Building networks of ontologies for the semantic Web

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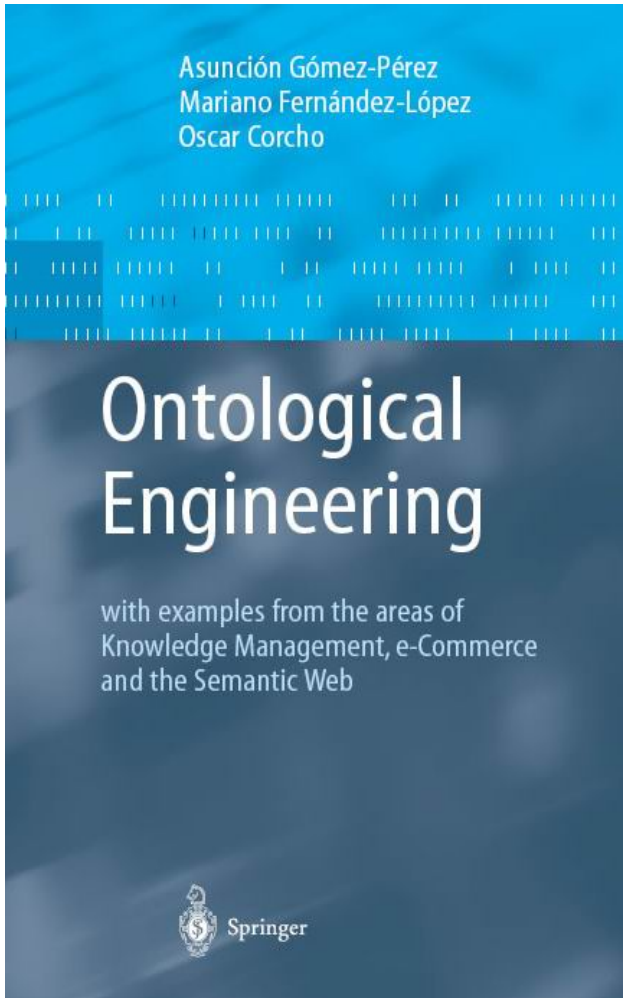
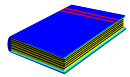
Main References



http://www.neon-project.org



D5.3.1. NeOn Development Process and Ontology Life Cycle

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

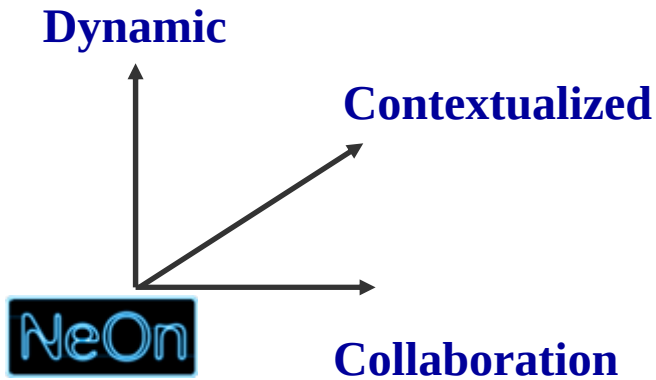
and languages that support them

Most relevant methodologies

Methodologies for building single ontologies from scratch

- 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



Ontologies are available anywhere in Internet

Conceptualize

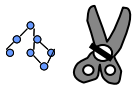
Evaluate

Requirements Specificaction

Extend

Import

Prune



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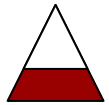
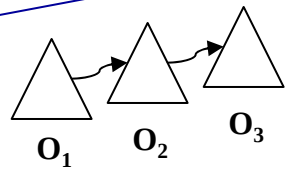
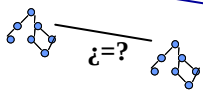


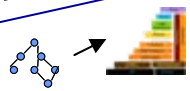
Evolution and Maintenance



Identify Differences



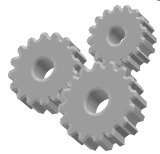
Export



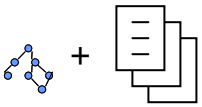
Integrate

Mappings

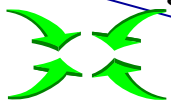
Reasoners



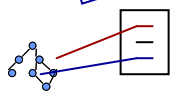
Document



Merge



Anotate



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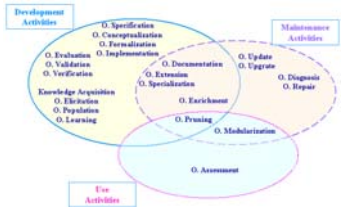
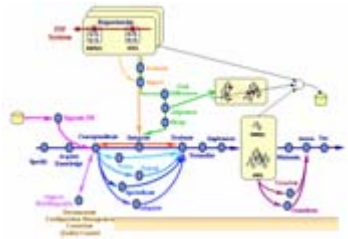
Methontology identifies three pillars of ontology development

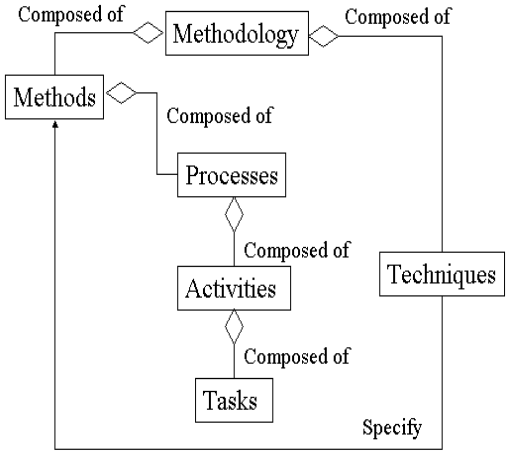


Development Process: Which activities



Life Cycle: Order of activities

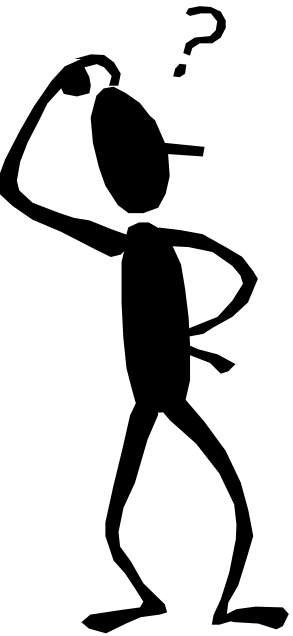
1. **Intra-ontology dependencies**
2. **Inter-ontology dependencies**



Methodologies: How to carry out the activities

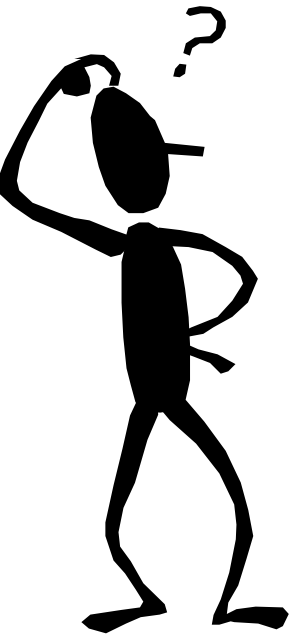
1. **Input and outputs**
2. **Methods, tasks, techniques, tools**
3. **Who, When, What, How, Where, Which**

I want to build my ontology



- Which one are the activities involved in the ontology development process?
- Which one is the goal of each activity?
- When should I carry out each activity?
- Where is the relationship of one activity with the others?
- Where can I find ontologies with the goal of reusing them?
- How can I build the ontology for my application?
- Do I need a single ontology or an ontology network?

