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)

Ontological Engineering

It refers to the set of activities that concern

the ontology development process,

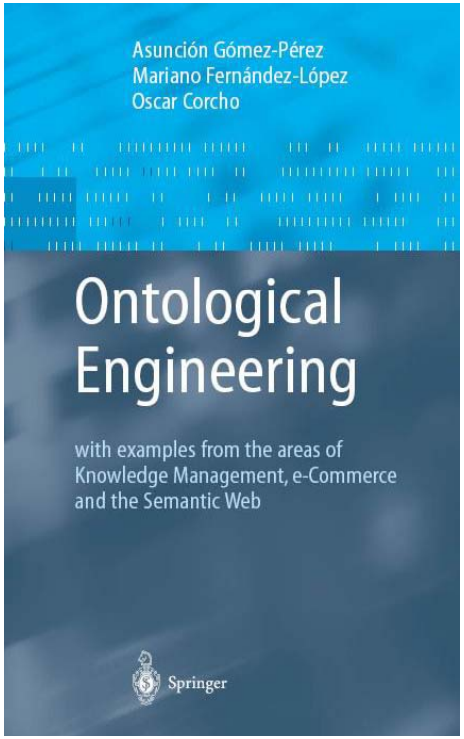
the ontology life cycle,

the methods and methodologies for building ontologies,

and the tool suites

and languages that support them

References



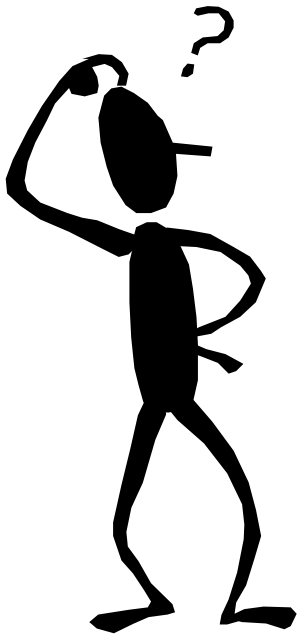
http://www.neon-project.org/

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

Index

- **Introduction**
- Scenarios in Ontology Building
- 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

I want to build my ontology



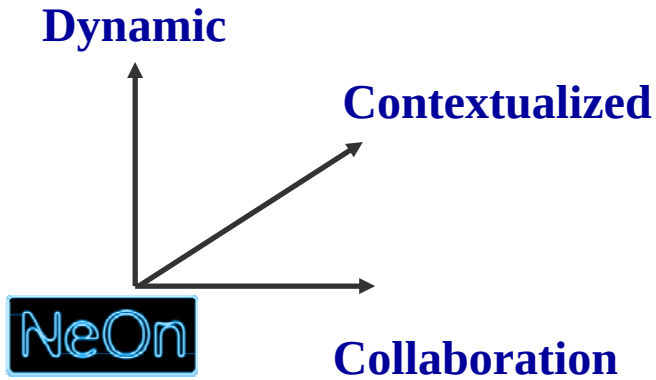
- Which are the key process and activities in ontology development?
- Which activities do I need in my development?
- When should I carry out each activity?
- Where is the relationship of one activity with the others?
- How do I collect the requirements of my ontology?
- Where can I find ontologies with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

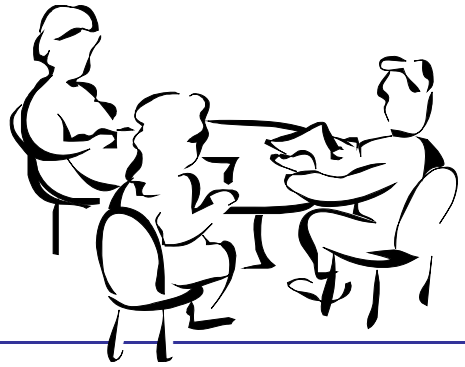
Most relevant methodologies

Methodologies for building single ontologies

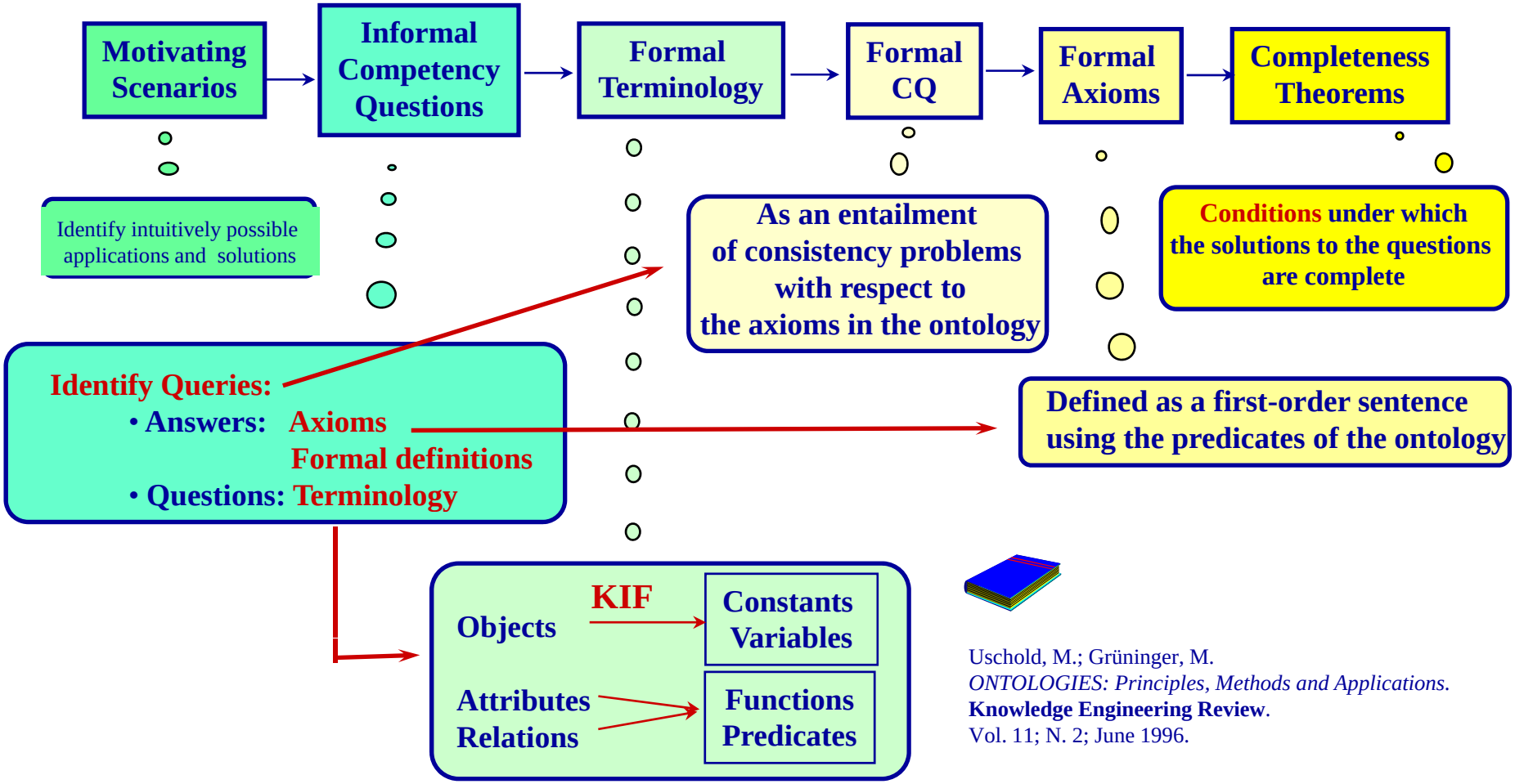
- Uschold and King's method
- Grüninger and Fox's methodology
- KACTUS approach
- METHONTOLOGY
- SENSUS method
- On-To-Knowledge
- DILIGENT

NeOn methodology for building ontology networks



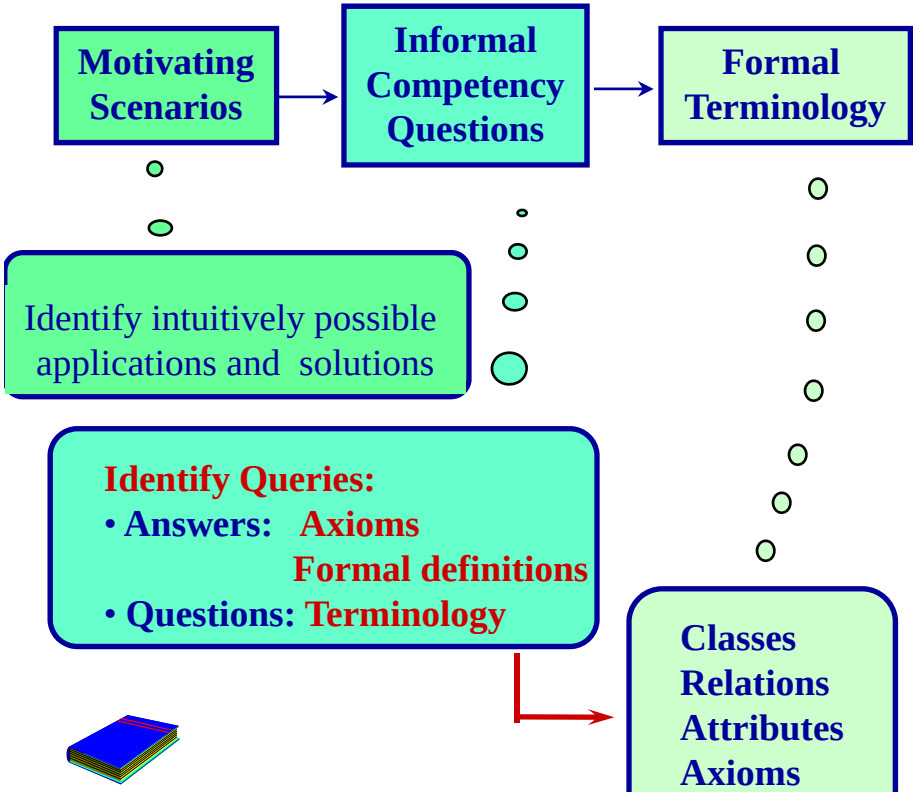


TOVE Methodology



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

Getting terminology using Competency Questions



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

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 Methodology

1. Identify Purpose and Scope

2. Building the ontology

   - Ontology Capture
   - Ontology Coding
   - Integrating existing ontologies

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

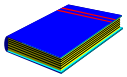
   • Commit to a meta-ontology
   • Choose a representation language
   • Write the code

   How and whether to reuse ontologies that already exist

3. Evaluation

4. Documentation

5. Guideliness for each phase

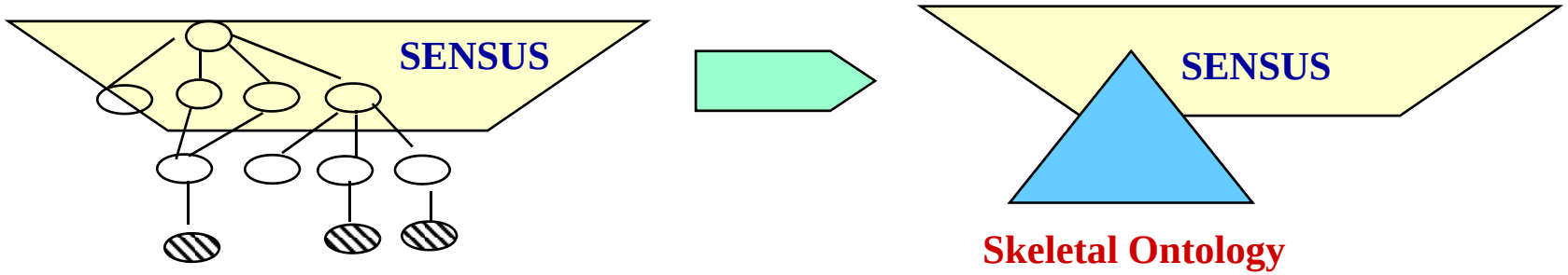


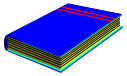
Uschold, M.; Grüninger, M. *ONTOLOGIES: Principles, Methods and Applications.* **Knowledge Engineering Review**. Vol. 11; N. 2; June 1996.

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

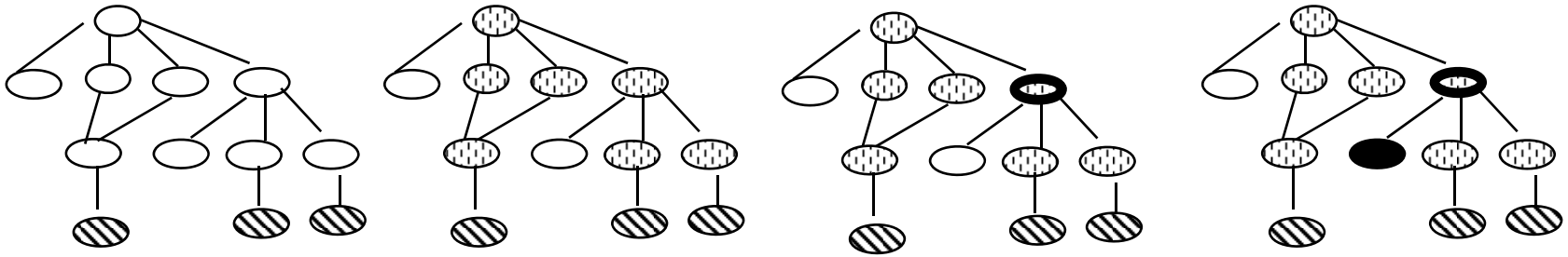

Sensus Term

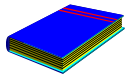

Seed


Path to root


Frequent Parent


Subtree Term

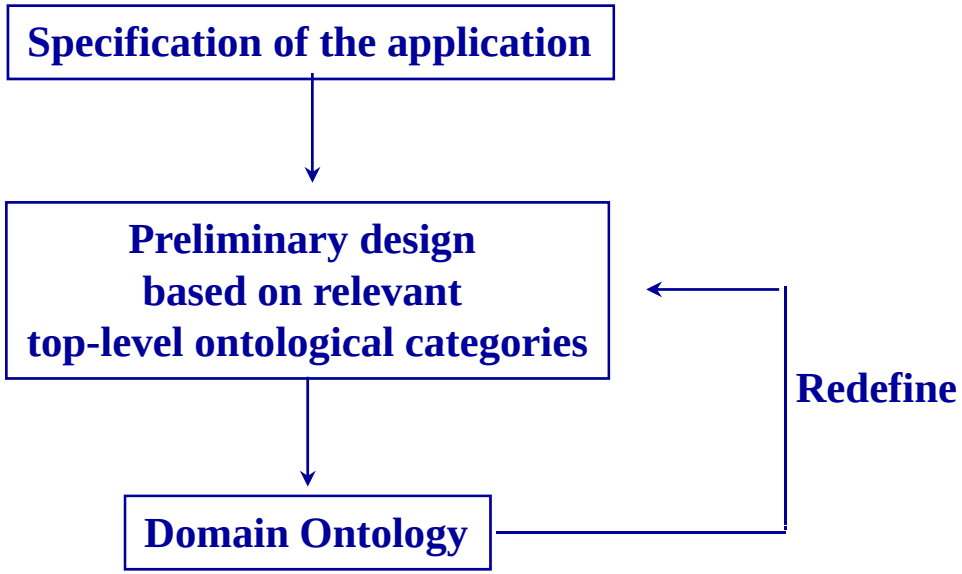


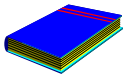


B. Swartout; R. Patil; k. Knight; T. Russ. *Toward Distributed Use of Large-Scale Ontologies* **Ontological Engineering.** AAAI-97 Spring Symposium Series. 1997. 138-148.

