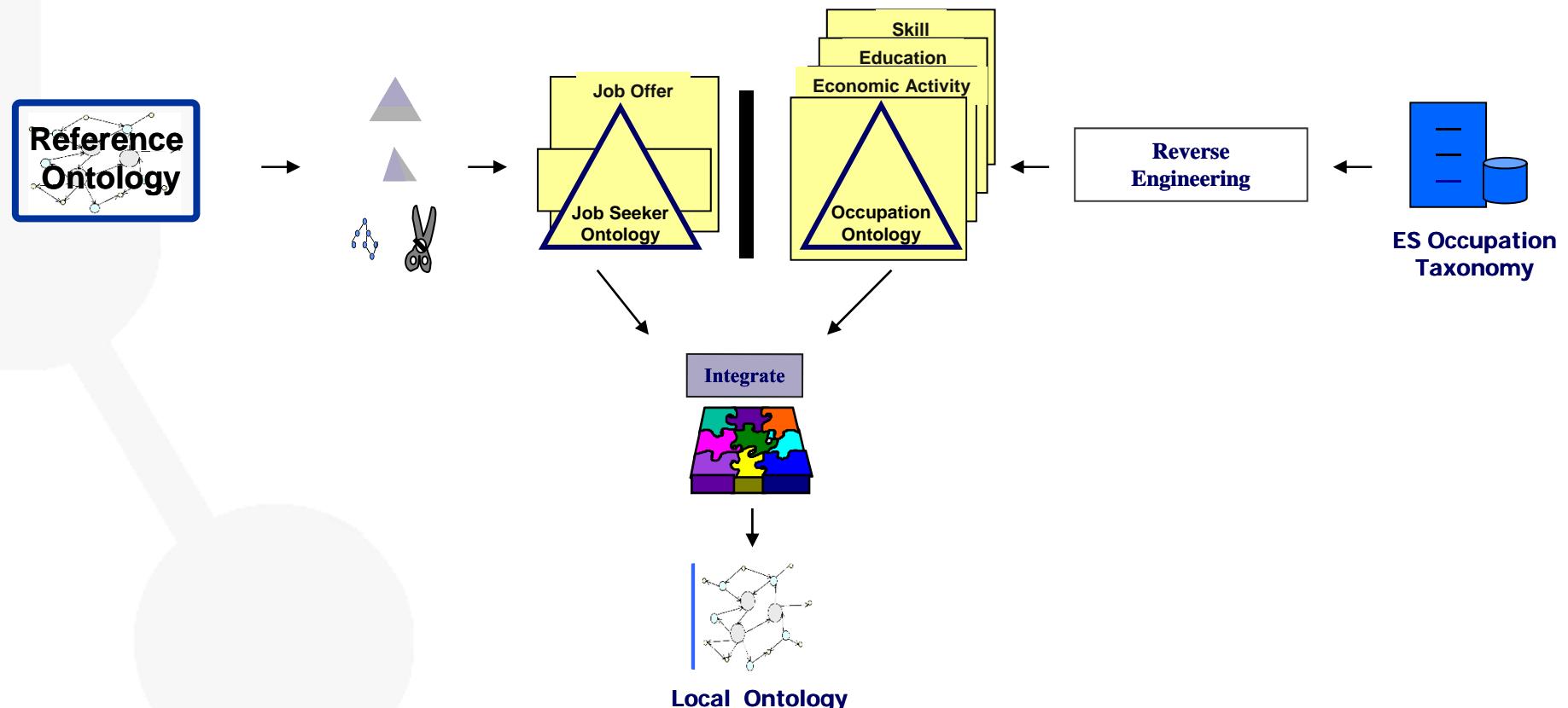
# Which option is the most appropriate for the use

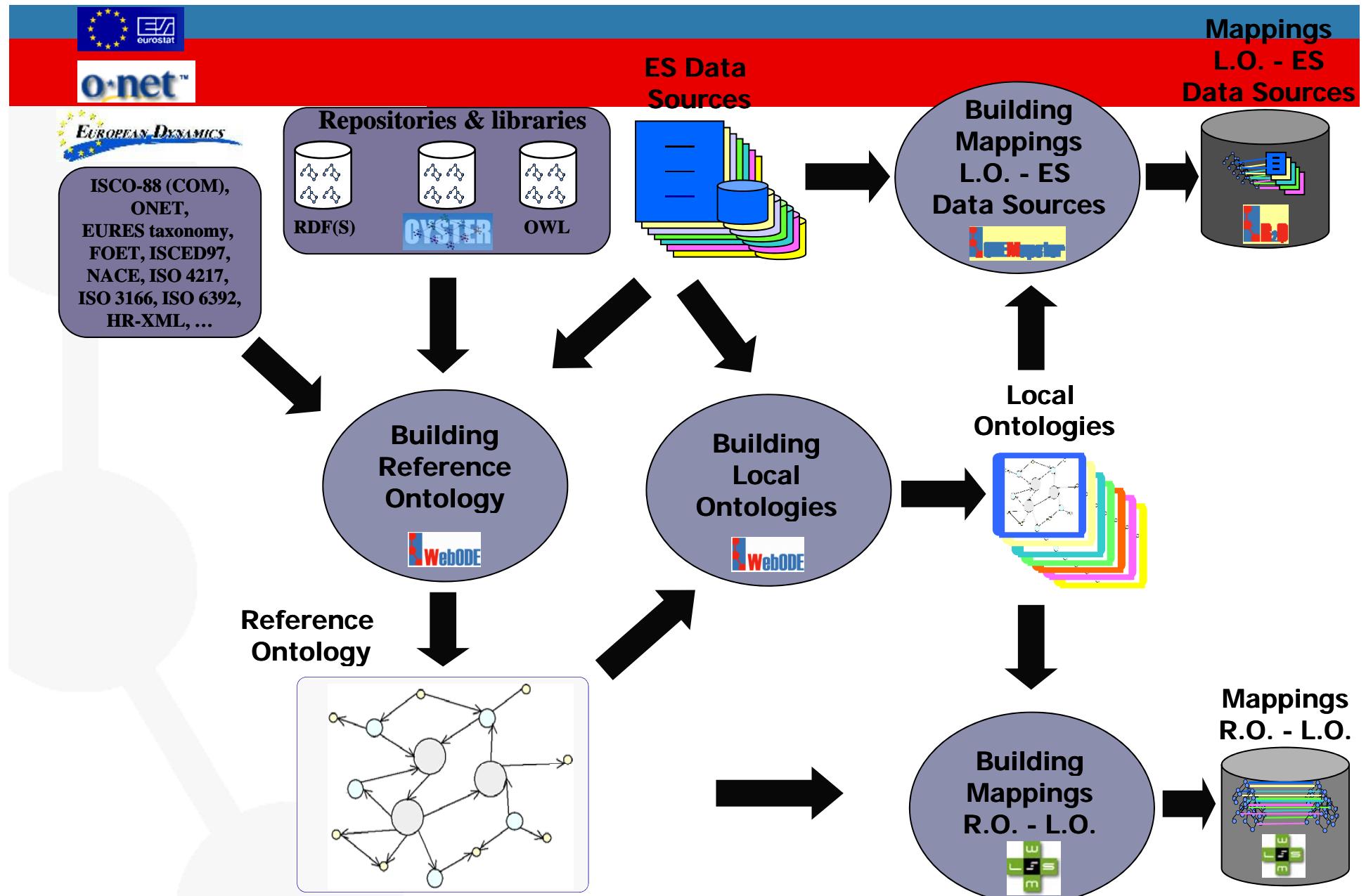
	Option 1: Building Local Ontologies from the Reference Ontology.	Option 2: Building Local Ontologies as a reverse engineering process from ES Data Sources.
<b>Mappings between Local Ontologies and Reference Ontology</b>	Mappings are not complex. They use the same terms.	Complex mappings due to terminology heterogeneity.
<b>Mappings between Local Ontologies and ES schema sources</b>	Complex mappings due to terminology and structural heterogeneity.	Mappings are not complex. They use the same terms.
<b>Building process</b>	Structured/guided by the architecture of the Reference Ontology and scoped with applications needs.	Requires more sophistication of knowledge engineering and good acquaintance of all the data and their structures of the application.
<b>Changes in the Reference Ontology</b>	Imply changes in <ul style="list-style-type: none"> <li>· the mappings between local and reference ontologies.</li> <li>· the mappings between the local ontologies and the ES schema sources.</li> <li>· the Local Ontology.</li> </ul>	Imply changes in <ul style="list-style-type: none"> <li>· the mappings between Local Ontologies and the Reference Ontology.</li> </ul>
<b>Changes in the ES schema sources</b>	Imply changes in <ul style="list-style-type: none"> <li>· its Local Ontology (probably the part that is not a mirror of the Reference Ontology).</li> <li>· the mappings between Local Ontologies and ES schema sources.</li> <li>· in the mappings between Local Ontology and the Reference Ontology.</li> </ul>	Imply changes in <ul style="list-style-type: none"> <li>· the Local Ontologies.</li> <li>· in mappings between ES sources and Local Ontologies.</li> <li>· mappings between local and the Reference Ontology.</li> </ul>

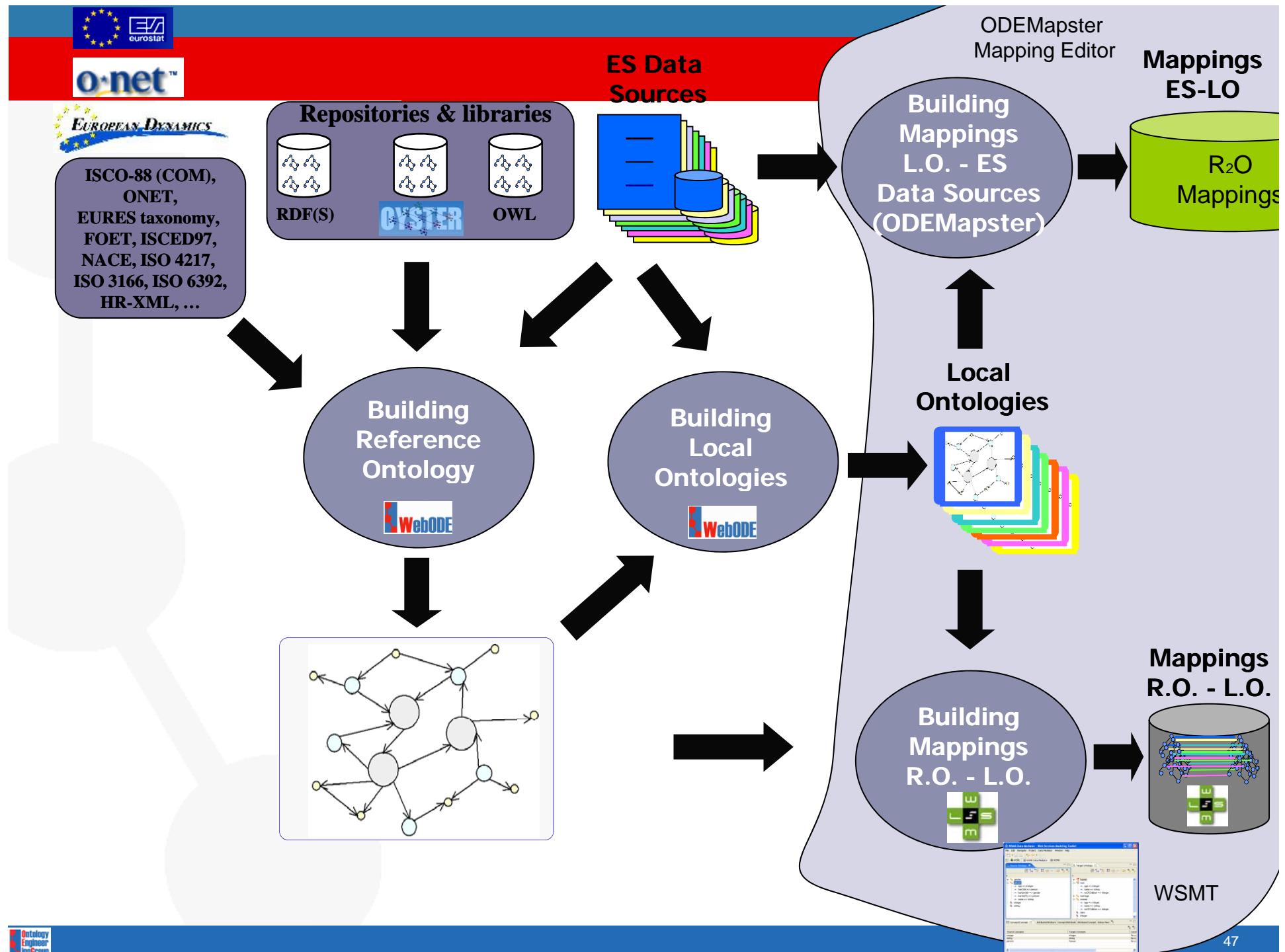
# Approach followed by SEEMP for building Local Ontologies

## A hybrid approach

- Option 1 for Job Seeker and Job Offer Ontologies
- Option 2 for Occupation, Education, etc.





