Metodologias (II)

Asunción Gómez-Pérez (asun@fi.upm.es)

Credits to:
Boris Villazón-Terrazas (bvillazon@fi.upm.es)
Mari Carmen Suárez -Figueroa (mcsuarez@fi.upm.es)
Guadalupe Aguado (lupe@fi.upm.es**)**

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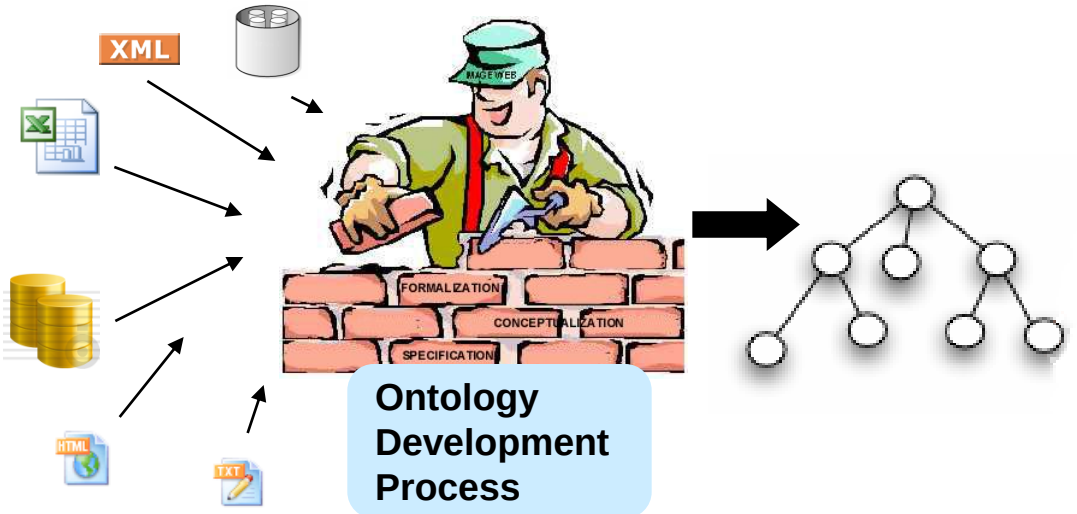
Current situation in 2010

- Reuse of knowledge-aware resources
- Ontologies are built collaboratively
- Ontologies are connected in ontology networks



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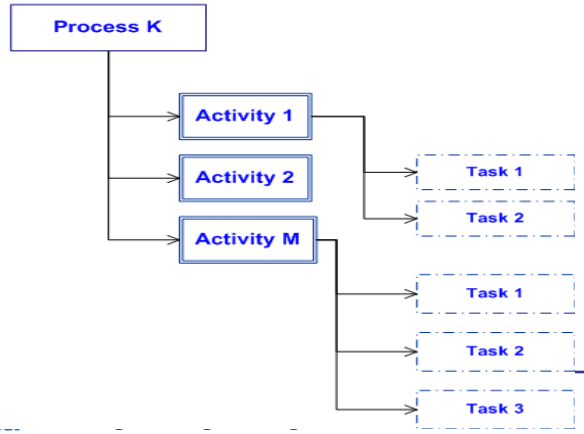
NeOn Methodology

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

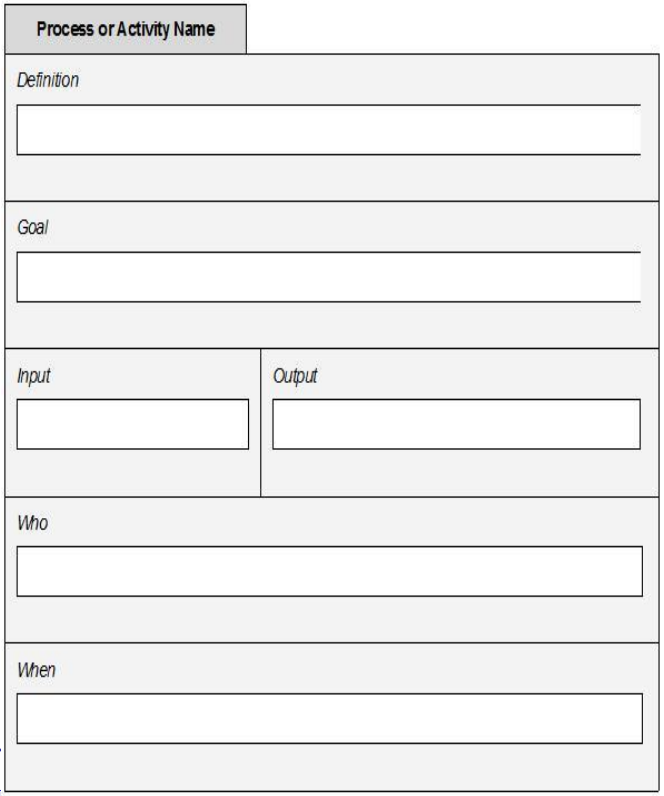
Process and activities covered:

- Ontology Specification
- Scheduling
- Non-Ontological Resource Reuse
- Non-Ontological Resource Re-engineering
- 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



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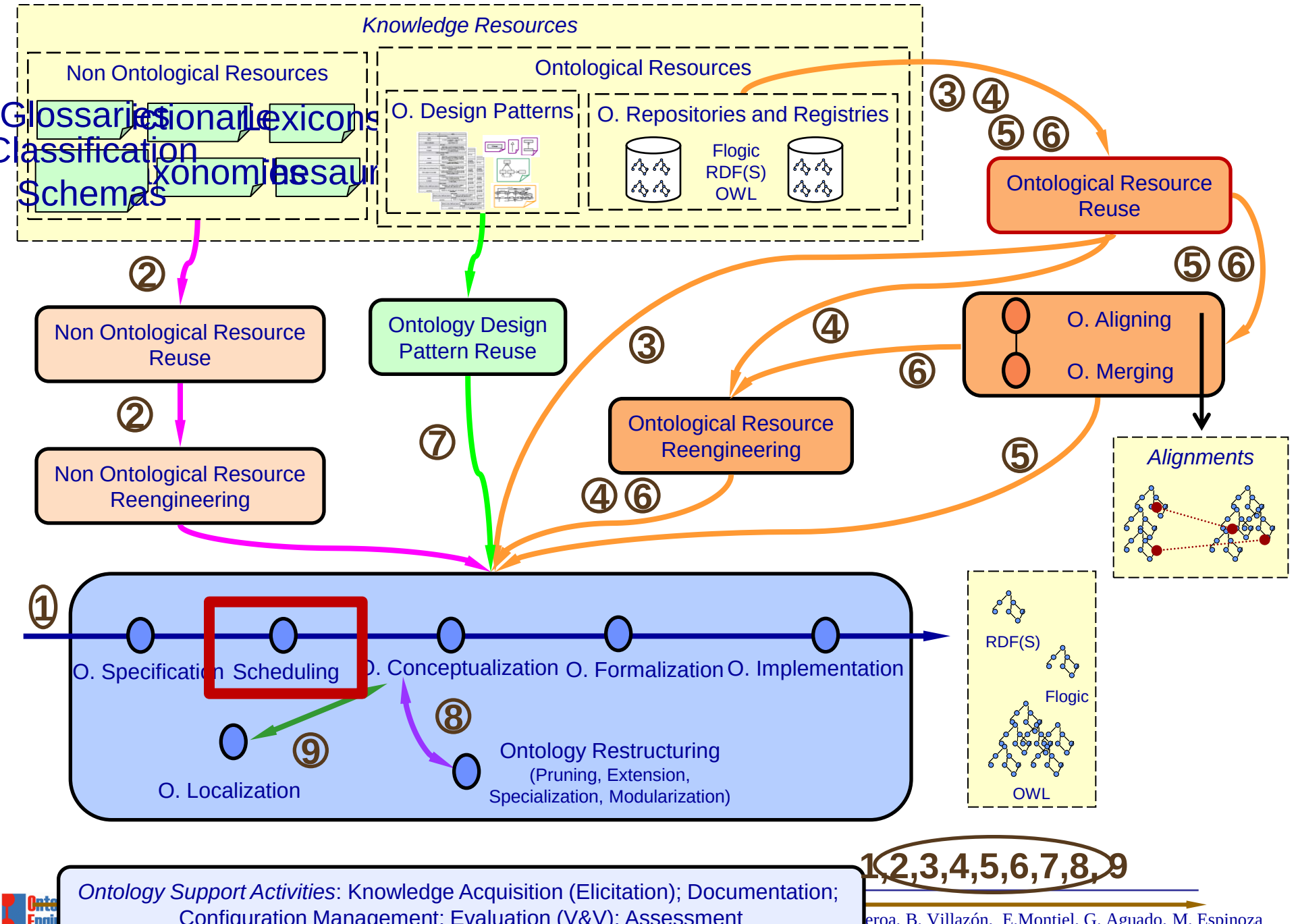
Knowledge Resources
Non Ontological Resources
Glossaries
Dictionaries
Lexicons
Classification Schemas
Taxonomies
Thesauri
Ontological Resources
O. Design Patterns
O. Repositories and Registries
Flogic
RDF(S)
OWL
Ontological Resource Reuse
Non Ontological Resource Reuse
Non Ontological Resource Reengineering
Ontology Design Pattern Reuse
Ontological Resource Reengineering
O. Aligning
O. Merging
Alignments
O. Specification
Scheduling
O. Conceptualization
O. Formalization
O. Implementation
O. Localization
Ontology Restructuring
(Pruning, Extension, Specialization, Modularization)
RDF(S)
Flogic
OWL
1,2,3,4,5,6,7,8,9
Ontology Support Activities: Knowledge Acquisition (Elicitation); Documentation; Configuration Management; Evaluation (V&V); Assessment

Scheduling Ontology Development Projects. Index

- **Life cycle models and life cycle**
- Guidelines for Scheduling
- Technological Support: gOntt

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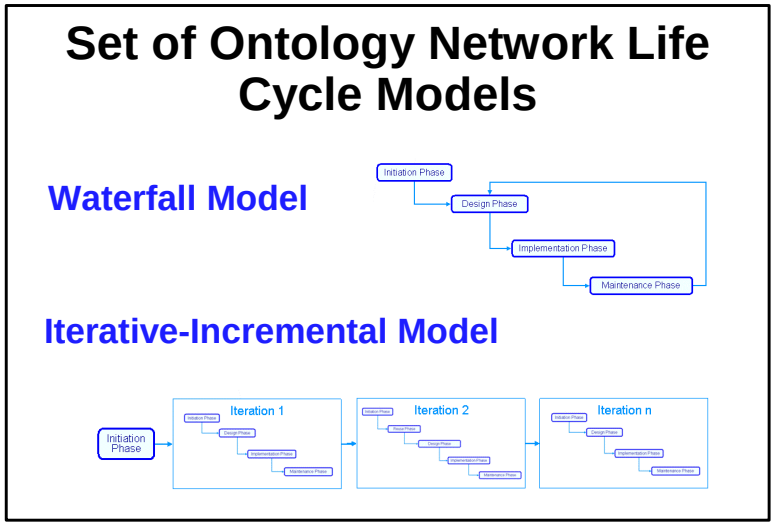
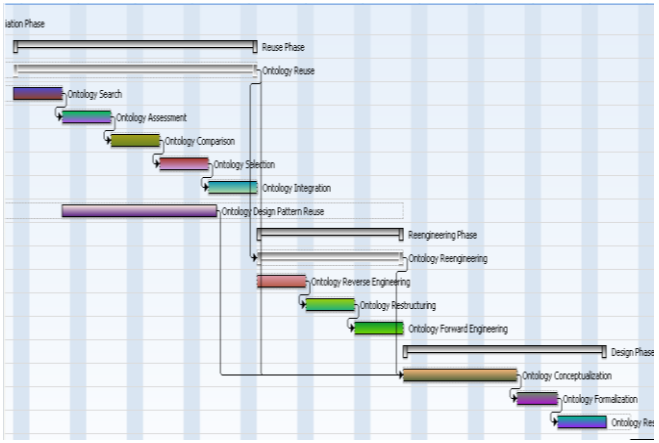
Life Cycle Models and Life Cycle for Ontology Networks

- **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.



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Ontology Life Cycle Models

Waterfall

- This model represents the stages as **sequential phases**
- This model family contains **5 versions**
- The **requirements** are
  - completely known, without ambiguities, and unchangeable at the beginning of the development

Iterative incremental

- The development of ontology networks is organized in a **set of iterations**
  - Each individual iteration can follow a different version of the waterfall model
- No backtracking is allowed between phases

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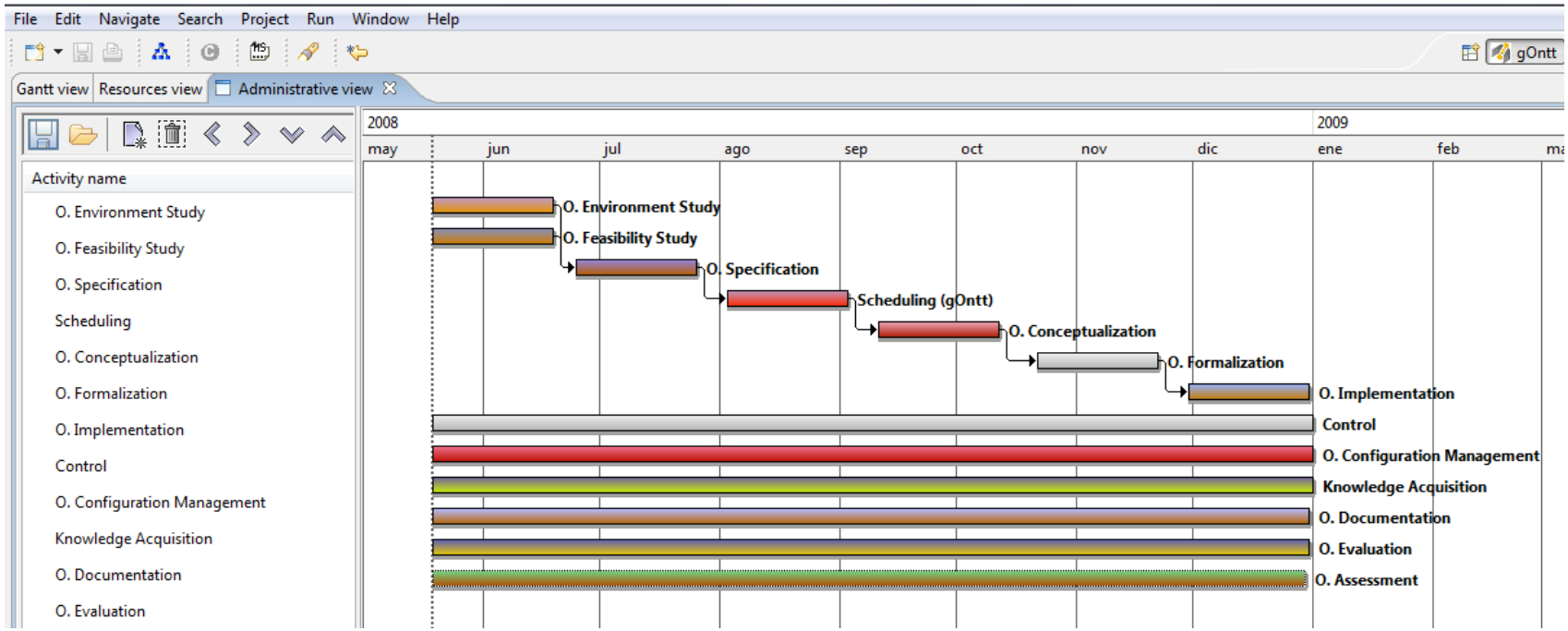
Ejemplo 1

Vamos a planificar el desarrollo de una ontología en el que se necesitan realizar

- La especificación de requisitos
- La planificación
- El desarrollo (conceptualización, formalización, implementación)



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Ejemplo 2 (I)

Vamos a planificar el desarrollo de una ontología en el que se necesitan realizar

- La especificación de requisitos
- La planificación
- La reutilización de ontologías
- La reutilización de recursos no ontológicos (NORs)
- El desarrollo (conceptualización, formalización, implementación)

Nota: La reutilización de recursos se debe realizar en paralelo.

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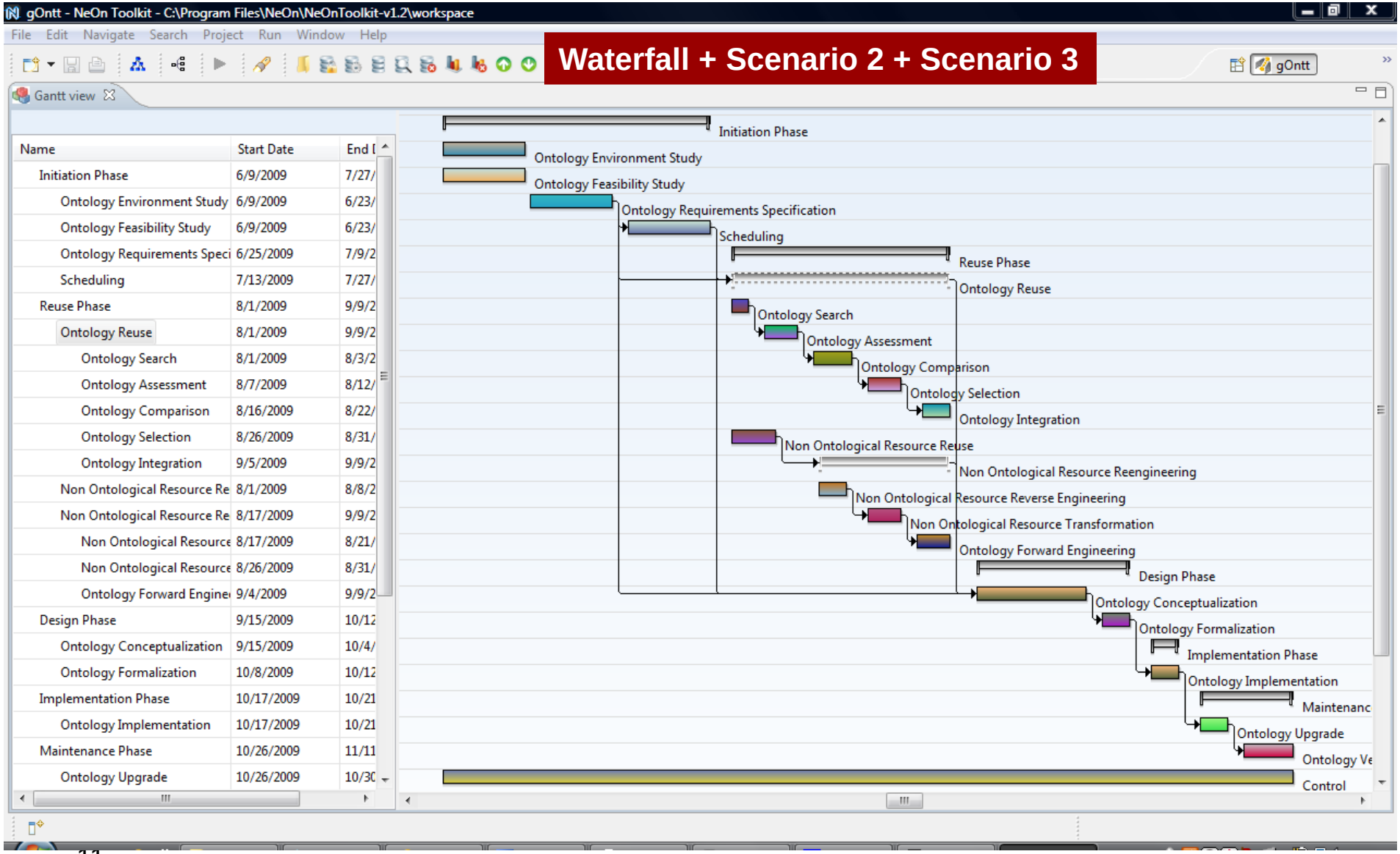
Ejemplo 2 (II)


gOntt - NeOn Toolkit - C:\Program Files\NeOn\NeOnToolkit-v1.2\workspace
File Edit Navigate Search Project Run Window Help
Waterfall + Scenario 2 + Scenario 3
gOntt
Gantt view
Name
Start Date
End D
Initiation Phase 6/9/2009 7/27/
Ontology Environment Study 6/9/2009 6/23/
Ontology Feasibility Study 6/9/2009 6/23/
Ontology Requirements Speci 6/25/2009 7/9/2
Scheduling 7/13/2009 7/27/
Reuse Phase 8/1/2009 9/9/2
Ontology Reuse 8/1/2009 9/9/2
Ontology Search 8/1/2009 8/3/2
Ontology Assessment 8/7/2009 8/12/
Ontology Comparison 8/16/2009 8/22/
Ontology Selection 8/26/2009 8/31/
Ontology Integration 9/5/2009 9/9/2
Non Ontological Resource Re 8/1/2009 8/8/2
Non Ontological Resource Re 8/17/2009 9/9/2
Non Ontological Resource 8/17/2009 8/21/
Non Ontological Resource 8/26/2009 8/31/
Ontology Forward Engine 9/4/2009 9/9/2
Design Phase 9/15/2009 10/12
Ontology Conceptualization 9/15/2009 10/4/
Ontology Formalization 10/8/2009 10/12
Implementation Phase 10/17/2009 10/21
Ontology Implementation 10/17/2009 10/21
Maintenance Phase 10/26/2009 11/11
Ontology Upgrade 10/26/2009 10/30
Initiation Phase
Ontology Environment Study
Ontology Feasibility Study
Ontology Requirements Specification
Scheduling
Reuse Phase
Ontology Reuse
Ontology Search
Ontology Assessment
Ontology Comparison
Ontology Selection
Ontology Integration
Non Ontological Resource Reuse
Non Ontological Resource Reengineering
Non Ontological Resource Reverse Engineering
Non Ontological Resource Transformation
Ontology Forward Engineering
Design Phase
Ontology Conceptualization
Ontology Formalization
Implementation Phase
Ontology Implementation
Maintenanc
Ontology Upgrade
Ontology Ve
Control

Ejemplo 3 (I)

Vamos a planificar el desarrollo de una ontología en el que se necesitan realizar

- La especificación de requisitos
- La planificación
- La reutilización de recursos no ontológicos (NORs)
- La reutilización de ontologías
- El desarrollo (conceptualización, formalización, implementación)

Notas:

- La reutilización de NORs se debe realizar antes que la reutilización de ontologías.
- Cada proceso de reutilización se debe realizar en una iteración distinta.

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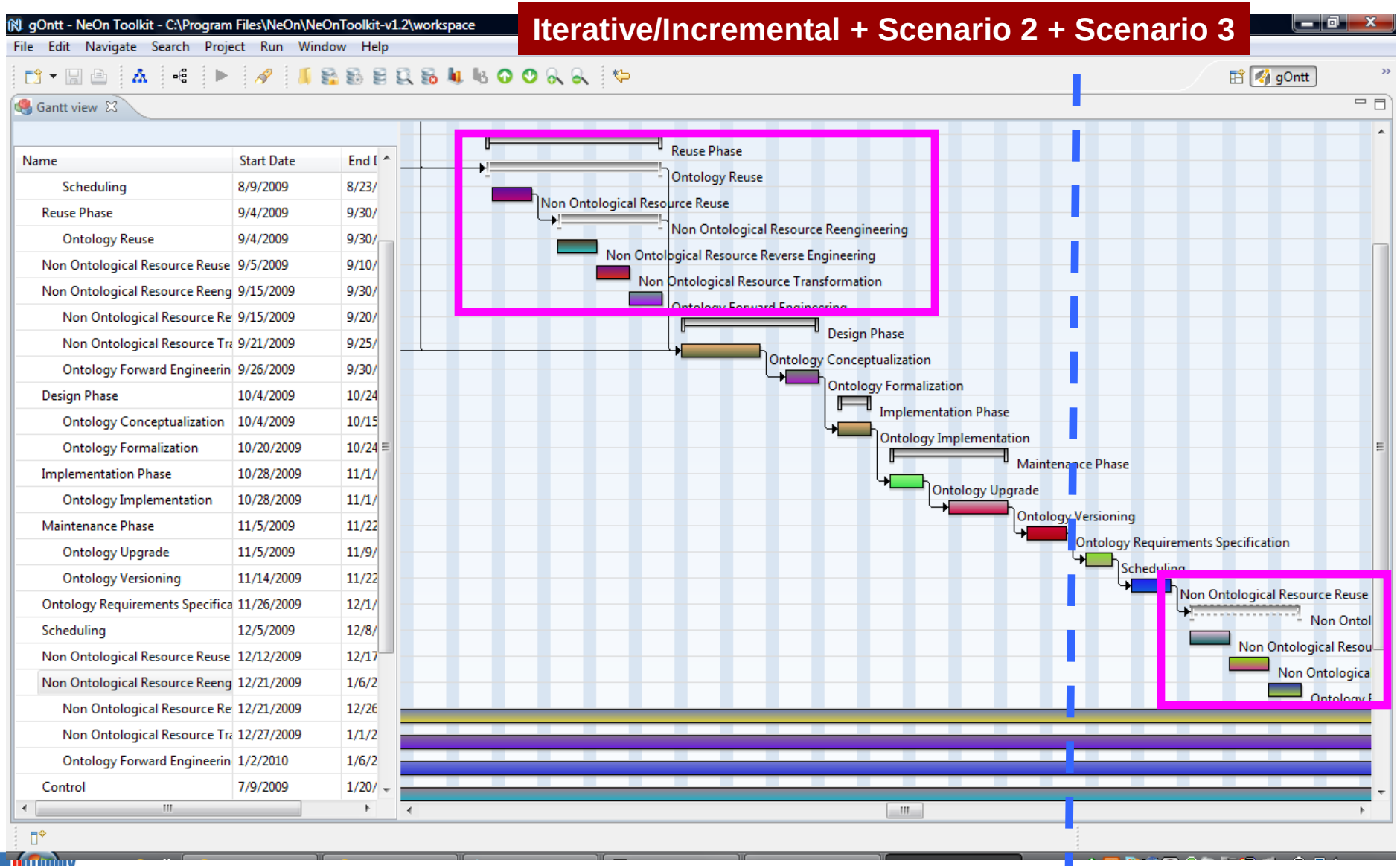
Iterative/Incremental + Scenario 2 + Scenario 3



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Scheduling Ontology Development Projects. Index

- Life cycle models and life cycle
- **Guidelines for Scheduling**
- Technological Support: gOntt

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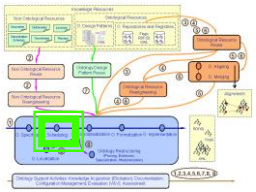
Scheduling



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

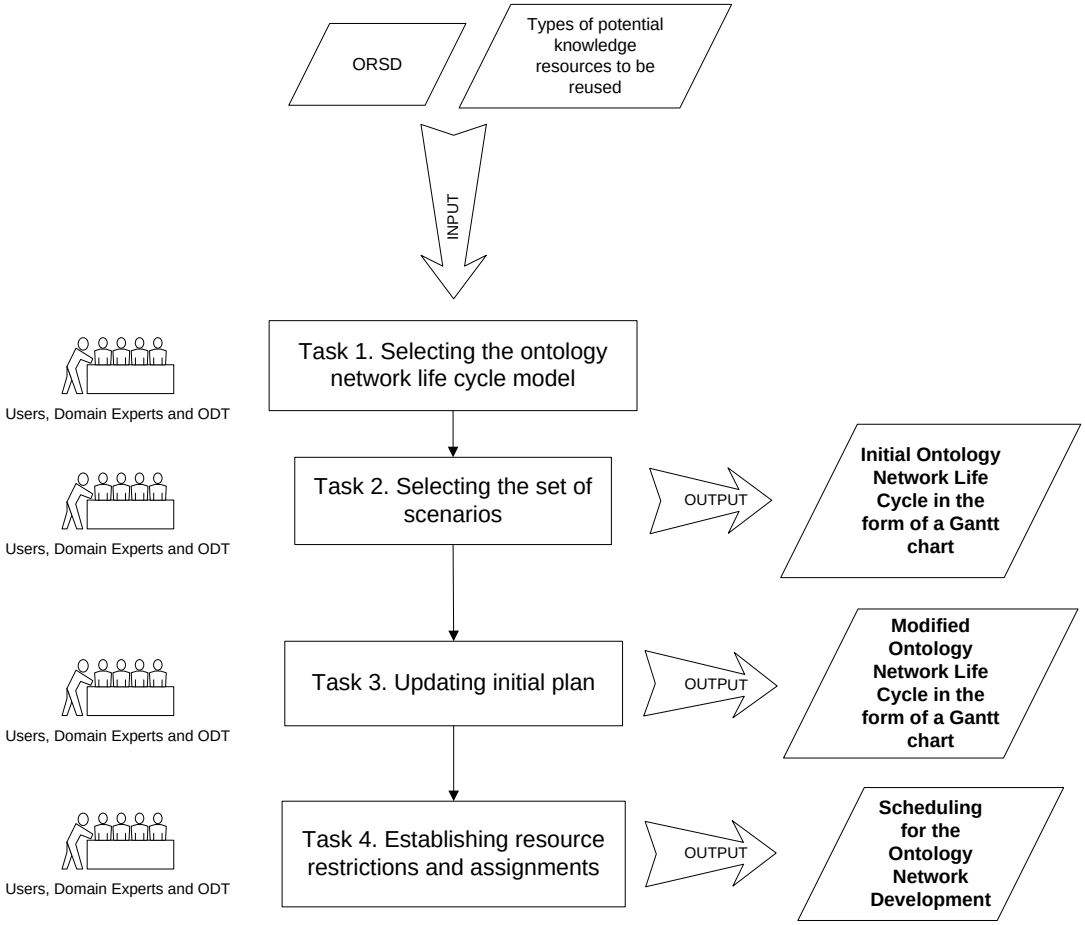
Schedule for the ontology network development.

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.


