Course: Intelligent Systems

Unit 3: Ontology Engineering

Methodologies for Developing Ontologies

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Course 2022 – 2023

Technical University of Madrid

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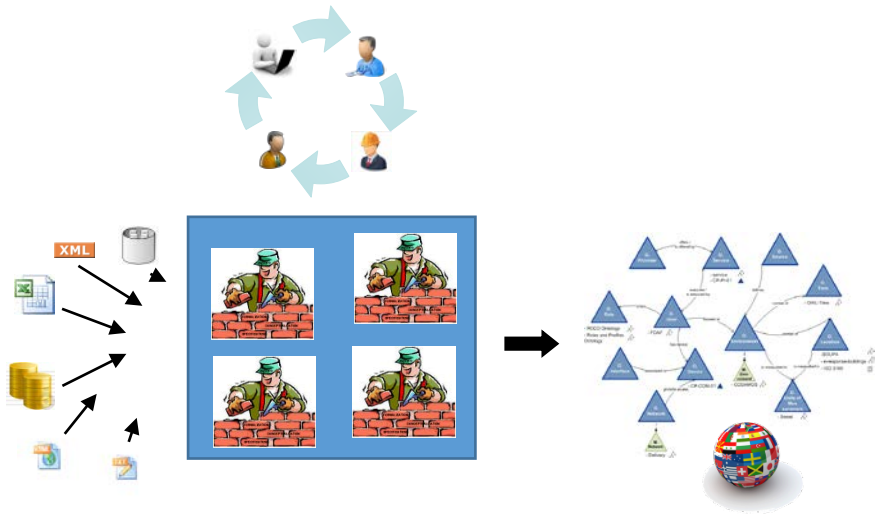
Index

- How to develop ontologies
  - The NeOn Methodology

How to develop ontologies?: Trends

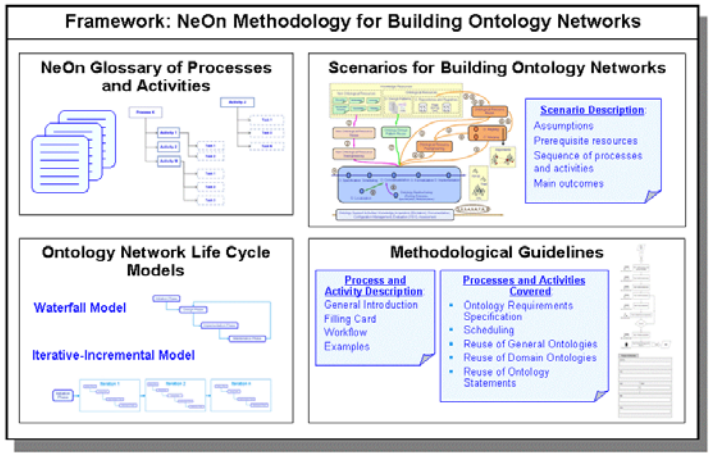
- Knowledge resource **reuse**
- Ontology and vocabulary building in a **collaborative way**
- Developing vocabularies and ontology **networks**
- **Multilingual** features in ontologies



NeOn Methodology

NeOn Methodology

- The NeOn Methodology is a **scenario-based methodology**
  - In contrast to other approaches that provide methodological guidance for ontology engineering, the NeOn Methodology does not prescribe a rigid workflow, but instead it suggests pathways and activities for a variety of scenarios
- The NeOn Methodology Framework for building ontology networks includes
  - a set of 9 scenarios
  - a glossary of processes and activities involved in the development of ontologies
  - a collection of ontology life cycle models
  - a set of methodological guidelines for different processes and activities, which are described
    - functionally in terms of goals, inputs, outputs and relevant constraints
    - procedurally by means of workflow specifications, and
    - empirically through a set of illustrative examples



Mari Carmen Suárez-Figueroa, Asunción Gómez-Pérez, Mariano Fernández-López: The NeOn Methodology framework: A scenario-based methodology for ontology development. Applied Ontology 10(2): 107-145 (2015).

NeOn Methodology: Methodological Guidelines

Ontology Design Pattern Reuse

Definition

Ontology Design Patterns (OPs) Reuse is defined as the activity of using available ontology design patterns in the solution of different modeling problems during the development of new ontologies.

Goal

The goal is to allow the reuse of ODPs during the ontology development in order to facilitate the solution of modeling issues and to improve interoperability.

Input

Requirements from the Ontology Requirements Specification Document.

