



Ontological Engineering

Asunción Gómez-Pérez (asun@fi.upm.es)

Mari Carmen Suárez -Figueroa (mcsuarez@fi.upm.es)

Boris Villazón (bvilla@delicias.dia.fi.upm.es)

Work distributed under the license Creative Commons Attribution-Noncommercial-Share Alike 3.0

Ontological Engineering

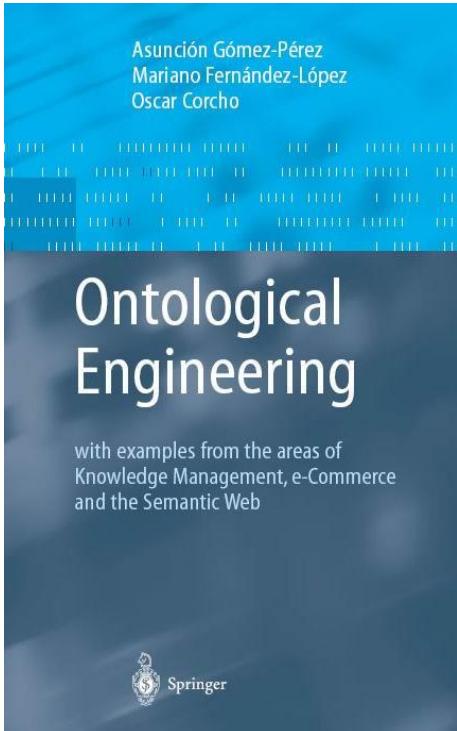
**It refers to the set of activities that concern
the ontology development process,
the ontology life cycle,
the methods and methodologies for building ontologies,
and the tool suites
and languages that support them**

I want to build my ontology



- Which are the key process and activities in ontology development?
- Which activities do I need in my development?
- When should I carry out each activity?
- Where is the relationship of one activity with the others?
- How do I collect the requirements of my ontology?
- Where can I find ontologies with the goal of reusing them?
- How can I reuse existing knowledge resources?
- ...

References



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

- Deliverable D5.3.1
- Deliverable D5.3.2
- Deliverable D5.4.1

NeOn Book



NeOn Methodology in a Nutshell

Title	Author(s)
Introduction	Asunción Gómez-Pérez, Enrico Motta, Mari Carmen Suárez-Figueroa
Definition of Ontology Networks	Mathieu d'Aquin, Aldo Gangemi, Peter Haase
NeOn Methodology Framework:	
Scenarios for Building Ontology Networks and Glossary of Processes and Activities	Mari Carmen Suárez-Figueroa, Asunción Gómez-Pérez
Collection of Ontology Life Cycle Models	Asunción Gómez-Pérez, Mari Carmen Suárez-Figueroa, Mariano Fernández-López
Methodology guidelines	
Ontology Requirements Specification	Asunción Gómez-Pérez, Mari Carmen Suárez-Figueroa
Searching Ontologies	Mathieu d'Aquin, Holger Lewen
Scheduling using qOntt	Mari Carmen Suárez-Figueroa, Asunción Gómez-Pérez
Reusing and Re-engineering Non-Ontological Resources	Asunción Gómez-Pérez, Boris Villazón-Terrazas
Reusing General Ontologies	Mariano Fernández-López, Asunción Gómez-Pérez, Mari Carmen Suárez-Figueroa
Reusing Domain Ontologies	Mari Carmen Suárez-Figueroa, Asunción Gómez-Pérez
Reusing Statements	Mari Carmen Suárez-Figueroa, Mathieu d'Aquin
Conceptualizing using ODPs	Eva Blomqvist, Enrico Daga, Aldo Gangemi, Valentina Presutti,

Home

Contact Us

About NeOn

Partners

Case Studies

NeOn Toolkit

Plugins

Application and Tools

Ontologies

Publications

NeOn Book

Executive Summaries on the NeOn Methodology

Ontology Requirements Specification

Authors: Asunción Gómez-Pérez, Mari Carmen Suárez-Figueroa

What is an Ontology Requirements Specification?

Ontology Requirements Specification

Definition
Ontology Requirements Specification refers to the activity of collecting the requirements that the ontology should fulfill (e.g., reasons to build the ontology, target group, intended uses) and possibly reach through a consensus process

Goal
The activity states why the ontology is being built, which its intended uses are, who the end-users are, and which requirements the ontology should fulfill

Input	Output
A set of ontological needs	Ontology Requirements Specification Document (ORSD)

Who
Software developers and ontology practitioners, who form the ontology development team (ODT), in collaboration with users and domain experts

When
This activity must be carried out at the beginning of the ontology project and in parallel with the knowledge acquisition activity

What is the output?

Ontology Requirements Specification Document Template

1 Purpose
The main goal of the ontology. In other words, the main function or role that the ontology should have.

2 Scope
The general coverage and the degree of detail that the ontology should have.

3 Implementation Language
The formal language that the ontology should use.

4 Intended End-Users
The intended end-users of the ontology.

5 Intended Uses
The intended uses of the ontology.

6 Ontology Requirements

- a. **Non-functional Requirements**
The general requirements or aspects that the ontology should fulfill, including optional priorities for each requirement.
- b. **Functional Requirements: Groups of Competency Questions**
The content specific requirements that the ontology should fulfill in the form of groups of competency questions and their answers, including optional priorities for each group and for each competency question.

7 Pre-Glossary of Terms

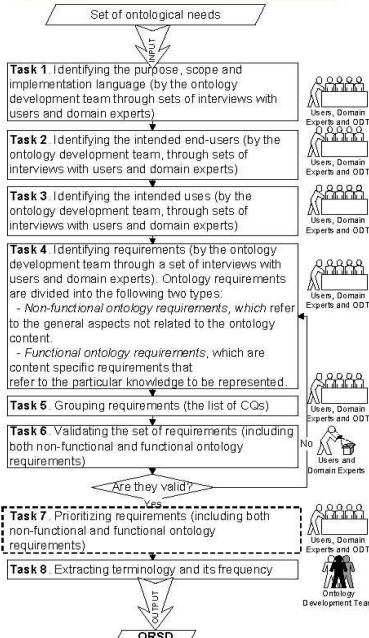
- a. **Terms from Competency Questions**
The list of terms included in the competency questions and their frequencies.
- b. **Terms from Answers**
The list of terms included in the answers and their frequencies.
- c. **Objects**
The list of objects included in the competency questions and in their answers.

NeOn IST-2005-027695
NeOn-project.org

Motivation

One of the critical activities when developing ontologies is to identify their requirements. Requirements included in the ORSD facilitates the ontology development in different ways: (1) allowing the identification of which particular knowledge should be represented in the ontology; (2) facilitating the reuse of knowledge resources by means of focusing the resource search towards the particular knowledge to be represented in the ontology; and (3) permitting the verification of the ontology with respect to the requirements that the ontology should fulfill.

What is the process?



Ontology Requirements Specification

Experiments and examples

SEBMP Reference Ontology Requirements Specification Document

1 Purpose	The purpose of building the Reference Ontology is to provide a consensual knowledge model of the employment domain to be used by public employment services.
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 Implementation Language	The ontology has to be implemented in WSMIL language.
4 Intended End-Users	User 1. Unemployed candidate searching for a job or another occupation for immediate or future purposes User 2. Employer who needs more human resources User 3. Public or private employment service that provides assistance to gather CVs or job postings and to prepare some data and statistics User 4. National and Local Governments that want to analyze the situation on the employment market in their countries and to prepare documents on employment, social and educational policy.
5 Intended Uses	Use 1. Publishing CV. Job seeker places his/her CV on the PES Portal. Use 2. Publishing Job Offer. An Employer places a Job Offer on the PES Portal. Use 3. Searching for Job Offers. The Employer looks for candidates for the Job Offer through the PES Portal. Use 4. Searching for Employment Information. Job Seeker looks for general information about employment in a given location at the PES Portal.
6 Ontology Requirements	<ul style="list-style-type: none"> a. Non-Functional Requirements NFR1. The ontology must support a multilingual scenario in the following languages: English, Spanish, Italian, and French. NFR2. The ontology must be based on the international, European or de-facto standards in existence or under development. b. Functional Requirements: Groups of Competency Questions
CQ01. What is the Job Seeker's name?	CQ02. Job Offer (11 CQ)
CQ02. What is the employer's information?	CEFRIEL Research Company, Milano, Italy; ATOS, Madrid, Spain
CQ03. What kind of job does the employer's offer?	Java Programmer; C Programmer; Database administration
CQ04. What kind of contract does the employer's offer?	Seasonal Job; Autonomous
CQ05. How much salary does the employer's offer?	3500 Euros, 3000 USD
CQ06. What kind of economical activity does the employer have?	Research; Financial; Education; Industrial
CQ07. What kind of contract does the Job Seeker want?	Full time; Part time; Autonomous; Seasonal Job
CQ08. What is the Job Seeker's work experience?	6 months, 1 year, 2 years
CQ09. What is the Job Seeker's area of knowledge?	Java Programming; Programming; Database Administration
CQ10. What is the Job Seeker's expertise?	Software Engineering
CQ11. Which are the Job Seeker's skills?	SQL programming, network administration
CQ12. What is the employer's information?	CEFRIEL Research Company
CQ13. What kind of job does the employer's offer?	Java Programmer; C Programmer; Database administration
CQ14. What kind of contract does the employer's offer?	Seasonal Job; Autonomous
CQ15. How much salary does the employer's offer?	3500 Euros, 3000 USD
CQ16. What kind of economical activity does the employer have?	Research; Financial; Education; Industrial
CQ17. What is the description of the job offer?	Sun Certified Java Programmer
CQ18. What are the working conditions of the job offer?	Full time; Part time; Autonomous; Seasonal Job
CQ19. What is the required education level for the job offer?	Basic education; Higher education/University
CQ20. What is the required work experience for the job offer?	1 year, 2 years, 3 years, 4 years, 5 or more years
CQ21. What is the required knowledge for the job offer?	Java, Haskell, Windows
CQ22. What are the required skills for the job offer?	ASP Programmer, Data warehouse, Hardware programming

Pre-Glossary of Terms

a. Terms from Competency Questions + Frequency

Job Seeker	27	Name	4	Address	1	Objective	3
CV	2	Gender	1	Nationality	1	Job Category	3
Personal Information	3	Birth date	1	Contact phone, fax, mail	3

b. Terms from Answers + Frequency

SW engineer, programmer	5	Autonomous, Seasonal Job, British, Spanish, Italian, French	2	Research, Financial, Education	4	3000 Euros per month	1
Basic education, Higher education	1	1 year, 2 years, 3 years	1	CEFRIEL Research Company	1		
Andorra, Argentina, Australia, Bolivia, France, Italy, Spain, etc.; Euro, Zloty, Great British Pound, US Dollar, Peso, etc.; CEFRIEL, ATOS, etc.							

Additional information

Contact person: mcsuarez@fi.upm.es

- NeOn Deliverable D5.4.1 (http://www.neon-project.org/web-content/images/Publications/neon_2008_d5.4.1.pdf)
- ODBASE'09 Paper: "How to write and use the Ontology Requirements Specification Document". Mari Carmen Suárez-Figueroa, Asunción Gómez-Pérez, and Boris Villazón-Terrazas



IST-2005-027695
NeOn-project.org

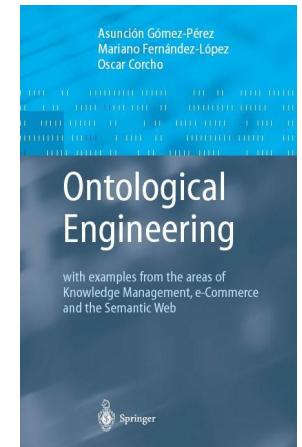
Index

- **State of the art and new trends**
- Needs in Ontology Building
- The NeOn Methodology
 - Glossary of activities
 - Scenarios
 - Lifecycle models
- Main Activities
 - Methodological Guidelines for Ontology Specification
 - Quick Search of Existing Knowledge Resources
 - Guidelines for Ontology development project Planning
 - Methodological Guidelines for Non Ontological Resource Reuse and Reengineering
 - Methodological Guideliness for Ontology Reuse
- Creating the final Ontology Model

Building ontologies in the 90s

Methodologies for building single ontologies

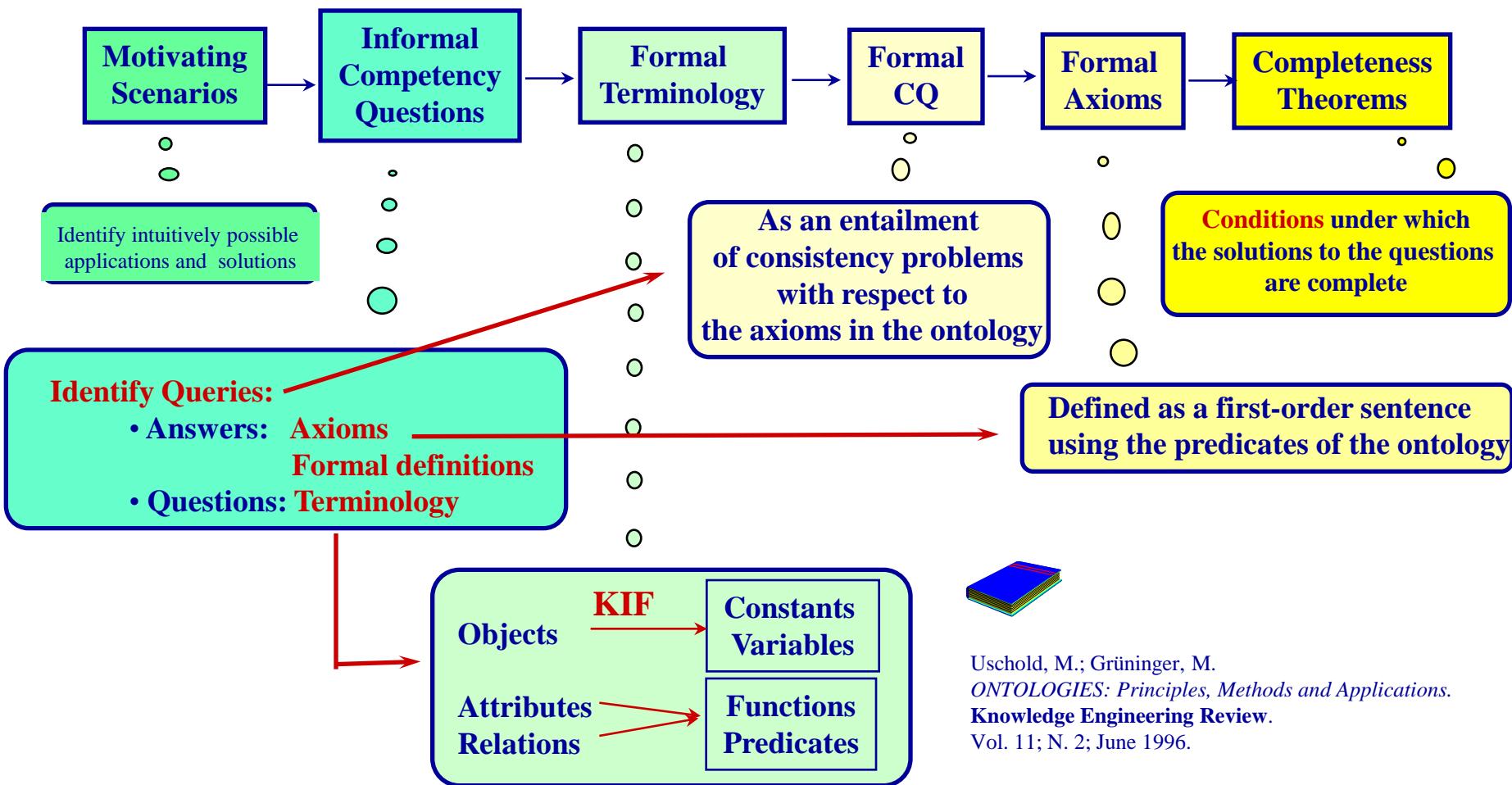
- Uschold and King's method
- Grüninger and Fox's methodology
- KACTUS approach
- METHONTOLOGY
- SENSUS method
- On-To-Knowledge
- DILIGENT



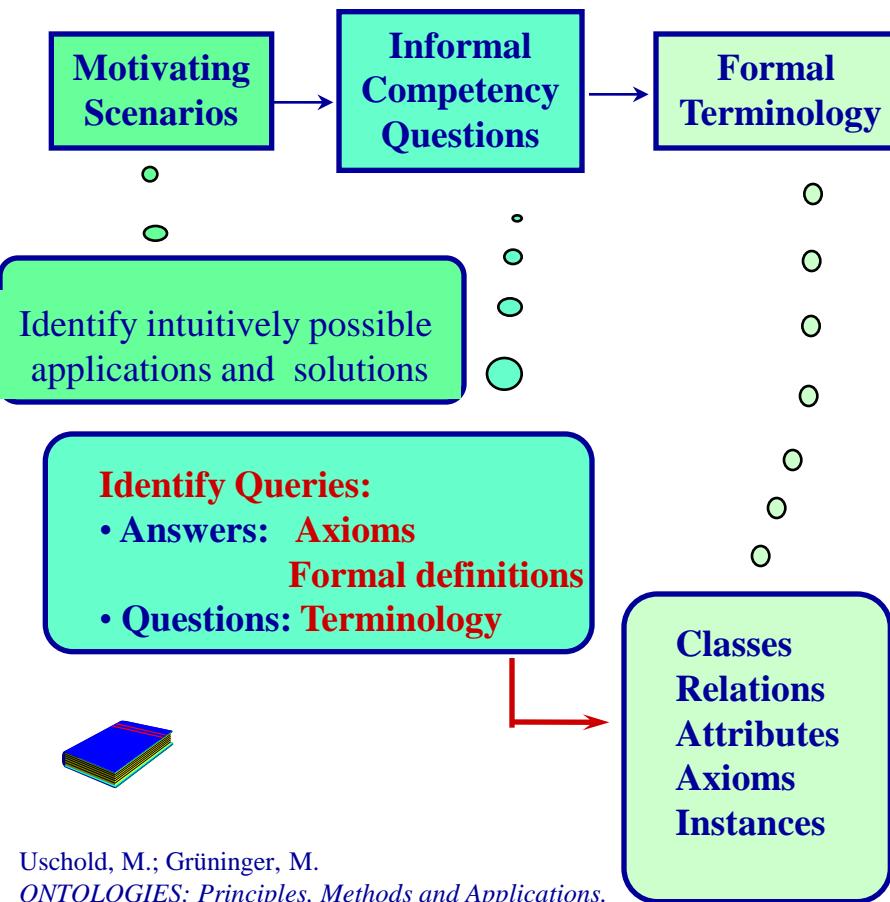
Ontology learning approaches for building ontologies from structured, semi-structured and non-structured data

- Are not integrated with current methodologies
- Mainly from non-structured data using NLP techniques

TOVE Methodology



Getting terminology using Competency Questions



Find documents written by Person P

Identify Queries:

- Questions: Document, Person, writes
- Answers: Document D1 is written by P1

Classes: Document, Person
Relations: Writes, written by
Attributes: ---
Axioms
Instances: P1, D1

Uschold, M.; Grüniger, M.
ONTOLOGIES: Principles, Methods and Applications.
Knowledge Engineering Review.
Vol. 11; N. 2; June 1996.

Uschold Methodology

1. Identify Purpose and Scope

- Identify key concepts and relationships
- Produce unambiguous text definitions
- Identify terms to refer to such concepts and relations

2. Building the ontology

- Ontology Capture
- Ontology Coding

- Commit to a meta-ontology
- Choose a representation language
- Write the code

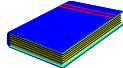
- Integrating existing ontologies

How and whether to reuse ontologies that already exist

3. Evaluation

4. Documentation

5. Guideliness for each phase

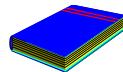
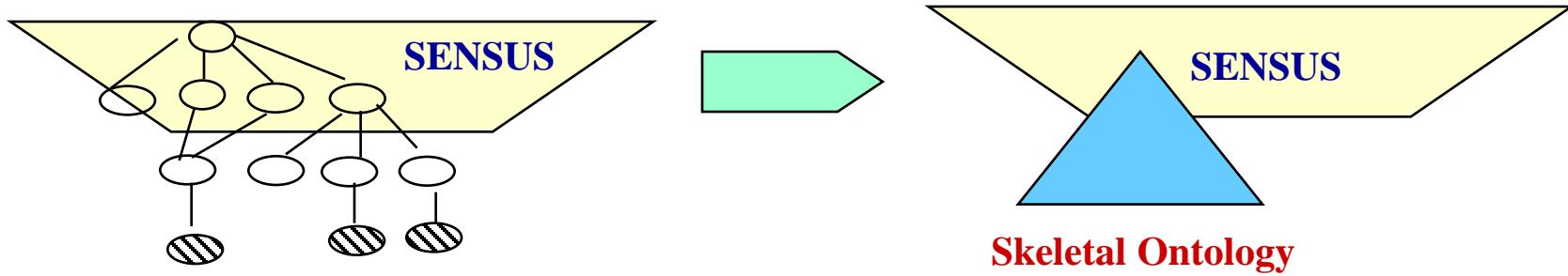


Uschold, M.; Grüninger, M. *ONTOLOGIES: Principles, Methods and Applications*.
Knowledge Engineering Review. Vol. 11; N. 2; June 1996.

SENSUS as a basis for a domain-specific ontology (I)

Linking Domain Specific Terms to a broad Coverage Ontology

To identify the terms in SENSUS that are relevant to a particular domain and then **prune** the skeletal ontology using heuristics

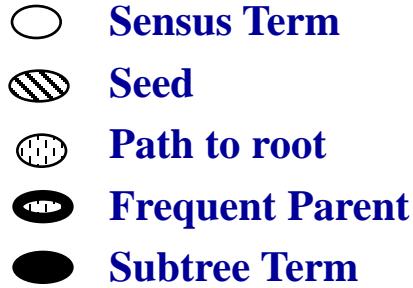


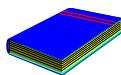
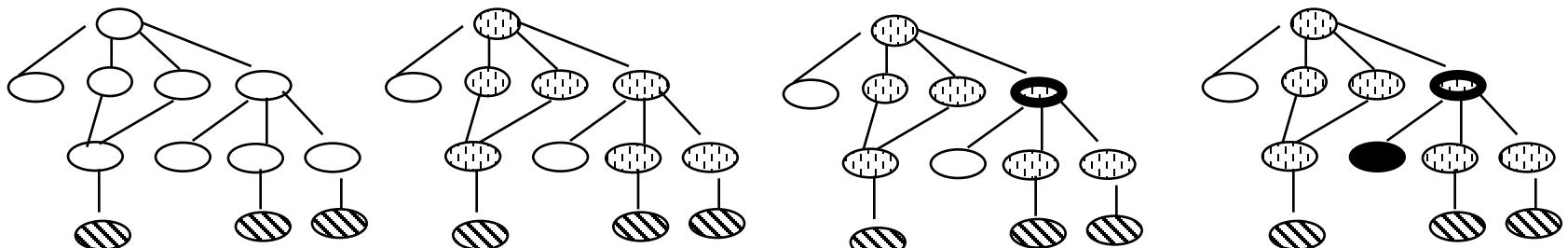
B. Swartout; R. Patil; k. Knight; T. Russ. *Toward Distributed Use of Large-Scale Ontologies*
Ontological Engineering. AAAI-97 Spring Symposium Series. 1997. 138-148.