Bernara, Laresgoiti, Corera Methodology

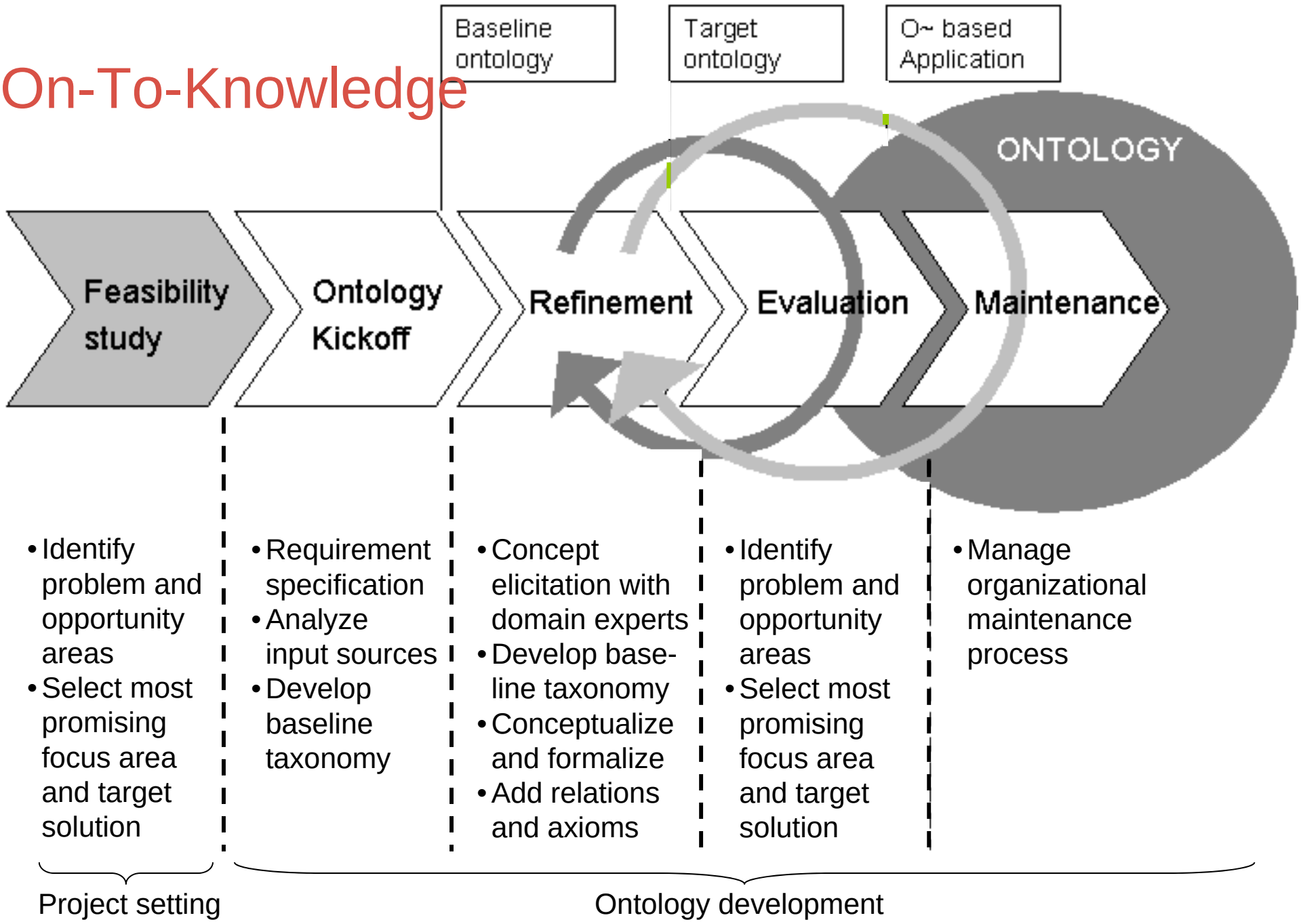
Build a preliminary ontology for refinement and augment with new definitions



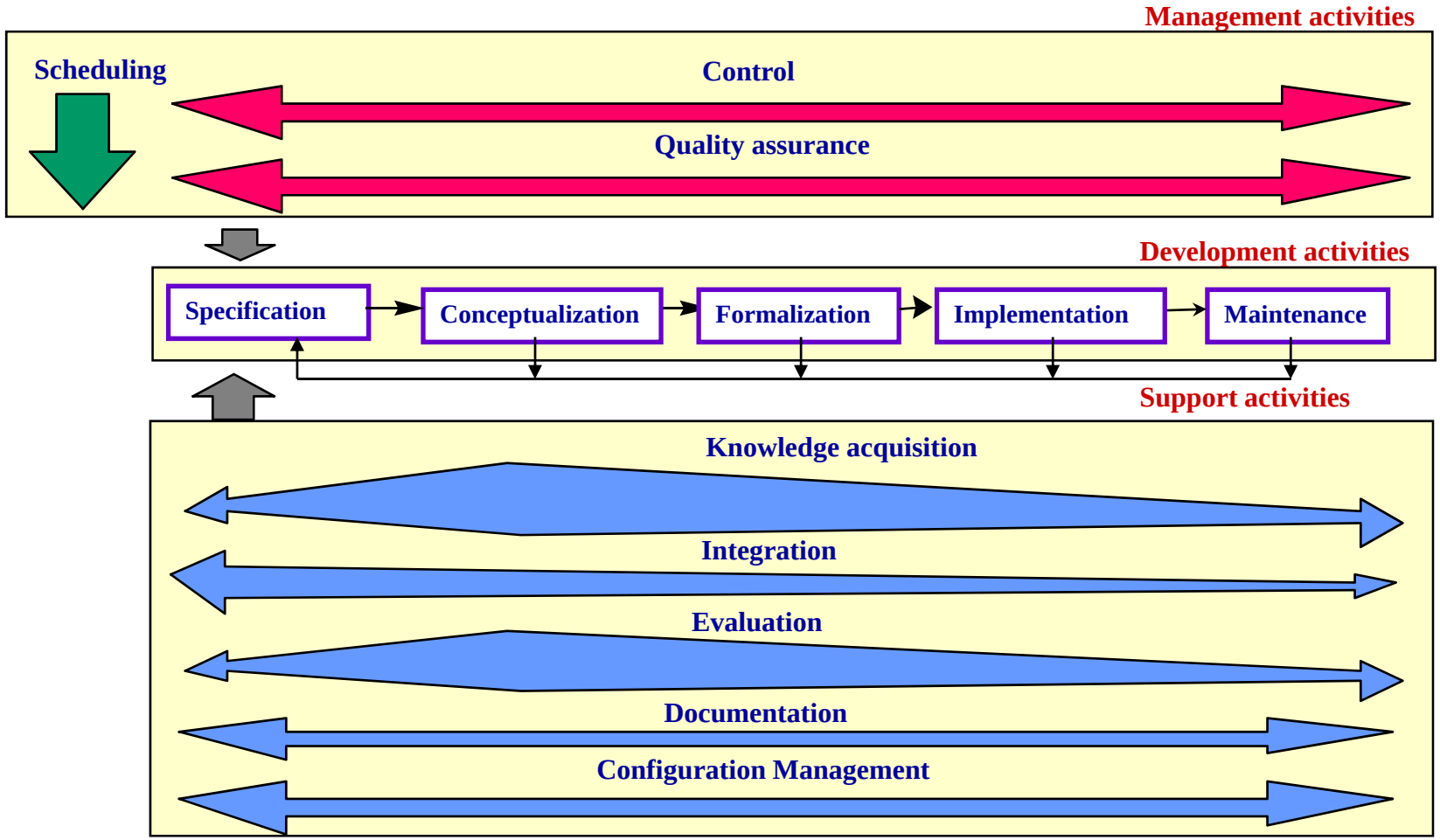


A. Bernaras; I. Laresgoiti; J. Corera. *Building and reusing ontologies for electrical network applications* **ECAI96. 12th European Conference on Artificial Intelligence.** 1996. 298-302

On-To-Knowledge



Methontology



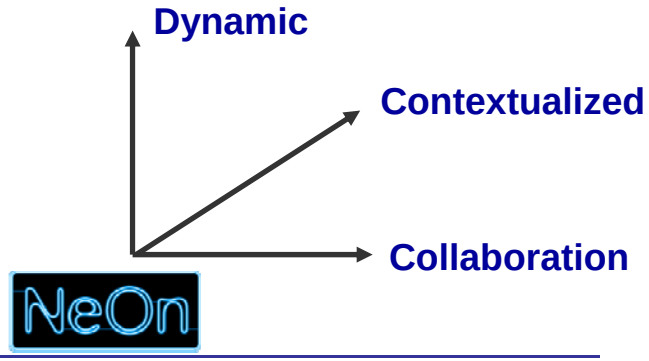
Limitations of current methodologies

- Methontology, On-To-Knowledge are for building ontologies from scratch
- They lack guidelines for:
  - building ontologies by reusing and reengineering existing knowledge aware resources
  - for contextualizing an existing ontology and plugging it in with existing ontologies that might be in continuous evolution
  - Building ontologies in a collaborative way
  - software developers that need to include ontologies into their IT developments

NeOn Ontology Development Paradigm

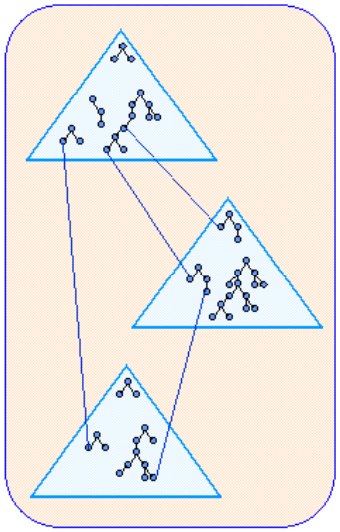
Whose emphasis is on

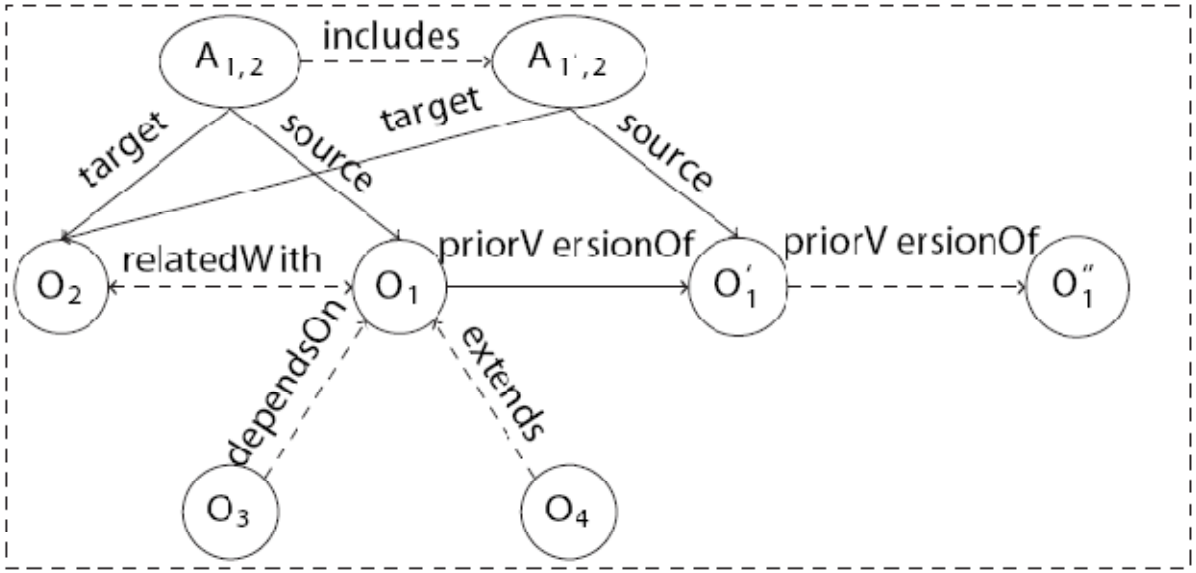
- the *reuse and reengineering of knowledge aware resources*
- the *collaborative and argumentative ontology development*
- the *building of ontology networks*, as opposed to custom-building new ontologies from scratch.



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.

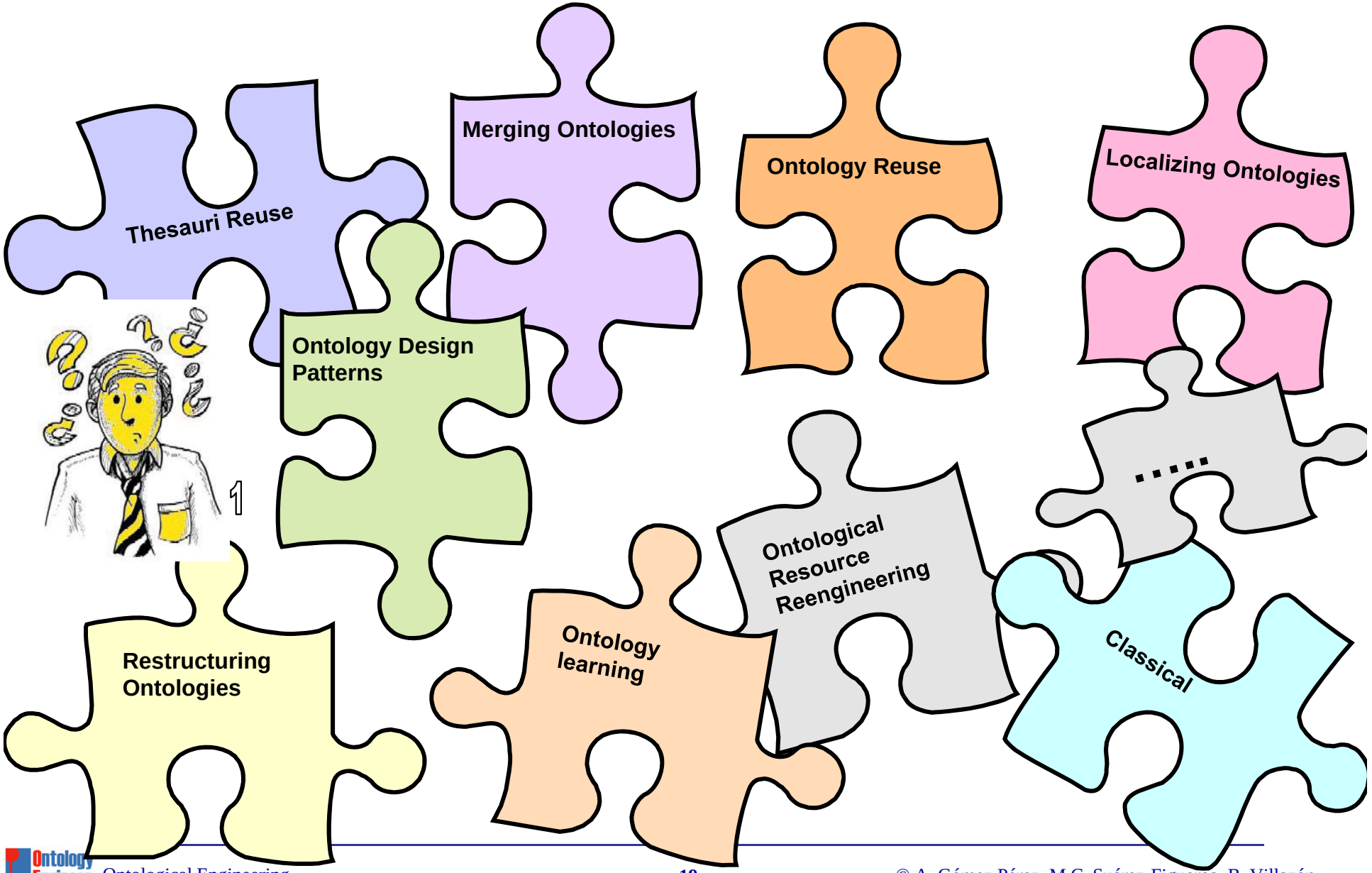




Index

- Introduction
- **NeOn Scenarios in Ontology Building**
- 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 Guidelineess for Ontology Reuse
- Creating the Ontology Model

