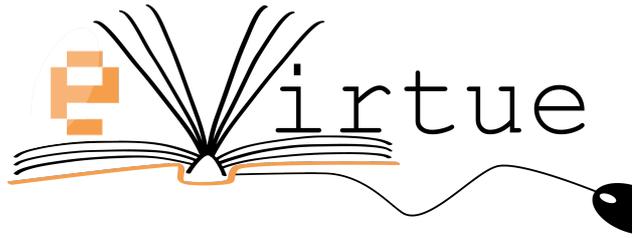




Lifelong
Learning
Programme



R5 SEMANTIC DESCRIPTION OF SKILLS / COMPETENCES

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Scope of the deliverable

This deliverable is being created in the context of Task 2.3 "Produce semantically rich descriptions of skills / competences" of project e-VIRTUE. A job profile represents a semantically rich description of a set of knowledge, skills, competences that a person should have in order to perform the respective job. A similar description is used to characterize training courses and content. The use of XML-based meta-data decouples the job profile description from the course description, because the meta-data plays the role of a semantic mediator. Vice versa, the educational content description is decoupled from the training course, because it relates mainly to the training objectives, which stem from the job profile. The added-value of creating machine readable semantically rich descriptions of job profiles (for example an ontology) is that these files can be used by any software application in order to extract the information contained in the job profiles and thus can facilitate the process of developing training course descriptions. Moreover, the production of XML-based machine-readable versions of the jobs profiles will greatly facilitate Europe-wide standardization of the core competence descriptions and at the same time will enable localization to adopt nation-specific particularities, without loss of compatibility among descriptions.

In the context of T2.3, we are engineering a semantically rich description of e-VIRTUE job profiles using ontologies. An ontology is usually defined as "a formal, explicit specification of a shared conceptualization" (Gruber, 1993). A "conceptualization" refers to an abstract model of some phenomenon in the world, which identifies the relevant concepts of that phenomenon. "Explicit" means that the type of concepts used and the constraints on their use are explicitly defined. "Formal" refers to the fact that the ontology should be machine readable. "Shared" reflects the notion that an ontology captures consensual knowledge, that is, it is not private of some individual, but accepted by a group. Thus, an ontology is a structure of knowledge, used as a means of knowledge sharing within a community of heterogeneous entities. It defines the basic terms and relations comprising the vocabulary of a topic area, as well as the rules for combining terms and relations, to define extensions to the vocabulary (Neches et al., 1991). Ontologies describe domain knowledge in a generic way and provide agreed understanding of a domain. They are means of knowledge sharing and reuse. Sharing means that different applications use the same resources. Reuse means to build new applications, by assembling already built components.

Methodology applied for engineering the ontologies

The aim of the e-VIRTUE ontology is to connect Job Profiles, e-Competences, e-CF levels and EQF levels to describe specific job profiles from e-VIRTUE project, as well as concepts like Qualification, Units/Digits from ECVET in order to establish a reference point not only for the Human Resources (HR) departments of companies searching for employees but also for people interested in working or studying in those specific fields.

The software used for the development of the ontology was Protégé 4.1 Ontology Editor and Knowledge Acquisition System (OWL DL language). The construction was based on the iterative methodology "Ontology Development 101: A Guide to Creating Your First Ontology" (Noy and McGuinness, 2001). Initially, a main structure was developed and the objects and properties were inserted gradually. The basic steps followed for the comprehension and construction of the ontology are listed below:

- Step 1:** Determine the domain and scope of the ontology
- Step 2:** Consider reusing existing ontologies
- Step 3:** Enumerate important terms in the ontology
- Step 4:** Define the classes and the class hierarchy
- Step 5:** Define the properties of classes
- Step 6:** Define the data properties of the classes
- Step 7:** Create instances
- Step 8:** Evaluate the ontology by implementing DL Queries

Developing the main structure of e-VIRTUE ontology: Representing e-CF as an ontology

Step 1: Determine the domain and scope of the ontology

The scope of the ontology at this stage is related to the e-CF¹ (European e-Competence Framework) and is mainly focused in connecting the three (d1: e-Competence areas, d2: e-Competences, d3: e-Competence Proficiency Levels) out of four (d4: knowledge, skills) dimensions of which it consists.

Step 2: Consider reusing existing ontologies

At the time of research, no existing ontology that would satisfy the specific requirements of the project was located.