SENSUS as a basis for a domain-specific ontology (II)

METHOD

1. Identify “seed” terms
 2. Link seed terms to SENSUS by hand
 3. Include nodes on the path to root
 4. Add entire subtrees using the heuristic:

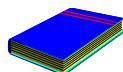
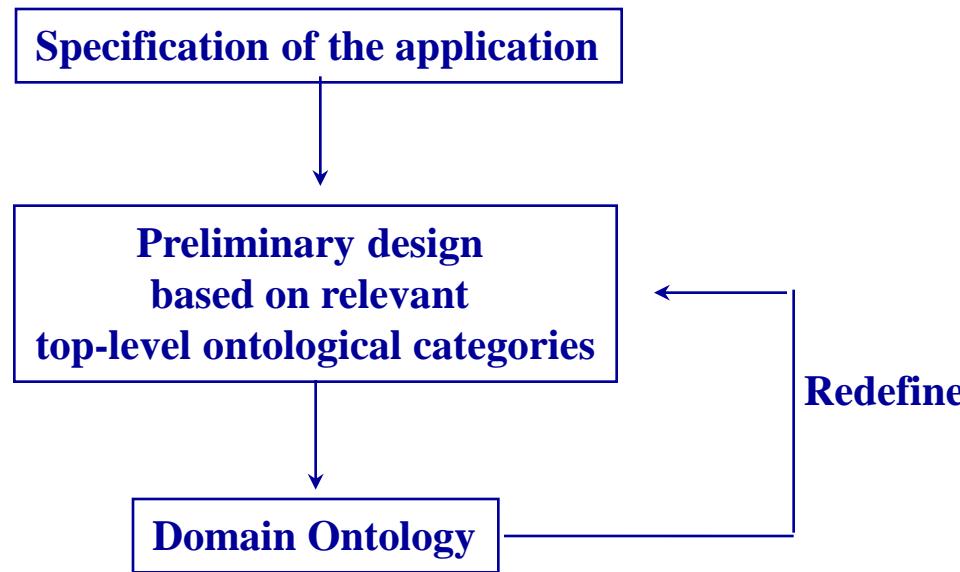
If many nodes in a subtree are relevant,
the other nodes in the subtree are relevant
- 



B. Swartout; R. Patil; k. Knight; T. Russ. *Toward Distributed Use of Large-Scale Ontologies*
Ontological Engineering. AAAI-97 Spring Symposium Series. 1997. 138-148.

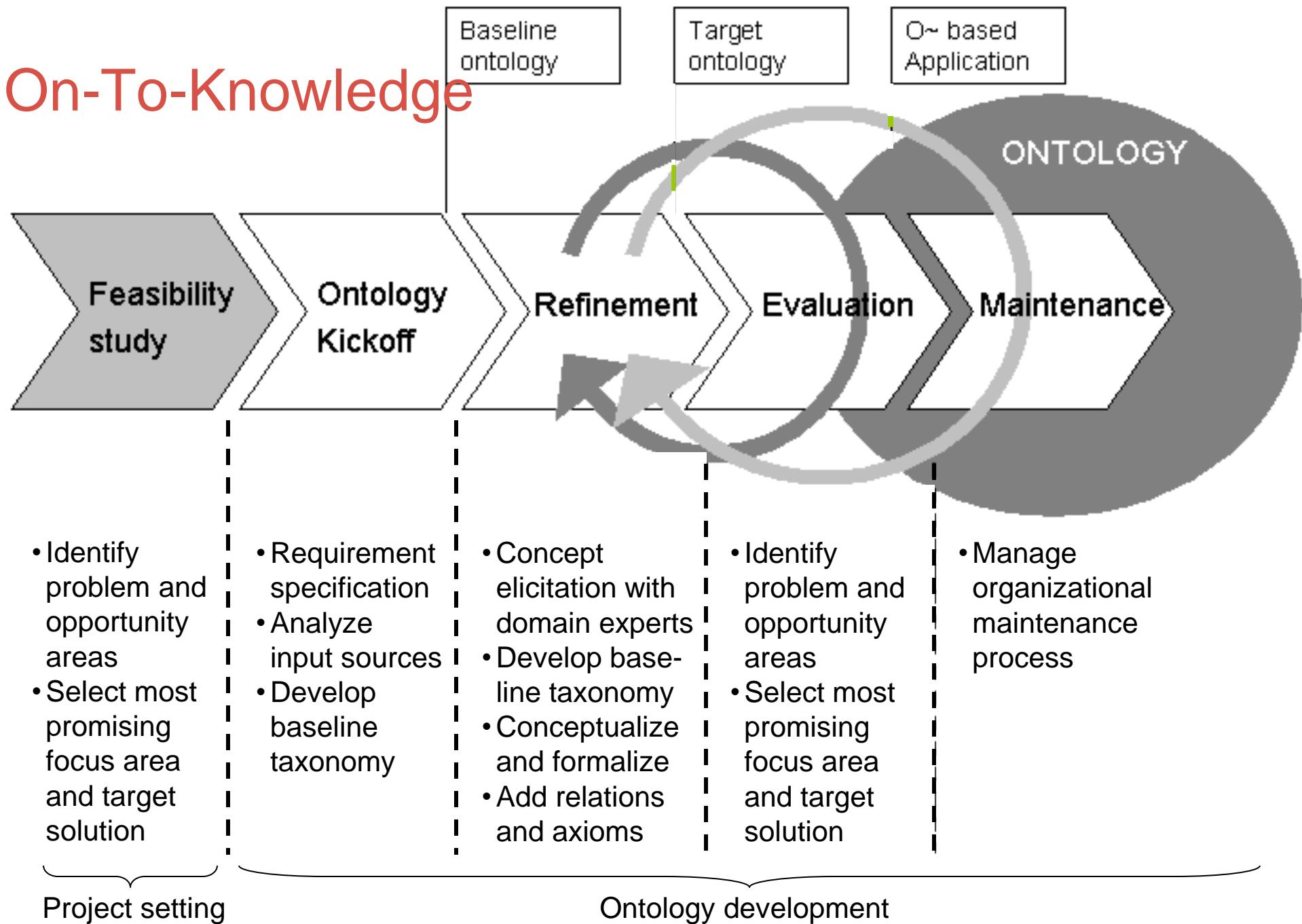
Bernara, Laresgoiti, Corera Methodology

Build a preliminary ontology for refinement and augment with new definitions

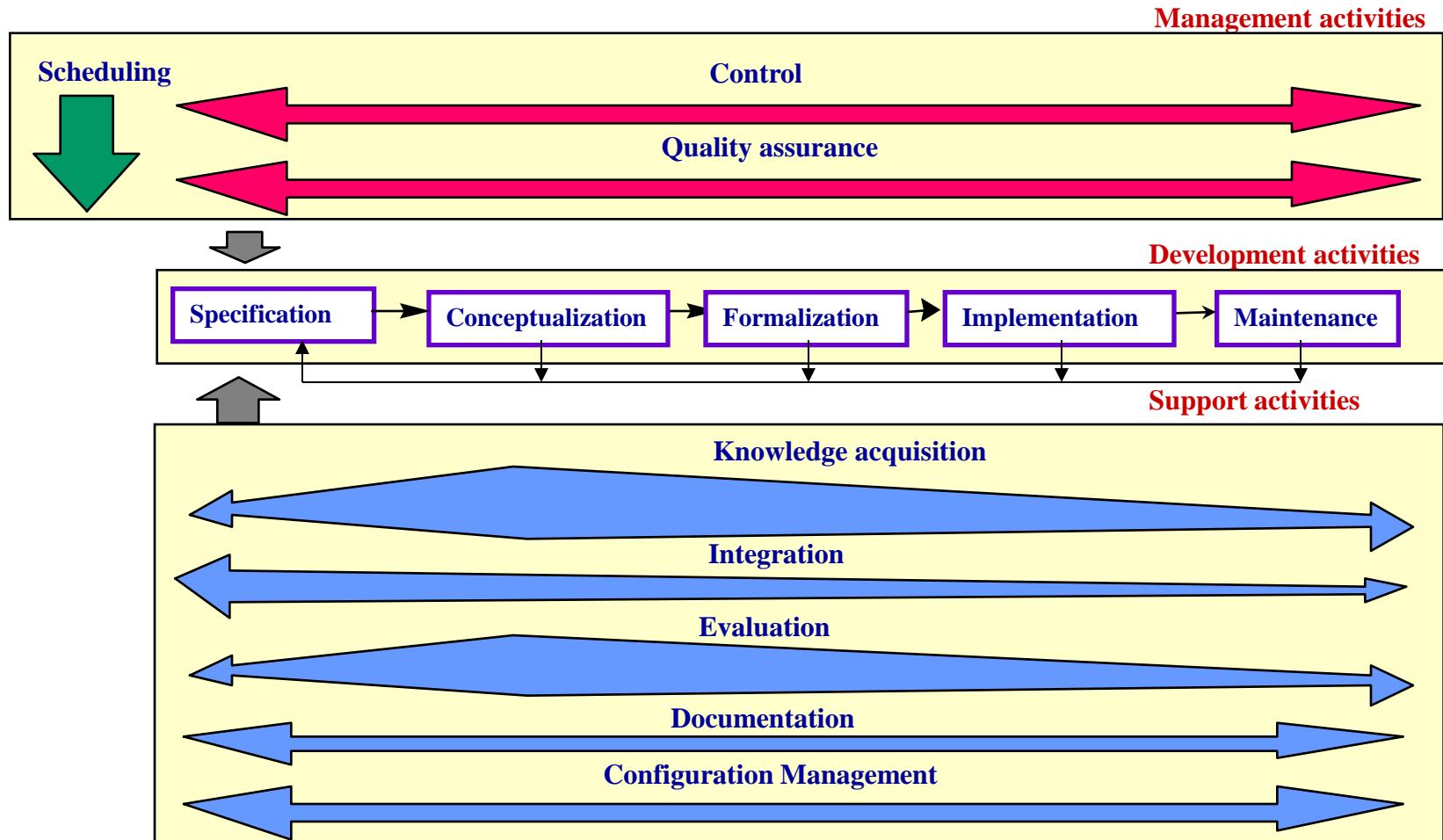


A. Bernaras; I. Laresgoiti; J. Corera. *Building and reusing ontologies for electrical network applications*
ECAI96. 12th European Conference on Artificial Intelligence. 1996. 298-302

On-To-Knowledge

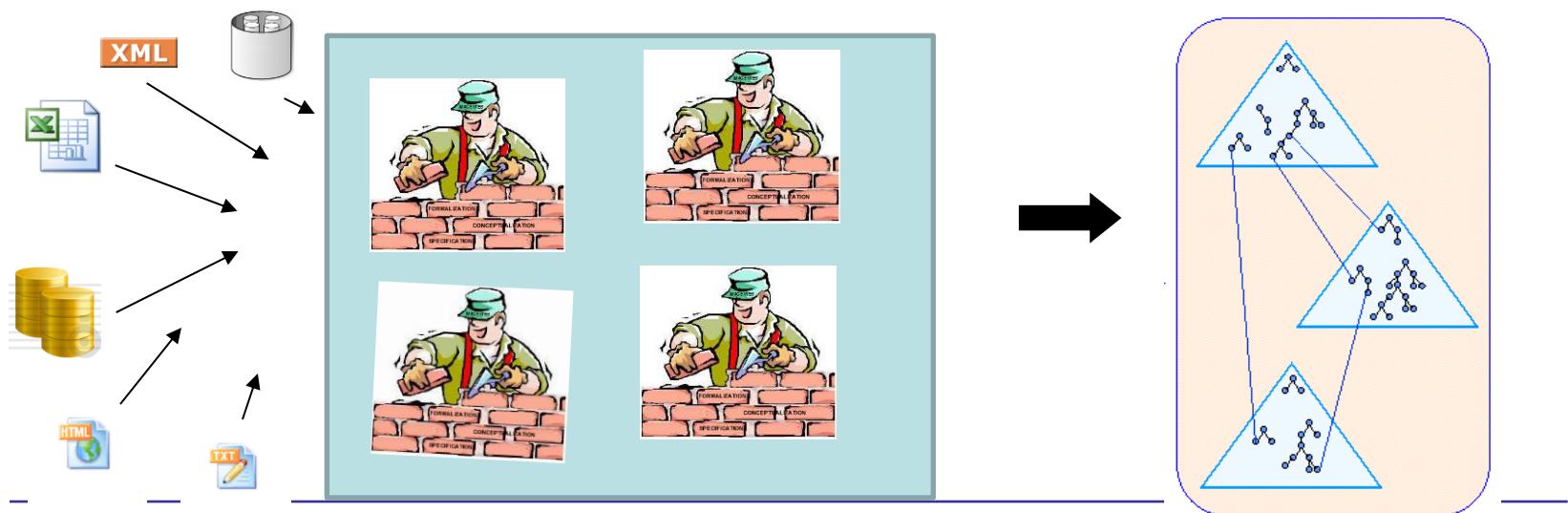


Methontology



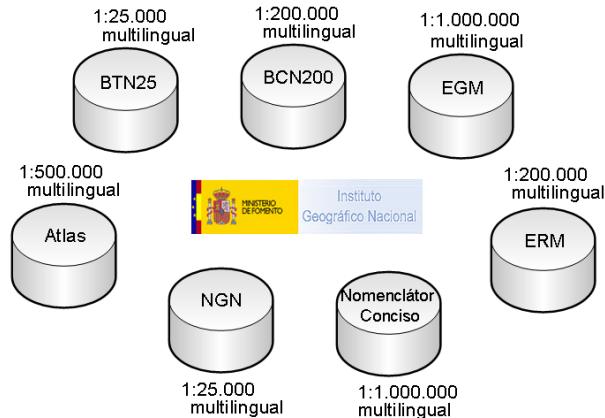
Current situation

- Reuse of knowledge-aware resources
- Ontologies are built collaboratively
- Ontologies are connected
- Multilingual features



Where is the terminology?

DBs from a Geographical institute



Heterogeneity

- Language
- Terminology
- Granularity

XX-YY-ZZ
02-01-02
02: transportation
01: road
02: 3-lines highway

Nomenclátor geográfico - Bloc de notas										
Archivo	Edición	Formato	Ayuda							
NOMENCLÁTOR GEOGRÁFICO										
ENTIDADES										
Catalog/ID										
Región geográfica										
Capital de Nación										
Elevación orográfica										
Comunidad Autónoma										
Llanura/Raso										
Ciudad con Estatuto de Autonomía										
Depresión orográfica										
Capital de Comarca										
Accidente costero										
Provincia										
Accidente marítimo										
Capital de Provincia										
Accidente hidrográfico										
Coprinicipado										
Corriente fluvial										
Capital de Copri										
Canal										
Comarca										
Embalse										
Capital de Comarca										
Lago/Laguna										
Isla Humedal										
Capital de Isla										
Isla fluvial										
Municipio										
Isla marítima										
Capital de Municipio										
Garganta/Hoz										
E.A.T.I.M.										
Lugar/Paraje										
Capital de E.A.T.I.M.										
Paseo/Collado										
Población										
Puerto de montaña										
Comunidad de Murcia										
Puerto comercial										
Enclave										
Helipuerto comercial										
Territorio anejo										
Aeródromo/Aeropuerto										
Punto autorizado										
Estación de ferrocarril										
Zona neutral										
Cerrado en										
Trato										
I: Info										
S: Text										
02000900										
02300902										
06005900										
06006900										
06009900										
06012900										
06015900										
06018900										
07013400										
07016400										
11003003										
11012000										
13003300										
13303300										
14002401										
14003301										
15003003										
15003004										
Bcn200.tbl - Bloc de notas										
Archivo	Edición	Formato	Ayuda	CODIGO	LV	COL	PS	LC	SIMB.	NOMBRE

010101	01	000	00	6	00006	LIMITE_MUNICIPAL				
010102	01	015	00	6	03846	LIMITE_MUNICIPAL_PROVISIONAL				
010201	01	030	03	4	07708	LIMITE_PROVINCIAL				
010301	01	045	06	3	11570	LIMITE_AUTONOMICO				
010401	01	060	06	3	15411	LIMITE_NACIONAL				
010501	01	075	00	1	19201	AGUAS_JURISDICCIONALES				
015101	01	090	00	6	23046	MUNICIPIO_CONTORNO				
015131	01	105	00	6	26886	MUNICIPIO_ANEJO				
015191	01	120	00	6	30726	MUNICIPIO_ENCLAVE				
015201	01	135	03	4	34588	PROVINCIA_CONTORNO				
015231	01	150	03	4	38428	PROVINCIA_ANEJO				
015291	01	165	03	4	42268	PROVINCIA_ENCLAVE				
015301	01	180	06	2	46130	AUTONOMIA_CONTORNO				
015331	01	195	06	2	49970	AUTONOMIA_ANEJO				
015391	01	210	06	2	53810	AUTONOMIA_ENCLAVE				
015401	02	000	06	3	00051	NACION_CONTORNO				
015431	02	015	06	3	03891	NACION_ANEJO				
015491	02	030	06	3	07731	NACION_ENCLAVE				
015501	02	045	00	6	11526	MUNICIPIO_EN_CONJUNTO_CONTORNO				
015531	02	060	00	6	15366	MUNICIPIO_EN_CONJUNTO_ANEJO				
015591	02	075	00	6	19206	MUNICIPIO_EN_CONJUNTO_ENCLAVE				
015601	02	090	00	6	23046	MUNICIPIO_EMPRIVIANO_CONTORNO				
015631	02	105	06	6	26886	MUNICIPIO_EMPRIVIANO_ANEJO				
015691	02	120	00	6	30726	MUNICIPIO_EMPRIVIANO_ENCLAVE				
015701	02	135	00	6	34566	MUNICIPIOS_SIN_DESLINDE_CONTORNO				
015731	02	150	00	6	38406	MUNICIPIOS_SIN_DESLINDE_ANEJO				
015791	02	165	00	6	42246	MUNICIPIOS_SIN_DESLINDE_ENCLAVE				
015801	02	180	00	6	46086	TERRITORIO_EMPRIVIANO_CONTORNO				
015831	02	210	00	6	53766	TERRITORIO_EMPRIVIANO_ANEJO				
015891	02	225	00	6	57606	TERRITORIO_EMPRIVIANO_ENCLAVE				
015901	03	000	03	3	00027	TERRITORIO_ESTATAL_CONTORNO				
015931	03	015	03	3	03867	TERRITORIO_ESTATAL_ANEJO				
015951	03	030	03	3	07707	TERRITORIO_ESTATAL_ENCLAVE				
016001	03	045	03	3	11547	COMARCA_CONTORNO				
016031	03	060	03	3	15387	COMARCA_ANEJO				
016091	03	075	03	3	19227	COMARCA_ENCLAVE				
016101	03	090	03	1	23065	PARQUE_NACIONAL_CONTORNO				
016131	03	105	03	1	26905	PARQUE_NACIONAL_ANEJO				
016191	03	120	03	1	30745	PARQUE_NACIONAL_ENCLAVE				
016201	03	135	03	3	34585	PARQUE_NATURAL_CONTORNO				
016231	03	150	03	3	38425	PARQUE_NATURAL_ANEJO				
016291	03	165	03	4	42265	PARQUE_NATURAL_ENCLAVE				
016301	03	180	03	4	46105	RESERVA_CONTORNO				
016331	03	195	03	4	49945	RESERVA_ANEJO				
016391	03	210	03	3	53785	RESERVA_ENCLAVE				
016401	04	000	06	0	00048	ZONA_FRANCA_CONTORNO				
016500	04	015	06	3	03891	ZONA_NEUTRAL				
016501	04	030	06	3	07731	ZONA_NEUTRAL_CONTORNO				
018101	04	045	01	0	11528	ADUANA				
018201	04	060	04	0	15392	MOJON_FRONTERIZO				
018202	04	075	04	0	19232	MOJON_DE_TERMINO_MUNICIPAL				
021101	08	006	00	1	01537	ESCARPADO				
021102	08	021	00	1	05377	ACANTILADO				

Different Data Models with the same information

ID	CSI_Name
20000	Water area
20000.21000	Environmental area
20000.24020	Jurisdiction area
20000.22000	Fishing Statistical area
20000.21000.21001	Inland/marine
20000.21000.21002	Ocean
20000.21000.21003	North/South/Equatorial
20000.22000.22001	FAO statistical area
20000.22000.22002	Areal grid system

ID	CSI_Name	Parent
20000	Water area	
21000	Environmental area	20000
24020	Jurisdiction area	20000
22000	Fishing Statistical area	20000
21001	Inland/marine	21000
21002	Ocean	21000
21003	North/South/Equatorial	21000
22001	FAO statistical area	22000
22002	Areal grid system	22000