Output

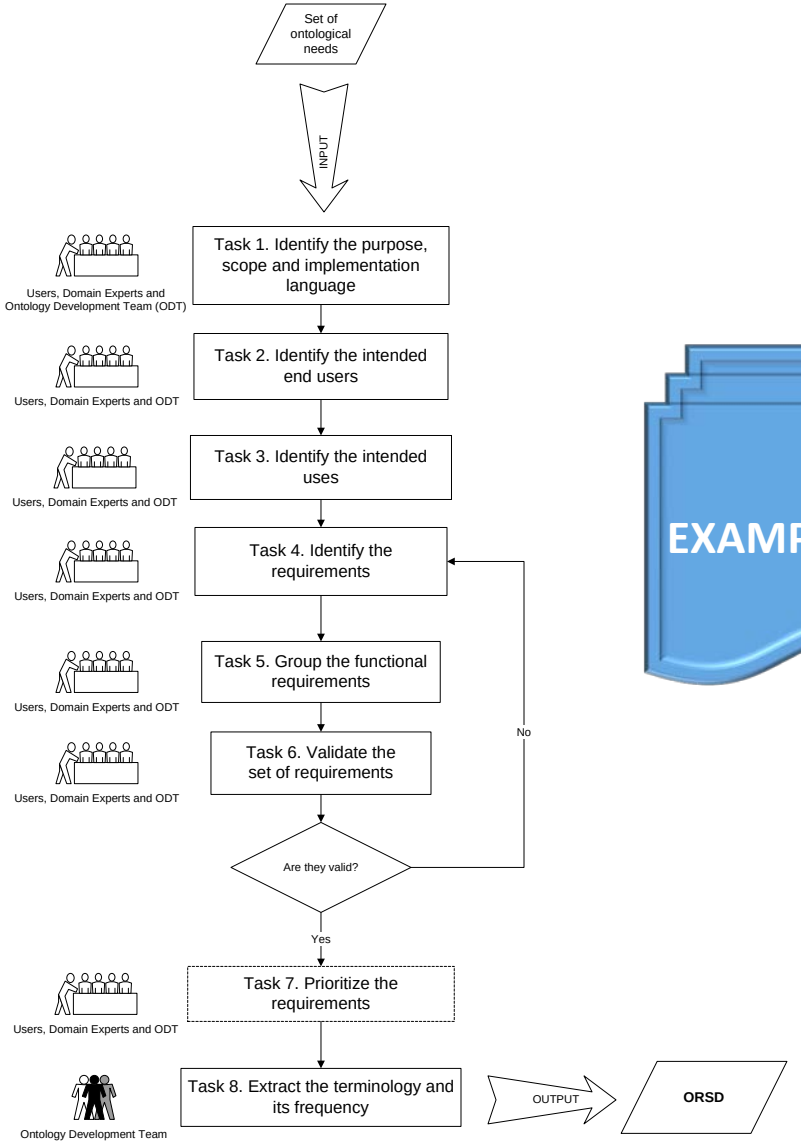
Ontology design patterns integrated into the ontology network being developed.

Who

The ontology development team.

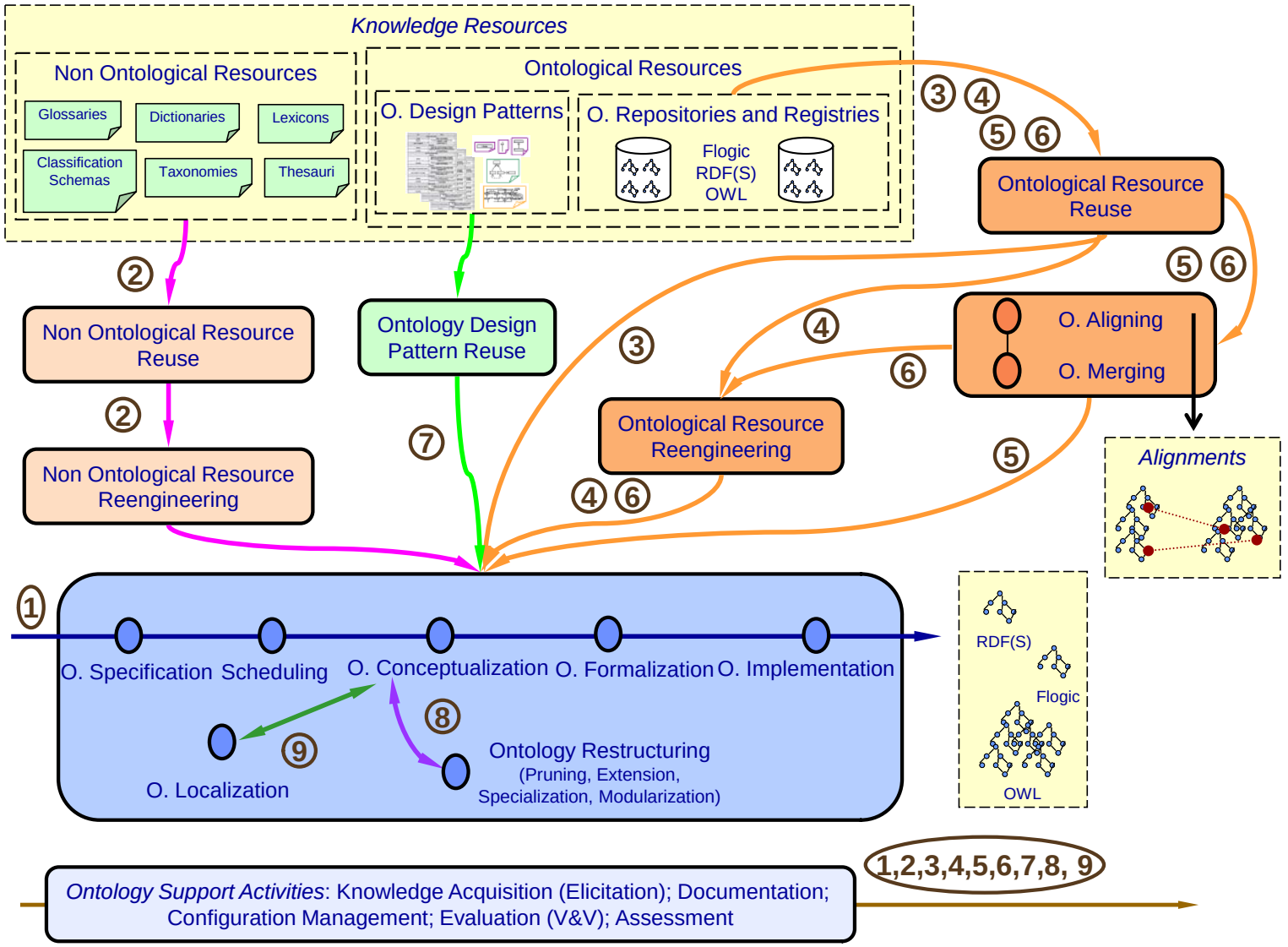
When

During the development of the Ontology Conceptualization activity, the Ontology Formalization activity, and/or the Ontology Implementation activity.