Too many activities…



Building Ontologies: Use Case

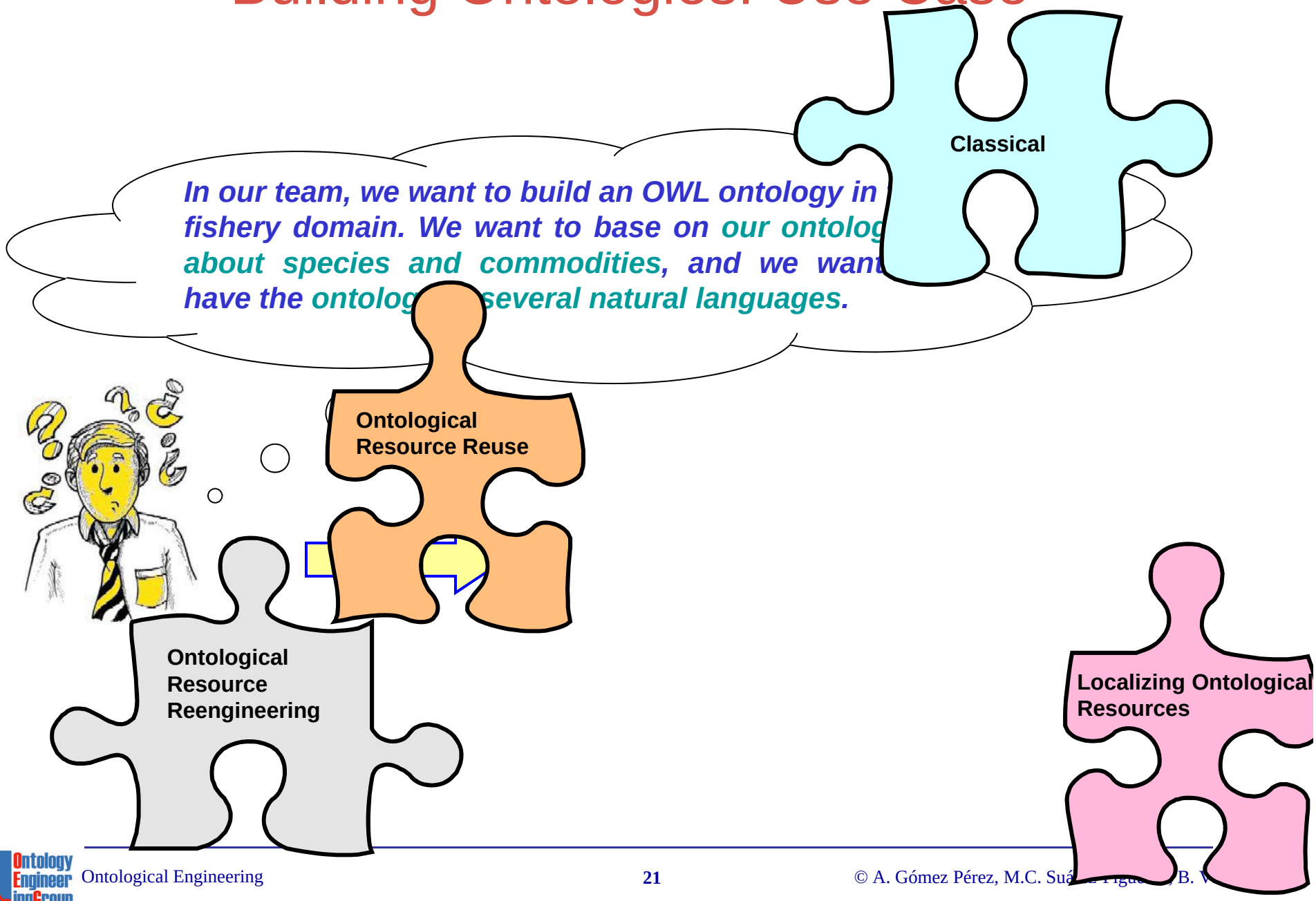
In our team, we want to build an OWL ontology in the pharmaceutical domain, but we want to use several pharmaceutical standards in XML and classification schemes in our own format.

Classical

Non Ontological Resource Reuse

Non Ontological Resource Reengineering

Building Ontologies: Use Case



Key asssets in the NeOn methodology

- The NeOn Glossary of activities
- Table of Recommended and If-Applicable" Activities
- The NeOn scenarios
- All processes and activities are described with:
  - A filling card
  - A workflow
  - Examples

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

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

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

Some definitions

article | discussion | 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*.

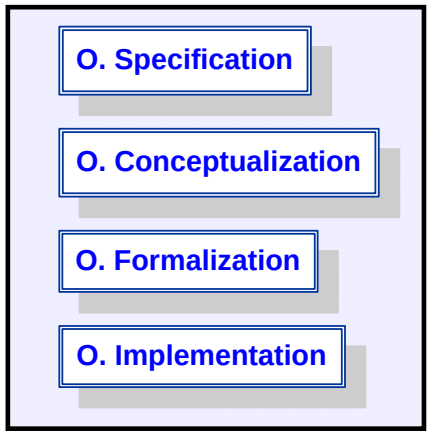
WP5WorkingArea: Ontology Population

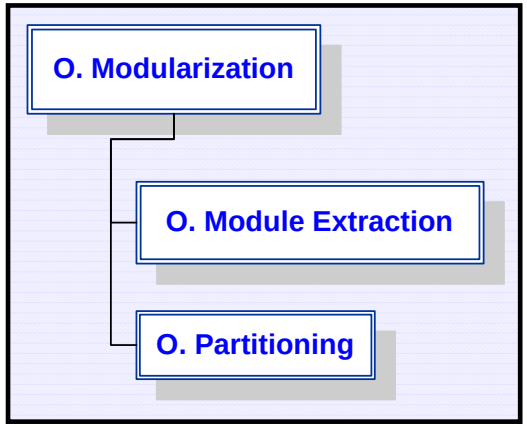
(Redirected from WP5WorkingArea: Ontology Population/Grounding)

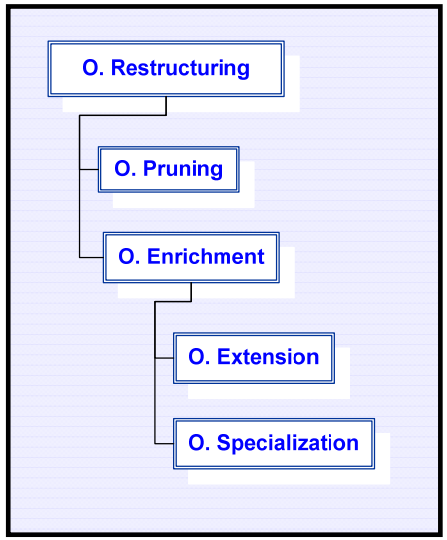
- **Final Definition**: *Ontology Population* is a knowledge acquisition activity that relies on (semi-) automatic methods to transform unstructured (e.g. corpora), semi-structured (e.g. folksonomies, html pages, etc.) and structured data sources (e.g. data bases) into instance data (e.g. A-Box).
- **Activity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

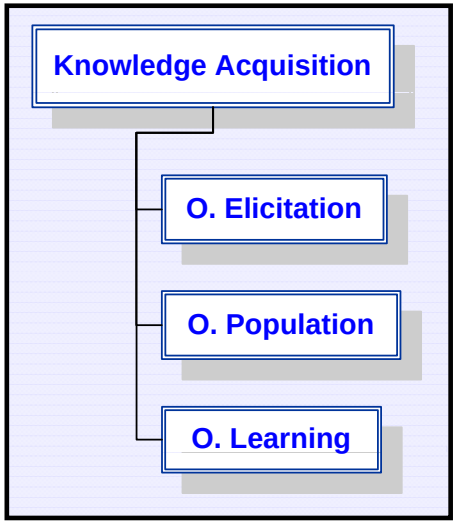
http://www.neon-project.org/wiki/index.php?title=WP5D5.3.1#NeOn_Glossary_of_Activities

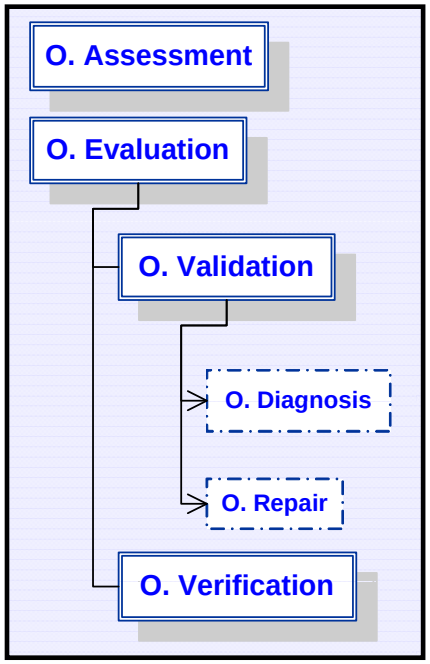
Relating Activities

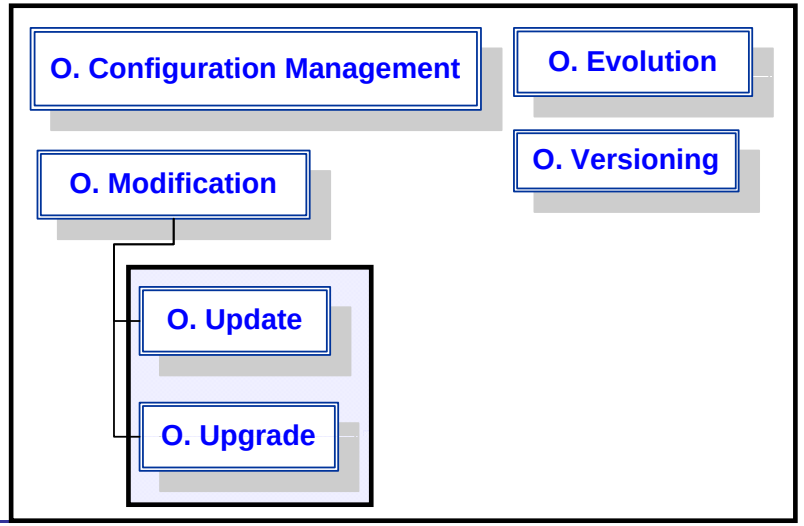










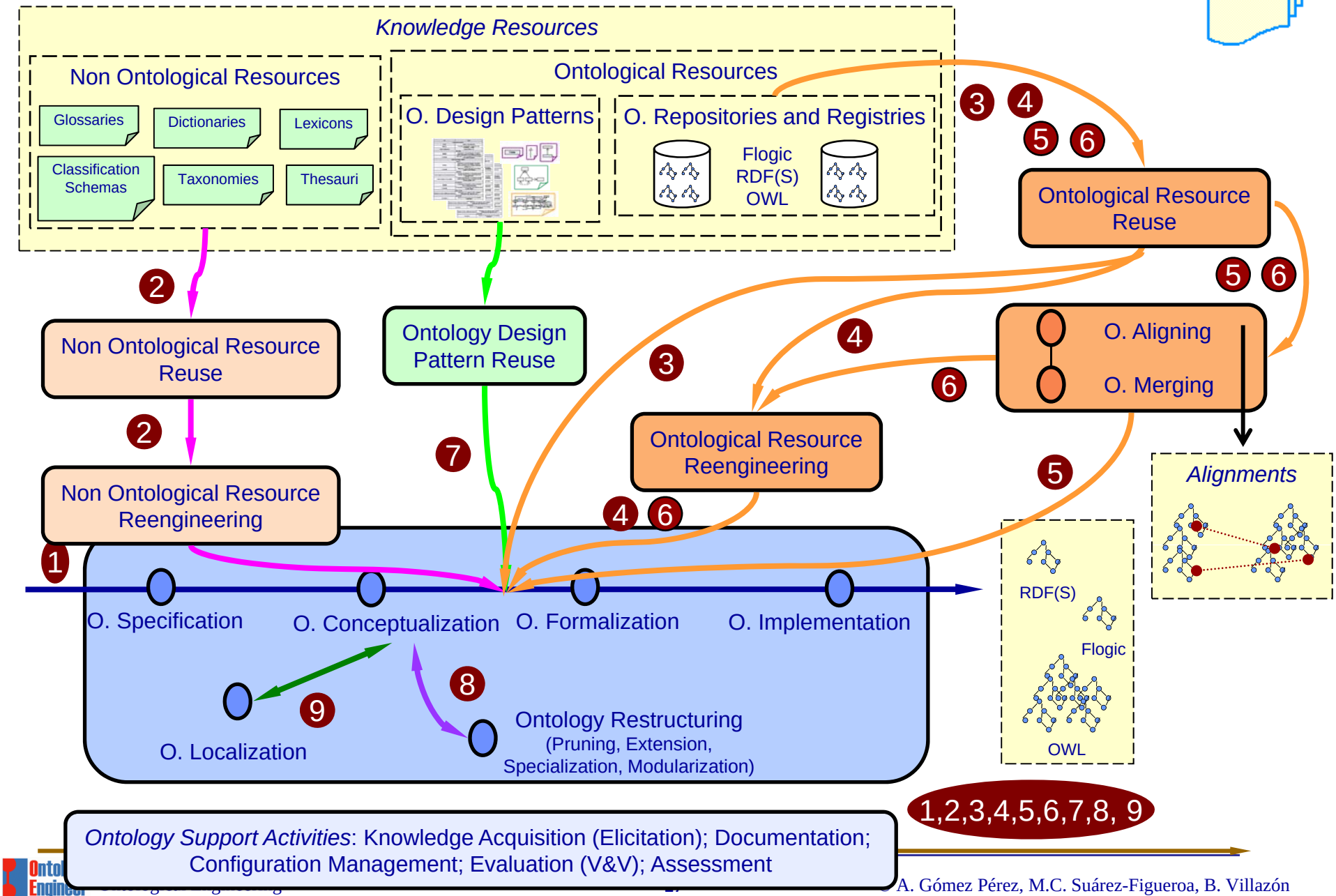


“Recommended and If-Applicable” Activities

- 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.

	Required	*If Applicable*
Ontology Conceptualization	X	
Ontology Evaluation	X	
Ontology Integration	X	
Knowledge Acquisition for Ontologies	X	
Ontology Learning		X
Ontology Localization		X
Ontology Matching		X
Ontology Search	X	
Ontology Specification	X	

NeOn Scenarios



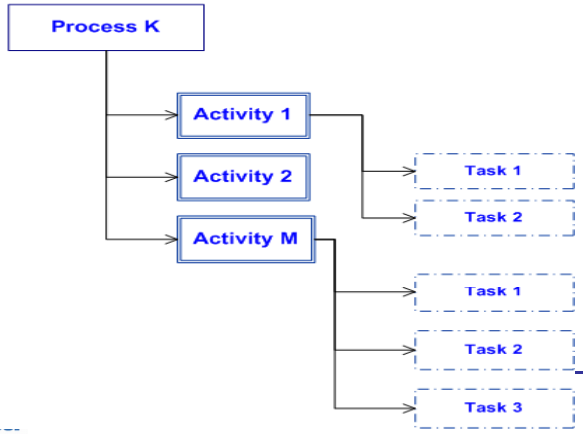
Scenarios

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.