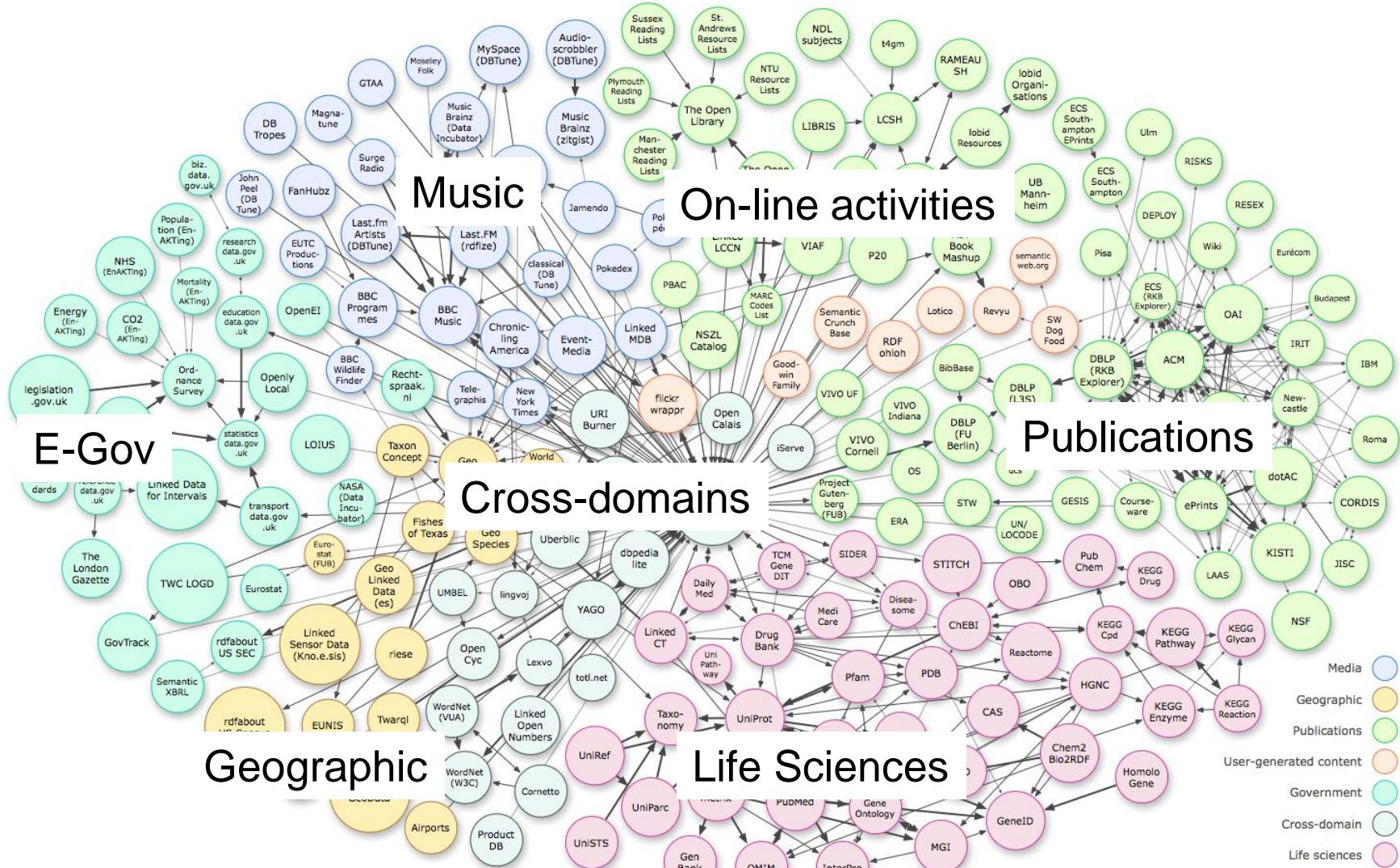
First Level	
ID	CSI_Name
20000	Water area

Second Level		
ID	First Level ID	CSI_Name
21000	20000	Environmental area
24020	20000	Jurisdiction area
22000	20000	Fishing Statistical area

Third Level		
ID	Second Level ID	CSI_Name
21001	21000	Inland/marine
21002	21000	Ocean
21003	21000	North/South/Equatorial
22001	22000	FAO statistical area
22002	22000	Areal grid system

First Level		Second Level		Third Level	
ID	CSI_Name	ID	CSI_Name	ID	CSI_Name
20000	Water area	21000	Environmental area	21001	Inland/marine
20000	Water area	21000	Environmental area	21002	Ocean
20000	Water area	21000	Environmental area	21003	North/South/Equatorial
20000	Water area	22000	Fishing Statistical area	22001	FAO statistical area
20000	Water area	22000	Fishing Statistical area	22002	Areal grid system
20000	Water area	24020	Jurisdiction area		

Lot of terminologies being used ...



As of September 2010

Tools for searching vocabularies

Schemaweb



<http://schemaweb.info>



<http://watson.kmi.open.ac.uk/WatsonWUI/>

1- <http://www.eftel.be/computerseminar/ontologynetworks/ontologystructureB.rdf> #

- [http://bnode.org#argmaxvalue](#)
- [http://bnode.org#argminvalue](#)
- [http://bnode.org#argmaxvalue](#) transfer
- [http://bnode.org#argmaxvalue](#) river
- [http://bnode.org#argmaxvalue](#) length, min__river

2- <http://www.eftel.be/kmi/semantics/WIShopping.rdf> #

- [http://bnode.org#argmaxvalue](#)
- [http://bnode.org#argminvalue](#)
- [http://bnode.org#argmaxvalue](#) transfer
- [http://bnode.org#argmaxvalue](#) major_river
- [http://bnode.org#argmaxvalue](#) length, min__river

3- <http://www.eftel.be/computerseminar/ontologynetworks/ontologystructureA.rdf> #

- [http://bnode.org#argmaxvalue](#)
- [http://bnode.org#argminvalue](#)
- [http://bnode.org#argmaxvalue](#) river

4- <http://www.eftel.be/kmi/semantics/WIShopping.rdf> #

- [http://bnode.org#argmaxvalue](#)
- [http://bnode.org#argminvalue](#)
- [http://bnode.org#argmaxvalue](#) transfer

5- <http://www.eftel.be/kmi/semantics/WIShopping.rdf> #

- [http://bnode.org#argmaxvalue](#) who-ontology:200404model#River
- [http://bnode.org#argmaxvalue](#) who-ontology:200404model#Watershed
- [http://bnode.org#argmaxvalue](#) who-ontology:200404model#ID
- [http://bnode.org#argmaxvalue](#) who-ontology:200404model#Event
- [http://bnode.org#argmaxvalue](#) who-ontology:200404model#ChanneNetworks
- [http://bnode.org#argmaxvalue](#) who-ontology:200404model#HEC-RAS
- [http://bnode.org#argmaxvalue](#) who-ontology:200404model#CE-QUAL-RIV1
- [http://bnode.org#argmaxvalue](#) who-ontology:200404model

Swoogle

semantic web search 2007



<http://swoogle.umbc.edu/>



Linked Open Vocabularies

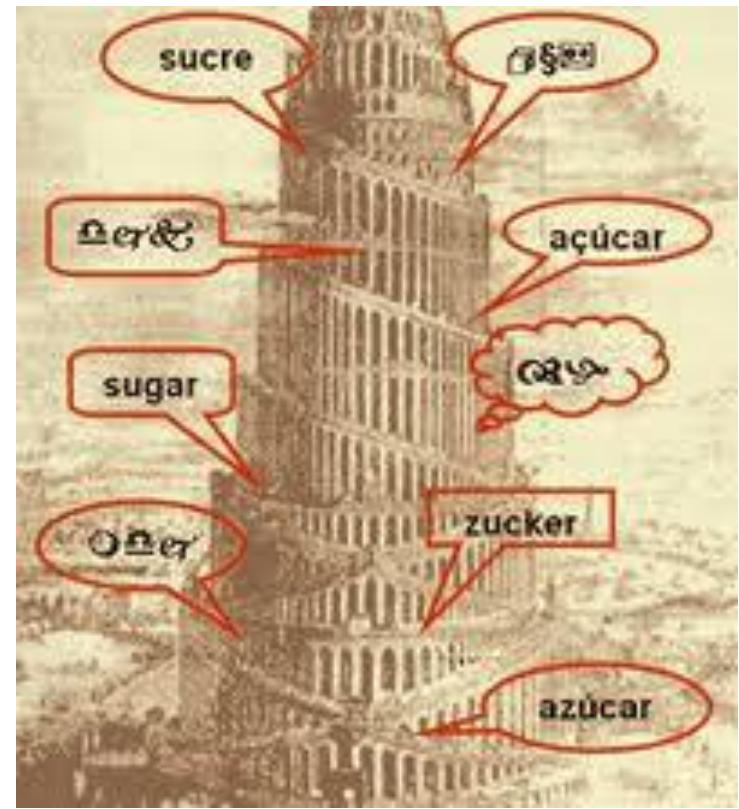


<http://labs.mondeca.com/dataset/lov>

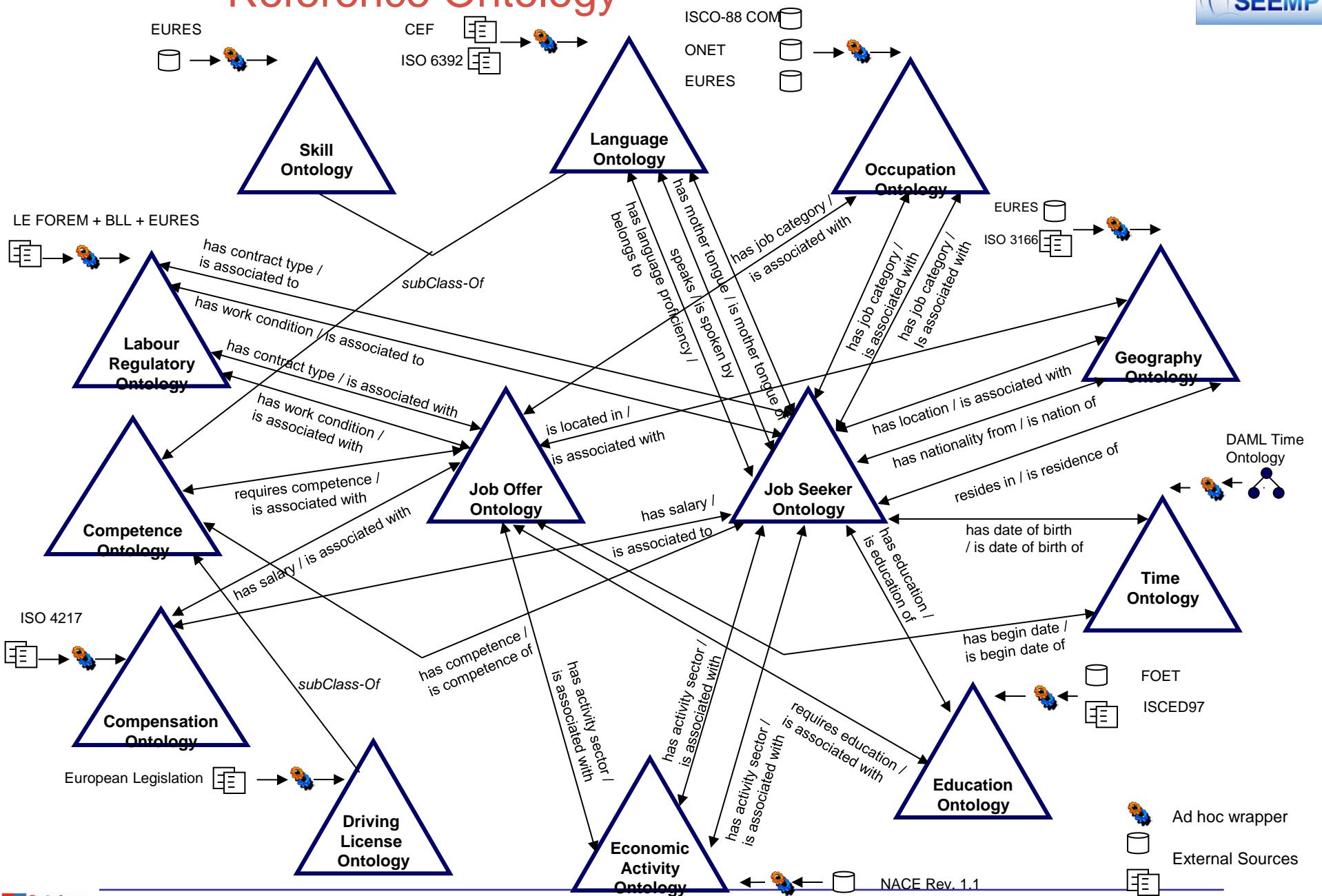
schema.org

Getting started with schema.org

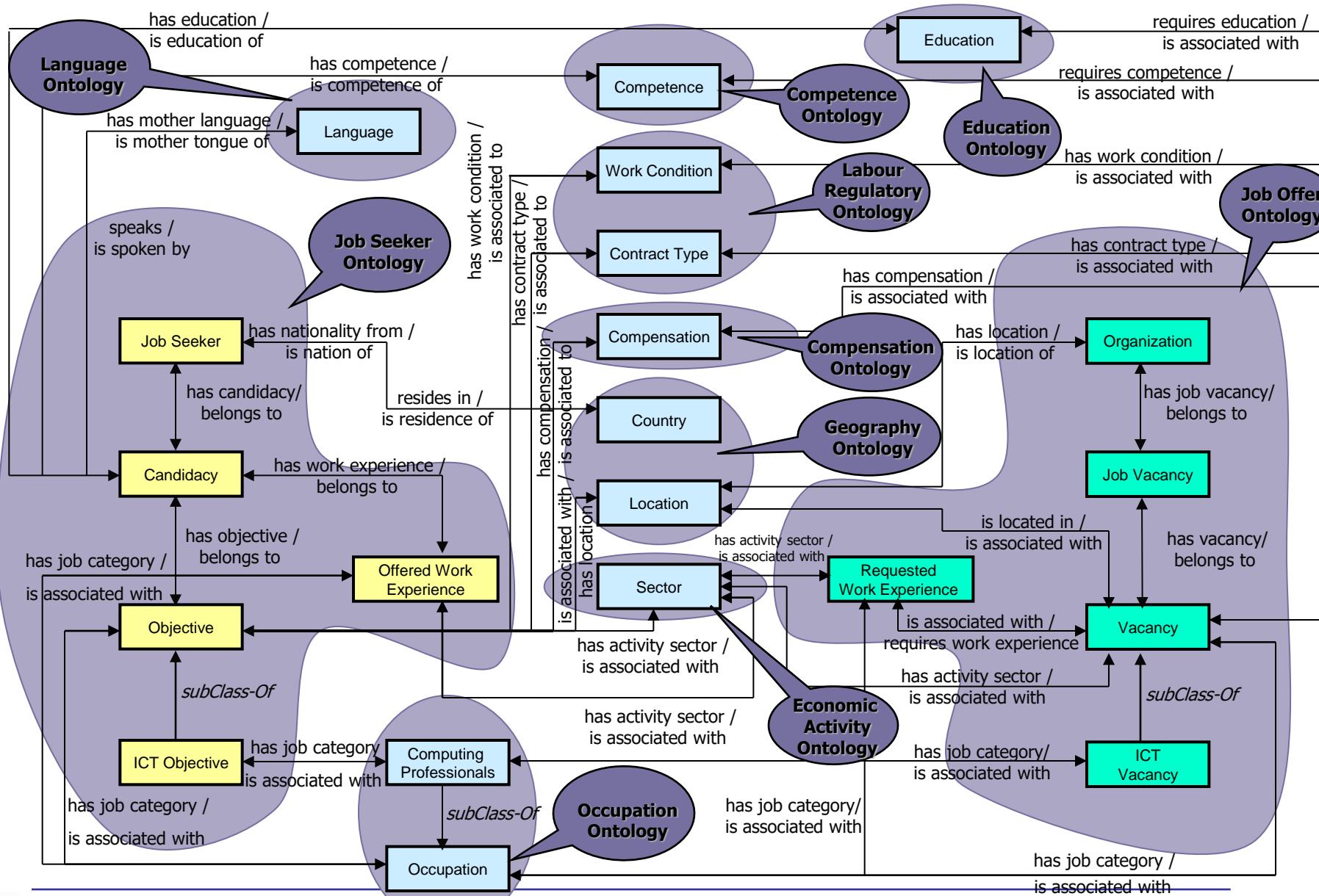
After some proces....



Reference Ontology



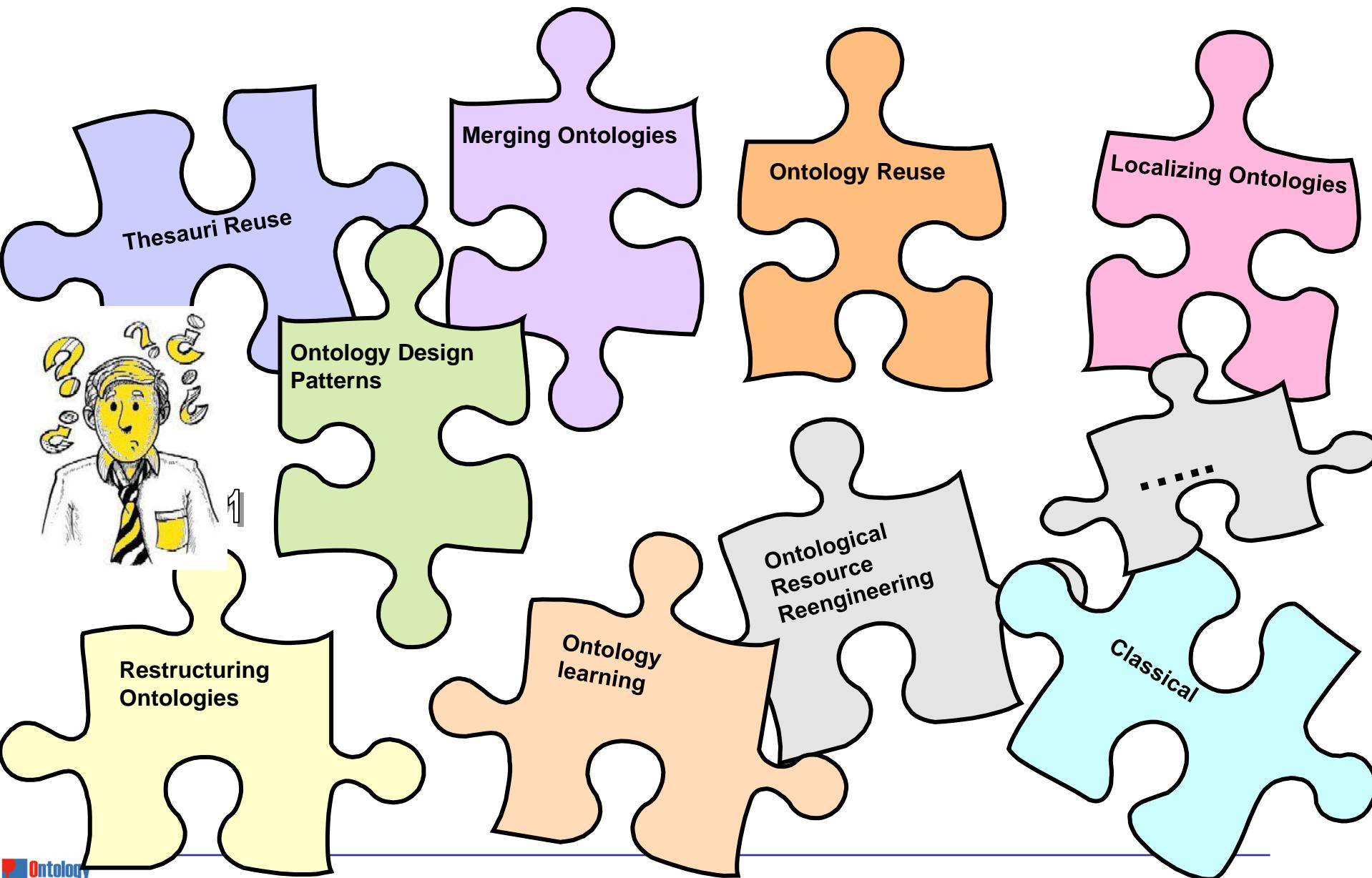
Details of the ontology



Index

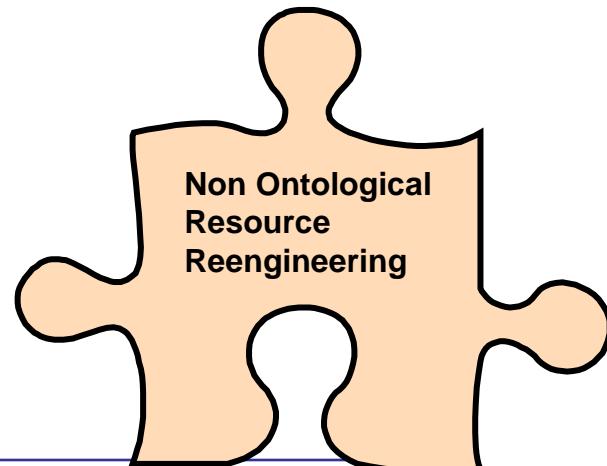
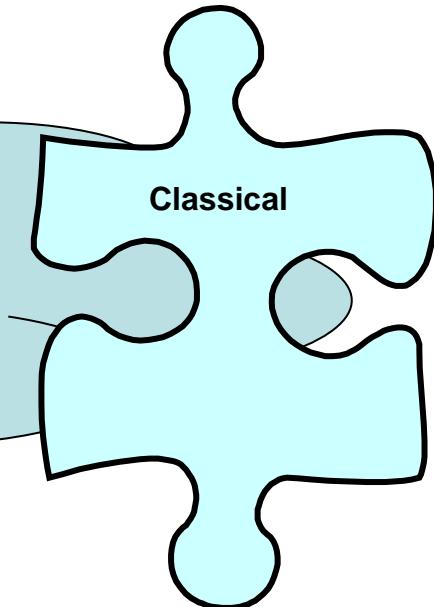
- State of the art and new trends
- Use cases in Ontology Building
- The NeOn Methodology
 - Glossary of activities
 - Scenarios
 - Lifecycle models
- Main Activities
 - Methodological Guidelines for Ontology Specification
 - Quick Search of Existing Knowledge Resources
 - Guidelines for Ontology development project Planning
 - Methodological Guidelines for Non Ontological Resource Reuse and Reengineering
 - Methodological Guidelines for Ontology Reuse
 - Creating the final Ontology Model

Too many activities...