ORSD
Types of potential knowledge resources to be reused
INPUT
Users, Domain Experts and ODT
Task 1. Selecting the ontology network life cycle model
Users, Domain Experts and ODT
Task 2. Selecting the set of scenarios
OUTPUT
Initial Ontology Network Life Cycle in the form of a Gantt chart
Users, Domain Experts and ODT
Task 3. Updating initial plan
OUTPUT
Modified Ontology Network Life Cycle in the form of a Gantt chart
Users, Domain Experts and ODT
Task 4. Establishing resource restrictions and assignments
OUTPUT
Scheduling for the Ontology Network Development

Scheduling Ontology Development Projects. Index

- Life cycle models and life cycle
- Guidelines for Scheduling
- **Technological Support: gOntt**

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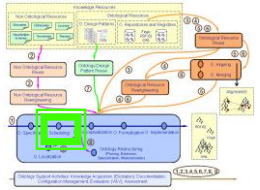

- **gOntt** helps in **scheduling an ontology network development**.
  - To create particular schedules from scratch
  - To create particular schedules in a guided way
    - gOntt provides wizard menus to select the ontology life cycle model and to select processes and activities
    - gOntt generates the **initial plan for the ontology project in the form of a Gantt chart**
- **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.

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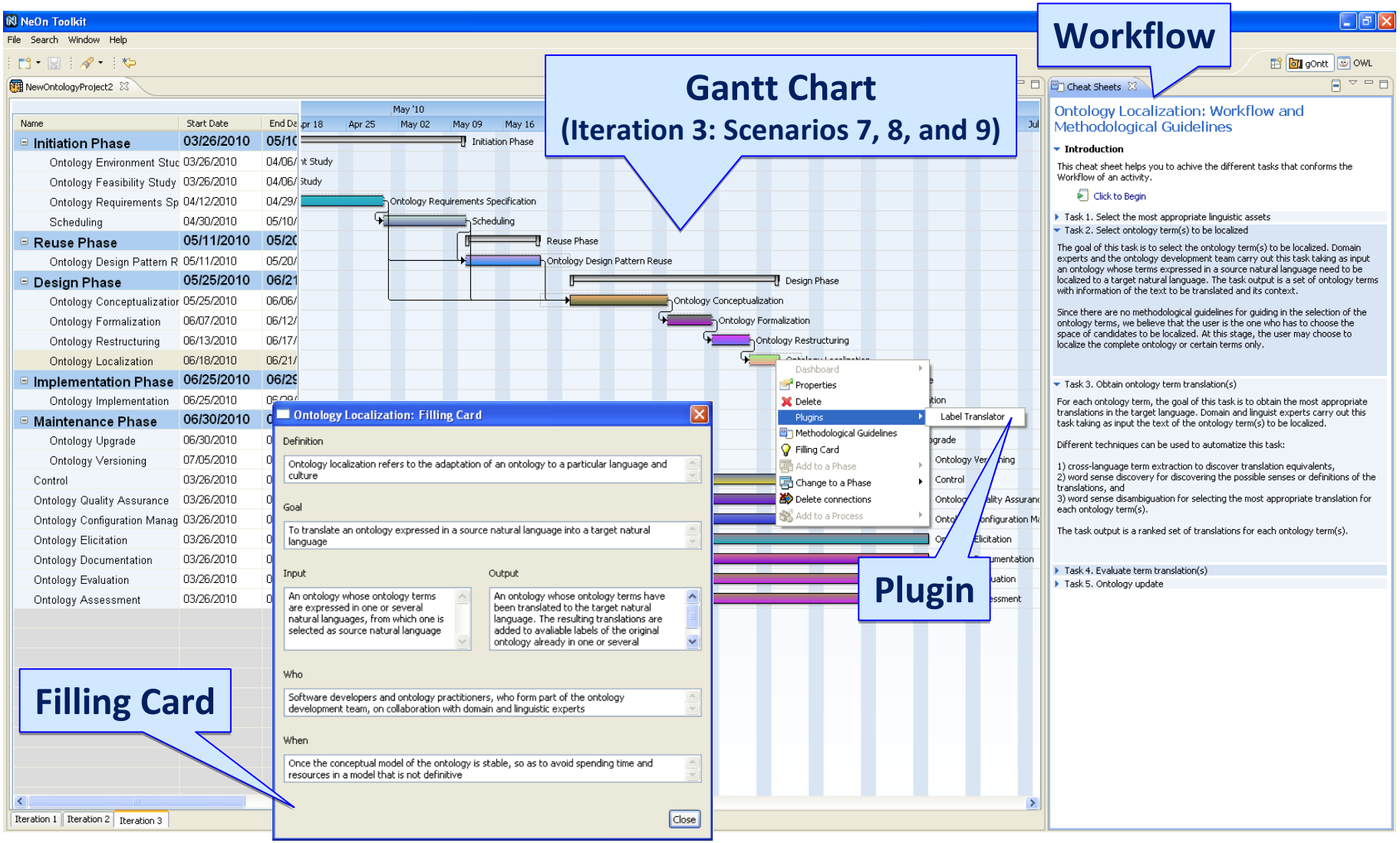
Scheduling. How gOntt looks like



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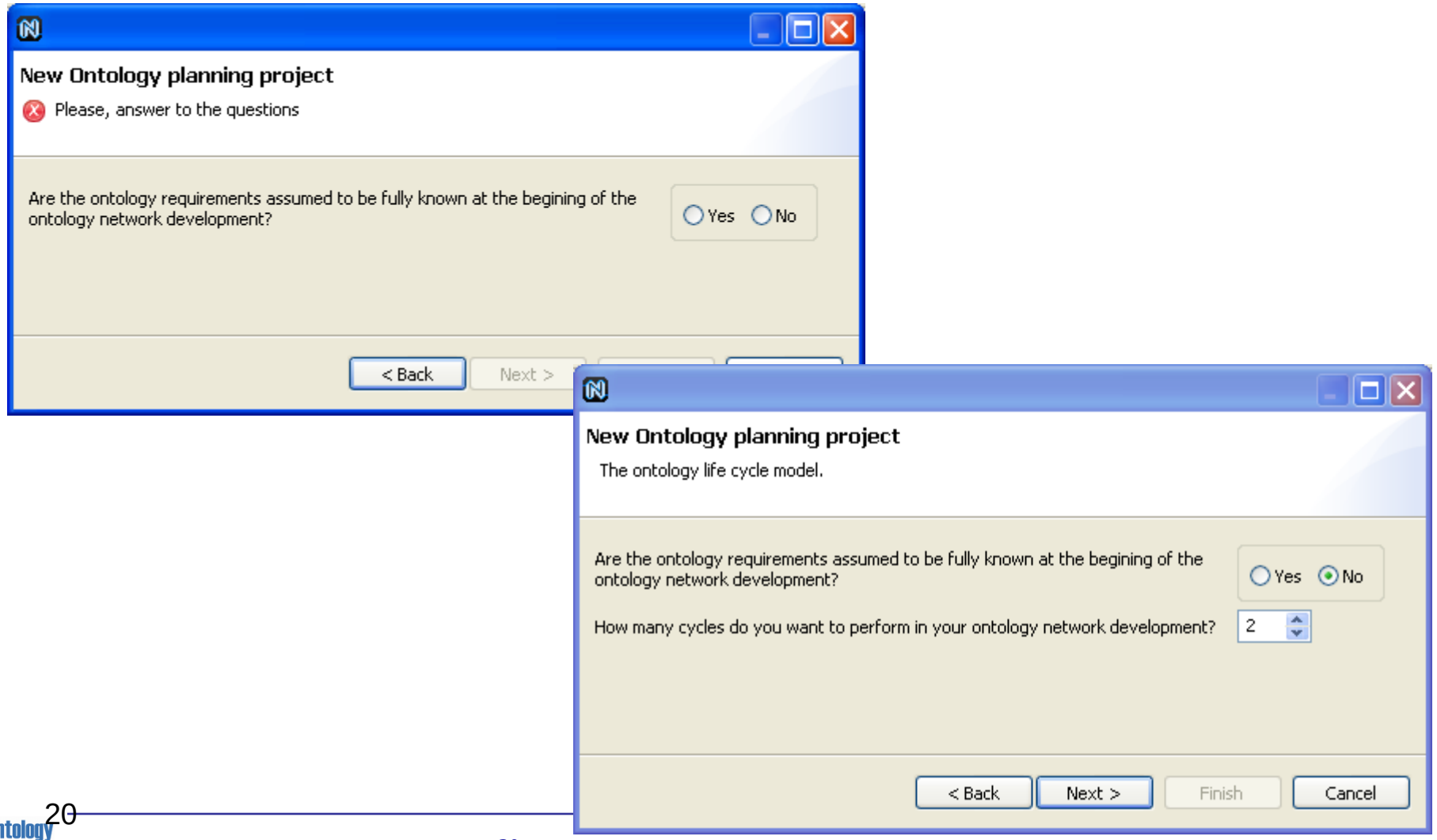
gOntt. How to create the Gantt chart in two clicks (I)

Selecting the life cycle model



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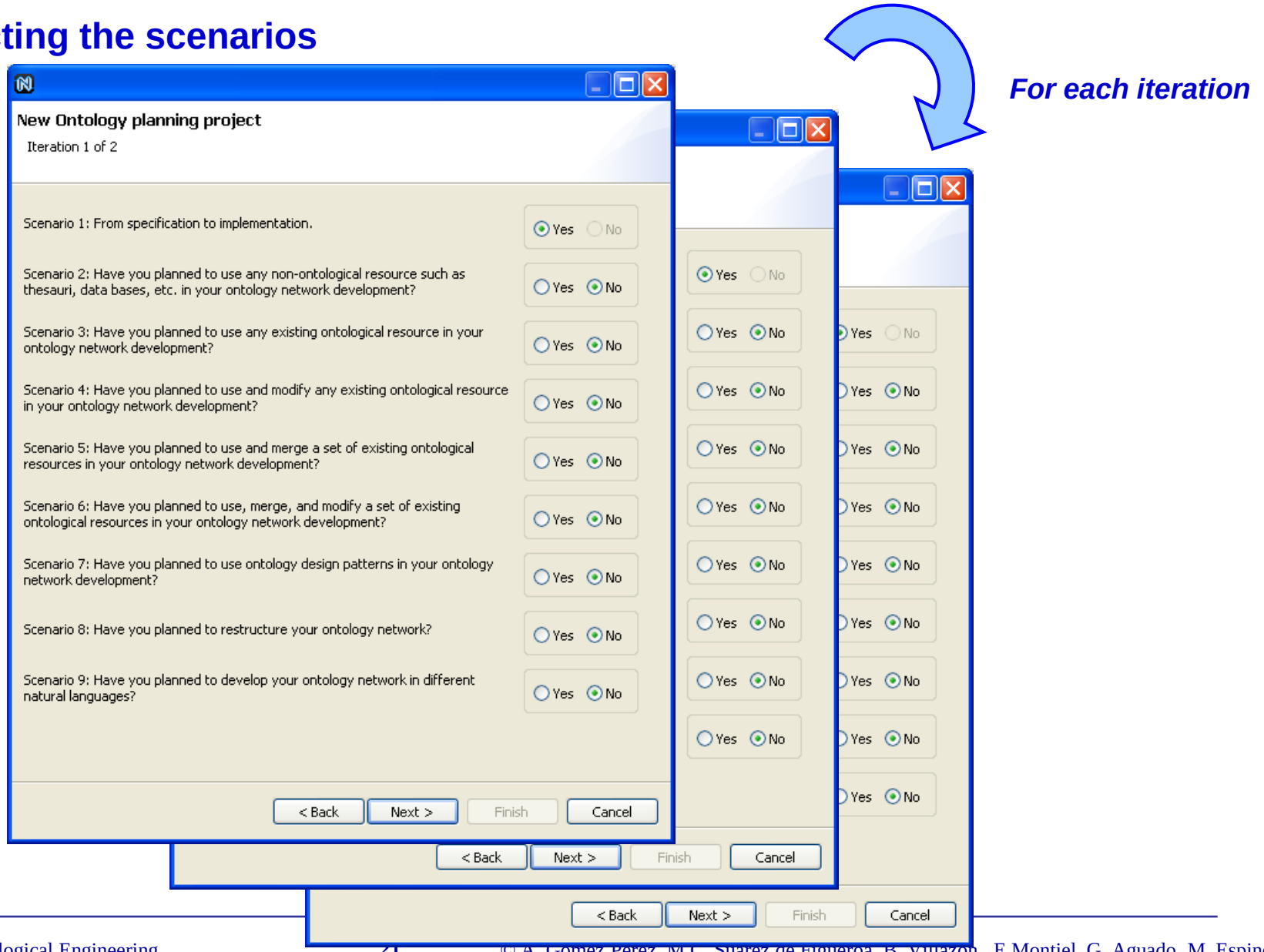
gOntt. How to create the Gantt chart in two clicks (II)

Selecting the scenarios



For each iteration

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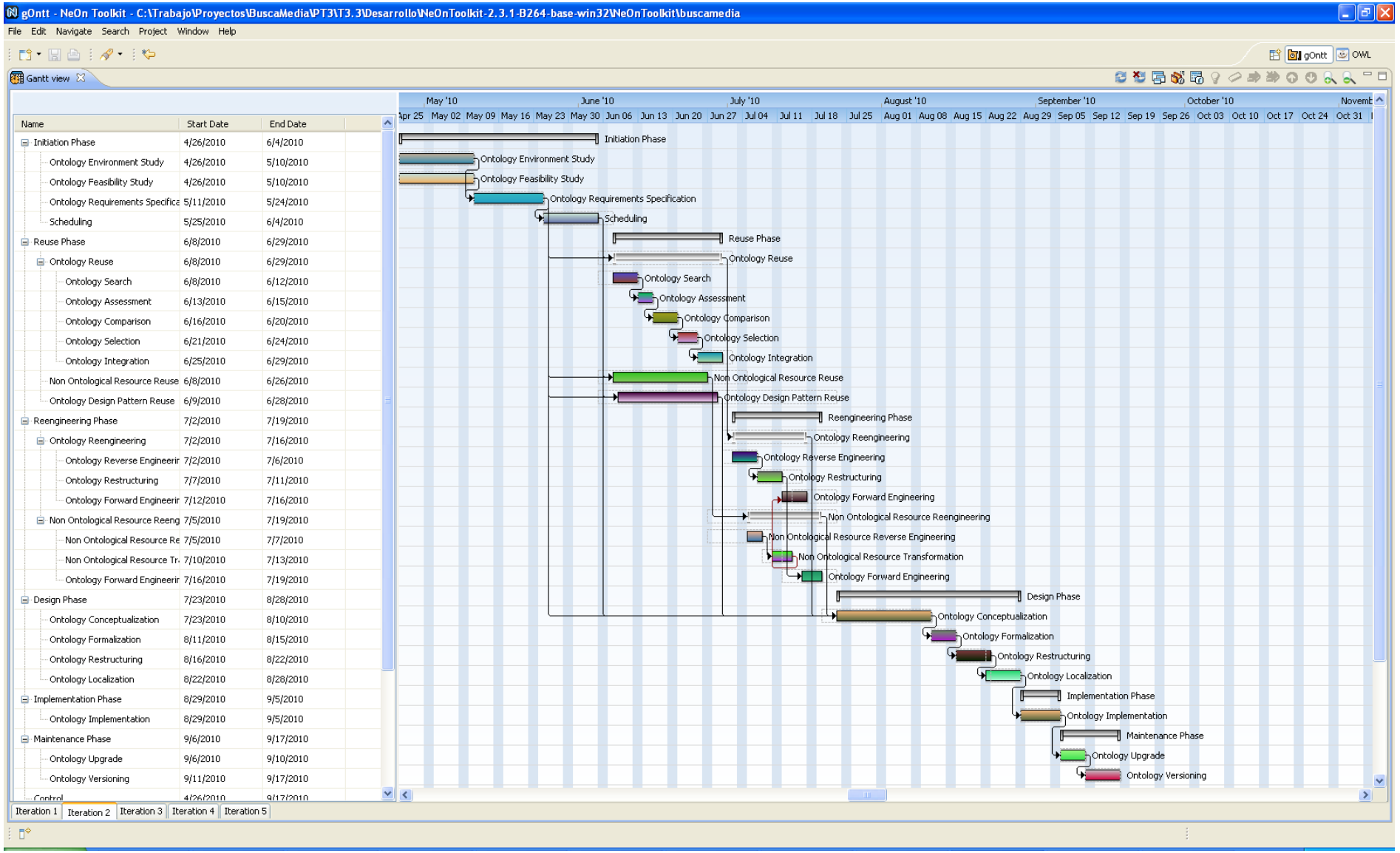
gOntt. The preliminary plan as a Gantt chart



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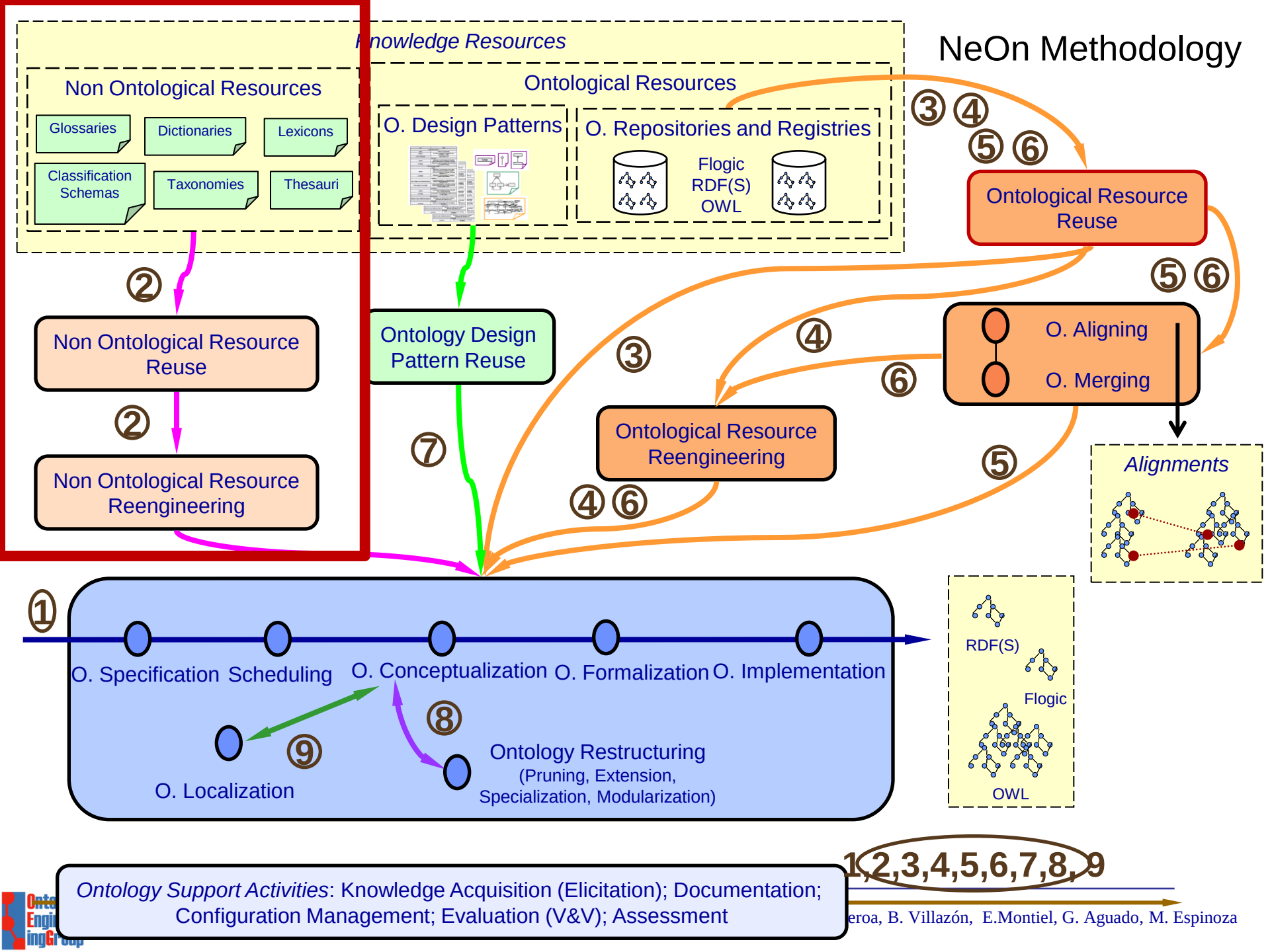
NeOn Methodology



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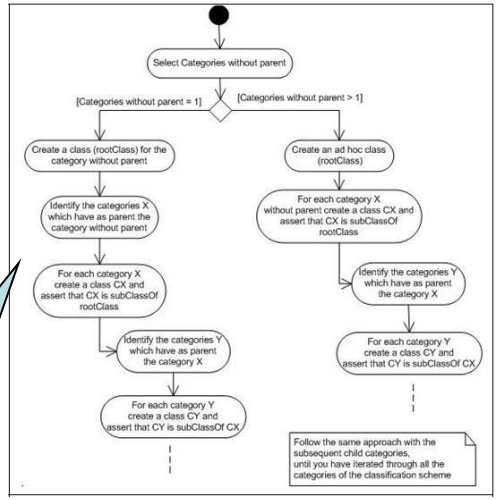
Motivation

resource

Id	Category Name	Parent
20000	Water area	1
21000	Environmental area	20000
22000	Fishing Statistical area	20000
24020	Jurisdiction area	20000
21001	Inland/marine	21000
21002	Ocean	21000
21003	North/South/Equatorial	21000
21004	Sub Ocean	21000
21005	Large Marine ecosystem	21000

Algorithm

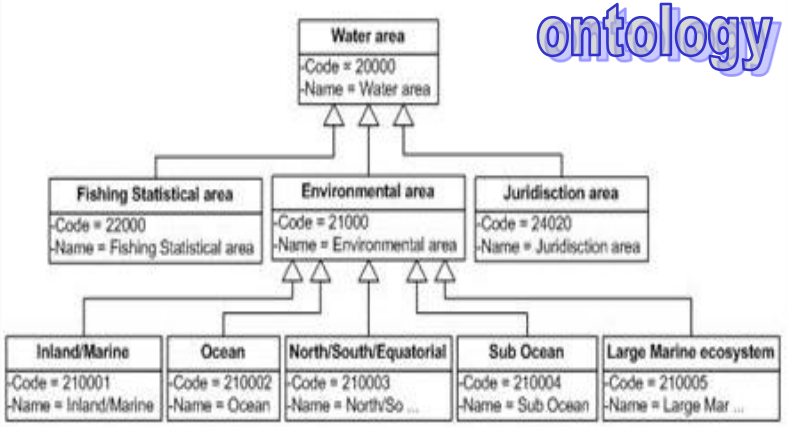


I want to transform my adjacency list-based classification into an ontology

(UML)

Example Solution Ontology

ontology



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Catalog/ID Glossary Thesaurus Informal is-a

Term	BT	NT	RT	UF
Rice	Cereals	Broken rice Basmati rice	Rice straw Oryza	Paddy
Oryza	Poaceae	Oryza sativa Oryza perennis Oryza rufipogon Oryza longistaminata Wetland rice Oryza glaberrima Upland rice Oryza punctata	Rice fields Cereal crops Rice	

Thesaurus

Informal is-a

Id	Category Name	Parent
20000	Water area	1
21000	Environmental area	20000
22000	Fishing Statistical area	20000
24020	Jurisdiction area	20000
21001	Inland/marine	21000
21002	Ocean	21000
21003	North/South/Equatorial	21000
21004	Sub Ocean	21000
21005	Large Marine ecosystem	21000

Catalog/ID

```
NOMENCLÁTOR GEOGRÁFICO
ENTIDADES
Nación
Región geográfica
Capital de Nación
Elevación orográfica
Comunidad Autónoma
Llanura/Raso
Ciudad con Estatuto de Autonomía
Depresión orográfica
Capital de Comunidad Autónoma
Accidente costero
Provincia
Accidente marítimo
Capital de Provincia
Accidente hidrográfico
Coprincipado
Corriente fluvial
Capital de Coprincipado
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.
Paso/Collado
Población
Puerto de montaña
Comunidad de Municipios
Puerto comercial
Enclave
Helipuerto comercial
Territorio anejo
Aeródromo/Aeropuerto
Territorio autonómico
Estación de ferrocarril
Zona neutral
```

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

```
Diccionario de conversión DGN -> EDM.
FORMATO:
  Tipo_dgn Entidad Tipo_istram Grupo Código_bcn Cerrado Trato [

Tipo_ dgn...NNSCCCGG                    Codigo_bcn...TTGGSS
      NN  : Nivel elemento                        TT : Tema
      S   : Estilo linea dgn                      GG : Grupo
      CCC : Color  linea dgn                      SS : Subgrupo
      GG  : Grosor linea dgn

Entidad                                 Tipo_istram....???
      104 : polilínea
      203 : célula se convierte a símbolo
       -1 : célula se explota en sus componentes
      304 : rótulo

Grupo
        0 : sin determinar
        1 : carreteras
        2 : hidrografía
        3 : conducciones
        4 : administrativo

       En textos el grupo corresponde a la fuente Microstation

Cerrado
      en lineas                                 en textos
              1 : perimetral                          n : altur
              0 : entidad lineal abierta
             -1 : cultivo perimetral
             -2 : cultivo linea abierta

Trato
  I: Intocable  A: Altimetría  N: No tratar  T: Textos Asociadc
  S: Textos Sueltos  C: Cultivo  F: Solo salida !: Tratar norma
                                  TTGGSS
02000900   104     1   0   090101   1   !I   Marco de hoja
02300902   104     2   0   100200   0   !    Base Geodésica de Ma
06003900   104     3   0   025102   0   !    Acantilado
06006900   104     4   0   025302   0   !    Costa rocosa no acar
06009900   104     5   2   037402   1   !    Playa fluvial de gui
06012900   104     6   0   025501   1   !    Lavas. Contorno
06015900   104     7   0   058303   0   !I   Dique de hormigón >1
06018900   104     8   0   058304   0   !I   Dique de hormigón <
07013400   104     9   0   058302   0   !I   Dique de tierra
07016400   104    10   0   055401   1   !    Vertedero. Contorno
11003003   104    11   1   062202   0   !    Autopista. Enlace
11012000   104    12   0   056091   1   !I   Patio. Contorno
13003300   104    13   1   060101   0   !    Autopista. Eje
13303300   104    14   1   060131   0   !    Autopista en Contruc
14002401   104    15   1   066901   1   !I   Puesto de S.O.S.
14003301   104    16   1   067901   1   !I   Peaje
15003003   104    17   1   062204   0   !    Autovía. Enlace
15003004   104    18   1   060701   0   !    Autovía
```

Implicit knowledge coded in numbers

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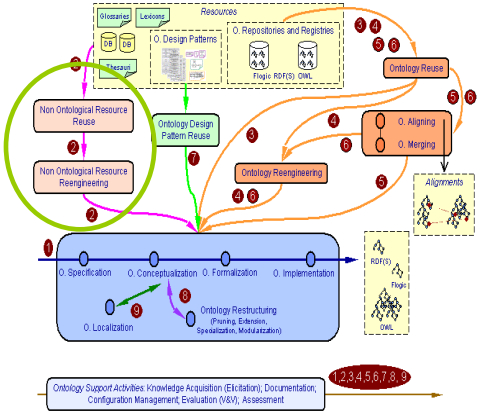
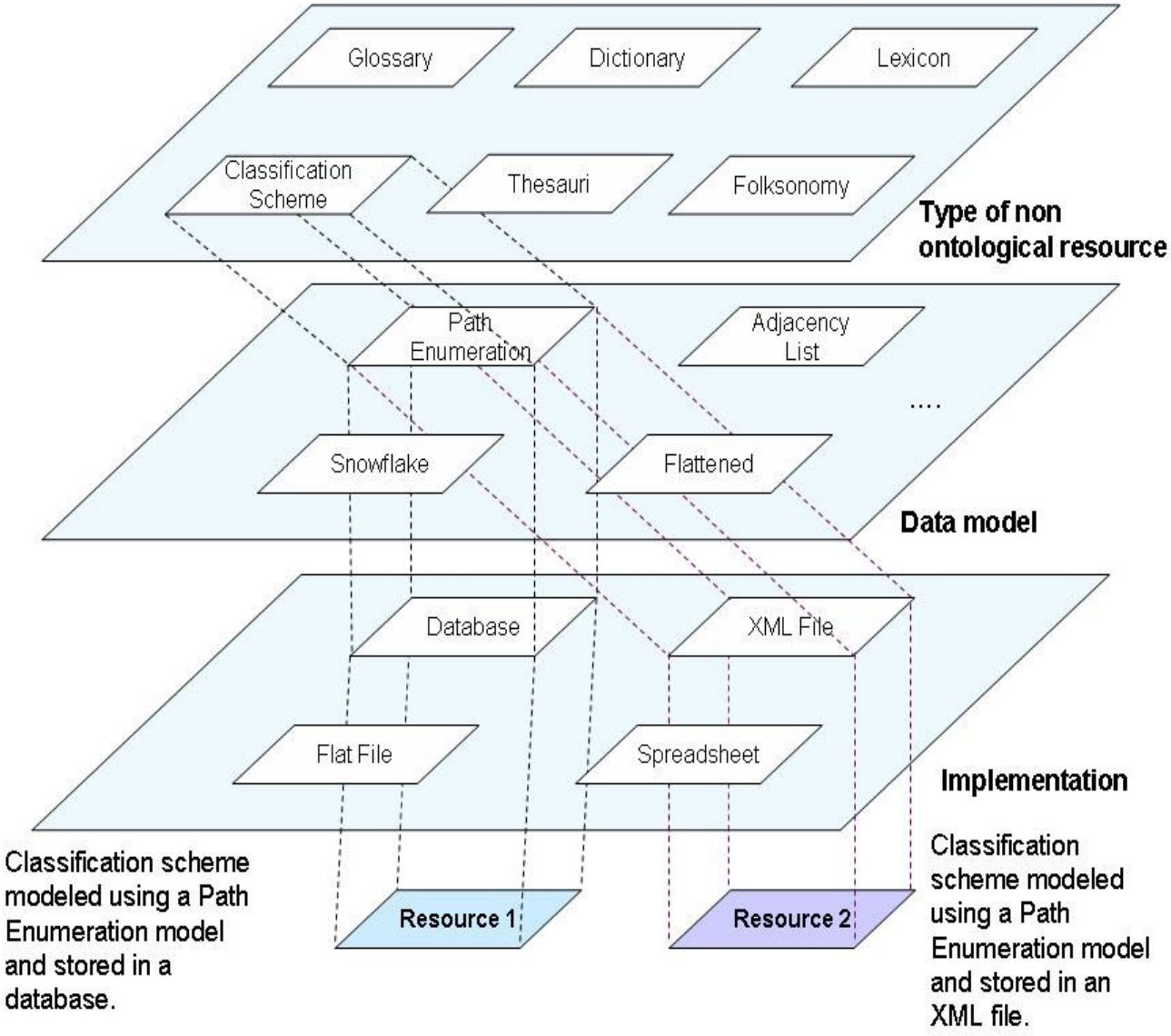
Types of non-ontological resources



