D1.6.2 Portal ontology

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Abstract.
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This deliverable presents the Knowledge Web portal ontologies.

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Changes

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Executive Summary

This deliverable presents the results of the conceptualisation phase of the ontologies used by the Knowledge Web Portal (http://knowledgeweb.semanticweb.org).

The document is structured as follows:

- Section 1 briefly describes the main objectives of the workpackage 1.6.
- Section 2 presents both the main current functionalities of the Knowledge Web (KW) portal and the different kinds of portal users.
- Section 3 describes the Knowledge Web portal ontologies (Documentation, Event, Organization, Person, and Project). These ontologies reuse and extend the OntoWeb[1] and Esperonto[2] ontologies. This section also presents the methodological approach followed to build KW portal ontologies.
- Section 4 includes the mappings between the concepts used by the KW portal ontologies and the concepts used by the OntoWeb and Esperonto portal ontologies. The mappings between the FOAF and the KW Person ontologies are also presented.

[1] http://www.ontoweb.org/
[2] http://esperonto.net/

Contents

1. Goals of WP1.6

The main goal of WP1.6 is to develop the software infrastructure underpinning the integration of the activities of the Knowledge Web partners. We call it the Knowledege Web (KW) Semantic Portal.

The main goals of the KW Semantic Portal are the following:

- To disseminate and promote the Knowledge Web Network of Excellence (NoE)
  - Outreach to Industry activities
  - To support Research (Virtual Research Center portal)
  - To support Education (Virtual Institute for Semantic Web Education (VISWE) portal)
- To monitor the Knowledge Web NoE

Firstly, the Knowledge Web Semantic Portal will be used as a portal for information access and as a dissemination point for ontology researchers, engineers, and application and content developers in both academic and industrial institutions. Secondly, it will be used for technology promotion, giving support to the outreach to industry activities. Thirdly, it will be also used as the platform support for the VISWE, whose portal will be integrated into the main Knowledge Web Portal.

That is, the semantic portal infrastructure will have two integrated instantiations: on the one hand, the industry and dissemination portal, and on the other hand, the Virtual Research Centre portal. And the semantic portal infrastructure will also integrate the VISWE portal.

One of the tasks to be carried out is the identification of the main requirements for the three uses of the Knowledge Web Portal, which are: technology promotion, dissemination of research results, and education. Another task is the development of the ontologies needed for dissemination, promotion and education, once the main requirements of the portal have been identified. After that, ontologies should be populated.

2. KW Semantic Portal Specification

The terms knowledge portal, semantic portal and community web portal can be found in the literature ([4], [5]) and they indistinctly refer to knowledge-based web sites that allow the corporate access to information and applications. A good definition of what these terms stand for can be found in [4], where they are defined as web applications that "provide the means to select, classify and access, in a semantically meaningful and ubiquitous way, various information resources (e.g., sites, documents, data) for diverse target audiences (corporate, inter-enterprise, e-marketplace, etc.)". From now on, we will use the term "semantic portal" to refer to this kind of applications. Ontologies are commonly used inside the semantic portal for structuring knowledge, since they represent shared knowledge within a community.

Figure 1 shows the different types of KW Portal users and their main functionalities.

1. The administrator users. These users are in charge of the KW Semantic Portal management and are responsible for managing the different users persmissions, the users themselves, and the instances, as well as the ontologies and their updates, including inclusion, removal and modification of concepts, properties, relations and axioms. We have distinguished between:
    a. A portal administrator, in charge of which is Ángel López-Cima (alopez@fi.upm.es).
    b. An ontology engineer, in charge of which is M. Carmen Suárez-Figueroa (mcsuarez@fi.upm.es).
2. The community users. These are the partners participating in KW NoE (the KW partners), and they are identified in the Technnical Annex. Their main responsibility is to populate the KW ontologies, that is, to introduce contents in the KW Semantic Portal. They can also navigate and search for information in the portal without any kind of restriction. All KW partners have the same permissions either for inserting content on the knowledge portal or for browsing the collected assets.
3. The external users:
    a. The guest users. They can navigate through hyper-linked information and search for information. Ontologies are used to provide a navigational structure to browse the KW Semantic Portal.
    b. The software agents. The KW Semantic Portal includes facilities for exporting the ontologies to OWL and RDF(S), and for generating the content in RDF. Because of this fact, the software agents will be able to use KW content for other purposes.

To sum up, the process of content provision in the KW Portal will be carried out collaboratively by KW partners. The Ontology Engineer is in charged of developing the ontologies to be used by the KW partners (as a primary piece of knowledge for describing knowledge assets) and by all of users (as indexes to browse the knowledge portal).

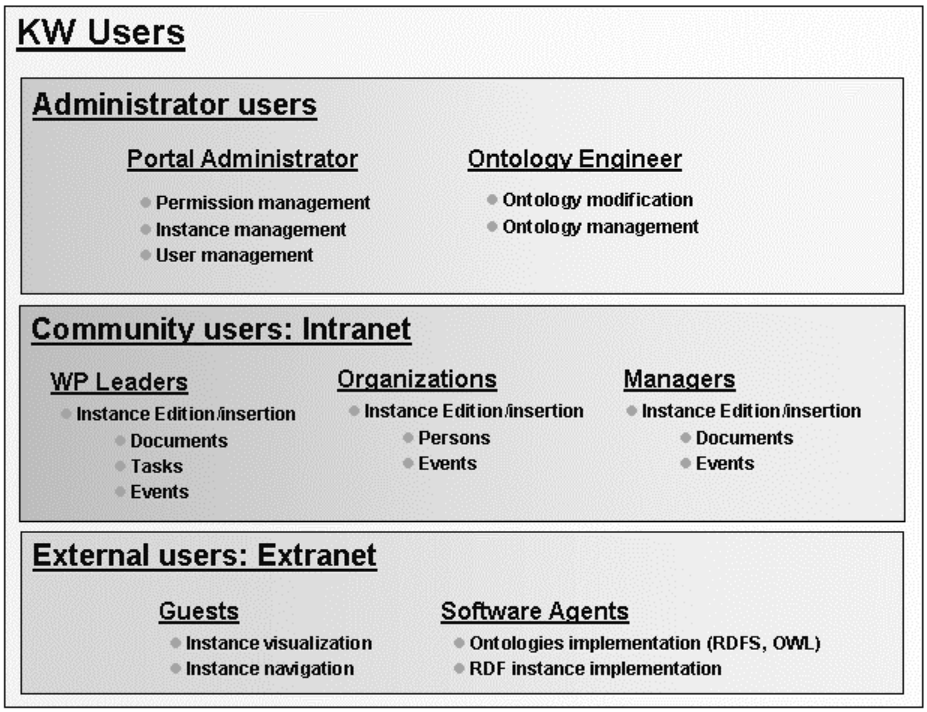

Figure 1. Type of Knowledge Web users

We have distinguished the following functionalities in the first prototype of the KW Portal:

- *Knowledge Presentation*. This is done by means of user-defined visualizations of ontology classes, relations and instances with different browsing permissions for portal users. The knowledge stored in the portal can be accessed with menus generated automatically from ontologies which are synchronized, and can be viewed differently according to the various types of information stored in them.
- *Knowledge Editing*. The KW Portal allows inserting, updating and removing class instances, their attributes and relation instances, in multiple inter-linked ontologies and with different edition permissions for the portal users.
- *Knowledge Search and Querying* based either on keywords or on the structured information provided by the ontologies inside the system.
- *Administration Services*, which allow managing the knowledge portal users, the editing and visualization permissions, and some other portal needs.

To use the semantic portal as a tool for monitoring the Knowledge Web project, the first draft of the ontologies includes information about the project (milestones, workpackages, etc.), the organizations participanting, the people involved in the project, the documents related to the project (deliverables, minutes, etc.), and the events associated with such project.

The Knowledge Web Semantic Portal (http://knowledgeweb.semanticweb.org) has been built reusing the ODESeW technology [2].

3. The KW Ontologies

In this section we present how we have built the KW ontologies, and we focus on the following issues:

- The methodological approach followed to build the ontologies and the identification of the technology used for their development.
- Brief explanation of the OntoWeb and Esperonto portal ontologies, which are being reused for building the KW portal ontologies.
- Detailed description of the KW portal ontology, which is composed of the following ones: Documentation, Event, Organization, Person and Project ontologies.

3.1. The Ontology Building Process

When dealing with ontologies, ontologists should not be anarchic in the use of modeling components in the ontology conceptualization. For building the KW portal ontologies we have reused efficiently the OntoWeb and the Esperonto portal ontologies. Once we have identified which parts of the ontologies can be reused, we have extended them following the steps proposed by the conceptualizacion phase of METHONTOLOGY [3], which are displayed in figure 2.

Figure 2 emphasizes the ontology components (concepts, attributes, relations, constants, formal axioms, rules, and instances) attached to each task, and illustrates the order proposed to create such components during the conceptualization activity. This modeling process is not sequential as in a waterfall life cycle model, though some order must be followed to ensure the consistency and completeness of the knowledge represented. If new vocabulary is introduced, the ontologist can return to any previous task.