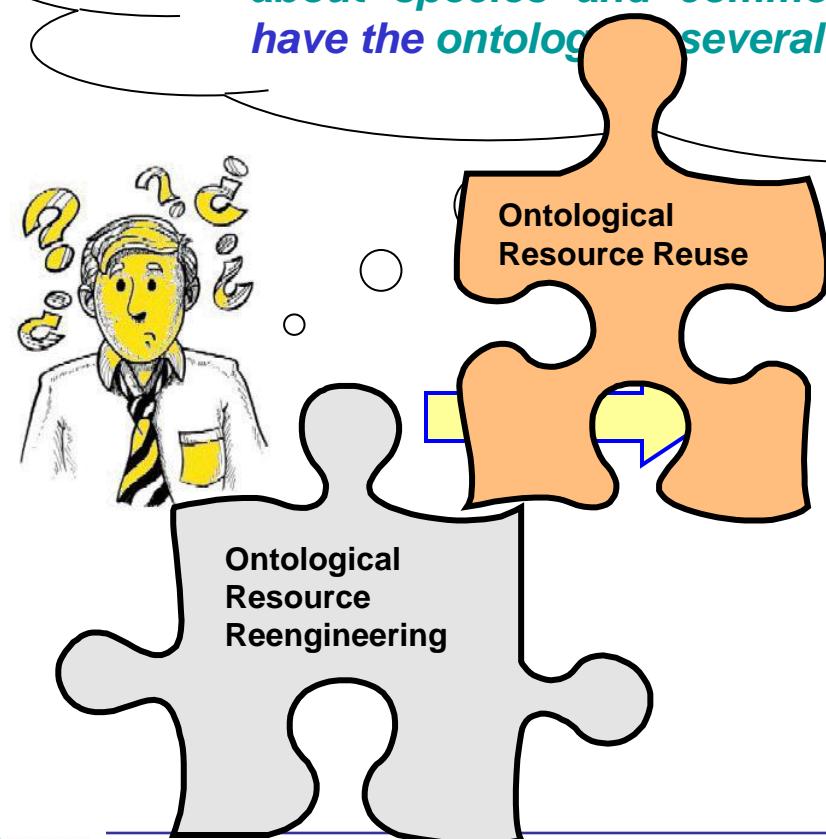
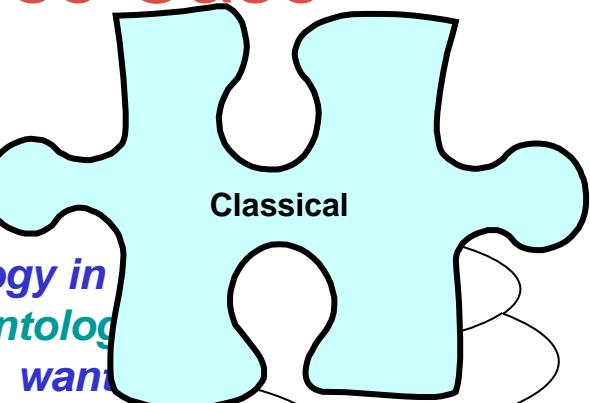
Building Ontologies: Use Case

In our team, we want to build an OWL ontology in the pharmaceutical domain, but we want to use several pharmaceutical standards in XML and classification schemes in our own format.

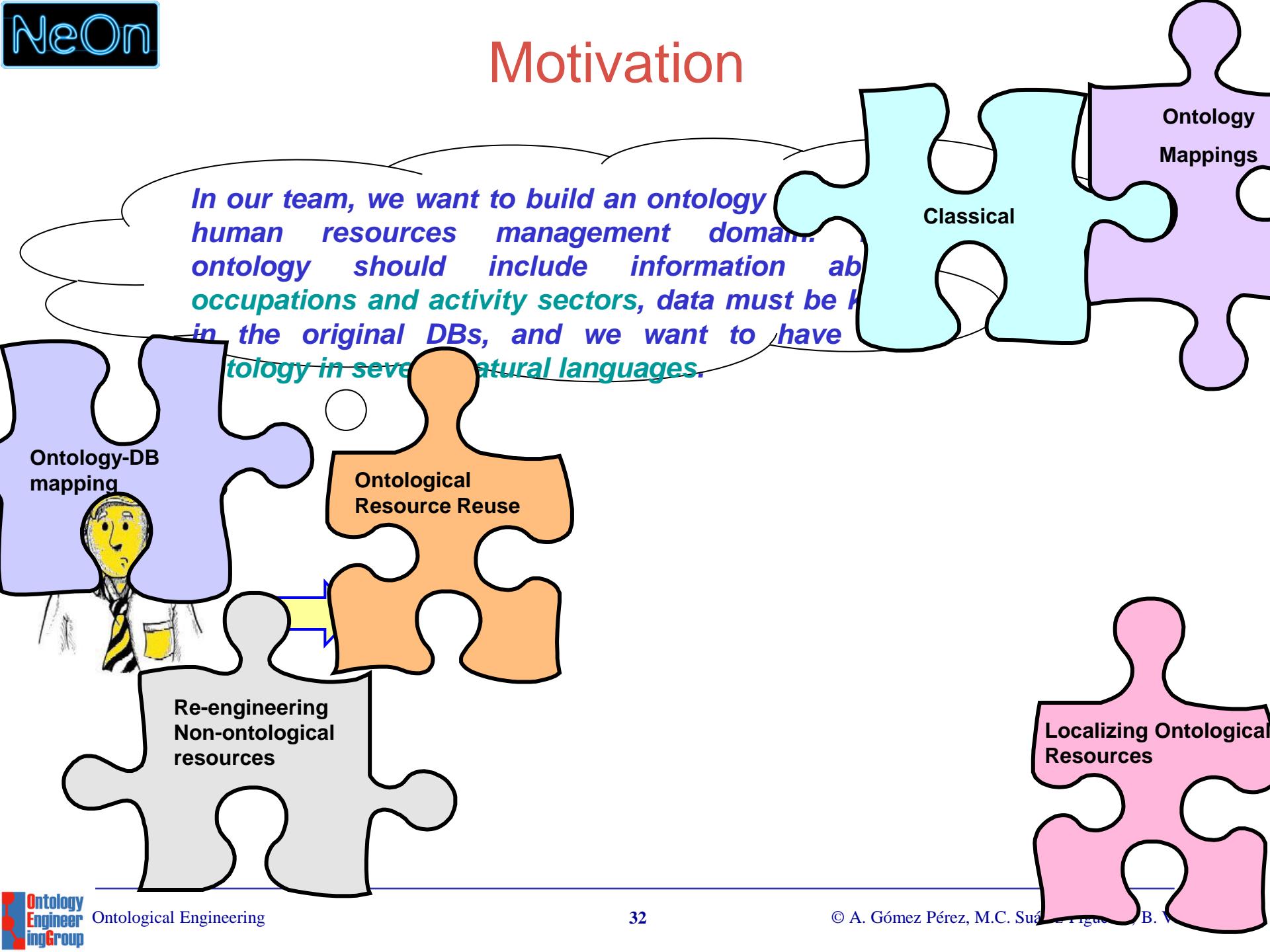


Building Ontologies: Use Case

In our team, we want to build an OWL ontology in fishery domain. We want to base on our ontology about species and commodities, and we want to have the ontology in several natural languages.



Motivation

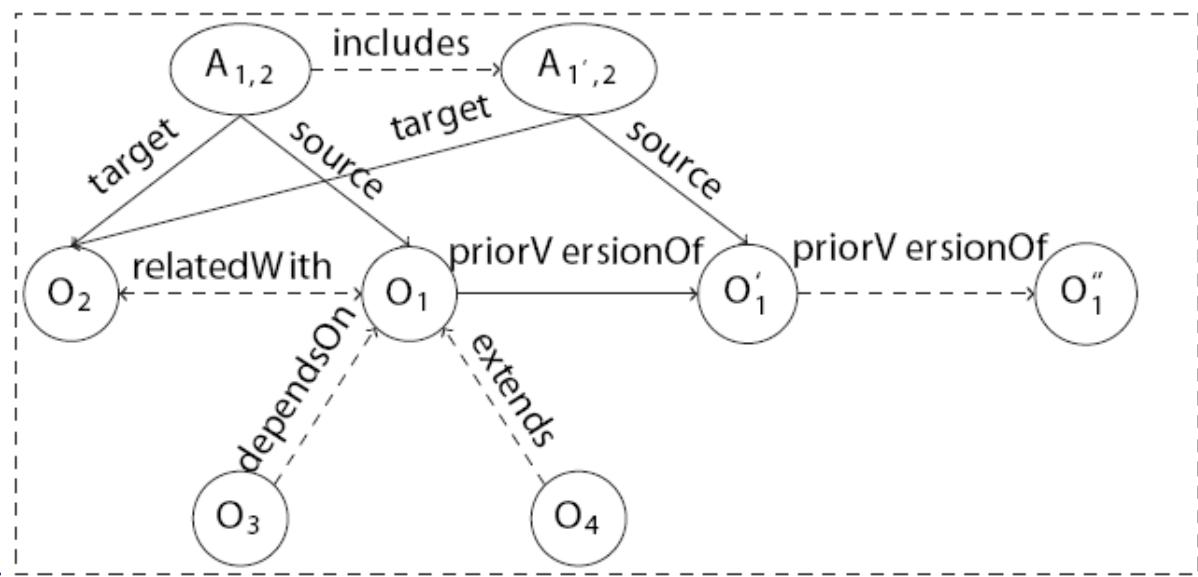
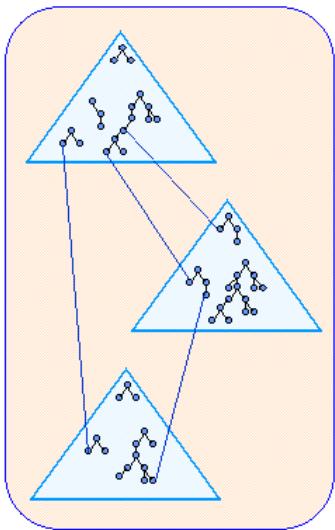


Index

- **Introduction**
- Scenarios in Ontology Building
- **The NeOn Methodology**
 - Glossary of activities
 - Scenarios
 - Lifecycle models
- **Main Activities**
 - Methodological Guidelines for Ontology Specification
 - Quick Search of Existing Knowledge Resources
 - Guidelines for Ontology development project Planning
 - Methodological Guidelines for Non Ontological Resource Reuse and Reengineering
 - Methodological Guideliness for Ontology Reuse
 - Creating the final Ontology Model

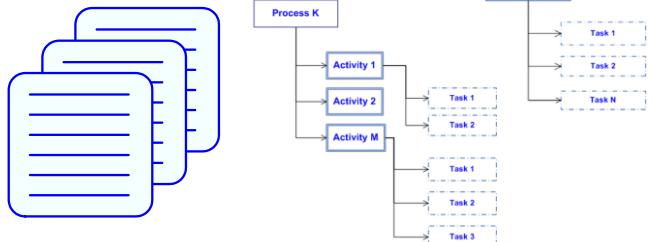
Ontology Networks

The Semantic Web of the future will be characterized by using a very large number of **ontologies embedded in ontology networks** built by distributed teams in a collaborative way.

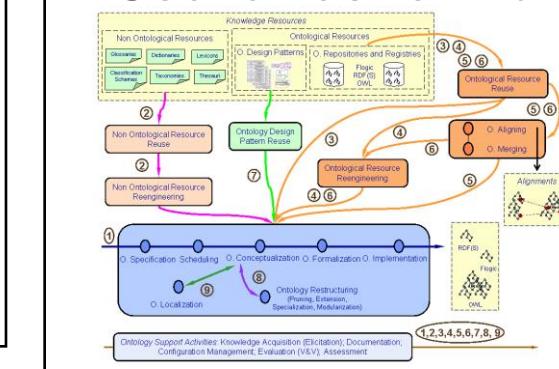


Framework: NeOn Methodology for Building Ontology Networks

NeOn Glossary of Processes and Activities

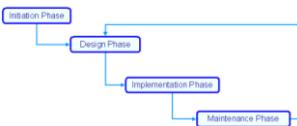


Scenarios for Building Ontology Networks

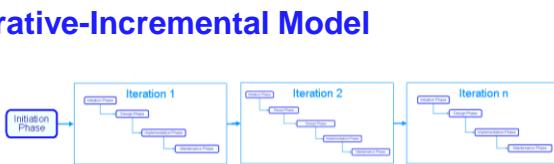


Set of Ontology Network Life Cycle Models

Waterfall Model



Iterative-Incremental Model

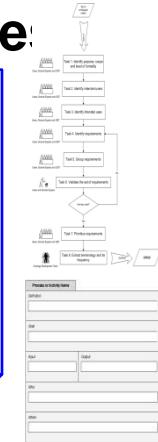


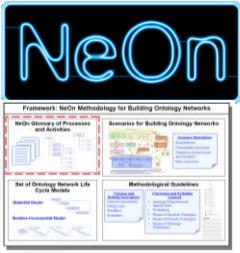
Methodological Guideline

Process and Activity Description:
General Introduction
Filling Card
Workflow Examples

Processes and Activities Covered:

- Ontology Requirements Specification
- Scheduling
- Reuse of General Ontologies
- Reuse of Domain Ontologies
- Reuse of Ontology Statements





The NeOn Glossary of Activities

- The *NeOn Glossary of Activities* identifies and defines 55 activities that are carried out when ontology networks are collaboratively built
- Published in the NeOn website
- Consensuated by *all NeOn* partners
- On-going procedure for getting feed-back from the community

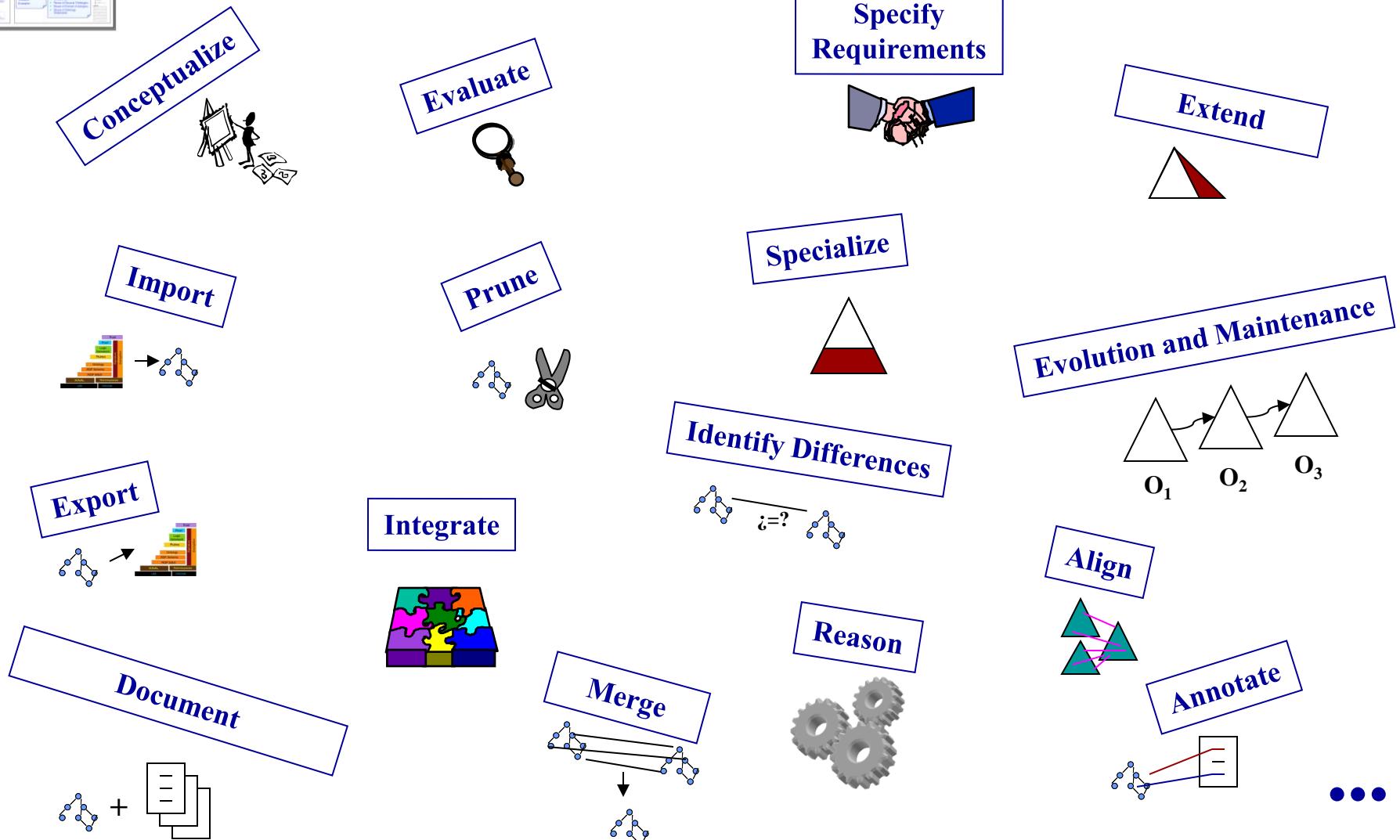


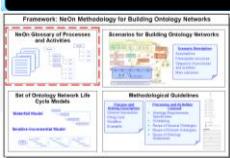
<http://www.neon-project.org/>

NeOn Glossary of Activities

- **Ontology Alignment / Aligning**
- **Ontology Articulation**
- **Ontology Assessment**
- **Ontology Combining**
- **Ontology Conceptualization**
- **Ontology Configuration Management**
- **Ontology Coordination**
- **Ontology Diagnosis**
- **Ontology Documentation**
- **Ontology Elicitation**
- **Ontology Enrichment**
- **Ontology Evaluation**
- **Ontology Evolution**
- **Ontology Extension**
- **Ontology Formalization**
- **Ontology Implementation**
- **Ontology Integration**
- **Knowledge Acquisition for Ontologies**
- **Ontology Learning**
- **Ontology Localization**
- **Ontology Mapping**
- **Ontology Matching**
- **Ontology Mediation**

Activities for Building Ontologies





Some definitions

scussion edit history protect delete move watch refresh

WP5WorkingArea: Knowledge Acquisition for Ontologies

- **Final Definition:** Knowledge Acquisition for Ontologies comprises activities for capturing knowledge (e.g., T-Box and A-Box) from a variety of sources. We distinguish between: **Ontology Elicitation**, **Ontology Learning** and **Ontology Population**.
- **Activity Group:** Development.



WP5WorkingArea: Ontology Elicitation

- **Final Definition:** *Ontology Elicitation* is a knowledge acquisition activity in which conceptual structures (e.g. T-Box) and their instances (e.g. A-Box) are acquired from domain experts.
- **Activity Group:** Development.

WP5WorkingArea: Ontology Learning

- **Final Definition:** *Ontology Learning* is a knowledge acquisition activity that relies on (semi-) automatic methods to transform unstructured (e.g. corpora), semi-structured (e.g. folksonomies, html pages, etc.) and structured data sources (e.g. data bases) into conceptual structures (e.g. T-Box).
- **Activity Group:** Development.

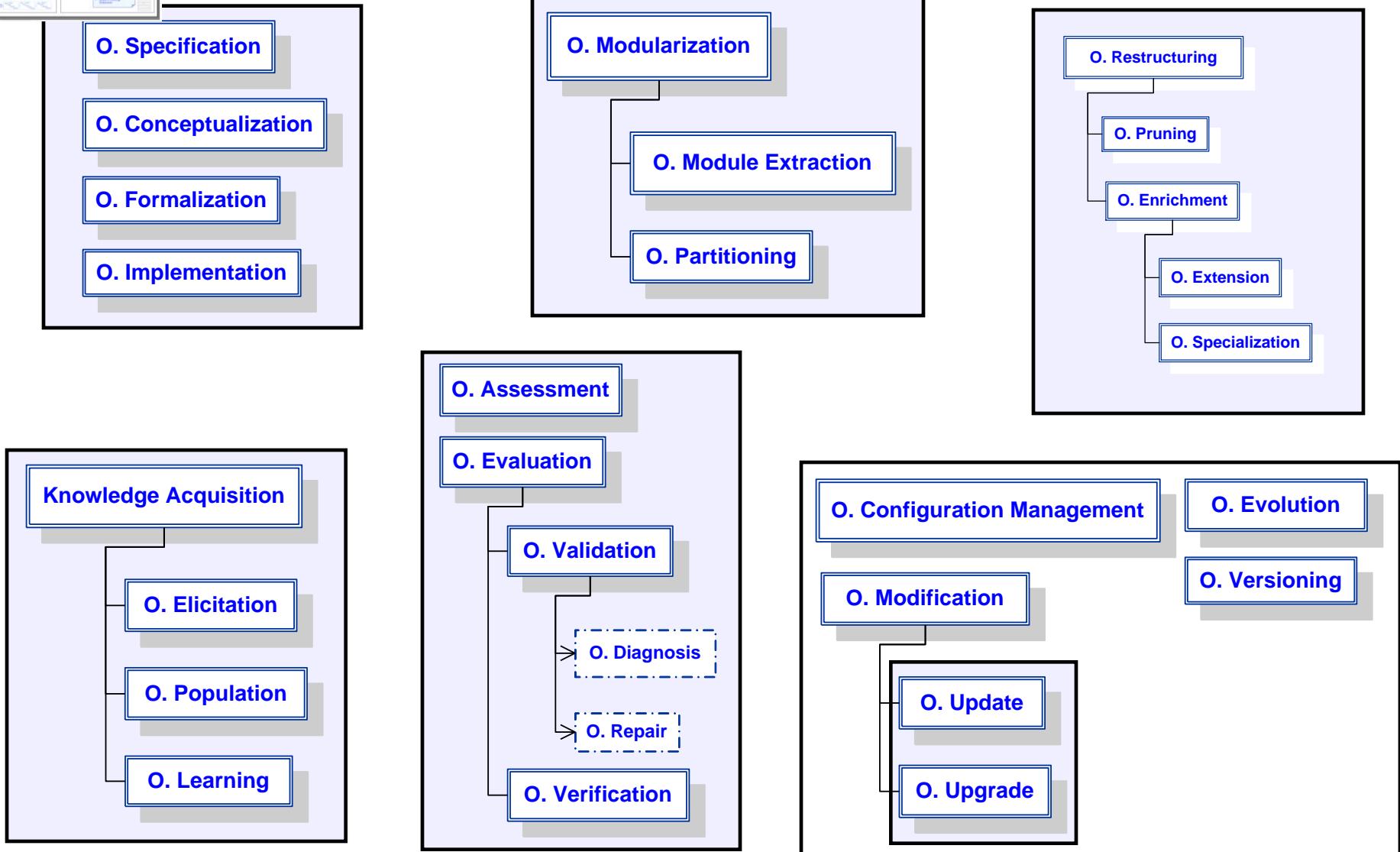
WP5WorkingArea: Ontology Population

(Redirected from [WP5WorkingArea: Ontology Population/Grounding](#))

- **Final Definition:** *Ontology Population* is a knowledge acquisition activity that relies on (semi-) automatic methods to transform unstructured (e.g. corpora), semi-structured (e.g. folksonomies, html pages, etc.) and structured data sources (e.g. data bases) into instance data (e.g. A-Box).
- **Activity Group:** Development.

http://www.neon-project.org/wiki/index.php?title=WP5D5.3.1#NeOn_Glossary_of_Activities