I want to build my ontology



- Which one are the activities involved in the ontology development process?
- Which one is the goal of each activity?
  - NeOn Glossary of Activities
  - NeOnTable of “Recommended and If-Applicable”
  - NeOn Development Process
- When should I carry out each activity?
- Where is the relationship of one activity with the others?
- Where can I find ontologies with the goal of reusing them?
- How can I build the ontology for my application?
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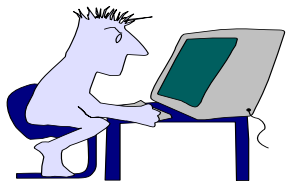
The NeOn Glossary of Activities

- The *NeOn Glossary of Activities* identifies and defines the activities that are carried out when ontology networks are collaboratively built
- 55 activities

On-going Steps:

- Publication in the NeOn website (http://www.neon-project.org)
- Procedure for getting feed-back from the community (http://cicero.uni-koblenz.de)



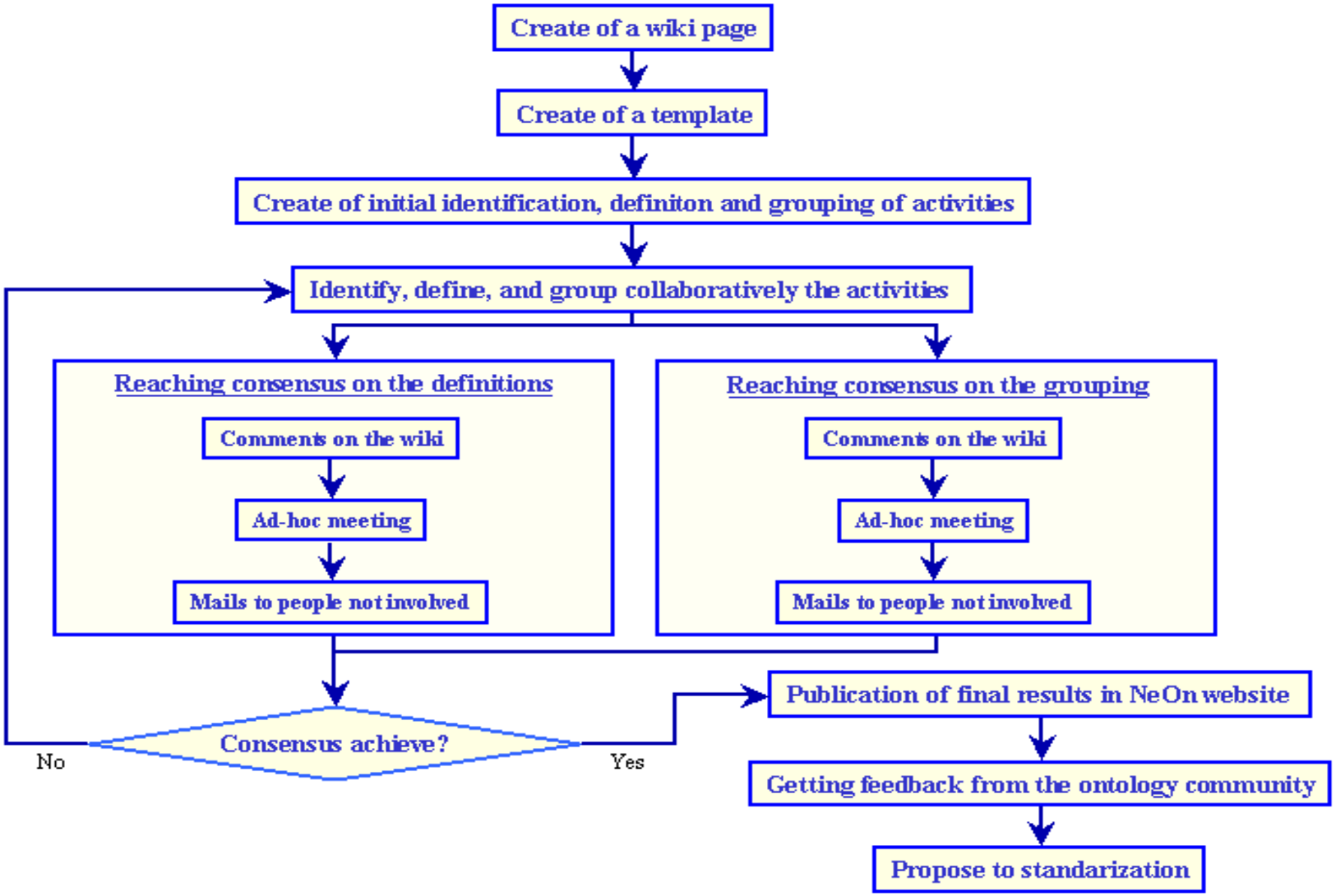
http://www.neon-project.org/

The NeOn Glossary of Activities

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
- Ontology Merging
- Ontology Modification
- Ontology Modularization
- Ontology Module Extraction
- Ontology Partitioning
- Ontology Population
- Ontology Pruning
- Ontology Reconciliation
- Ontology Repair
- Ontology Reuse
- Ontology Selection (Marta)
- Ontology Specialization
- Ontology Specification
- Ontology Summarization
- Ontology Transforming
- Ontology Translating
- Ontology Update
- Ontology Upgrade
- Ontology Validation
- Ontology Verification
- Ontology Versioning
- To find candidate ontologies to be reused
- To find ontology differences
- To inspect the content and granularity of the

The process for creating the NeOn Glossary



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*.

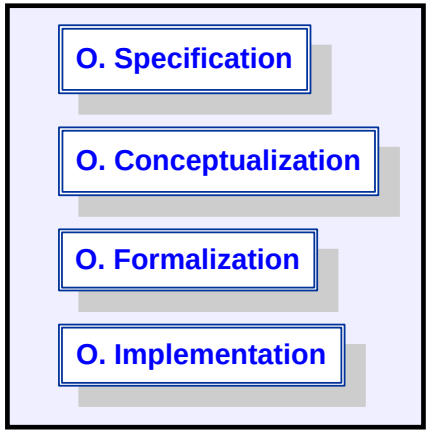
WP5WorkingArea: Ontology Population

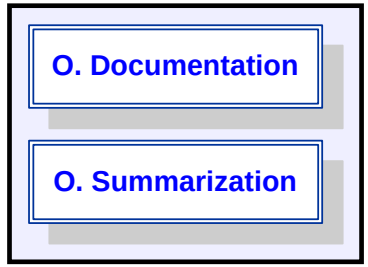
(Redirected from WP5WorkingArea: Ontology Population/Grounding)

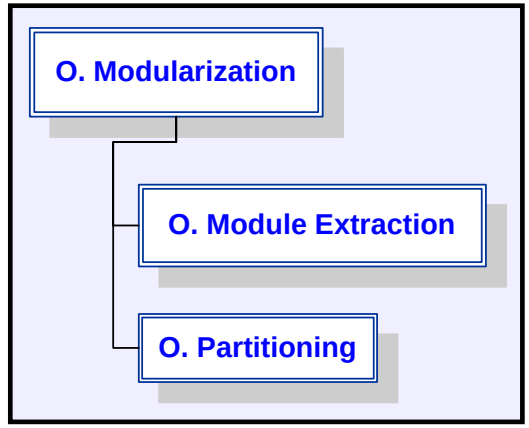
- **Final Definition**: *Ontology Population* is a knowledge acquisition activity that relies on (semi-) automatic methods to transform unstructured (e.g. corpora), semi-structured (e.g. folksonomies, html pages, etc.) and structured data sources (e.g. data bases) into instance data (e.g. A-Box).
- **Activity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

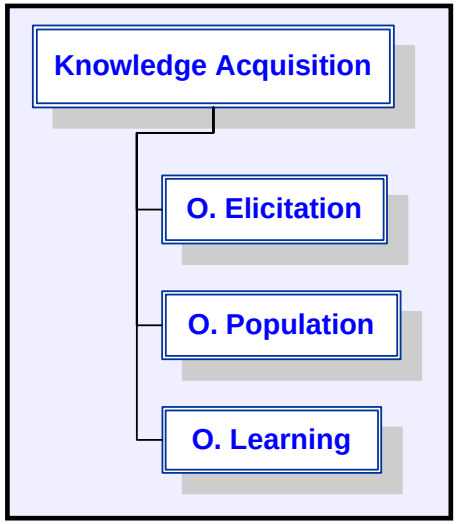
http://www.neon-project.org/wiki/index.php?title=WP5D5.3.1#NeOn_Glossary_of_Activities