NeOn Methodology

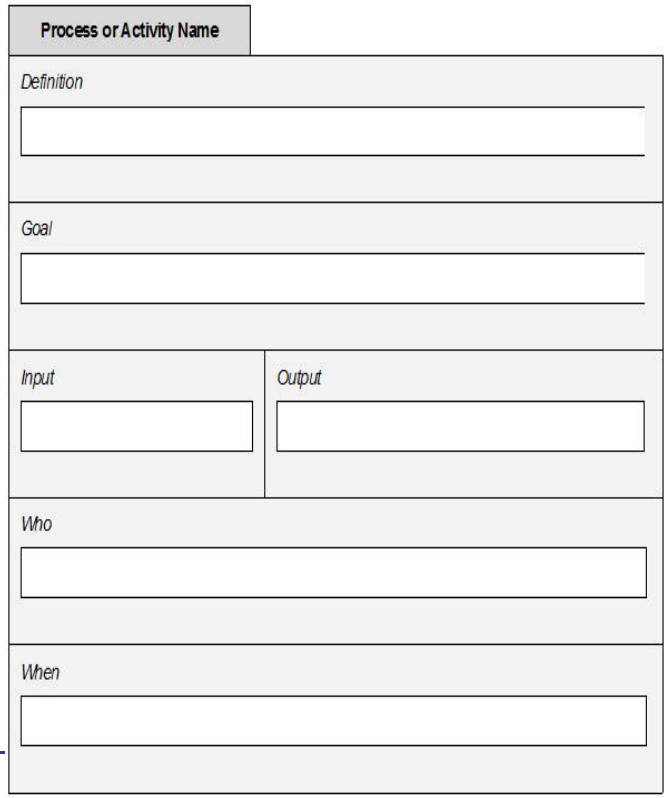
Process and activities covered:

- 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:

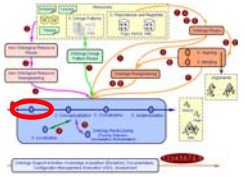
- A filling card
- A workflow
- Examples



Index

- Introduction
- Scenarios in Ontology Building
- **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 Requirement Specification

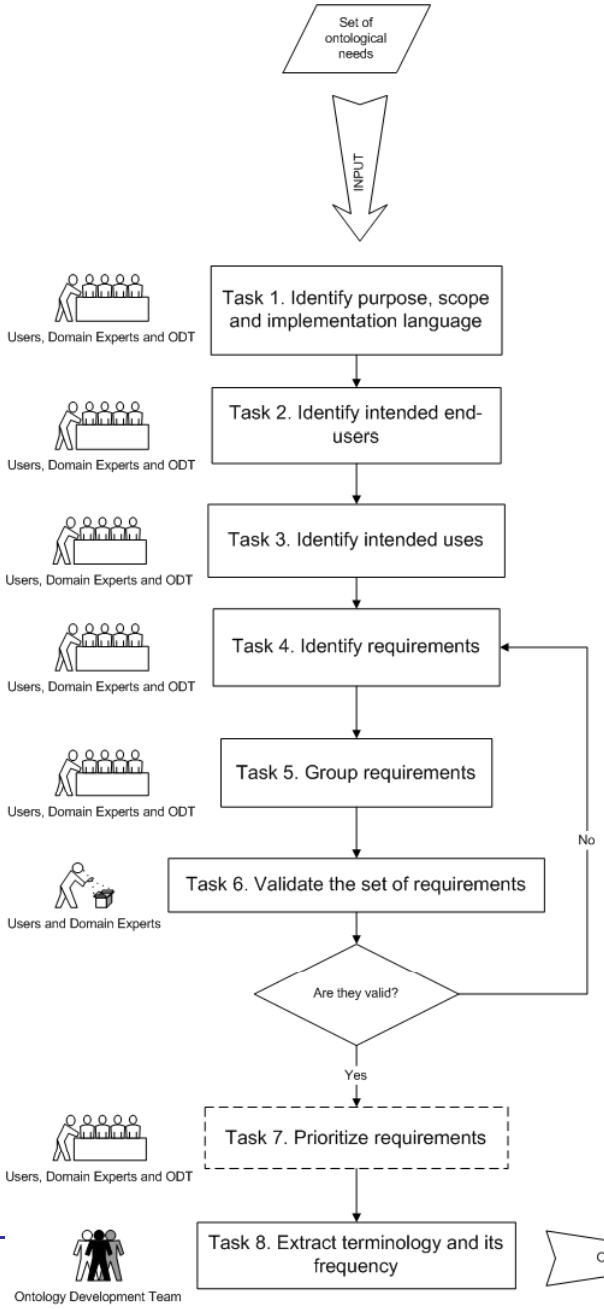


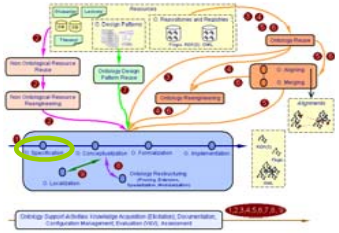
Ontology Specification	
Definition *Ontology Specification* refers to the activity of collecting the requirements that the ontology should fulfill, e.g. reasons to build the ontology, target group, intended uses, possibly reached through a consensus process.	
Goal The specification activity states why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



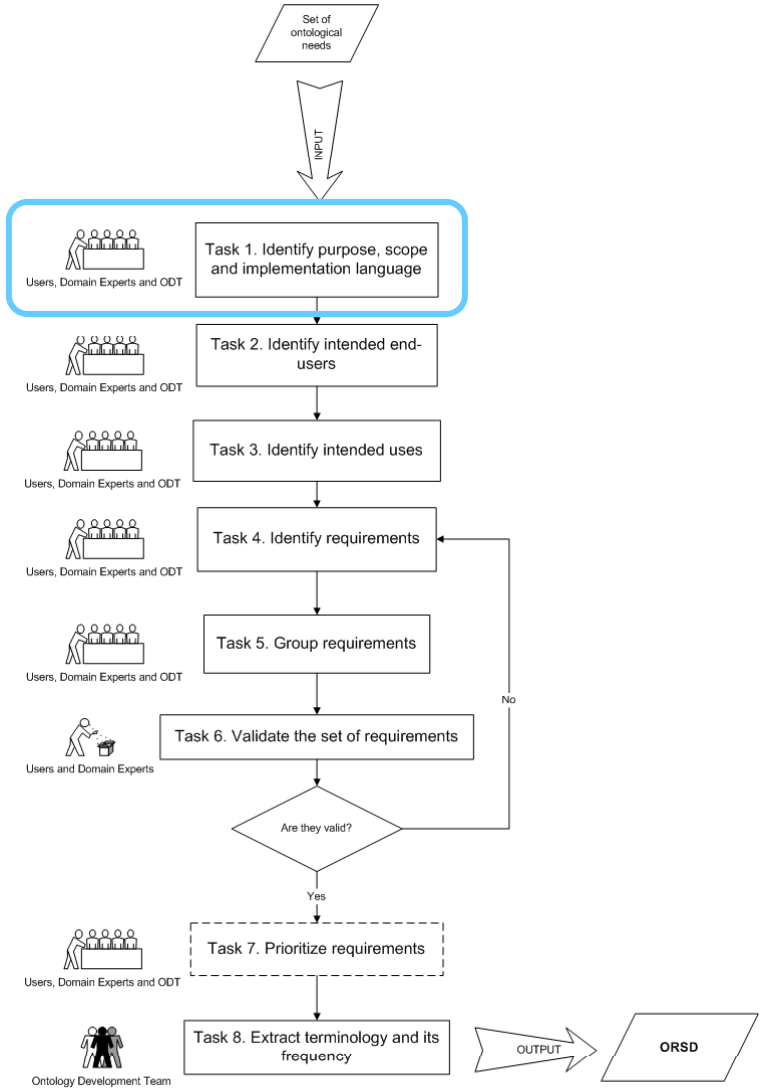


Ontology Requirements Specification Document. Template

Ontology Requirements Specification Document Template	
1	**Purpose**
	The main general 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 have.
4	**Intended End-Users**
	The intended end-users expected for the ontology.
5	**Intended Uses**
	The intended uses expected for the ontology.
6	**Ontology Requirements**
	a. Non-Functional Requirements
	The general requirements or aspects that the ontology should fulfil, including optionally priorities for each requirement.
	b. Functional Requirements: Groups of Competency Questions
	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.
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.

Helping Job Seekers on their way

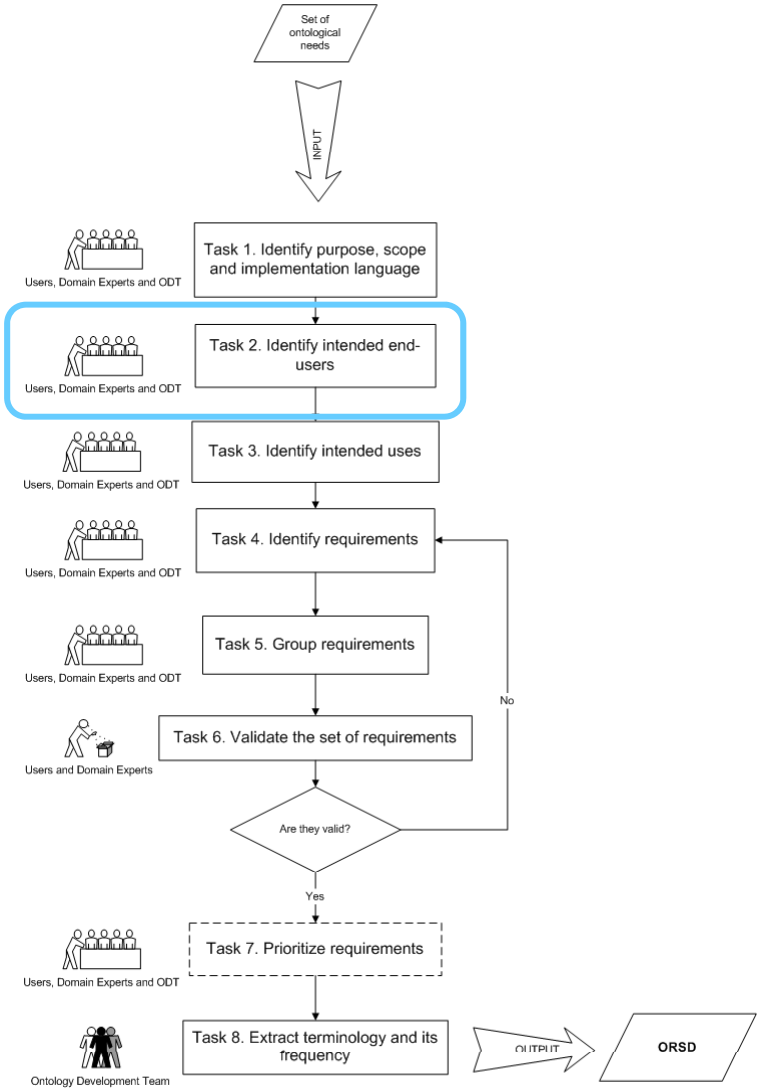
Ontology Requirements Specification. Task 1



- 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 WSML language.

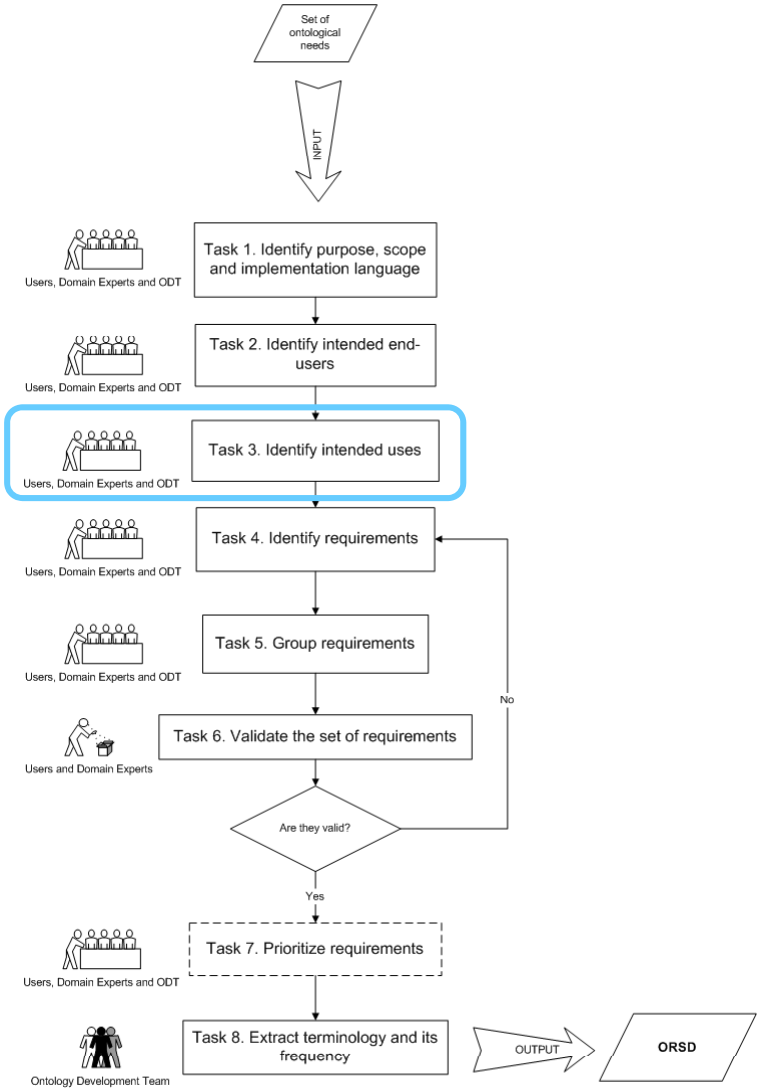
Ontology Requirements Specification. Ta
2



- 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.

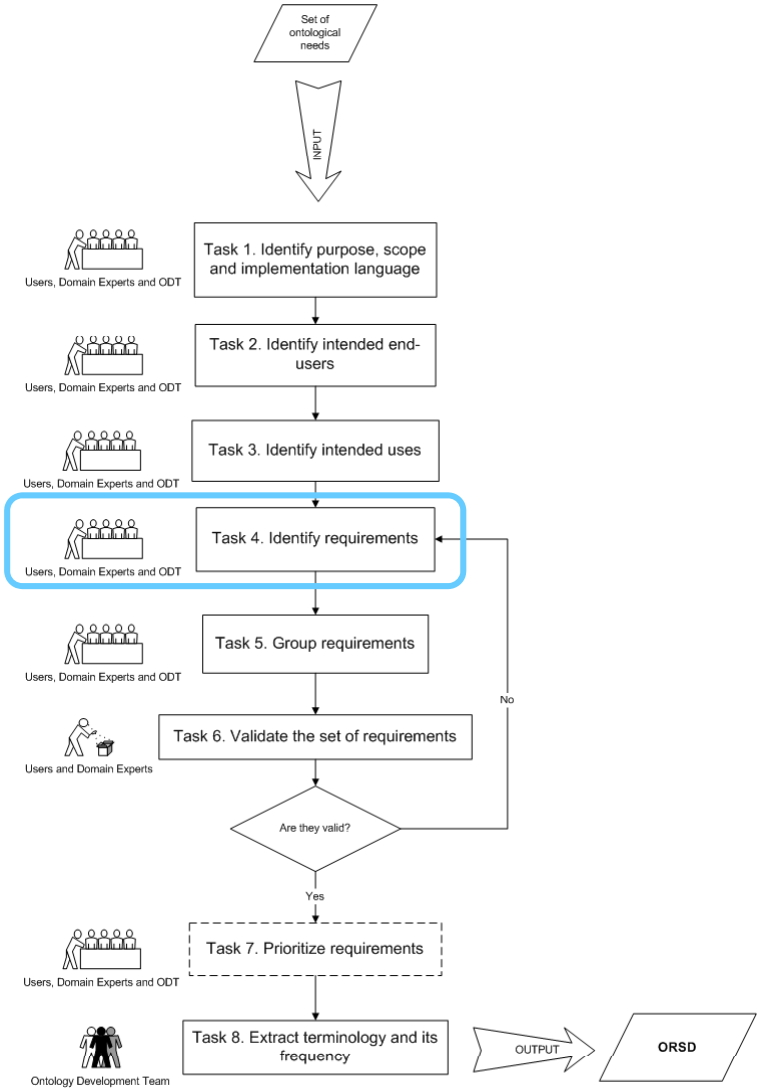
Ontology Requirements Specification. Task 3



- 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.