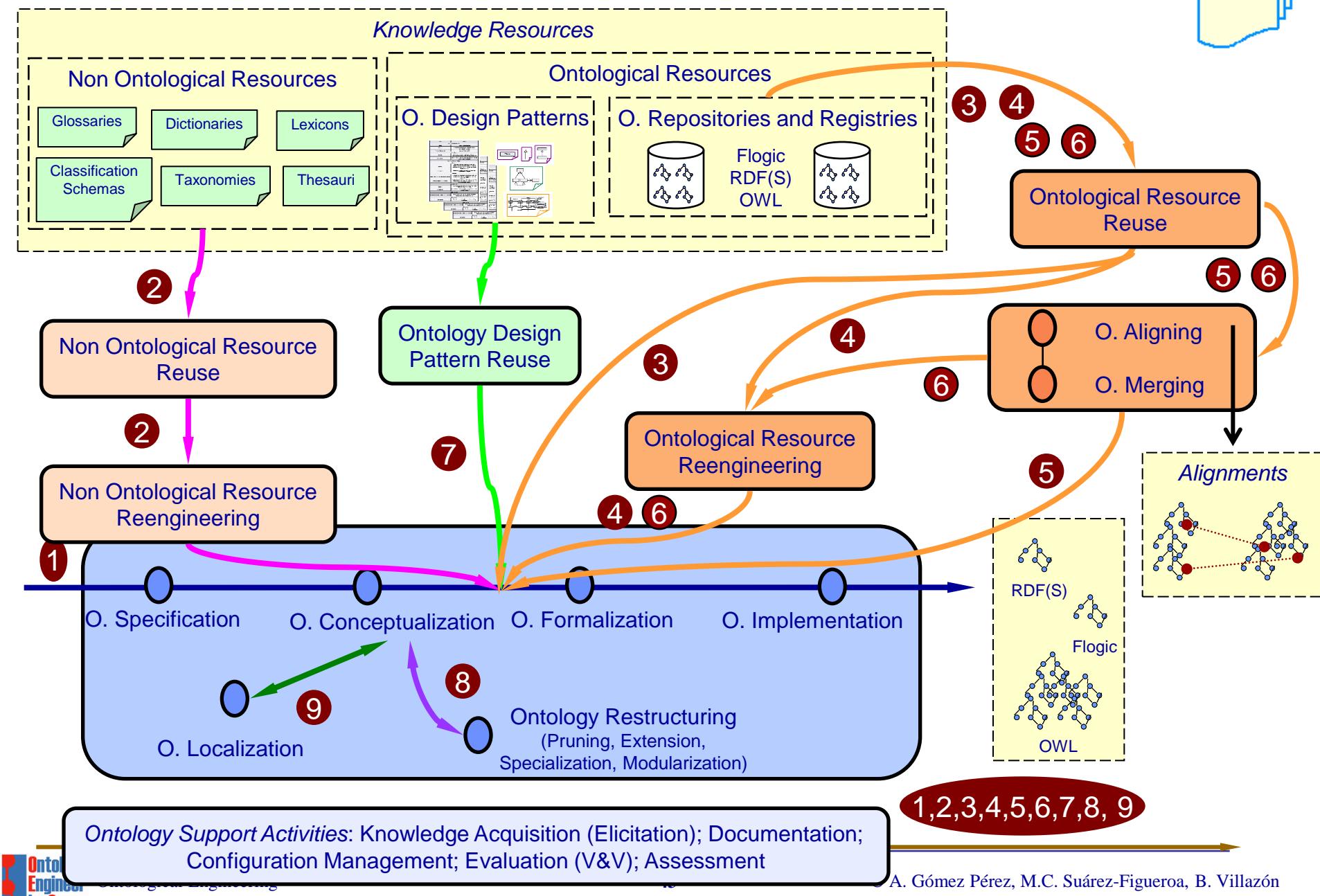
Relating Activities

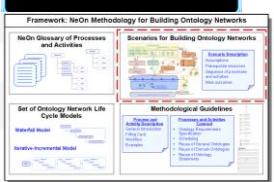


“Recommended and If-Applicable” Activities

- For each activity included in the NeOn Glossary of Activities, the table identifies which activities are **required** and which activities are **optional** (can be carried out or not, depending on the case) during the ontology network building process.

	<i>Required</i>	<i>If Applicable</i>
<i>Ontology Conceptualization</i>	X	
<i>Ontology Evaluation</i>	X	
<i>Ontology Integration</i>	X	
<i>Knowledge Acquisition for Ontologies</i>	X	
<i>Ontology Learning</i>		X
<i>Ontology Localization</i>		X
<i>Ontology Matching</i>		X
<i>Ontology Search</i>	X	
<i>Ontology Specification</i>	X	





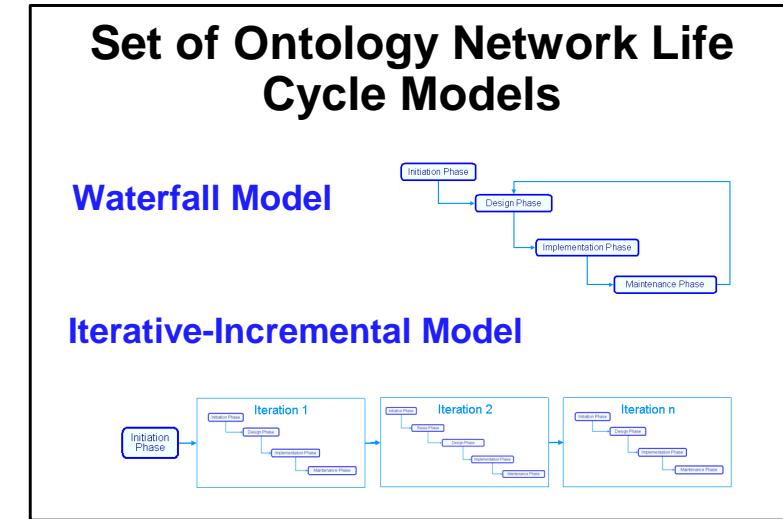
Scenarios

1. Building ontology networks from scratch without reusing existing resources.
2. Building ontology networks by reusing and reengineering non ontological resources.
3. Building ontology networks by reusing ontologies or ontology modules.
4. Building ontology networks by reusing and reengineering ontologies or ontology modules.
5. Building ontology networks by reusing and merging ontology or ontology modules.
6. Building ontology networks by reusing, merging and reengineering ontologies or ontology modules.
7. Building ontology networks by reusing ontology design patterns.
8. Building ontology networks by restructuring ontologies or ontology modules.
9. Building ontology networks by localizing ontologies or ontology modules.

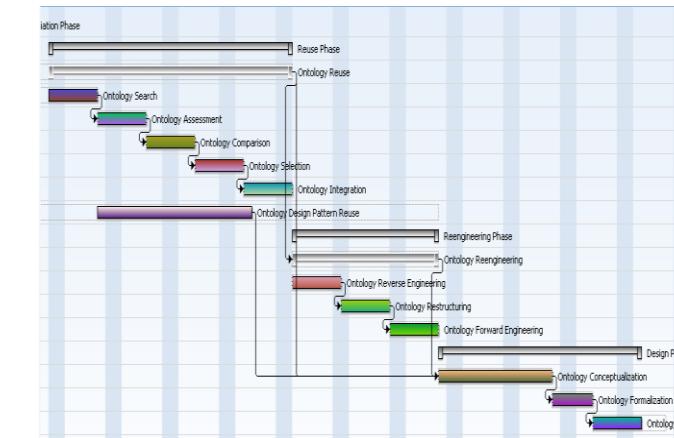


Life Cycle Models for Ontology Networks

- **Ontology network life cycle model:** a model to describe how to develop (and maintain) an ontology network project.



- The **ontology life cycle** is the specific sequence of activities that the ontology practitioners carry out for developing an ontology.



Index

- **Introduction**
- Use cases in Ontology Building
- The NeOn Methodology
 - Glossary of activities
 - Scenarios
 - Lifecycle models
- **Main Activities**
 - Methodological Guidelines for Ontology Specification
 - Quick Search of Existing Knowledge Resources
 - Guidelines for Ontology development project Planning
 - Methodological Guidelines for Non Ontological Resource Reuse and Reengineering
 - Methodological Guideliness for Ontology Reuse
 - Creating the final Ontology Model

NeOn Methodology

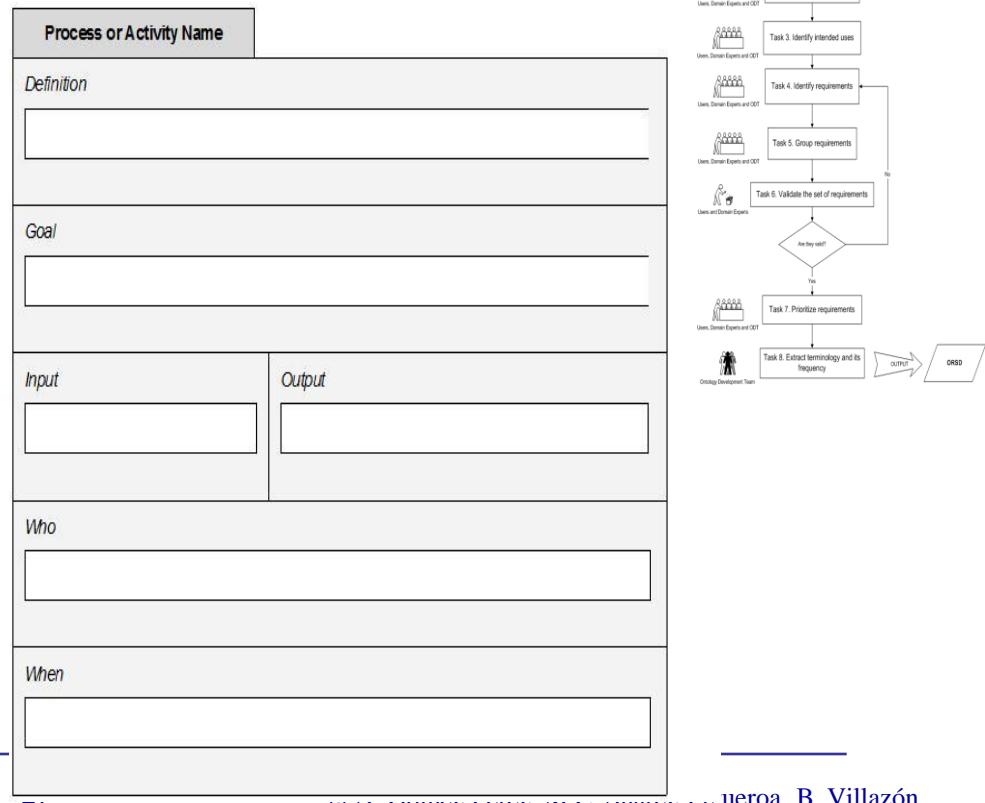
Process and activities covered:

- Ontology Specification
- Scheduling
- Non Ontological Resource Reuse
- Non Ontological Resource Reengineering
- Reuse General Ontologies
- Reuse Domain Ontologies
- Reuse Ontology Statements
- Reuse Ontology Design Patterns



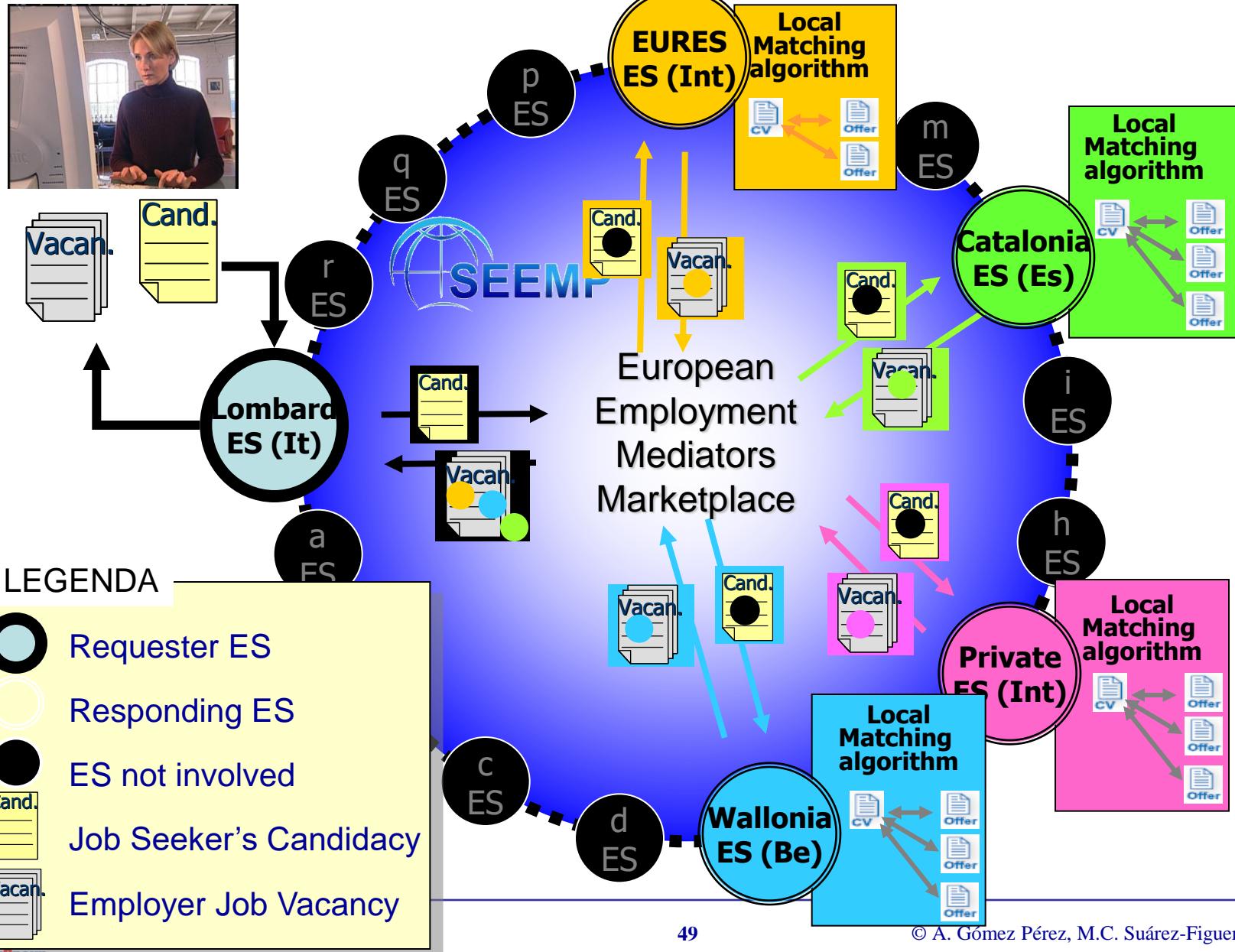
All processes and activities are described with:

- A filling card
- A workflow
- Examples

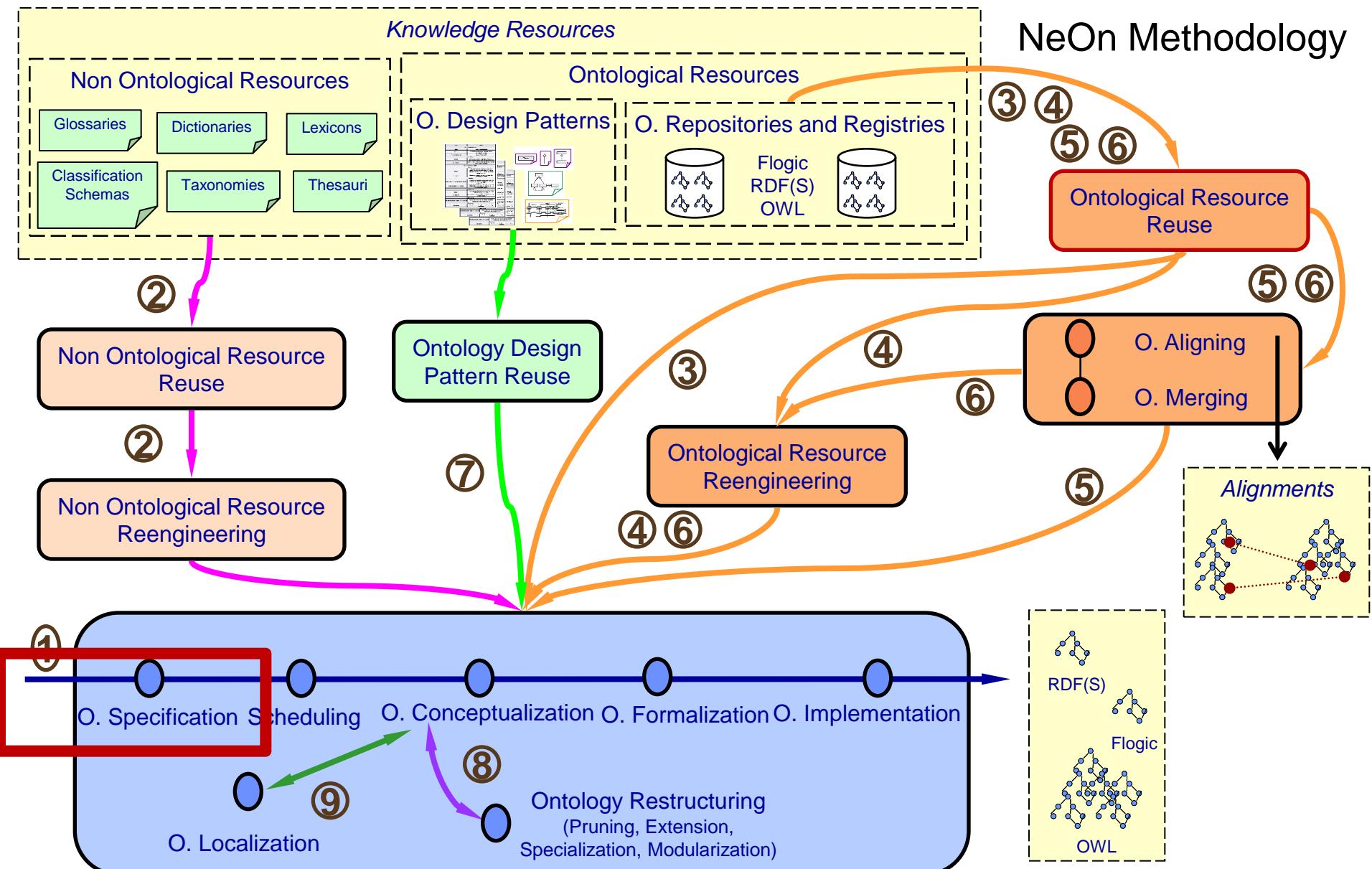


Index

- **Introduction**
- Use cases in Ontology Building
- The NeOn Methodology
 - Glossary of activities
 - Scenarios
 - Lifecycle models
- **Main Activities**
 - **Methodological Guidelines for Ontology Specification**
 - Quick Search of Existing Knowledge Resources
 - Guidelines for Ontology development project Planning
 - Methodological Guidelines for Non Ontological Resource Reuse and Reengineering
 - Methodological Guideliness for Ontology Reuse
 - Creating the final Ontology Model



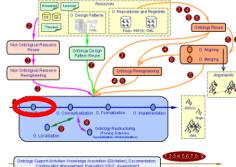
NeOn Methodology



Ontology Support Activities: Knowledge Acquisition (Elicitation); Documentation; Configuration Management; Evaluation (V&V); Assessment

A. Gómez Pérez, M.C. Suárez-Figueroa, B. Villazón

NeOn Ontology Requirement Specification



Ontology Specification

Definition

Ontology Specification refers to the activity of collecting the requirements that the ontology should fulfill, e.g. reasons to build the ontology, target group, intended uses, possibly reached through a consensus process.

Goal

The specification activity states why the ontology is being built, what its intended uses are, who the end-users are, and what the requirements the ontology should fulfill are.

Input

A set of ontological needs.

Output

Ontology Requirements Specification Document (ORSD).

Who

Software developers and ontology practitioners, who form the ontology development team (ODT), in collaboration with users and domain experts.

When

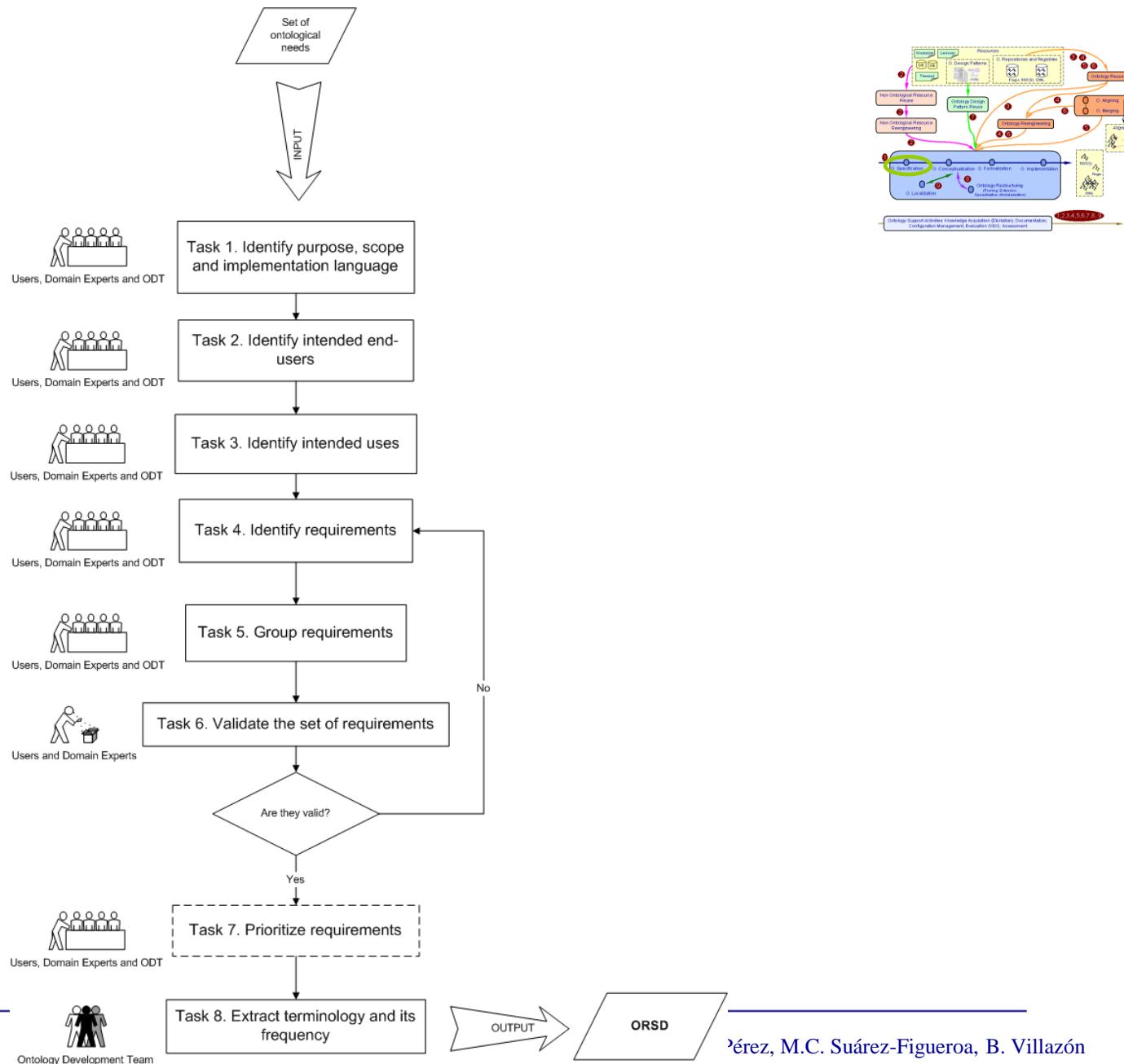
This activity must be carried out in parallel with the knowledge acquisition activity.