Step 3: Enumerate the terms of the ontology and describe the way they are related

For the main structure the terms introduced are: E-cf Proficiency Level, Eqf ProficiencyLevel, eCompetences. The connections developed between the EQF (European

¹ <http://www.ecompetences.eu/>

Qualification Framework for lifelong Learning, 2008) or e-CF levels correspond to the values that levels return to the competences.

Step 4: Define the classes and the class hierarchy

The classes and subclasses developed at this part of the ontology are the following:

The Class **ProficiencyLevel**: Represents the third dimension of the e-CF (d3: e-Competence Proficiency level), which describes the level to which a competence is assigned according to the e-CF. Subclasses of this class: E-cfProficiencyLevel, EqfProficiencyLevel

The Class **eCompetences**: This class represents electronic competences mentioned at e-CF. These competences are classified in five categories: Enable Run, Build, Plan and Manage. As a result, there are five subclasses for this class: Enable_eCompetences, Manage_eCompetences, Build_eCompetences, Plan_eCompetences and Run_eCompetences.

Step 5: Define the properties of classes

In the OWL language, object properties are used to represent special class features. For the classes above, the object properties developed are mentioned below:

Object properties	Classes
hasProficiencyLevel	eCompetences (domain)-> e-CFlevel (range)
isRrelatedTo	E-cfProficiencyLevel(domain)-> EqfProficiencyLevel (range)
Inverse object properties	Classes
relatesTo	EqfProficiencyLevel (domain)-> E-cfProficiencyLevel (range)
isProficiencyLevelFor	e-cfProficiencyLevel (domain) -> eCompetences (range)

Step 6: Define the data properties of classes

This step is skipped.

Step 7: Create instances

For the subclasses mentioned, the instances introduced are listed below:

ProficiencyLevel

E-cfProficiencyLevel: e-1, e-2, e-3, e-4, e-5

EqfProficiencyLevel: EQF_3, EQF_4, EQF_5, EQF_6, EQF_7, EQF_8

ECompetences

Enable_eCompetences: Information_Security_Strategy_Development, ICT_Quality_Strategy_Development, Education_and_Training_Provision, Purchasing, Sales_Proposal_Development, Channel_Management, Sales_Management, Contract_Management, Personnel_Development, Information_and_Knowledge_Management

Manage_eCompetences: Forecast_Development, Process_Improvement, Project_and_Portfolio_Management, IT_Governance Risk_Management, Relationship_Management, Information_Security_Management, ICT_Quality_Management, Business_Change_Management

Plan_eCompetences: Technology_Watching, Sustainable_Development IS_and_Business_Strategy_Alignment, Design_Architecture Application_Design, Service_Level_Management, Product_or_Project_Planning Business_Plan_Development

Run_eCompetences: User_Support, Change_Support, Service_Delivery, Problem_Management

Build_e Competences: Design_and_Development, Systems_Integration, Testing, Solution_Deployment, Documentation_Production

Figure 1.1 represents the main structure of the competence ontology with all the classes, subclasses, instances and object properties.

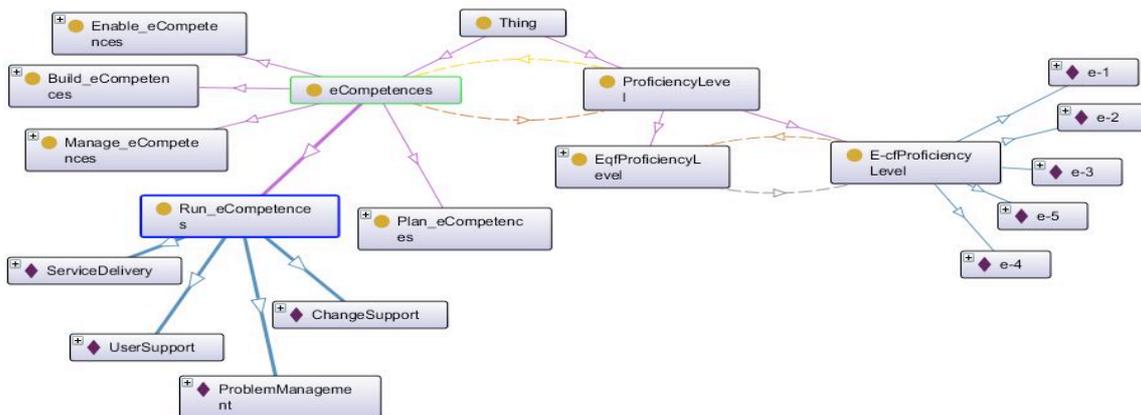


Figure 1.1. Graphical representation of the ontology

Step 8: Evaluate the ontology by implementing DL Queries

In order to verify if the ontology is developed properly, a series of DL Queries was implemented. These queries follow the Manchester Owl Syntax. Some of them together with their results are described below:

Query 1.1: Which e-cf Proficiency level is related to the Proficiency level EQF3?

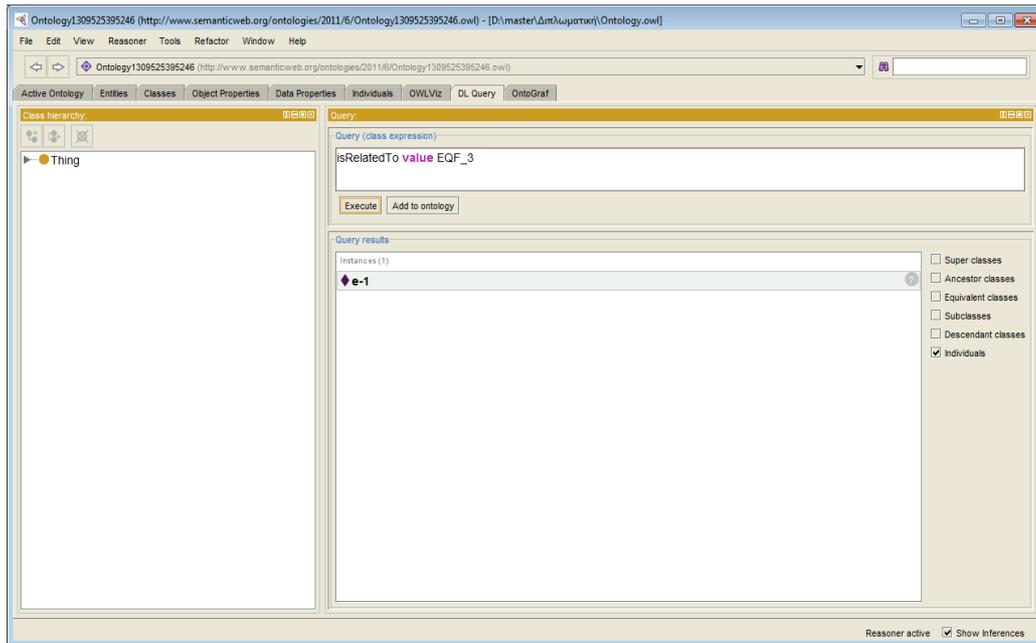


Figure 1.2. Query 1.1 and Query Result

Query 1.2: Which levels are related to the IS and Business Strategy competence?