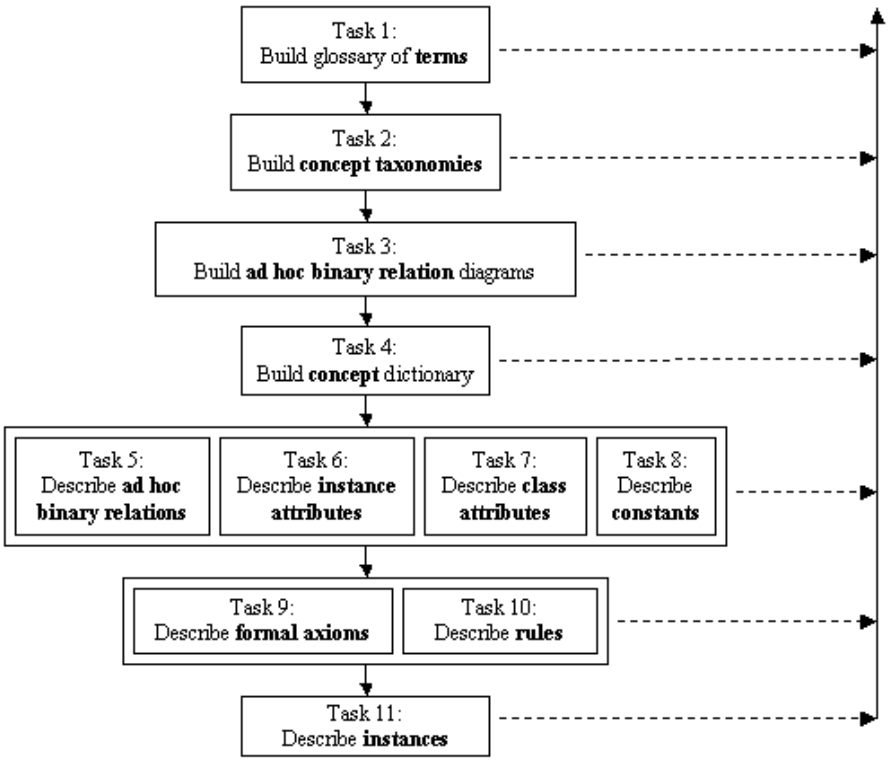

Figure 2. Tasks of the conceptualization activity according to METHONTOLOGY

Our experience of building ontologies has revealed that ontologists should carry out the following tasks:

Task 1: To build the glossary of terms that identifies the set of terms to be included in the ontology, their natural language definition, and their synonyms and acronyms.

Task 2: To build concept taxonomies to classify concepts. The output of this task could be one or more taxonomies where concepts are classified.

Task 3: To build ad-hoc binary relation diagrams to identify ad-hoc relationships between concepts of the ontology and with concepts of other ontologies. The ad-hoc relationships are similar to the objects properties[3] in OWL vocabulary.

Task 4: To build the concept dictionary, which mainly includes the concept instances[4] for each concept, their instance and class attributes, and their ad-hoc relations.

Once the concept dictionary is built, the ontologist should define in detail each of the ad-hoc binary relations, instance attributes and class attributes identified in the concept dictionary, as well as the main constants of that domain.

[3] http://www.w3.org/TR/owl-ref/#Properties

[4] Although instances can be created when the ontology is used (after its construction) the ontologist can decide whether to model relevant instances or not. This field is optional.

Task 5: To describe in detail each ad-hoc binary relation that appears on the ad-hoc binary relation diagram and in the concept dictionary. The result of this task is the ad-hoc binary relation table.

Task 6: To describe in detail each instance attribute that appears in the concept dictionary. The result of this task is the table where instance attributes are described. The instance attributes are those attributes whose value(s) may be different for each instance of the concept. These attributes can be a kind of datatype property[5] in OWL vocabulary.

Task 7: To describe in detail each class attribute that appears on the concept dictionary. The result of this task is the table where class attributes are described. Unlike instance attributes, which describe concept instances and take their values in instances, class attributes describe concepts and take their values in the class where they are defined. These attributes can be a kind of datatype property[6] in OWL vocabulary.

Task 8: To describe in detail each constant and to produce a constant table. Constants specify information related to the domain of knowledge, and they always take the same value, and are normally used in formulas.

Once concepts, taxonomies, attributes and relations have been defined, the ontologist should describe formal axioms (task 9) and rules (task 10) that are used for checking constraints and for inferring values for attributes. And only optionally should the ontologists introduce information about instances (task 11).

3.2. Reusing OntoWeb and Esperonto Portal Ontologies

As we said before, the ontologies developed for the Knowledge Web Portal have been developed following existing ontologies in the same or similar domain. These existing ontologies have been reused and extended to be used in the Knowledge Web NoE.

To develop the KW portal ontologies, the OntoWeb portal ontology (http://www.aifb.uni-karlsruhe.de/ontology) and the Esperonto portal ontologies (http://esperonto.net) have been reviewed in order to reuse them efficiently. In addition, the KW Technical Annex has been used to complement the knowledge included in the reused ontologies. The participant comments have also been added to improve the ontologies.

First, we have analyzed the ontology used in the **OntoWeb** project (http://www.ontoweb.org/). Such ontology models information about events, news, organizations, persons, products, projects, publications, etc. The OntoWeb ontology (also know as SWRC-Semantic Web Research Community Ontology[7]) includes:

- 54 concepts
- 84 attributes

[5] http://www.w3.org/TR/owl-ref/#Properties
[6] http://www.w3.org/TR/owl-ref/#Properties
[7] http://ontobroker.semanticweb.org/ontos/swrc.html

- 109 ad-hoc relations

Second, we have reviewed the ontologies used in the **Esperonto** project (http://esperonto.net). The Esperonto portal ontology is composed of the following modular ontologies: *project*, *documentation*, *person*, *organization*, and *meeting*. They describe respectively projects and their structure, documents that are generated in a project, people and organizations participating in it, and meetings (administrative, technical, etc.) held during a project lifecycle.

Figure 3 presents the aforementioned five modular ontologies (each ontology is represented by a triangle) and the ad-hoc relationships between different concepts belongs to these ontologies (a project has associated meetings, a document belongs to a project, a document summarizes a meeting, people participate in a meeting and have a role in a project, etc.). The aim of this figure is to show all the relations in the Esperonto ontology without expliciting the domain and the range of such relations (which are shown in the ad-hoc relationships diagram of each modular ontology).

The Esperonto ontologies, which can be reused to describe R&D projects, include:

- 71 concepts
- 144 attributes
- 39 ad-hoc relations

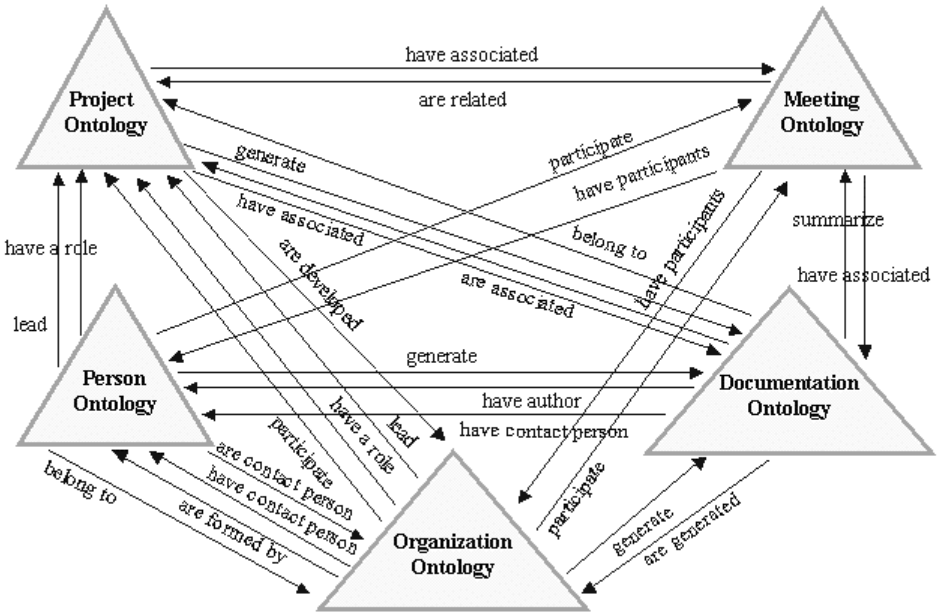

Figure 3. Relations between the Esperonto portal ontologies

3.3. Building the KW Ontologies

The Knowledge Web Portal (http://knowledgeweb.semanticweb.org) is able to manage multiple ontologies. Currently, five domain-specific ontologies (*Documentation*, *Event*,

Organization, *Person* and *Project*) have been developed to be included in the KW Portal. These ontologies are intended to support the Knowledge Web NoE management and the results dissemination. Such ontologies describe the project and its structure, the documents generated in the project, the people and the organizations participating in it, and the events related to the project. The five ontologies have been developed with METHONTOLOGY [3] and the WebODE ontology editor (http://webode.dia.fi.upm.es/), and such ontologies have been evaluated using ODEval [1]. They are available in RDFS and OWL at http://knowledgeweb.semanticweb.org.