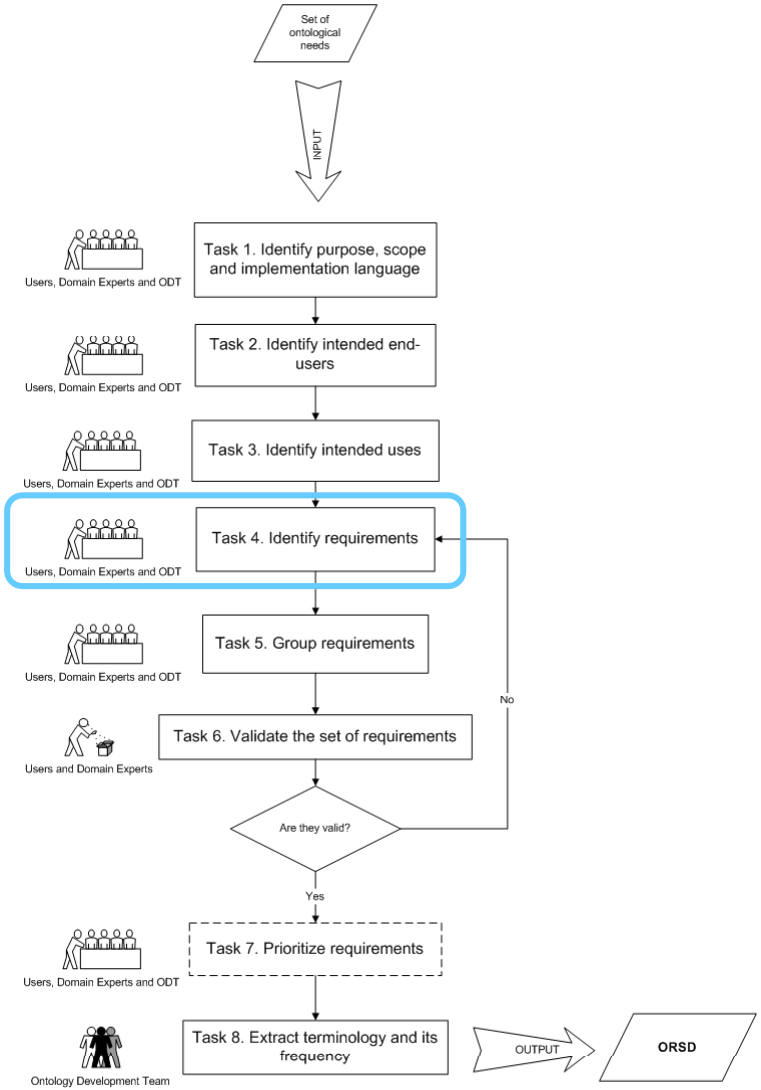
5	Intended Uses
Use 1.	Publish CV. Job seeker places his/her CV on the PES Portal.
Use 2.	Publish Job Offer. An Employer places a Job Offer on the PES Portal.
Use 3.	Search for Job Offers. The Employer looks for candidates for the Job Offer through PES Portal.
Use 4.	Search for Employment information. Job Seeker looks for of 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

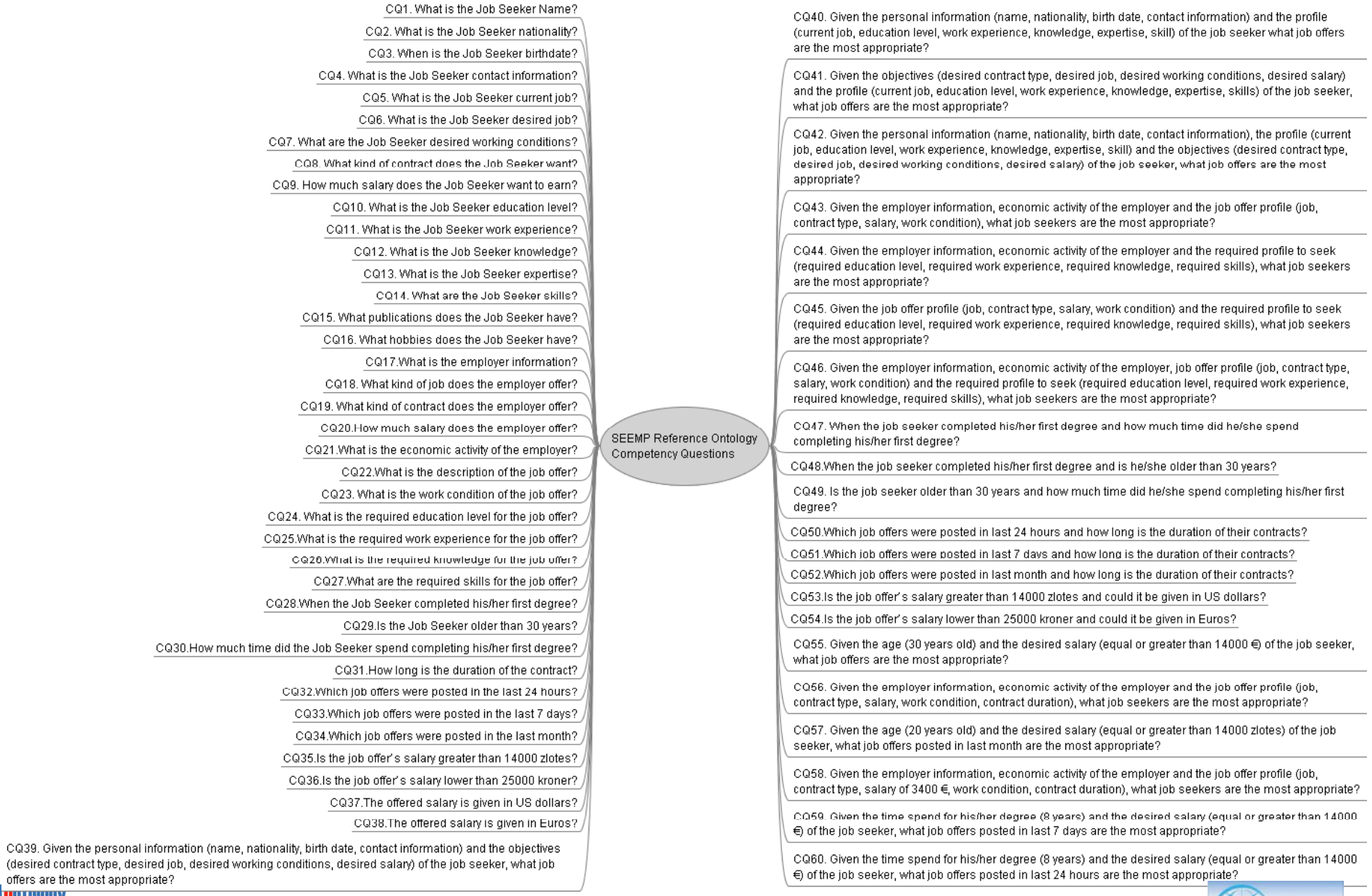
Ontology Requirements Specification. Task 4 (II)



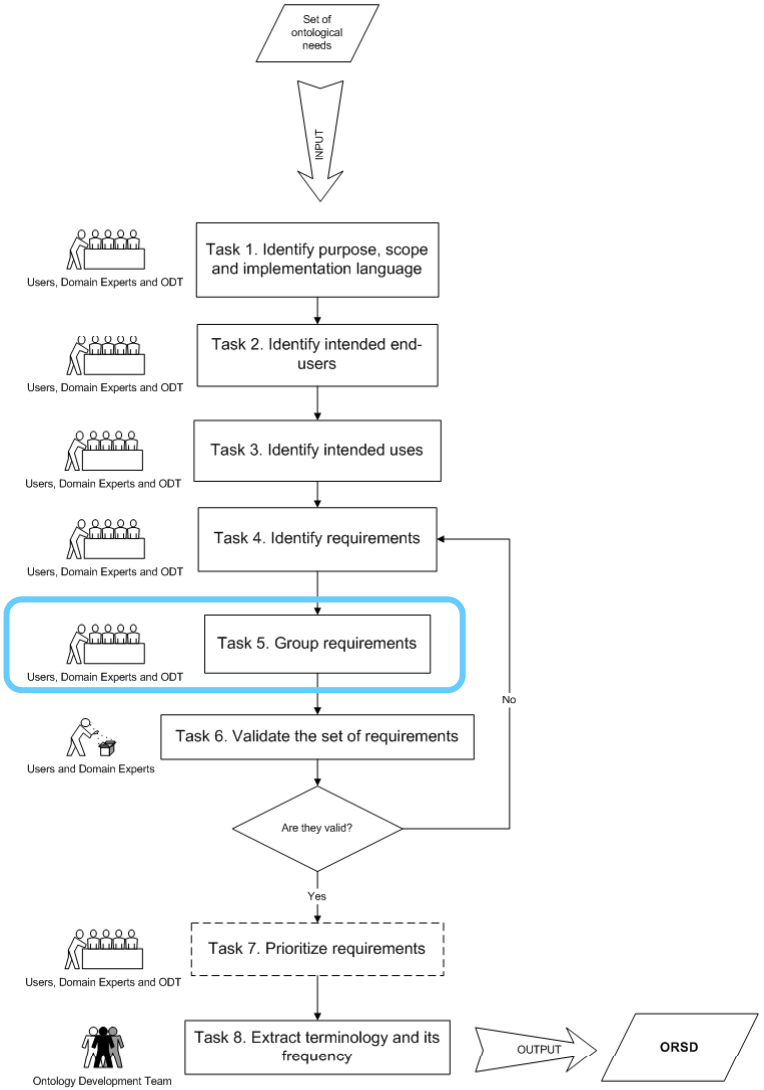
- *Approaches*:
  - Top-Down: Complex questions are decomposed in simple ones.
  - Bottom-Up: Simple questions that are organised to form complex ones.
  - Middle out: Mix approach between top-down and bottom-up.

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



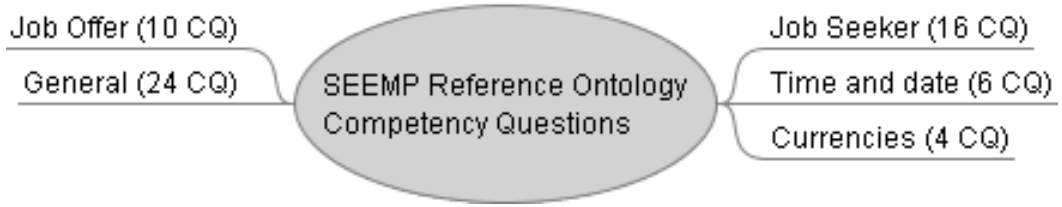
Ontology Requirements Specification. Task 5

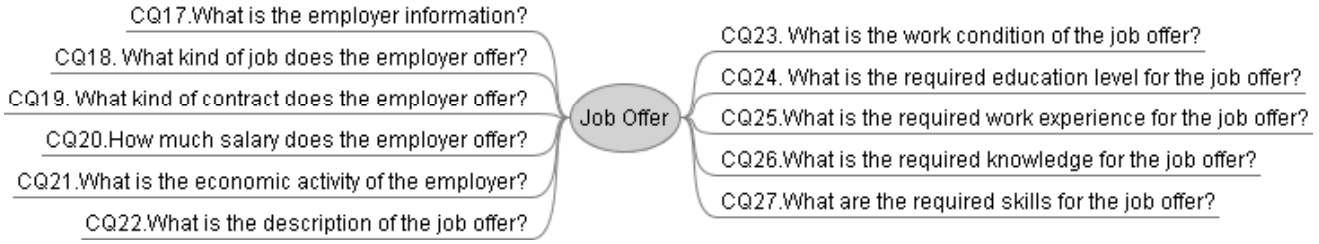


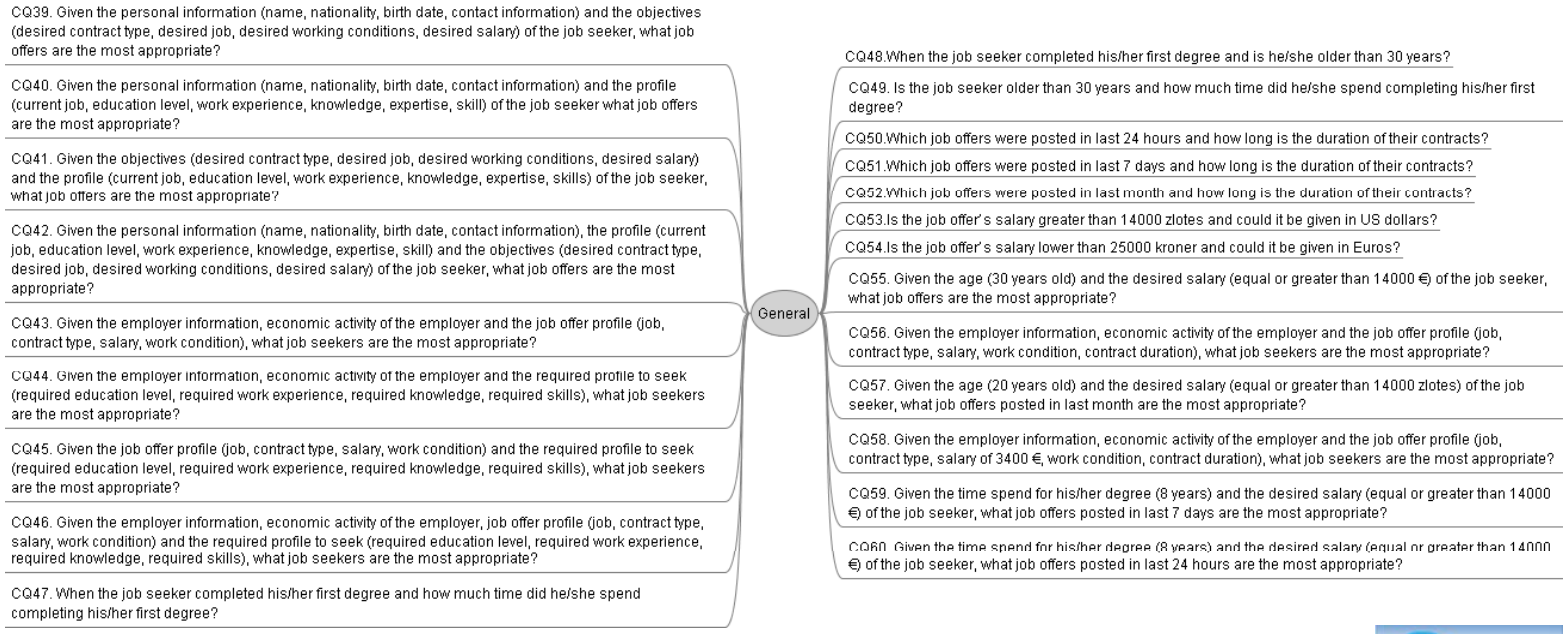
- *Input*: the list of CQs
- *Objective*: obtaining different **groups of CQs**
- *Techniques*: Card Sorting, when the grouping is done manually, and Clustering NL sentences or Information Extraction when the grouping is done automatically
- *Tools*: MindMap Tools or Cicero Tool (for distributed teams)
- *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.

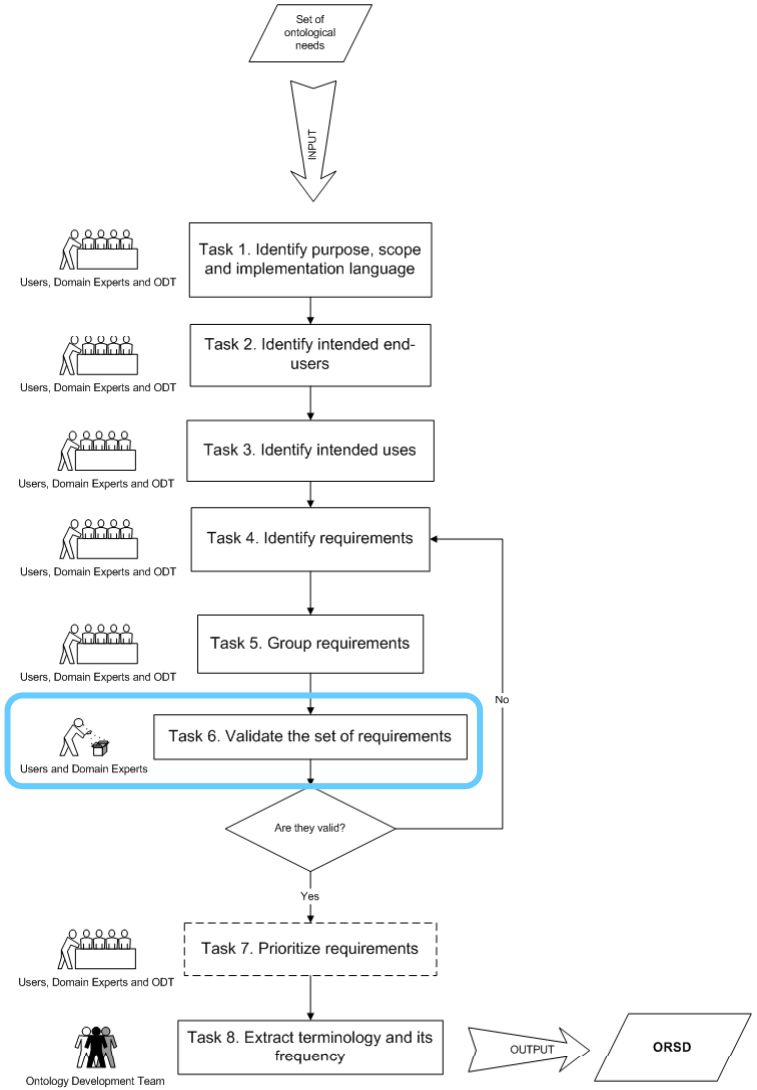
Task 5. Group requirements (CQs)