EXAMPLES

NeOn Methodology: Scenarios



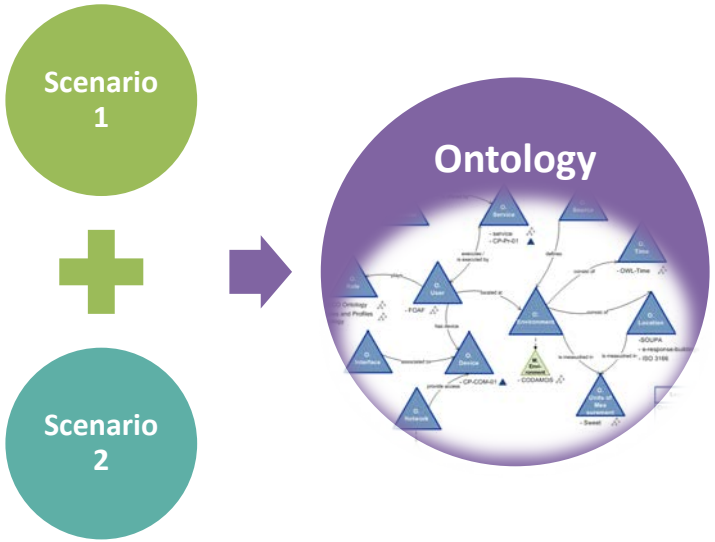
NeOn Methodology: Scenarios

1. Building ontology networks from specification to implementation
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

It is worth mentioning that ***these scenarios can be combined in different ways***, and that ***any combination of scenarios should include scenario 1*** because this scenario is made up of the core activities that have to be performed in any ontology development