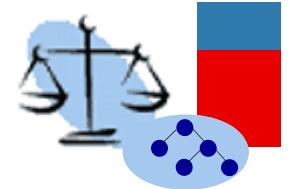


# Table of Contents

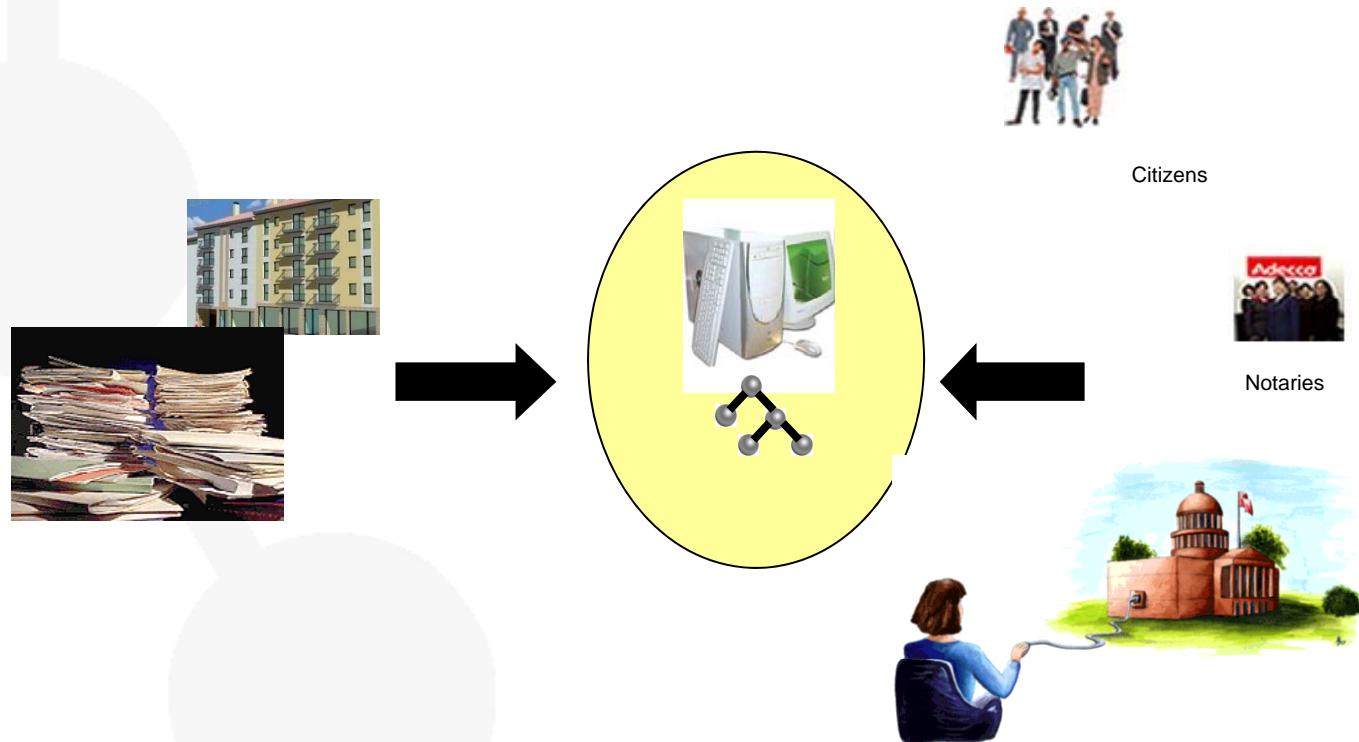
- Semantic Web Portals: ODESeW
- SEEMP
- Information Retrieval: ReimDoc
- NeOn Use Cases

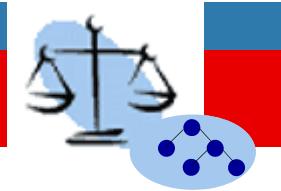


# Semantic Information Retrieval

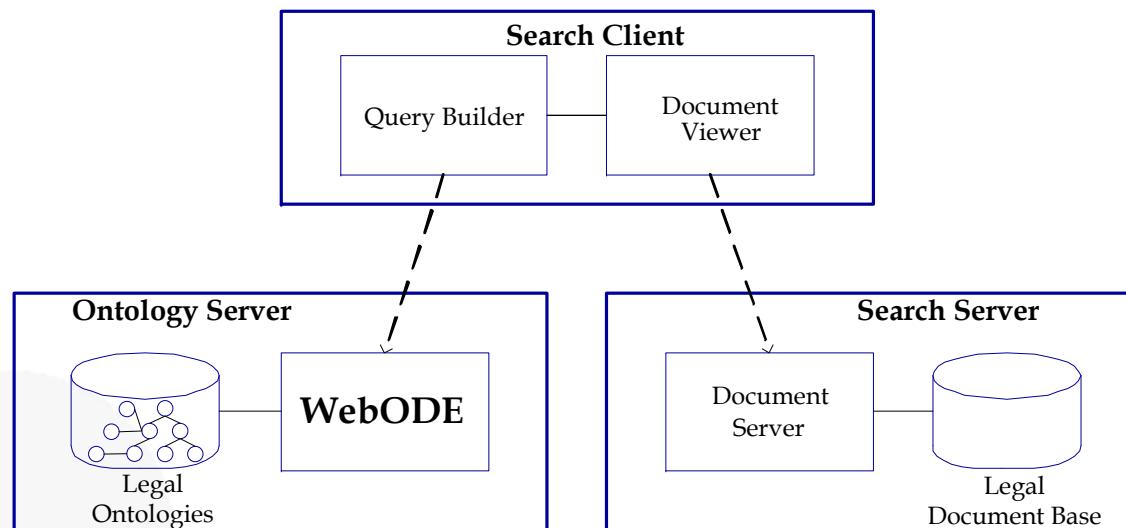


- e-Government
- Domain: real estate transaction documents
- Goal: Integrate and retrieve related documents for citizens, enterprises and the Government.

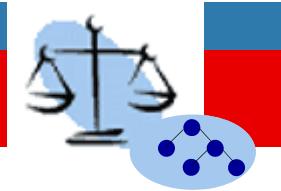




- The system is the result of integrating Ontological Workbench WebODE , and a text search engine library, Lucene.
- The system integration of the EgoIR is built and composed by the Search Client, the Search Server and the Ontology Server modules.

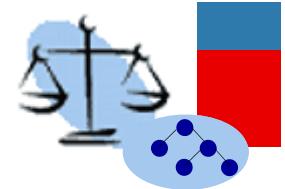


# EgoIR (Demo)



A screenshot of a web-based application login interface. At the top center is a logo featuring a blue balance scale icon next to the word "Reimdoc". Below the logo is a horizontal line. Underneath the line, there are two input fields: "Usuario : " and "Contraseña : ". Below these fields are two buttons: "Aceptar" and "Limpiar". Another horizontal line is located below the buttons.

# EgoIR (Demo)



Reimdoc - lucas - Administración Pública logout

Búsqueda - Herramienta de Recuperación de Documentos

Documentos 1-10 (de 10 documentos en total):

CODIGO CIVIL (Arts 17 a 332)

LEY 491960, de 21 de julio

CODIGO CIVIL (Arts 1445 a 1546 )

DECRETO, de 8 de febrero de 1946

REAL DECRETO LEGISLATIVO 15641989, de 22 de diciembre

REAL DECRETO 1784 1996, de 19 de julio

REAL DECRETO LEGISLATIVO 2 2004, de 5 de marzo

Persona Legal ▾

Año

- Personalidad Civil
  - Persona Jurídica
    - Asociación
      - Civil
      - Industrial
      - Mercantil
    - Compañía
      - Privada
        - Control Compartido
      - Pública
        - Control Compartido
  - Fundación
  - Persona Natural
    - Capacidad Legal
    - Incapacidad Legal

Fundación

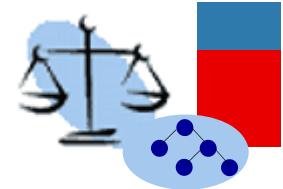
Año  
Civil

Documentos que contengan

Todos los conceptos  Algun Concepto

Avanzada ▾

# EgoIR (Demo)



Reimdoc - lucas - Administración Pública [logout](#)

## Búsqueda - Herramienta de Recuperación de Documentos

Documentos **1-8** (de 8 documentos en total):

- Compraventa de bien inmueble - 31 Octubre
- Compraventa de bien inmueble - 2 Noviembre
- Compraventa de bien inmueble - 1 Noviembre
- Compraventa de bien inmueble - 30 Octubre
- Compraventa de bien inmueble - 29 Octubre
- Compraventa de bien inmueble - 28 Octubre
- Compraventa de bien inmueble - 27 Octubre

**Asociación**  
Civil  
Industrial  
Mercantil

**Compañía**  
Privada  
Control Compartido  
Publica  
Control Compartido

Fundación

**Persona Natural**  
Capacidad Legal  
Incapacidad Legal

Contenido

Concedente (Vendedor)

Optante (Comprador)

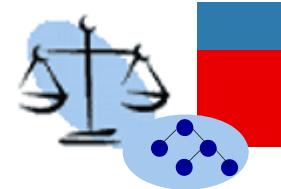
Lugar

Precio

Fecha

[Normal](#)

# EgoIR (Demo)



Reimdoc - lucas - Administración Pública [logout](#)

Campo/Atributo	Valor
Titulo	Compraventa de bien inmueble - 2 Noviembre
Pago	3000
Nombre Optante	Raúl García Castro
Nombre Concedente	José Ángel Ramos Gargantilla
Lugar de celebración	Madrid
Fecha	02/11/2005
Domicilio Optante	Usera, 26, Madrid
Domicilio Concedente	Getafe, 35, Madrid
Documento	Compraventa de bien inmueble - 2 Noviembre.rf
DNI/CIF Optante	005433-E
DNI/CIF Concedente	4426461-L

**Asociación**

- Civil
- Industrial
- Mercantil

**Compañía**

- Privada
- Control Compartido
- Publica
- Control Compartido

Fundación

**Persona Natural**

- Capacidad Legal
- Incapacidad Legal

Contenido

Concedente (Vendedor)

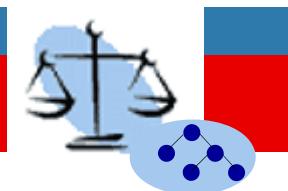
Optante (Comprador)

Lugar

Precio

Fecha

# EgoIR (Demo)



Compraventa de bien inmueble - 2 Noviembre[1].rtf - Microsoft Word

Asociación  
Civil  
Industrial  
Mercantil  
Compañía  
Privada  
Control  
Publica  
Control  
Fundación  
Persona Natural  
Capacidad Le  
Incapacidad L

Contenido  
Fundación  
Concedente (Vendedor)  
Raúl  
Optante (Comprador)  
Lugar  
Precio  
1000  
Fecha

CONTRATO DE COMPRAVENTA DE BIEN INMUEBLE

En Madrid, a 2 de Noviembre de 2005.

REUNIDOS

De una Parte,

Don/ Doña José Ángel Ramos Gargantilla, mayor de edad, casado, Ing. Informático, vecino/ a de Madrid, con domicilio Getafe número 35 y con Documento Nacional de Identidad 4426461-L, en adelante, "el Vendedor".

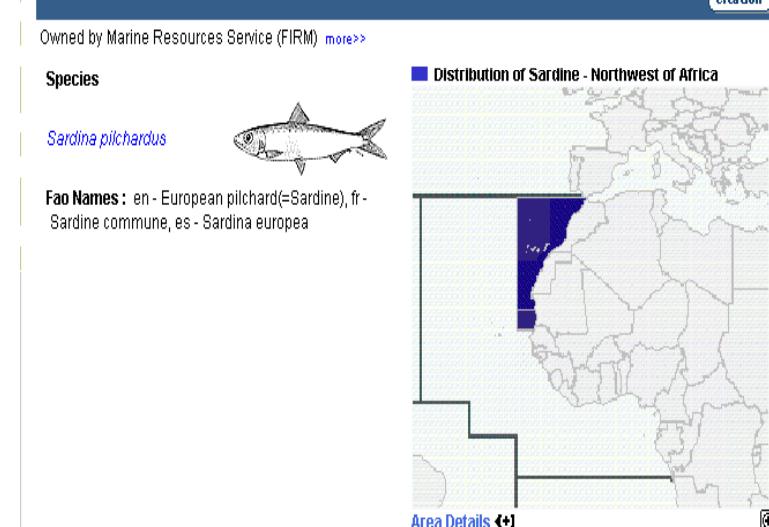
Normal

# Table of Contents

- Semantic Web Portals: ODESeW
- SEEMP
- Information Retrieval: ReimDoc
- NeOn Use Cases



- Large scale semantic web app.
- Managing fishery knowledge to support automatic alert mechanisms
- Pharmaceutical sector
  - E-Invoice management
  - Integration and management of information about pharmaceutical products