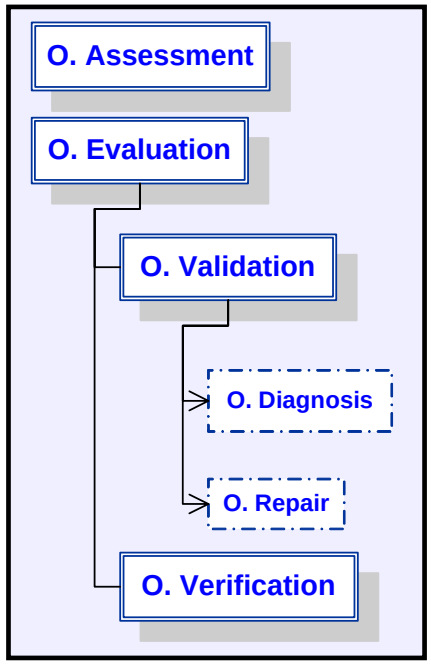
Grouping Activities

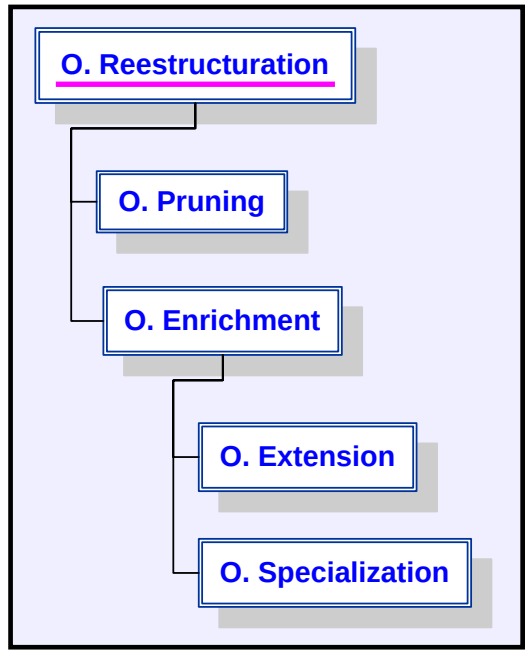












Grouping Activities

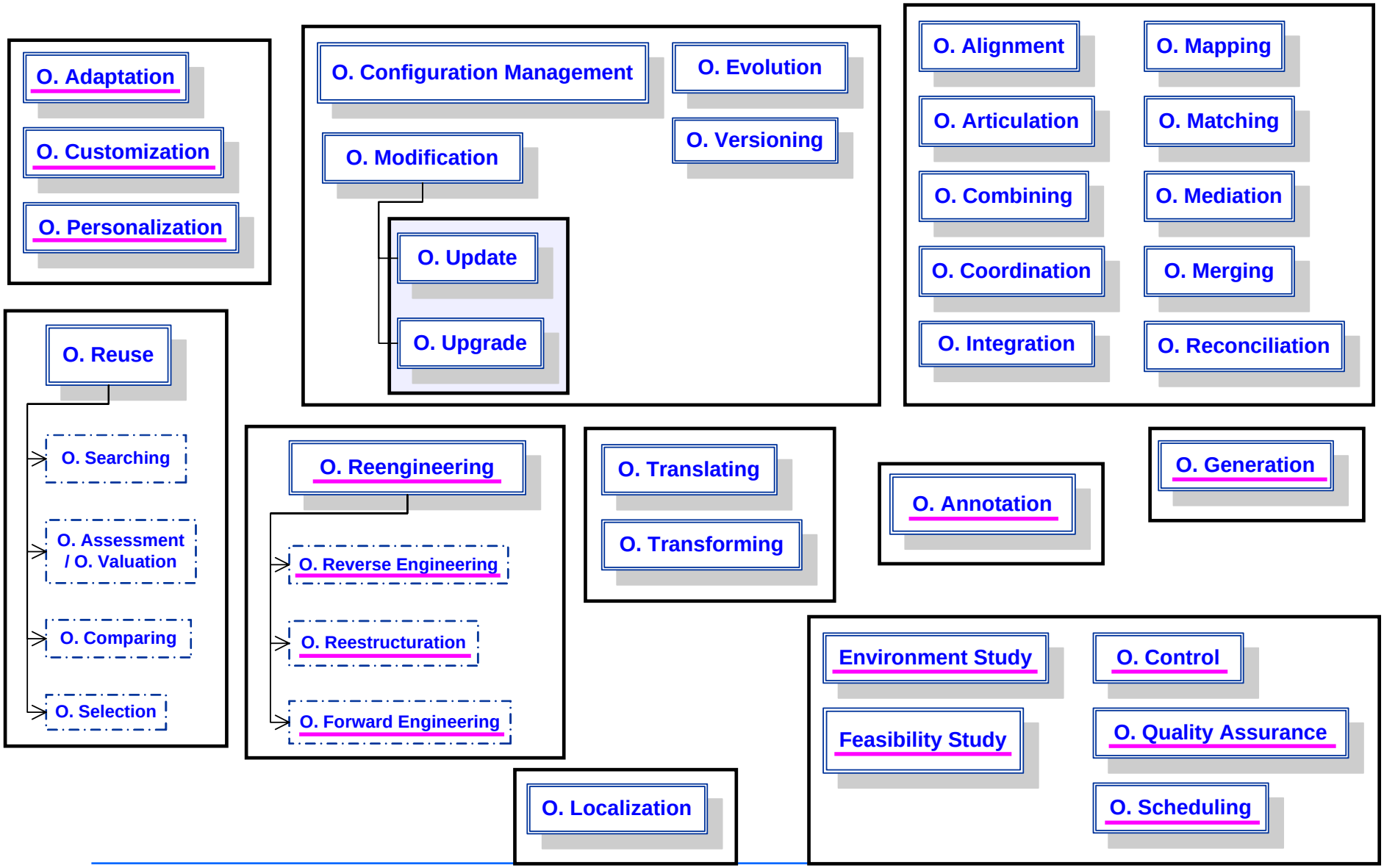


Table of “Recommended and If-Applicable” Activities

- 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	

Ontology Network Development Process

Management

Scheduling

Control

O. Quality Assurance

Development-oriented

Pre-Development

O. Environment Study

O. Feasibility Study

Development

O. Specification

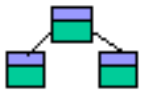
O. Conceptualization

O. Reuse

O. Translation

O. Restructuring

Non Ontological Resource Reengineering



O. Formalization

O. Implementation

Non Ontological Resource Reuse

O. Reengineering

O. Annotation

O. Customization

O. Aligning

O. Integration

O. Modularization

O. Update

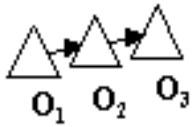
O. Modification

O. Localization

O. Merging

Post-Development

O. Upgrade



O. Versioning

O. Evolution

Support

Knowledge Acquisition

O. Documentation

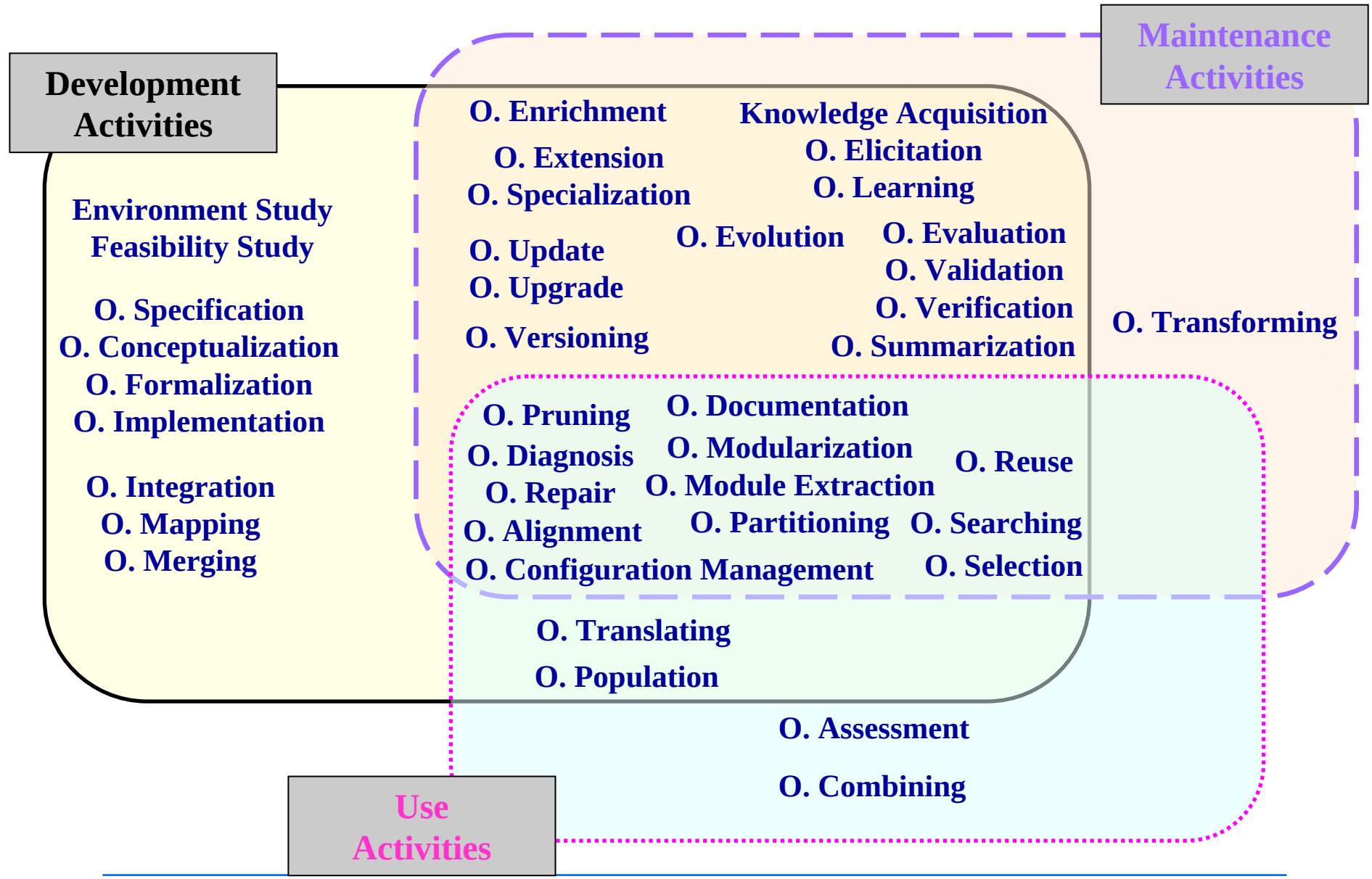
O. Summarization

O. Evaluation (V&V)

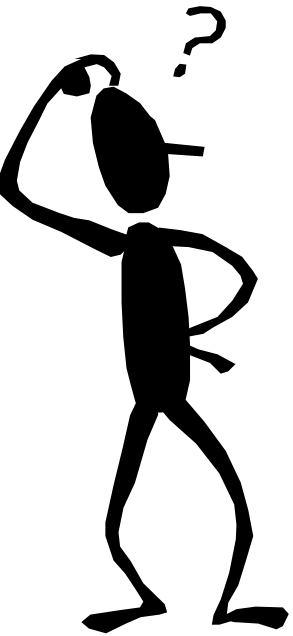
O. Configuration Management

O. Assessment

Ontology Network Development Process



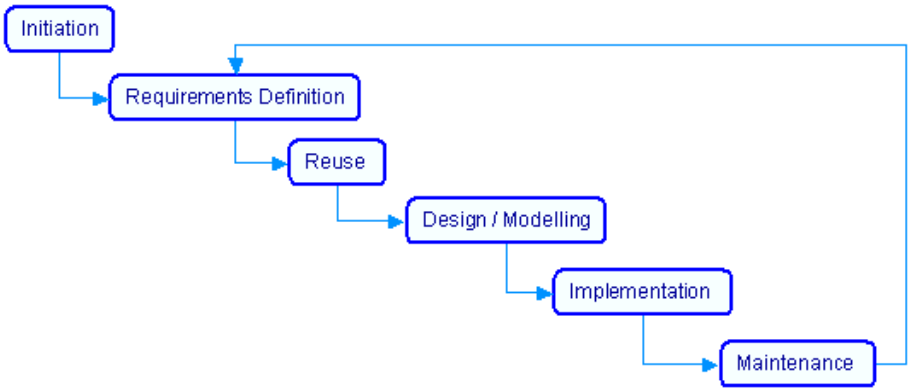
I want to build my ontology

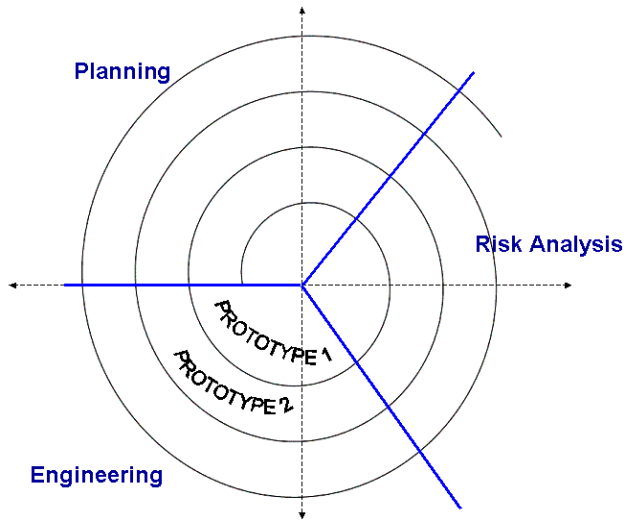


- Which one are the activities involved in the ontology development process?
- Which one is the goal of each activity?
- When should I carry out each activity?
- Where is the relationship of one activity with the others?
  - Ontology Network Life Cycle models