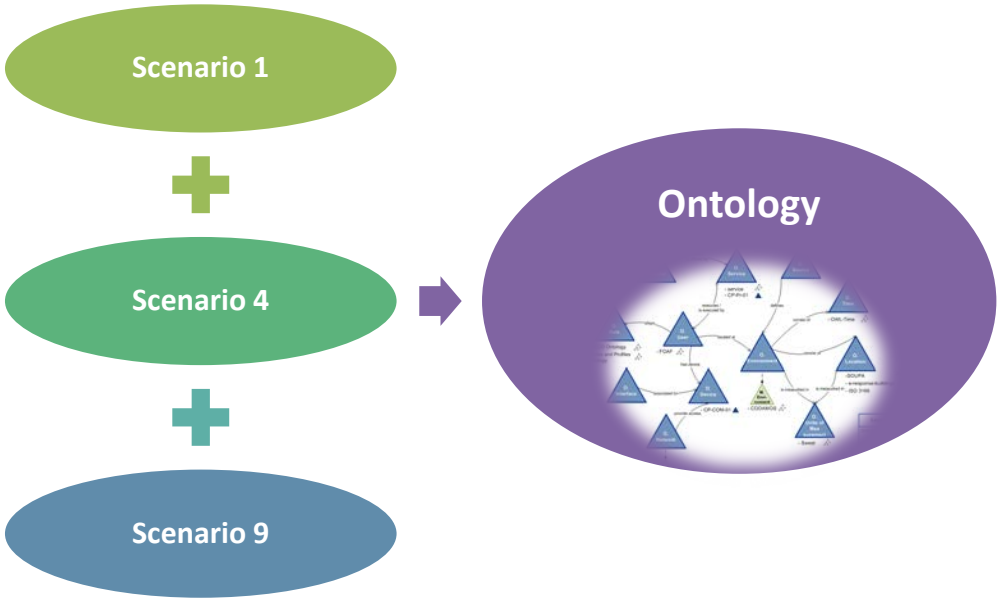
NeOn Methodology: Example I

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



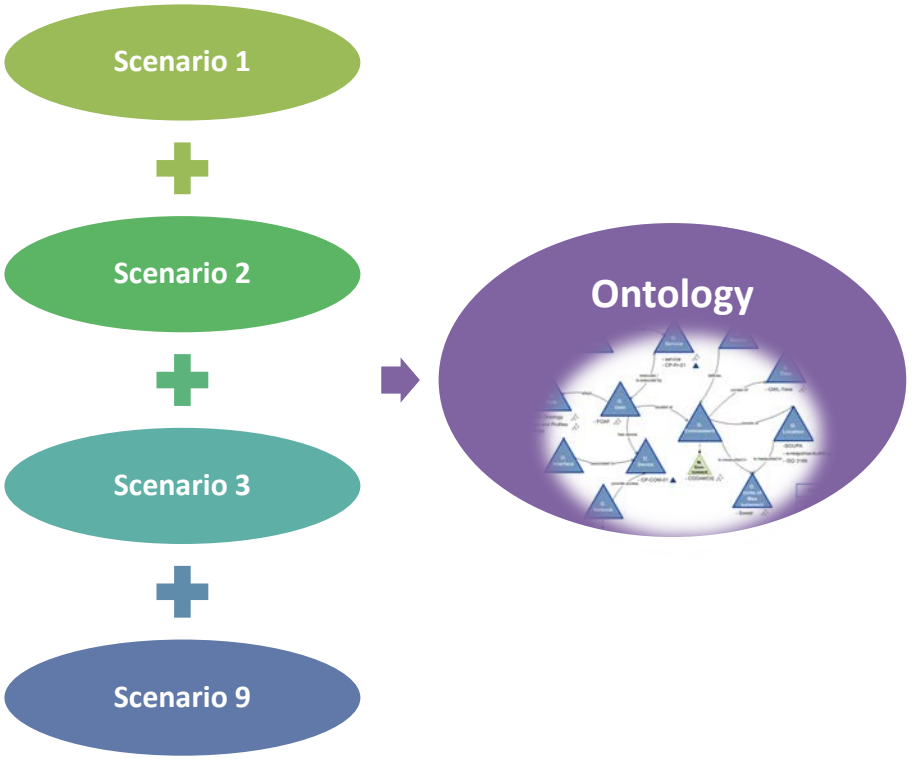
NeOn Methodology: Example II

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

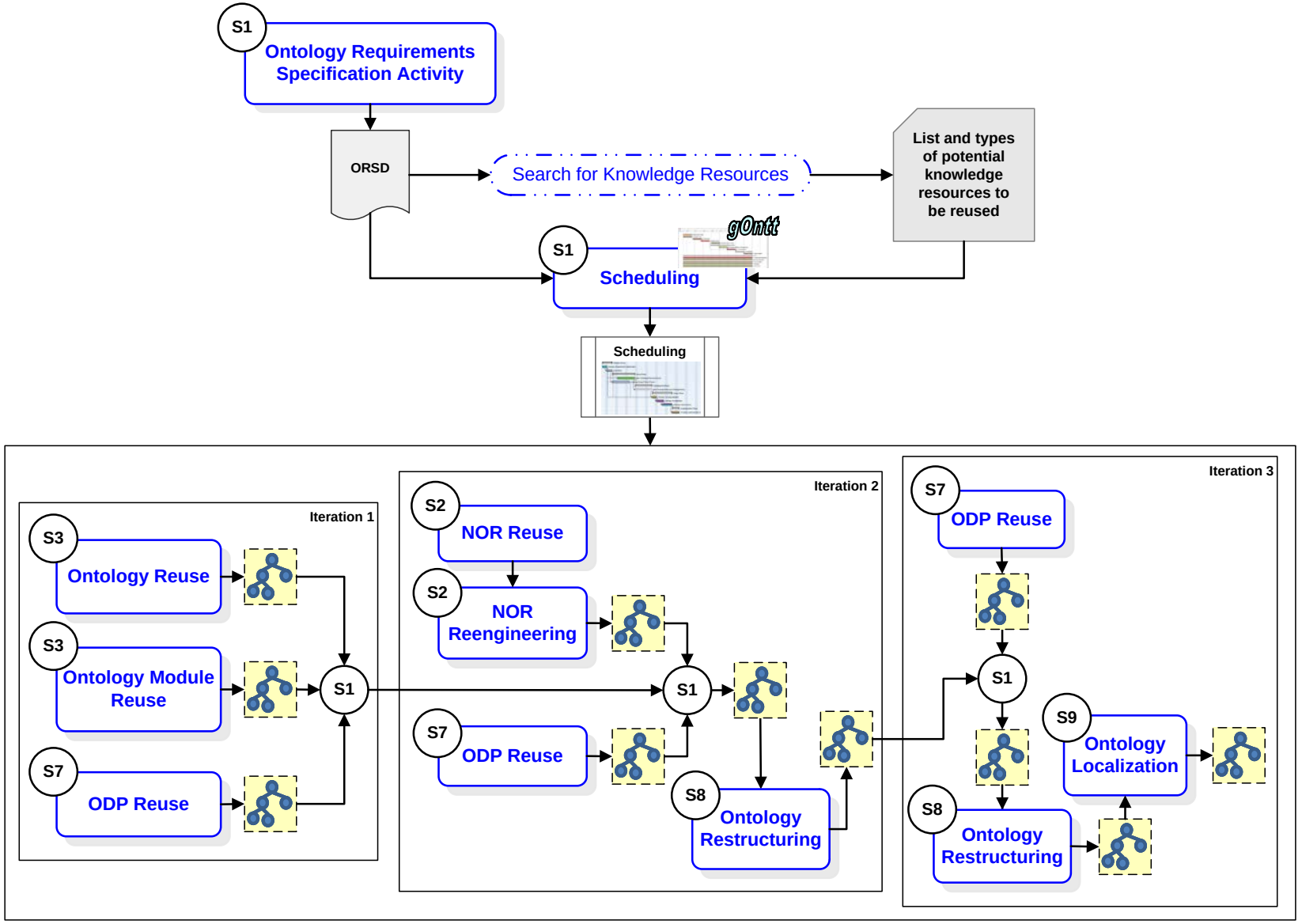


NeOn Methodology: Example III

We want to build an OWL ontology in the employment domain. We want to base on different human resource standards, on general existing ontologies, and we want to have the ontology in English, French and Spanish.