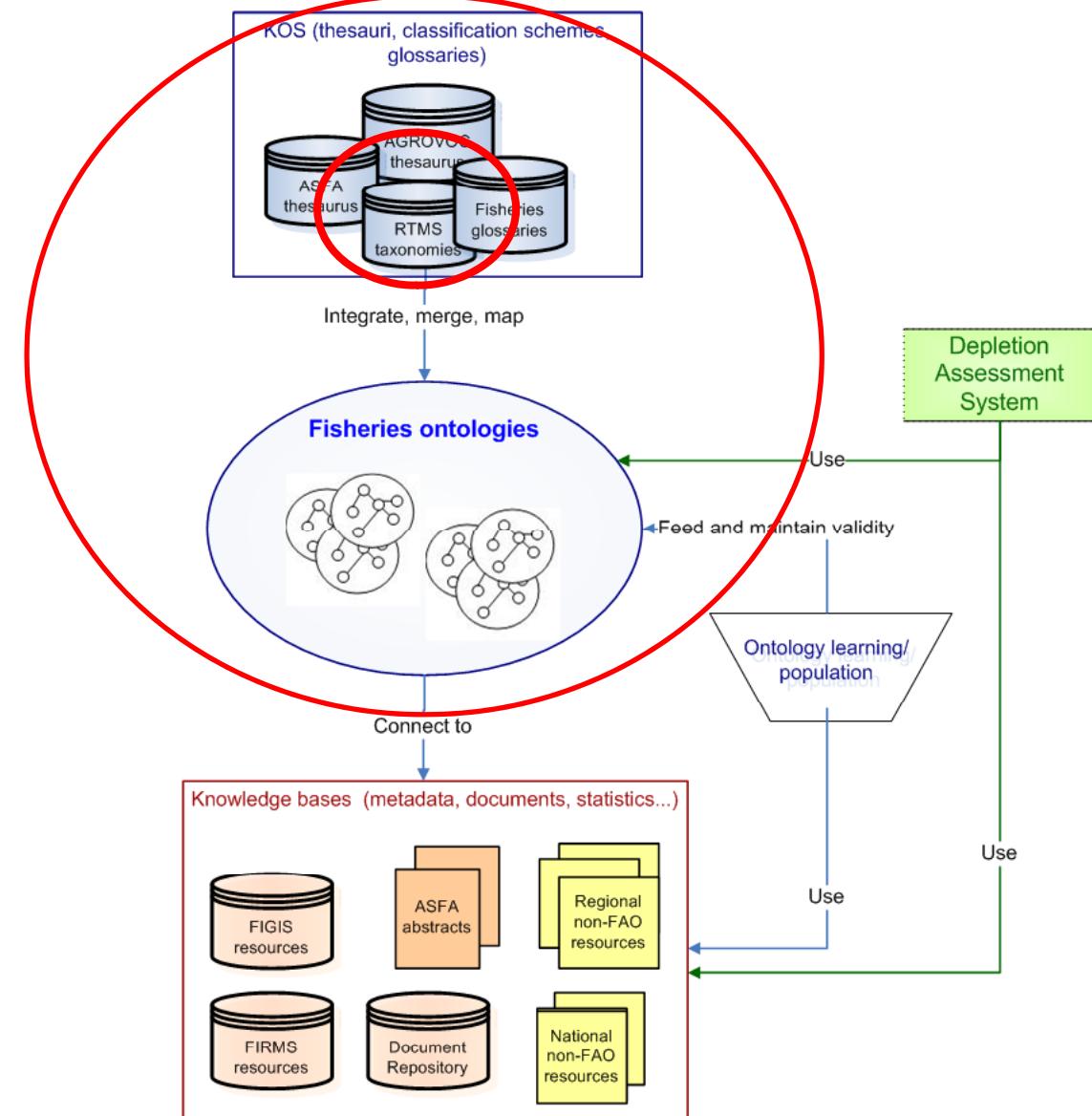
Global: 14.716.896 €



80

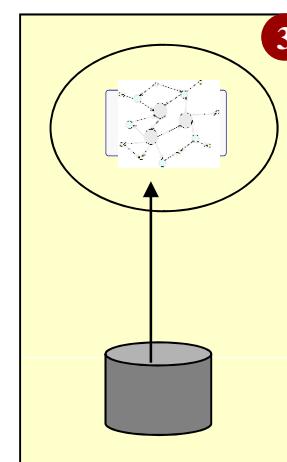
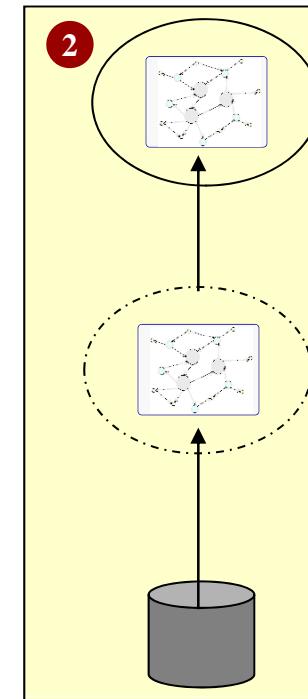
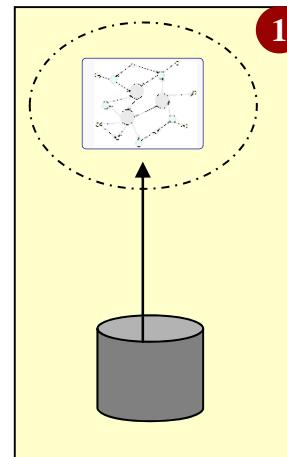
# R2O & ODEMapster within NeOn

- Ontologies that will be used by the FSDAS (Ontology Driven Fisheries Stock Depletion Alert System )



## Existing approaches

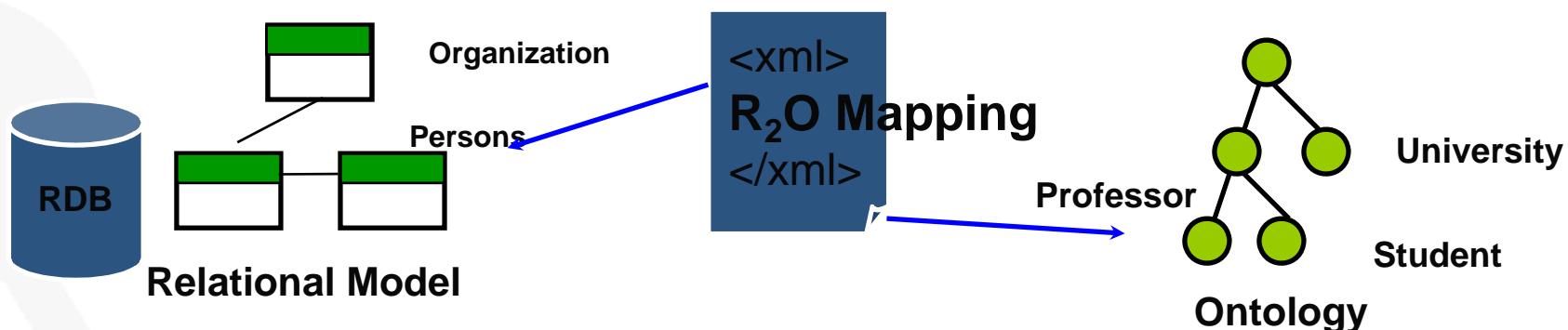
1. To build a **new ontology** from a database schema and content (OntoStudio, KaOn Reverse)
2. To map the ontology created in approach (1) to a **legacy ontology** (NeOn toolkit UKARL)
3. To map an existing DB to a **legacy ontology** (NeOn Toolkit UPM)
  - a) Massive batch data upgrade
  - b) Query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



new ontology  
 existing ontology

- Introduction
- R<sub>2</sub>O
  - ConceptMap definition
  - AttributeMap definition
  - RelationMap definition
- ODEMapster
  - Query Driven
  - Massive batch data upgrade
- FAO Use Case
- NeOn Toolkit plug in
- R2O Mapping Example

- R<sub>2</sub>O is an extensible, fully declarative language to describe mappings between relational database schemas and ontologies.



- Out of scope: to create an ontology that reflects the DB schema.

# ConceptMap definition

$$\mathcal{E}_M(C) = [f_C^{Id}, e_C^{Cond}, e_C^{Reun}]$$

BNF:

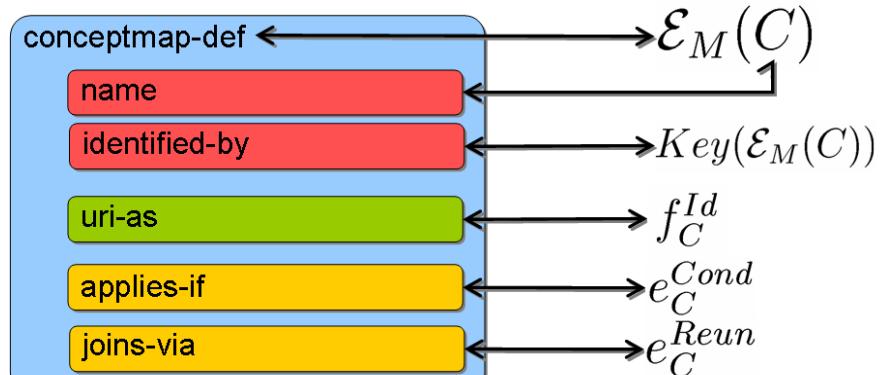
```

conceptmapping-definition ::= conceptmap-def name
                           identified-by+
                           (uri-as selector)?
                           (applies-if cond-expr)?
                           (joins-via concept-join-expr)?
                           documentation?
                           (described-by propertymap-def)*

identified-by ::= identified-by literal

concept-join-expr ::= (join-expr conceptJoinOper cond-expr)

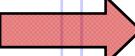
conceptJoinOper ::= join | union | difference
  
```



Example:

```

<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 definition

$$\mathcal{E}_M(A) = [C, e_A^{Cond}, e_A^{Reun}, f_A^{Trf}]$$



BNF:

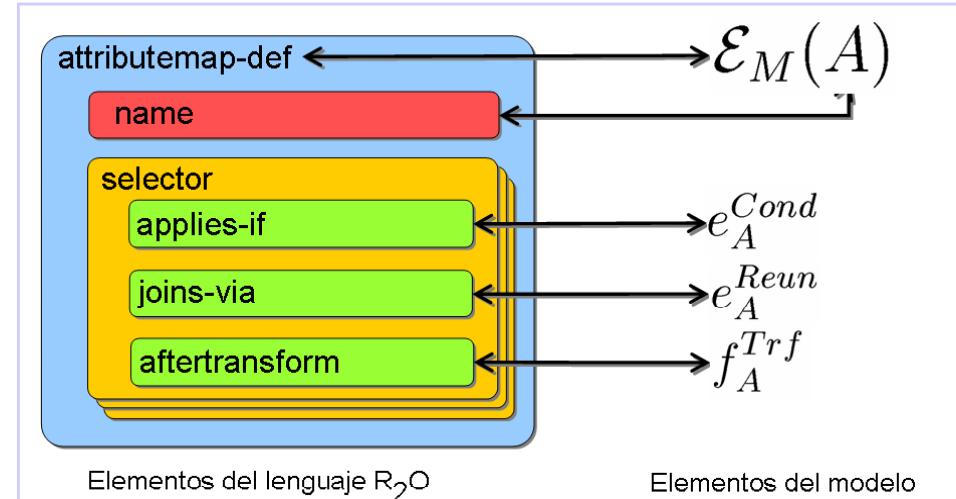
attributemap-def ::= **attributemap-def** name  
 (selector\* | use-dbcoll)  
 documentation?

use-dbcoll ::= **use-dbcoll** literal

selector ::= **selector** (applies-if cond-expr)?  
 (aftertransform transformation)?

newobj-type ::= **newobject-type** literal

to-concept ::= **to-concept** literal



Example:

```
<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 definition

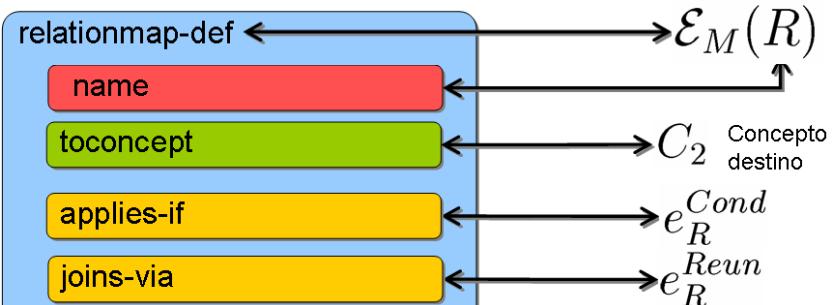
$$\mathcal{E}_M(R) = [C_O, C_D, e_R^{Cond}, e_R^{Reun}]$$

BNF:

```
relationmap-def ::= relationmap-def to-concept
                  (applies-if cond-expr)?
                  (joins-via relation-join-expr)?  

relation-join-expr ::= join (join-expr cond-expr)?  

to-concept ::= to-concept literal
```