Competency Questions (CQs)

are questions that the ontology to be built should be able to answer.

- CQs in natural language
- CQs in SPARQL

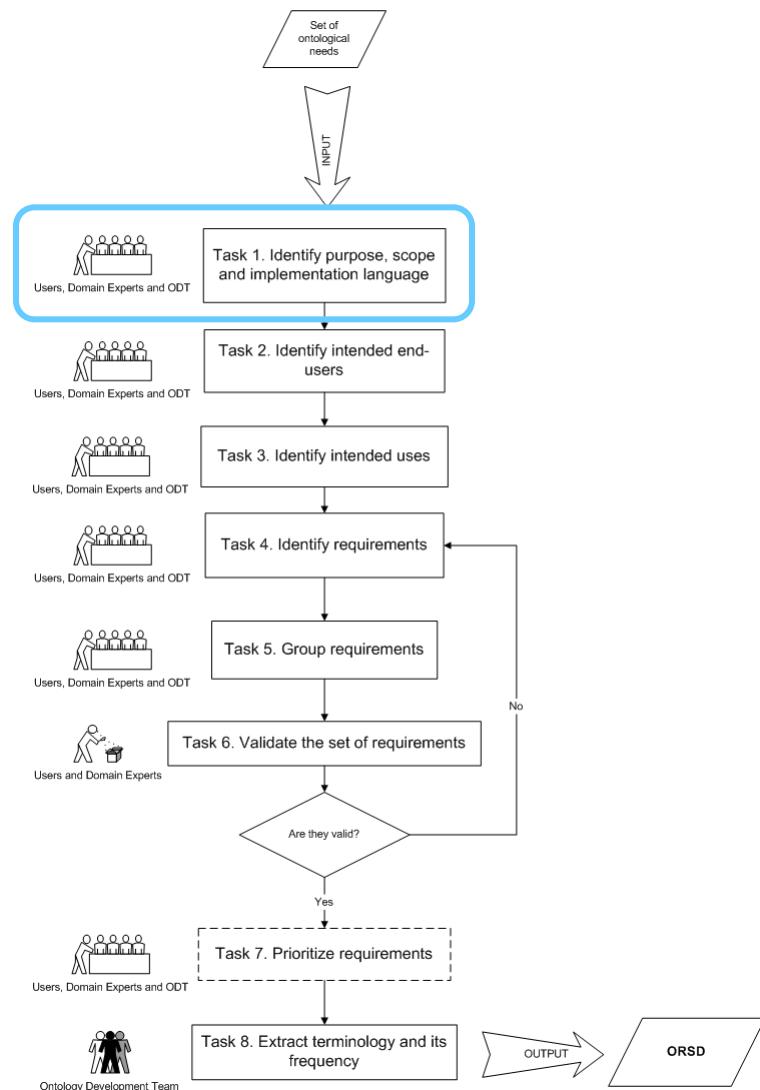
Ontology Requirements Specification. Tasks



Ontology Requirements Specification Document Template

Ontology Requirements Specification Document Template	
1	Purpose
	<i>The main general goal of the ontology. In other words, the main function or role that the ontology should have.</i>
2	Scope
	<i>The general coverage and the degree of detail that the ontology should have.</i>
3	Implementation Language
	<i>The formal language that the ontology should have.</i>
4	Intended End-Users
	<i>The intended end-users expected for the ontology.</i>
5	Intended Uses
	<i>The intended uses expected for the ontology.</i>
6	Ontology Requirements
	a. Non-Functional Requirements
	<i>The general requirements or aspects that the ontology should fulfil, including optionally priorities for each requirement.</i>
	b. Functional Requirements: Groups of Competency Questions
	<i>The content specific requirements that the ontology should fulfil, in the form of groups of competency questions and their answers, including optionally priorities for each group and for each competency question.</i>
7	Pre-Glossary of Terms
	a. Terms from Competency Questions
	<i>The list of terms included in the competency questions and their frequencies.</i>
	b. Terms from Answers
	<i>The list of terms included in the answers and their frequencies.</i>
	c. Objects
	<i>The list of objects included in the competency questions and in their answers.</i>

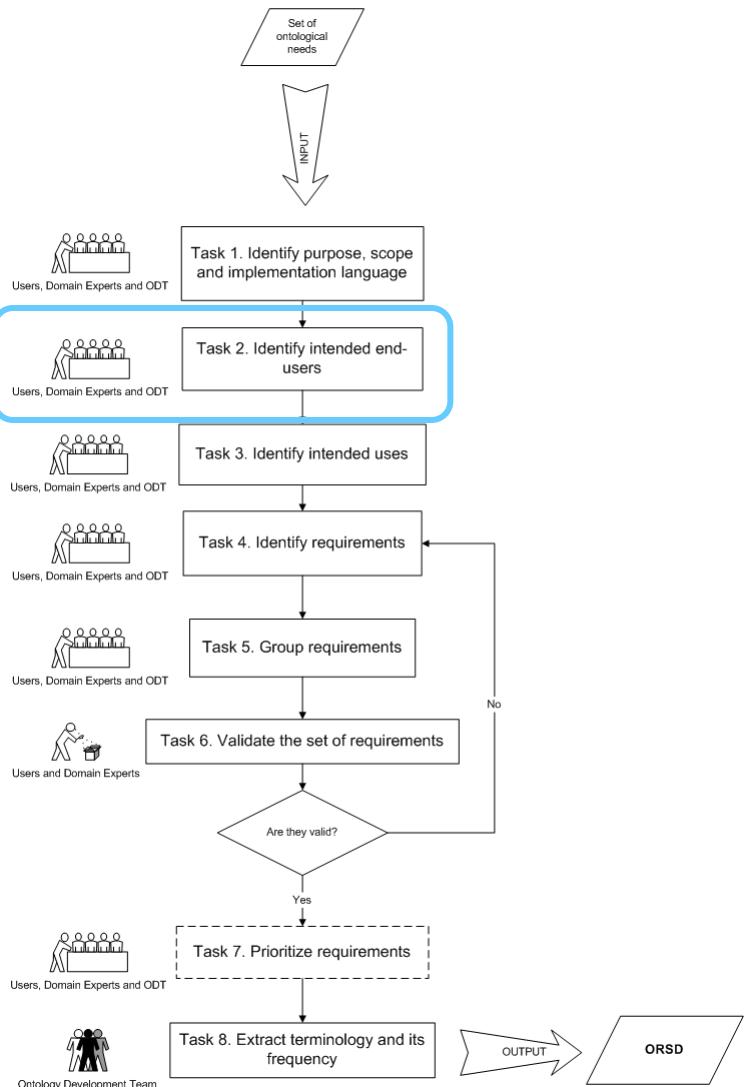
Ontology Requirements Specification. Task 1



- Input: a set of ontological needs
- Objective: obtaining the **purpose, scope and formality level of the ontology**
- Techniques: physical or virtual interviewers
- Output: purpose, scope and level of formality of the ontology, which will be included in the corresponding slots of the OSRD template

SEEMP Reference Ontology Requirements Specification Document	
1	Purpose
	The purpose of building the Reference Ontology is to provide a consensual knowledge model of the employment domain that can be used by public e-Employment services.
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	Implementation Language
	The ontology has to be implemented in WSMIL language.

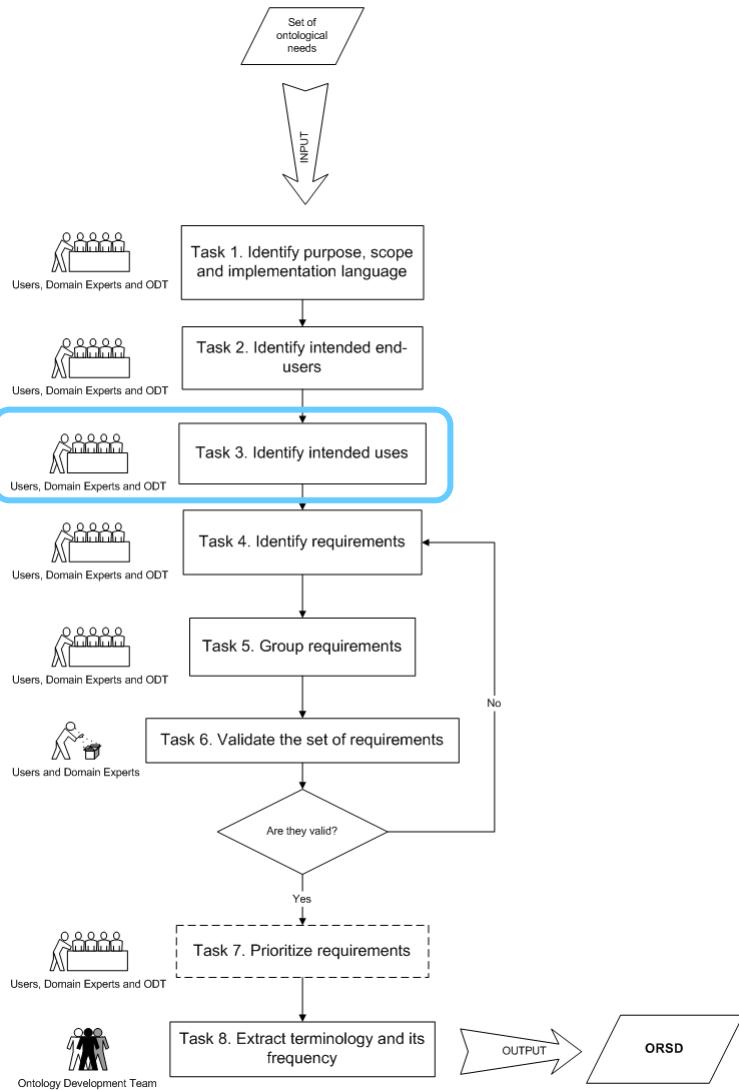
Ontology Requirements Specification. Task 2



- Input: a set of ontological needs
- Objective: identifying the **intended end-users**
- Techniques: physical or virtual interviewers
- Output: a list with the intended users, which will be included in the corresponding slot of the OSRD template

4 Intended End-Users	
User 1.	Candidate who is unemployed and searching for a job or searching another occupation for immediate or future purposes
User 2.	Employer who needs more human resources.
User 3.	Public or private employment search service which offers services to gather CVs or job postings and to prepare some data and statistics.
User 4.	National and Local Governments which want to analyze the situation on the employment market in their countries and prepare documents on employment, social and educational policy.
User 5.	European Commission and the governments of EU countries which want to analyze the statistics and prepare international agreements and documents on the employment, social and educational policy.

Ontology Requirements Specification. Task 3

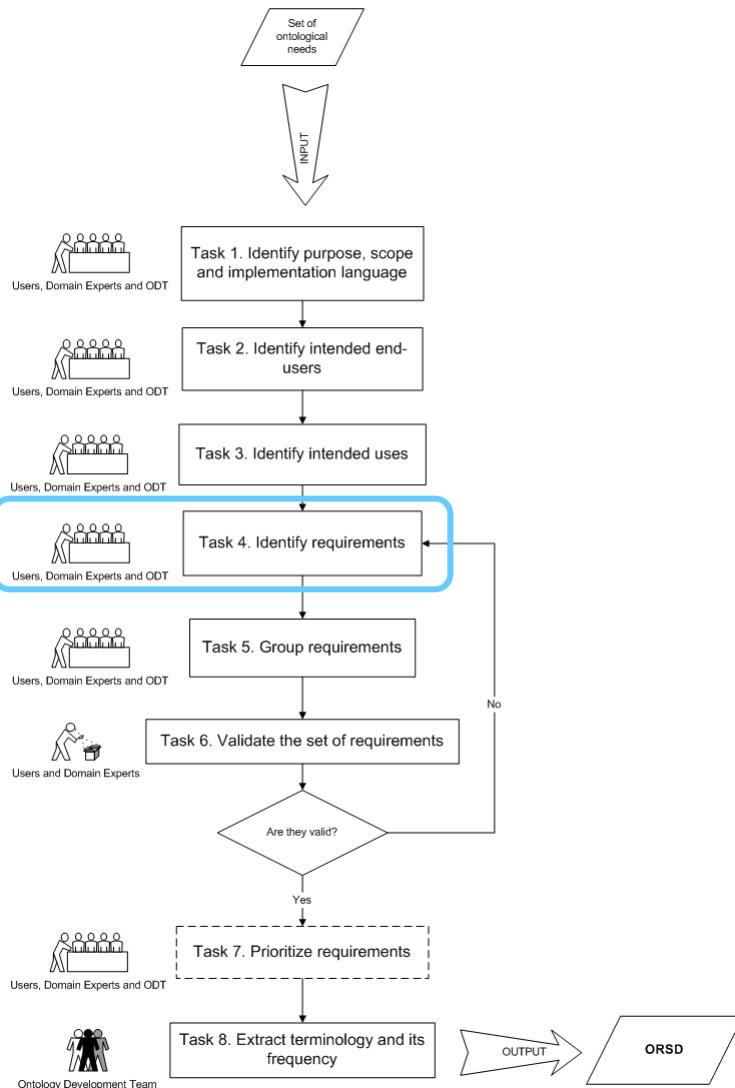


- Input: a set of ontological needs
- Objective: identifying the **intended uses**
- Techniques: physical or virtual interviewers between them
- Output: a list of intended uses in the form of scenarios. The scenarios can be described in natural language or expressed in UML as use cases. The list of scenarios will be included in the corresponding slot of the OSRD template.

5	Intended Uses
	<ul style="list-style-type: none">Use 1. Publish CV. Job seeker places his/her CV on the PES Portal.Use 2. Publish Job Offer. An Employer places a Job Offer on the PES Portal.Use 3. Search for Job Offers. The Employer looks for candidates for the Job Offer through PES Portal.Use 4. Search for Employment information. Job Seeker looks for general information about employment in a given location at the PES Portal.Use 5. Provide Job Statistics. The PES Portal provides employment statistics to the Job Seeker and Employer.

Ontology Requirements Specification.

Task 4 (I)



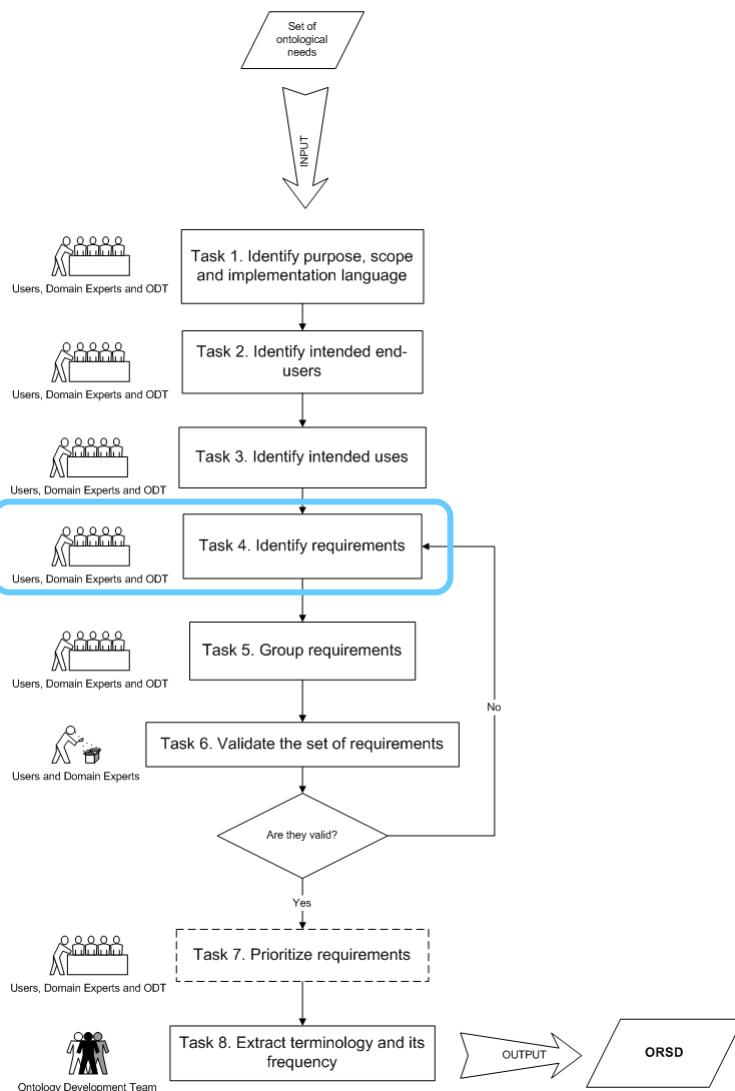
- **Input:** a set of ontological needs
- **Objective:** identifying the set of **ontology requirements that the ontology should satisfy**

- **Non-functional ontology requirements** refer to the characteristics, qualities, or general aspects not related to the ontology content that the ontology should satisfy
- **Functional ontology requirements**, which can be also seen as content specific requirements, refer to the particular knowledge to be represented by the ontology

- **Techniques:** interview users and domain experts. For functional ontology requirements → writing the requirements in Natural Language in the form of the so-called **competency questions (CQs)**
- **Tools:** mind map tools, excel, and collaborative tools (e.g., Cicero)
- **Output:** (1) a list of non-functional ontology requirements written in natural language; and (2) a list functional ontology requirements in the form of CQs and their associated answers

Ontology Requirements Specification.

Task 4 (II)



□ Approaches:

- Top-Down: Complex questions are decomposed in simple ones.
- Bottom-Up: Simple questions that are organised to form complex ones.
- Middle out: Mix approach between top-down and bottom-up.

6	Ontology Requirements
a.	Non-Functional Requirements
	NFR1. The ontology must support a multilingual scenario in the following languages: English, Spanish, Italian, and French.
	NFR2. The ontology must be based on the international, European or de-facto standards in existence or under development.

Task 4. Identify requirements: Functional requirements

- CQ1. What is the Job Seeker Name?
CQ2. What is the Job Seeker nationality?
CQ3. When is the Job Seeker birthdate?
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?
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?
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?
CQ22. What is the description of the job offer?
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?
CQ27. What are the required skills for the job offer?
CQ28. When the Job Seeker completed his/her first degree?
CQ29. Is the Job Seeker older than 30 years?
CQ30. How much time did the Job Seeker spend completing his/her first degree?
CQ31. How long is the duration of the contract?
CQ32. Which job offers were posted in the last 24 hours?
CQ33. Which job offers were posted in the last 7 days?
CQ34. Which job offers were posted in the last month?
CQ35. Is the job offer's salary greater than 14000 zlotes?
CQ36. Is the job offer's salary lower than 25000 kroner?
CQ37. The offered salary is given in US dollars?
CQ38. The offered salary is given in Euros?
- CQ39. Given the personal information (name, nationality, birth date, contact information) and the objectives (desired contract type, desired job, desired working conditions, desired salary) of the job seeker, what job offers are the most appropriate?

SEEMP Reference Ontology
Competency Questions

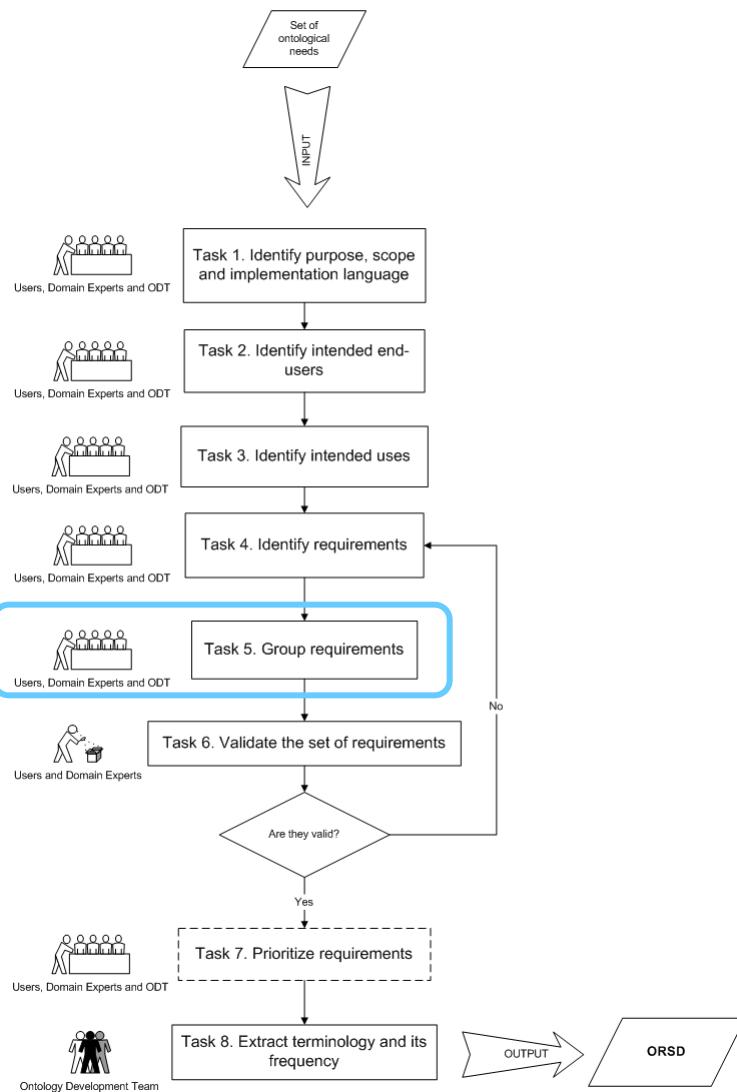
- CQ40. Given the personal information (name, nationality, birth date, contact information) and the profile (current job, education level, work experience, knowledge, expertise, skill) of the job seeker what job offers are the most appropriate?
CQ41. Given the objectives (desired contract type, desired job, desired working conditions, desired salary) and the profile (current job, education level, work experience, knowledge, expertise, skills) of the job seeker, what job offers are the most appropriate?
CQ42. Given the personal information (name, nationality, birth date, contact information), the profile (current job, education level, work experience, knowledge, expertise, skill) and the objectives (desired contract type, desired job, desired working conditions, desired salary) of the job seeker, what job offers are the most appropriate?
CQ43. Given the employer information, economic activity of the employer and the job offer profile (job, contract type, salary, work condition), what job seekers are the most appropriate?
CQ44. Given the employer information, economic activity of the employer and the required profile to seek (required education level, required work experience, required knowledge, required skills), what job seekers are the most appropriate?
CQ45. Given the job offer profile (job, contract type, salary, work condition) and the required profile to seek (required education level, required work experience, required knowledge, required skills), what job seekers are the most appropriate?
CQ46. Given the employer information, economic activity of the employer, job offer profile (job, contract type, salary, work condition) and the required profile to seek (required education level, required work experience, required knowledge, required skills), what job seekers are the most appropriate?
CQ47. When the job seeker completed his/her first degree and how much time did he/she spend completing his/her first degree?
CQ48. When the job seeker completed his/her first degree and is he/she older than 30 years?
CQ49. Is the job seeker older than 30 years and how much time did he/she spend completing his/her first degree?
CQ50. Which job offers were posted in last 24 hours and how long is the duration of their contracts?
CQ51. Which job offers were posted in last 7 days and how long is the duration of their contracts?
CQ52. Which job offers were posted in last month and how long is the duration of their contracts?
CQ53. Is the job offer's salary greater than 14000 zlotes and could it be given in US dollars?
CQ54. Is the job offer's salary lower than 25000 kroner and could it be given in Euros?
CQ55. Given the age (30 years old) and the desired salary (equal or greater than 14000 €) of the job seeker, what job offers are the most appropriate?
CQ56. Given the employer information, economic activity of the employer and the job offer profile (job, contract type, salary, work condition, contract duration), what job seekers are the most appropriate?
CQ57. Given the age (20 years old) and the desired salary (equal or greater than 14000 zlotes) of the job seeker, what job offers posted in last month are the most appropriate?
CQ58. Given the employer information, economic activity of the employer and the job offer profile (job, contract type, salary of 3400 €, work condition, contract duration), what job seekers are the most appropriate?
CQ59. Given the time spent for his/her degree (8 years) and the desired salary (equal or greater than 14000 €) of the job seeker, what job offers posted in last 7 days are the most appropriate?
CQ60. Given the time spent for his/her degree (8 years) and the desired salary (equal or greater than 14000 €) of the job seeker, what job offers posted in last 24 hours are the most appropriate?