Figure 4 shows the relationships between the five ontologies aforementioned (each ontology is represented by a triangle). The aim of this figure is to show all the ad-hoc relations between the KW ontologies without expliciting the domain and the range of such relations (which are shown in the ad-hoc relationships diagram of each modular ontology).

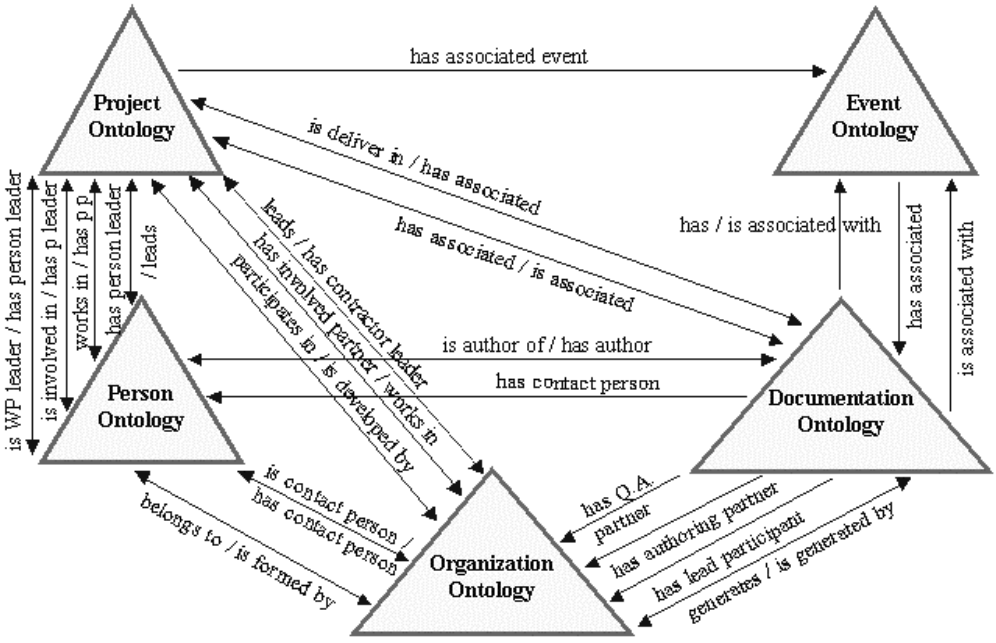

Figure 4. Main ad-hoc relationships between the ontologies for the Knowledge Web NoE

In this section, we provide the conceptualization of the ontologies, which is based on the set of intermediate representations proposed in METHONTOLOGY [3]. The intermediate representations used in this document are: the *concept classification tree* (also known as *concept taxonomy*) and the *concept dictionary*. In order to illustrate the ad-hoc relationships between different concepts (in the same or in different ontology), several figures are also shown. In the future versions, the ontologies will include several axioms and will supply different inferences.

3.1.1. The Documentation Ontology

This ontology models knowledge of documentation used in the Knowledge Web NoE.

The main concept of this ontology is 'Documentation', which is organized according to the type of document (additional documentation, management documentation, publication, technical documentation, and thesis) within a taxonomy. This taxonomy is shown in figure 5. As it can be seen in the figure, the technical documentation related to a project are manuals, slides and deliverables. For example, publications can be books or articles (an article in a workshop, an article in a book, etc.).

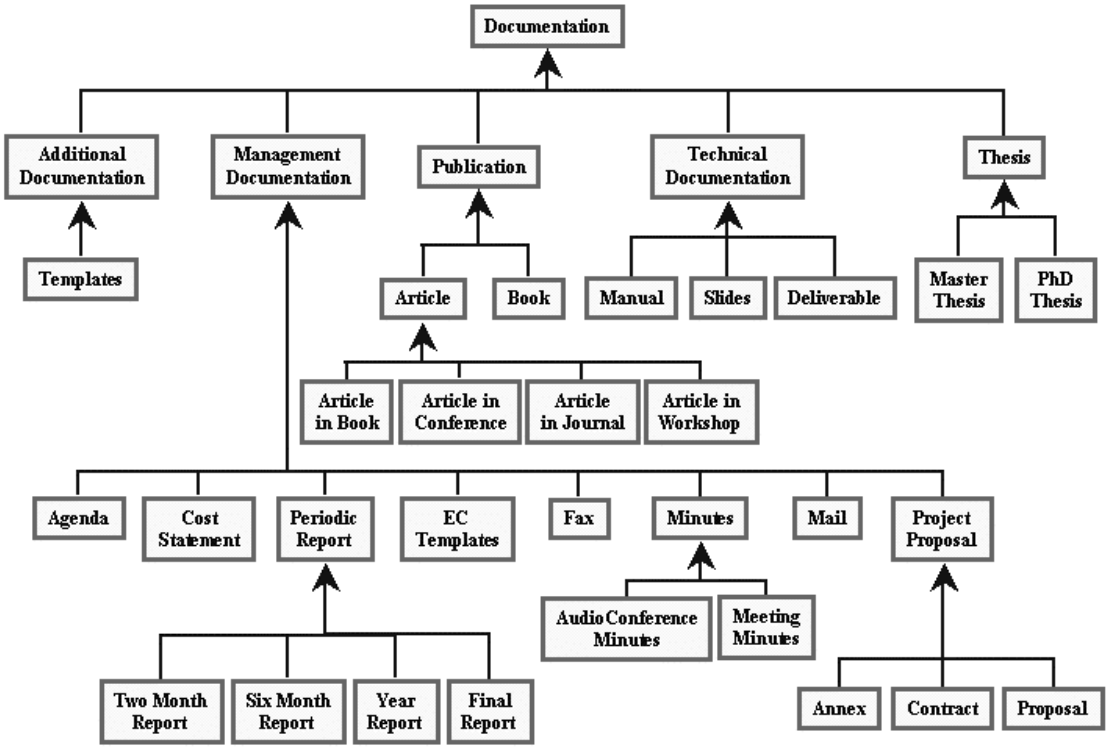

Figure 5. The taxonomy of the Documentation ontology

In table 1 we provide the concept dictionary of the Documentation ontology, including all the domain concepts, their concept instances dated June 15, 2004, their instance attributes, and their ad-hoc relations. In this table typical instance attributes for 'Documentation' (title, abstract, on-line version, etc.) can be seen. The ad-hoc relations specified for each concept are those whose domain is the concept. For example, the concept 'Agenda' has one binary relation: 'is associated with'. This table also shows the instances for each concept. For example, the concept 'Templates' has (on June 15, 2004) three instances: 'Deliverable template - LaTeX', 'Deliverable template - Word', and 'Template for new participant applications'.

Concept name	Instances	Instance attributes	Ad-hoc relations
Additional Documentation	Knowledge Web Detailed-Programme of Activities Knowledge Web Fact Sheet Knowledge Web Membership Application Quality Management Procedure	--	--

Concept name	Instances	Instance attributes	Ad-hoc relations
Agenda	KnowledgeWeb Crete Meeting Agenda	--	is associated with
Annex	Annex I Annex II Annex III Annex IV Annex V Annex VI	--	--
Article	--	Pages	--
Article in Book	--	Volume Edition Chapter Book Name	--
Article in Conference	--	Name of Conference Conference Place	--
Article in Journal	--	Volume Number Journal Name	--
Article in Workshop	--	Workshop URL Name of Workshop Editors of Workshop	--
AudioConference Minutes	--	--	--
Book	--	Number of Pages ISBN Editorial Edition Place Edition	--
Contract	KW Contract	--	--
Cost Statement	--	Period Number	--
Deliverable	D1.1.1v1: Industry board member list, clustering and organizational and operational charter (MoU) D1.1.1v2: Board member list, clustering and organizational and operational charter (MoU) D1.1.2: Prototypical business use cases D1.1.3: Typology of ontology-based processing tasks D1.1.4: System requirements and knowledge processing requirements for prototypical applications and business cases D1.2.1: Evaluation of the utility of ontology development tools for different types of industrial application needs D1.2.2: Report on Semantic Web Framework requirements analysis D1.2.3: Methods for ontology evaluation D1.3.1: Best practices and guidelines for industry D1.3.2: Identification of standards on metadata for ontologies	Status Nature Keywords Dissemination level Delivery date Deliverable number Contractual date of delivery Attached software Actual date of delivery	is delivered in has authoring partner has lead participant has Q.A. partner has contact person is associated with