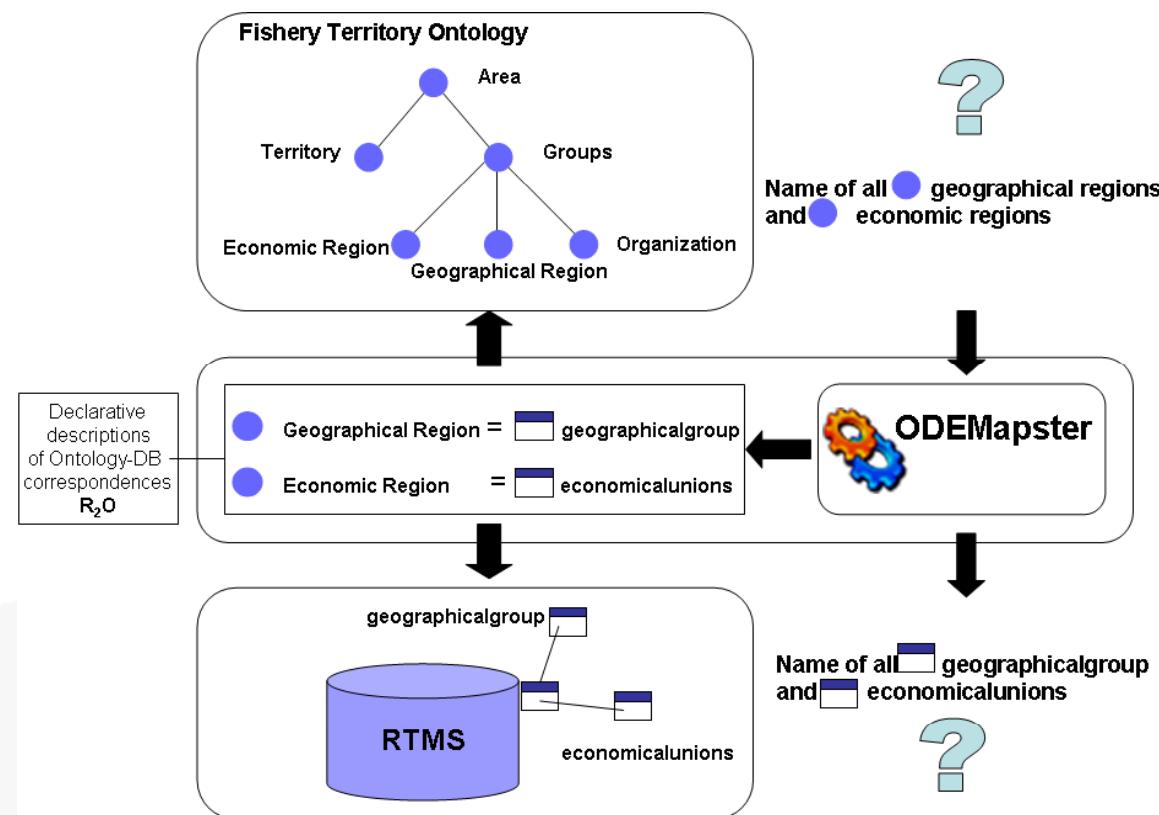
Elementos del lenguaje  $R_2O$

Elementos del modelo

Example:

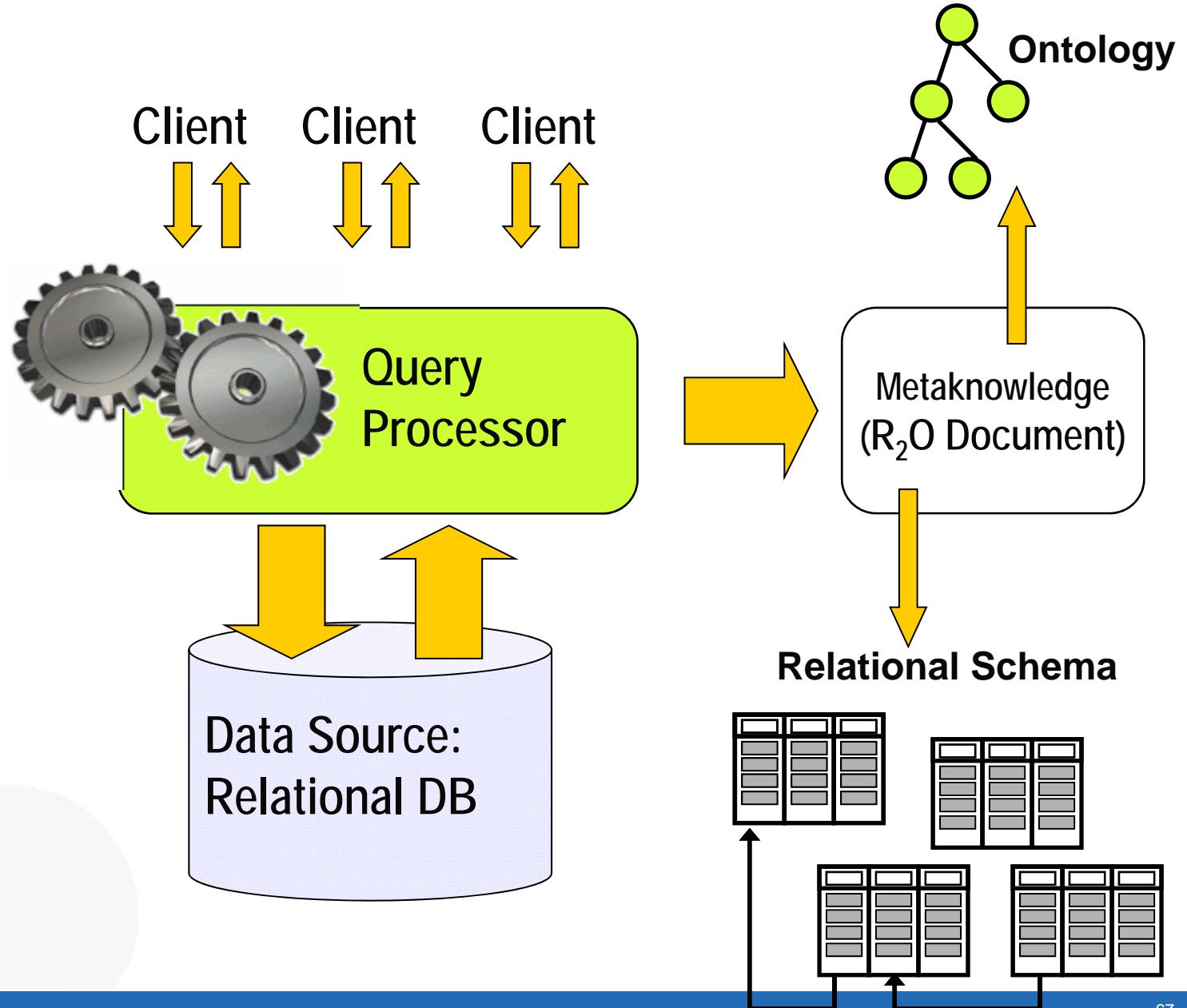
```
<relationmap-def name="http://esperonto/ff#isCandidateFor">
  <to-concept name="http://esperonto/ff#FundOpp">
    <joins-via>
      <operation oper-id="equals">
        <arg-restriction on-param="value1">
          <has-column>fsb_ajut.id</has-column>
        </arg-restriction>
        <arg-restriction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

- The ODEMapster processor generates Semantic Web instances from relational instances based on the mapping description expressed in the R<sub>2</sub>O document
  - Batch process: DB records migrated to the ontology
  - On demand: Querying the DB in terms of ontological terms

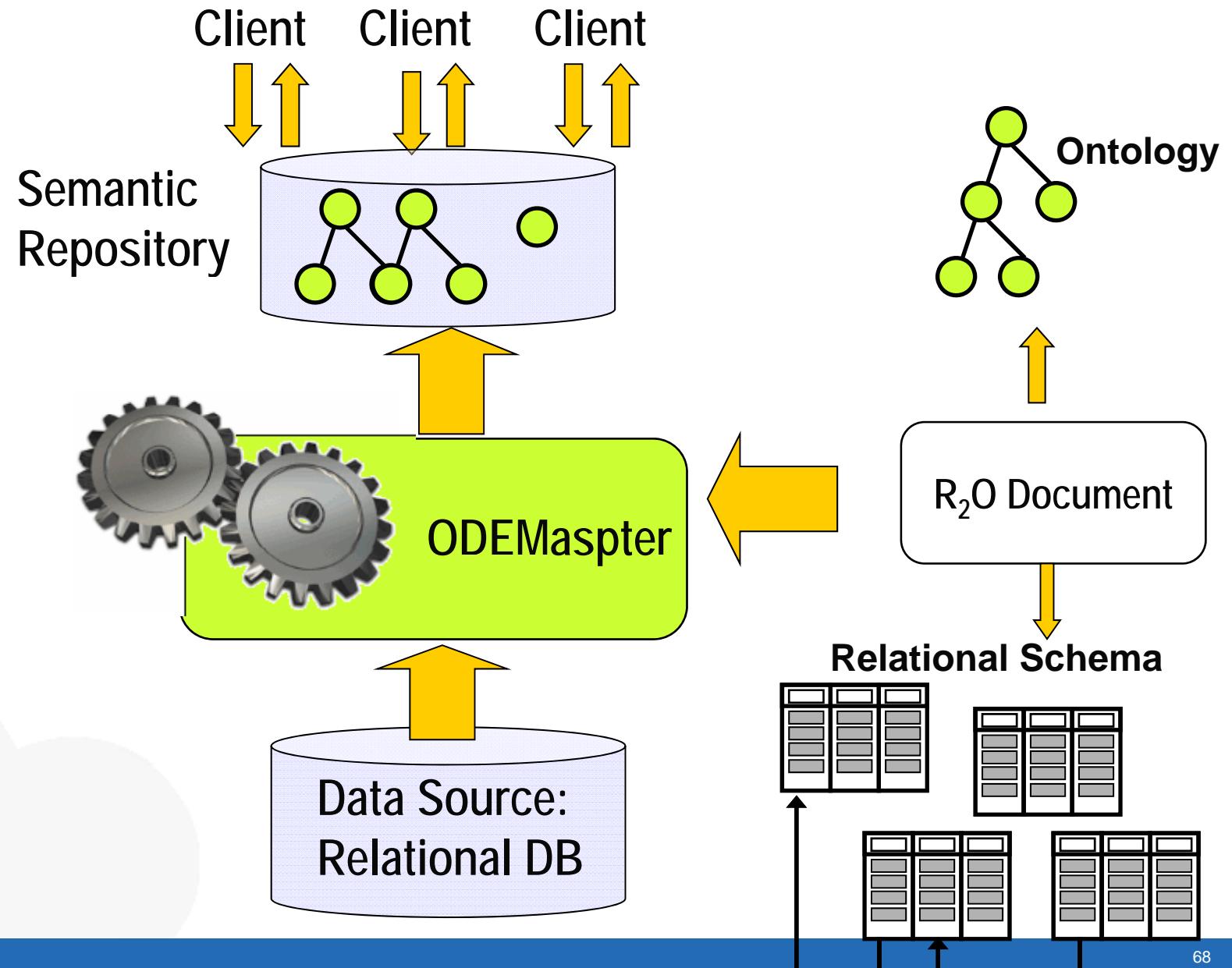


- Introduction
- R<sub>2</sub>O
  - ConceptMap definition
  - AttributeMap definition
  - RelationMap definition
- ODEMster
  - Query Driven
  - Massive batch data upgrade
- FAO Use Case
- NeOn Toolkit plug in
- R2O Mapping Example

# Query Driven (on demand process)

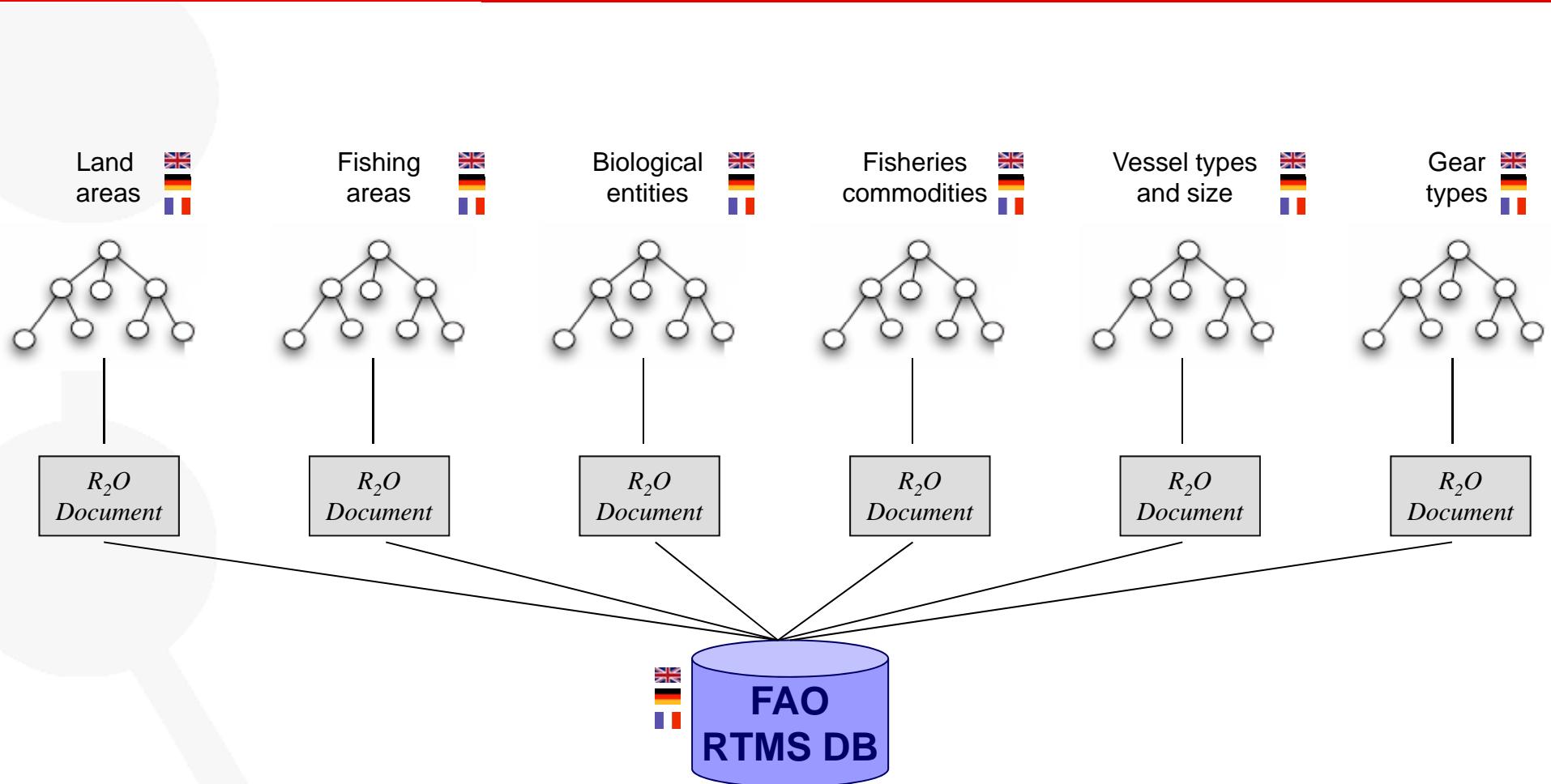


# Massive Batch data upgrade



- Introduction
- R<sub>2</sub>O
  - ConceptMap definition
  - AttributeMap definition
  - RelationMap definition
- ODEMapster
  - Query Driven
  - Massive batch data upgrade
- FAO Use Case
- NeOn Toolkit plug in
- R2O Mapping Example

# 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 commodities	
Concepts	5
Properties	14
Instances	1380

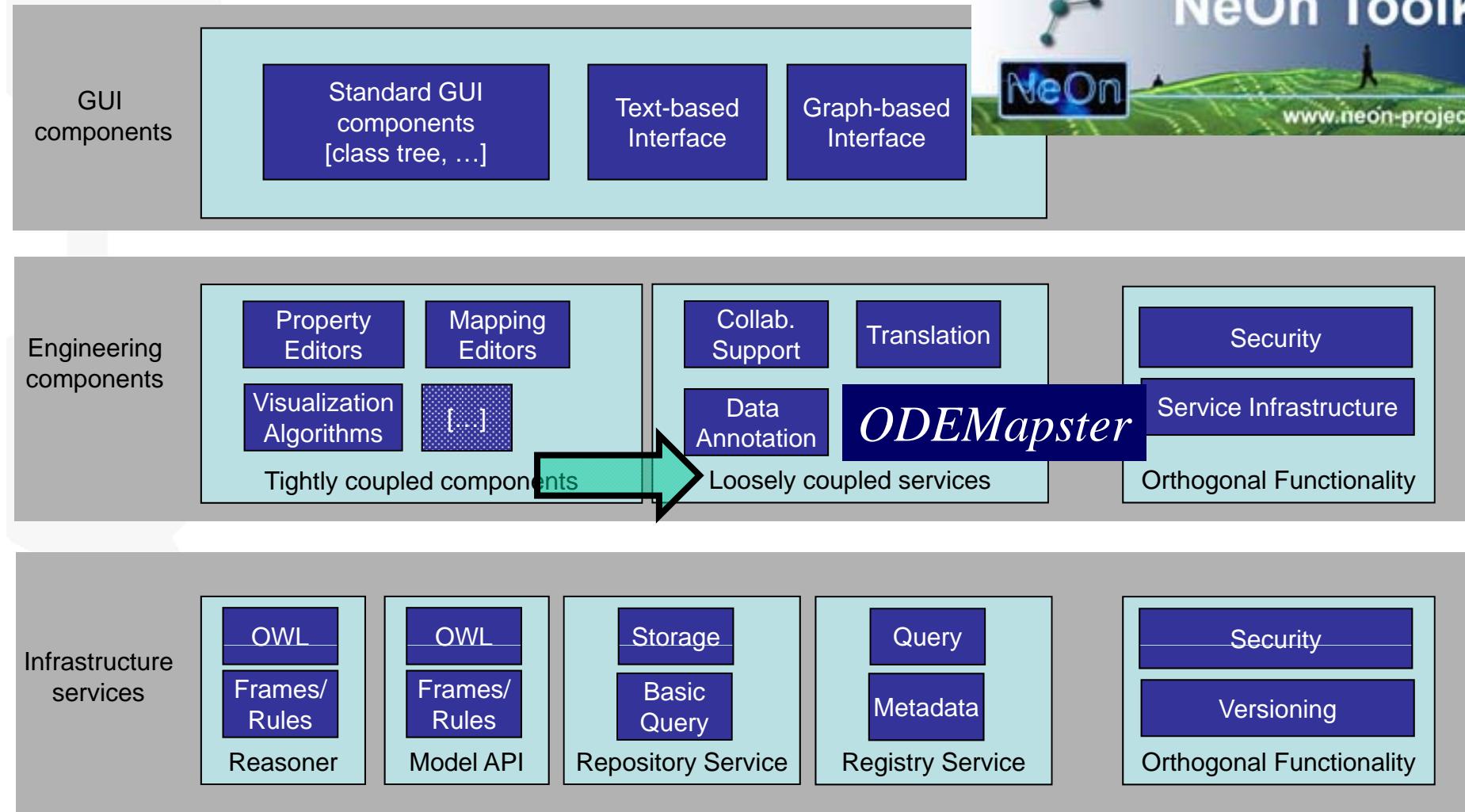
Vessel types and size	
Concepts	5
Properties	20
Instances	120

Gear types	
Concepts	4
Properties	14
Instances	0



- Introduction
- R<sub>2</sub>O
  - ConceptMap definition
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  - Query Driven
  - Massive batch data upgrade
- FAO Use Case
- NeOn Toolkit plug in
- R2O Mapping Example

<http://www.neon-toolkit.org>



- Introduction
- R<sub>2</sub>O
  - ConceptMap definition
  - AttributeMap definition
  - RelationMap definition
- ODEMster
  - Query Driven
  - Massive batch data upgrade
- FAO Use Case
- NeOn Toolkit plug in
- R2O Mapping Example

# Create a DB to Ontology mapping

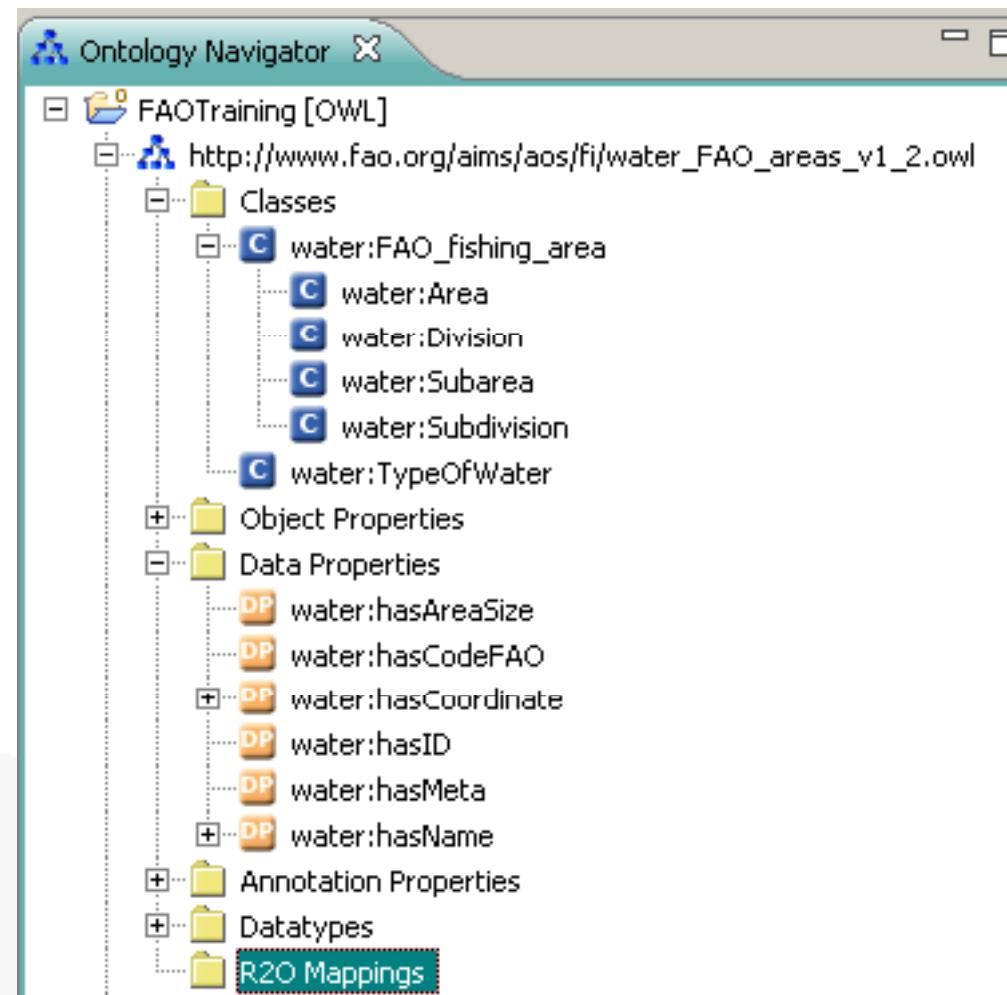
Select  
Mappings

Click new  
Mapping

Select  
Database

Mapping  
File  
created

Mapping  
Editor  
opens



# Create a DB to Ontology mapping

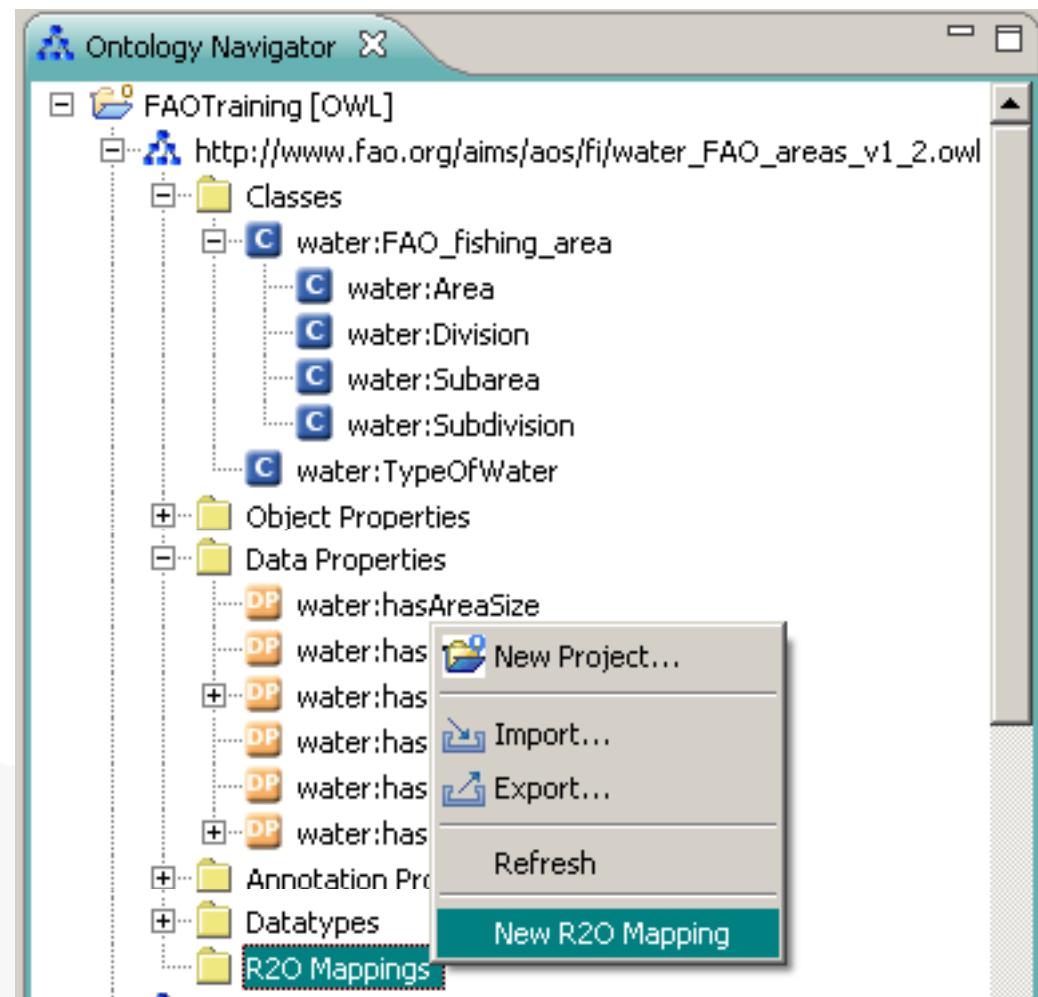
Select  
Mappings

Click new  
Mapping

Select  
Database

Mapping  
File  
created

Mapping  
Editor  
opens



# Create a DB to Ontology mapping

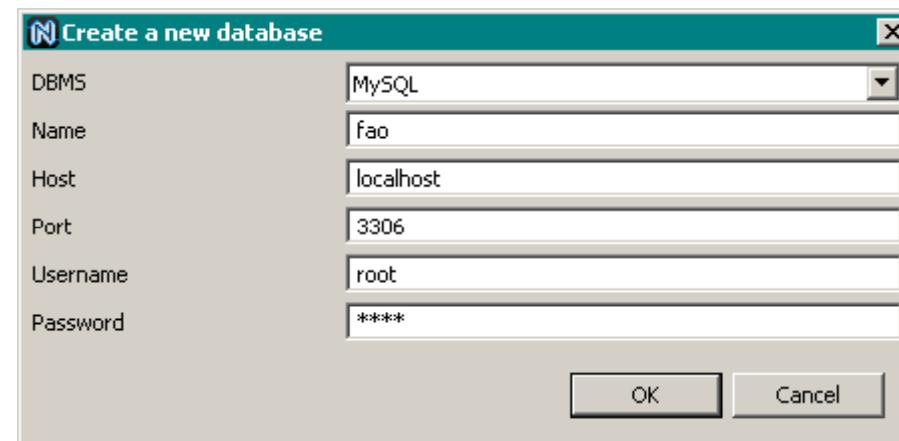
Select  
Mappings

Click new  
Mapping

Select  
Database

Mapping  
File  
created

Mapping  
Editor  
opens



# Create a DB to Ontology mapping

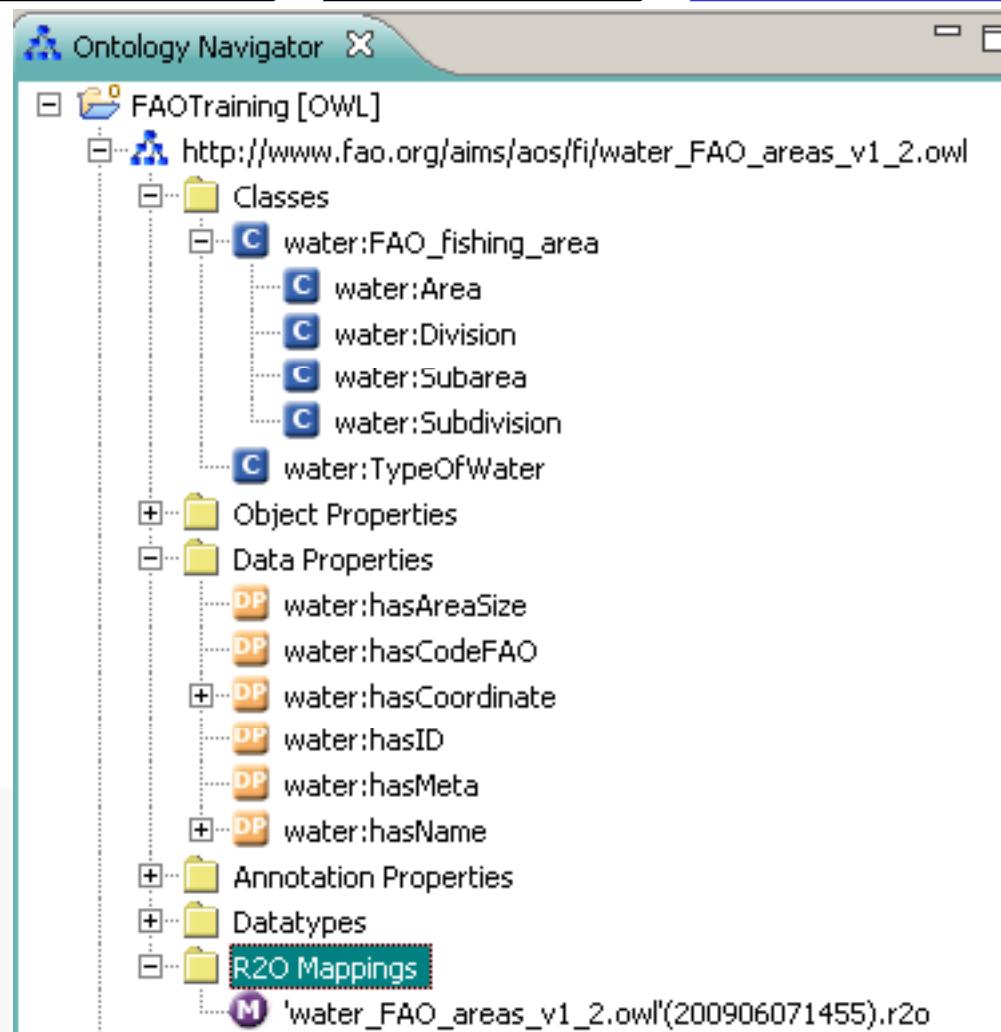
Select  
Mappings

Click new  
Mapping

Select  
Database

Mapping  
File  
created

Mapping  
Editor  
opens



# Create a DB to Ontology mapping

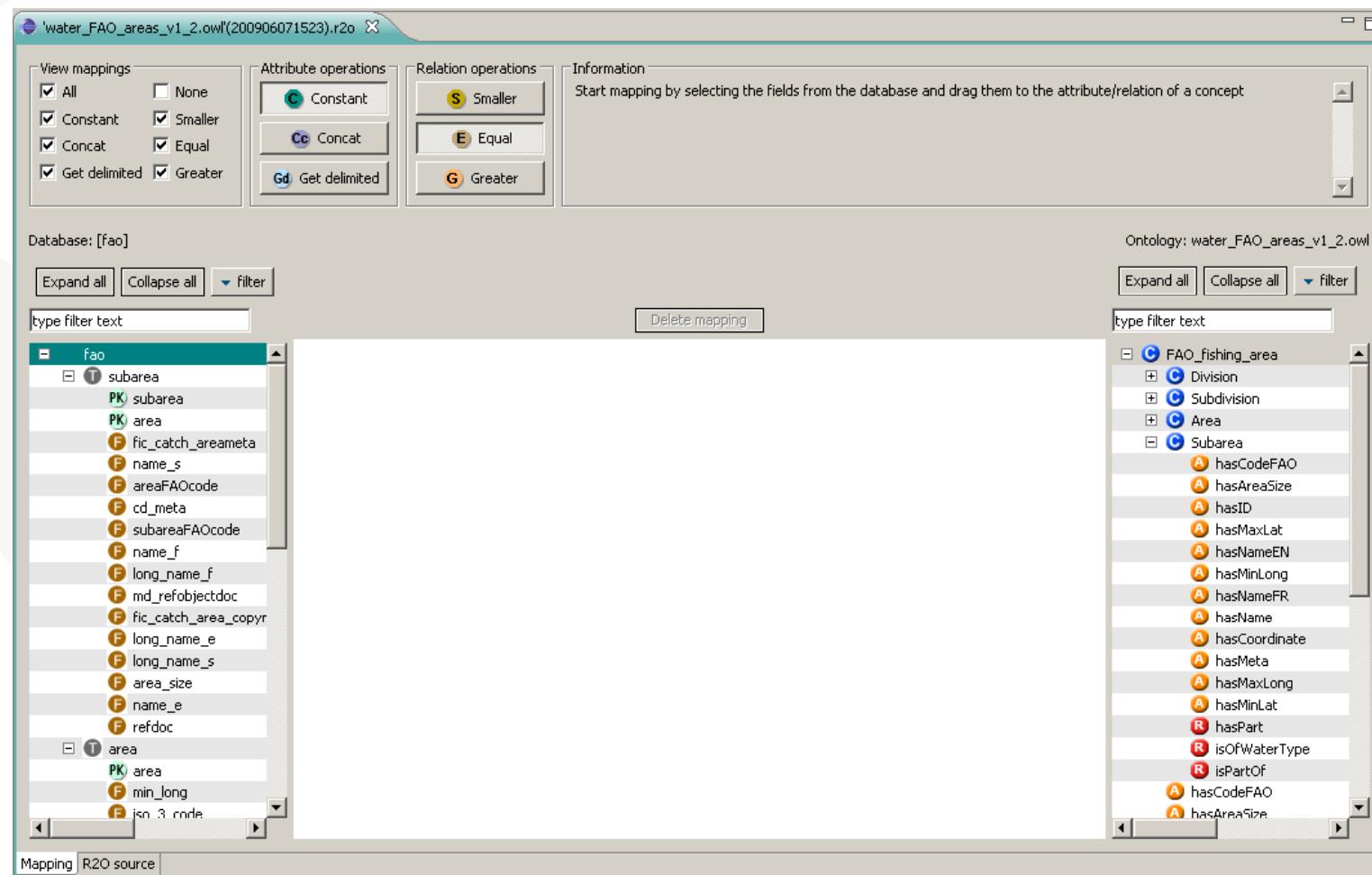
Select  
Mappings

Click new  
Mapping

Select  
Database

Mapping  
File  
created

Mapping  
Editor  
opens



# Create attribute mapping – Constant Operation

Select Field

Drag Field

Drop Field

Mapping established

'water\_FAO\_areas\_v1\_2.owl'(200906071523).r2o X

View mappings

- All
- None
- Constant
- Smaller
- Concat
- Equal
- Get delimited
- Greater

Attribute operations

- Constant
- Smaller
- Concat
- Equal
- Get delimited
- Greater

Relation operations

- Smaller
- Equal
- Greater

Information

Start mapping by selecting the fields from the database and drag them to the attribute/relation of a concept

Database: [fao]

Ontology: water\_FAO\_areas\_v1\_2.owl

type filter text

type filter text

Delete mapping

Expand all   Collapse all   filter

Expand all   Collapse all   filter

PK subarea

PK area

PK\_fic\_catch\_areameta

PK\_areaFAOcode

PK\_cd\_meta

PK\_subareaFAOcode

PK\_name\_f

PK\_long\_name\_f

PK\_md\_refobjectdoc

PK\_fic\_catch\_area\_copyr

PK\_long\_name\_e

PK\_long\_name\_s

PK\_area\_size

PK\_name\_e

PK\_refdoc

PK\_area

PK\_min\_long

PK\_isn\_3\_rndre

C FAO\_fishing\_area

C Division

C Subdivision

C Area

C Subarea

A hasCodeFAO

A hasAreaSize

A hasID

A hasMaxLat

A hasNameEN

A hasMinLong

A hasNameFR

A hasName

A hasCoordinate

A hasMeta

A hasMaxLong

A hasMinLat

R hasPart

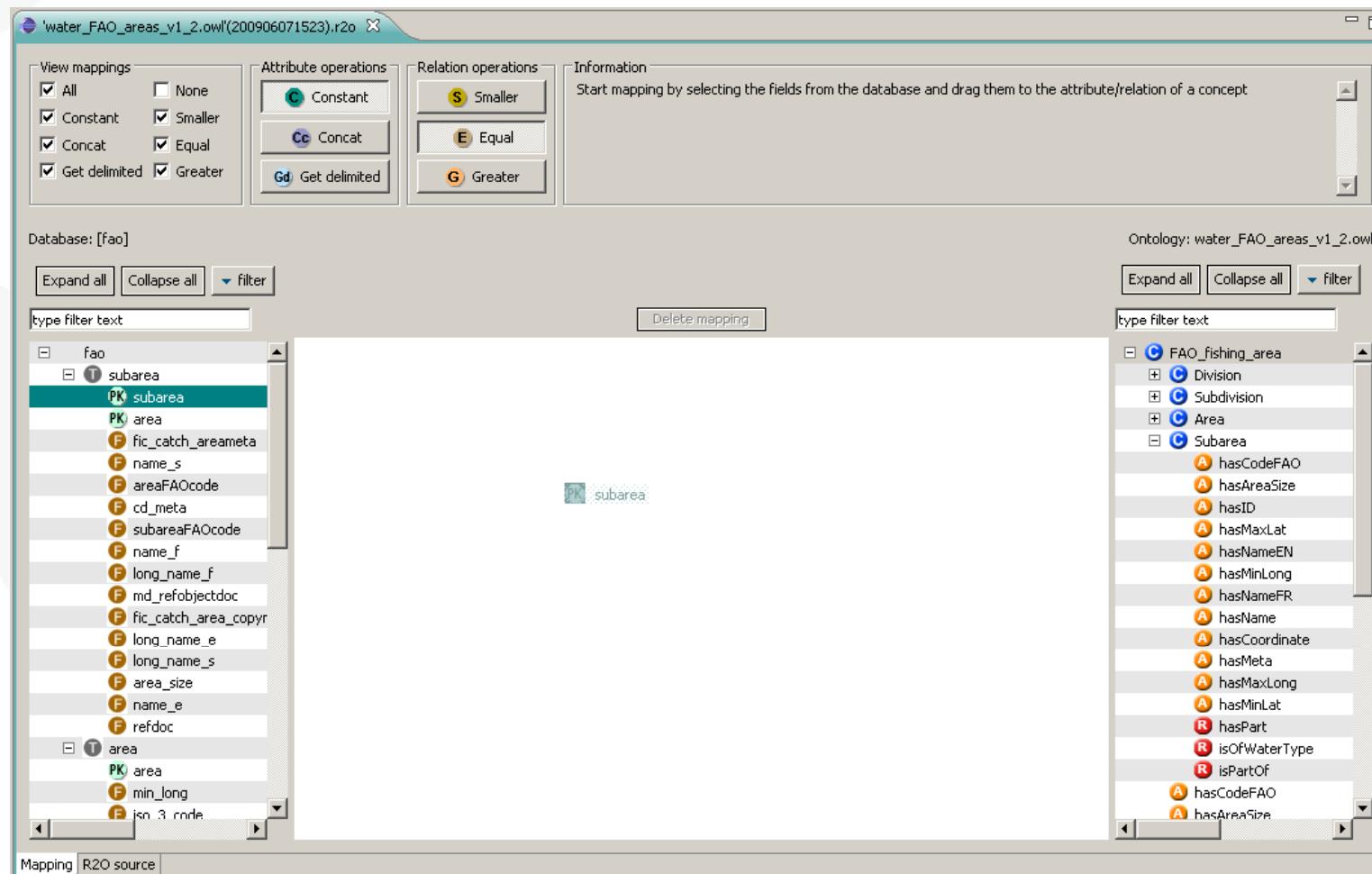
R isPartOf

A hasCodeFAO

A hasAreaSize

Mapping R2O source

## Create attribute mapping – Constant Operation



# Create attribute mapping – Constant Operation

Select Field

Drag Field

Drop Field

Mapping established

'water\_FAO\_areas\_v1\_2.owl'(200906071523).r2o X

View mappings

- All       None
- Constant       Smaller
- Concat       Equal
- Get delimited       Greater

Attribute operations

- C** Constant
- S** Smaller
- Cc** Concat
- E** Equal
- Gd** Get delimited
- G** Greater

Relation operations

- S** Smaller
- E** Equal
- G** Greater

Information

Start mapping by selecting the fields from the database and drag them to the attribute/relation of a concept

Database: [fao]

Expand all   Collapse all   filter

type filter text

- fao**
  - subarea**
    - PK** subarea
    - area
    - fic\_catch\_areameta
    - name\_s
    - areaFAOcode
    - cd\_meta
    - subareaFAOcode
    - name\_f
    - long\_name\_f
    - md\_refobjectdoc
    - fic\_catch\_area\_copy
    - long\_name\_e
    - long\_name\_s
    - area\_size
    - name\_e
    - refdoc
  - area**
    - PK** area
    - min\_long
    - iso\_3\_code

Delete mapping

Ontology: water\_FAO\_areas\_v1\_2.owl

Expand all   Collapse all   filter

type filter text

- C** FAO\_fishing\_area
  - C** Division
  - C** Subdivision
  - C** Area
  - C** Subarea
    - A** hasCodeFAO
    - A** hasAreaSize
    - A** hasID **subarea**
    - A** hasMaxLat
    - A** hasNameEN
    - A** hasMinLong
    - A** hasNameFR
    - A** hasName
    - A** hasCoordinate
    - A** hasMeta
    - A** hasMaxLong
    - A** hasMinLat
    - R** hasPart
    - R** isOfWaterType
    - R** isPartOf
    - A** hasCodeFAO
    - A** hasAreaSize

Mapping R2O source

# Create attribute mapping – Constant Operation

Select Field

Drag Field

Drop Field

Mapping established

\*water\_FAO\_areas\_v1\_2.owl(200906071523).r2o

View mappings

- All       None
- Constant       Smaller
- Concat       Equal
- Get delimited       Greater

Attribute operations

- Constant
- S Smaller
- Cc Concat
- E Equal
- Gd Get delimited
- G Greater

Relation operations

- S Smaller
- E Equal
- G Greater

Information

Start mapping by selecting the fields from the database and drag them to the attribute/relation of a concept

Database: [fao]

Expand all   Collapse all   filter

type filter text

Ontology: water\_FAO\_areas\_v1\_2.owl

Expand all   Collapse all   filter

type filter text

Mapping   R2O source

The screenshot shows the 'Mapping' tab of the Ontology Engineering tool. On the left, the 'Database' pane displays the 'fao' schema with tables like 'subarea' and 'area'. A specific field, 'PK subarea', is selected and highlighted with a green border. A blue circular selection handle is placed next to it. On the right, the 'Ontology' pane shows the 'water\_FAO\_areas\_v1\_2.owl' ontology with classes like 'FAO\_fishing\_area' and 'Subarea'. A blue circular selection handle is placed next to a relation or attribute in the 'Subarea' class. A line connects the two handles, indicating a mapping is being established. The top navigation bar shows the file path '\*water\_FAO\_areas\_v1\_2.owl(200906071523).r2o'.

# Create attribute mapping - Concat operation



\*water\_FAO\_areas\_v1\_2.owl(200906071523).r20 X

View mappings:

- All
- None
- Constant
- Smaller
- Concat
- Equal
- Get delimited
- Greater

Attribute operations:

- Constant
- Smaller
- Concat
- Equal
- Greater

Relation operations:

- Smaller
- Equal
- Greater

Information:

Concat

Concatenates two database columns to an attribute/relation

Select the first column in the database tree, then hold down ctrl and select the second column in the tree. Now release ctrl and drag the columns to the attribute/relation.

Database: [fao]

Expand all | Collapse all | filter

type filter text

Delete mapping

Ontology: water\_FAO\_areas\_v1\_2.owl

Expand all | Collapse all | filter

type filter text

Mapping R2O source