  - Ontology network life cycles
- Where can I find ontologies with the goal of reusing them?
- How can I use the ontology in my application?
- Do I need a single ontology or an ontology network?

Life Cycle Models and Life Cycles

- An **ontology life cycle model** is the framework (waterfall, evolving prototyping, spiral, etc.), selected by each using organization, on which to map the activities identified in the ontology development process.





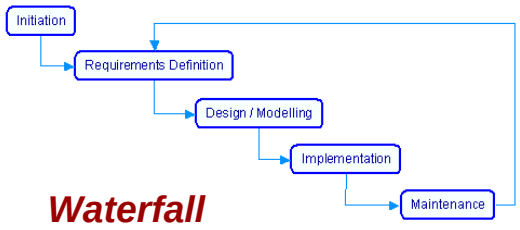
- The **ontology life cycle** is the specific sequence of activities that the ontology practitioners carry out for developing an ontology.

Several Ontology Life Cycle Models are possible

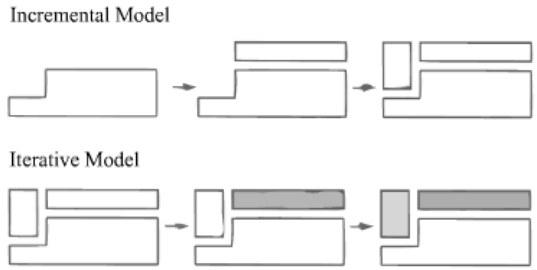
There is **no a unique life cycle model** valid for all the ontology development projects and that each life cycle model is appropriate for a concrete project, depending on several features.

For example, sometimes it is better a simple one (like waterfall), whereas other times it is most suitable a spiral one (if the analysis of the risk is needed within the project).

- **Assumption: Ontology requirements are known at the begining of the ontology development project.**



Waterfall



- **Assumption: Ontology requirements can be not known at the begining of the ontology development project and can change during the project.**

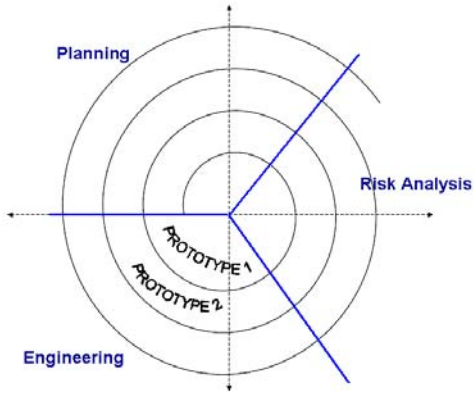
Evolutionary Prototyping

Rapid Throwaway Prototyping

Several Ontology Life Cycle Models are possible

- **Assumption: Uncertainties in the ontology requirements can derive into risks in the project.**

Spiral



Risks can be:

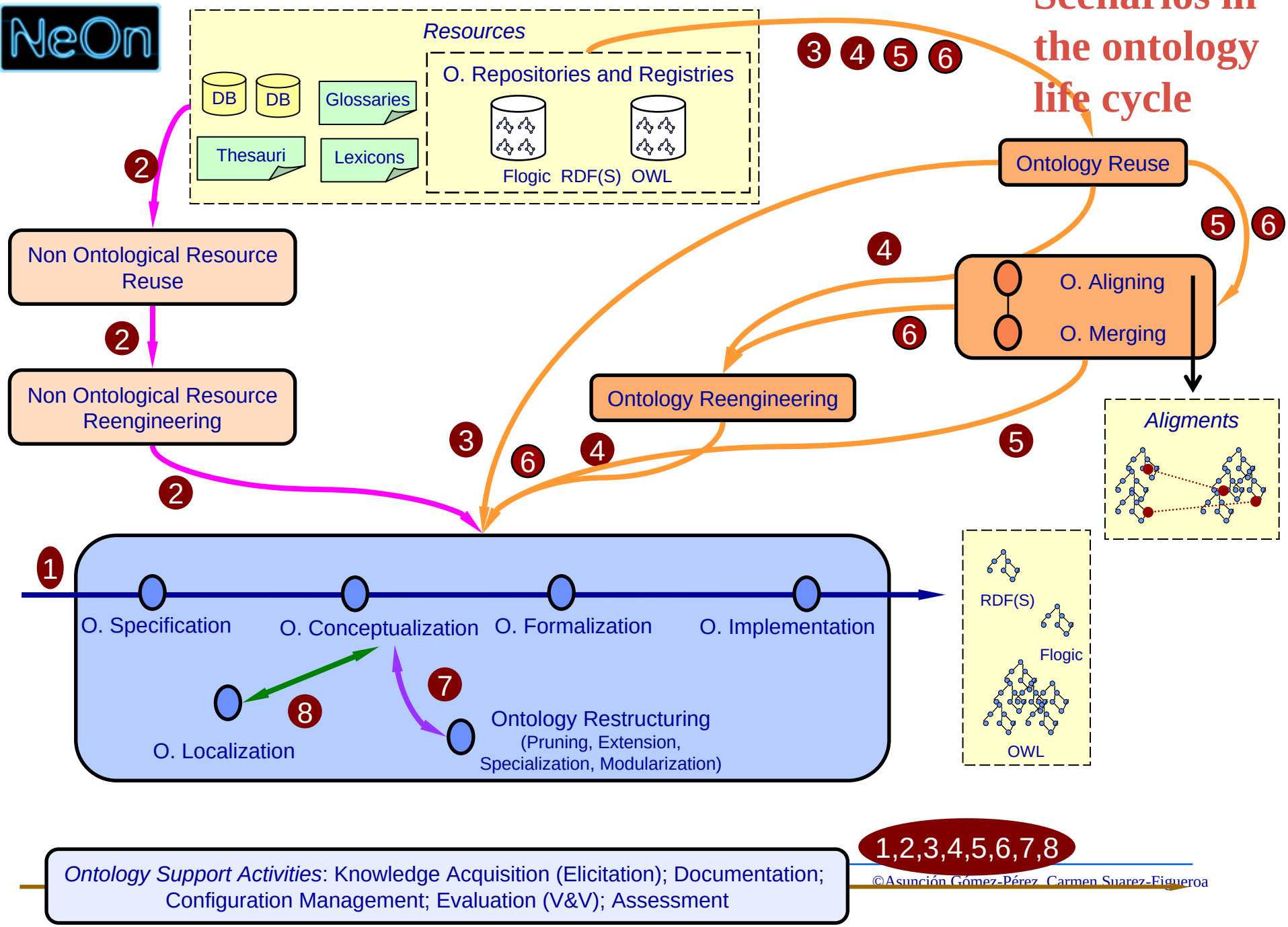
- **Properties became classes**
- **Move from frames to DL**
- **Reuse new existing resources**

❑ **Planning**: in this phase it is carried out the whole schedule for the ontology network development and the specification of the ontology network requirements.

❑ **Risk analysis**: after analysing the possible risk within the ontology network development, the decision of continuing or not with a new iteration around the spiral is taken.

❑ **Engineering**: in this phase it is developed a prototype of the ontology network based on the specified requirements, following any type of waterfall ontology network life cycle model.

Scenarios in the ontology life cycle



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

1,2,3,4,5,6,7,8

Scenarios

1. Building ontology networks from scratch without reusing existing resources.
2. Building ontology networks by reusing 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 restructuring ontologies or ontology modules.
8. Building ontology networks by localizing ontologies or ontology modules.