Non-Ontological Resources *are knowledge-aware resources whose semantics have not been formalized yet by means of an ontology*



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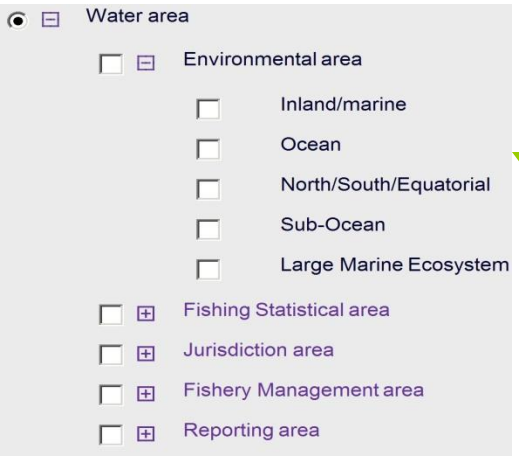
Types of non-ontological resources



Id	Category Name	Parent
20000	Water area	1
21000	Environmental area	20000
22000	Fishing Statistical area	20000
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21001	Inland/marine	21000
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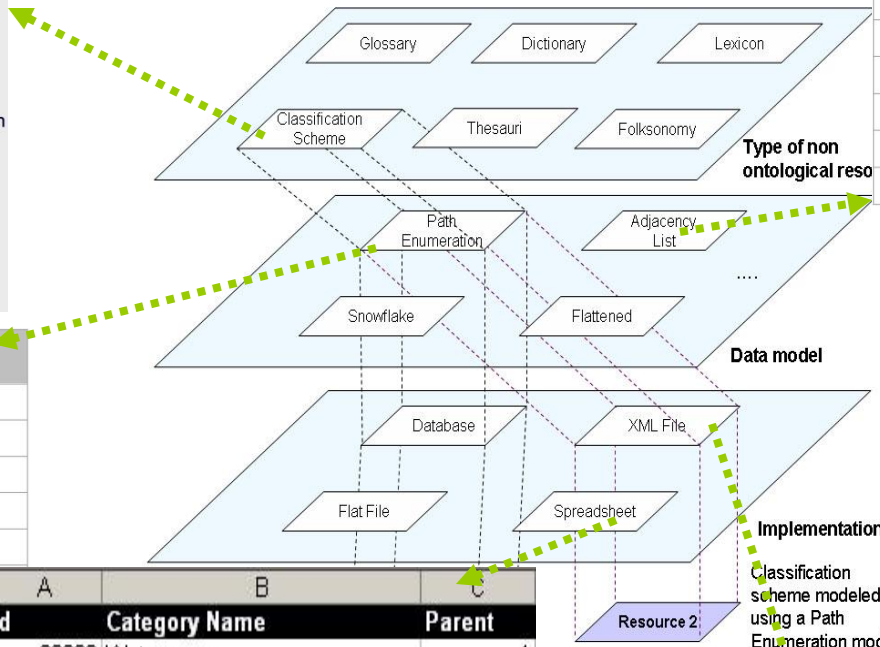

Id	Category Name
20000	Water area
20000. 21000	Environmental area
20000.22000	Fishing Statistical area
20000. 24020	Jurisdiction area
21000.21001	Inland/marine
21000.21002	Ocean
21000.21003	North/South/Equato
21000.21004	Sub Ocean
21000.21005	Large Marine ecosys

	A	B	C
1	Id	Category Name	Parent
2	20000	Water area	1
3	21000	Environmental area	20000
4	22000	Fishing Statistical area	20000
5	24020	Jurisdiction area	20000
6	21001	Iland/marine	21000
7	21002	Ocean	21000
8	21003	North/South/Equatorial	21000
9	21004	Sub Ocean	21000
10	21005	Large Marine ecosystem	21000

```
<Classification>
  <Category>
    <NodeId>20000</NodeId>
    <WaterCategory>Water Area</WaterCategory>
    <parentNodeId>1</parentNodeId>
  </Category>
  <Category>
    <NodeId>21000</NodeId>
```


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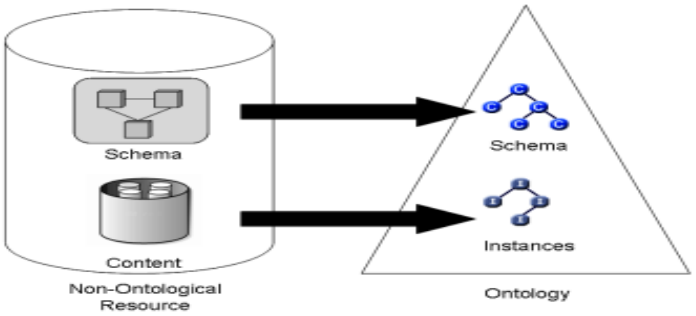
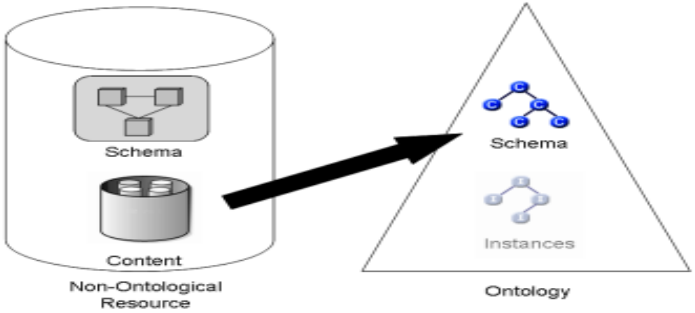
Approaches to transform resources into ontologies

ABox



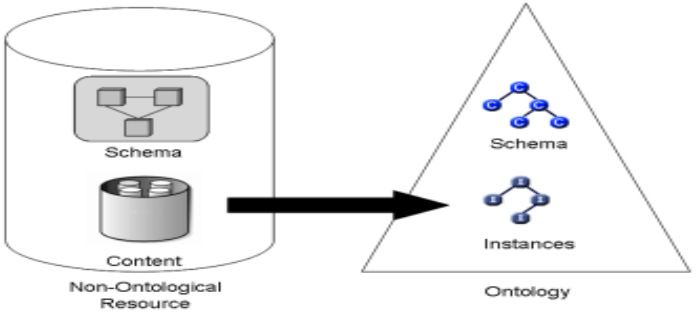
Transforming resource schema into an ontology schema, and resource content into ontology instances

TBox



Transforming resource content into an ontology schema

Population



Transforming resource content into instances of an existing ontology

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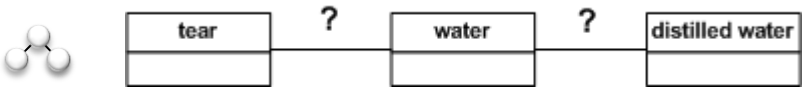
From Knowledge resources to Ontologies

- Making explicit the semantic of the relations between concepts

```
<TERM>
<DESCRIPTOR>water</DESCRIPTOR>
 <RT>distilled water</RT>
 <RT>tear</RT>
</TERM>
```



ID	Name
10	Vehicle
10.01	Car
10.02	Motorcycle
10.03	Bicycle
10.01	Vehicle
10.01.01	Wheel
10.01.02	Seat
10.01.03	Door

?

?

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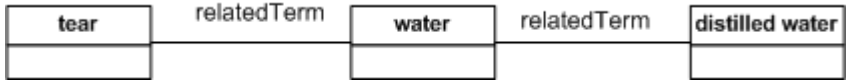
Semantics of the Relations among the entities

- TBox transformation: patterns must disambiguate the semantics of the relations among the NOR entities.

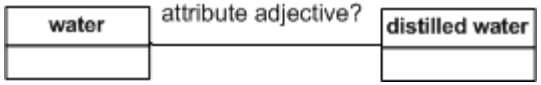
```
<TERM>
<DESCRIPTOR>water</DESCRIPTOR>
 <RT>distilled water</RT>
 <RT>tear</RT>
</TERM>
```



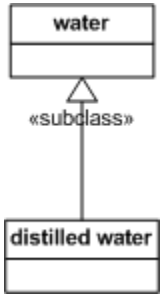
isPartOf **subclass**

1.

2.

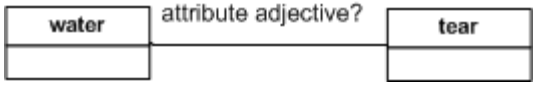


3.

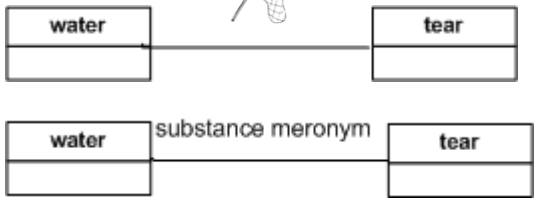


1.

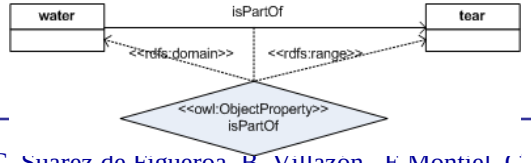
2.



4. a.



4. b.



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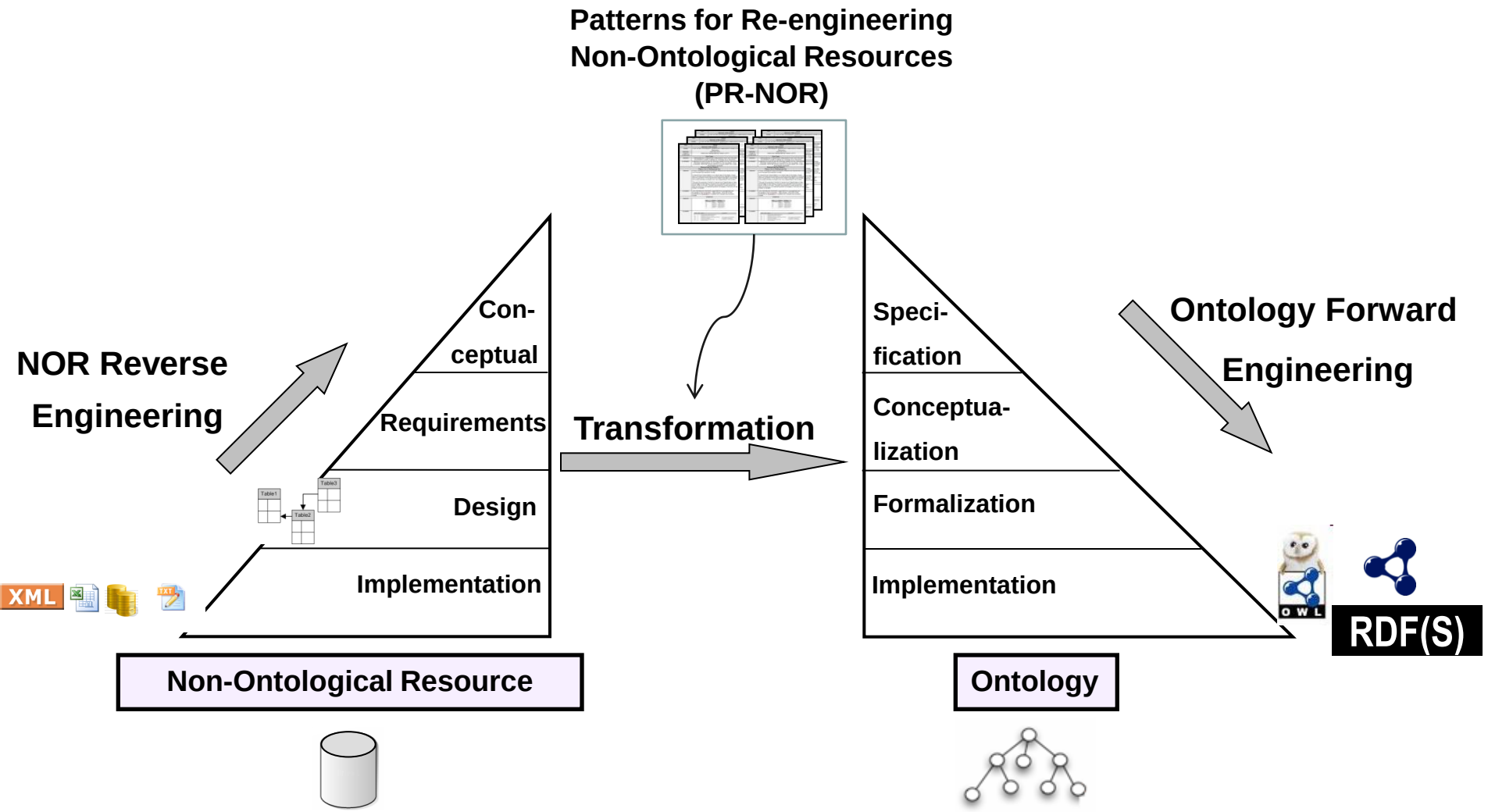
Re-engineering Model for NORs



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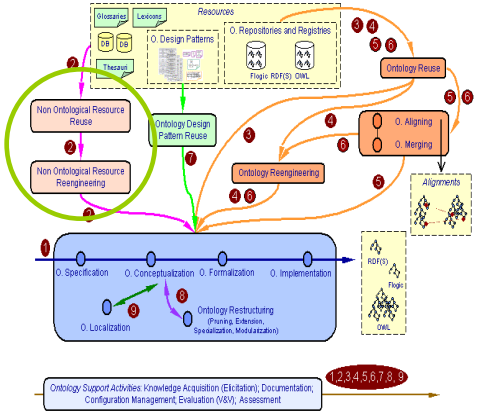
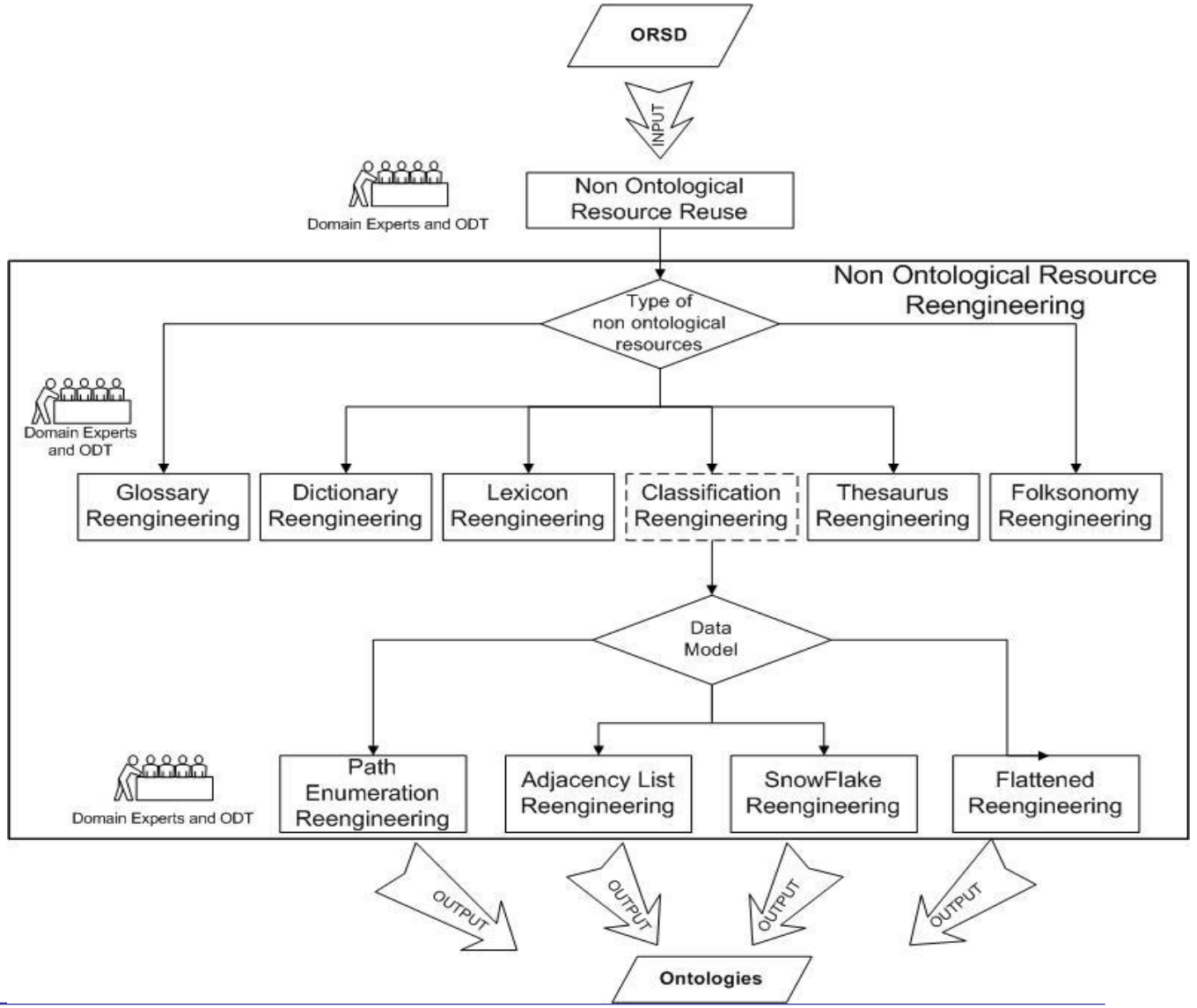
Reuse and Re-engineering Non-ontological Resources





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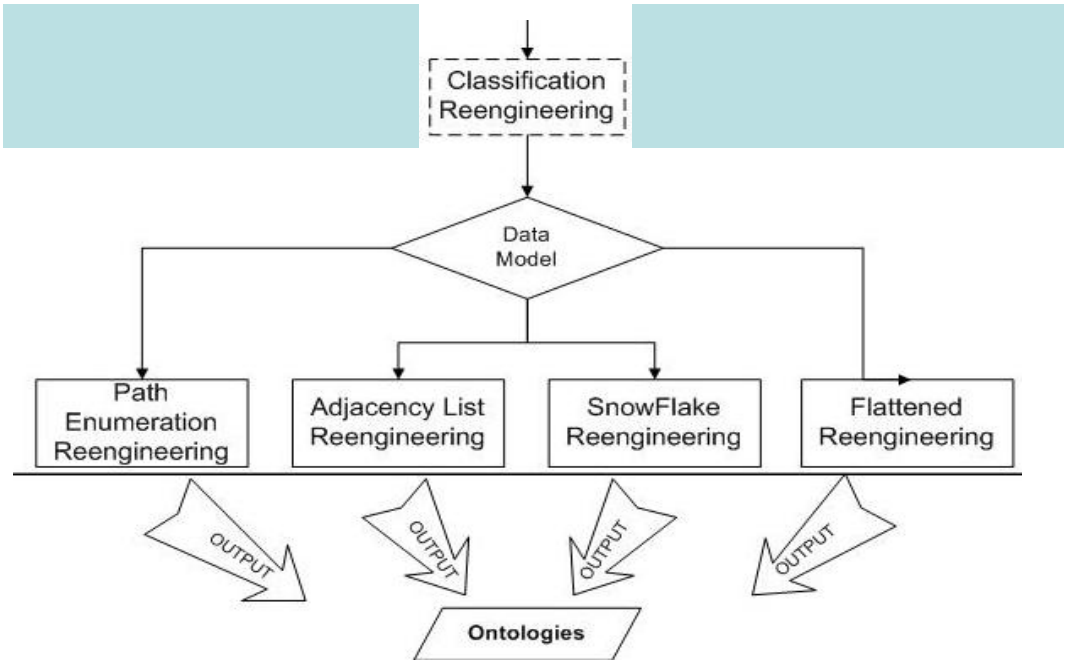
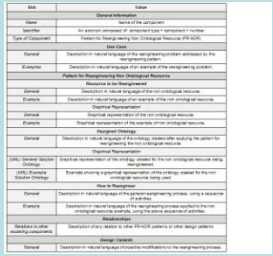
A pattern for each resource data model

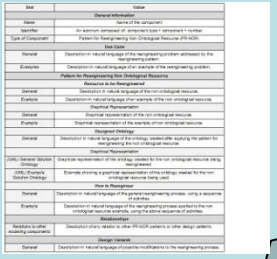


Classification to Taxonomy (Adjacency List)

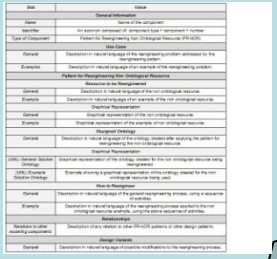
Classification to Taxonomy (Path Enumeration Model)



Classification to Taxonomy (Flattened Model)



Classification to Taxonomy (Snowflake Model)



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Template for the PR-NOR

Slot	Value
General Information	
Name	Name of the pattern
Identifier	An acronym composed of component type + abbreviated name of the component + number
Component Type	Pattern for Re-engineering Non-Ontological Resource (PR-NOR)
Use Case	
General	Description in natural language of the re-engineering problem addressed by the pattern for re-engineering non-ontological resources.
Example	Description in natural language of an example of the re-engineering problem.
Pattern for Re-engineering Non-Ontological Resource	
INPUT: Resource to be Re-engineered	
General	Description in natural language of the non-ontological resource.
Example	Description in natural language of an example of the non-ontological resource.
Graphical Representation	
General	Graphical representation of the non-ontological resource.
Example	Graphical representation of the example of non-ontological resource.
OUTPUT: Designed Ontology	
General	Description in natural language of the ontology created after applying the pattern for re-engineering the non-ontological resource.
Graphical Representation	
(UML) General Solution Ontology	Graphical representation, using the UML profile (Brockmans & Haase, 2006), of the ontology created for the non-ontological resource being re-engineered.
(UML) Example Solution Ontology	Example showing a graphical representation, using the UML profile (Brockmans & Haase, 2006), of the ontology created for the non-ontological resource being used.
PROCESS: How to Re-engineer	
General	Description in natural language of the general re-engineering process, using a sequence of activities.
Example	Description in natural language of the re-engineering process applied to the non-ontological resource example, using the above sequence of activities.
Formal Transformation	
General	Formal description of the transformation by using the formal definitions of the resources.
Relationships (Optional)	
Relations to other modelling components	Description of any relation to other PR-NOR patterns or other ontology design patterns.

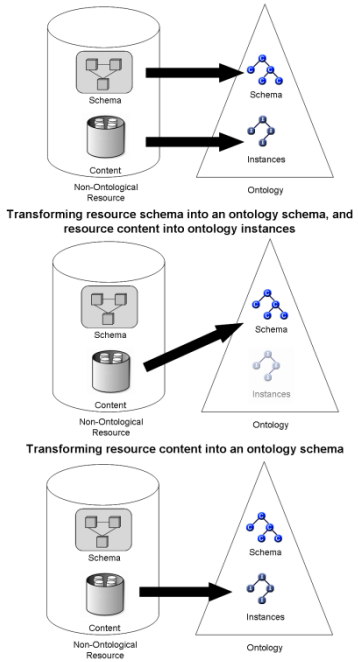
INPUT

OUTPUT

PROCESS

Patterns for Re-engineering Classification Schemes into Ontologies

N	Identifier	Type of NOR	NOR Data Model	Transformation approach	Target
1	PR-NOR-CLTX-01	Classification Scheme	Path Enumeration	TBox	Ontology Schema
2	PR-NOR-CLTX-02	Classification Scheme	Adjacency List	TBox	Ontology Schema
3	PR-NOR-CLTX-03	Classification Scheme	Snowflake	TBox	Ontology Schema
4	PR-NOR-CLTX-04	Classification Scheme	Flattened	TBox	Ontology Schema
5	PR-NOR-CLLO-10	Classification Scheme	Path Enumeration	ABox	Ontology
6	PR-NOR-CLLO-11	Classification Scheme	Adjacency List	ABox	Ontology
7	PR-NOR-CLLO-12	Classification Scheme	Snowflake	ABox	Ontology
8	PR-NOR-CLLO-13	Classification Scheme	Flattened	ABox	Ontology



– ABox transformation

– TBox transformation

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Pattern for re-engineering a classification scheme, which follows the adjacency list data model, into an ontology schema

INPUT: Non-Ontological Resource

General

A non-ontological resource holds a classification scheme which follows the adjacency list model.
A classification scheme is a rooted tree of concepts, in which each concept groups entities by some particular degree of similarity.
The semantics of the hierarchical relation between parents and children concepts may vary depending of the context.
The adjacency list data model for hierarchical classifications proposes to create an entity which holds a list of items with a linking column associated to their parent items.

Category Code	Category Name	Parent Category Code
1	Category1	Null
2	Category2	Null
3	Category3	1
4	Category4	1
5	Category6	3
6	Category7	4
…	…	…

Example

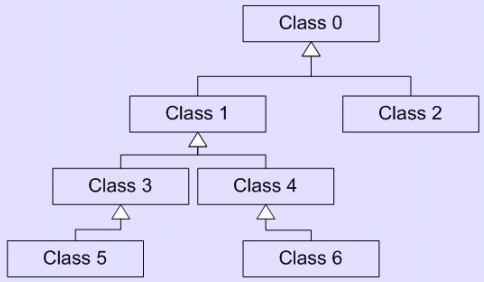
The FAO classification for water areas groups them according to some different criteria as environment, statistics, and jurisdiction, among others. This classification scheme is available at http://www.fao.org/figis/servlet/RefServlet

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

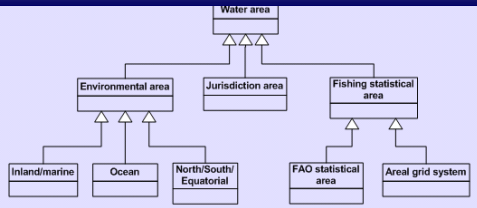
OUTPUT: Ontology

General

The ontology generated will be based on the taxonomy architectural pattern (AP-TX-01).
Each category in the classification scheme is mapped to a class, and the semantics of the relationship between children and parent are disambiguated by using an external resource.



Example



PROCESS: How to Re-engineer

2. Create the `Environmental area` class.
3. Using the external resource identify the semantics of the relation between the `Environmental area` class and the `Water area` class, and set up the relation identified.
   - 3.1. Create the `Inland/marine` class.
   - 3.2. Using the external resource identify the semantics of the relation between the `Inland/marine` class and the `Environmental area` class, and set up the identified relation.
   - 3.3. Create the `Ocean` class.
   - 3.4. Using the external resource identify the semantics of the relation between the `Ocean` class and the `Environmental area` class, and set up the relation identified.
   - 3.5. Create the `North/South/Equatorial` class.
   - 3.6. Using the external resource identify the semantics of the relation between the `North/South/Equatorial` class and the `Environmental area` class, and set up the relation identified.
4. Create the `Fishing Statistical area` class.
5. Using the external resource identify the semantics of the relation between the `Fishing Statistical area` class and the `Water area` class, and set up the relation identified.
   - 5.1. Create the `FAO statistical area` class.
   - 5.2. Using the external resource identify the semantics of the relation between the `FAO statistical area` class and the `Fishing Statistical area` class, and set up the relation identified.
   - 5.3. Create the `Areal grid system` class.
   - 5.4. Using the external resource identify the semantics of the relation between the `Areal grid system` class and the `Fishing Statistical area` class, and set up the relation identified.
6. Create the `Jurisdiction area` class.
7. Using the external resource identify the semantics of the relation between the `Jurisdiction area` class and the `Water area` class, and set up the relation identified.