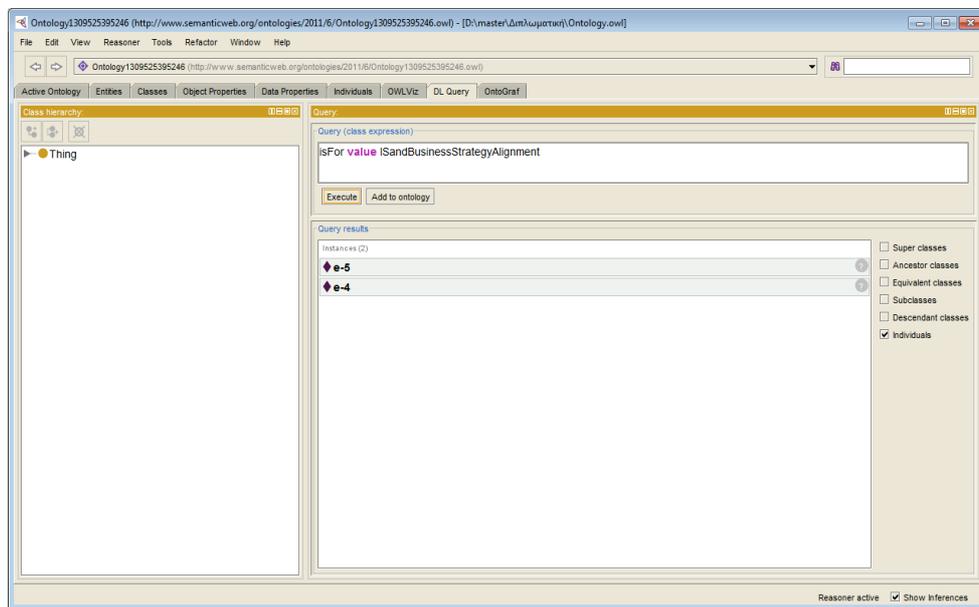


Figure 1.3. Query 1.2 and Query Result

Query 1.3: Which competences' level is related to EQF 4 level?

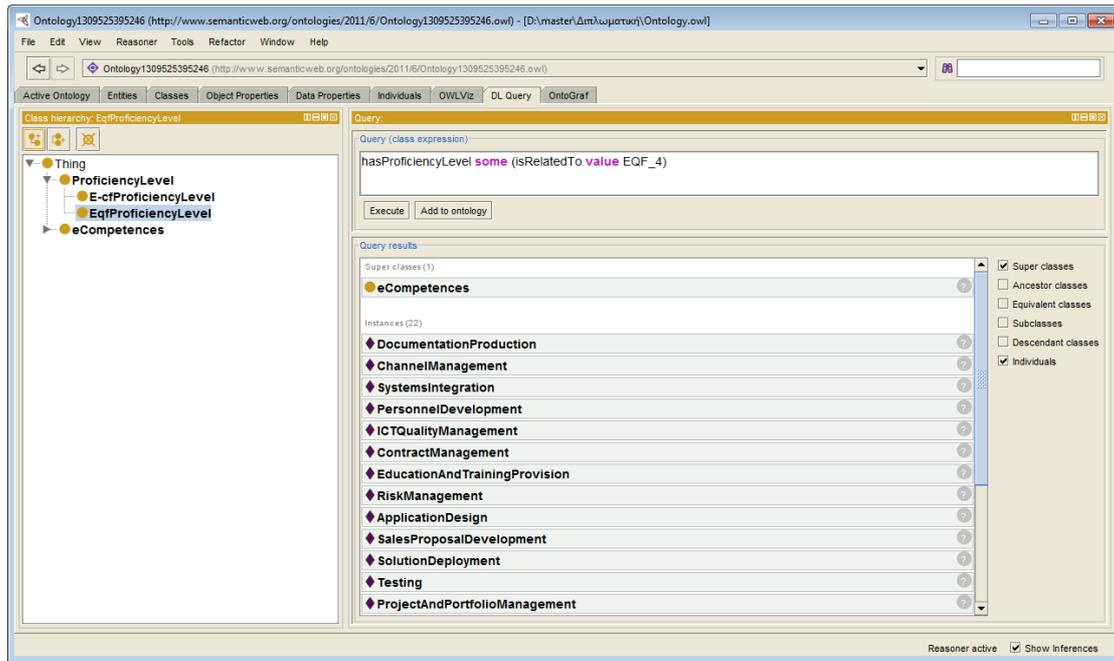


Figure 1.4. Query 1.3 and Query Result

Query 1.4: Which competences from the ones that belong to the subclasses Build_eCompetences and Run_eCompetences have level e1?