Ontology Requirements Specification. Task 6



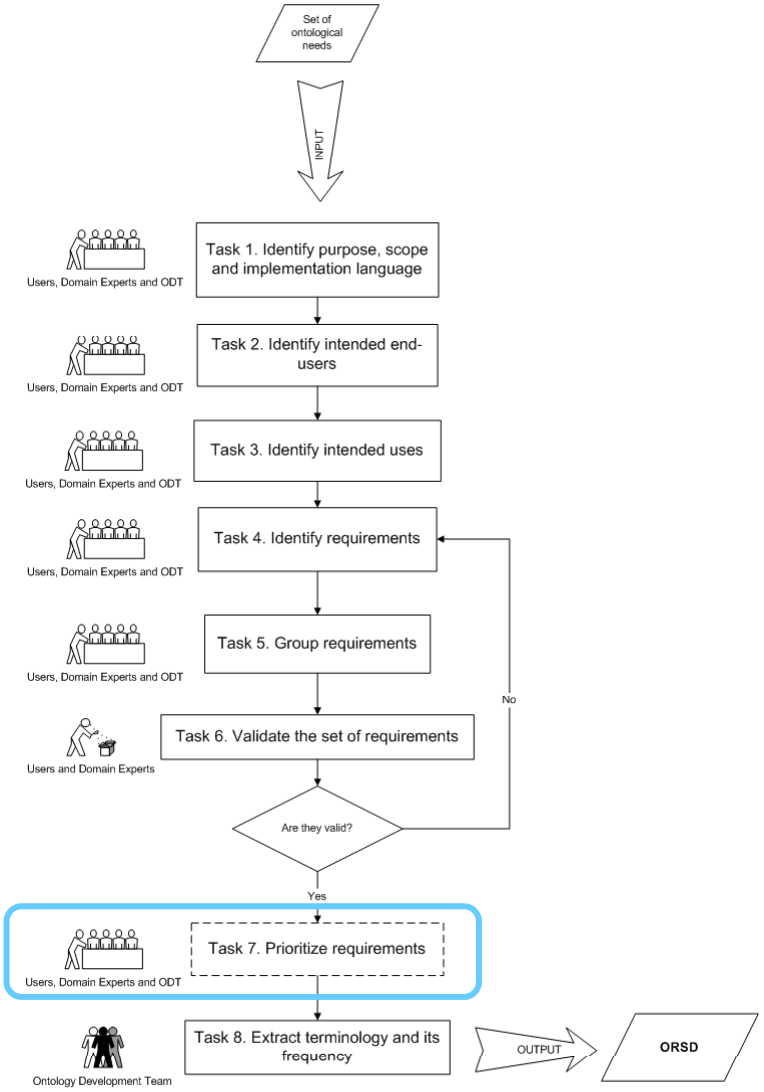
- *Input*: the set of grouped CQs
- *Objective*: to identify possible conflicts between CQs, missing CQs, and contradictions in CQs. To decide **if such CQs are valid or not**
- *Output*: a confirmation about the validity of the set of COs
- *Criteria*:

Correctness.
Consistent.
Understandable.
Conciseness.
Modifiable.
Traceable.
Completeness.
Verifiable.
No Ambiguity.
Realism.

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.

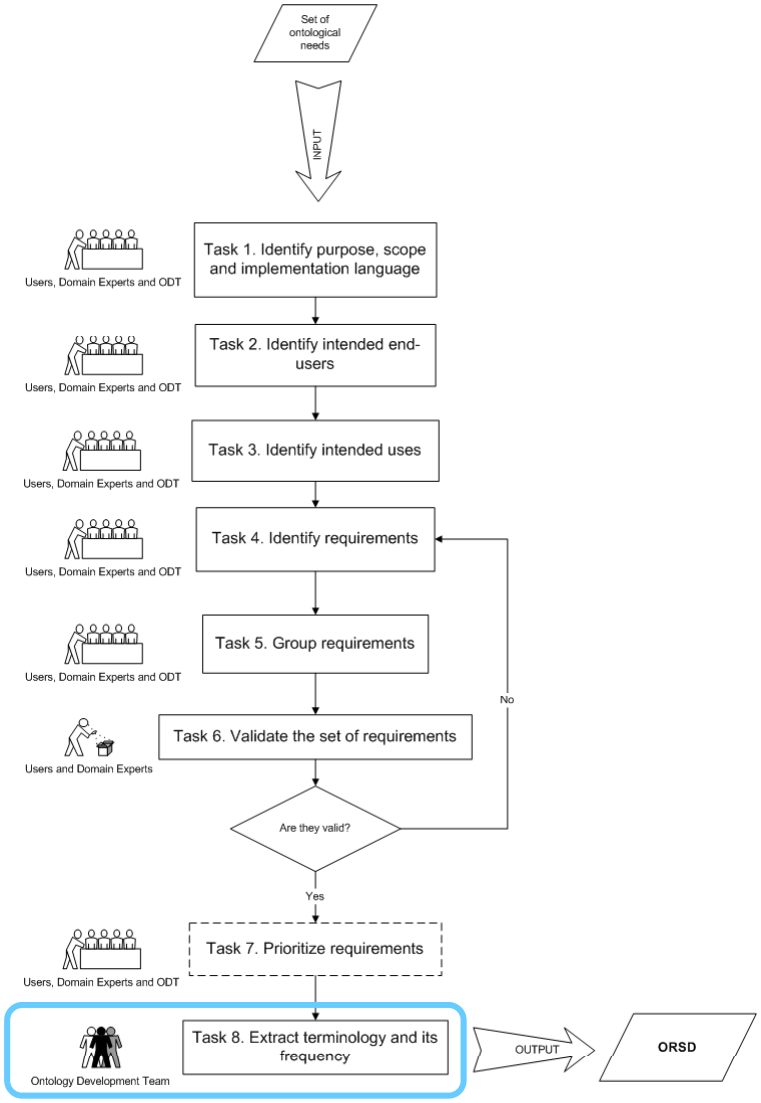
Ontology Requirements Specification. Task 7



- *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
	User 1. Candidate who is unemployed and searching for a jo occupation for immediate or future purposes
	User 2. Employer who needs more human resources.
	User 3. Public or private employment search service which c CVs or job postings and to prepare some data and statis
	User 4. National and Local Governments which want to anal employment market in their countries and prepare doc social and educational policy.
	User 5. European Commission and the governments of EU c analyze the statistics and prepare international agreen the employment, social and educational policy.

5	Intended Uses
	Use 1. Publish CV. Job seeker places his/her CV on the PES P
	Use 2. Publish Job Offer. An Employer places a Job Offer on
	Use 3. Search for Job Offers. The Employer looks for cand through PES Portal.
	Use 4. Search for Employment information. Job Seeker information about employment in a given location at th
	Use 5. Provide Job Statistics. The PES Portal provides emp Job Seeker and Employer.

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.

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

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.			

ish; Italian; French;
0/03/1970; 15/04/1978
Tel: 34600654231. Email:
mer; Computer Engineer;
gineer; Hardware designer;
conditions? Autonomous;
t? Full time; Partial time;
m? 3000 Euros per month,
Basic education; Higher
as, 1 year, 2 years
amming; C Programming,
neering
; network administration
esearch Company, Milano,
r? Java Programmer; C
easonal Job; Autonomous
Euros, 3000 USD
yer? Research; Financial;
ied Java Programmer
r? Full time; Partial time;
b offer? Basic education;

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

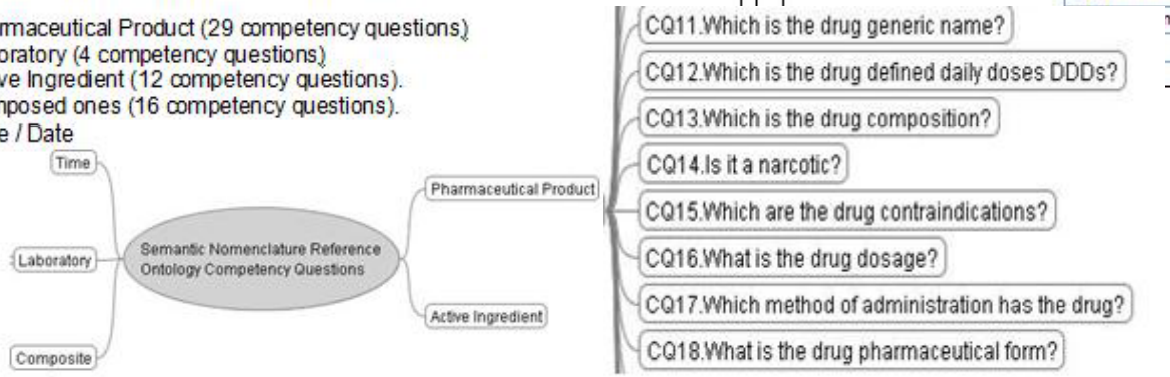
	Semantic Nomenclature Reference Ontology Requirements Specification
1	**Purpose**
	The purpose of building the Reference Ontology is to provide a network of ontologies for the pharmaceutical domain. This model is a compilation of the main terms and objects for this particular domain and could be used 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**
	User 1: Pharmacist. Pharmacists are the end-users of the ontology and navigate across the ontology searching for drug information. 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 User 3: Spanish Government. Spanish Government analysts study the situation of the pharmaceutical product information in the Spanish market or update the content.
5	**Intended Uses**
	Use1. Search updated information about the characteristics of pharmaceutical products Use2. Connect heterogeneous pharmaceutical models Use3. Update pharmaceutical product information databases
6	**Groups of Competency Questions**
	CQG1. Pharmaceutical Product (29 competency questions) CQG2. Laboratory (4 competency questions) CQG3. Active Ingredient (12 competency questions). CQG4. Composed ones (16 competency questions). CQG5. Time / Date

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

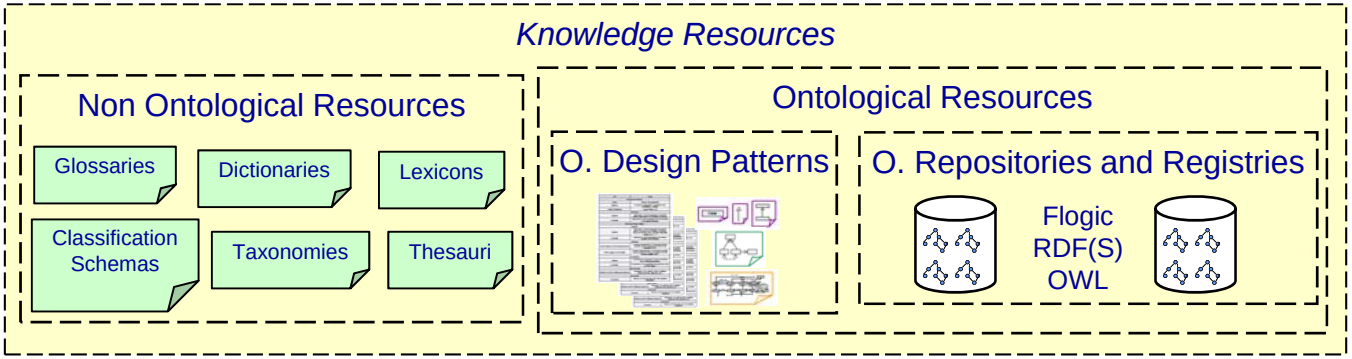


Index

- Introduction
- Scenarios in Ontology Building
- Methodological Guidelines for Ontology Specification
- **Quick Search and Selection 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

Searching Resources

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



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

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

ISO 4217 (currencies)

Entitiy	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 ausdrück 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 Geburtsh
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 préprimaire	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

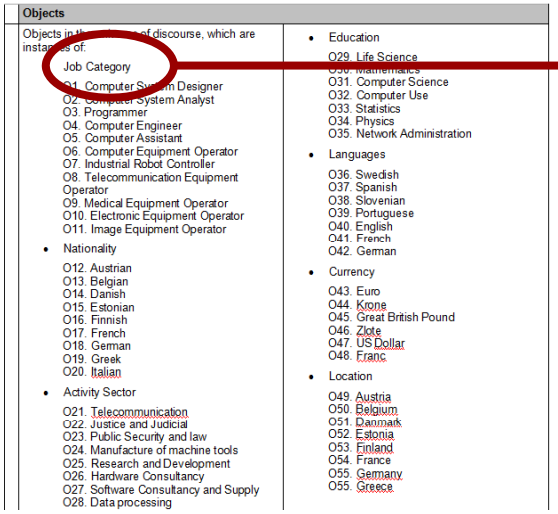
Is the terminology included in the Ontology Requirements Specification Document covered by the resources?