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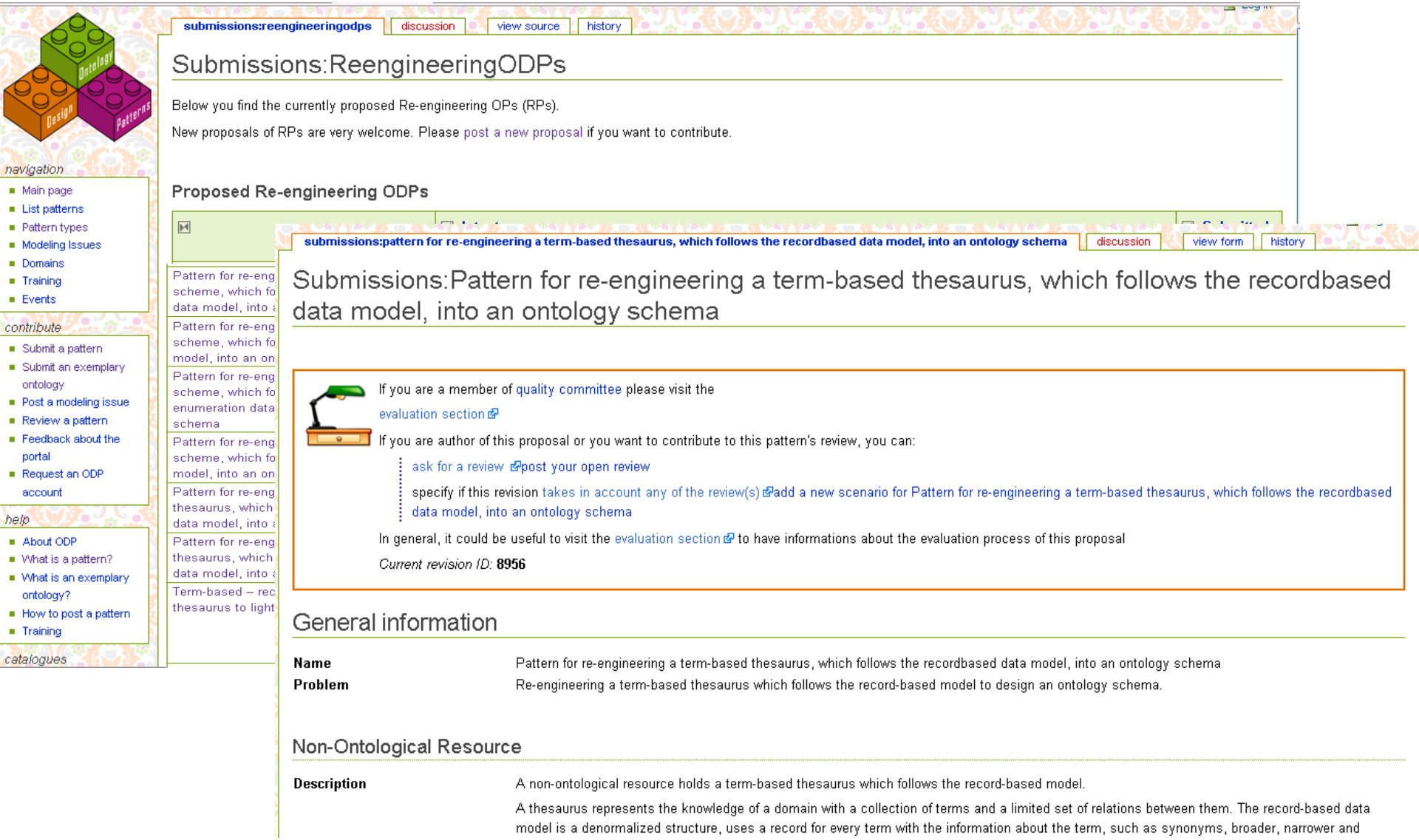
PR-NOR library at the ODP Portal



http://ontologydesignpatterns.org/wiki/Submissions:ReengineeringODPs

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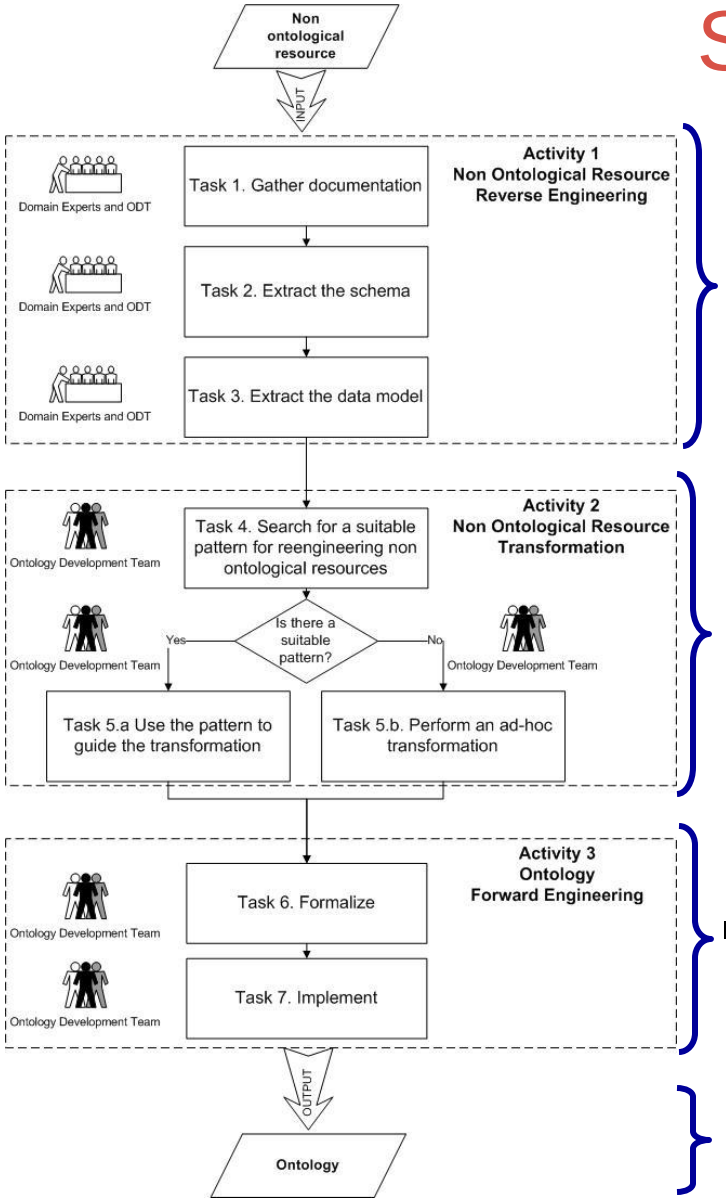
SEEMP Use Case - ISTAT



Istat.it

Eurostat

Adjacency list

Search criteria:

- NOR Type**: classification scheme**
- Data model**: adjacency list**
- Target ontology**: lightweight**
- The semantics of the relations between classification scheme items**: *subClassOf***

ad-hoc wrapper

Italian Geography Ontology

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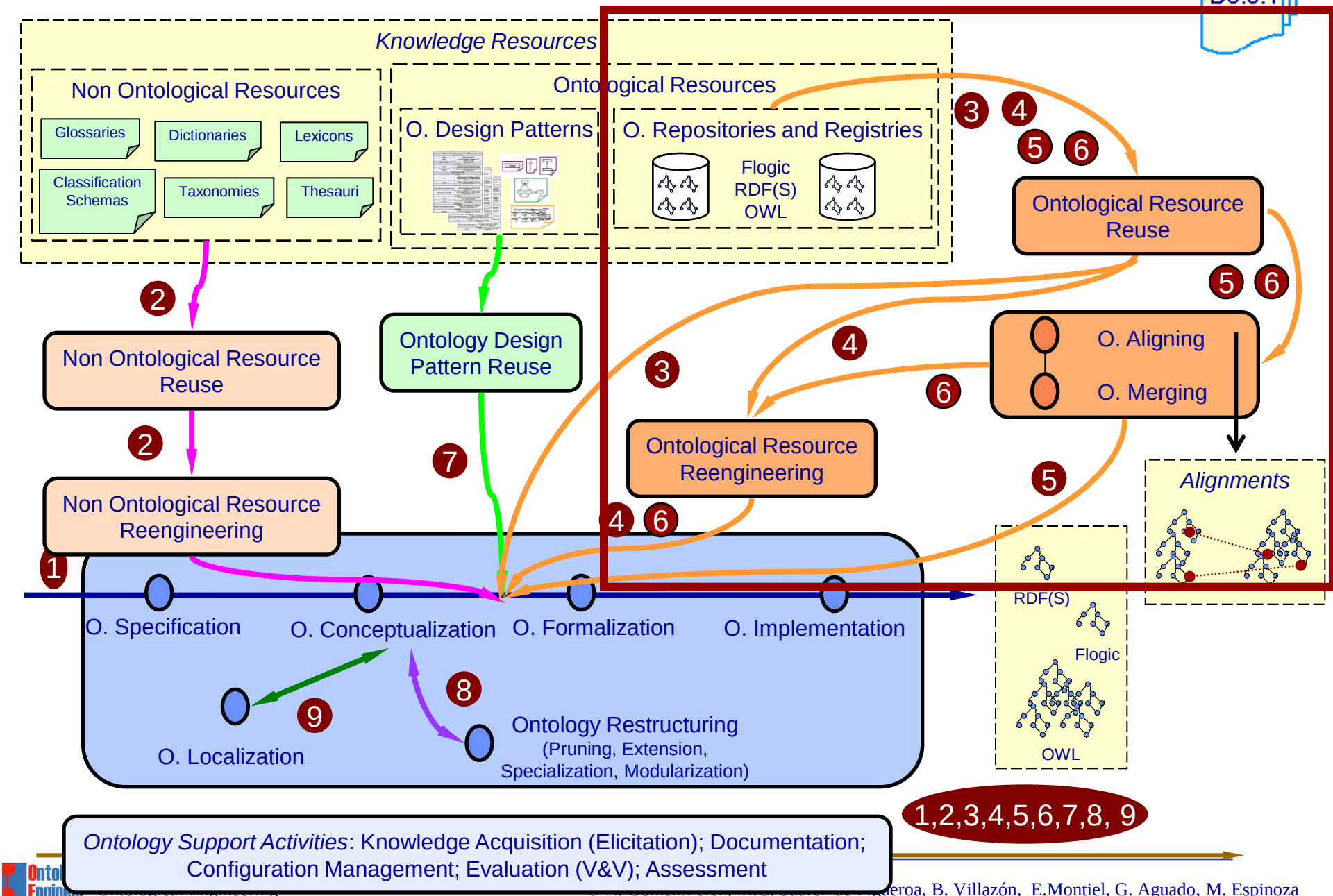
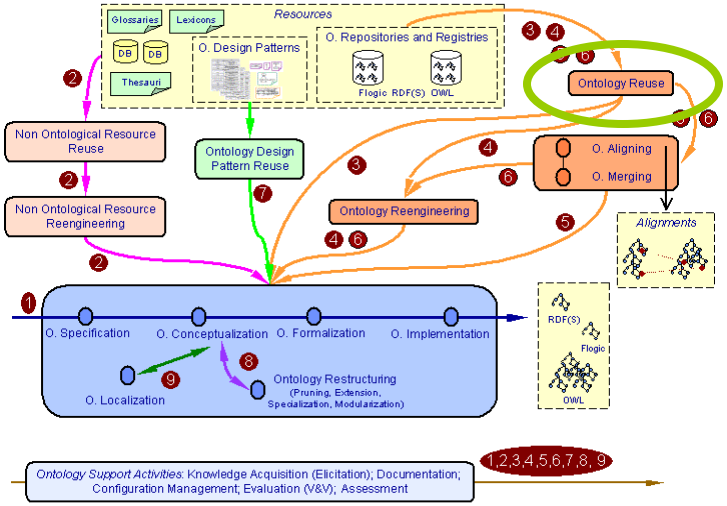
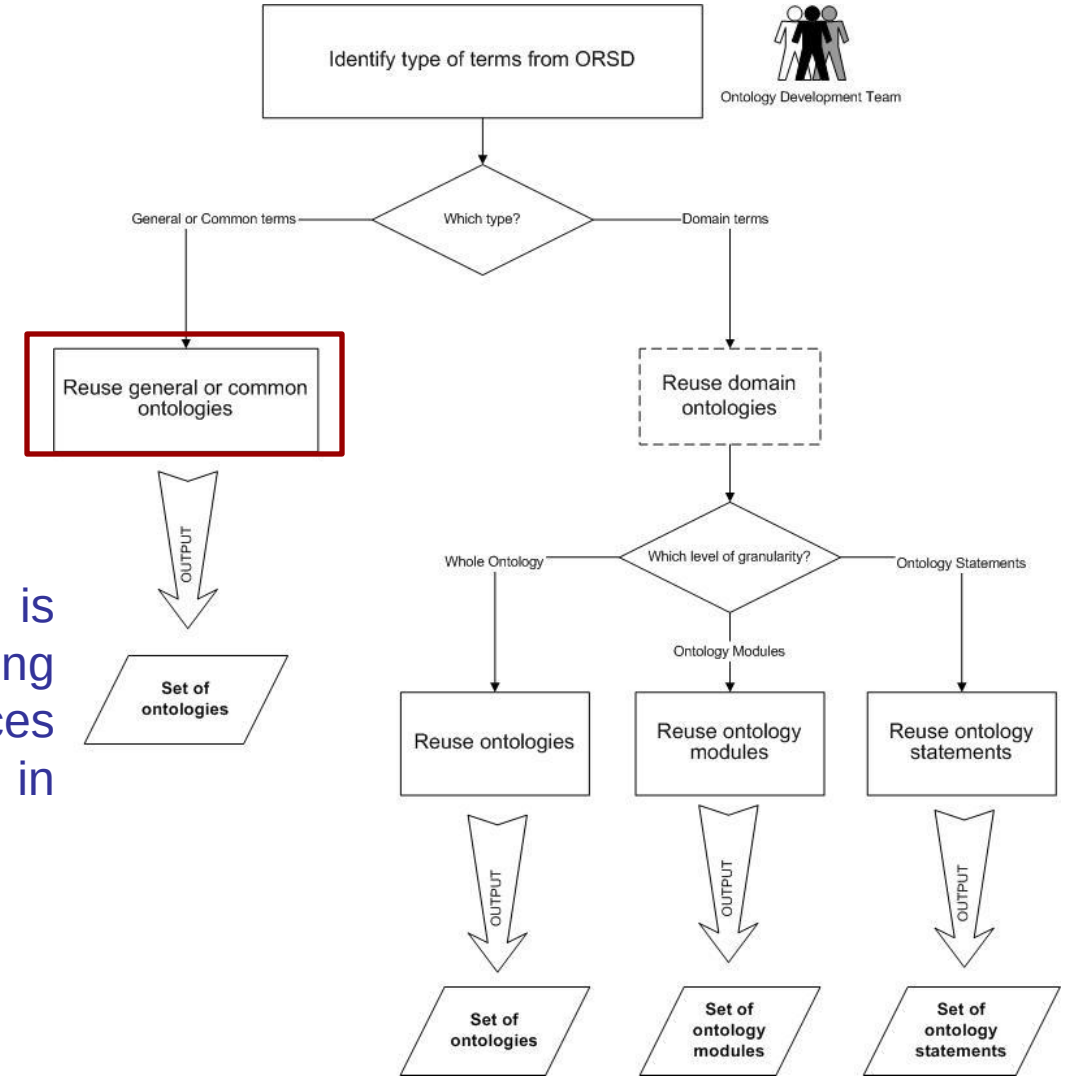
NeOn Scenarios

D5.3.1



Ontological Resource Reuse Process





- **Ontological Resource Reuse** is defined as the process of using available ontological resources (ontologies, modules, statements) in the solution of different problems.

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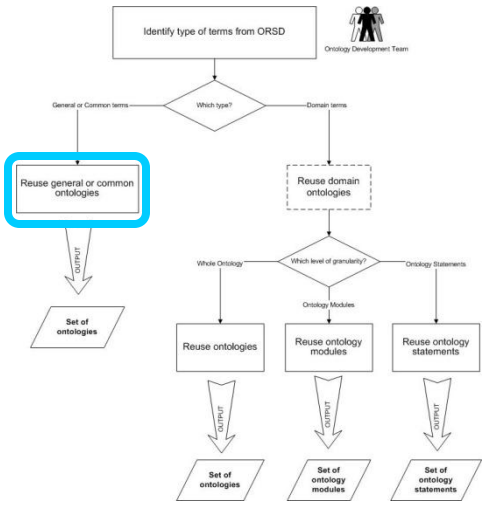
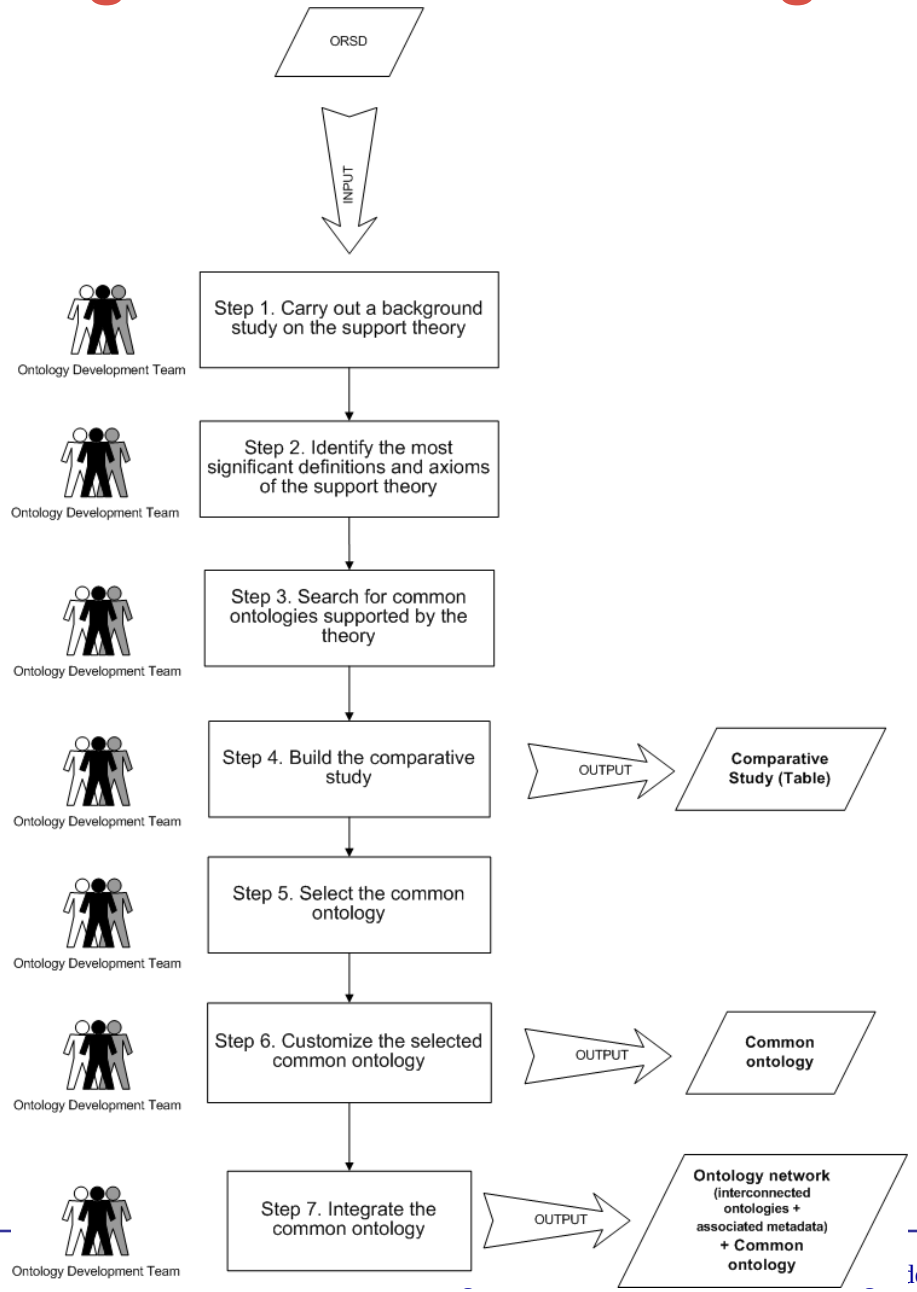
Reusing Common Ontologies

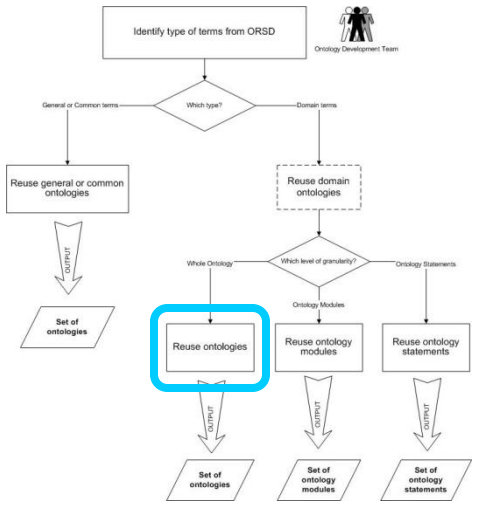


3 examples:

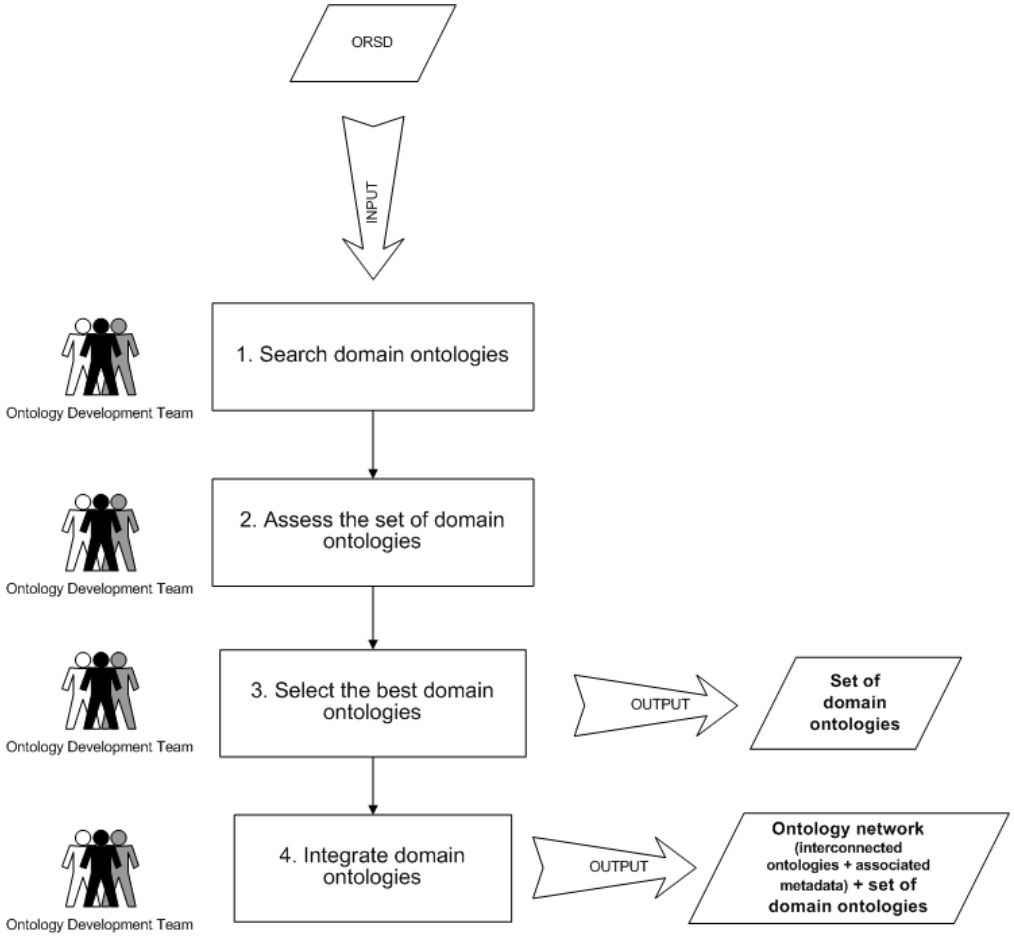
- SEEMP Project
- Invoice Use Case
- Nomenclature Use Case



Reusing Ontologies as a Whole



Ontology Reuse is redefined as the activity of using ontologies (in this case domain ontologies) in the solution of different problems.



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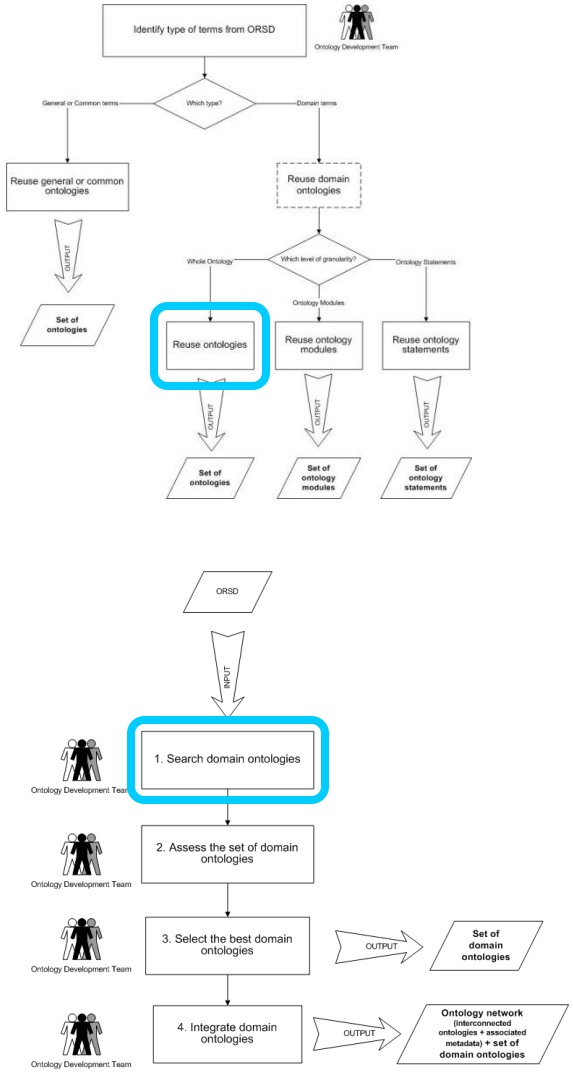
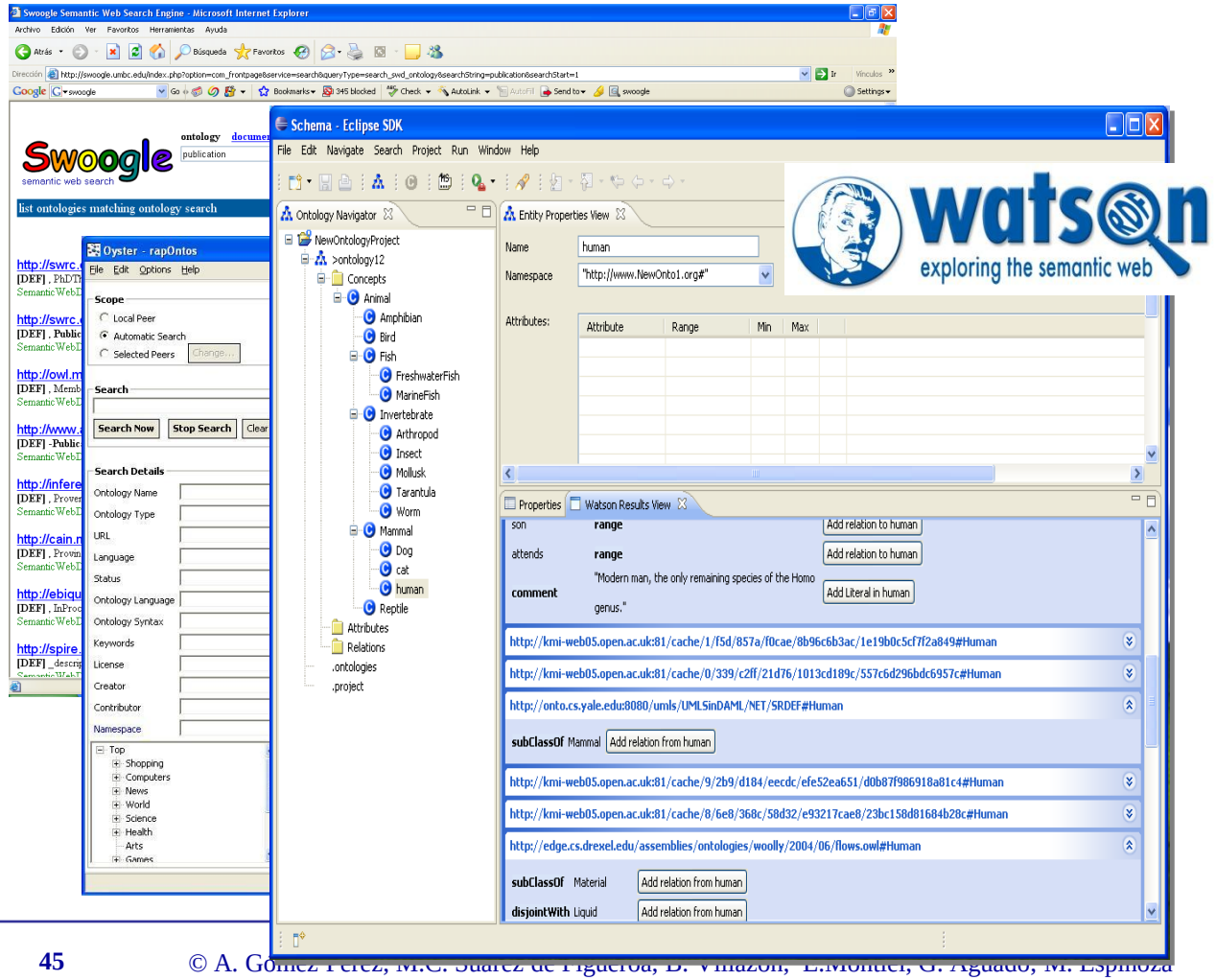
Reusing Ontologies as a Whole. Domain Ontology Search



Use ontology libraries and ontology repositores to search domain ontologies, using those terms that have a high frequency in the ORSD.