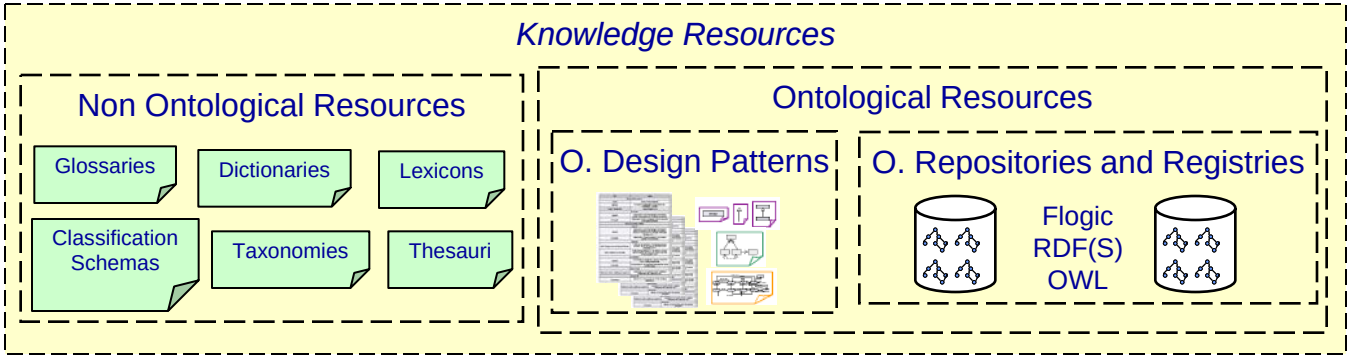


Application of the NeOn Methodology



Search for Knowledge Resources

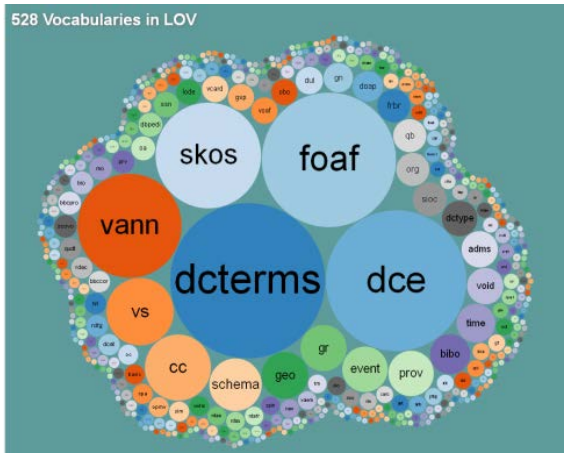
- Use the terminology from the ORSD
- Find resources covering the terminology



- In:
  - Internet
  - Standardization bodies (ISO, …)
  - Intranet of the organization
  - LOD cloud
  - Ontology Registries
  - Vertical ontology portals: smart cities, medicine

Tools for Searching Vocabularies or Patterns

LOV (Linked Open Vocabularies)