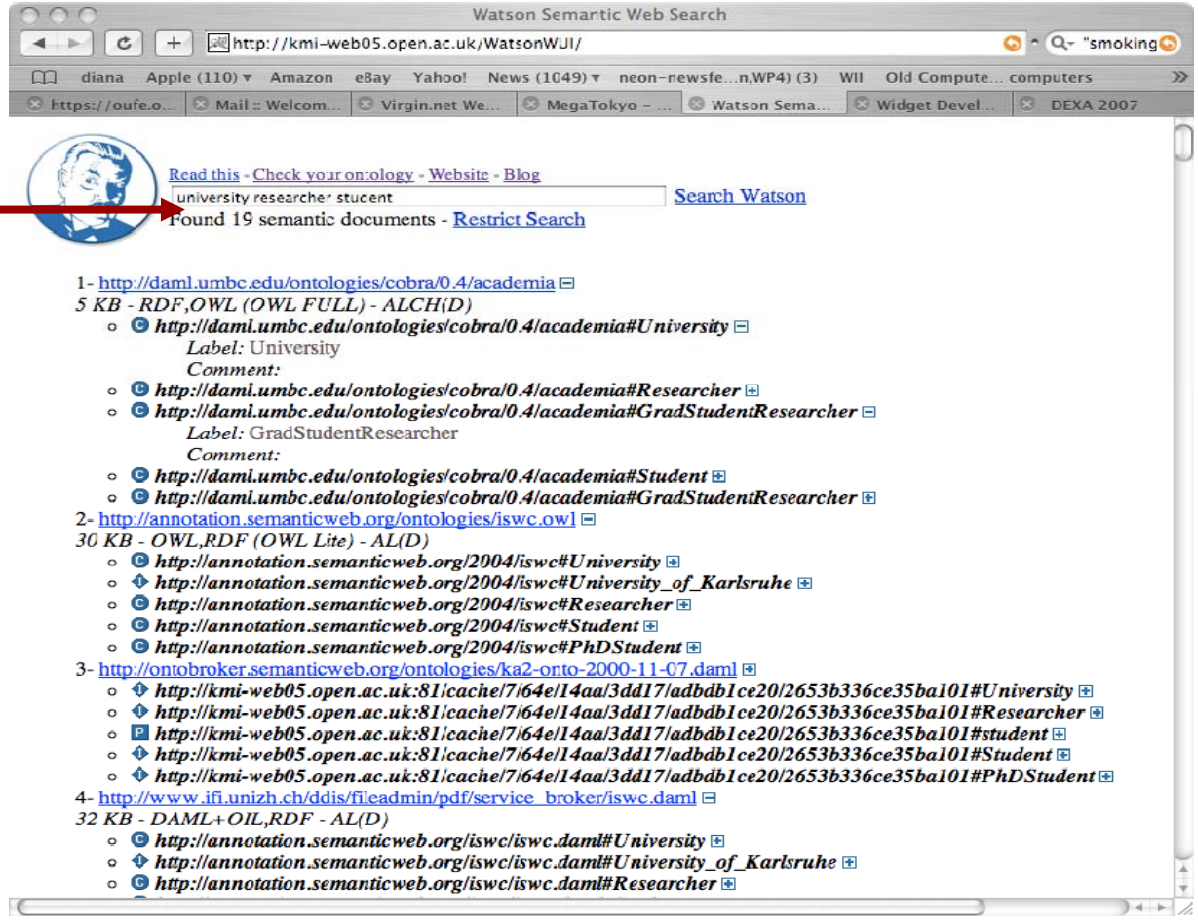
Selection of Ontologies

- 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

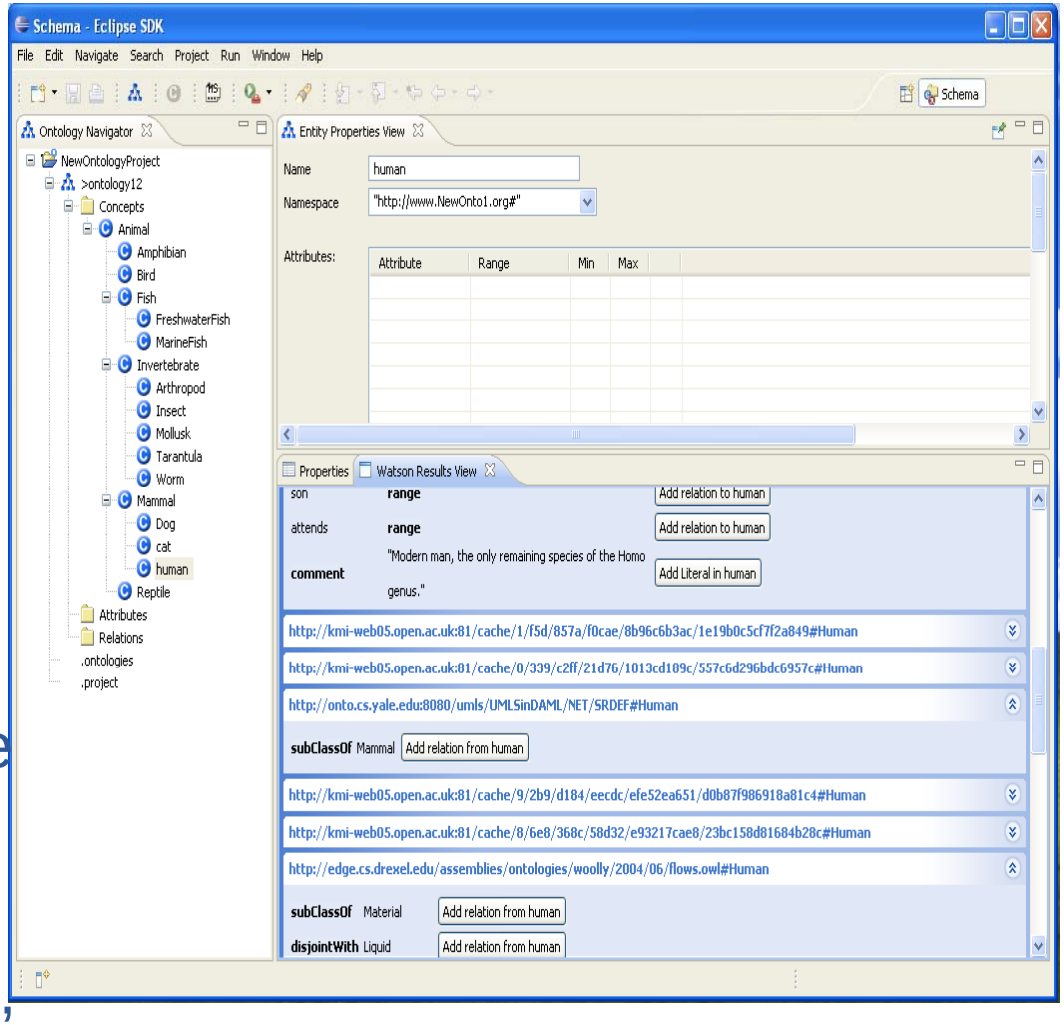
Ontology Requirement Specification Document





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



Index

- Introduction
- Scenarios in Ontology Building
- Methodological Guidelines for Ontology Specification
- **Quick Search and Selection 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 Network Life Cycle Model

An **ontology network life cycle model** is defined as the framework, selected by each organization, on which to map the activities identified and defined in the NeOn Glossary of Activities in order to produce the *ontology network life cycle*.

- As in Software Engineering, in the *Ontology Engineering field*, there is not a unique model valid for all ontology development projects, since each life cycle model is appropriate for a concrete development, depending on several features.

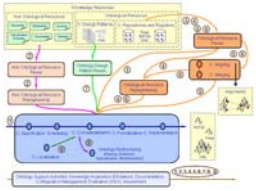
The **ontology life cycle** is the specific sequence of activities that the ontology practitioners carry out for developing an ontology.

NeOn Deliverable D5.3.1 (2007)

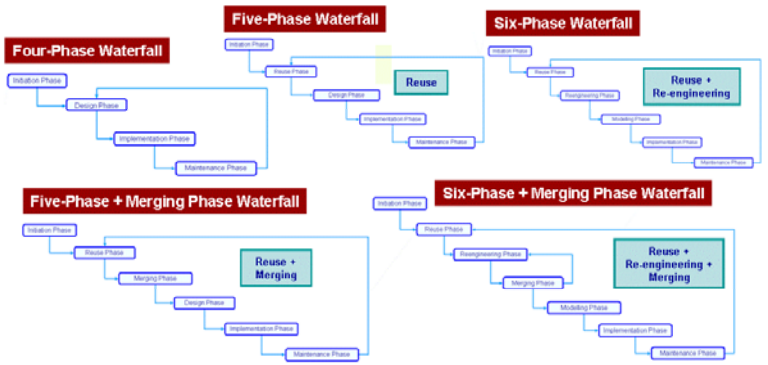
I-SEMANTICS 2008

Waterfall Model

– To be used when: **the requirements are completely known, without ambiguities and unchangeable at the beginning of the ontology network development**.



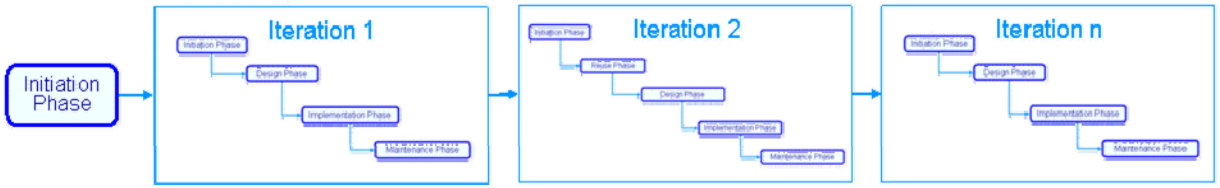
Scenarios identified caused the creation of different versions



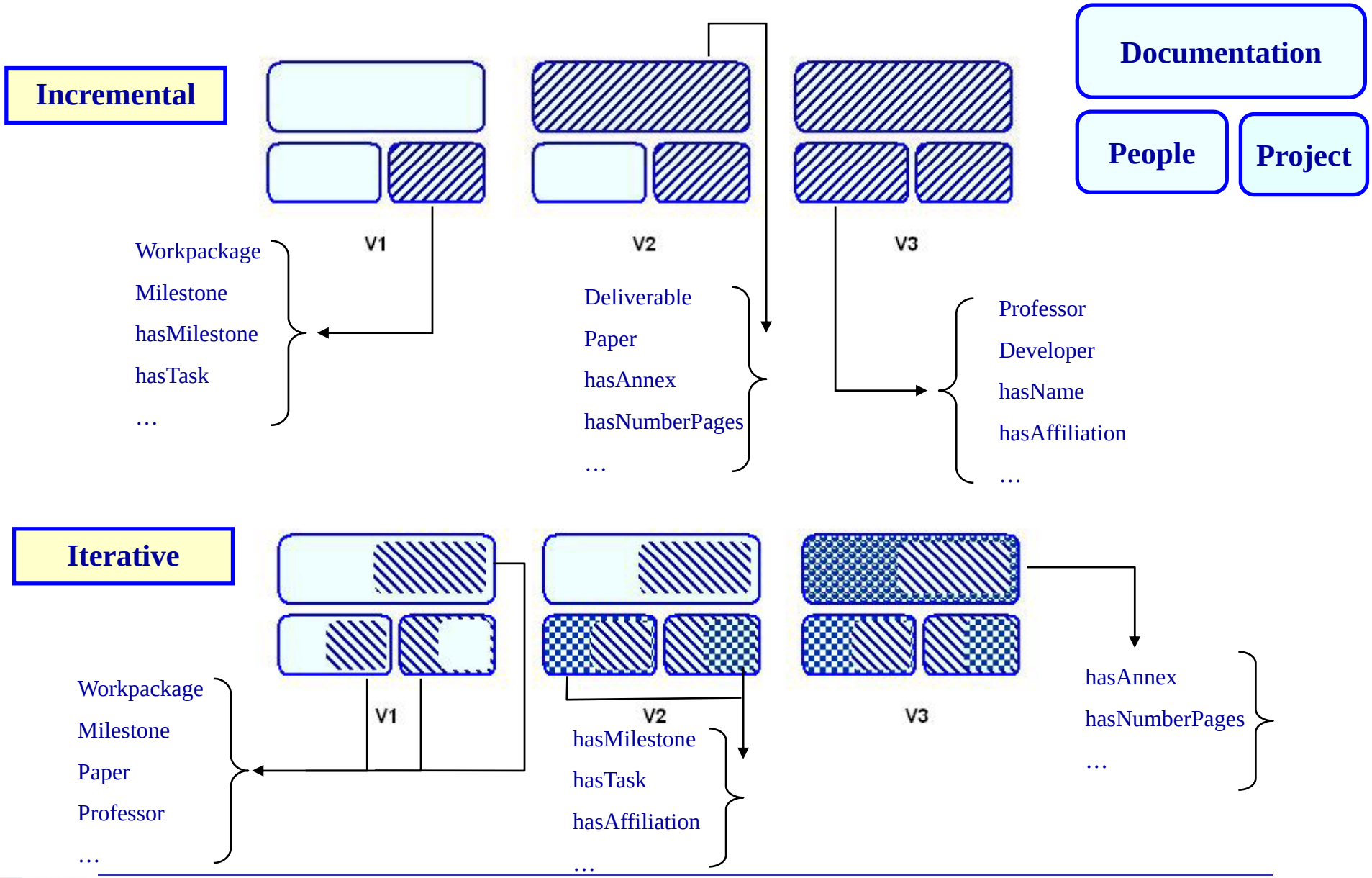
Iterative-Incremental Model

– The **development of ontology networks organized in a set of iterations**.

– The **result of any iteration is a functional and partial ontology network** that meets a subset of the ontology network requirements.

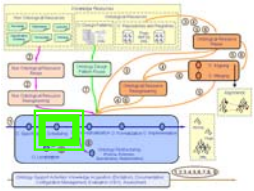


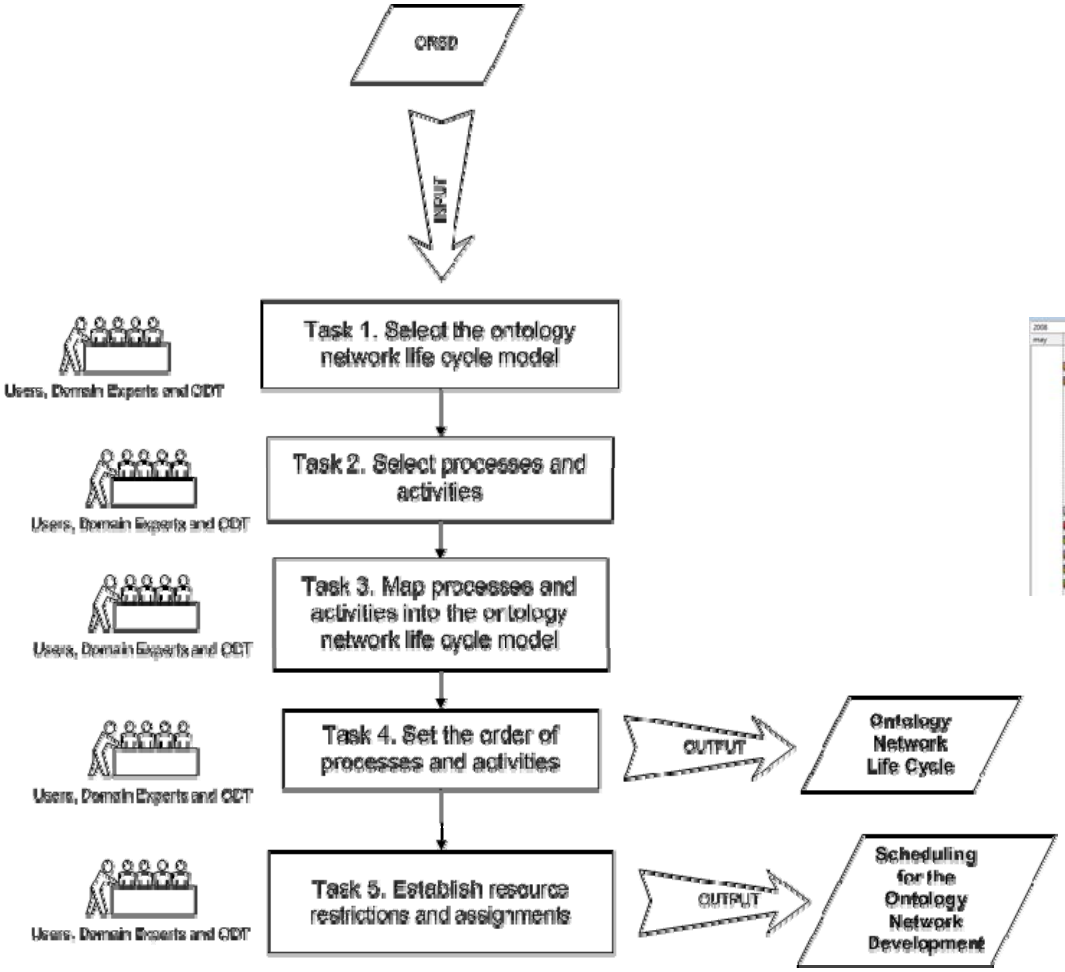
Example: Incremental vs Iterative

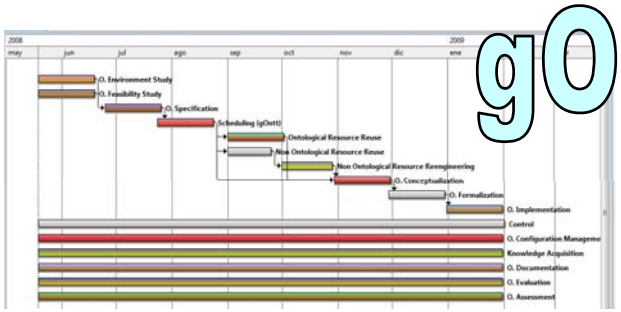


Scheduling. Methodological Guidelines

D5.3.2





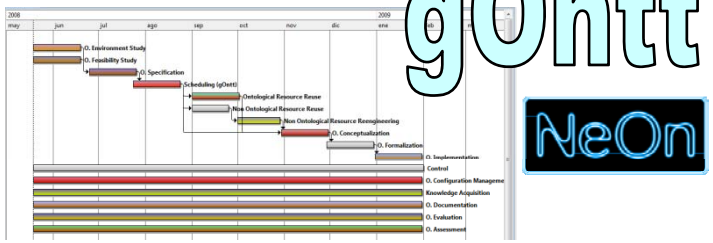


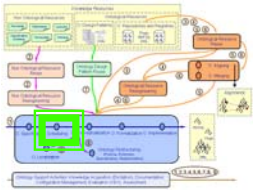
gOntt

NeOn

Scheduling. gOntt Plug-in

D5.3.2

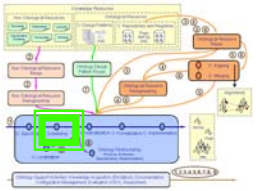




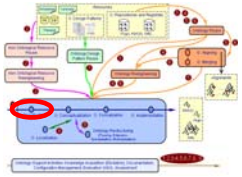
- **gOntt** helps in **scheduling an ontology network development**.
- **gOntt** is a **NeOn plug-in for integrating the NeOn Methodology and the NeOn Toolkit.**
  - gOntt provides filling cards, workflows, and methodological guidelines.
  - gOntt triggers the NeOn plug-ins associated to each process and activity planned.