Concept name	Instances	Instance attributes	Ad-hoc relations
	D1.3.3: Report on requirements of OOA D1.4.1: Presentation of technology roadmap D1.4.2: Presentation of business cases and success stories in industry D1.4.3: Report on first international technology show D1.5.1: Project presentation and project showcase D1.5.2: Report on joint education and training activities with cooperating networks D1.6.1: Portal requirements analysis and system design D1.6.2: Portal ontology D1.6.3: Portal versions D1.6.4: Portal contents releases D2.1.1: State of the art on the scalability of ontology-based technology D2.1.2: Report on methods for approximate reasoning, using knowledge compilation, language weakening and approximate deduction D2.1.3: Report on modularization of ontologies D2.1.4: Definition of a methodology, general criteria, test suites for benchmarking ontology building tools D2.2.1v1: Specification of a common framework for characterizing alignment D2.2.1v2: Specification of a common framework for characterizing alignment D2.2.2: Specification of a benchmarking methodology for alignment techniques D2.2.3: State of the art on current alignment techniques D2.2.4: Description of alignment implementation and benchmarking results D2.3.1: Specification of a methodology for ontology syntactic and semantic versioning D2.3.2: Specification of knowledge acquisition and modelling of the process of the consensus D2.4.1: Semantic requirements for web services description D2.4.2: Definition of semantics for web service discovery and composition D2.4.3: State of the art on agent-based services D2.4.4: Guidelines for the integration of agent-based services and web-based services D2.5.1: Specification of coordination of rule and ontology languages D2.5.2: Report on query language design and standarization D2.6.1: Report on budget allocation D2.6.2: Report on research excahnge and collaboration D2.6.3: Report on workshop and conference organization D2.6.4: Report on the research advance D3.1.1: Specification of VISWE tasks and goals (as		

Concept name	Instances	Instance attributes	Ad-hoc relations
	result of a requirements analysis) D3.1.2: Document on organizational structure and legal form of VISWE to which all participating partners have agreed D3.1.3: Memorandum of Understanding signed by participating partners, regarding commitment to organizational structure and legal form of VISWE D3.2.1v1: Learning unit collection available D3.2.1v2: Learning unit collection available D3.2.2: Report on educational events D3.2.3: Report on core curricula in Ontology and Semantic Web D3.2.4: Document describing M.Sc. curriculum on which all participating universities have agreed D3.2.5: Memorandum of Understanding regarding curriculum and mutual course approval signed by participating universities D3.2.6: Summer school on semantic web technologies D3.3.1: Report on the agreed metadata standard for learning units D3.3.2v1: Basic infrastructure available, provides initial learning unit collection from task 3.2.3 D3.3.2v2: Basic infrastructure available, provides initial learning unit collection from task 3.2.3 D3.3.3: Prototype of advanced learning platform D3.3.4: Report on collaboration with IMS consortium and ProLEARN D4.1.1: EC reporting D4.1.2: Report on Audit regime D4.1.3: Public report D4.2.1: Financial and accounting report D4.3.1: Technical report D4.4.1: Consortium Agreement (including resolution of conflicts) D4.4.2: Setting up legal entities D4.5.1: Report on Gender Action Plan D4.5.2: Report on public engagement activities D4.6.1: Report on self-assessment, risk analysis and market watch E-D2: Co-operation with Knowledge Web/VISWE on graduate education. T-D2: Co-operation with Knowledge Web and other NoE on industrial competence centres and VISWE		
Documentation	--	Title Abstract Version Number On-line PDF Version On-line Version	is generated by has author is associated with
EC Templates	--	--	--
Fax	--	--	--

Concept name	Instances	Instance attributes	Ad-hoc relations
Final Report	--	--	--
Mail	--	--	--
Management Documentation	--	--	--
Manual	--	--	--
Master Thesis	--	--	--
Meeting Minutes	--	--	--
Minutes	--	--	--
Periodic Report	--	--	--
PhD Thesis	--	--	--
Project Proposal	--	--	--
Proposal	--	--	--
Publication	--	Keywords	--
Six Month Report	--	--	is associated with
Slides	C-OWL: contextualizing ontologies Crete - O2I Meeting Report Crete - O2I Plenary Report Presentation Crete - WP1.6 - Semantic Portal Crete - WP2.1 - Benchmarking Ontology Technology Crete - WP2.6 - Towards a Virtual Research Centre Kick-off - Industry Area presentation Kick-off - WP 1.1 presentation Representing and Reasoning with Heterogeneous, Modular and Distributed ontologies 1st technical O2I Workshop Report, 5 March 2004, Paris	--	is associated with
Technical Documentation	--	--	--
Templates	Deliverable template - LaTeX Deliverable template - Word Template for new participant applications	--	--
Thesis	--	--	--
Two Month Report	--	--	--
Year Report	--	--	--

Table 1. The concept dictionary of the Documentation ontology

The KW Documentation ontology imports concepts from the event ontology, the organization ontology, the person ontology and the project ontology, and these imported concepts are used to connect the Documentation ontology with different ontologies. Examples of these relations can be the following: 'Agenda is associated with Event', 'Documentation is generated by Organization', 'Deliverable has contact person Person', 'Deliverable is delivered in Milestone', etc. Figure 6 shows all the ad-hoc relations whose domain is one concept that belongs to the Documentation ontology.

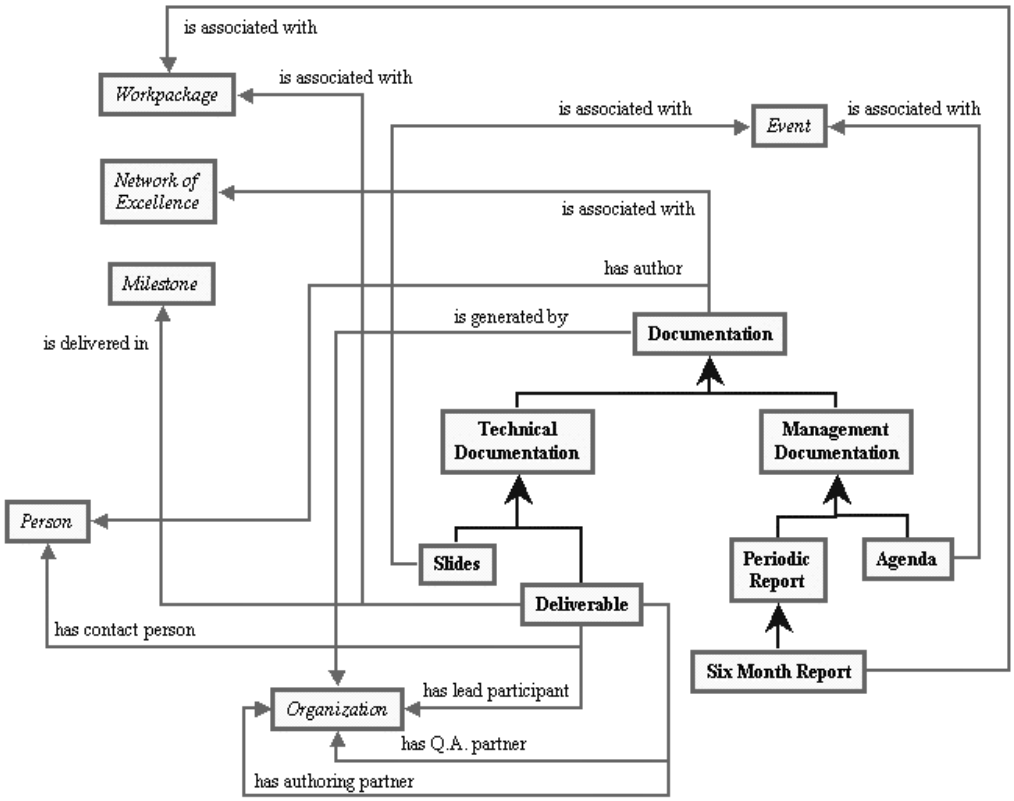

Figure 6. The ad-hoc relationships of the Documentation ontology

Finally, table 2 shows the Documentation ontology statistics (number of concepts, attributes, ad-hoc relations and instances).

Concepts	*35*
Instance Attributes	*35*
Ad-hoc relations	*12*
Instances	*93*

Table 2. Documentation ontology statistics

3.3.2. The Event Ontology

This ontology models knowledge of events that are related to the Knowledge Web NoE.

The main concept of this ontology is 'Event'. This concept is organized in the taxonomy presented in figure 7. As the figure shows, we distinguish five types of events: the international conference, the international workshop, the management project meeting, the KW area meeting and the KW plenary meeting.

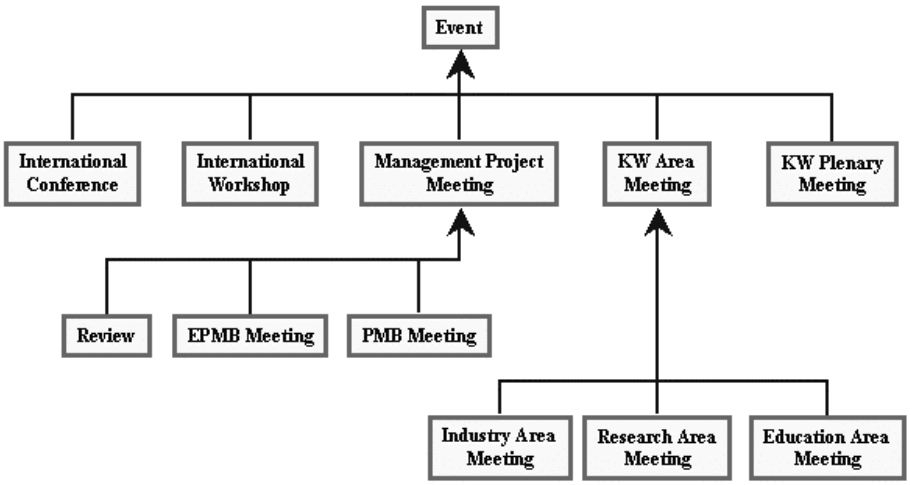

Figure 7. The taxonomy of the Event ontology

Table 3 presents the concept dictionary of the Event ontology, including all the domain concepts, their concept instances dated June 15, 2004, their instance attributes, and their ad-hoc relations. In this table it can be seen the main instance attributes for 'Event', that is 'name', 'about', 'description', 'start date', 'end date', and 'place', and the unique ad-hoc relation for this concept ('has').