```
graph LR; subarea --> area; FAO_fishing_area --> property
```

# Create attribute mapping - Concat operation



The screenshot shows the Protege interface for creating an attribute mapping. The top bar indicates the file is titled "\*water\_FAO\_areas\_v1\_2.owl(200906071523).r2o".

**View mappings:** All, Constant, Concat, Get delimited.

**Attribute operations:** Constant, Concat.

**Relation operations:** Smaller, Equal, Greater.

**Information:** Concat  
Concatenates two database columns to an attribute/relation.  
Select the first column in the database tree, then hold down ctrl and select the second column in the tree. Now release ctrl and drag the columns to the attribute/relation.

**Database:** [fao]  
Expand all, Collapse all, filter, type filter text.

**Ontology:** water\_FAO\_areas\_v1\_2.owl  
Expand all, Collapse all, filter, type filter text.

**Mapping Tree:**

- Left pane (Database):
  - fao
    - subarea
      - PK subarea
      - PK area
      - fic\_catch\_areameta
      - name\_s
      - areaFAOcode
      - cd\_meta
      - subareaFAOcode
      - name\_f
      - long\_name\_f
      - md\_refobjectdoc
      - fic\_catch\_area\_copyr
      - long\_name\_e
      - long\_name\_s
      - area\_size
      - name\_e
      - refdoc
    - area
      - PK area
      - min\_long
      - jsn\_3\_rnode
  - Right pane (Ontology):
    - C FAO\_fishing\_area
      - C Division
      - C Subdivision
      - C Area
      - C Subarea
        - A hasCodeFAO
        - A hasAreaSize
        - A hasID
        - A hasMaxLat
        - A hasNameEN
        - A hasMinLong
        - A hasNameFR
        - A hasName
        - A hasCoordinate
        - A hasMeta
        - A hasMaxLong
        - A hasMinLat
        - R hasPart
        - R isOfType
        - R isPartOf
        - A hasCodeFAO
        - A hasAreaSize

Mapping R2O source

# Create attribute mapping - Concat operation



\*water\_FAO\_areas\_v1\_2.owl(200906071523).r20 X

View mappings

- All
- None
- Constant
- Smaller
- Concat
- Equal
- Get delimited
- Greater

Attribute operations

- C Constant
- S Smaller
- Cc Concat
- E Equal
- G Greater
- Gd Get delimited

Relation operations

- S Smaller
- Cc Concat
- E Equal
- G Greater

Information

Concat

Concatenates two database columns to an attribute/relation

Select the first column in the database tree, then hold down ctrl and select these second column in the tree. Now release ctrl and drag the columns to the attribute/relation.

Database: [fao]

Expand all | Collapse all | filter

type filter text

Delete mapping

Ontology: water\_FAO\_areas\_v1\_2.owl

Expand all | Collapse all | filter

type filter text

Mapping R2O source

# Create attribute mapping - Concat operation



\*water\_FAO\_areas\_v1\_2.owl(200906071523).r20

**View mappings:**

- All
- None
- Constant
- Smaller
- Concat
- Equal
- Get delimited
- Greater

**Attribute operations:**

- Constant
- Concat
- Equal
- Get delimited

**Relation operations:**

- Smaller
- Concat
- Equal
- Greater

**Information:**

Concat  
Concatenates two database columns to an attribute/relation  
Select the first column in the database tree, then hold down ctrl and select the second column in the tree. Now release ctrl and drag the columns to the attribute/relation.

**Database: [fao]**

Expand all | Collapse all | filter | type filter text | Delete mapping | Ontology: water\_FAO\_areas\_v1\_2.owl | Expand all | Collapse all | filter | type filter text

**Mapping Tree:**