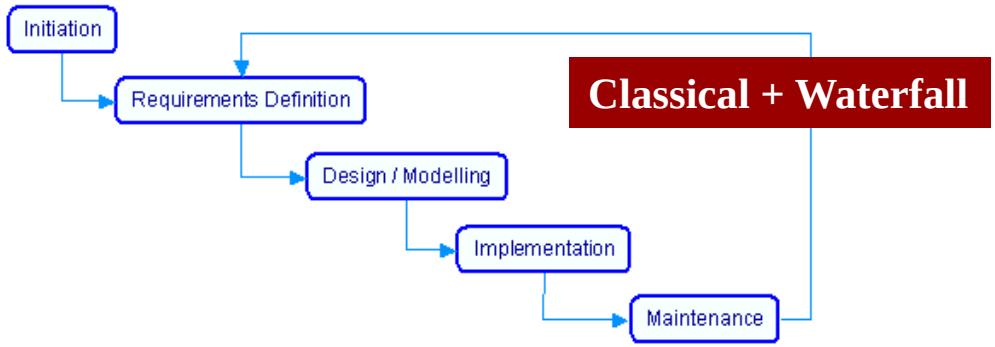
Scheduling. Filling Card

D5.3.2

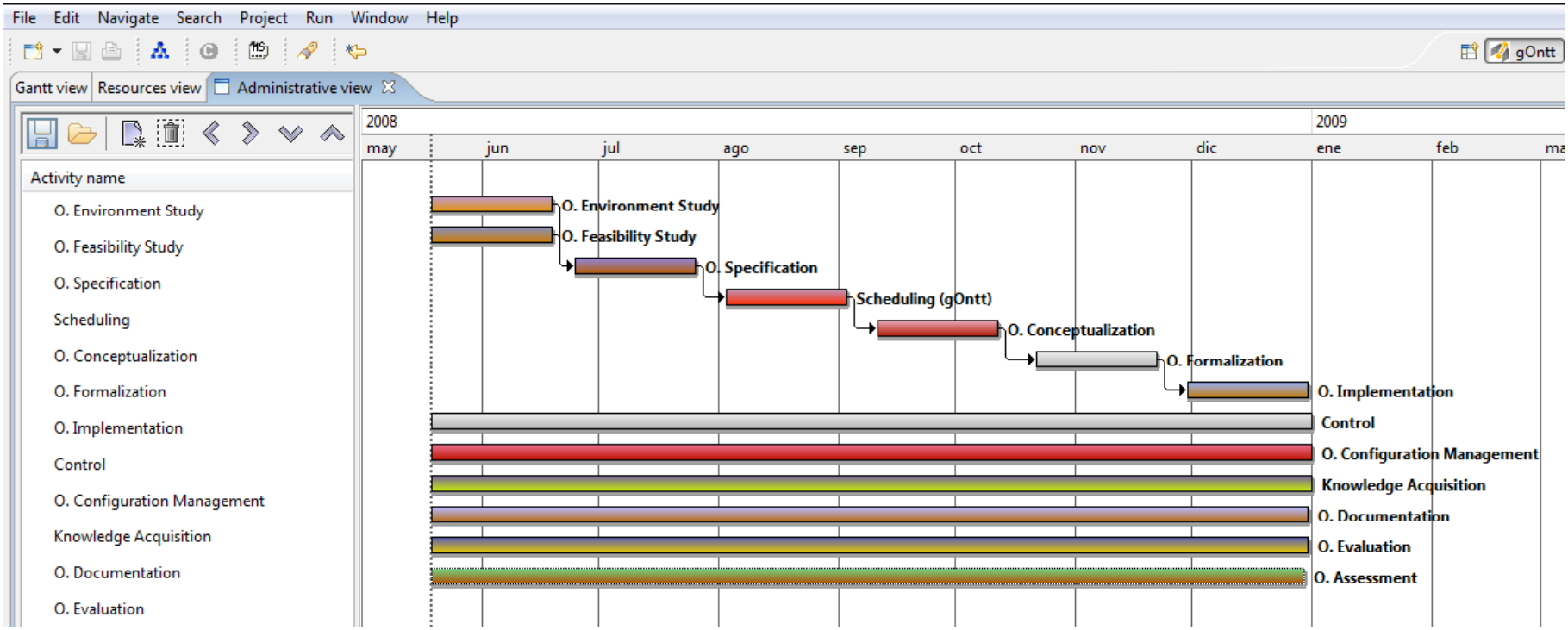


Scheduling	
Definition *Scheduling* refers to the activity of identifying the different activities and processes to be performed during the ontology development, their arrangement, and the time and resources needed for their completion.	
Goal The scheduling activity states a concrete programming or scheduling to guide the ontology network development, including processes and activities, their order, and time and human resources restrictions and assignments.	
Input Ontology Requirements Specification Document (ORSD).	*Output* Schedule for the ontology network development.
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 after the ontology requirements specification activity.	

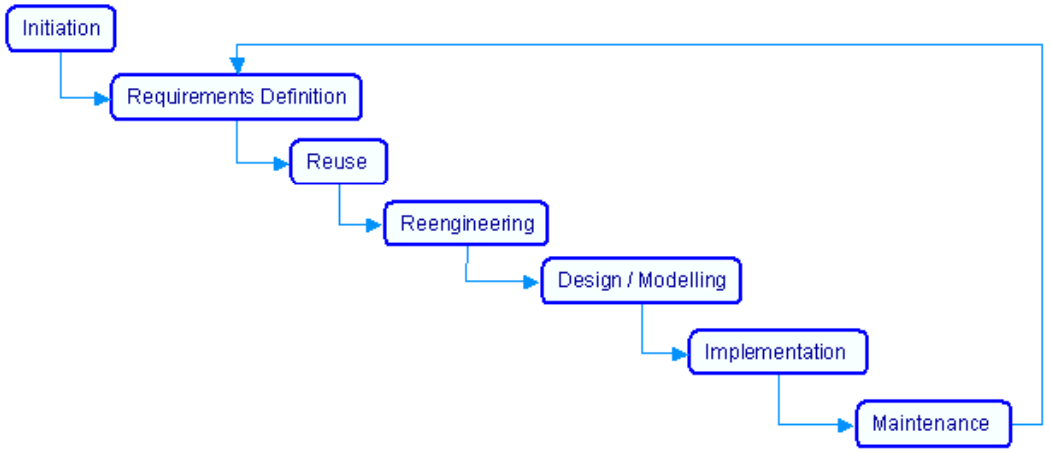


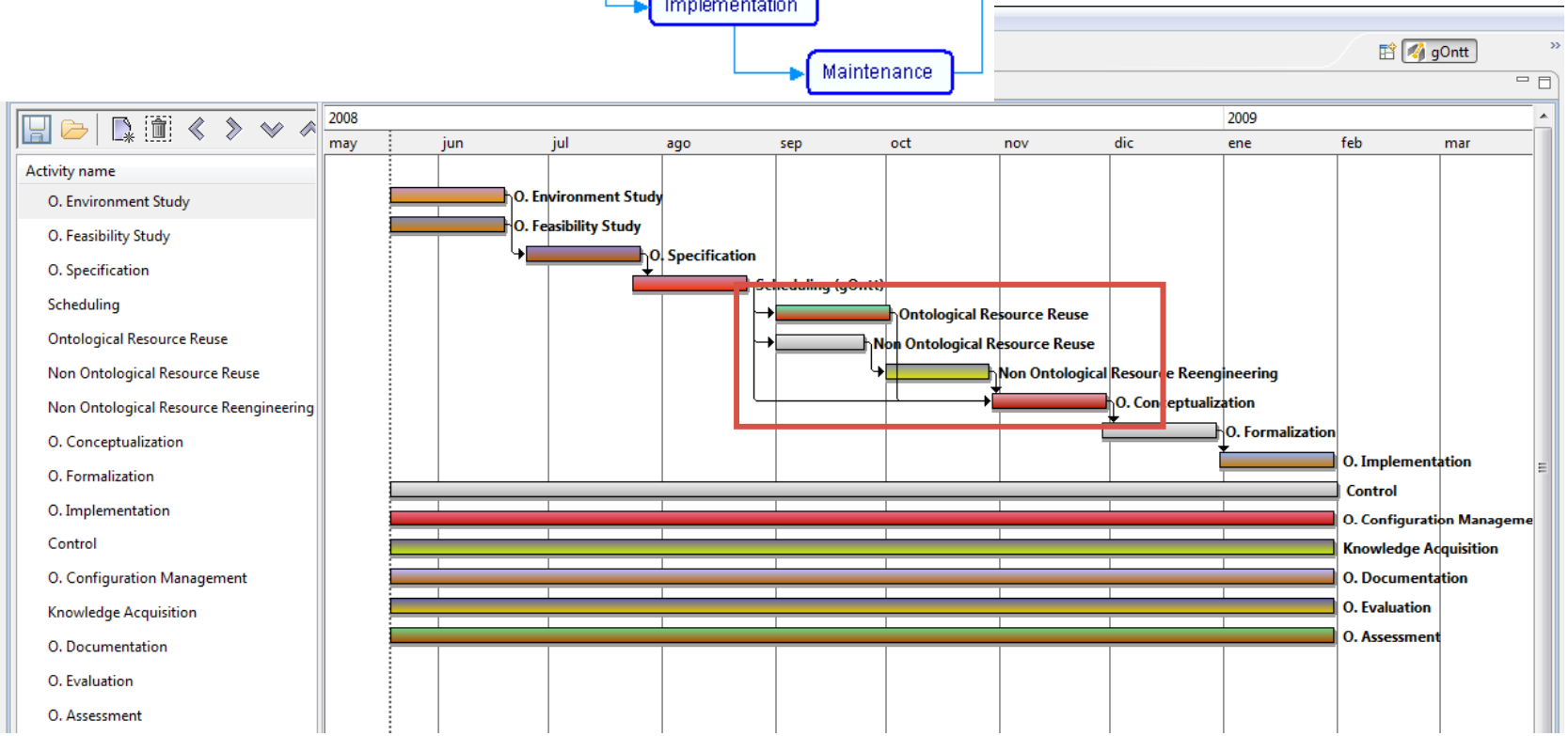


Classical + Waterfall



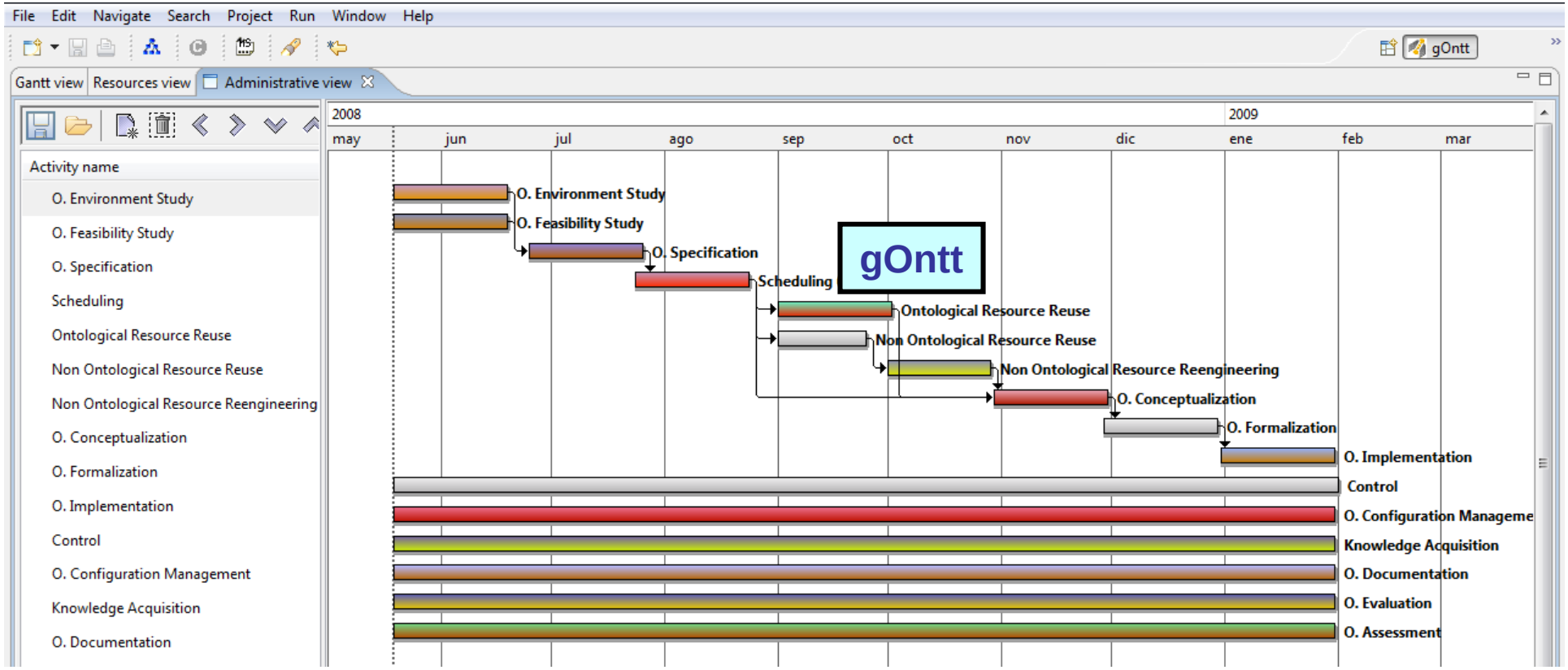
Reuse and Reengineering + Waterfall



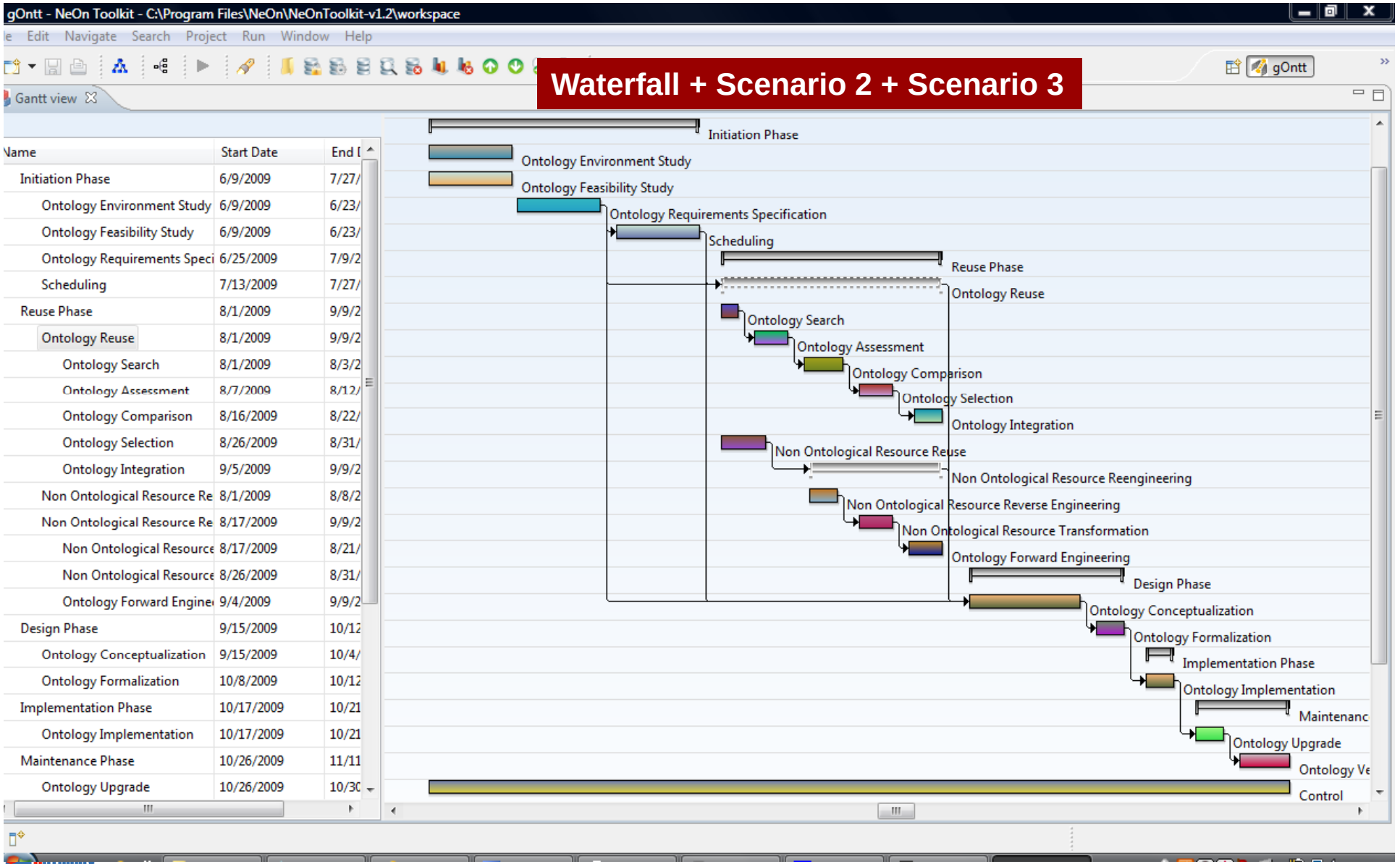


An Ontology Network Life Cycle Example

Waterfall + Scenario 2 + Scenario 3



Gantt chart for your project (I)



Iterative/Incremental + Scenario 2 + Scenario 3