Task 4. Identify requirements. SEEMP Example

	A	B	C
1	N	Competency Questions	Answers
2	CQ1	What is the Job Seeker Name?	Lewis Hamilton
3	CQ2	What is the Job Seeker nationality?	British; Spanish; Italian; French; German
4	CQ3	When is the Job Seeker birthdate?	13/09/1984; 30/03/1970; 15/04/1978
5	CQ4	What is the Job Seeker contact information?	
6	CQ5	What is the Job Seeker current job?	Programmer; Computer Engineer; Computer Assistant
7	CQ6	What is the Job Seeker desired job?	Radio engineer; Hardware designer; Software Engineer
8	CQ7	What are the Job Seeker desired working conditions?	Autonomous; Seasonal Job; Traineeship; Consultant
9	CQ8	What kind of contract does the Job Seeker want?	
10	CQ9	How much salary does the Job Seeker want to earn?	
11	CQ10	What is the Job Seeker education level?	Basic education; Higher education/University
12	CQ11	What is the Job Seeker work experience?	3 months, 6 months, 1 year, 2 years, 3 years
13	CQ12	What is the Job Seeker knowledge?	
14	CQ13	What is the Job Seeker expertise?	
15	CQ14	What are the Job Seeker skills?	SQL programming, network administration
16	CQ15	What publications does the Job Seeker have?	
17	CQ16	What hobbies does the Job Seeker have?	
18	CQ17	What is the employer information?	CEFRIEL Research Company, Milano, Italy
19	CQ18	What kind of job does the employer offer?	Java Programmer; C Programmer, Database administration
20	CQ19	What kind of contract does the employer offer?	
21	CQ20	How much salary does the employer offer?	3500 euros, 3000 USD, 2000 euros
22	CQ21	What is the economic activity of the employer?	Research; Financial; Education; Industrial
23	CQ22	What is the description of the job offer?	Sun Certified Java Programmer
24	CQ23	What is the work condition of the job offer?	Full time; Partial time; Autonomous; Seasonal Job;
25	CQ24	What is the required education level for the job offer?	Basic education; Higher education/University
26	CQ25	What is the required work experience for the job offer?	1 year, 2 years, 3 years, 4 years, 5 or more years
27	CQ26	What is the required knowledge for the job offer?	Java, Object oriented design, Haskell, Windows
28	CQ27	What are the required skills for the job offer?	ASP Programmer, Data warehouse, Hardware programming
29	CQ28	When the Job Seeker completed his/her first degree?	2001; March 1999; 23/10/1970
30	CQ29	Is the Job Seeker older than 30 years?	
31	CQ30	How much time did the Job Seeker spend completing his/her first degree?	4 years, 6 years, 7 years and 6 months
32	CQ31	How long is the duration of the contract?	1 month, 6 months, 1 year, 2 years, 3 years
33	CQ32	Which job offers were posted in the last 24 hours?	
34	CQ33	Which job offers were posted in the last 7 days?	
35	CQ34	Which job offers were posted in the last month?	

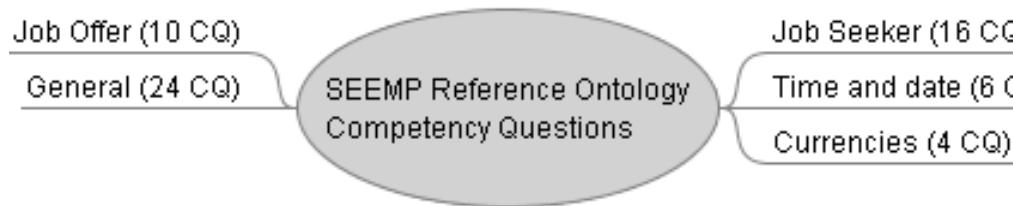
« Competency Questions »

Ontology Requirements Specification. Task 5



- **Input:** the list of CQs
 - **Objective:** obtaining different **groups of CQs**
 - **Techniques:** Card Sorting, when the grouping is done manually, and Clustering NL sentences or Information Extraction when the grouping is done automatically
 - **Tools:** MindMap Tools or Cicero Tool (for distributed teams)
 - **Output:** a set of groups including CQs
-
- **Hybrid approach:**
 - The analysis of the frequency of terms and the grouping of CQs based on those terms that have a higher frequency.
 - The use of pre-established categories, such as time and date, units of measure, currencies, location, languages, etc.

Task 5. Group requirements (CQs)



- 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?
- CQ22.What is the description of the job offer?

CQ39. Given the personal information (name, nationality, birth date, contact information) and the objectives (desired contract type, desired job, desired working conditions, desired salary) of the job seeker, what job offers are the most appropriate?

CQ40. Given the personal information (name, nationality, birth date, contact information) and the profile (current job, education level, work experience, knowledge, expertise, skill) of the job seeker what job offers are the most appropriate?

CQ41. Given the objectives (desired contract type, desired job, desired working conditions, desired salary) and the profile (current job, education level, work experience, knowledge, expertise, skill) of the job seeker, what job offers are the most appropriate?

CQ42. Given the personal information (name, nationality, birth date, contact information), the profile (current job, education level, work experience, knowledge, expertise, skill) and the objectives (desired contract type, desired job, desired working conditions, desired salary) of the job seeker, what job offers are the most appropriate?

CQ43. Given the employer information, economic activity of the employer and the job offer profile (job, contract type, salary, work condition), what job seekers are the most appropriate?

CQ44. Given the employer information, economic activity of the employer and the required profile to seek (required education level, required work experience, required knowledge, required skills), what job seekers are the most appropriate?

CQ45. Given the job offer profile (job, contract type, salary, work condition) and the required profile to seek (required education level, required work experience, required knowledge, required skills), what job seekers are the most appropriate?

CQ46. Given the employer information, economic activity of the employer, job offer profile (job, contract type, salary, work condition) and the required profile to seek (required education level, required work experience, required knowledge, required skills), what job seekers are the most appropriate?

CQ47. When the job seeker completed his/her first degree and how much time did he/she spend completing his/her first degree?

Job Offer

Job Seeker (16 CQ)

Time and date (6 CQ)

Currencies (4 CQ)

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?

CQ27.What are the required skills for the job offer?

General

CQ48 When the job seeker completed his/her first degree and is he/she older than 30 years?

CQ49. Is the job seeker older than 30 years and how much time did he/she spend completing his/her first degree?

CQ50.Which job offers were posted in last 24 hours and how long is the duration of their contracts?

CQ51.Which job offers were posted in last 7 days and how long is the duration of their contracts?

CQ52.Which job offers were posted in last month and how long is the duration of their contracts?

CQ53.Is the job offer's salary greater than 14000 zloties and could it be given in US Dollars?

CQ54.Is the job offer's salary lower than 25000 kroner and could it be given in Euros?

CQ55. Given the age (30 years old) and the desired salary (equal or greater than 14000 €) of the job seeker, what job offers are the most appropriate?

CQ56. Given the employer information, economic activity of the employer and the job offer profile (job, contract type, salary, work condition, contract duration), what job seekers are the most appropriate?

CQ57. Given the age (20 years old) and the desired salary (equal or greater than 14000 zloties) of the job seeker, what job offers posted in last month are the most appropriate?

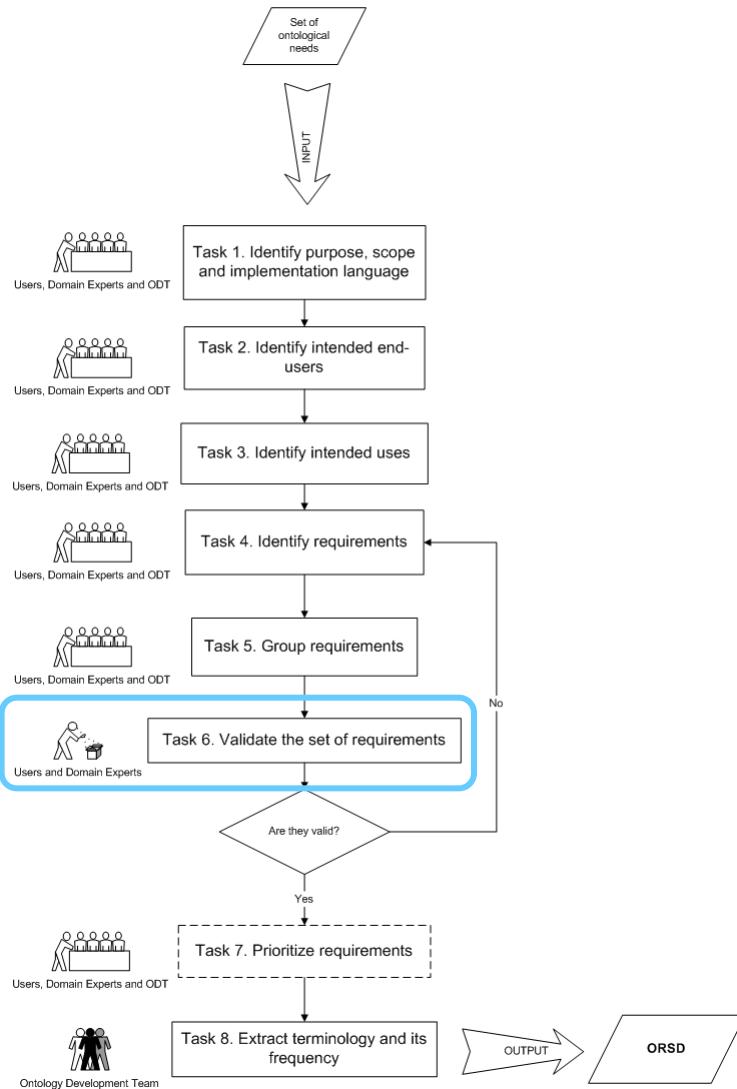
CQ58. Given the employer information, economic activity of the employer and the job offer profile (job, contract type, salary of 3400 €, work condition, contract duration), what job seekers are the most appropriate?

CQ59. Given the time spent for his/her degree (8 years) and the desired salary (equal or greater than 14000 €) of the job seeker, what job offers posted in last 7 days are the most appropriate?

CQ60. Given the time spent for his/her degree (8 years) and the desired salary (equal or greater than 14000 €) of the job seeker, what job offers posted in last 24 hours are the most appropriate?

Ontology Requirements Specification.

Task 6



- **Input:** the set of grouped CQs
- **Objective:** to identify possible conflicts between CQs, missing CQs, and contradictions in CQs. To decide **if such CQs are valid or not**
- **Output:** a confirmation about the validity of the set of CQs
- **Criteria:**

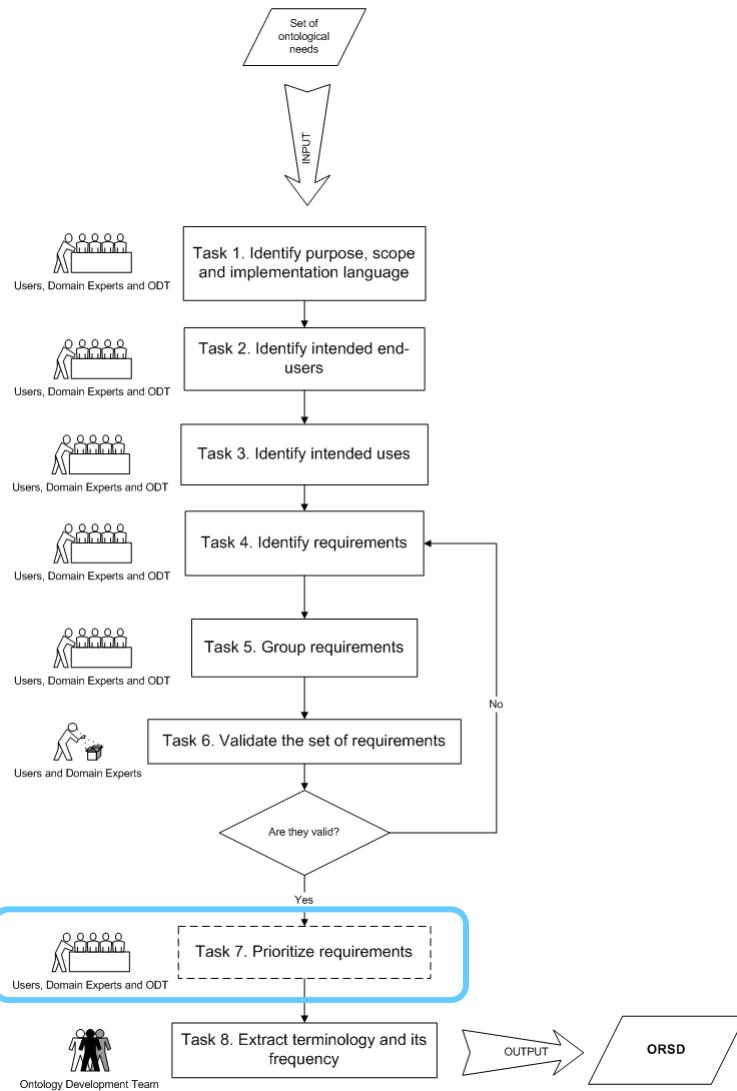
<i>Correctness.</i>	<i>Completeness.</i>
<i>Consistent.</i>	<i>Verifiable.</i>
<i>Understandable.</i>	<i>No Ambiguity.</i>
<i>Conciseness.</i>	<i>Realism.</i>
<i>Modifiable.</i>	
<i>Traceable.</i>	

Correctness. Domain experts checked the correctness of each competency question, verifying that its formulation and answers were correct.

Consistent. Domain experts also verified that the competency questions did not have any possible inconsistency.



Ontology Requirements Specification. Task 7

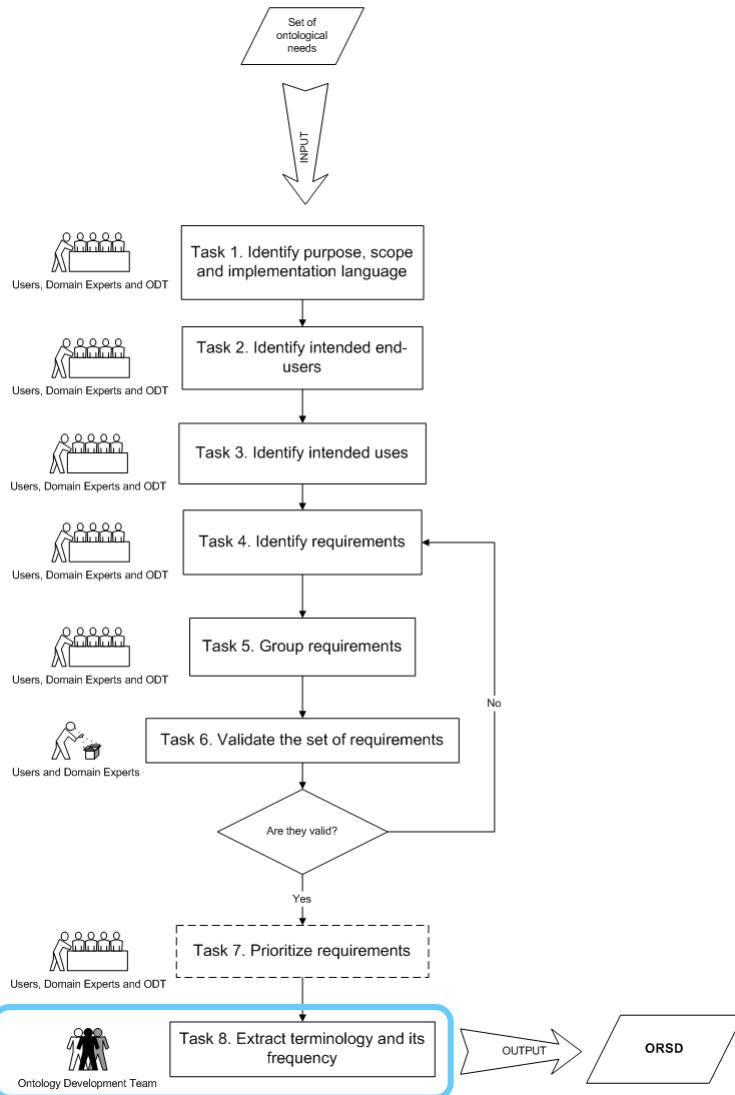


- ❑ *Input:* the groups of CQs written in natural language (obtained in task 5)
- ❑ *Objective:* to give **different levels of priority** to the different groups of CQs, and within each group to the identified requirements (in the form of CQs)
- ❑ *Output:* a set of priorities attached to each group of CQs and to each CQ in a group

Within the SEEMP Reference Ontology specification we did not carry out this step. This means the first version of the ontology must be able to represent the knowledge contained in all the competency questions.



Ontology Requirements Specification. Task 8



- ❑ **Input:** the list of identified CQs and their answers
- ❑ **Objective:** to extract from the list of CQs a pre-glossary to be used in the conceptualization activity. Obtaining a list of the **most used terms**
- ❑ **Techniques:** terminology extraction techniques and tools supporting such techniques

From the requirements in form of competency questions, we extract the terminology (names, adjectives and verbs) that will be formally represented in the ontology by means of concepts, attributes and relations.

From the answers to the CQs we extract the objects in the universe of discourse that will be represented as instances.

Task 8. Extract terminology and its frequency

7 Pre-Glossary of Terms			
a. Terms from Competency Questions + Frequency			
Job Seeker	27	Address	1
CV	2	Nationality	1
Personal Information	3	Contact (phone, fax, mail)	3
Name	4	Objective	3
Gender	1	Job Category	3
Birth date	1	...	
b. Terms from Answers + Frequency			
SW engineer, programmer	5	Research, Financial, Education	4
British, Spanish, Italian, French	1	1 year, 2 years, 3 years	1
Autonomous, Seasonal Job,	2	3000 Euros per month	1
Basic education, Higher education	1	CEFRIEL Research Company	1
c. Objects			
Andorra, Angola, Argentina, Australia, Bolivia, France, Italy, Malta, Spain, etc. Euro, Zloty, Great British Pound, US Dollar, Peso, etc. CEFRIEL, ATOS, etc.			

SEEMP Ontology Requirement Specification Document

SEEMP Reference Ontology Requirements Specification Document	
1 Purpose	The purpose of building the Reference Ontology is to provide a consensual knowledge model of the employment domain that can be used by public e-Employment services.
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 Implementation Language	The ontology has to be implemented in WSML language.
4 Intended End-Users	<p>User 1. Candidate who is unemployed and searching for a job occupation for immediate or future purposes</p> <p>User 2. Employer who needs more human resources.</p> <p>User 3. Public or private employment search service which collect CVs or job postings and to prepare some data and statistics</p> <p>User 4. National and Local Governments which want to analyze employment market in their countries and prepare documents about social and educational policy.</p> <p>User 5. European Commission and the governments of EU countries which want to analyze the statistics and prepare international agreements about the employment, social and educational policy.</p>
5 Intended Uses	<p>Use 1. Publish CV. Job seeker places his/her CV on the PES Portal.</p> <p>Use 2. Publish Job Offer. An Employer places a Job Offer on the PES Portal.</p> <p>Use 3. Search for Job Offers. The Employer looks for candidates through PES Portal.</p> <p>Use 4. Search for Employment information. Job Seeker finds information about employment in a given location at the PES Portal.</p> <p>Use 5. Provide Job Statistics. The PES Portal provides employment statistics for the Job Seeker and Employer.</p>

6	Ontology Requirements
	<p>a. Non-Functional Requirements</p> <p>NFR1. The ontology must support a multilingual scenario in the following languages: English, Spanish, Italian, and French.</p> <p>NFR2. The ontology must be based on the international, European or de-facto standards in existence or under development.</p>

6	Ontology Requirements
	<p>b. Functional Requirements: Groups of Competency Questions</p> <p>CQG1. Job Seeker (14 CQ)</p>

7	Pre-Glossary of Terms																								
	<p>a. Terms from Competency Questions + Frequency</p> <table> <tbody> <tr> <td>Job Seeker</td> <td>27</td> <td>Address</td> <td>1</td> </tr> <tr> <td>CV</td> <td>2</td> <td>Nationality</td> <td>1</td> </tr> <tr> <td>Personal Information</td> <td>3</td> <td>Contact (phone, fax, mail)</td> <td>3</td> </tr> <tr> <td>Name</td> <td>4</td> <td>Objective</td> <td>3</td> </tr> <tr> <td>Gender</td> <td>1</td> <td>Job Category</td> <td>3</td> </tr> <tr> <td>Birth date</td> <td>1</td> <td>...</td> <td></td> </tr> </tbody> </table>	Job Seeker	27	Address	1	CV	2	Nationality	1	Personal Information	3	Contact (phone, fax, mail)	3	Name	4	Objective	3	Gender	1	Job Category	3	Birth date	1	...	
Job Seeker	27	Address	1																						
CV	2	Nationality	1																						
Personal Information	3	Contact (phone, fax, mail)	3																						
Name	4	Objective	3																						
Gender	1	Job Category	3																						
Birth date	1	...																							
	<p>b. Terms from Answers + Frequency</p> <table> <tbody> <tr> <td>SW engineer, programmer</td> <td>5</td> <td>Research, Financial, Education</td> <td>4</td> </tr> <tr> <td>British, Spanish, Italian, French</td> <td>1</td> <td>1 year, 2 years, 3 years</td> <td>1</td> </tr> <tr> <td>Autonomous, Seasonal Job,</td> <td>2</td> <td>3000 Euros per month</td> <td>1</td> </tr> <tr> <td>Basic education, Higher education</td> <td>1</td> <td>CEFRIEL Research Company</td> <td>1</td> </tr> </tbody> </table>	SW engineer, programmer	5	Research, Financial, Education	4	British, Spanish, Italian, French	1	1 year, 2 years, 3 years	1	Autonomous, Seasonal Job,	2	3000 Euros per month	1	Basic education, Higher education	1	CEFRIEL Research Company	1								
SW engineer, programmer	5	Research, Financial, Education	4																						
British, Spanish, Italian, French	1	1 year, 2 years, 3 years	1																						
Autonomous, Seasonal Job,	2	3000 Euros per month	1																						
Basic education, Higher education	1	CEFRIEL Research Company	1																						
	<p>c. Objects</p> <table> <tbody> <tr> <td>Andorra, Angola, Argentina, Australia, Bolivia, France, Italy, Malta, Spain, etc.</td> <td></td> </tr> <tr> <td>Euro, Zloty, Great British Pound, US Dollar, Peso, etc.</td> <td></td> </tr> <tr> <td>CEFRIEL, ATOS, etc.</td> <td></td> </tr> </tbody> </table>	Andorra, Angola, Argentina, Australia, Bolivia, France, Italy, Malta, Spain, etc.		Euro, Zloty, Great British Pound, US Dollar, Peso, etc.		CEFRIEL, ATOS, etc.																			
Andorra, Angola, Argentina, Australia, Bolivia, France, Italy, Malta, Spain, etc.																									
Euro, Zloty, Great British Pound, US Dollar, Peso, etc.																									
CEFRIEL, ATOS, etc.																									