```

graph LR
    A[fao subarea PK subarea] --- B[long_name_e]
    A --- C[long_name_s]
    A --- D[area_size]
    A --- E[name_e]
    A --- F[refdoc area PK area]
    A --- G[min_long]
    A --- H[jon_3_rnde]
    B --- I[FAO_fishing_area Subdivision]
    C --- J[Division]
    D --- K[Subdivision]
    E --- L[Area]
    F --- M[Subarea]
    G --- N[hasCodeFAO]
    G --- O[hasAreaSize]
    G --- P[hasID]
    G --- Q[hasMaxLat]
    G --- R[hasNameEN]
    G --- S[hasMinLong]
    G --- T[hasNameFR]
    G --- U[hasName]
    G --- V[hasCoordinate]
    G --- W[hasMeta]
    G --- X[hasMaxLong]
    G --- Y[hasMinLat]
    G --- Z[hasPart]
    G --- AA[isOfWaterType]
    G --- AB[isPartOf]
    G --- AC[hasCodeFAO]
    G --- AD[hasAreaSize]
  
```

**Mapping Details:**

The screenshot shows a mapping configuration for the 'Concat' operation. On the left, the 'fao' database is selected, and the 'long\_name\_e' attribute is highlighted. On the right, the ontology 'water\_FAO\_areas\_v1\_2.owl' is selected, and the 'long\_name\_e' attribute is also highlighted. A line connects the highlighted 'long\_name\_e' from the database to the highlighted 'long\_name\_e' from the ontology, indicating they are being mapped together using the 'Concat' operation.

# Create attribute mapping - Concat operation



The screenshot shows the Protege interface for creating an attribute mapping between a R2O source and an ontology.

**Attribute operations:** Concat is selected.

**Information:** Concat concatenates two database columns to an attribute/relation. It describes how to select the first column in the database tree, hold down Ctrl, and select the second column, then release Ctrl and drag the columns to the attribute/relation.

**Database:** [fao]

**Ontology:** water\_FAO\_areas\_v1\_2.owl

**Mappings:** A mapping is being created between the R2O source and the ontology. The source column is "name\_e" under "subarea" in the fao database, and the target column is "hasNameEN" under "Subarea" in the ontology.

**Buttons:** Expand all, Collapse all, type filter text, Delete mapping.

# Create attribute mapping - Concat operation



\*water\_FAO\_areas\_v1\_2.owl(200906071523).r2o

**View mappings:**

- All
- None
- Constant
- Concat
- Get delimited
- Smaller
- Equal
- Greater
- Get delimited

**Attribute operations:**

- Constant
- Smaller
- Concat
- Equal
- Greater
- Get delimited

**Relation operations:**

- Smaller
- Concat
- Equal
- Greater

**Information:**

Concat  
Concatenates two database columns to an attribute/relation  
Select the first column in the database tree, then hold down ctrl and select the second column in the tree. Now release ctrl and drag the columns to the attribute/relation.

**Database: [fao]**

Expand all | Collapse all | filter

**Ontology: water\_FAO\_areas\_v1\_2.owl**

Expand all | Collapse all | filter

**Mapping R2O source**

## R2O generated