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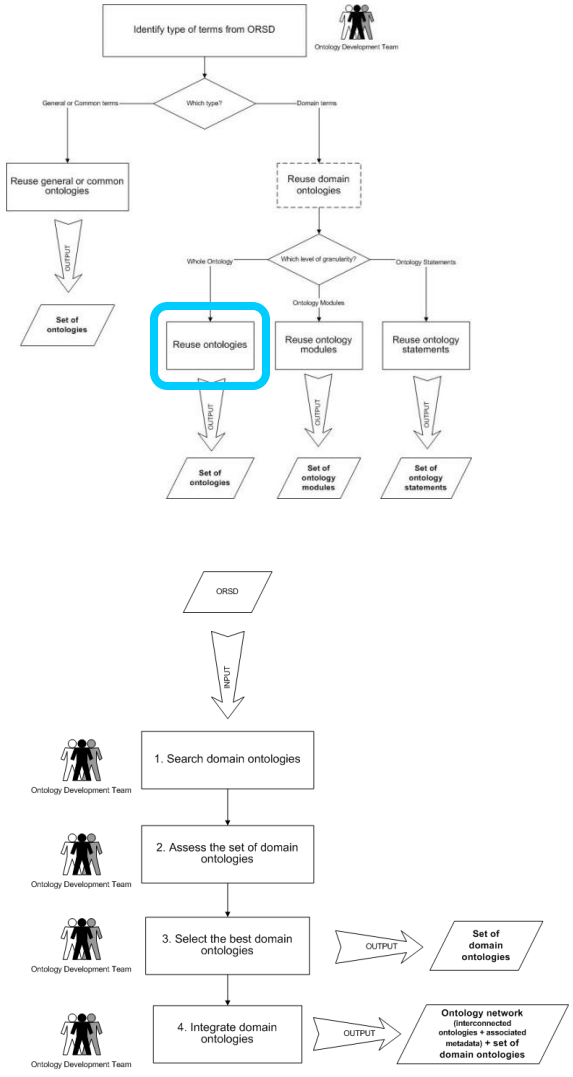
Reusing Ontologies as a Whole. Domain Ontology Assess



Are the found ontologies useful?

- ❑Check the terminology in the CQs in the found ontologies
- ❑ Other requirements: language, standardized terms, multilinguality, etc.

Which ones are the best?

- ❑ Good documentation
- ❑ Modular ontology
- ❑ Integration effort is low.
- ❑ Ontology is reused by others.
- ❑ If the ontology used naming conventions.
- ❑ If the ontology have been evaluated.

How do I integrate?

- ❑Reused as it is.
- ❑ Ontology reengineering
- ❑ Ontology merge

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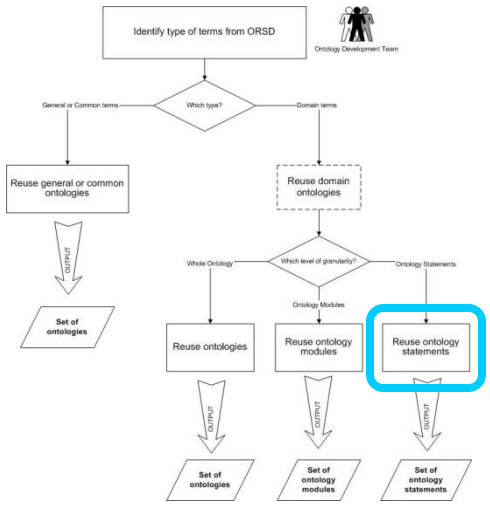
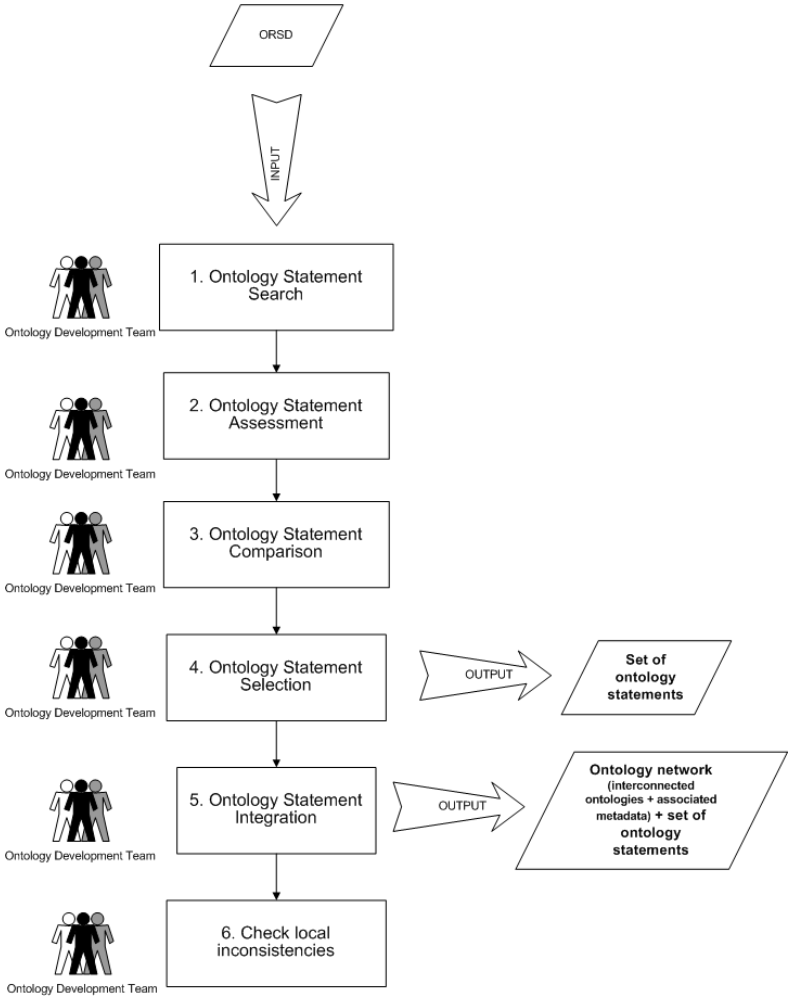
Reusing Ontology Statements



Ontology Statement Reuse is defined as the activity of using ontology statements in the solution of different problems.



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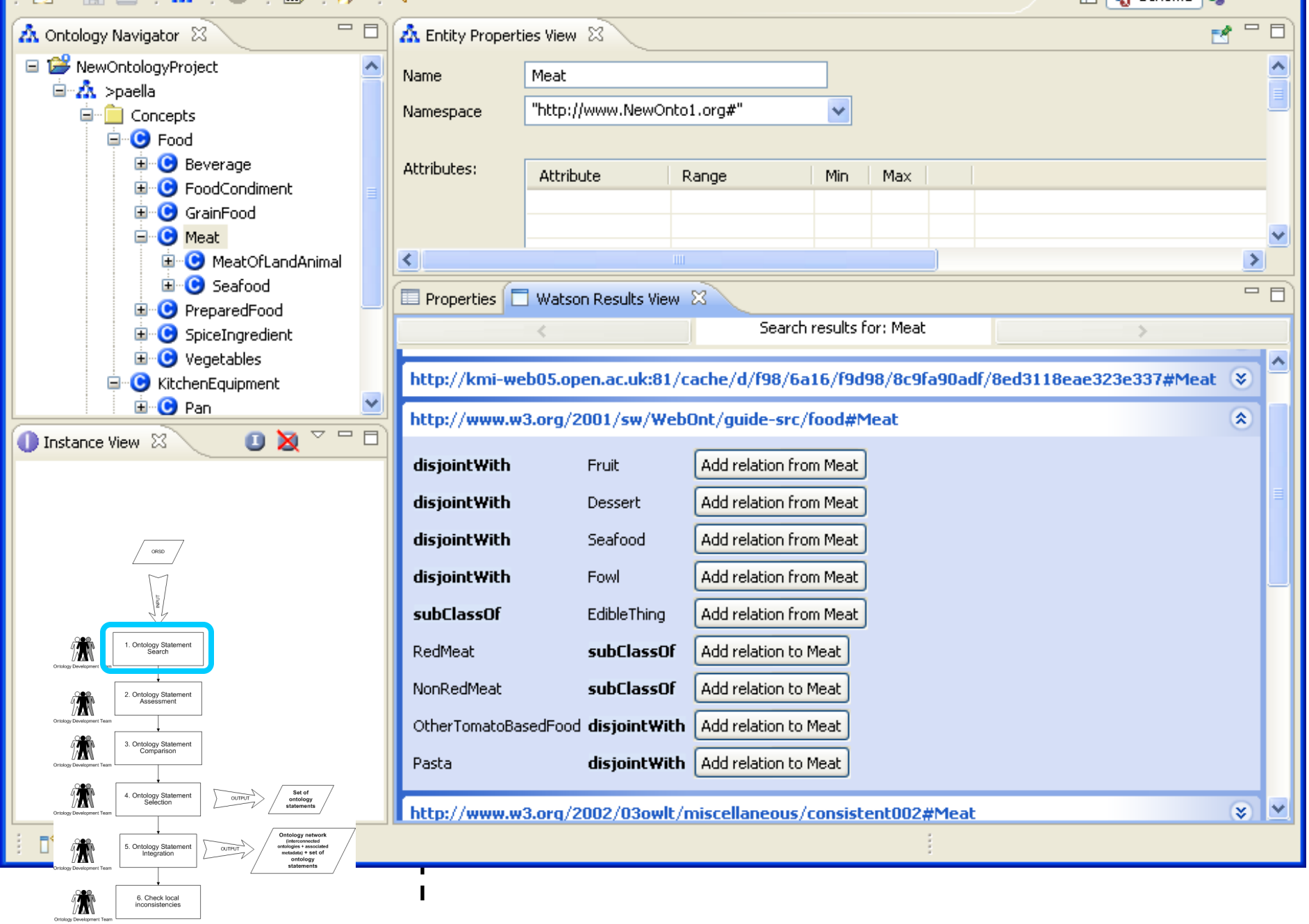

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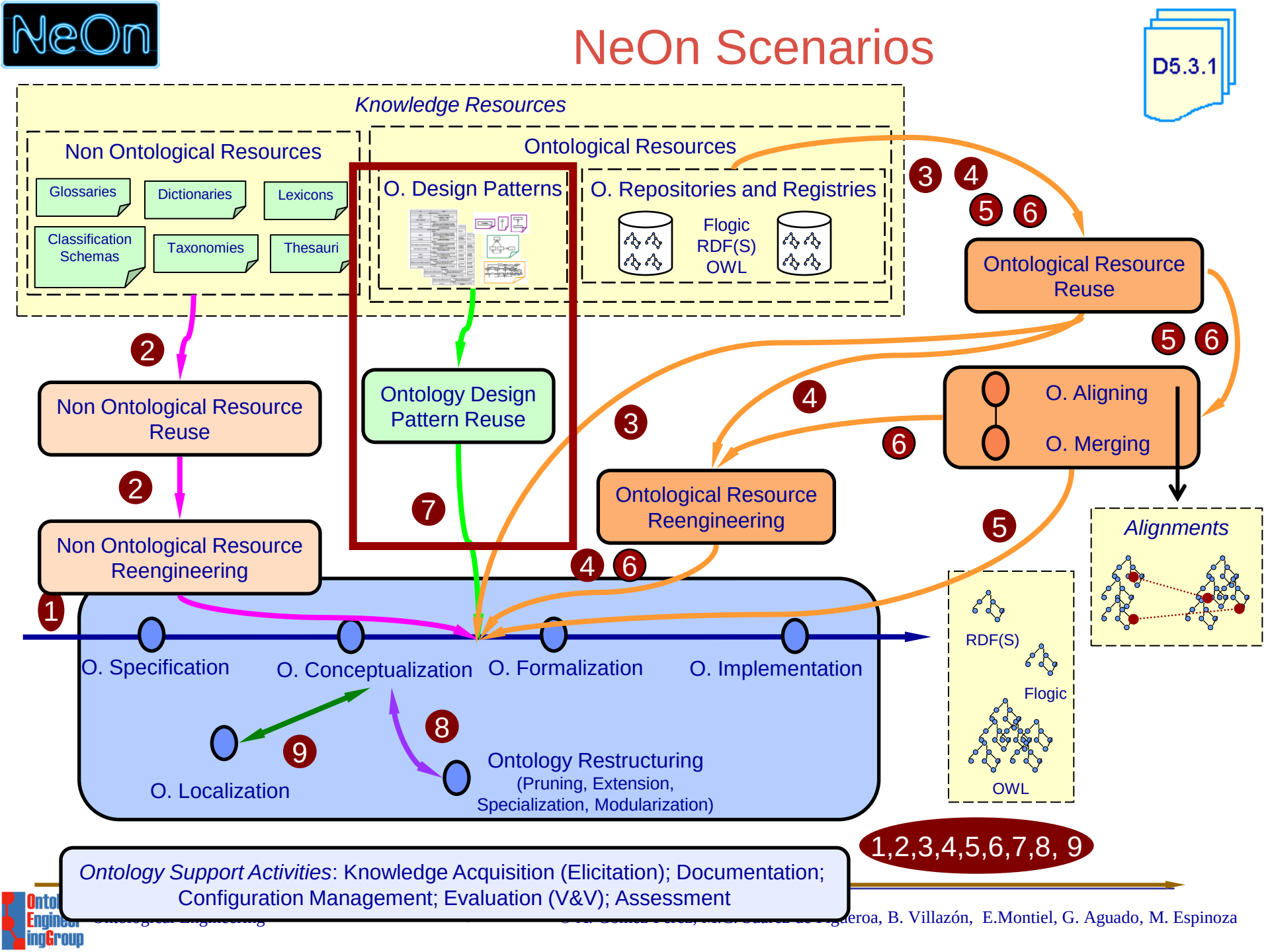
NeOn Scenarios

D5.3.1



O. Corcho, M.C. Suárez de Figueroa, B. Villazón, E.Montiel, G. Aguado, M. Espinoza

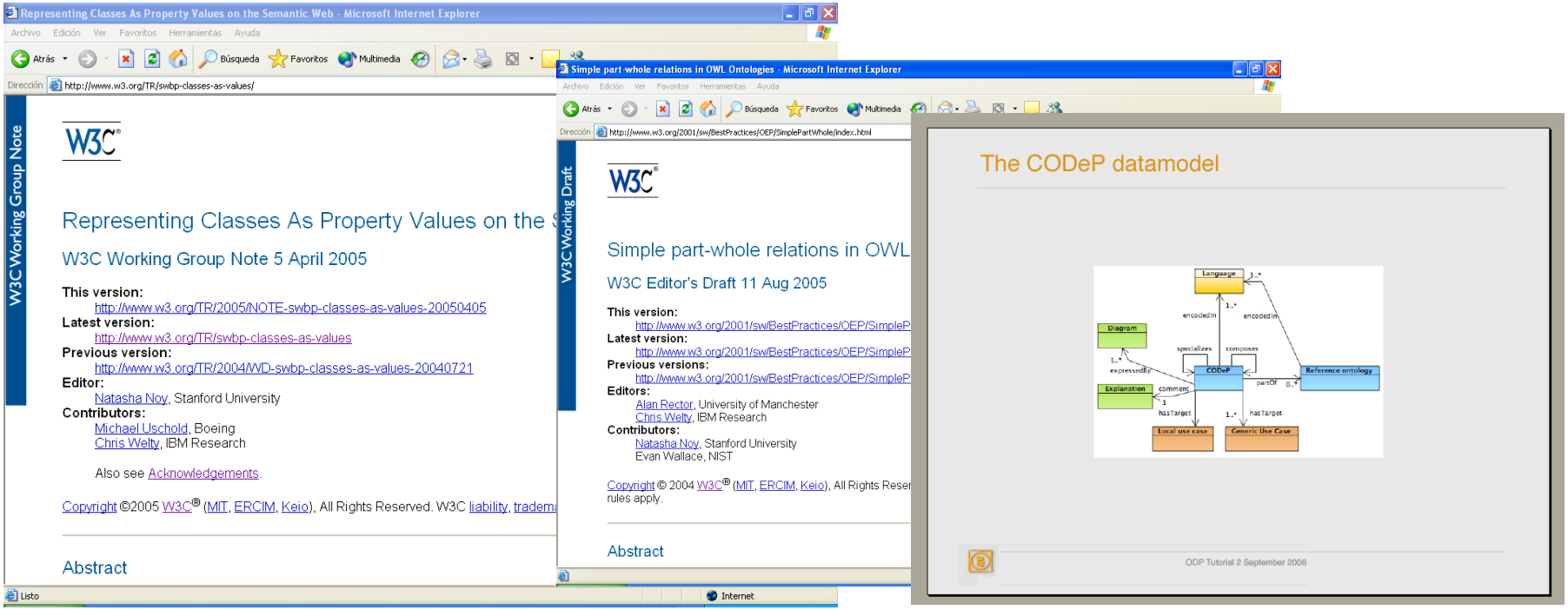
Patterns

Pattern is something proposed for imitation.

Design Pattern refers to shared guidelines that help solve design problems.

Ontology Design Pattern (ODP) is a modeling solution to solve a recurrent ontology design problem.

> Our concept of "pattern" is associable with the wider "good/best practice" of software engineering. It includes a wider range of solution types. For example: naming conventions in software engineering are considered good practices, they are not design patterns.



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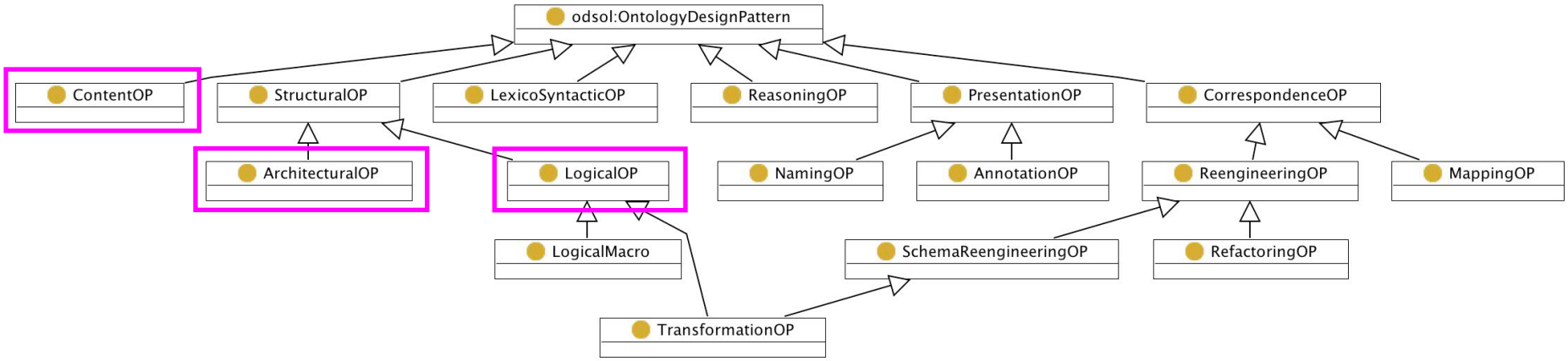
Types of Ontology Design Patterns



Content OPs (CPs) encode conceptual, rather than logical design patterns.
Logical OPs solve design problems independently of a particular conceptualization.
CPs propose patterns for solving design problems for the domain classes and properties that populate an ontology. They address content problems.

A **Logical OP** is a formal expression, whose only parts are expressions from a logical vocabulary e.g., OWL DL, that solves a problem of expressivity.
Logical OPs are independent from a specific domain of interest i.e. they are content-independent

Architectural OPs affect the overall shape of the ontology: their aim is to constrain 'how the ontology should look like'.

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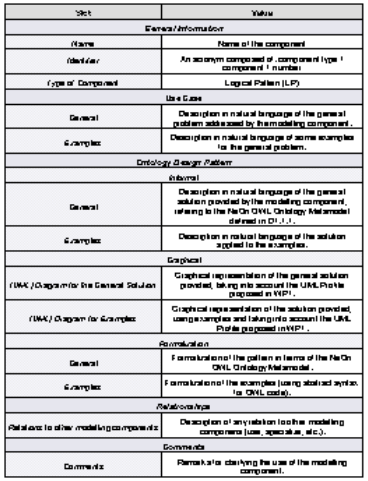
Inventory of Patterns (I)



Slot	Value
General Information	
Name	Name of the component
Identifier	An acronym composed of : component type + component + number
Type of Component	Logical Pattern (LP)
Use Case	
General	Description in natural language of the general problem addressed by the modeling component.
Examples	Description in natural language of some examples to the general problem.
Ontology Design Pattern	
Informal	
General	Description in natural language of the general solution provided by the modeling component, refering to the NeOn OWL Ontology Metamodel defined in D1.1.1.
Examples	Description in natural language of the solution applied to the examples.
Graphical	
UML) Diagram for the General Solution	Graphical representation of the general solution provided, taking into account the UML Profile proposed in WP1.
(UML) Diagram for Examples	Graphical representation of the solution provided, using examples and taking into account the UML Profile proposed in WP1.
Formalization	
General	Formalization of the pattern in terms of the NeOn OWL Ontology Metamodel.
Examples	Formalization of the examples (using abstract syntax, for OWL code).
Relationships	
Relations to other modeling components	Description of any relation to the modeling components (use_specialize, etc.).
Comments	
Comments	Remarks for clarifying the use of the modeling component.

- *General Information*:
  - Name
  - Identifier
  - Ontology modelling component type (LP, AP and CP)
- *Use Case*, or problem to be addressed.
- *Ontology Design Pattern*, or proposed solution in different formats.
- *Relations to other ontology model components*. This slot is optional.
- *Comments*. This slot is also optional.

NeOn Deliverable D5.1.1

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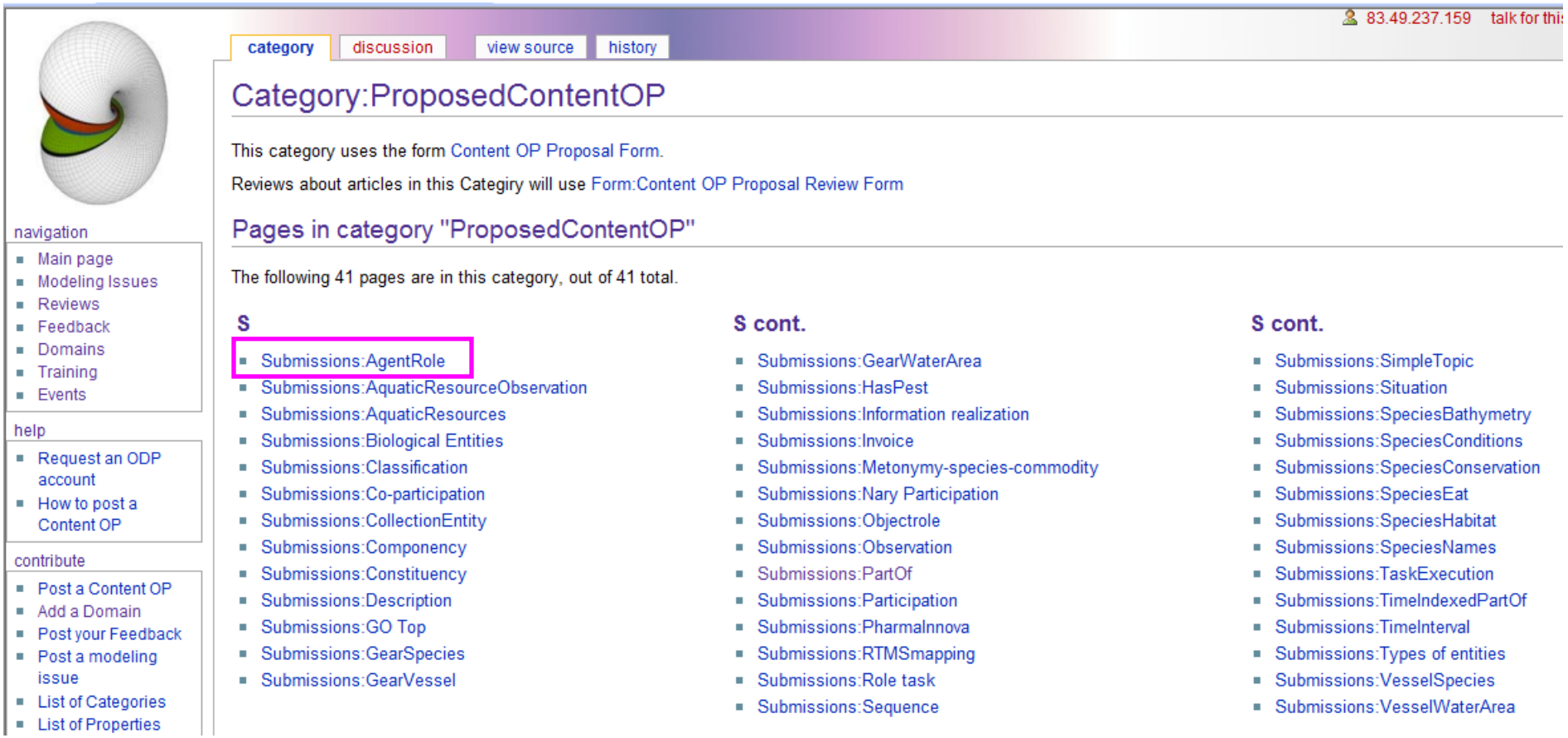
Inventory of Patterns (II)

http://ontologydesignpatterns.org



NeOn Deliverable D2.5.1

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Looking for an European Employment

EURES ES (Int)

Lombard ES (It)

Catalonia ES (Es)

Private ES (Int)

Wallonia ES (Be)

p ES, q ES, r ES, a ES, b ES, c ES, d ES, f ES, h ES, i ES, m ES, n ES

Cand., Vacan.

LEGENDA

- ES — Employment Service
- Cand. — Job Seeker's Candidacy
- Vacan. — Employer Job Vacancy

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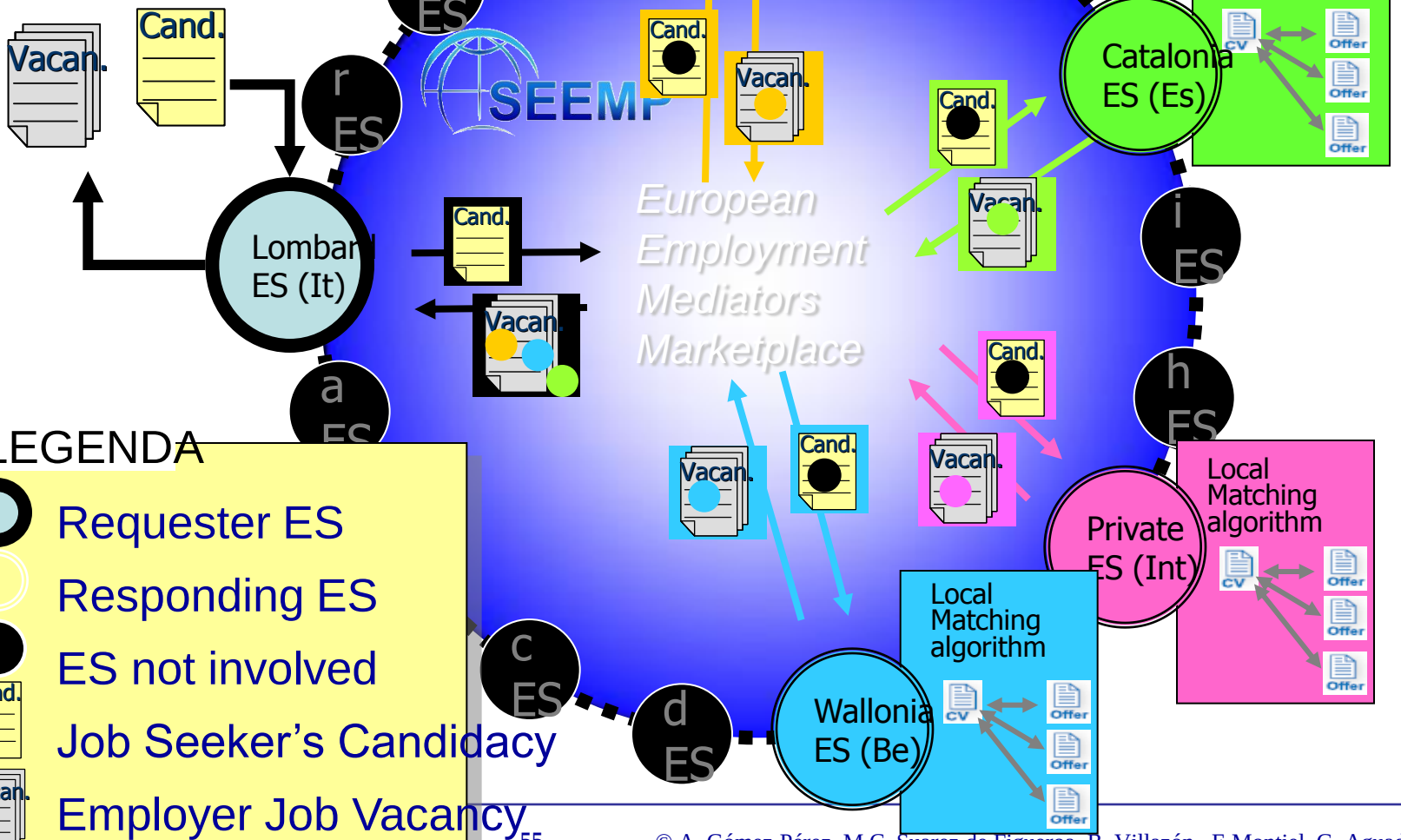
The Goal: Helping Job Seekers on their way



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Key aspects of Ontological Engineering