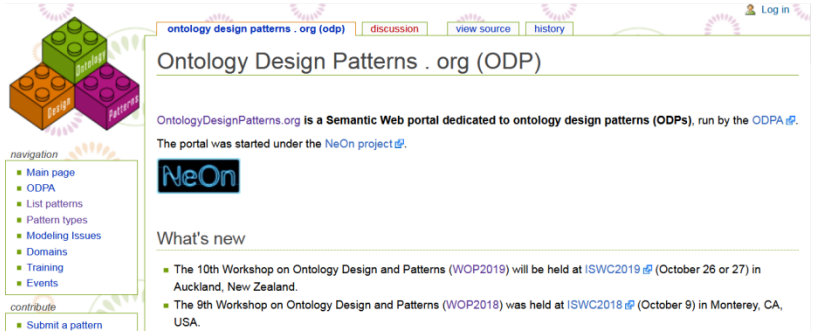


https://lov.linkeddata.es/dataset/lov/

schema.org

Getting started with schema.org

https://schema.org/



ontologydesignpatterns.org

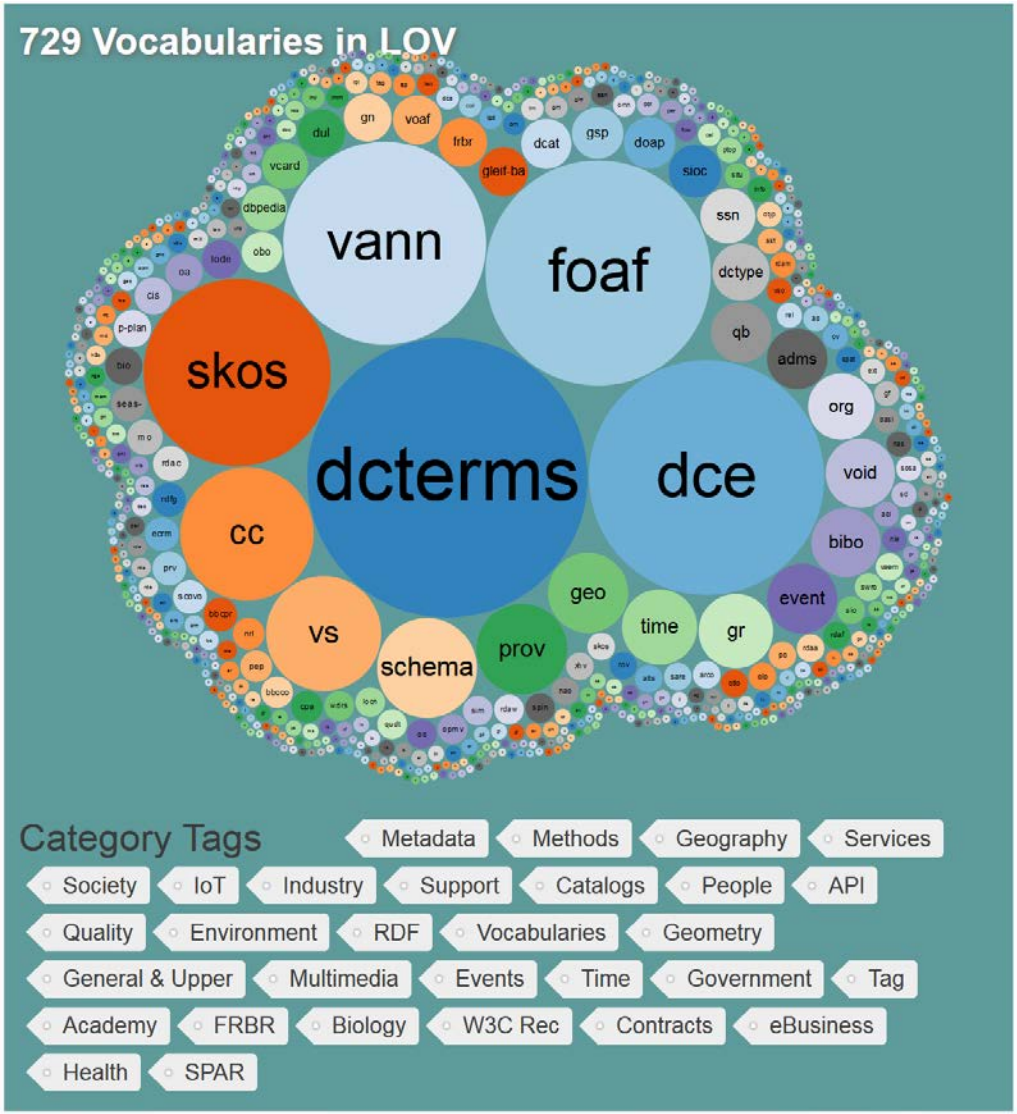
Vocabulary Search in Linked Data using **LOV**

- Ecosystem of **vocabularies** used in Linked Open Data (RDFS or OWL ontologies)
  - 792 vocabularies described by means of metadata
  - Vocabularies in different domains
  - Linked using VOAF
  - Curated medatada information about vocabularies
  - Services
    - Look up
    - Search
    - Metrics
    - Suggest new vocabularies

https://lov.linkeddata.es/dataset/lov/

Linked Open Vocabularies (LOV)

Vocabulary Search using LOV



https://lov.linkeddata.es/dataset/lov/

Linked Open Vocabularies (LOV)

Vocabulary Description in LOV

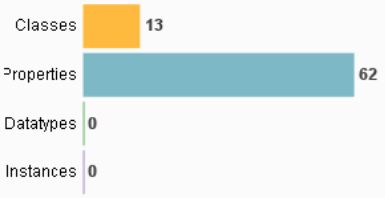
Friend of a Friend vocabulary (foaf)

Metadata

URI	http://xmlns.com/foaf/0.1/
Namespace	http://xmlns.com/foaf/0.1/
homepage	http://www.foaf-project.org/
Description	FOAF is a project devoted to linking people and information using the Web. Regardless of whether information is in people's heads, in physical or digital documents, or in the form of factual data, it can be linked. @en
Language	
Creator	Libby Miller http://data.semanticweb.org/person/libby-miller Dan Brickley http://google.com/+DanBrickley
Publisher	Dan Brickley http://google.com/+DanBrickley
Comment	(2013-06-04) Bernard Vatant: From the specification : "FOAF has been evolving gradually since its creation in mid-2000. There is now a stable core of classes and properties that will not be changed, beyond modest adjustments to their documentation to track implementation feedback and emerging best practices." (2014-12-16) Bernard Vatant: Annual review OK (2014-01-15) Bernard Vatant: Looking forward for v1.0 :)