```
→ <attributemap-def name="http://www.fao.org/aims/aos/fi/water#hasID">
  <selector>
  <aftertransform>
  <operation oper-id="constant">
    <arg-restriction on-param="const-val">
      <has-column>subarea.subarea</has-column>
    </arg-restriction>
  </operation>
  </aftertransform>
</selector>
</attributemap-def>
→ <attributemap-def name="http://www.fao.org/aims/aos/fi/water#hasNameEN">
  <selector>
  <aftertransform>
  <operation oper-id="concat">
    <arg-restriction on-param="string1">
      <has-column>subarea.long_name_e</has-column>
    </arg-restriction>
    <arg-restriction on-param="string2">
      <has-column>subarea.name_e</has-column>
    </arg-restriction>
  </operation>
  </aftertransform>
</selector>
</attributemap-def>
</described-by>
</conceptmap-def>
</r2o>
```

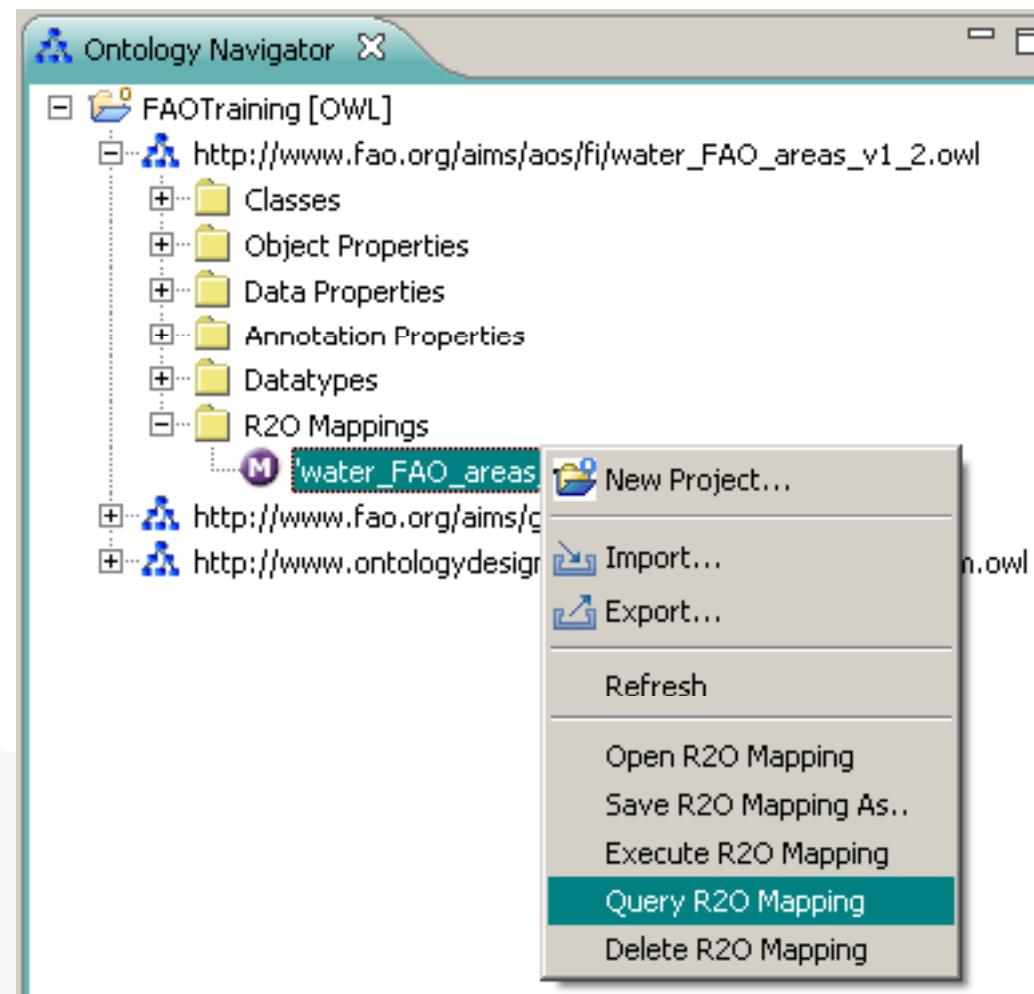
Mapping R2O source

## Query the ontology instances

Select Mapping  
& Click on Query

Query Editor Opens &  
Select ontology elements

Click on Execute query

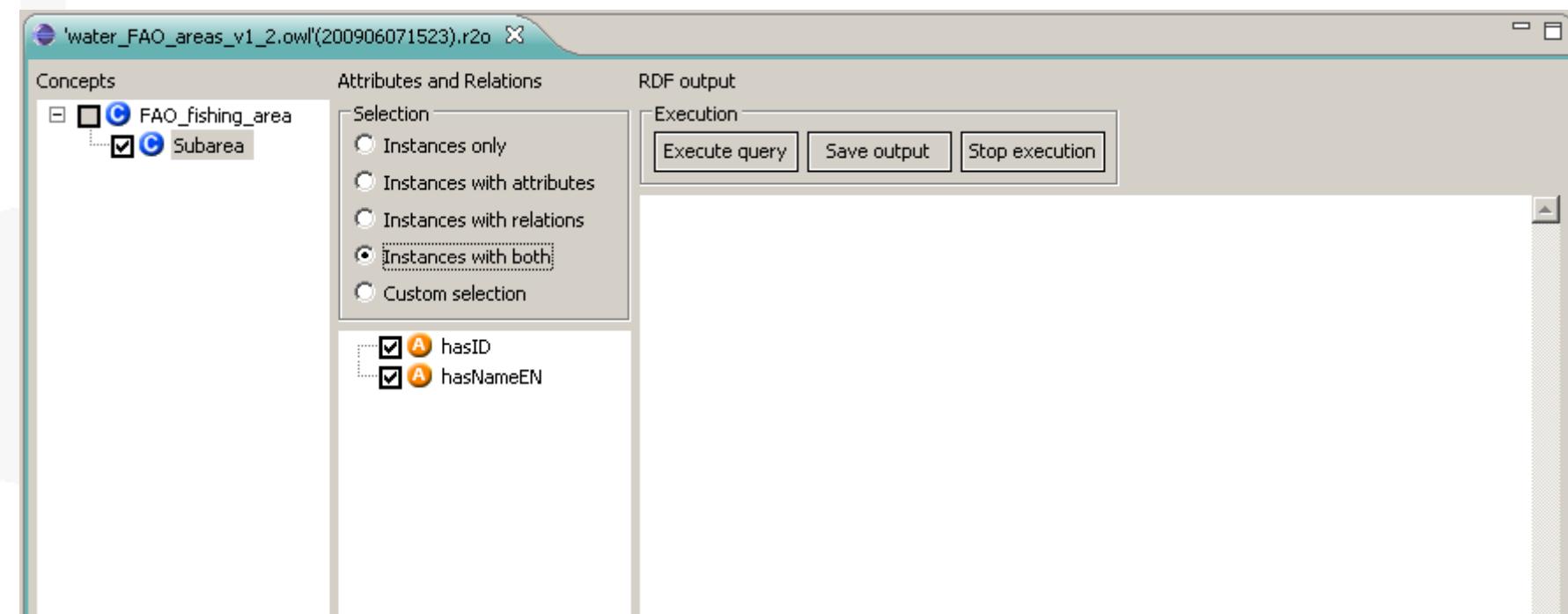


## Query the ontology instances

Select Mapping  
& Click on Query

Query Editor Opens &  
Select ontology elements

Click on Execute query

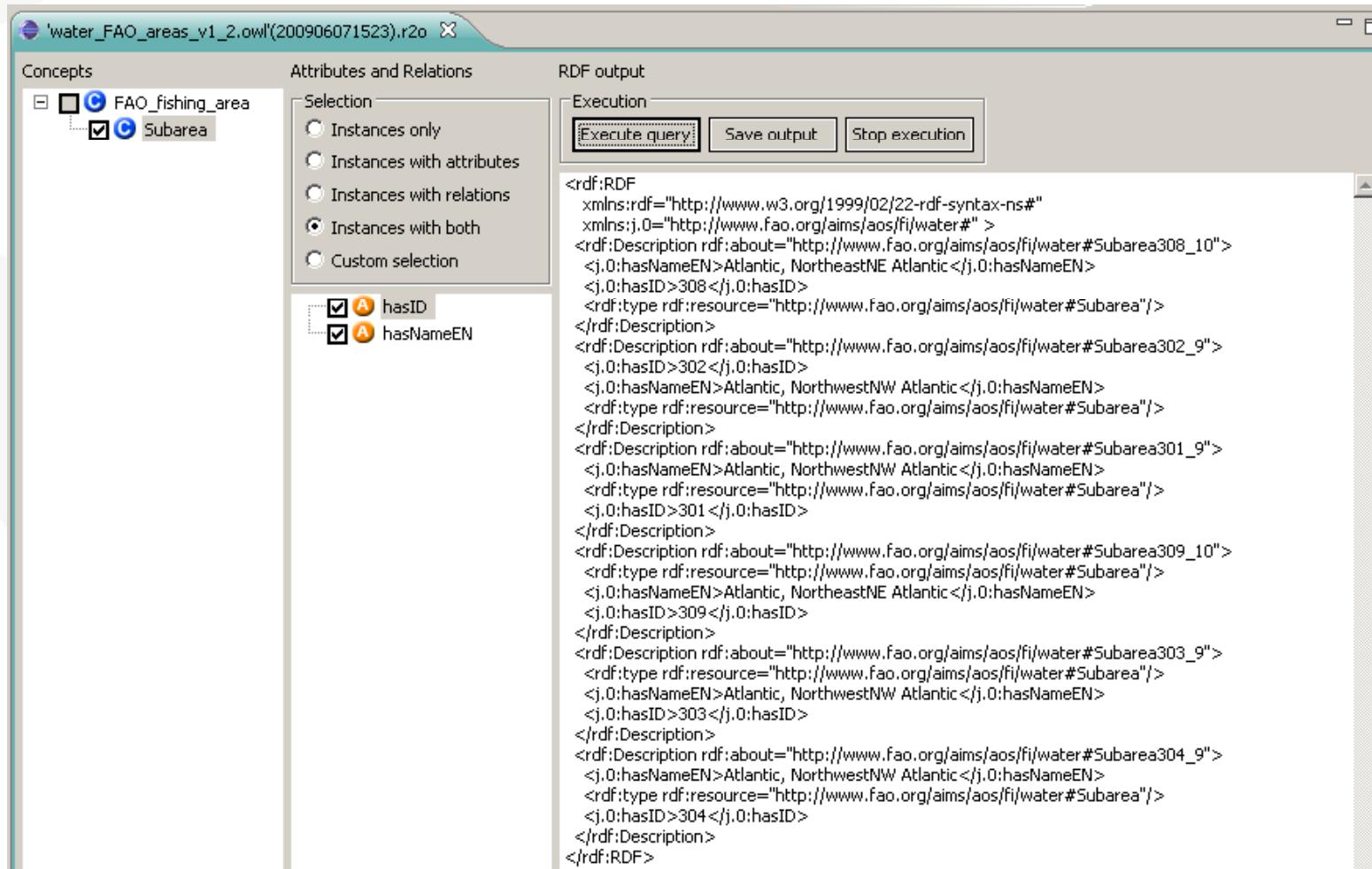


## Query the ontology instances

Select Mapping & Click on Query

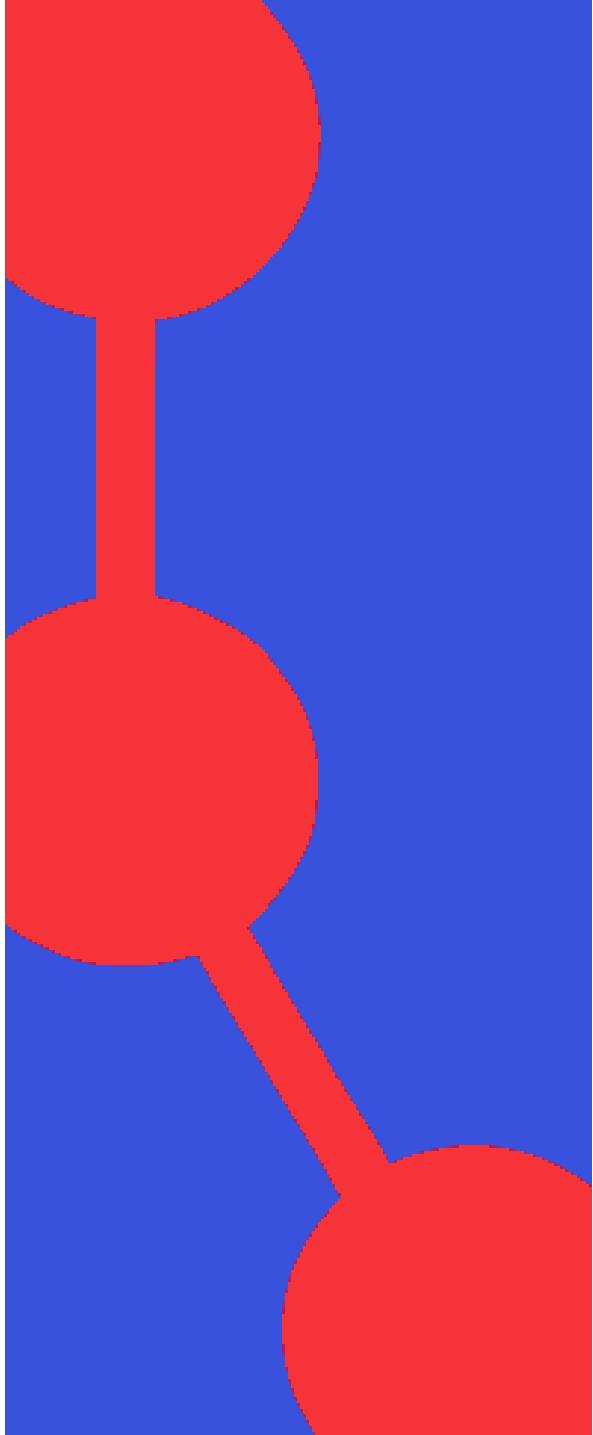
Query Editor Opens & Select ontology elements

Click on Execute query



# Mapping Relational Data to RDF (RDB2RDF)

- Status of the W3C RDB2RDF work in November 2010
  - <http://www.w3.org/2001/sw/rdb2rdf/status/2010/>



## ATHENS Course: Ontologies and the Semantic Web

# Ontologies: Semantic Web Applications

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