Ontology Life Cycle. Intra-dependencies

Time

Management

Control

O. Quality Assurance

Development-oriented

Development

Post-Development

Pre-Development

O. Environment Study

O. Feasibility Study

Management

Scheduling

Support

Knowledge Acquisition

O. Documentation

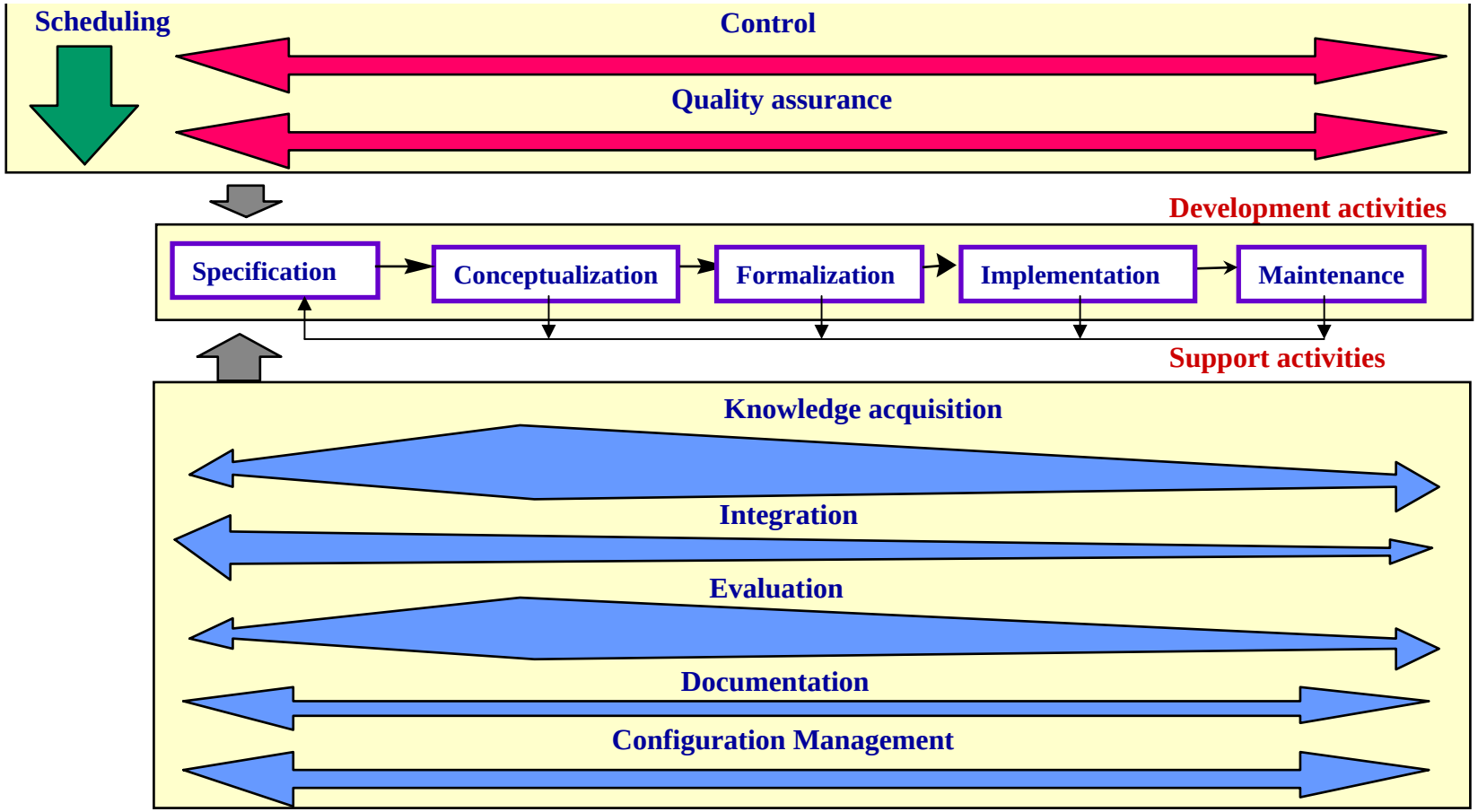
O. Summarization

O. Evaluation (V&V)

O. Configuration Management

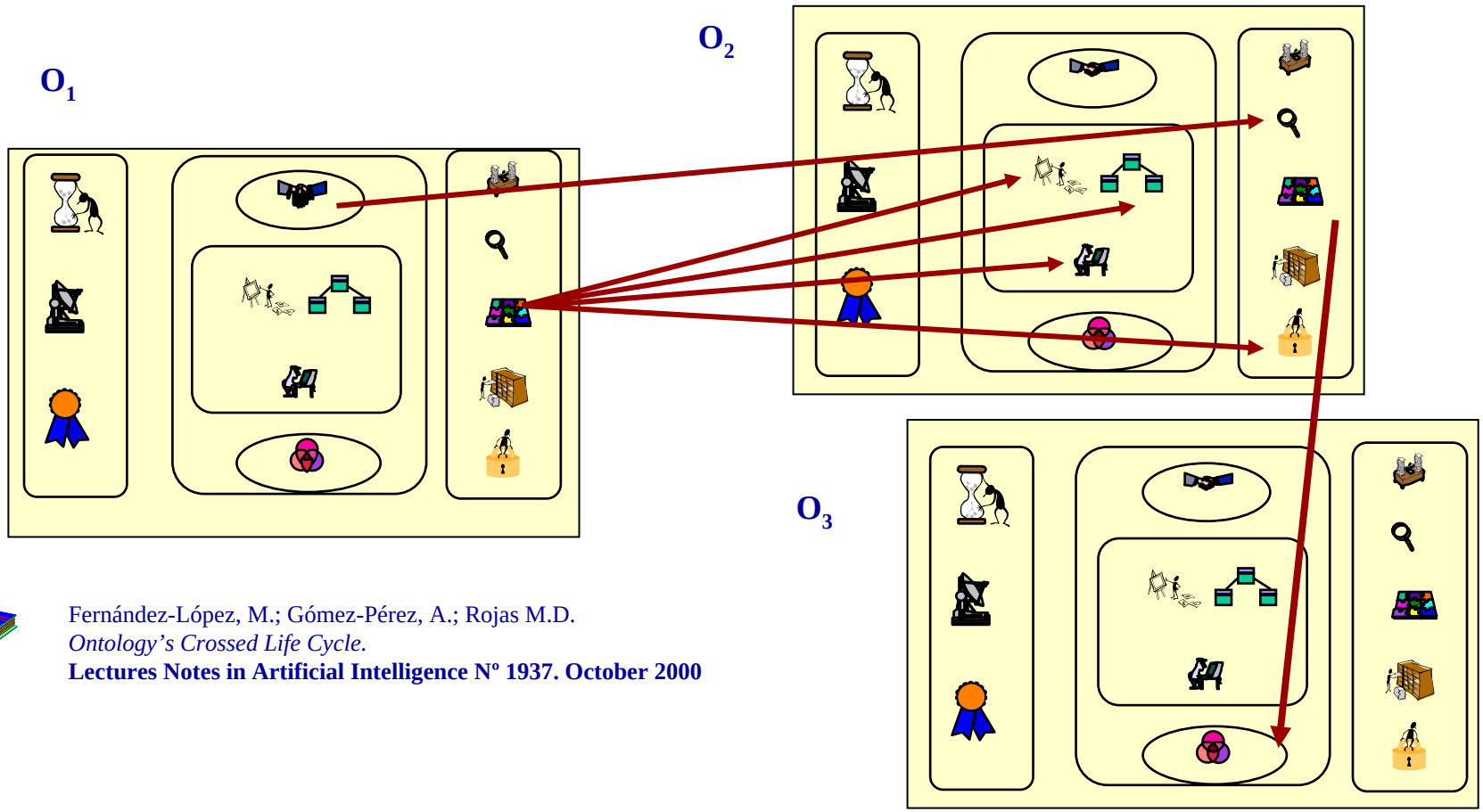
O. Assessment

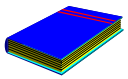
Ontology Life Cycle. Intra-dependencies



Ontology Life Cycle. Inter-dependencies

Inter-dependencies refer the relationship between activities carried out when building different ontologies



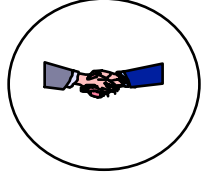


Fernández-López, M.; Gómez-Pérez, A.; Rojas M.D.
Ontology's Crossed Life Cycle.
Lectures Notes in Artificial Intelligence Nº 1937. October 2000

How software developers and ontology practitioners decide which **ontology network life cycle model** is the most appropriate for their ontology network and which **concrete activities** should be carried out in their ontology network life cycle?

Proposed steps:

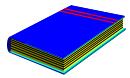
1. Identify ontology network development requirements.
2. Select the ontology network life cycle model (ONLCM) to be used.
3. Select activities to be carried out from the “Required–if Applicable” table.
4. Map the selected activities into the selected ontology network life cycle model.
5. Set the order of the activities: the result is the ontology network life cycle for the ontology network.



Step 1: Identify ontology network development requirements

To produce an Ontology Specification Document

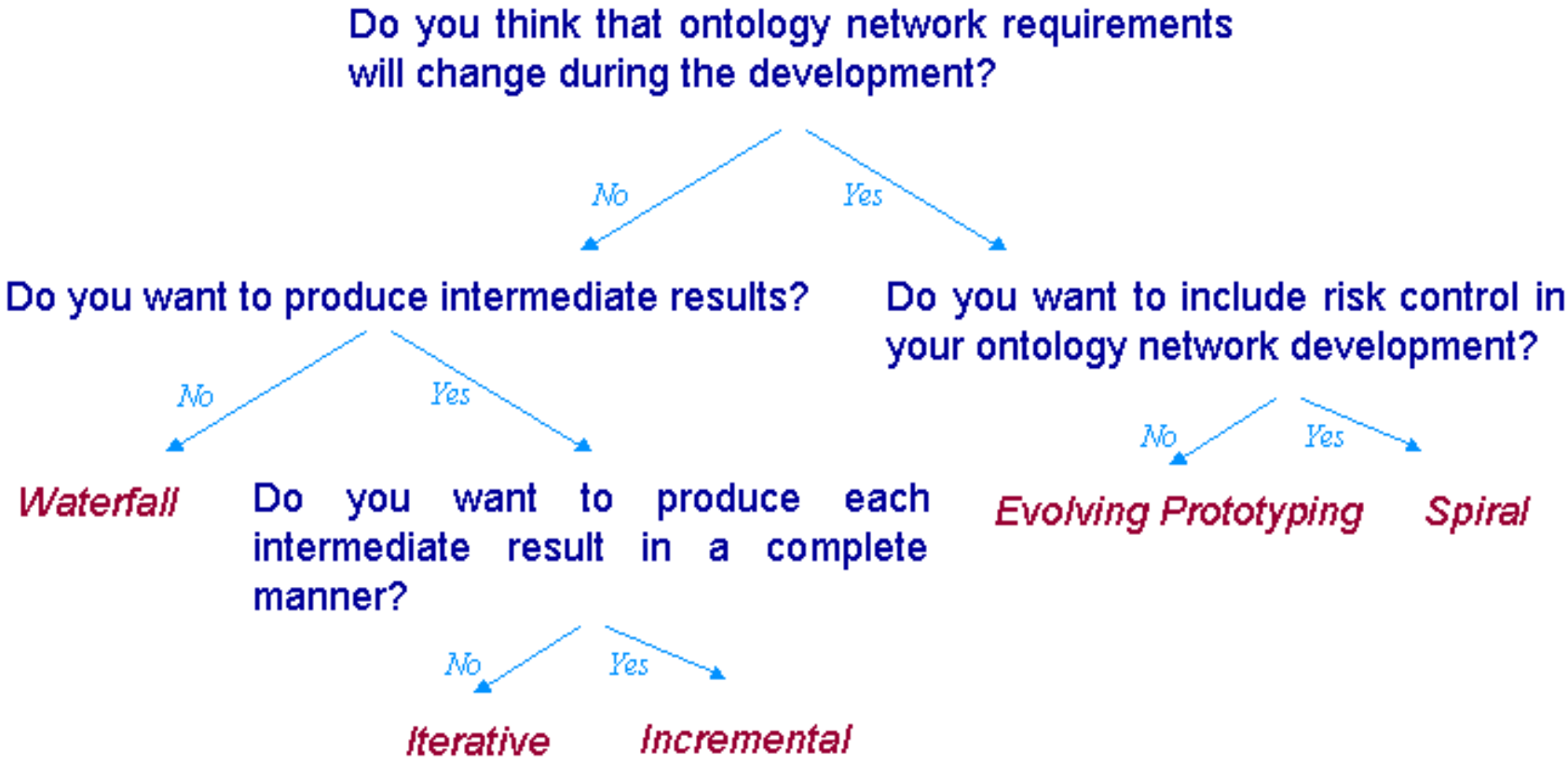
- ***Content:***
  - **Purpose**
  - **Scenarios of use**
  - **Possible end users**
  - **Level of formality of the ontology**
  - **Scope**
  - **Granularity**
- ***Language:***
  - **Informal**
  - **Semi-formal**
  - **Competency Questions**



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

Gómez-Pérez, A. *Knowledge Sharing and Reuse.*
In the Handbook of Applied Expert Systems. CRC Press. 1998.

Step 2: Decision Tree for Selecting the Ontology Network Life Cycle Model



Step 3: Decision Tree for Selecting Activities to be mapped in the Ontology Network Life Cycle Model

Have you developed more than 5 ontologies?

No

Yes

Set of "yes/no" natural language questions for identifying the 'if-applicable' activities to be carried out.

- Do you want to have your ontology network in different natural languages, as for example, in English, Spanish and French? YES → *O. Localization*.
- Do you want to take an existing and implemented ontology, in order to enhance it and implement it again? NO → *O. Reengineering is not selected*.