Concept name	Instances	Instance attributes	Ad-hoc relations
Education Area Meeting	Second European Summer School on Ontological Engineering and the Semantic Web	--	--
EPMB Meeting	--	Type Decisions	--
Event	--	Name About Description Start date End date Place	has
Industry Area Meeting	1st Technical O2I Workshop 5 March 2004, Paris	--	--
International Conference	1st European Semantic Web Symposium -- ESWS2004	--	--
International Workshop	P2PKM workshop SWS2004 SWWC workshop	--	--
KW Area Meeting	--	--	has associated
KW Plenary Meeting	Knowledge Web 2nd Meeting - Crete KnowledgeWeb kick-off meeting, 3-4 February 2004, Madrid	--	has associated
Management Project Meeting	--	--	--

Concept name	Instances	Instance attributes	Ad-hoc relations
PMB Meeting	--	Type Decisions	--
Research Area Meeting	Amsterdam Meeting 3-4. March, 2004	--	--
Review	--	--	--

Table 3. The concept dictionary of the Event ontology

The KW Event ontology imports concepts from the documentation ontology to represent the following binary relations: 'Event has Agenda', 'KW Area Meeting has associated Slides', and 'KW Plenary Meeting has associated Slides'. These ad-hoc relationships are shown in figure 8.

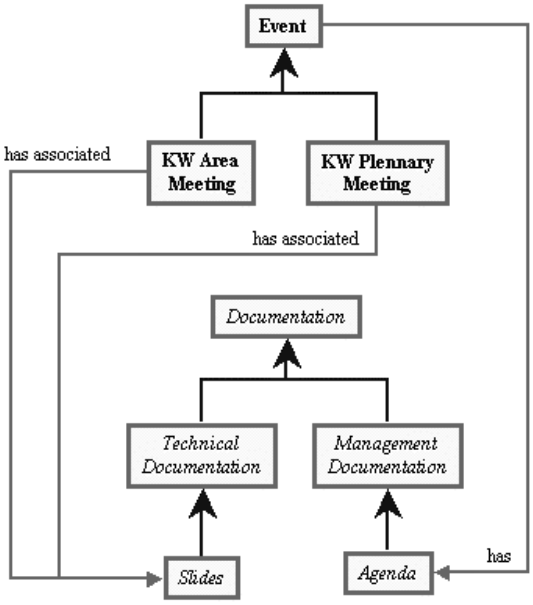

Figure 8. The ad-hoc relationships of the Event ontology

Finally, the Event ontology statistics is provided in table 4.

Concepts	*12*
Instance Attributes	*10*
Ad-hoc Relations	*3*
Instances	*9*

Table 4. Event ontology statistics

3.3.3. The Organization Ontology

This ontology models knowledge of organizations that work in the Knowledge Web NoE.

The main concept in this ontology is 'Organization', which is split into three subclasses: 'Company' (representing enterprises), 'University' and 'Research Institute'. The most important information about organizations working in KW is related to the organization itself (such as, name, acronym, logo, etc.) and to its location (i.e., country, street address, etc.).

In table 5 the concept dictionary of the Organization ontology is provided, including all the domain concepts, their concept instances dated June 15, 2004, their instance attributes, and their ad-hoc relations. In this table it can be seen the instance attributes for 'Organization', that is 'full name', 'acronym', 'logo', 'web site', 'country', 'city', 'zip code', and 'street address'. The ad-hoc relations specified for each concept are those whose domain is the concept. For example, the concept 'Organization' has 9 binary relations: 'generates', 'has contact person', 'team is formed by', 'participates in', 'leads', 'works in', 'has', 'is involved in', and 'is task leader in'. This table also shows the instances for each concept. For example, the concept 'Company' has one instance (on June 15, 2004): 'France Telecom'.

Concept name	Instances	Instance attributes	Ad-hoc relations
Company	France Telecom	--	--
Organization	--	Organization full name Organization acronym Organization logo Organization Web Country City Zip code Street address	generates has contact person team is formed by participates in leads works in has is involved in is task leader in
Research Institute	Centre for Research and Technology Hellas Institut National de Recherche en Informatique et en Automatique	--	--
University	École Polythechnique Fédérale de Lausanne Free University of Bozen-Bolzano Freie Universität Berlin Learning Lab Lower Saxony National University of Ireland Galway The Open University Universidad Politécnica de Madrid University of Innsbruck University of Karlsruhe University of Liverpool University of Machester University of Sheffield University of Trento Vrije Universiteit Amsterdam Vrije Universiteit Brussel	--	--

Table 5. The concept dictionary of the Organization ontology

The KW Organization ontology imports concepts from the documentation, the person, and the project ontologies, to be connected with the other ontologies. Figure 9 shows all the ad-hoc relationships whose domain belongs to the Organization ontology. For example: 'Organization generates Documentation', 'Organization team is formed by Person', 'Organization leads Workpackage', etc.

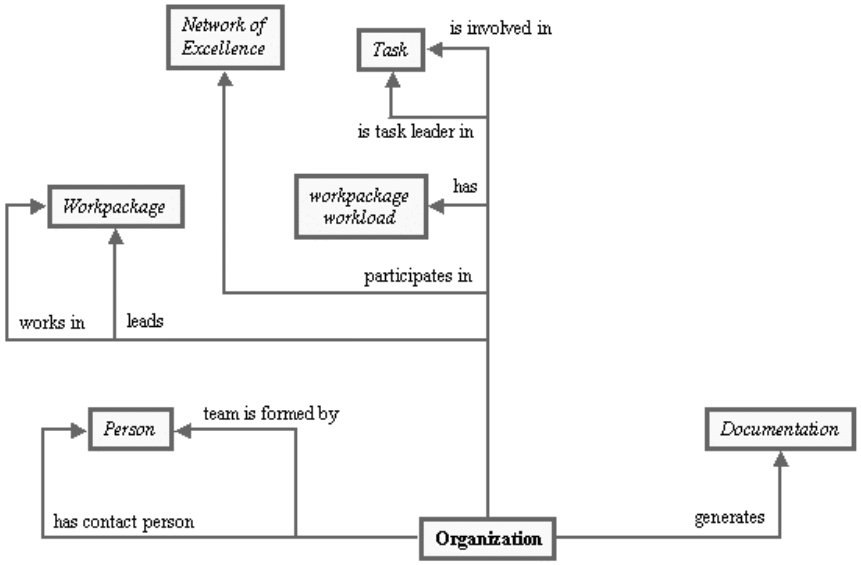

Figure 9. The ad-hoc relationships of the Organization ontology

Finally, table 6 shows the Organization ontology statistics.

Concepts	*4*
Instance Attributes	*8*
Ad-hoc Relations	*9*
Instances	*18*

Table 6. Organization ontology statistics

3.3.4. The Person Ontology

This ontology models knowledge of persons who work in the Knowledge Web NoE. The person ontology is focused on general purpose personal information.

The main concept of this ontology is 'Person'. This concept is organized in the taxonomy, which is shown in figure 10. As it can be seen in the figure, we have divided the concept 'Person' into four different types (university staff, company staff, project officer, and student). For example, a student can be a master student, a phd student or an undergraduate student.

We should mention that in the case of 'University Staff', 'Associate Professor' is almost synonymous with 'Senior Lecture' and 'Assistant Professor' is almost synonymous with 'Lecture'.

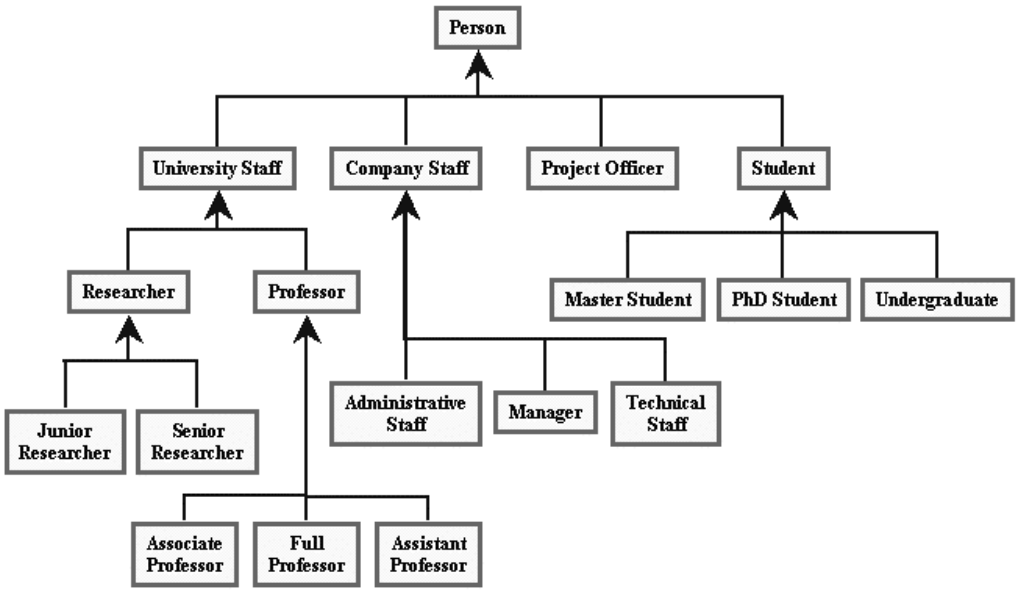

Figure 10. The taxonomy of the Person ontology

Table 7 presents the concept dictionary of the Person ontology, including all the domain concepts, their concept instances dated June 15, 2004, their instance attributes, and their ad-hoc relations. In the table it can be observed the main instance attributes for 'Person': 'name', 'photo', 'e-mail', 'homepage', 'date of birth', 'role', 'country', 'city', 'zip code', 'street address', 'telephone', and 'fax'. It can also be seen the 7 ad-hoc relations for this concept (i.e., 'belongs to', 'is contact person of'). This table shows the instances for each concept. For example, the concept 'Associate Professor' has two instances (on June 15, 2004): 'Asunción Gómez-Pérez' and 'Enrico Franconi'.