n3

Statistics



Expressivity

RDF RDFS

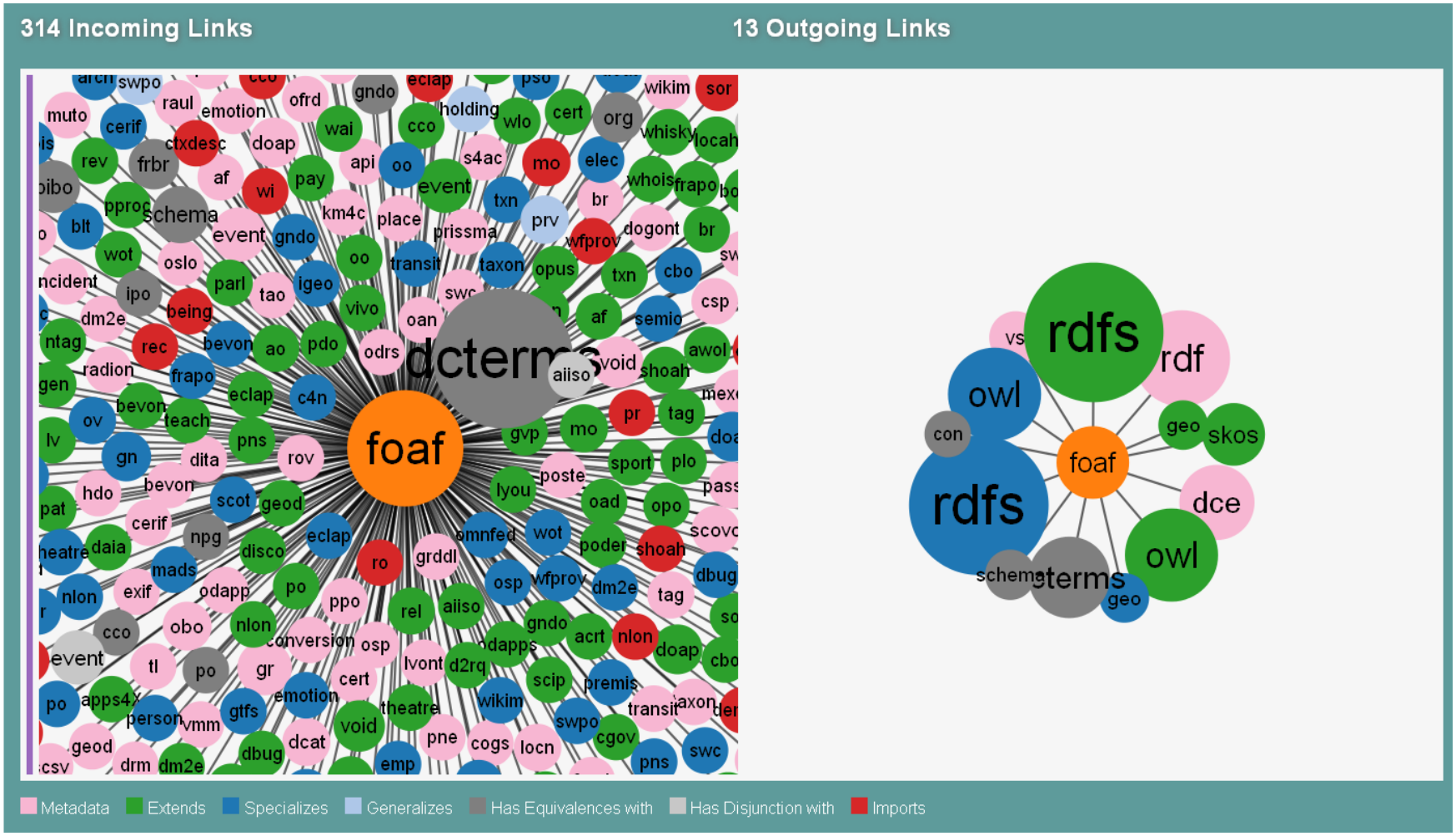
Tags

People

LOD

Vocabulary used in **249 datasets**

Vocabulary Description in LOV



Reusing Knowledge Resources

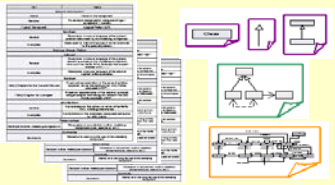
Non Ontological Resources

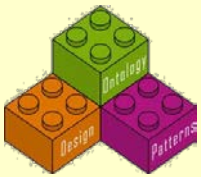
Glossaries | Dictionaries | Lexicons | Classification Schemas | Taxonomies | Thesauri

Ontologies

Flogic
RDF(S)
OWL

Ontology Design Patterns





Reach Consensus

Save Resources

Save Time

Promote Best Practices

Reusing Knowledge Resources

Ontology Search

Are there suitable vocabularies?

Yes

Build the vocabulary by reusing available vocabularies

No

Search for non-ontological resources

Institutional catalogues and standards

Are there suitable resources?