- Higher education/University
- CQ23. What is the required work experience for the job offer? 1 year, 2 years, 3 years, 4 years, 5 or more years
- CQ24. What is the required knowledge for the job offer? Java, Haskell, Windows
- CQ25. What are the required skills for the job offer? ASP Programmer, Data warehouse, Hardware programming

Semantic Nomenclature Reference Ontology Specification Document

Semantic Nomenclature Reference Ontology Requirements Specification	
1 Purpose	The purpose of building the Reference Ontology is to provide a network of ontologies for the pharmaceutical domain. This model is a compilation of the main terms and objects for this particular domain and could be used by health & pharmaceutical entities.
2 Scope	The ontology has to focus just on the Spanish & European pharmaceutical 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 OWL
4 Intended Users	<p>User 1: Pharmacist. Pharmacists are the end-users of the ontology and navigate across the ontology searching for drug information.</p> <p>User 2: GSCoP technician. GSCoP technicians navigate across the ontology network and search for more information or relations about a given concept (drug, active ingredient, etc.). Also, GSCoP technicians extract the latest information from different sources and update their BOTPlus database</p> <p>User 3: Spanish Government. Spanish Government analysts study the situation of the pharmaceutical product information in the Spanish market or update the content.</p>
5 Intended Uses	<p>Use1. Search updated information about the characteristics of pharmaceutical products</p> <p>Use2. Connect heterogeneous pharmaceutical models</p> <p>Use3. Update pharmaceutical product information databases</p>
6 Groups of Competency Questions	<p>CQG1. Pharmaceutical Product (29 competency questions)</p> <p>CQG2. Laboratory (4 competency questions)</p> <p>CQG3. Active Ingredient (12 competency questions).</p> <p>CQG4. Composed ones (16 competency questions).</p> <p>CQG5. Time / Date</p> <pre> graph LR A([Semantic Nomenclature Reference Ontology Competency Questions]) --> B[Time] A --> C[Laboratory] A --> D[Composite] A --> E[Pharmaceutical Product] A --> F[Active Ingredient] </pre>
	<p>CQ11.Which is the drug generic name?</p> <p>CQ12.Which is the drug defined daily doses DDDs?</p> <p>CQ13.Which is the drug composition?</p> <p>CQ14.Is it a narcotic?</p> <p>CQ15.Which are the drug contraindications?</p> <p>CQ16.What is the drug dosage?</p> <p>CQ17.Which method of administration has the drug?</p> <p>CQ18.What is the drug pharmaceutical form?</p>

7 Pre-Glossary of Terms	
Terms	
Term	Frequency
Drug	29
▪ Date (registration, withdrawal)	3
▪ Price (reference, commercial)	3
▪ Therapeutical Subgroup	3
▪ Dosage	1
▪ Composition	2
▪ Identification	2
▪ National Health financing	2
▪ Route of administration	1
▪ Units content	1
▪ Indications	2
▪ Status	1
▪ Pharmaceutical form	1
Objects	
Active Ingredient Objects	
Ibuprofeno	
Butibufeno	
Penicilamina	
Niflumico Acid	
Galamina	
Tetrazepam	
Procaina	
Ketamina	

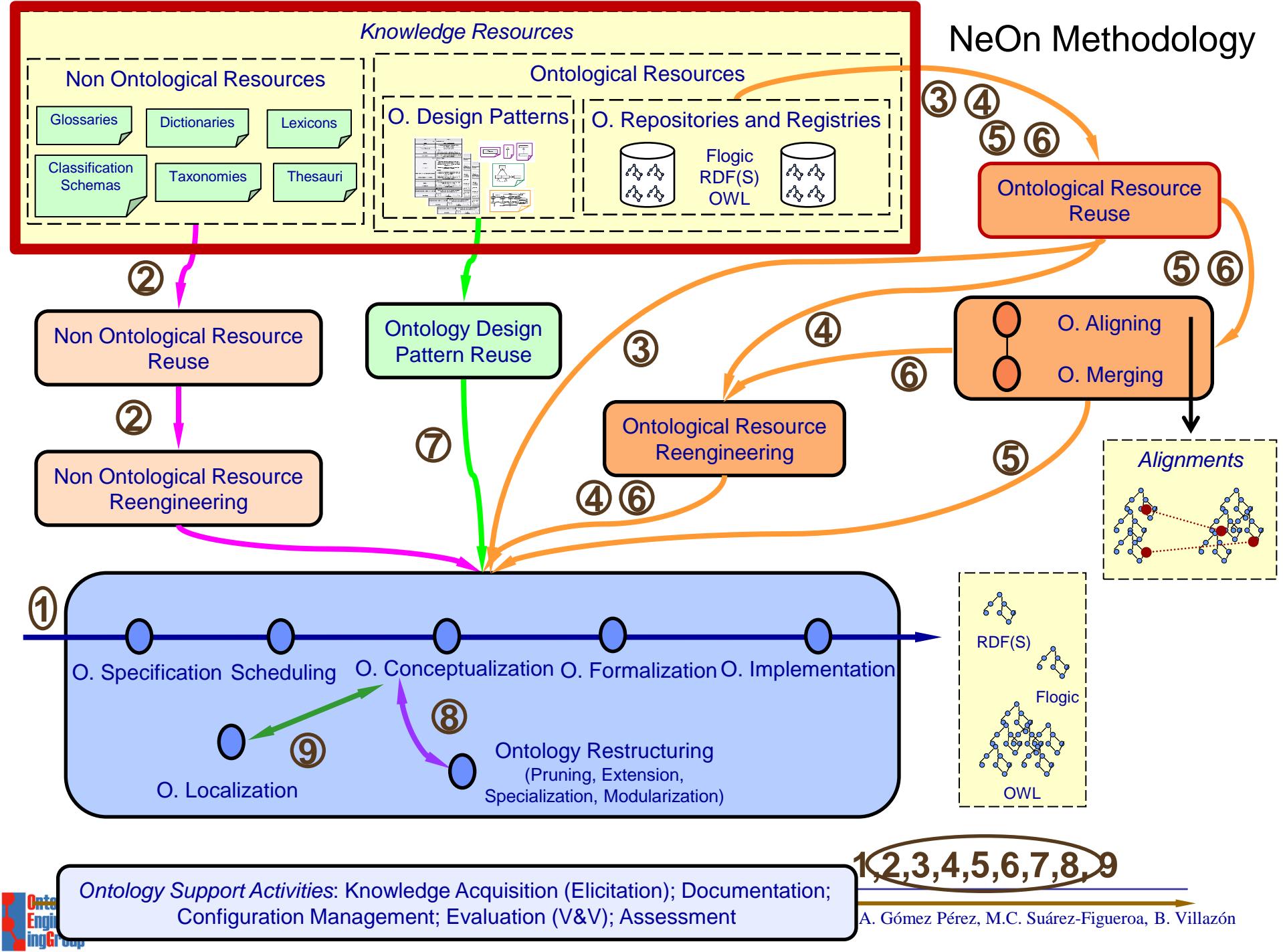
n	

NeOn

Index

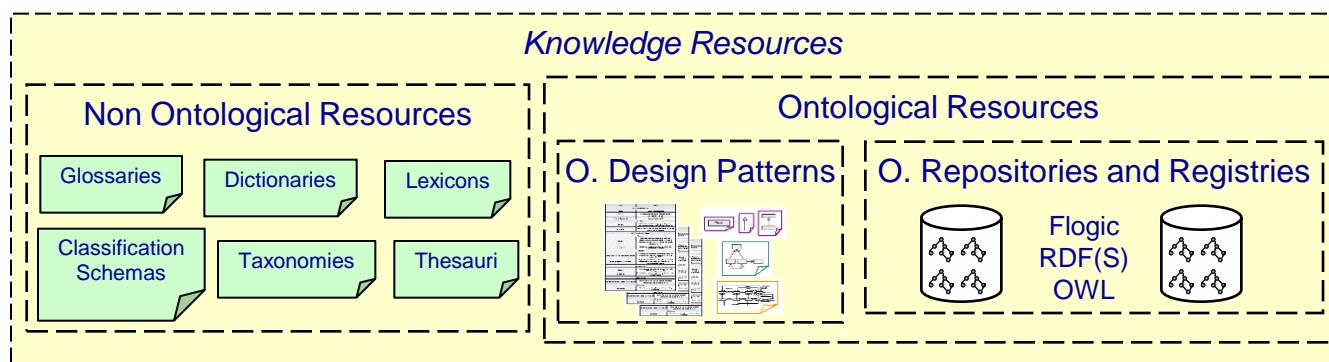
- **Introduction**
- Use cases in Ontology Building
- The NeOn Methodology
 - Glossary of activities
 - Scenarios
 - Lifecycle models
- **Main Activities**
 - Methodological Guidelines for Ontology Specification
 - **Quick Search of Existing Knowledge Resources**
 - Guidelines for Ontology development project Planning
 - Methodological Guidelines for Non Ontological Resource Reuse and Reengineering
 - Methodological Guideliness for Ontology Reuse
 - Creating the final Ontology Model

NeOn Methodology



Searching Resources

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



Objects
Objects in the universe of discourse, which are instances of.
<ul style="list-style-type: none"> • Job Category <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> O12. Austrian O13. Belgian O14. Danish O15. Estonian O16. Finnish O17. French O18. German O19. Greek O20. Italian

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



ISO 4217 (currencies)

Entity	Currency	Code	
		Alphabetic	Numeric
AFGHANISTAN	Afghani	AFN	971
ALBANIA	Lek	ALL	008
ALGERIA	Algerian Dinar	DZD	012
AMERICAN SAMOA	US Dollar	USD	840
ANDORRA	Euro	EUR	978
ANGOLA	Kwanza	AOA	973
ANGUILLA	East Caribbean Dollar	XCD	951
ANTARCTICA	No universal currency		
ANTIGUA AND BARBUDA	East Caribbean Dollar	XCD	951
ARGENTINA	Argentine Peso	ARS	032
ARMENIA	Armenian Dram	AMD	051
ARUBA	Aruban Guilder	AWG	533
AUSTRALIA	Australian Dollar	AUD	036
AUSTRIA	Euro	EUR	978
AZERBAIJAN	Azerbaijanian Manat	AZN	944
BAHAMAS	Bahamian Dollar	BSD	044
BAHRAIN	Bahraini Dinar	BHD	048
BANGLADESH	Taka	BDT	050
BARBADOS	Barbados Dollar	BBD	052
BELARUS	Belarussian Ruble	BYR	974

ISO 3166 (countries)

```
<?xml version="1.0" encoding="ISO-8859-1" standalone="yes"?>
<ISO_3166-1_List_en xml:lang="en">
  <ISO_3166-1_Entry>
    <ISO_3166-1_Country_name>AFGHANISTAN</ISO_3166-1_Country_name>
    <ISO_3166-1_Alpha-2_Code_element>AF</ISO_3166-1_Alpha-2_Code_element>
  </ISO_3166-1_Entry>
  <ISO_3166-1_Entry>
    <ISO_3166-1_Country_name>ÅLAND ISLANDS</ISO_3166-1_Country_name>
    <ISO_3166-1_Alpha-2_Code_element>AX</ISO_3166-1_Alpha-2_Code_element>
  </ISO_3166-1_Entry>
  <ISO_3166-1_Entry>
    <ISO_3166-1_Country_name>ALBANIA</ISO_3166-1_Country_name>
    <ISO_3166-1_Alpha-2_Code_element>AL</ISO_3166-1_Alpha-2_Code_element>
  </ISO_3166-1_Entry>
  <ISO_3166-1_Entry>
    <ISO_3166-1_Country_name>ALGERIA</ISO_3166-1_Country_name>
    <ISO_3166-1_Alpha-2_Code_element>DZ</ISO_3166-1_Alpha-2_Code_element>
  </ISO_3166-1_Entry>
  <ISO_3166-1_Entry>
    <ISO_3166-1_Country_name>AMERICAN SAMOA</ISO_3166-1_Country_name>
    <ISO_3166-1_Alpha-2_Code_element>AS</ISO_3166-1_Alpha-2_Code_element>
  </ISO_3166-1_Entry>
  <ISO_3166-1_Entry>
    <ISO_3166-1_Country_name>ANDORRA</ISO_3166-1_Country_name>
    <ISO_3166-1_Alpha-2_Code_element>AD</ISO_3166-1_Alpha-2_Code_element>
  </ISO_3166-1_Entry>
  <ISO_3166-1_Entry>
    <ISO_3166-1_Country_name>ANGOLA</ISO_3166-1_Country_name>
    <ISO_3166-1_Alpha-2_Code_element>AO</ISO_3166-1_Alpha-2_Code_element>
  </ISO_3166-1_Entry>
  <ISO_3166-1_Entry>
    <ISO_3166-1_Country_name>ANGUILLA</ISO_3166-1_Country_name>
    <ISO_3166-1_Alpha-2_Code_element>AI</ISO_3166-1_Alpha-2_Code_element>
  </ISO_3166-1_Entry>
```

Non-ontological resources - ISCO-88 (COM)

level	description EN	description FR	description DE	texte auto EN	
3	Religious professionals	Membres du clergé	Geistliche, Seelsorger		
3	Public service administrative professionals	Cadres administratifs des services publics	Wissenschaftliche Verwaltungsfachkräfte des öffentlichen Dienstes	This is a new minor group, designed explicitly for the classification of occupations in which the primary tasks consist of general administrative functions within the public	Hier han ausdrückl deren Ha
3	Physical and engineering science technicians	Techniciens des sciences physiques et techniques	Material- und ingenieurtechnische Fachkräfte		
3	Computer associate professionals	Pupitreurs et autres opérateurs de matériels informatiques	Datenverarbeitungsfachkräfte	If the job title and associated information on activities does not permit a clear distinction, additional information on a level of relevant qualifications or description of tasks may	Wenn di Informati erlauben
3	Optical and electronic equipment operators	Techniciens d'appareils optiques et électroniques	Bediener optischer und elektronischer Anlagen		
3	Ship and aircraft controllers and technicians	Techniciens des moyens de transport maritime et aérien	Schiffs-, Flugzeugführer und verwandte Berufe		
3	Safety and quality inspectors	Inspecteurs d'immeubles, de sécurité, d'hygiène et de qualité	Sicherheits- und Qualitätskontrolleure		
3	Life science technicians and related associate professional	Techniciens et travailleurs assimilés des sciences de la vie et de la santé	Biotechniker und verwandte Berufe		
3	Health associate professionals (except nursing)	Professions intermédiaires de la médecine moderne (à l'exception du personnel infirmier)	Medizinische Fachberufe (ohne Krankenpflege)		
3	Nursing and midwifery associate professionals	Personnel infirmier et sages-femmes (niveau intermédiaire)	Nicht-wissenschaftliche Krankenpflege- und Geburtshilfefachkräfte	Concerning "Nursing and midwifery professionals", see notes to sub-major group 22.	Für "Wis Geburtst
3	Primary education teaching associate professionals	Professions intermédiaires de l'enseignement primaire	Nicht-wissenschaftliche Lehrkräfte des Primarbereiches		
3	Pre-primary education teaching associate professionals	Professions intermédiaires de l'enseignement pré primaire	Nicht-wissenschaftliche Lehrkräfte des Vorschulbereiches		
3	Special education teaching associate professionals	Professions intermédiaires de l'éducation des handicapés	Nicht-wissenschaftliche Sonderschullehrkräfte		

Searching non ontological resources

- 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

Is the terminology included in
the Ontology Requirements Specification Document
covered by the resources?

Selection of Ontologies

- Search ontologies
- Compare ontologies in the same domain using a set of criteria
- Assess if the ontologies cover the set of competency questions
- Select the best ontology based on
 - Coverage of the domain
 - Expressivity of the Implementation language

Searching Ontologies in Watson

Ontology Requirement Specification Document

Objects	
Objects in the domain of discourse, which are instances of:	
Job Category	• Education
O1 Computer System Designer	029. Life Science
O2 Computer System Analyst	030. Mathematics
O3 Programmer	031. Computer Science
O4 Computer Engineer	032. Computer Use
O5 Computer Assistant	033. Statistics
O6 Computer Equipment Operator	034. Physics
O7 Industrial Robot Controller	035. Network Administration
O8 Telecommunication Equipment Operator	• Languages
O9 Medical Equipment Operator	036. Swedish
O10 Electronic Equipment Operator	037. Spanish
O11 Image Equipment Operator	038. German
• Nationality	039. Portuguese
O12 Austrian	040. English
O13 Belgian	041. French
O14 Danish	042. German
O15 Estonian	• Currency
O16 Finnish	043. Euro
O17 French	044. Krone
O18 German	045. Great British Pound
O19 Greek	046. Zlate
O20 Italian	047. US Dollar
• Activity Sector	048. Franc
O21 Telecommunication	• Location
O22 Justice and Judicial	049. Austria
O23 Public Security and law	050. Belgium
O24 Manufacture of machine tools	051. Denmark
O25 Research and Development	052. Estonia
O26 Hardware Consultancy	053. Finland
O27 Software Consultancy and Supply	054. France
O28 Data processing	055. Germany
	056. Greece

Watson Semantic Web Search
<http://kmi-web05.open.ac.uk/WatsonWUI/>

diana Apple (110) ▾ Amazon eBay Yahoo! News (1049) ▾ neon-newsfe...n,WP4 (3) WII Old Compute... computers

https://oufe.o... Mail :: Welcom... Virgin.net We... MegaTokyo - ... Watson Sema... Widget Devel... DEXA 2007

 Read this - Check your ontology - Website - Blog university researcher student Search Watson

Found 19 semantic documents - [Restrict Search](#)

1- <http://daml.umbc.edu/ontologies/cobra/0.4/academia> □
 5 KB - RDF,OWL (OWL FULL) - ALCH(D)

- <http://daml.umbc.edu/ontologies/cobra/0.4/academia#University> □
 Label: University
 Comment:
- <http://daml.umbc.edu/ontologies/cobra/0.4/academia#Researcher> □
 Label: Researcher
- <http://daml.umbc.edu/ontologies/cobra/0.4/academia#GradStudentResearcher> □
 Label: GradStudentResearcher
 Comment:
- <http://daml.umbc.edu/ontologies/cobra/0.4/academia#Student> □
- <http://daml.umbc.edu/ontologies/cobra/0.4/academia#GradStudentResearcher> □

 2- <http://annotation.semanticweb.org/ontologies/iswc.owl> □
 30 KB - OWL,RDF (OWL Lite) - AL(D)

- <http://annotation.semanticweb.org/2004/iswc#University> □
- http://annotation.semanticweb.org/2004/iswc#University_of_Karlsruhe □
- <http://annotation.semanticweb.org/2004/iswc#Researcher> □
- <http://annotation.semanticweb.org/2004/iswc#Student> □
- <http://annotation.semanticweb.org/2004/iswc#PhDStudent> □

 3- <http://ontobroker.semanticweb.org/ontologies/ka2-onto-2000-11-07.daml> □

- <http://kmi-web05.open.ac.uk:81/cache/7/64e/14aa/3dd17/adbdb1ce20/2653b336ce35ba101#University> □
- <http://kmi-web05.open.ac.uk:81/cache/7/64e/14aa/3dd17/adbdb1ce20/2653b336ce35ba101#Researcher> □
- <http://kmi-web05.open.ac.uk:81/cache/7/64e/14aa/3dd17/adbdb1ce20/2653b336ce35ba101#student> □
- <http://kmi-web05.open.ac.uk:81/cache/7/64e/14aa/3dd17/adbdb1ce20/2653b336ce35ba101#Student> □
- <http://kmi-web05.open.ac.uk:81/cache/7/64e/14aa/3dd17/adbdb1ce20/2653b336ce35ba101#PhDStudent> □

 4- http://www.ifi.unizh.ch/ddis/fileadmin/pdf/service_broker/iswc.daml □
 32 KB - DAML+OIL,RDF - AL(D)

- <http://annotation.semanticweb.org/iswc/iswc.daml#University> □
- http://annotation.semanticweb.org/iswc/iswc.daml#University_of_Karlsruhe □
- <http://annotation.semanticweb.org/iswc/iswc.daml#Researcher> □

Watson NeOn Toolkit plugin

- While building an ontology with the Neon toolkit
- Find descriptions of existing entities in Web ontologies
- Integrate these descriptions into the edited ontology
- Thus allowing knowledge reuse at the scale of the Semantic Web
- In one simple, integrated, and interactive tool