Concept name	Instances	Instance attributes	Ad-hoc relations
Administrative Staff	Paolo Traverso	--	--
Assistant Professor	Jesús Barrasa Paolo Bouquet Valentina Tamma York Sure	--	--
Associate Professor	Asunción Gómez-Pérez Enrico Franconi	--	--
Company Staff	--	--	--
Full Professor	Boi Faltings Carole Goble Dieter Fensel Enrico Motta Fausto Giunchiglia Ian Horrocks Karl Aberer Michael G. Strintzis	--	--

Concept name	Instances	Instance attributes	Ad-hoc relations
	Michael Wooldridge Stefano Spaccapietra Stefanos Kollias		
Junior Researcher	Andrei Lopatenko Arthur Stutt Jens Hartmann Marc Ehrig Martin Dzbor Max Völkel Roberta Cuel Sven Van Acker Vasileios Papastathis	--	--
Manager	--	--	--
Master Student	--	--	--
Person	Alain Leger Alice Carpentier Christian Ernst Mayer Ellen Schulten Guus Schreiber Heidrun Allert Leonarda Haid-Garcia Wolf Siberski Wolfgang Nejdl Ying Ding	Full Name Photo e-mail Homepage Date of Birth Role Country City Zip code Street Address Telephone Fax	belongs to is contact person of is WP leader in works in is involved in leads is author of
PhD Student	Andreas Harth Andrei Tamilin Angel López-Cima Anna V. Zhdanova Dasiopoulou Stamatia David Manzano-Macho Diego Ponte Giorgos Stoilos Ilya Zaihrayeu Ion Constantinescu José Ángel Ramos Gargantilla Knud Möller Mª del Carmen Suárez-Figueroa Mark Carman Miguel Esteban Gutiérrez Mikalai Yatskevich Mustafa Jarrar Nikolaos Simou Pavel Shvaiko Philippe Cudre-Mauroux Rafael González-Cabero Raúl García-Castro	--	--

Concept name	Instances	Instance attributes	Ad-hoc relations
	Rubén Lara Hernández Stefano Zanobini Wolf Winkler		
Professor	Robert Meersman Robert Tolksdorf Rudi Studer	--	--
Project Officer	Brian Macklin	--	--
Researcher	Diana Maynard Elena Paslaru Jeff Pan Jerome Euzenat John Breslin Klaus Schild Lyndon JB Nixon Malgorzata Mochol Michal Zaremba Vassilis Tzouvaras	--	--
Senior Researcher	Giorgos Stamou Hamish Cunningham Holger Wache Luciano Serafini Manfred Hauswirth Marco Ronchetti Martin Rajman Matteo Bonifacio Walter Binder Yiannis Kompatsiaris	--	--
Student	--	--	--
Technical Staff	Alexandre Delteil Benjamin Schwarz François Paulus Luigi Lancieri Marco Nanni Michel Plu Patrick Grohan	--	--
Undergraduate	--	--	--
University Staff	--	--	--

Table 7. The concept dictionary of the Person ontology

The KW Person ontology imports concepts from the documentation ontology, the organization ontology, and the project ontology, to connect the Person ontology with the others. In figure 11 we can see all the ad-hoc relationships whose domain is a concept that belongs to the Person ontology. Examples of these relationships can be: 'Person is author of Documentation', 'Person belongs to Organization', 'Person is involved in Task', etc.

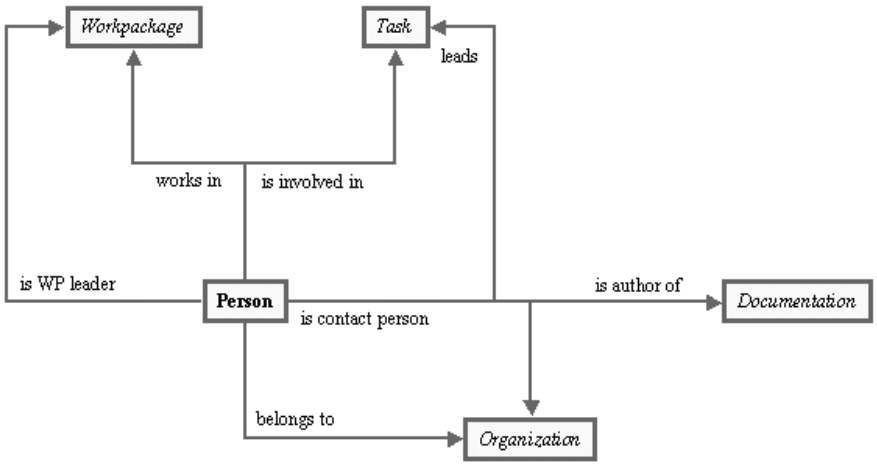

Figure 11. The ad-hoc relationships of the Person ontology

Finally, table 8 shows the Person ontology statistics.

Concepts	*18*
Instance Attributes	*12*
Ad-hoc Relations	*7*
Instances	*93*

Table 8. Person ontology statistics

3.3.5. The Project Ontology

This ontology models the Technical Annex of a NoE, including information about: milestones, workpackages, tasks, projects or networks of excellence, etc. This ontology is not organized in a taxonomy; it only includes several concepts and the relationships between them.

In table 9 we can see the concept dictionary of the Project ontology, including all the domain concepts, their concept instances dated June 15, 2004, their instance attributes, and their ad-hoc relations. For example, let us see the concept 'Workpackage'. As we can see, this concept has the following instance attributes: 'title', 'number', 'description of work', 'objectives', 'expected results', 'mailing list', 'person-months', 'start month', and 'end month'. We can also see the ad-hoc relations for this concept (i.e., 'has associated', 'has involved partner'). This concept has 21 instances ('WP1.1: Industrial Application Needs', 'WP1.6: Semantic Portal Structure', etc) which are the WPs already identified in the Technical Annex of KW NoE.

Concept name	Instances	Instance attributes	Ad-hoc relations
Activity	--	Activity name Activity number Activity deliverables Activity objectives	--

Concept name	Instances	Instance attributes	Ad-hoc relations
		Activity tasks Activity timeline Start date	
Milestone	--	Month Milestone number Milestone description	has associated is associated with
Network of Excellence	Knowledge Web	Network full title Network acronym Proposal/Contract Number Network URL Network summary Network objectives Network start date Network end date	has associated has associated event is developed by
Task	T1.1.1 Establishment of an industrial board T1.1.2 System requirements analysis T1.1.3 Knowledge processing requirements analysis T1.1.4 Self-assessment T1.2.1 Utility of ontology-based tools T1.2.2 Interoperability of tools and services T1.2.3 Ontology content evaluation and usability T1.2.4 Self-assessment T1.3.1 Best Practices and Guidelines T1.3.2 Ontology repository T1.3.3 Standards T1.3.4 Ontology Outreach Authority (OOA) T1.3.5 Self-assessment T1.4.1 Technology Roadmap T1.4.2 Business cases and success stories T1.4.3 International Technology Show T1.4.4 Self-assessment T1.5.1 Negotiation with identified potential co-operators T1.5.2 Detailed discussion about possible joint education and training activities T1.5.3 Define a program of joint activities with each network T1.5.4 Self-assessment T1.6.1 Semantic portal analysis requirements and design T1.6.2 Semantic portal ontology prototype development T1.6.3 Semantic portal prototype development T1.6.4 Semantic Portal Unit and integration testing T1.6.5 Content annotation and management T1.6.6 hosting and running http://knowledgeweb.semanticweb.org	Task name Task number Task description Start month End month	has involved partner has participant leader has person leader team is formed by belongs to