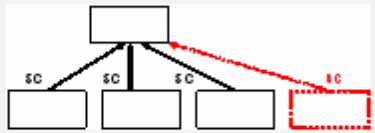
Software developers and ontology practicioners select the activities to be carried out from the "Required-If Applicable" table

	If Applicable	Selected
Ontology Aligning	X	X
Ontology Customization	X	
Ontology Learning	X	
Ontology Localization	X	X
Ontology Matching	X	X
Ontology Modification	X	
Ontology Reengineering	X	
Ontology Restructuring	X	X

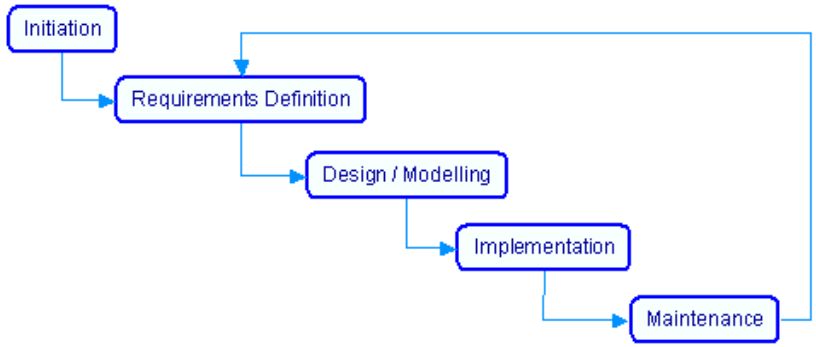
Automatically

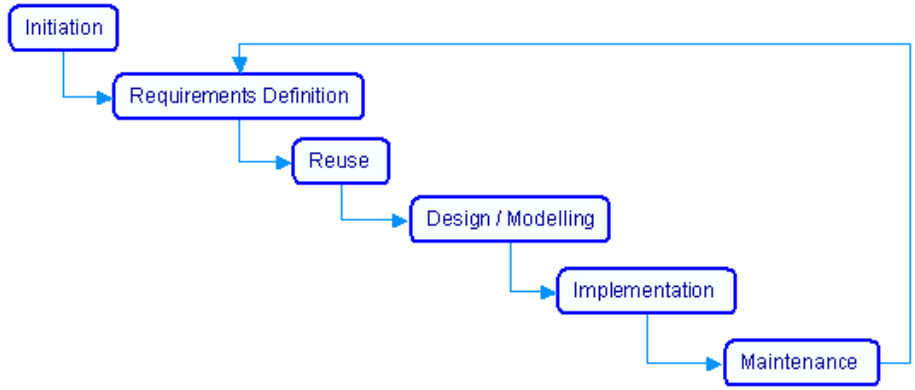
“Yes/No” Natural Language Questions

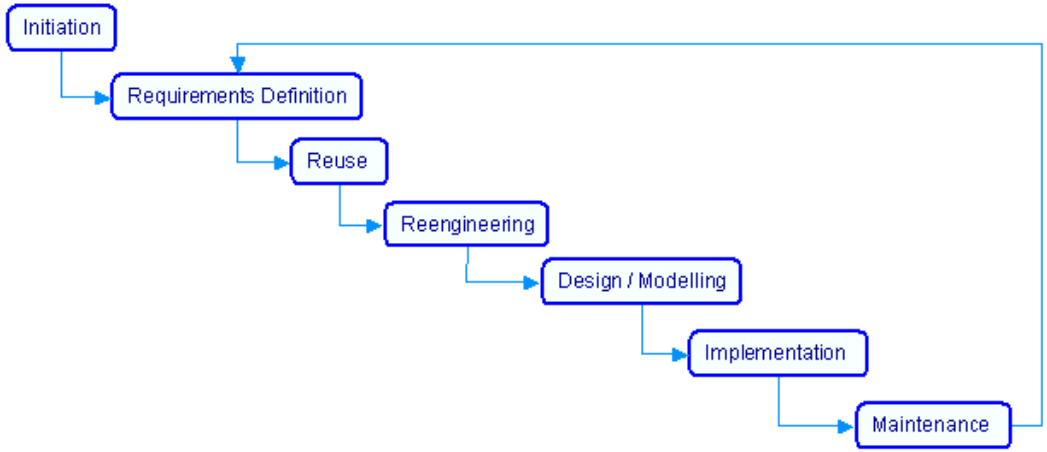
Set of “yes/no” natural language questions for identifying the ‘if-applicable’ activities to be carried out.

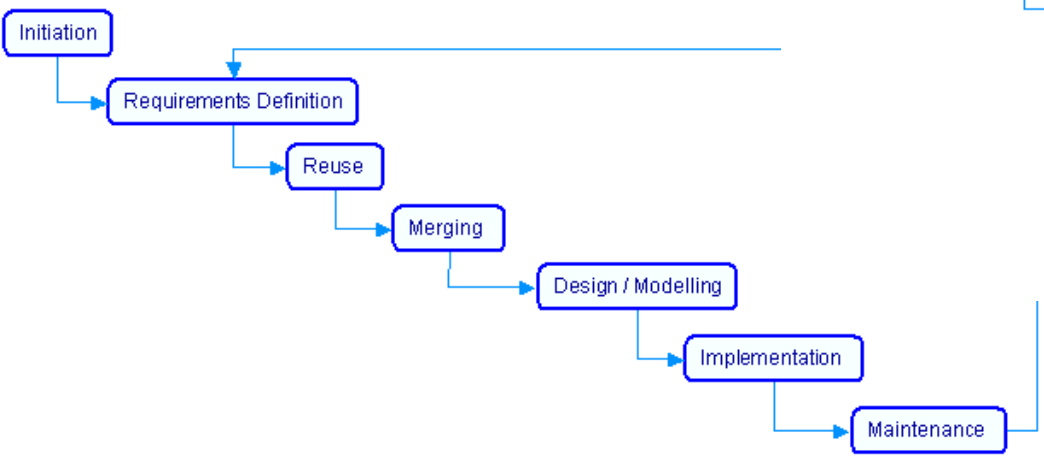
Activity	*Natural Language Questions*
Ontology Aligning **(or Ontology Mapping)**	Do you have two or more ontologies at your disposal that you want to examine to find correspondences and to take advantage of them? Do you want to find out correspondences among ontologies to use them?
Ontology Customization	Do you want to adapt the ontology network to a specific user profile? Do you want to modify the ontology network to meet specific user needs?
Ontology Enrichment	Do you want to widen/extend your current ontology network with additional elements (e.g., concepts, roles, axioms, etc.)?
Ontology Extension	Do you want to stretch, widen, broaden or expand your current ontology network by adding new concepts "in a horizontal way/direction" with the aim of widenning its sphere of action?  (cf. Ontology Specialization)
Ontology Forward Engineering	Are you going to carry out a new implementation for a previously modified conceptual model? Are you going to produce a new implementation for a modified conceptual model, whose previous version had already been implemented?