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

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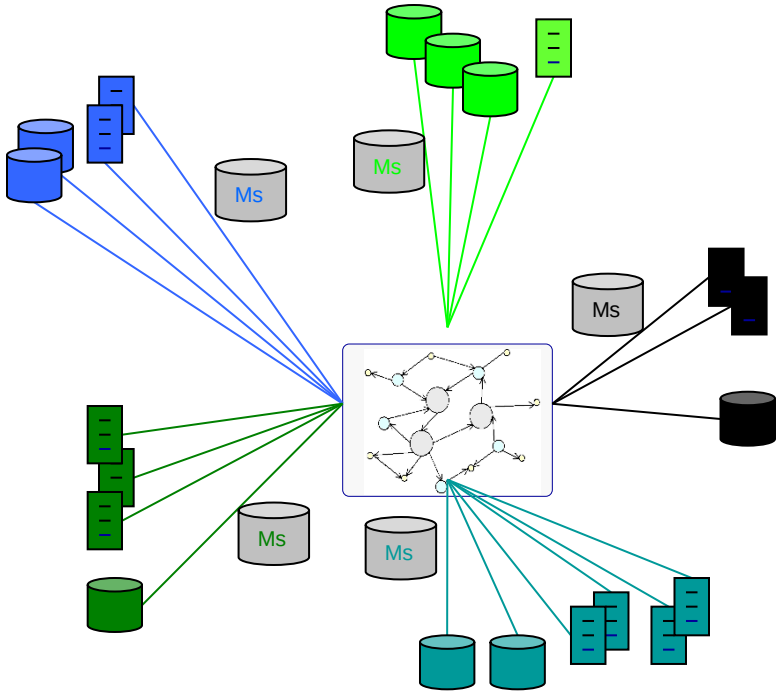
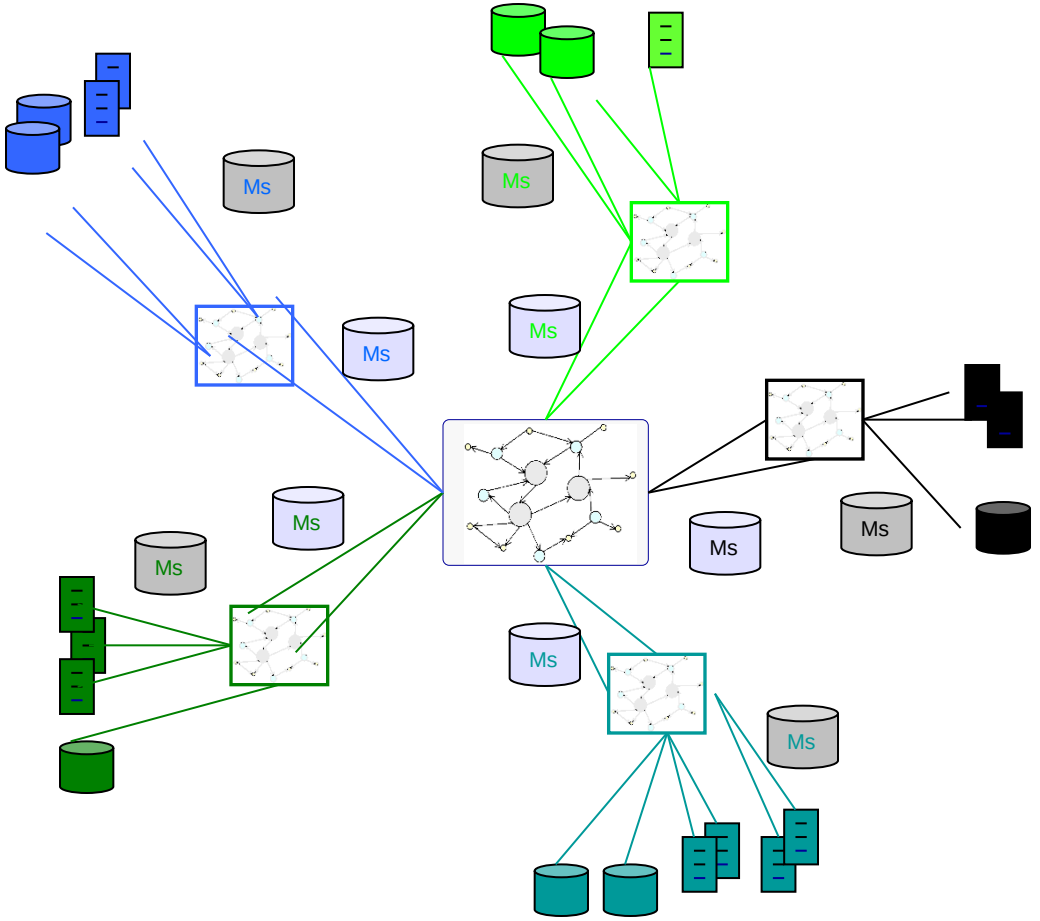
Centralized network of ontologies



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

Federated network of ontologies



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

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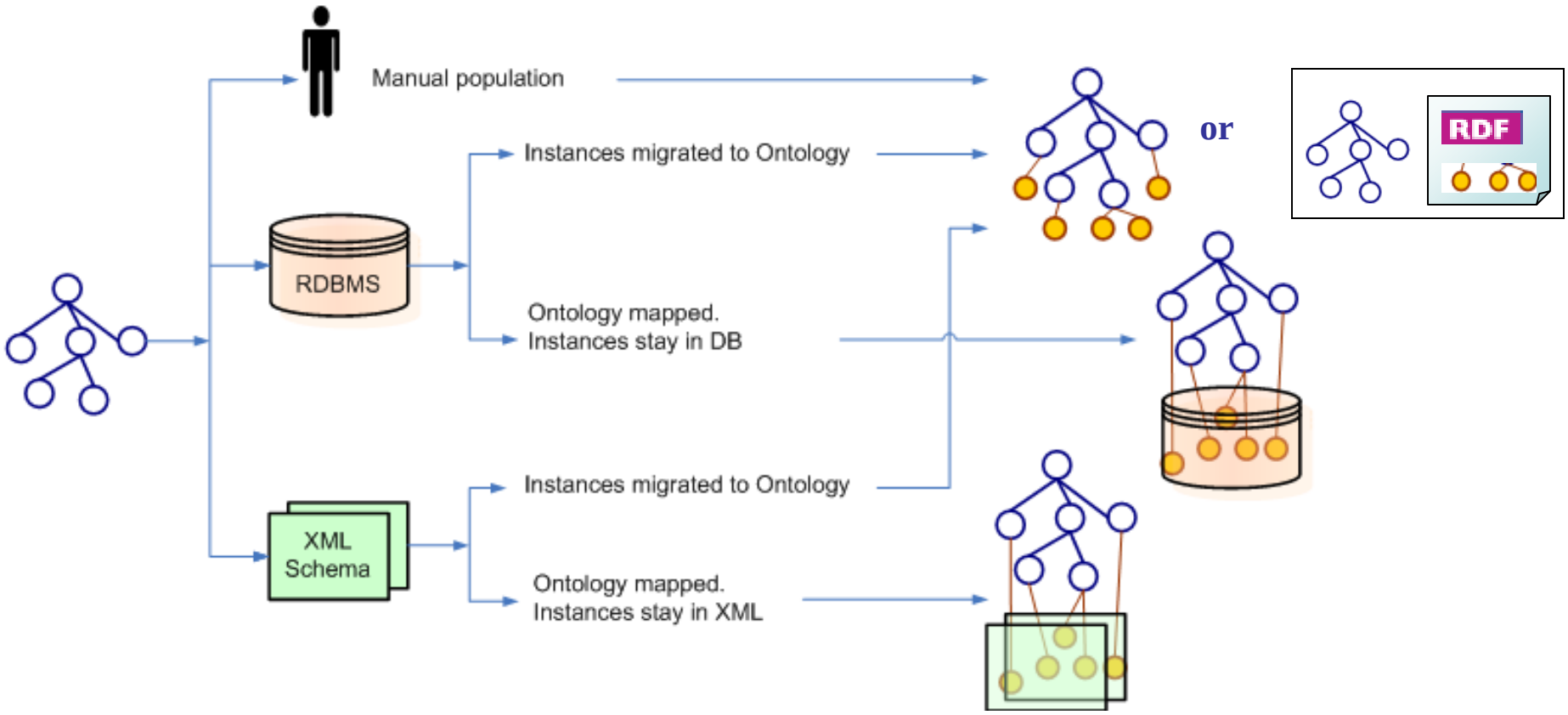
Where are the instances?



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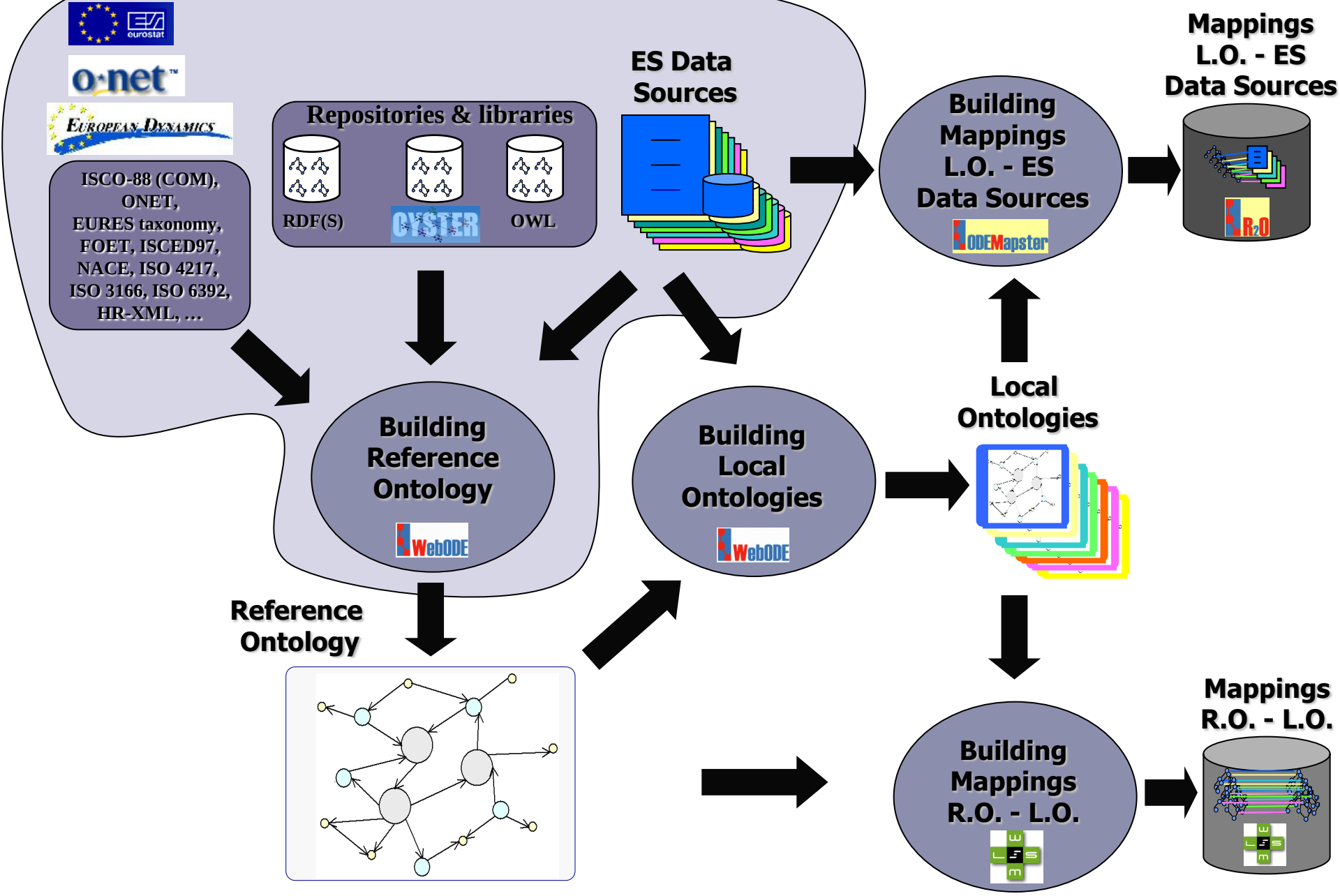

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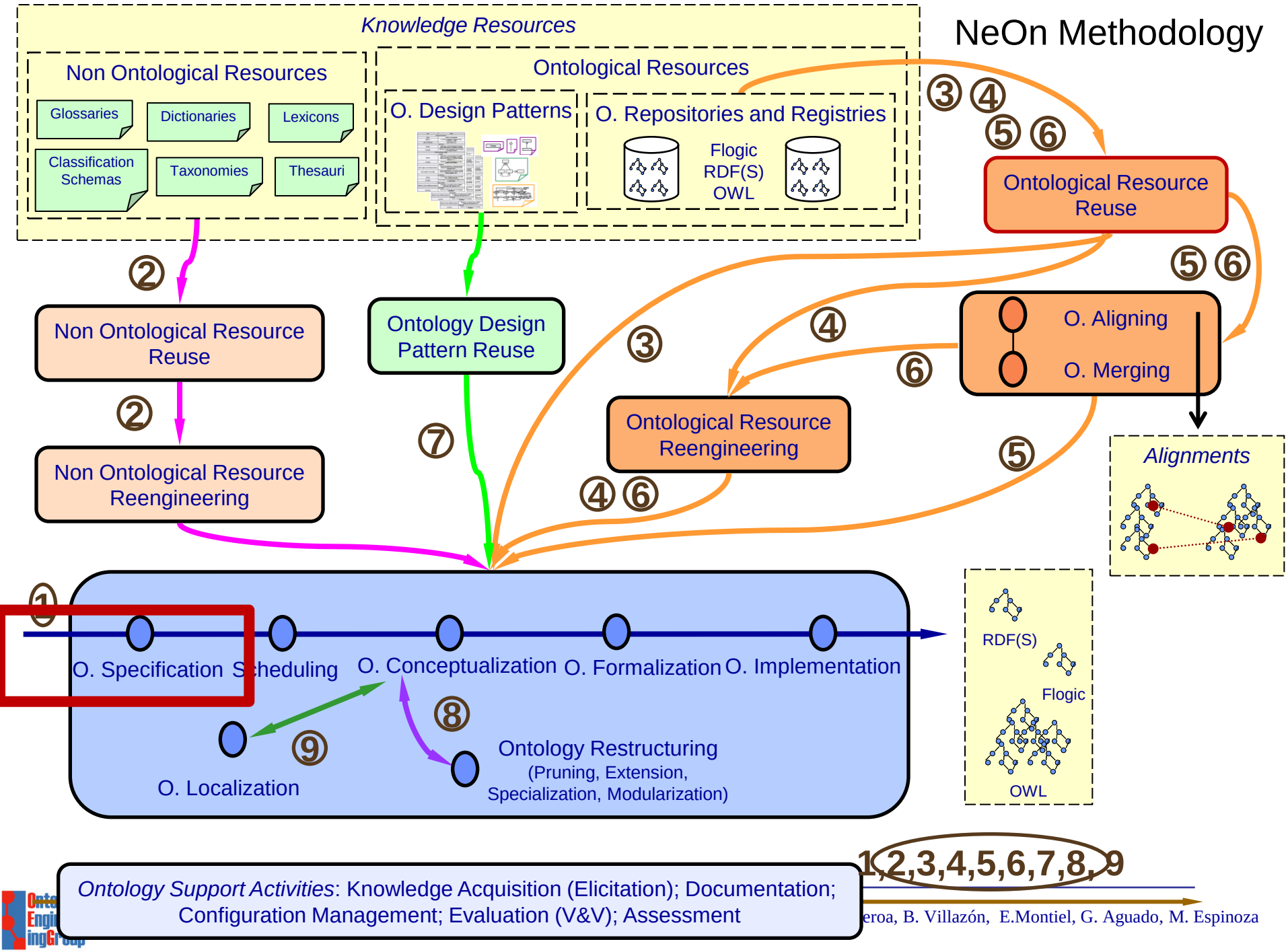
NeOn Methodology



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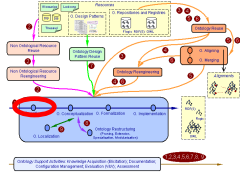
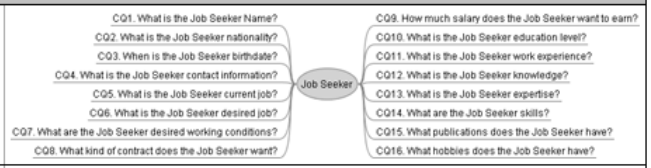
Ontology Specification. The Ontology Requirement Specification Document



	SEEMP Reference Ontology Requirements Specification
1	**Purpose**
	The purpose of building the Reference Ontology is to provide a consensual knowledge model of the employment domain that could be used by public e-Employment services (PES).
2	**Scope**
	The ontology has to focus just on the ICT (Information and Communication Technology) domain. The level of granularity is directly related to the competency questions and terms identified.
3	**Level of Formality**
	The ontology has to be implemented in WSML language
4	**Intended Users**
	User 1. Candidate who is unemployed and searching for a job or searching another occupation for immediate or future purposes
	User 2.
	User 3.
	User 4.
	User 5.
5	**Intend**
	Use 1.
	Use 2.
	Use 3.
	Use 4.
	Use 5.

7	Pre-Glossary of Terms		
	Terms		**Frequency**
	a.	Job Seeker	27
	b.	CV	2
	c.	Personal Information	3
	d.	Name	5
	e.	Gender	1
	f.	Birth date	1
	g.	Address	2
	h.	Nationality	1
	i.	Contact (phone, fax, mail)	4
	j.	Objective	3
	k.	Job Category	6
	l.	Job Offer	27
	m.	Employer Information	1
	n.	Vacancy	1
	o.	Activity Sector	1
	p.	Location	3
	q.	Work Condition	3
	r.	Contract Type	3
	s.	Salary	3
	t.	Education	3
	u.	Work Experience	3

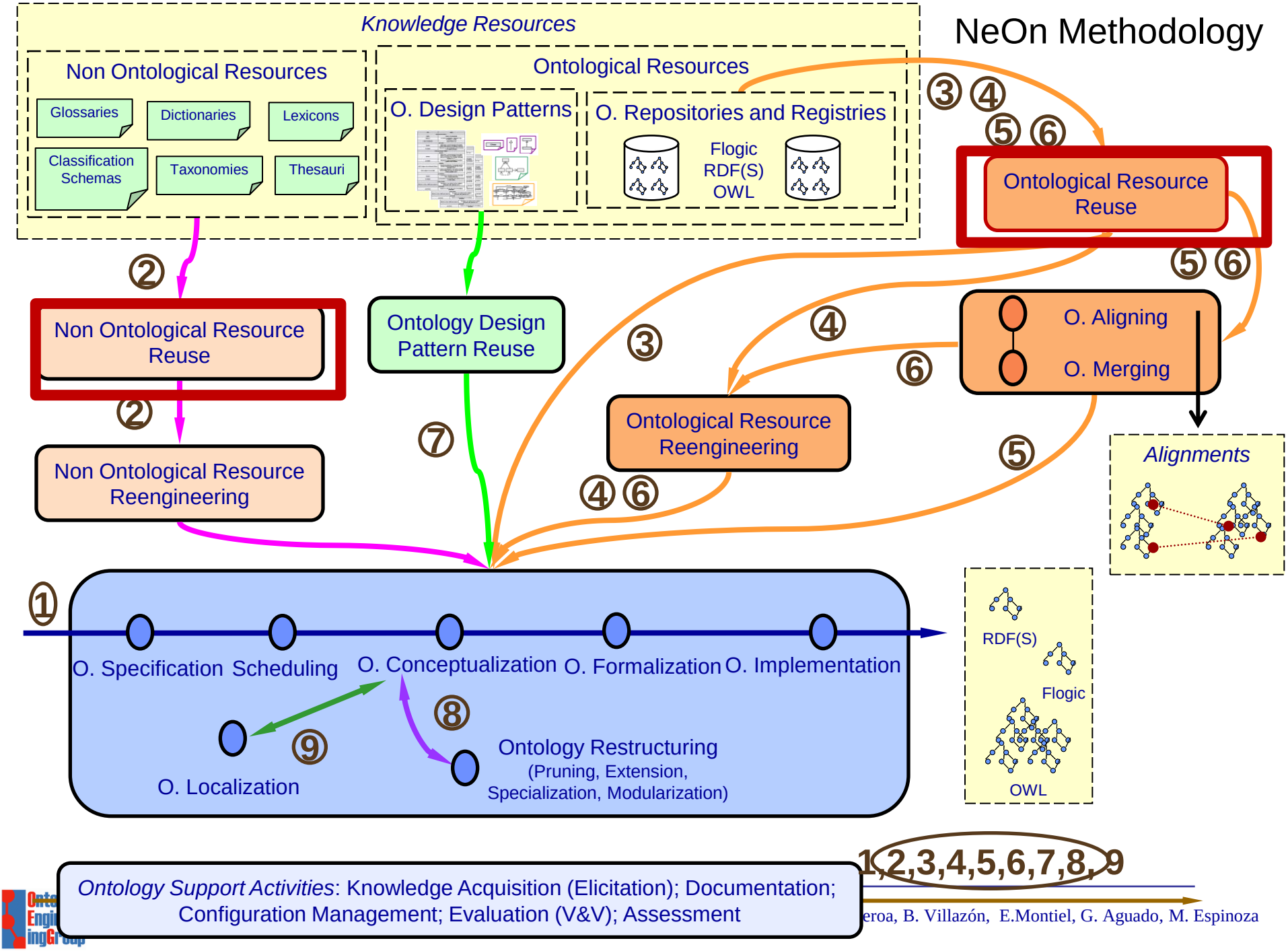
6	Groups of Competency Questions	
	CQG1. Job Seeker (16 CQ)	
	CQG2. Job Offer (10 CQ)	
	CQG3	

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
- Activity Sector
  - O21. Telecommunication
  - O22. Justice and Judicial
  - O23. Public Security and law
  - O24. Manufacture of machine tools
  - O25. Research and Development
  - O26. Hardware Consultancy
  - O27. Software Consultancy and Supply
  - O28. Data processing
- Education
  - O29. Life Science
  - O30. Mathematics
  - O31. Computer Science
  - O32. Computer Use
  - O33. Statistics
  - O34. Physics
  - O35. Network Administration
- Languages
  - O36. Swedish
  - O37. Spanish
  - O38. Slovenian
  - O39. Portuguese
  - O40. English
  - O41. French
  - O42. German
- Currency
  - O43. Euro
  - O44. Krone
  - O45. Great British Pound
  - O46. Zlote
  - O47. US Dollar
  - O48. Franc
- Location
  - O49. Austria
  - O50. Belgium
  - O51. Danmark
  - O52. Estonia
  - O53. Finland
  - O54. France
  - O55. Germany
  - O55. Greece

NeOn Methodology



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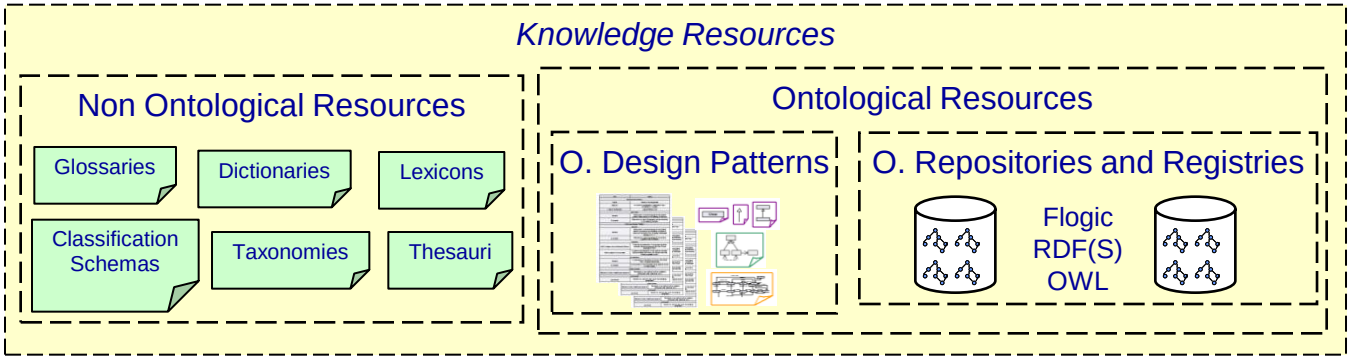
Searching Resources

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



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  - 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

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Search and Select 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?

Searching Ontologies in Watson

Ontology Requirement Specification Document

Objects

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

Job Category
01. Computer System Designer
02. Computer System Analyst
03. Programmer
04. Computer Engineer
05. Computer Assistant
06. Computer Equipment Operator
07. Industrial Robot Controller
08. Telecommunication Equipment Operator
09. Medical Equipment Operator
010. Electronic Equipment Operator
011. Image Equipment Operator

- Nationality

012. Austrian
013. Belgian
014. Danish
015. Estonian
016. Finnish
017. French
018. German
019. Greek
020. Italian

- Activity Sector

021. Telecommunication
022. Justice and Judicial
023. Public Security and law
024. Manufacture of machine tools
025. Research and Development
026. Hardware Consultancy
027. Software Consultancy and Supply
028. Data processing

- Education

029. Life Science
030. Mathematics
031. Computer Science
032. Computer Use
033. Statistics
034. Physics
035. Network Administration

- Languages

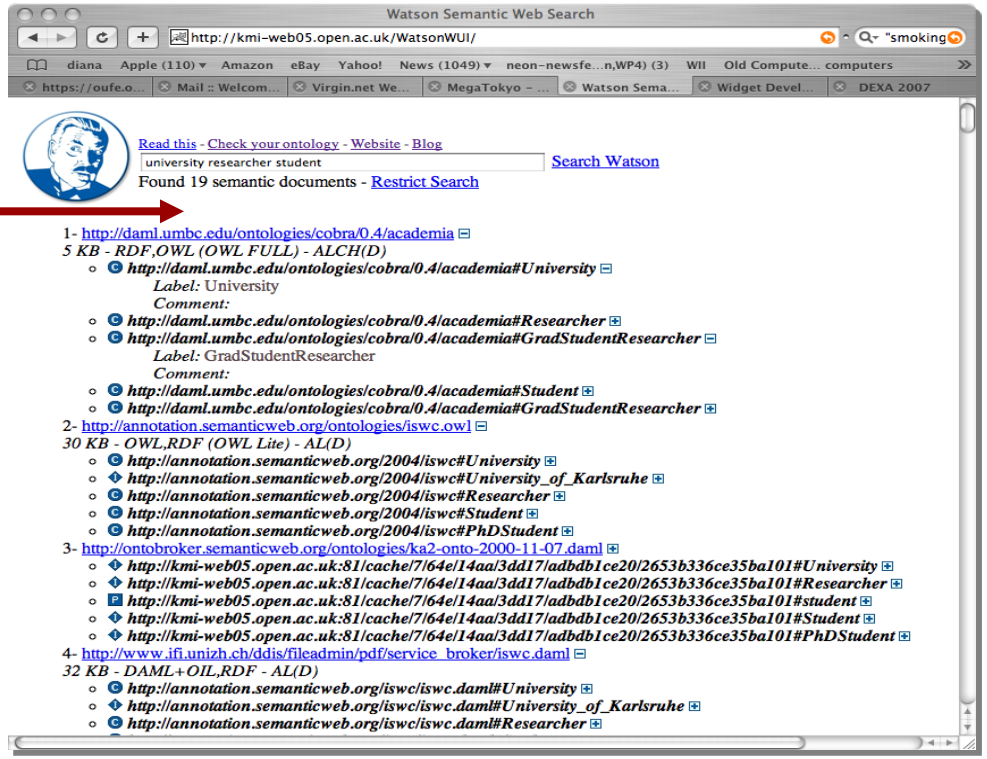
036. Swedish
037. Spanish
038. Slovenian
039. Portuguese
040. English
041. French
042. German

- Currency

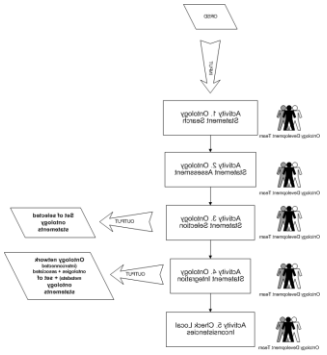
043. Euro
044. Krone
045. Great British Pound
046. Zlote
047. US Dollar
048. Franc