Concept name	Instances	Instance attributes	Ad-hoc relations
	T1.6.7 hosting and running www.iswsa.org T1.6.8 Self-assessment T2.1.1 State of the art on the technology participating on the scalability WP T2.1.2 Approximate reasoning with ontologies T2.1.3 Modularization of ontologies T2.1.4 Definition of a methodology and general criteria for ontology-based tools benchmarking T2.1.5 Construction of prototypes of tools for benchmarking ontology building tools T2.1.6 Benchmarking of ontology building tools according to the criteria and test beds produced T2.1.7 Self-assessment T2.2.1 Definition of a common framework for characterizing alignment T2.2.2 Design of a benchmark suite for alignment T2.2.3 Synthesis of current alignment techniques T2.2.4 Research on alignment techniques and implementations T2.2.5 Definition of the format for delivering alignment T2.2.6 Self-assessment T2.3.1 Ontology versioning T2.3.2 Process modeling of consensus T2.3.3 Patterns of ontology versioning T2.3.4 Self-assessment T2.4.1 Survey on the state of the art of current semantic web services initiatives T2.4.1:Survey on the state of the art of current semantic web services initiatives T2.4.2 Analysis of current initiatives to identify semantic needs not covered within existing research efforts T2.4.3 Define requirements for web service description T2.4.4 Define semantics for dynamic web service discovery and automatic composition T2.4.5 Define semantics for automatic web service invocation and interoperation T2.4.6 Survey on the state of the art on agent based services T2.4.7 Guidelines for the integration of agent-based services and web-based services T2.4.8 Self-assessment T2.5.1 Cooperation and coordination with rule language development activities T2.5.2 Participation in query language development efforts T2.5.3 Participation in any relevant query		

Concept name	Instances	Instance attributes	Ad-hoc relations
	language standardization efforts T2.5.4 Monitoring of and participation in efforts to design additional language layers or to extend existing languages T2.5.5 Self-assessment T2.6.1 Monitoring the research advance T2.6.2 Potential redistribution of budget to research tasks T2.6.3 Facilitating and managing the exchange and research collaboration T2.6.4 Organization of workshops T2.6.5 Self-assessment T3.1.1 Conducting a detailed requirements analysis for VISWE T3.1.2 Investigation of prior attempts T3.1.3 Negotiations among Universities T3.1.4 Investigation of the feasibility of participating in other European development and training programs T3.1.5 Self-assessment T3.2.1 Identification of core curriculum/a, adaptation or creation of learning units T3.2.2 Provision of training events and learning units specifically targeted to professionals T3.2.3 Organization of educational events T3.2.4 Identification of core curriculum/a T3.2.5 Development of an initial M.Sc. course T3.2.6 Negotiations among Universities T3.2.7 Enhancement and promotion of the teaching materials provided by REWERSE, MUSCLE, Aim@Shape, KB2.0 and Agentlink III T3.2.8 Self-assessment T3.3.1: Agreement on formats, metadata standards, etc. T3.3.2: Setup of learning management system as repository for learning units T3.3.2: Setup of learning management system as repository for learning units v2 T4.1.1 Communication with the EC and co-ordination of reporting T4.1.2 Resolution of Conflicts T4.1.3 Auditing T4.1.4 Focus on integration T4.2.1 Accounting T4.2.2 Monitoring income and expense plan execution T4.3.1 Activity report T4.3.2 Joint Programme of Activity revision and expansion		

Concept name	Instances	Instance attributes	Ad-hoc relations
	T4.4.1 Negotiations and monitoring of Consortium Agreement T4.4.2 Spinning off and relations with legal bodies T4.4.3 Intellectual property management T4.5.1 Overseeing the science and society issues related to Knowledge Web T4.6.1 Self-assessment, risk analysis and market watch		
Workpackage	WP1.1: Industrial Application Needs WP1.2: Evaluation for technology selection WP1.3: Technology Recommendations WP1.4: Promotion of Ontology Technology WP1.5: Cross Network cooperations WP1.6: Semantic Portal Structure WP2.1: Scalability WP2.2: Heterogenity WP2.3: Dynamics WP2.4: Semantic Web Services WP2.5: Semantic Web Language Extensions WP2.6: Towards a Virtual Research Centre WP3.1: VISWE WP3.2: Educational Contents and Event Provision WP3.3: Semantic delivery platform WP4.1: Operational Management WP4.2: Financial Management WP4.3: Technical Management WP4.4: Legal and Knowledge Management WP4.5: Society and Gender Issues WP4.6: Self-Assessment, Risk Analysis and Market Watch	Workpackage title Workpackage number Workpackage description of work Workpackage objectives Workpackage expected results Workpackage mailing list Person-months Start month End month	has associated has contractor leader has involved partner has person leader has person participant has is made up of has participant with workload
workpackage workload	--	Person-months	is workload of is workload on workpackage

Table 9. The concept dictionary of the Project ontology

The KW Project ontology imports concepts from the documentation ontology, the event ontology, the organization ontology, and the person ontology. These imported concepts are used to connect the Project ontology with the other ontologies. In figure 12 we can see all the ad-hoc relationships whose domain is a concept belonging to the Project ontology. Examples of these relationships can be: 'Milestone has associated Deliverable', 'Network of Excellence has associated event Event', 'Network of Excellence is developed by Organization', 'Workpackage has person participant Person', 'Workpackage is made up of Task', etc.

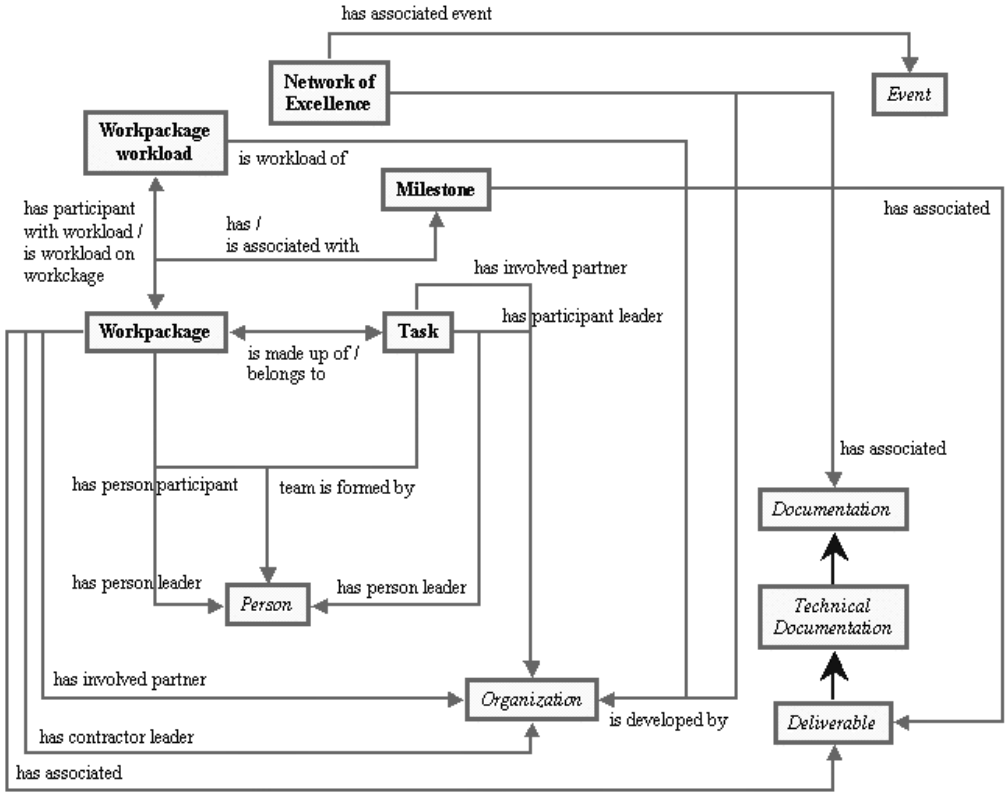

Figure 12. The ad-hoc relationships of the Project ontology

Finally, table 10 shows the Project ontology statistics.

Concepts	*6*
Instance Attributes	*33*
Ad-hoc Relations	*20*
Instances	*365*

Table 10. Project ontology statistics

4. Different Mappings between Ontologies

In this section we make explicit the mappings between the concepts used by the KW ontologies and the concepts used by the OntoWeb and Esperonto ontologies. In addititon, this section presents the existing mappings between FOAF[8] and KW Person ontologies.

4.1. Mappings between OntoWeb, Esperonto and KW Ontologies

Tables 11 and 12 shows the reused concept from the OntoWeb ontology and the five Esperonto ontologies, and the mappings between them, respectively. The first column presents the concepts of the OntoWeb or Esperonto ontologies in alphabetical order, and the second column presents their corresponding concept in the five KW ontologies. Note that 48% of the OntoWeb concepts and 76% of the Esperonto concepts have been reused in the KW ontologies.