Several ontology life cycles for the same model









Waterfall

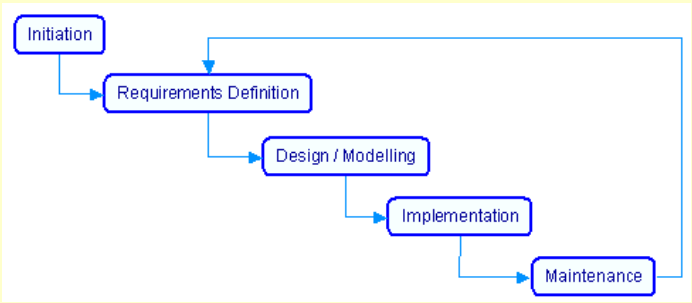
Management activities

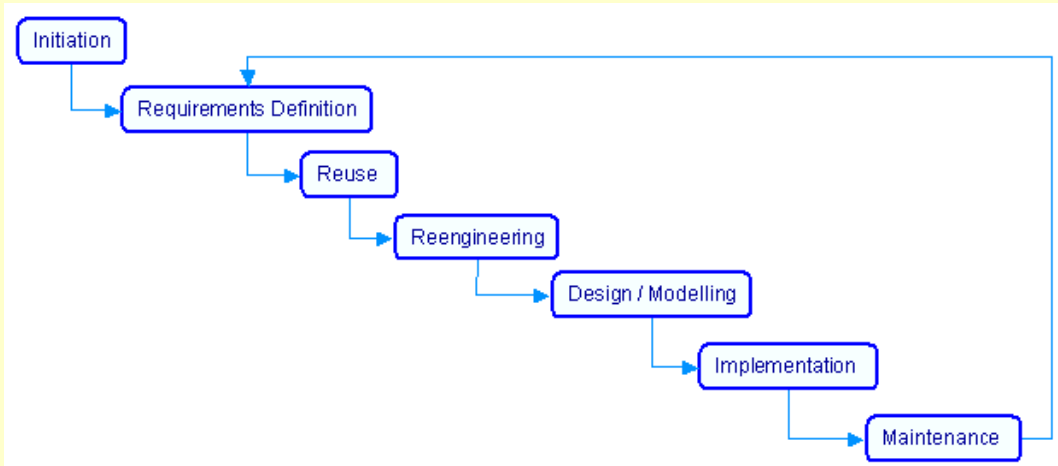
Scheduling

Control

Quality assurance

Development activities

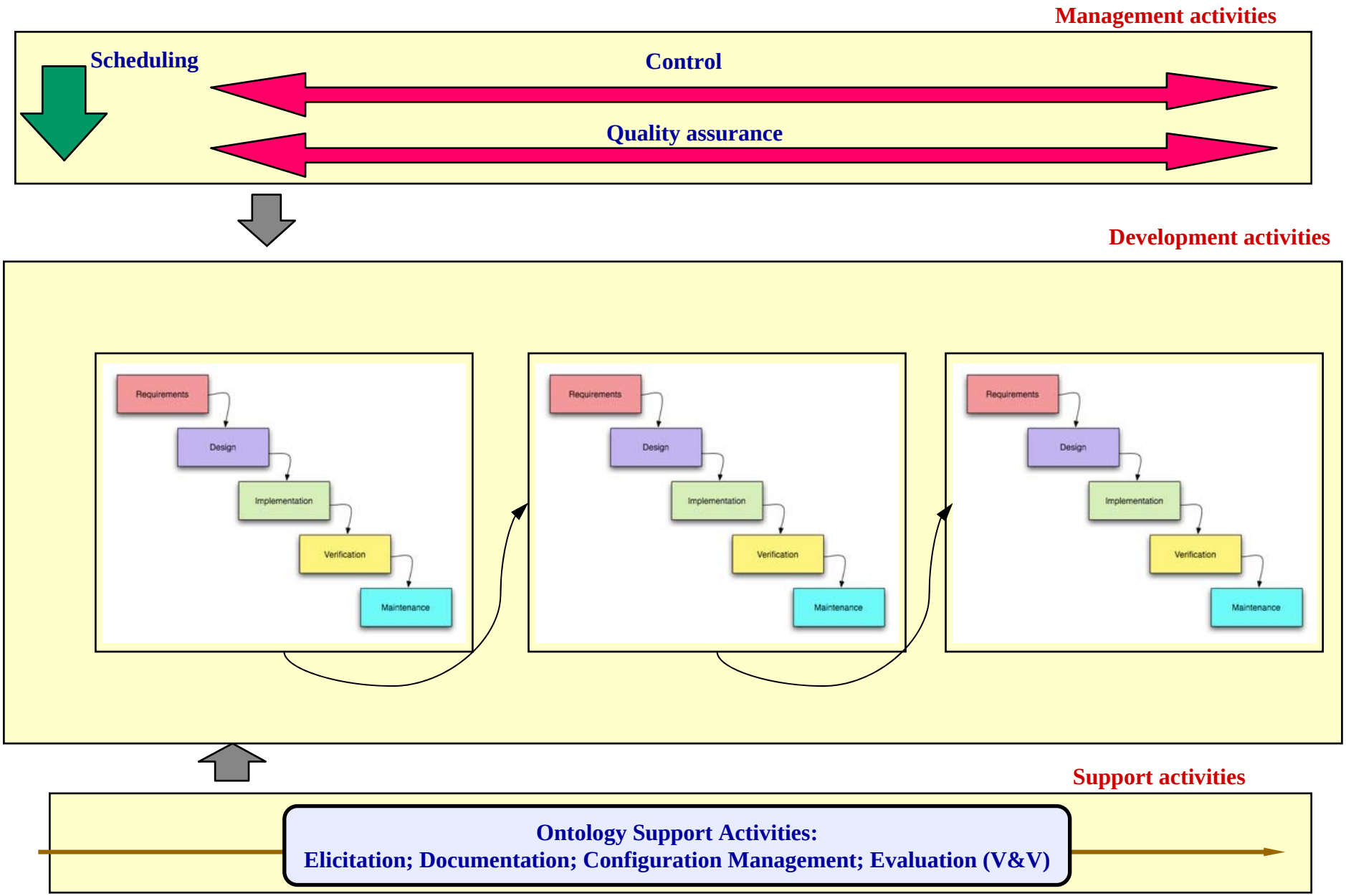




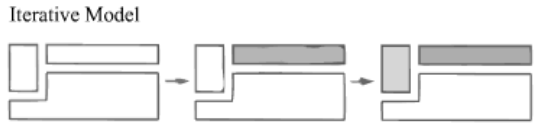
Support activities

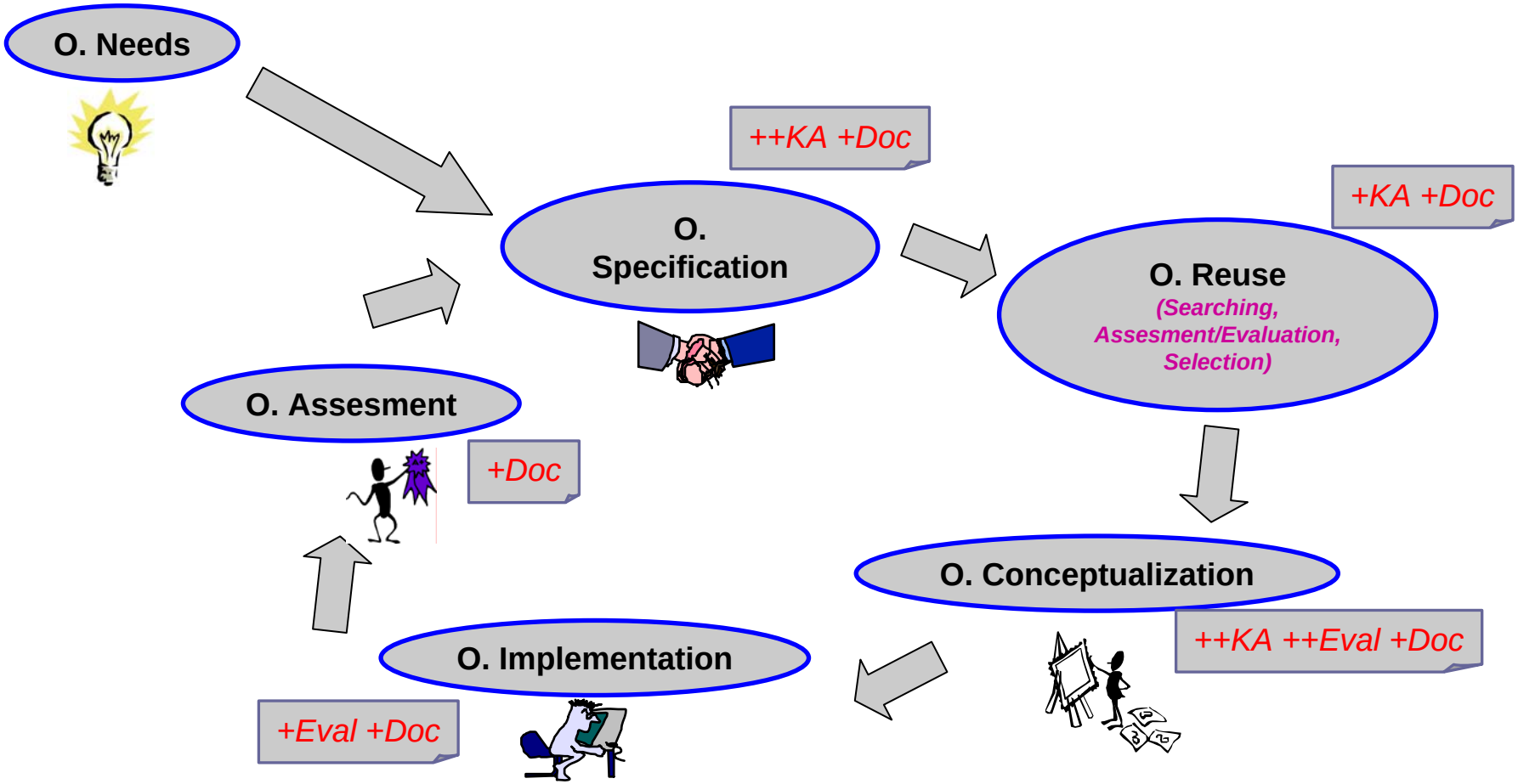
Ontology Support Activities:
Elicitation; Documentation; Configuration Management; Evaluation (V&V)

Incremental Model



Iterative Ontology Network Life Cycle





Conclusions

- Which one are the activities involved in the ontology development process?
- Which one is the goal of each activity?
  - NeOn Glossary of Activities
  - NeOnTable of “Recommended and If-Applicable”
  - NeOn Development Process
- When should I carry out each activity?
- Where is the relationship of one activity with the others?
  - Ontology Network Life Cycle models
  - Ontology network life cycles