- Location

049. Austria
050. Belgium
051. Danmark
052. Estonia
053. Finland
054. France
055. Germany
055. Greece



The NeOn methodology includes guideliness for reusing statements



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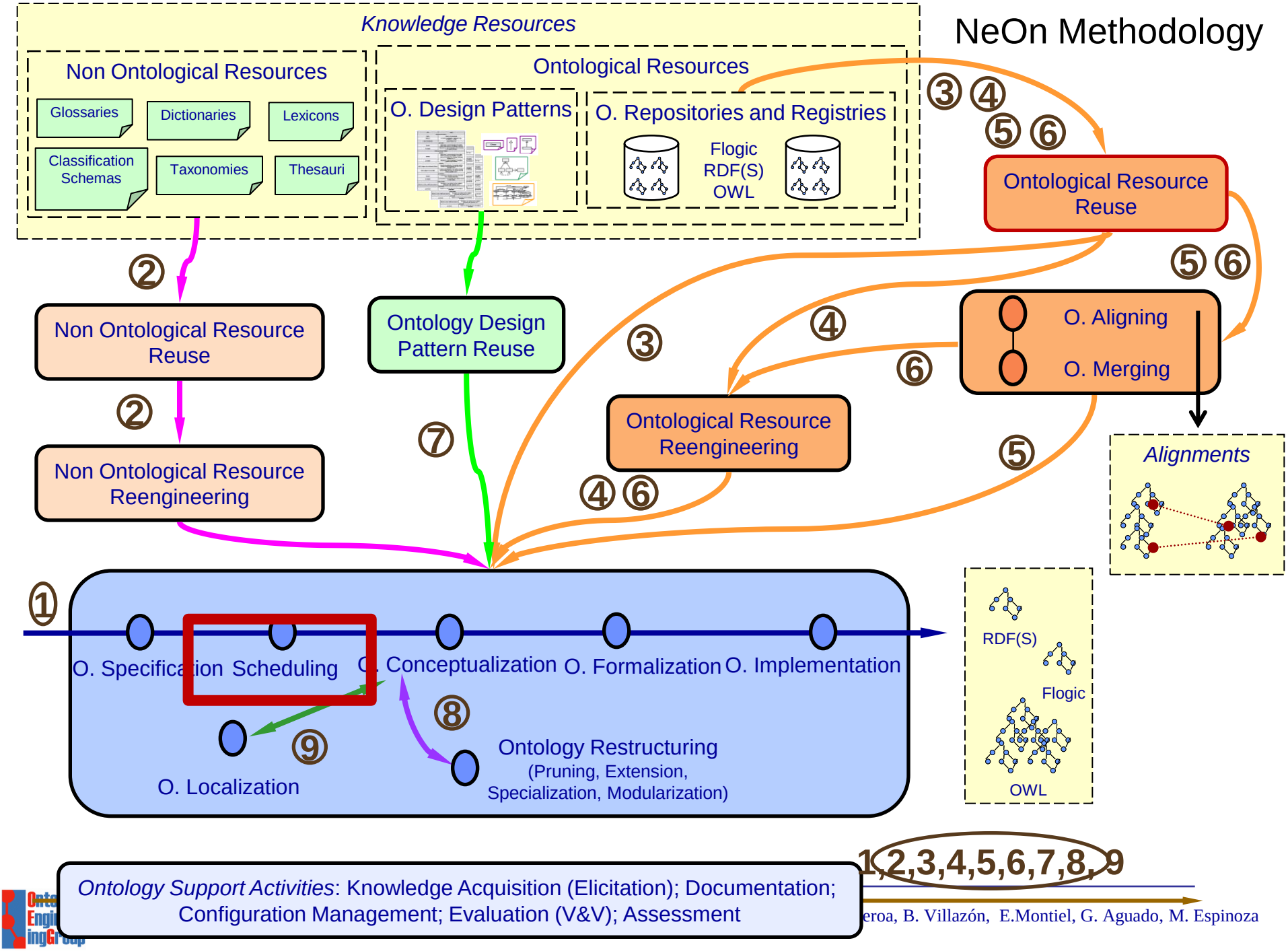
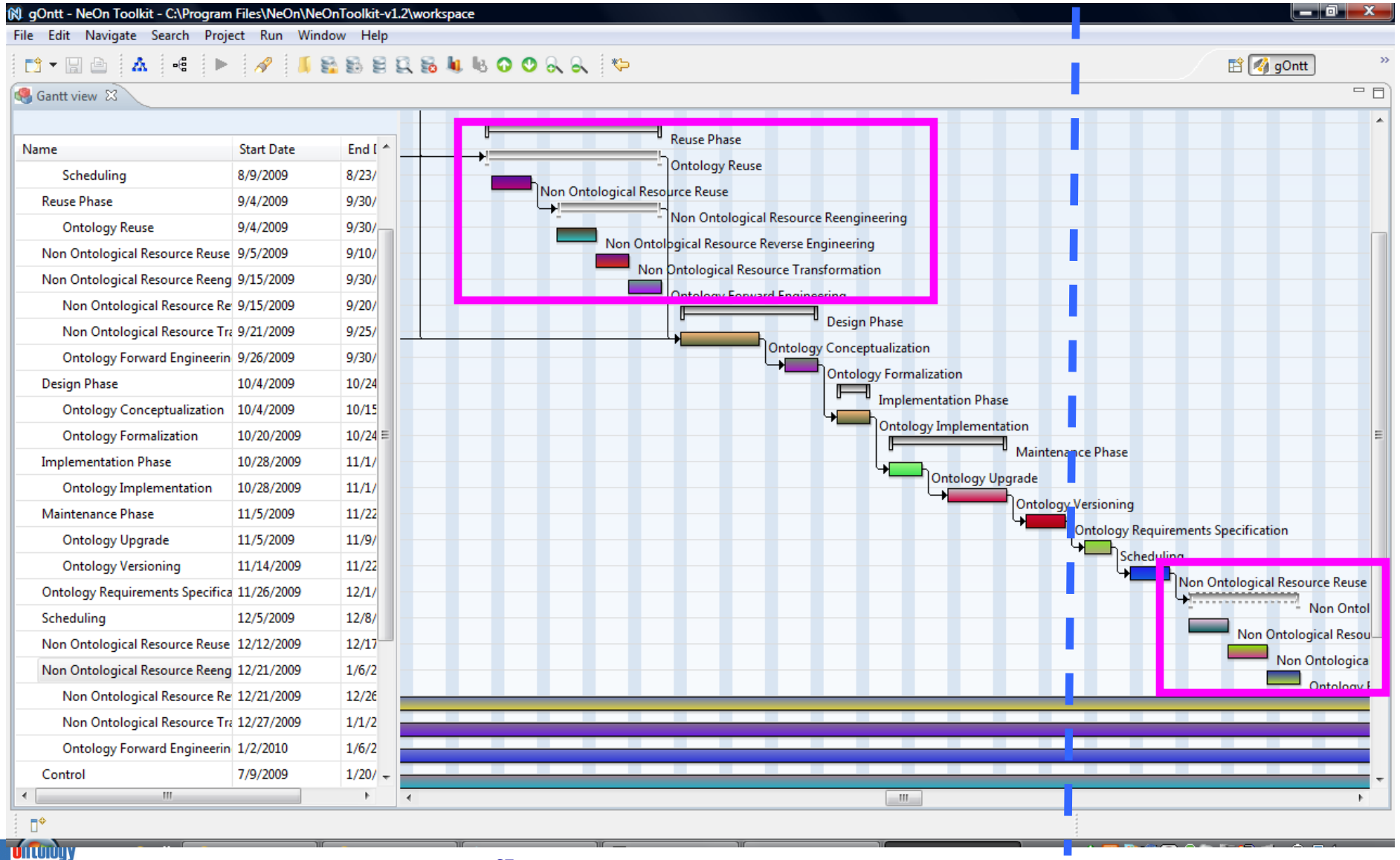
NeOn Methodology



Reuse and Re-engineering + Incremental



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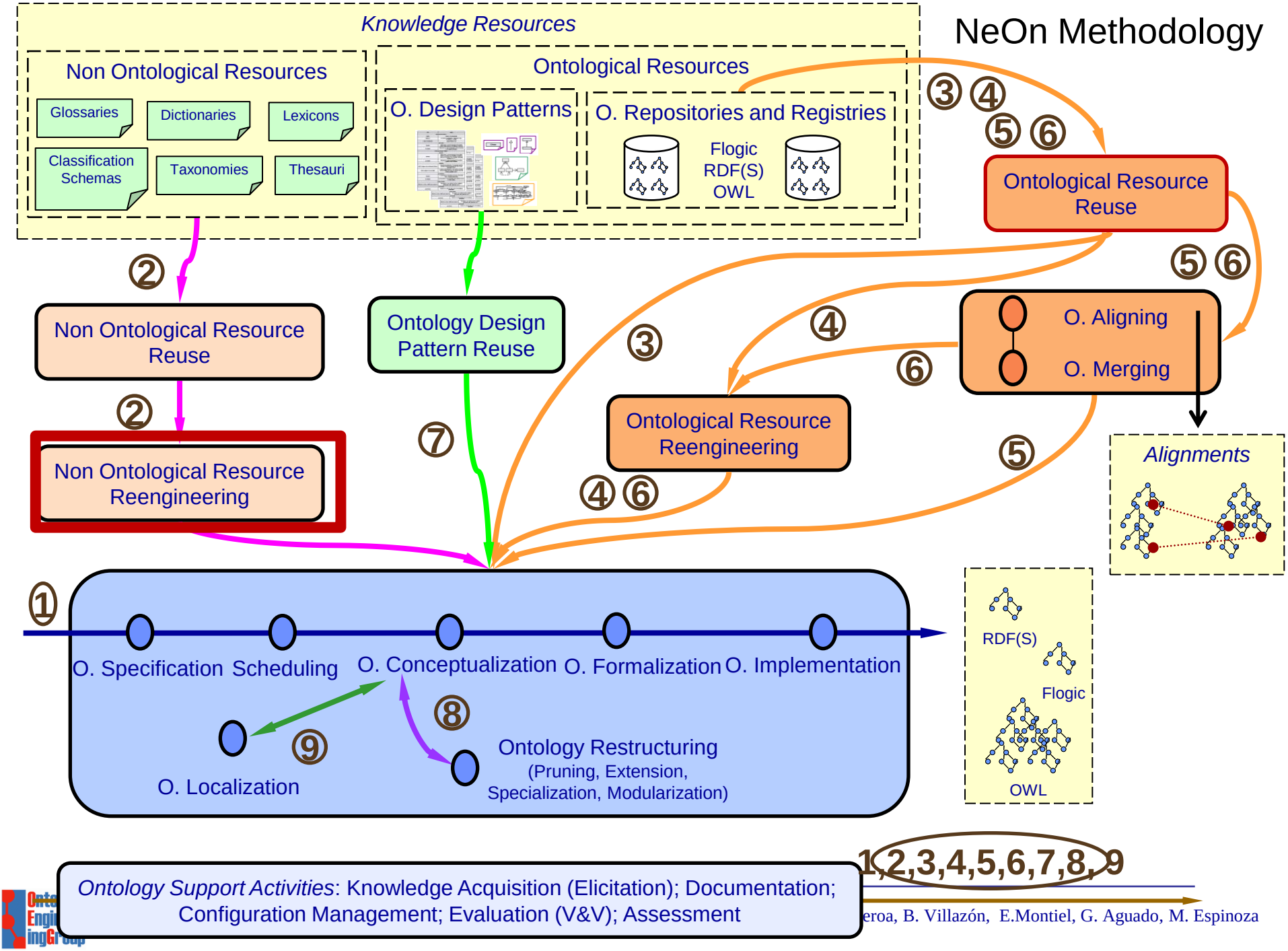
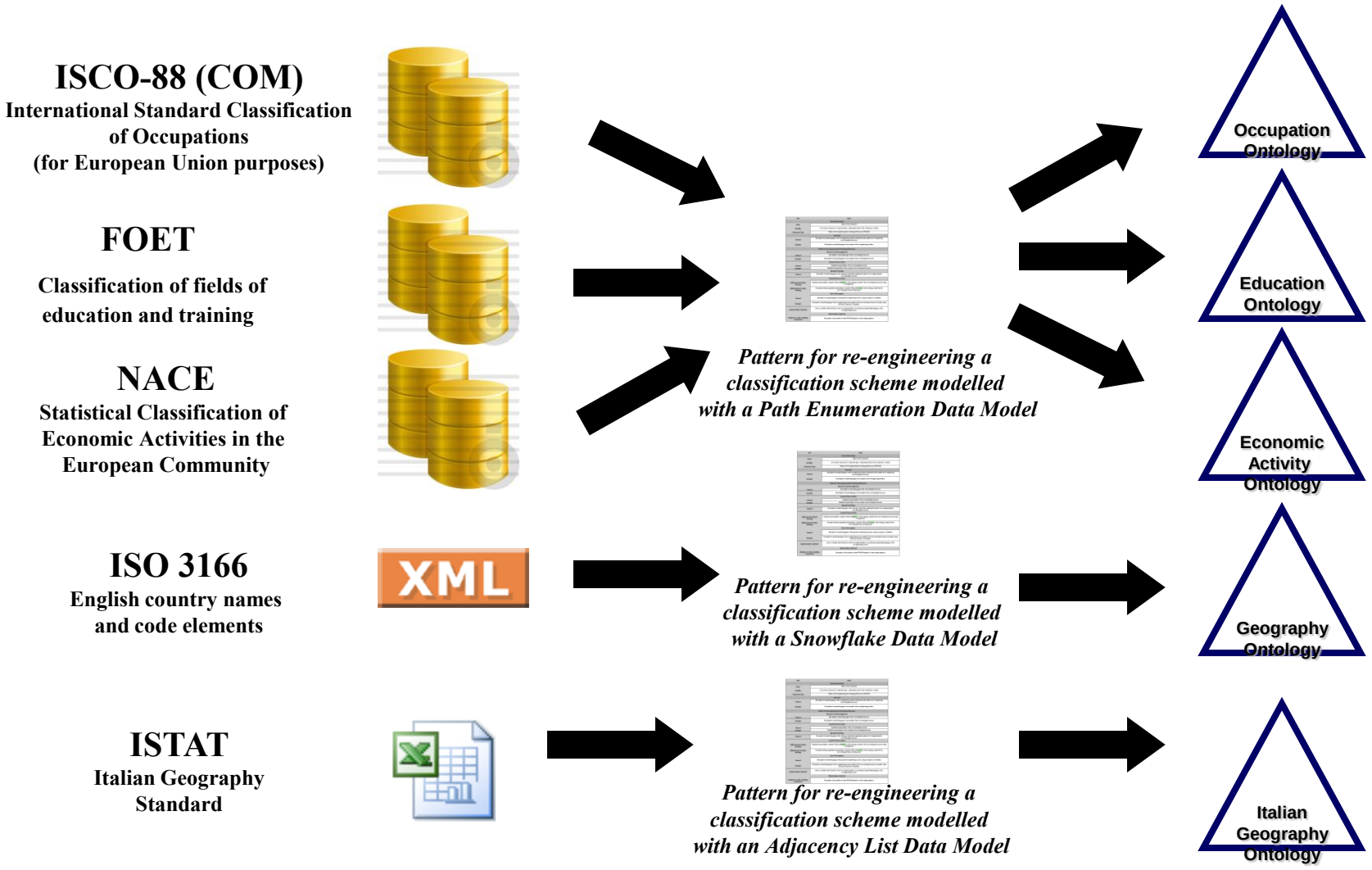
NeOn Methodology



Pattern based approach for re-engineering non ontological resources



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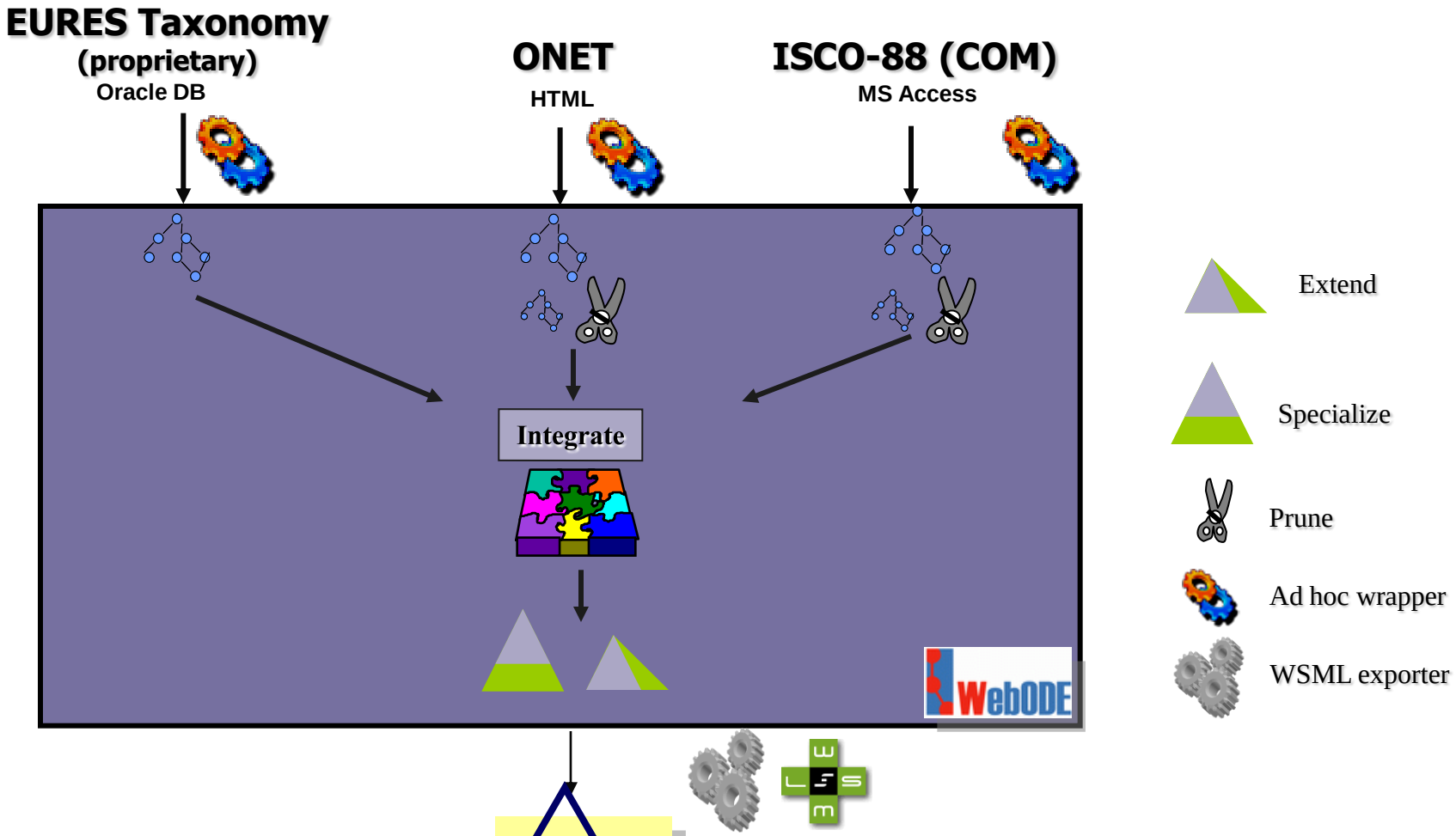
Reengineering and agregating resources



Knowledge Resource Re-engineering and Aggregation

ISO 3166-1 (XML)

....

```
<ISO_3166-1_Entry>
   <ISO_3166-1_Country_name>SPAIN</ISO_3166-1_Country_name>
   <ISO_3166-1_Alpha-2_Code_element>ES</ISO_3166-1_Alpha-2_Code_element>
 </ISO_3166-1_Entry>
```

...

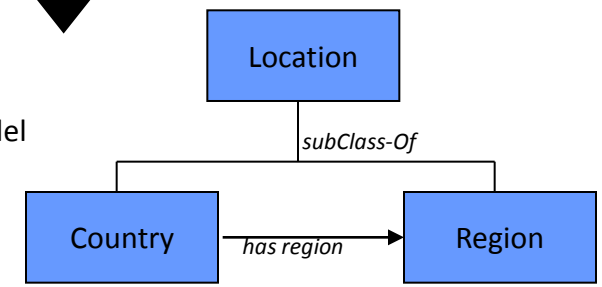
Regions Table (Eures Oracle DB)

N	ISO31661 Code	Region
100	ES	Cataluña
101	ES	Canarias
102	ES	Galicia
103	ES	Andalucia
104	ES	Navarra
105	ES	Asturias
106	ES	Baleares
107	ES	Murcia
108	ES	Aragon

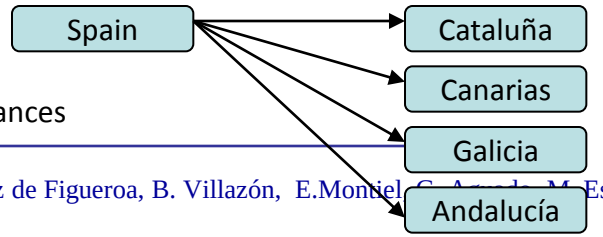
Excerpt of the Geography Ontology

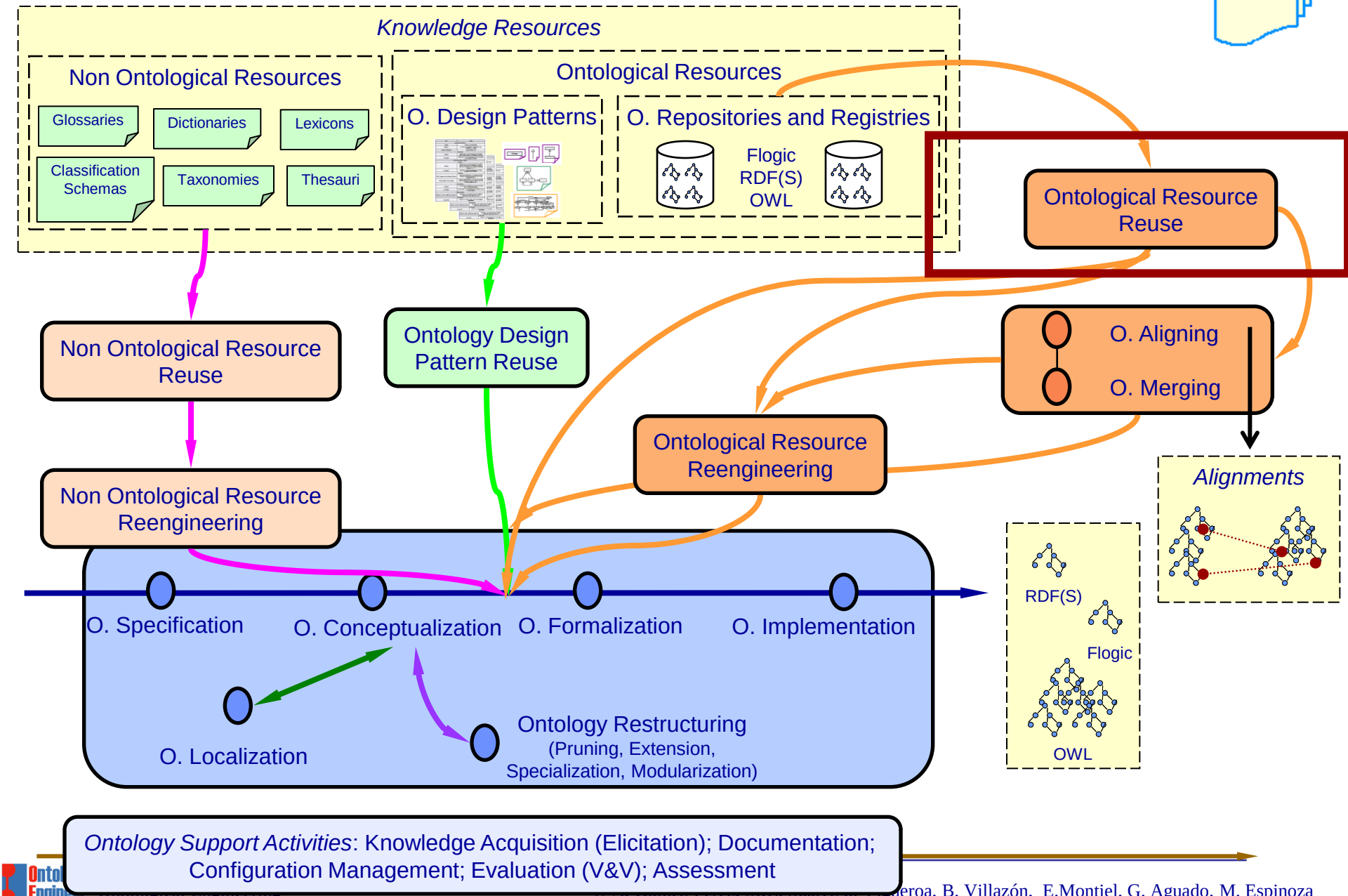
```
<rdf:Description rdf:about="webode://mccarthy.dia.fi.upm.es/Geography_Ontology#Country_SPAIN">
  <rdf:type rdf:resource="webode://mccarthy.dia.fi.upm.es/Geography_Ontology#Country"/>
  <GeoOnt:Code rdf:datatype="http://www.w3.org/2001/XMLSchema#string">ES</GeoOnt:Code>
  <GeoOnt:Name rdf:datatype="http://www.w3.org/2001/XMLSchema#string">SPAIN</GeoOnt:Name>
  <GeoOnt:is_located_in_Continent rdf:resource="webode://mccarthy.dia.fi.upm.es/Geography_Ontology#EU_Europe"/>
  <GeoOnt:has_region_Region rdf:resource="webode://mccarthy.dia.fi.upm.es/Geography_Ontology#Catalunya"/>
  <GeoOnt:has_region_Region rdf:resource="webode://mccarthy.dia.fi.upm.es/Geography_Ontology#Canarias"/>
  <GeoOnt:has_region_Region rdf:resource="webode://mccarthy.dia.fi.upm.es/Geography_Ontology#Galicia"/>
  <GeoOnt:has_region_Region rdf:resource="webode://mccarthy.dia.fi.upm.es/Geography_Ontology#Andalucia"/>
</rdf:Description>
```

Ontology model



Ontology instances




Knowledge Resources
Non Ontological Resources
Glossaries
Dictionaries
Lexicons
Classification Schemas
Taxonomies
Thesauri
Ontological Resources
O. Design Patterns
O. Repositories and Registries
Flogic
RDF(S)
OWL
Ontological Resource Reuse
Non Ontological Resource Reuse
Ontology Design Pattern Reuse
O. Aligning
O. Merging
Ontological Resource Reengineering
Alignments
Non Ontological Resource Reengineering
O. Specification
O. Conceptualization
O. Formalization
O. Implementation
RDF(S)
Flogic
OWL
O. Localization
Ontology Restructuring
(Pruning, Extension, Specialization, Modularization)
Ontology Support Activities: Knowledge Acquisition (Elicitation); Documentation; Configuration Management; Evaluation (V&V); Assessment

The Time Ontology Selection

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

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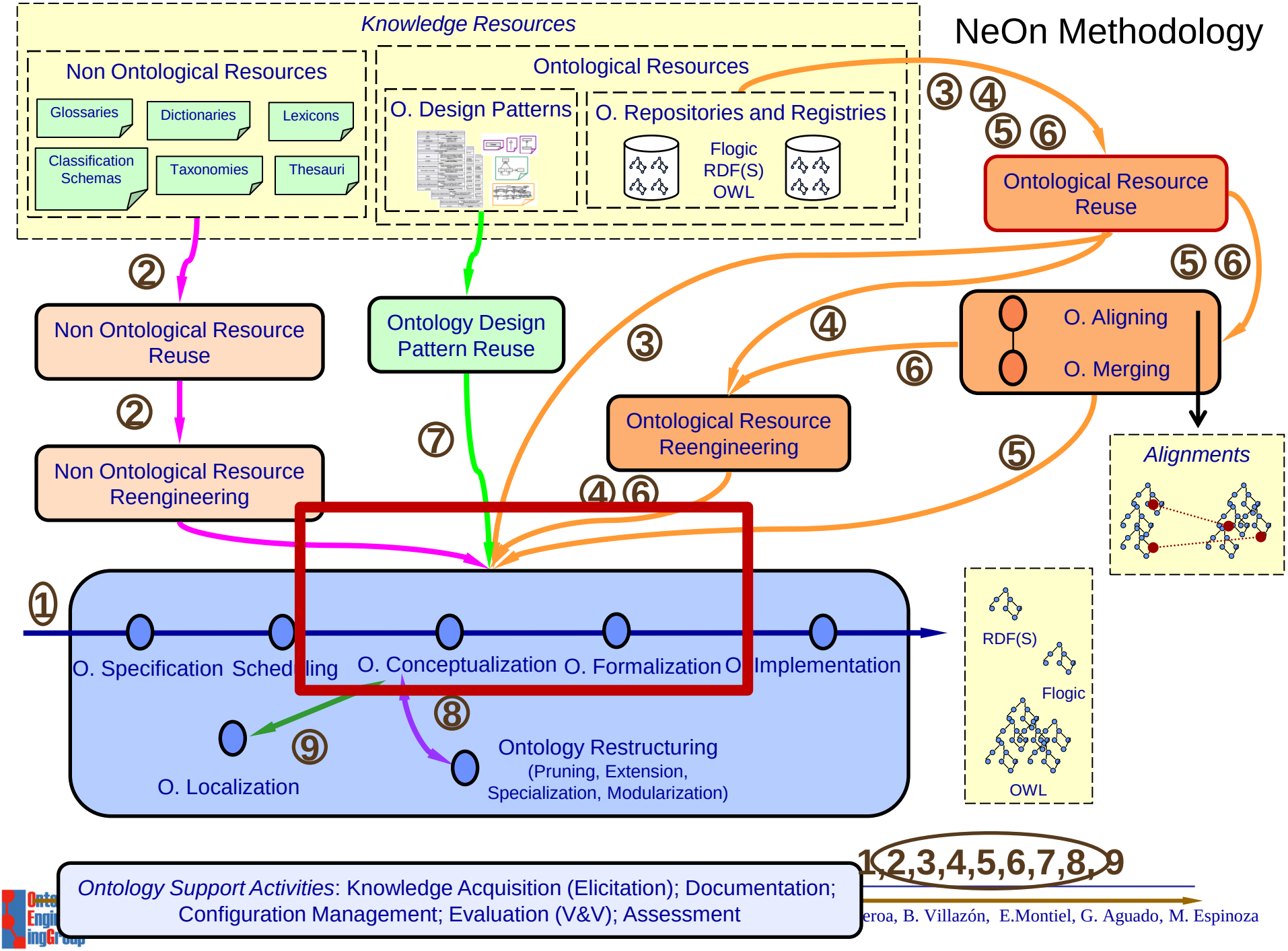
NeOn Methodology