Concept name (OntoWeb Ontology)	Concept name (KW Ontologies)
AcademicStaff	
AdministrativeStaff	Administrative Staff
Article	Article
AssistantProfessor	Assistant Professor
AssociateProfessor	Associate Professor
Association	
Book	Book
Booklet	
Conference	International Conference
Department	
DevelopmentProject	
Employee	
Enterprise	Company
Event	Event
Exhibition	
FacultyMember	
FullProfessor	Full Professor
Graduate	
InBook	Article in Book
InCollection	
InProceedings	Article in Conference
Institute	
Lecture	
Lecturer	
Manager	Manager
Manual	Manual
MasterThesis	Master Thesis

[8] http://xmlns.com/foaf/0.1/

Meeting	
Misc	
Organization	Organization
Person	Person
PhDStudent	PhD Student
PhDThesis	PhD Thesis
Proceedings	
Product	
Project	Network of Excellence
ProjectMeeting	
ProjectReport	
Publication	Publication
Report	
ResearchGroup	
ResearchProject	
ResearchTopic	
SoftwareComponent	
SoftwareProject	
Student	Student
TechnicalReport	
TechnicalStaff	Technical Staff
Thesis	Thesis
Topic	
Undergraduate	Undergraduate
University	University
Unpublished	
Workshop	International Workshop
	Additional Documentation
	Agenda
	Annex
	Article in Journal
	Article in Workshop
	AudioConference Minutes
	Contract
	Cost Statement
	Deliverable
	Documentation
	EC Templates
	Fax
	Final Report
	Mail
	Management Documentation
	Meeting Minutes

	Minutes
	Periodic Report
	Project Proposal
	Proposal
	Six Month Report
	Slides
	Technical Documentation
	Templates
	Two Month Report
	Year Report
	Education Area Meeting
	EPMB Meeting
	Industry Area Meeting
	KW Area Meeting
	KW Plennary Meeting
	Management Project Meeting
	PMB Meeting
	Research Area Meeting
	Review
	Research Institute
	Company Staff
	Junior Researcher
	Master Student
	Professor
	Project Officer
	Researcher
	Senior Researcher
	University Staff
	Activity
	Milestone
	Task
	Workpackage
	workpackage workload

Table 11. OntoWeb and Knowledge Web concepts

Concept name (Esperonto Documentation Ontology)	**Concept name (KW Documentation Ontology)**
Additional Documentation	Additional Documentation
Agenda	Agenda
Annex	Annex

Annex I	
Annex II	
Annex III	
Annex IV	
Annex V	
Article	Article
Article in Book	Article in Book
Article in Conference	Article in Conference
Article in Journal	Article in Journal
Article in Workshop	Article in Workshop
AudioConference Minutes	AudioConference Minutes
Book	Book
Contract	Contract
Cost Statement	Cost Statement
Deliverable	Deliverable
Documentation	Documentation
EC Templates	EC Templates
Fax	Fax
Final Report	Final Report
Mail	Mail
Management Documentation	Management Documentation
Manual	Manual
Master Thesis	Master Thesis
Meeting Minutes	Meeting Minutes
Minutes	Minutes
Periodic Report	Periodic Report
PhD Thesis	PhD Thesis
Project Proposal	Project Proposal
Proposal	Proposal
Publication	Publication
Six Month Report	Six Month Report
Slides	Slides
Technical Documentation	Technical Documentation
Thesis	Thesis
Year Report	Year Report
	Templates
	Two Month Report
Concept name (Esperonto Meeting Ontology)	**Concept name (KW Event Ontology)**
Audio Conference	
Meeting	
Project Meeting	
Review	Review

Technical Meeting	
Video Conference	
	Education Area Meeting
	EPMB Meeting
	Event
	Industry Area Meeting
	International Conference
	International Workshop
	KW Area Meeting
	KW Plenary Meeting
	Management Project Meeting
	PMB Meeting
	Research Area Meeting
Concept name (Esperonto Organization Ontology)	**Concept name (KW Organization Ontology)**
Coordinator	
Organization	Organization
Partner	
Subcontractor	
	Company
	Research Institute
	University
Concept name (Esperonto Person Ontology)	**Concept name (KW Person Ontology)**
Academic Staff	
Administrative Staff	Administrative Staff
Assistant Professor	Assistant Professor
Associate Professor	Associate Professor
Company Staff	Company Staff
Full Professor	Full Professor
Junior Academic Staff	
Manager	Manager
Master Student	Master Student
Person	Person
PhD Student	PhD Student
Professors	Professor
Project Officer	Project Officer
Senior Academic Staff	
Student	Student
Technical Staff	Technical Staff
Undergraduate	Undergraduate
	Junior Researcher
	Researcher
	Senior Researcher

	University Staff
Concept name (Esperonto Project Ontology)	**Concept name (KW Project Ontology)**
Milestone	Milestone
Project	Network of Excellence
Project Workplan	
Task	Task
Workpackage	Workpackage
workpackage workload	workpackage workload
	Activity

Table 12. Esperonto and Knowledge Web concepts

The Venn Diagramm presented in figure 13 shows graphically shows how the three ontologies overlap.

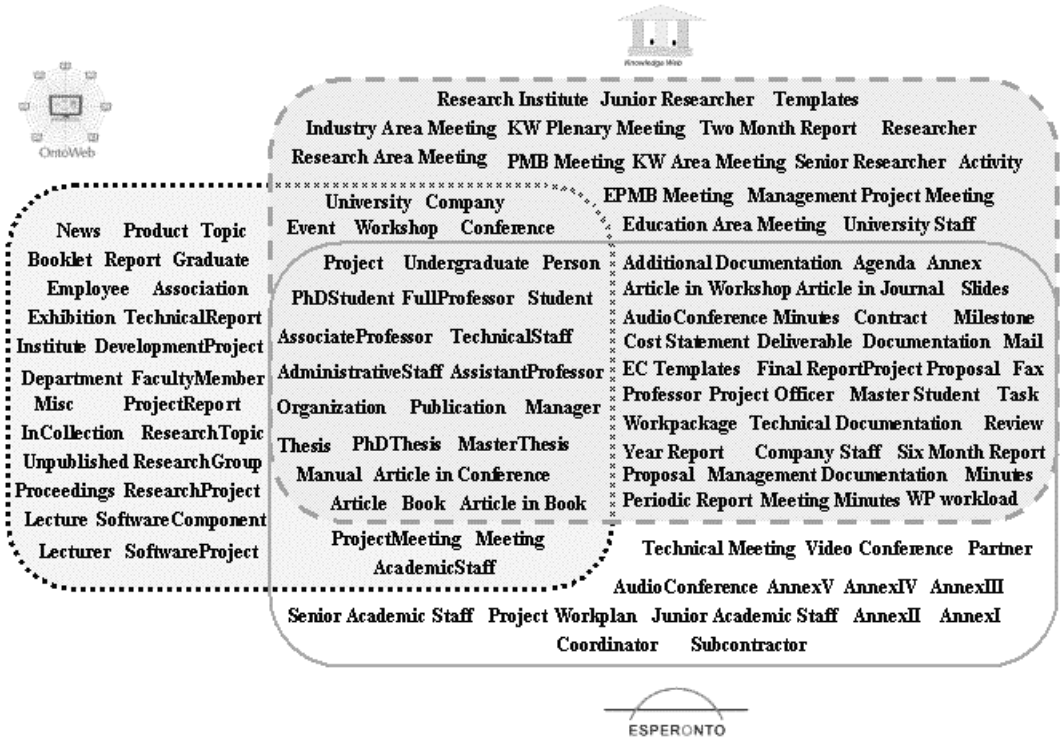

Figure 13. The overlaps between OntoWeb, Esperonto and KW ontologies

4.2. Mappings between FOAF and Person Ontologies

This section presents the existing mappings between FOAF[9] and KW Person ontologies, focused on the concept 'Person'. Such mappings are presented in table 13.

We should mention that most FOAF class and properties are testing and unstable terms.

[9] http://xmlns.com/foaf/0.1/

Knowledge Web Person Concept	FOAF Person Class
Full Name	name givenname firstName + surname firstName + family_name
Photo	img
e-mail	mbox
Homepage	homepage
Date of Birth	
Role	
Country	
City	
Zip code	
Street Address	
Telephone	phone
Fax	
belongs to ('Organization')	
is contact person of ('Organization')	
is WP leader in ('Workpackage')	
works in ('Workpackage')	
is involved in ('Task')	
leads ('Task')	
is author of ('Documentation')	publications ('Document')

Table 13. Mappings between KW Person concept and FOAF Person class

5. Conclusions

In this deliverable we have presented the conceptualization of the current five ontologies used by the Knowledge Web Portal (http://knowledgeweb.semanticweb.org). These five ontologies, which are the *Documentation*, *Event*, *Organization*, *Person* and *Project* ones, have been built reusing and extending the OntoWeb (http://www.aifb.uni-karlsruhe.de/ontology) ontology and the five Esperonto (http://esperonto.net) ontologies.

The KW ontologies reuse 48% of the OntoWeb concepts and 76% of the Esperonto concepts. The KW ontologies include:

- 75 concepts
- 98 instance attributes
- 51 ad-hoc relations
- 578 instances

Table 14 summarizes the statistics (number of concepts, attributes, and ad-hoc relations) of the OntoWeb, Esperonto and Knowledge Web ontologies.

	Concepts	**Attributes**	**Ad-hoc relations**
OntoWeb Ontology	*54*	*84*	*109*
Esperonto Ontologies	*71*	*144*	*39*
Knowledge Web Ontologies	*75*	*98*	*51*

Table 14. OntoWeb, Esperonto and KW statistics

6. References

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