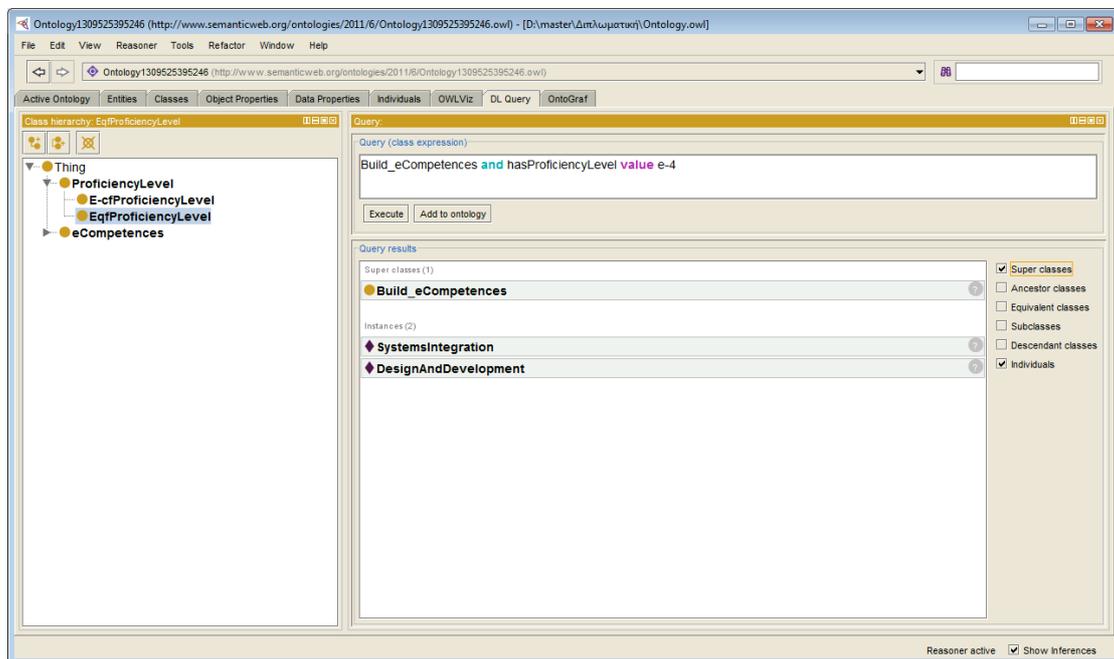


Figure 1.5. Query 1.4 and Query Result

Query 1.5: Which competences are simultaneously related to levels e2 and e5?

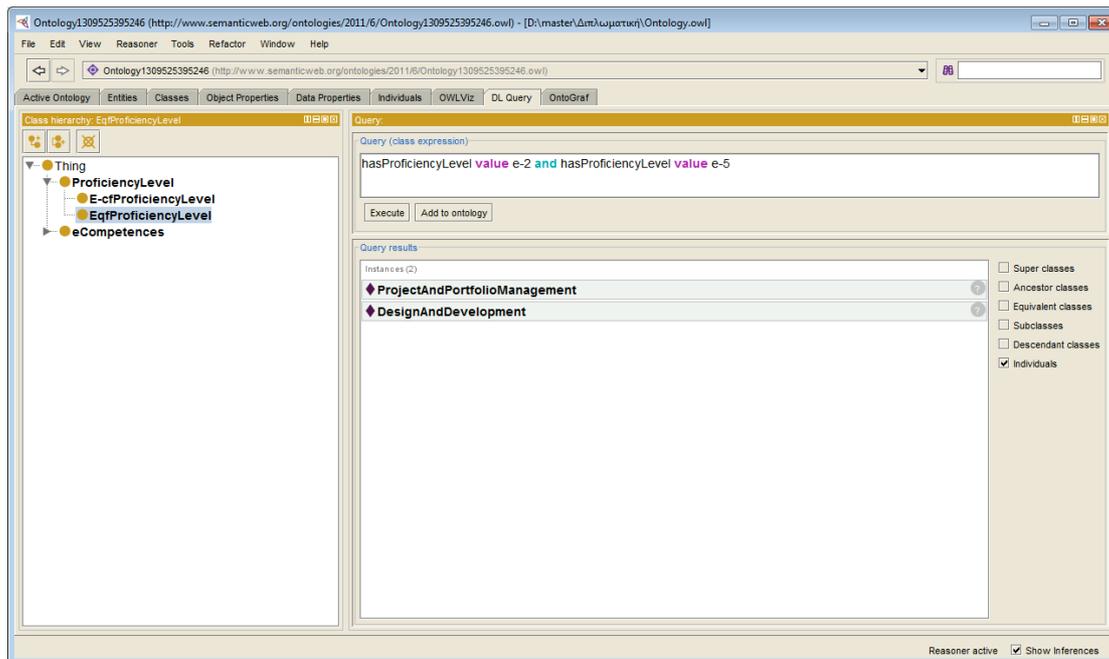


Figure 1.6. Query 1.1.5 and Query Result

Future steps

In the next stage of WP implementation, we plan to:

- Introduce job profile descriptions in the ontology
- Associate job profile descriptions with learning outcome representation
- Add the job profiles developed in the project
- Create ontology instances
- Validate the ontology and the ontology instances

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