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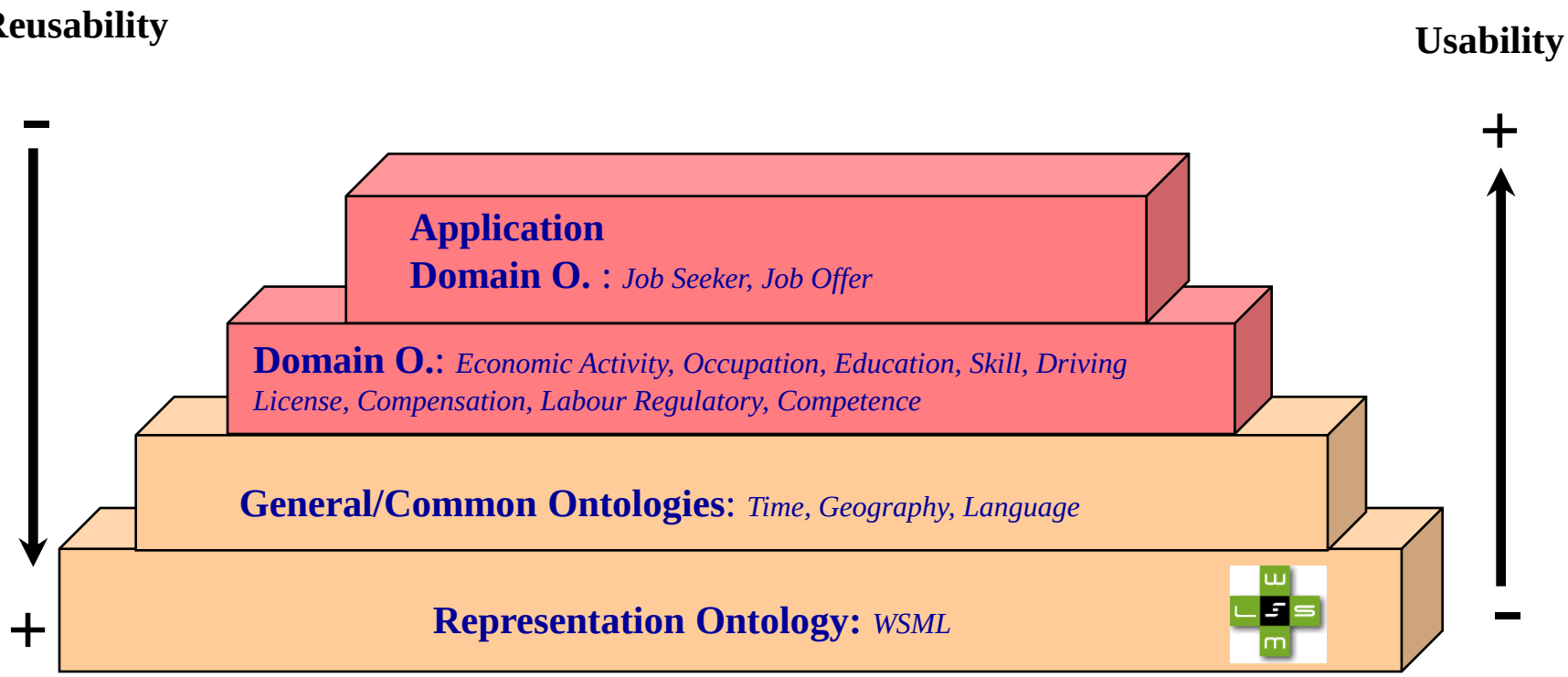
Conceptualization:
Modular approach for ontology construction



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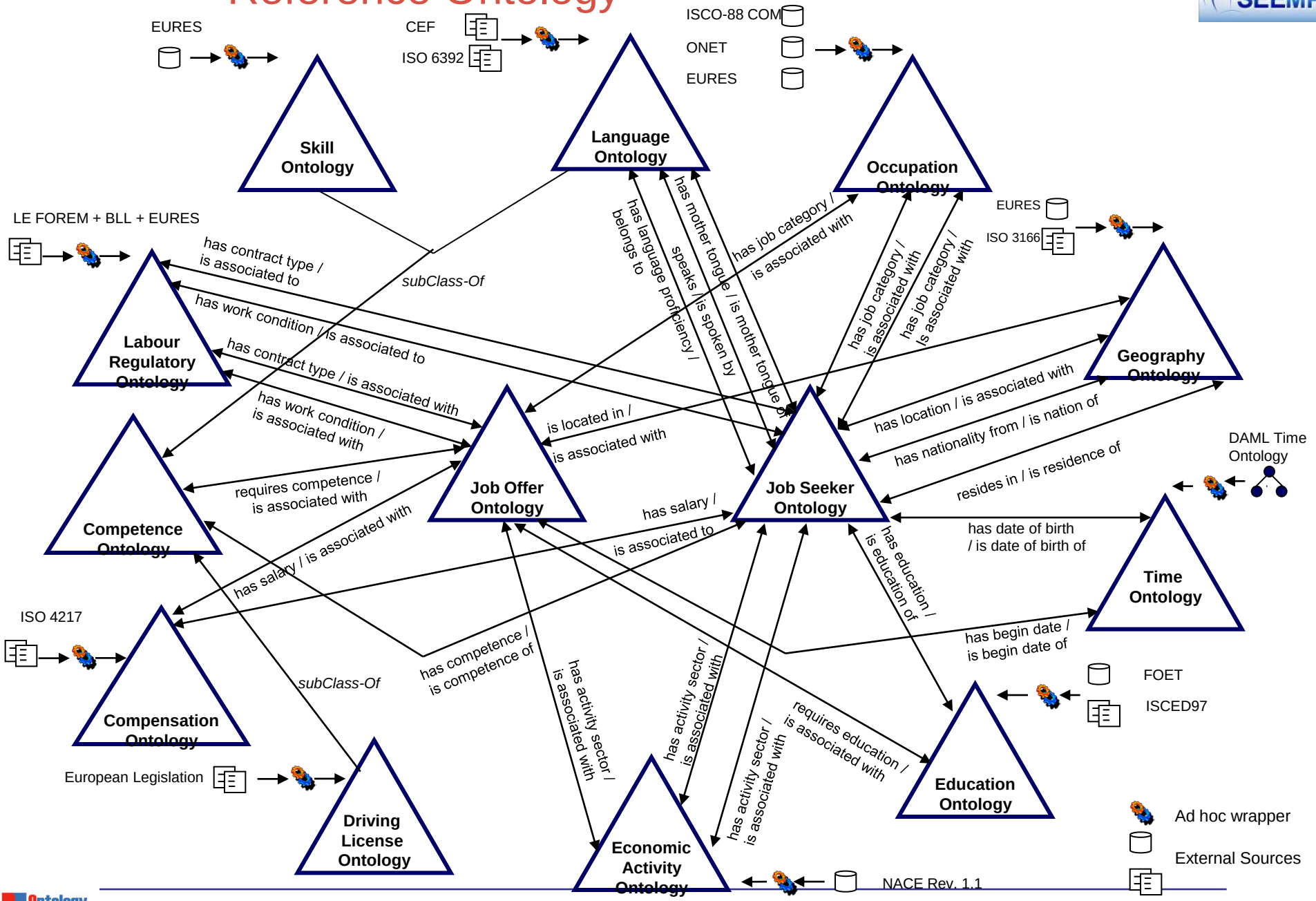
Reference Ontology



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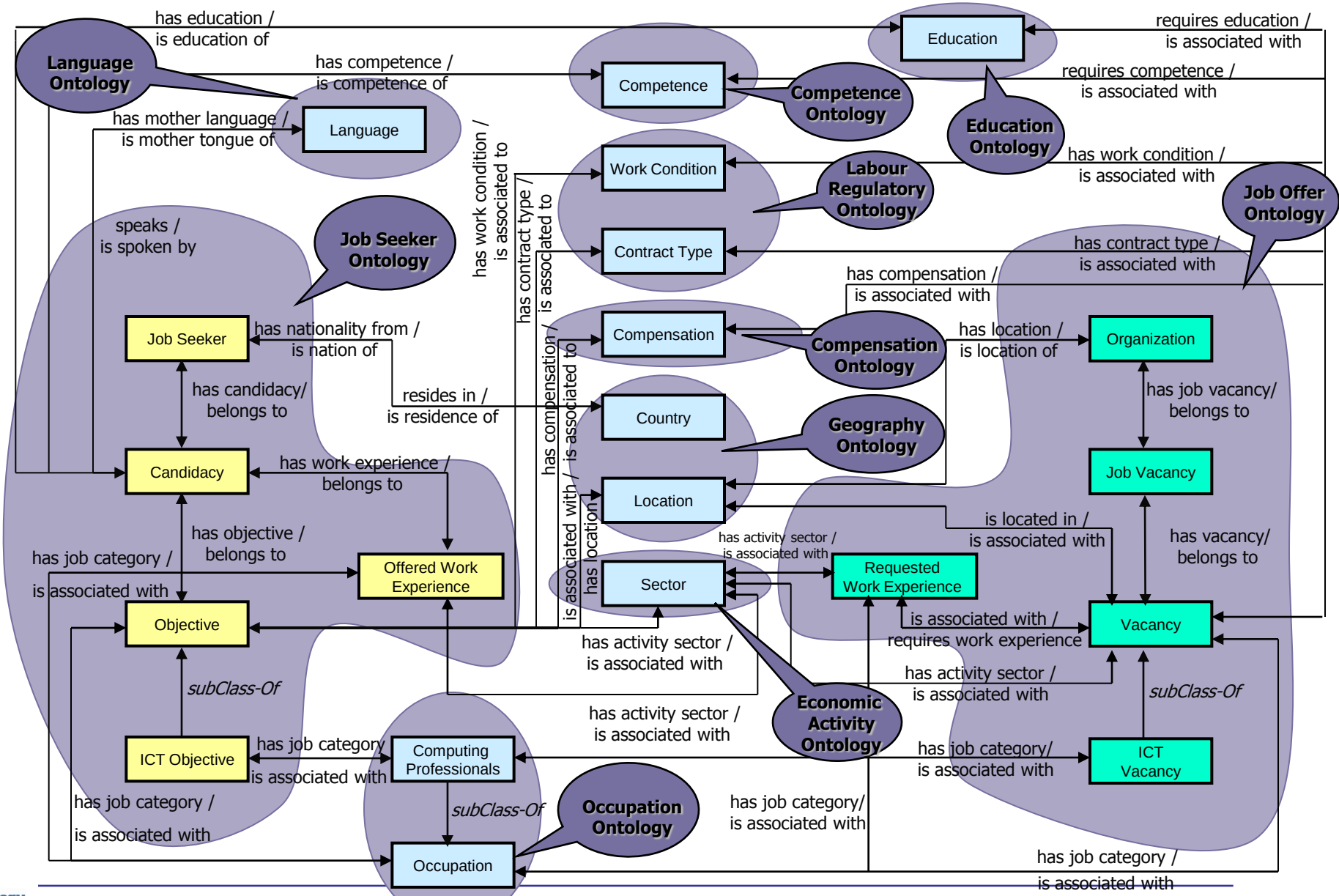
Details of the ontology



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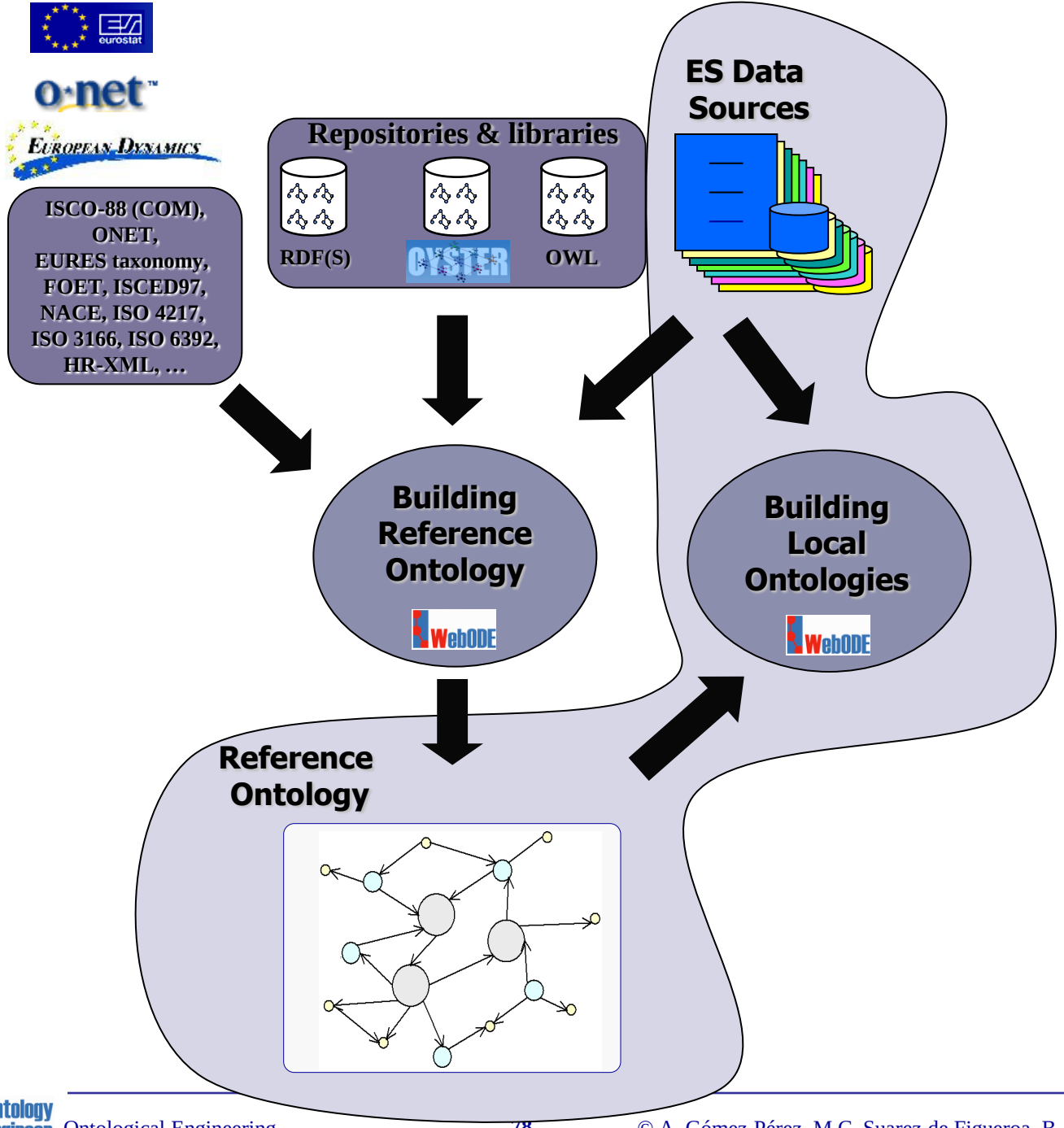

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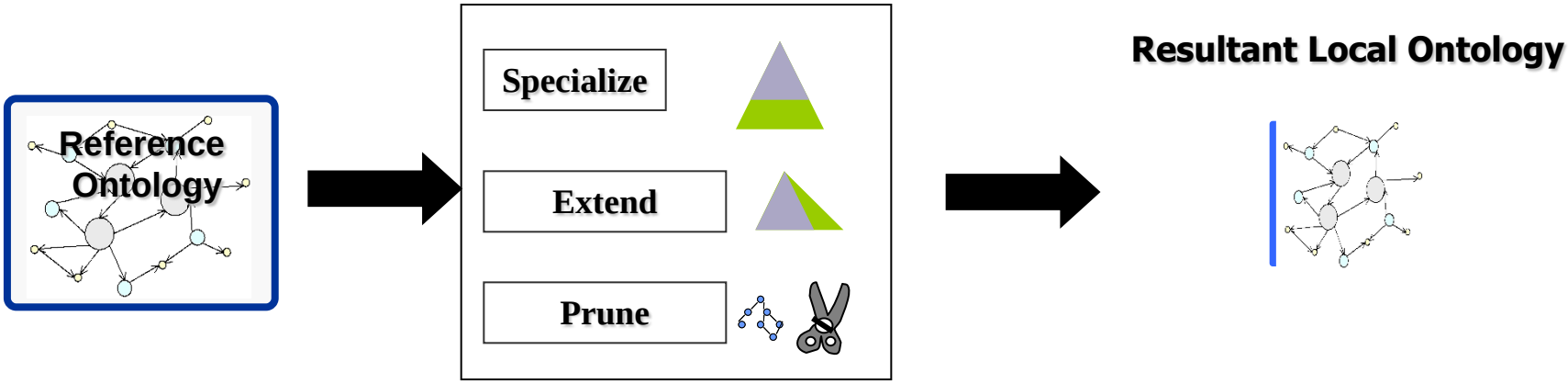
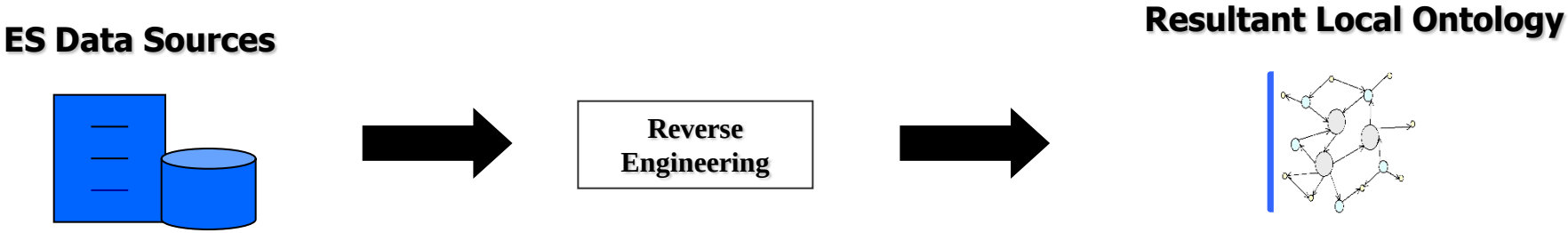
Local Ontologies Building Process

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



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



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Which option is the most appropriate for the use

	Option 1: Building Local Ontologies from the Reference Ontology.	Option 2: Building Local Ontologies as a reverse engineering process from ES Data Sources.
Mappings between Local Ontologies and Reference Ontology	Mappings are not complex. They use the same terms.	Complex mappings due to terminology heterogeneity.
Mappings between Local Ontologies and ES schema sources	Complex mappings due to terminology and structural heterogeneity.	Mappings are not complex. They use the same terms.
Building process	Structured/guided by the architecture of the Reference Ontology and scoped with applications needs.	Requires more sophistication of knowledge engineering and good acquaintance of all the data and their structures of the application.
Changes in the Reference Ontology	Imply changes in · the mappings between local and reference ontologies. · the mappings between the local ontologies and the ES schema sources. · the Local Ontology.	Imply changes in · the mappings between Local Ontologies and the Reference Ontology.
Changes in the ES schema sources	Imply changes in · its Local Ontology (probably the part that is not a mirror of the Reference Ontology). · the mappings between Local Ontologies and ES schema sources. · in the mappings between Local Ontology and the Reference Ontology.	Imply changes in · the Local Ontologies. · in mappings between ES sources and Local Ontologies. · mappings between local and the Reference Ontology.

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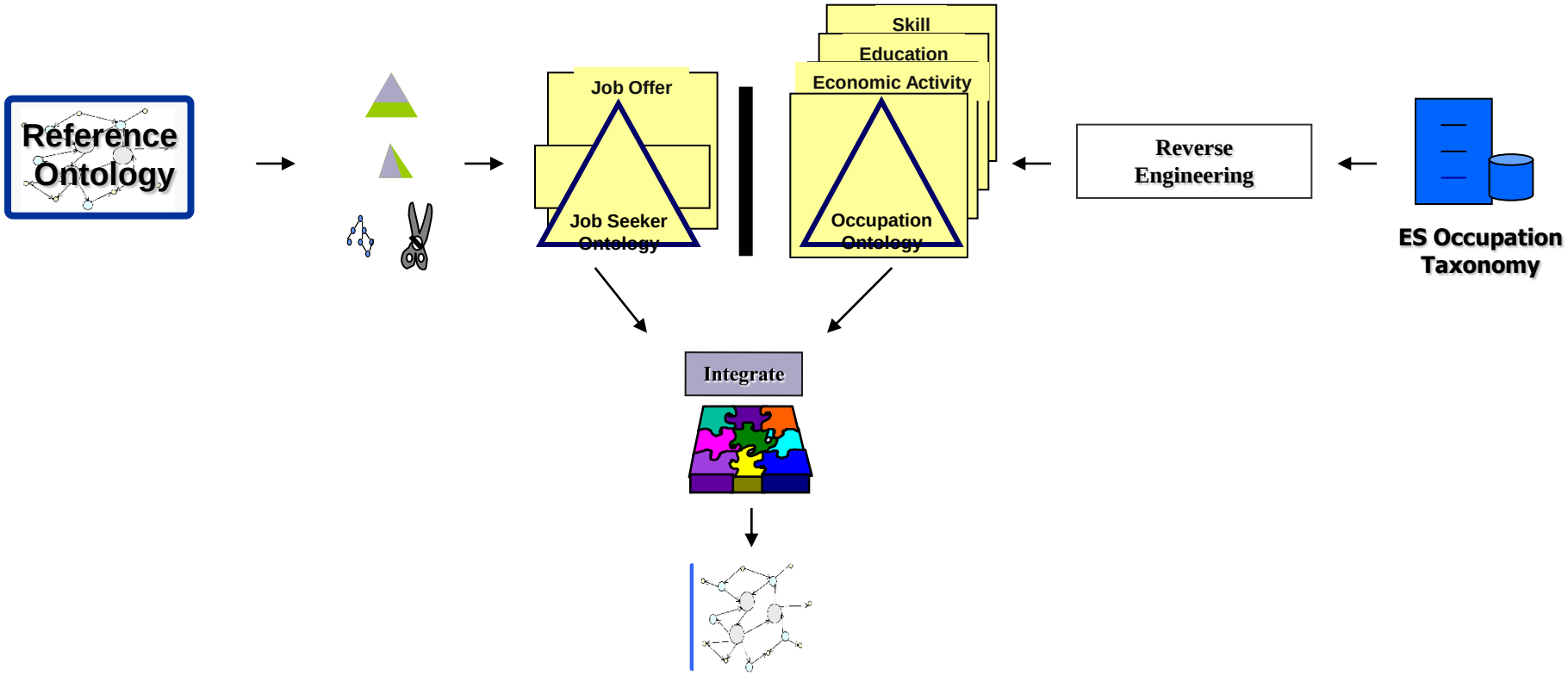
Approach followed by SEEMP for building Local Ontologies

A hybrid approach

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



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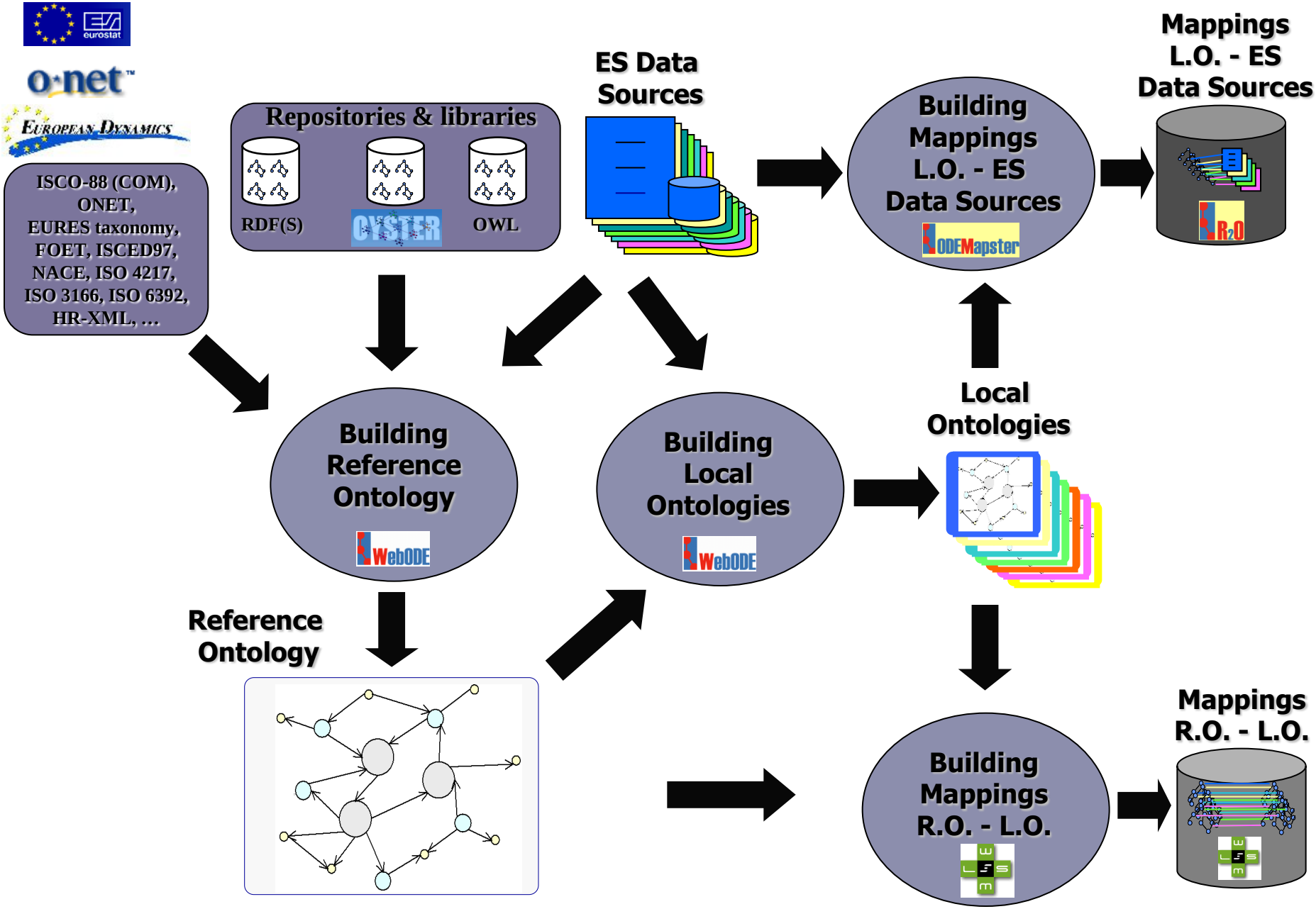

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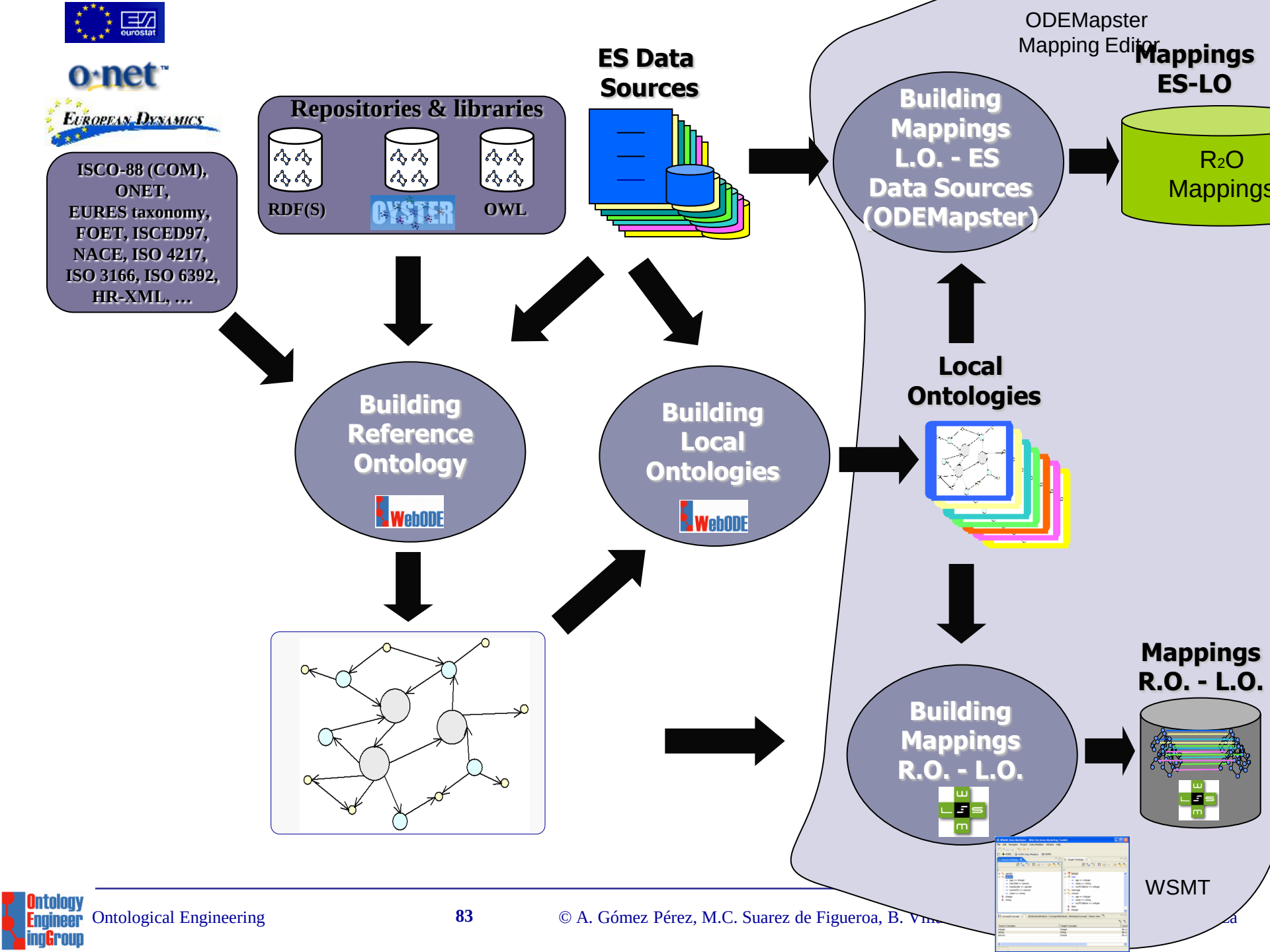

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Conclusions

1. **The NeOn methodology facilitates the reuse and reengineering of non ontological resources into ontologies**

2. The reuse of non-ontological resources that have been reached some degree of consensus in a community allows the development of ontologies easier and quicker

3. The use of external resources for disambiguating the semantics of the relations in the resource, the resultant ontology will have better quality degree.

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NeOn Methodology Pointers

- Scenarios for Building Ontology Networks → **D5.3.1 and D5.4.2**
- NeOn Glossary of Processes and Activities → **D5.3.1 and D5.3.2**
- Set of Ontology Network Life Cycle Models → **D5.3.2**
- Methodological Guidelines for Ontology Requirements Specification → **D5.4.1**
- Methodological Guidelines for Scheduling and gOntt plug-in → **D5.3.2**
- Methodological Guidelines for Non-Ontological Resource Reuse and Reengineering → **D5.4.1 and D2.2.2**
- Methodological Guidelines for Ontological Resource Reuse → **D5.4.1**
- Methodological Guidelines for ODP Reuse → **D5.4.1 and D5.4.2**
- Methodological Guidelines for Ontology Modularization → **D5.4.2**
- Methodological Guidelines for Ontology Evaluation → **D5.4.2**
- Methodological Guidelines for Ontology Evolution → **D5.4.2**
- Methodological Guidelines for Ontology Localization → **D5.4.2**

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