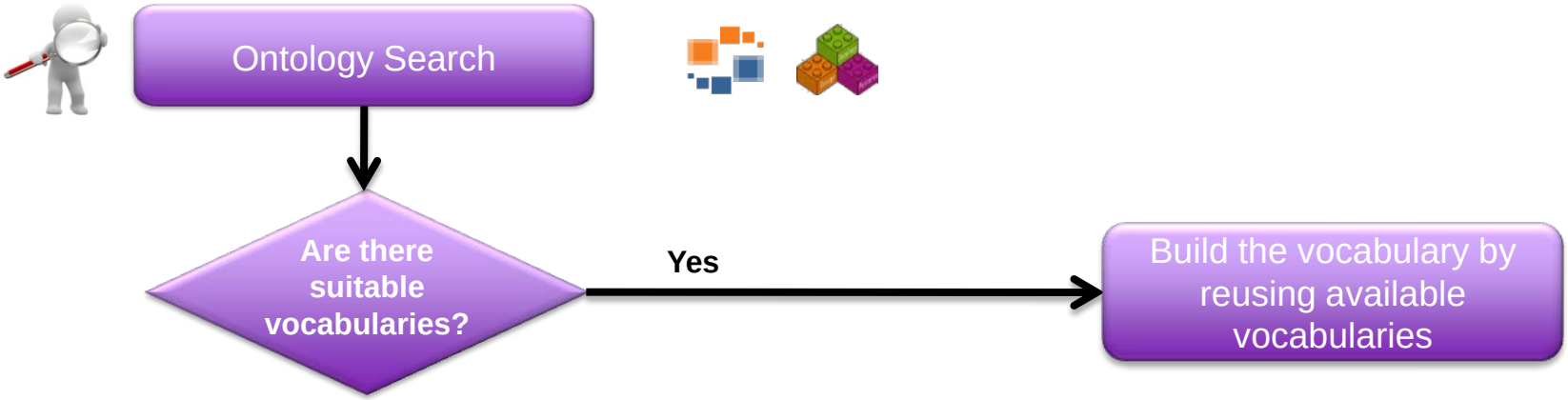
Yes

Transform the non-ontological resource into an ontology

No

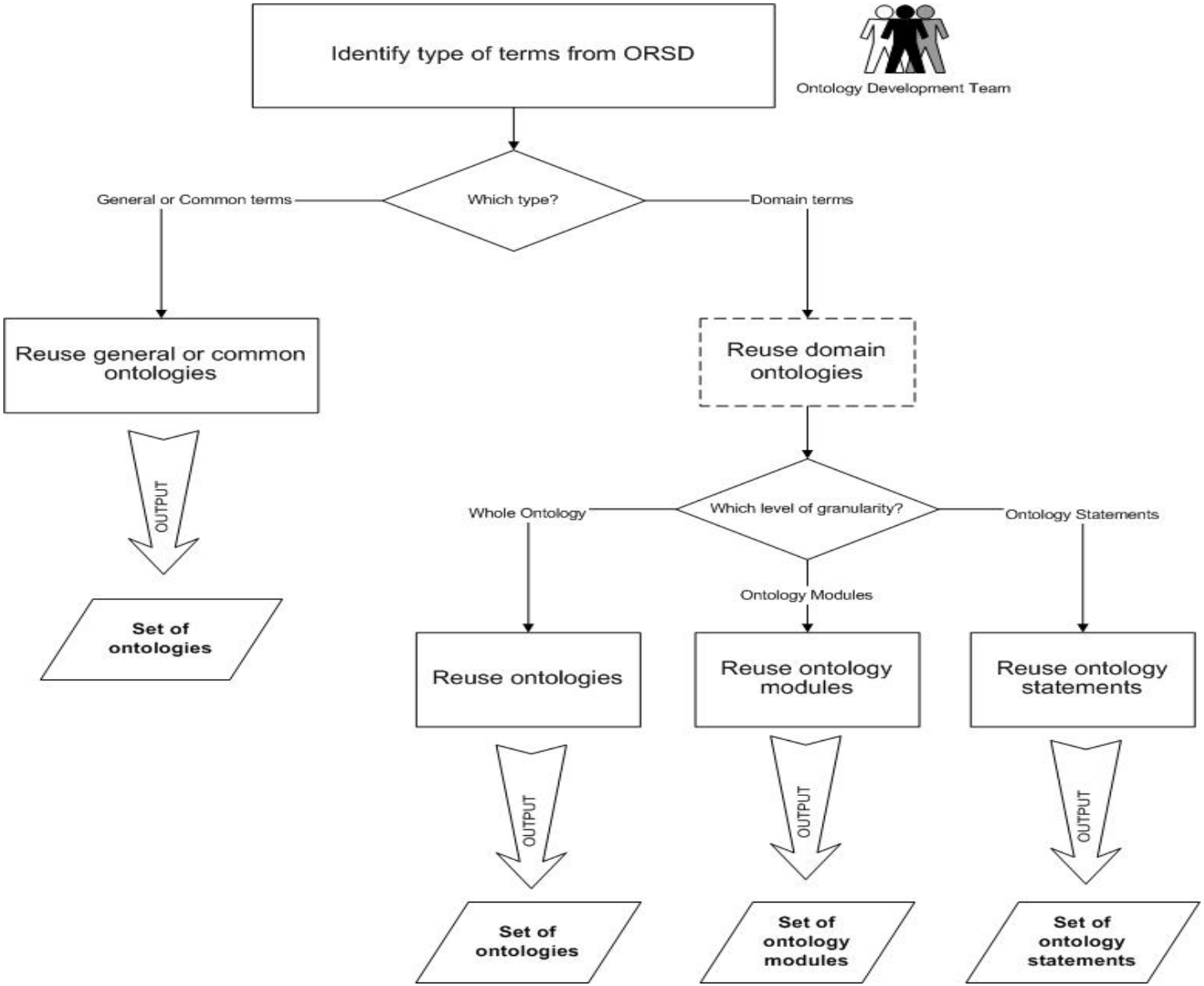
To build the ontology from scratch

Reusing Ontologies: Selection

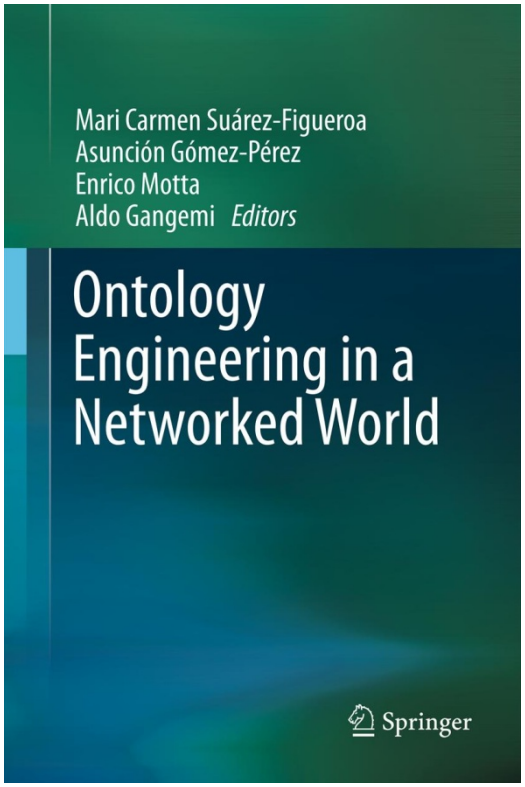


- Compare ontologies in the same domain using a set of criteria
- Assess whether the ontologies cover the set of competency questions
- Select the best ontology based on
  - Coverage of the domain
  - Expressivity of the implementation language

Reusing Ontologies: Different Ways



Main References



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Acknowledgments

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