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Clustering The Semantic Web Challenge's Applications: Architecture and Metadata Overview *

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Abstract. This paper describes a first attempt to classify the applications submitted to the Semantic Web Challenge, which is a parallel event in the International Semantic Web Conference. So far, 35 applications were submitted in the last 3 editions of the challenge. This work will investigate some aspects about the applications in order to come up with a(some) framework(s) for Semantic Web applications that attends the requirements of the challenge. Consequently, showing the benefits of the Semantic Web techniques to the final user. Our first step in that direction is presenting some metadata and the architecture of the submitted applications on this paper. And also a first speculation about the categories of Semantic Web Applications submitted to the challenge so far.

Keywords: Semantic Web, Semantic Web Applications, Semantic Web Challenge, Software Engineering, Frameworks

Resumo. Este artigo descreve uma classificação hipotética das aplicações submetidas ao *Semantic Web Challenge*, um concurso que ocorre em paralelo com a *International Semantic Web Conference*. Até o presente momento, 35 aplicações disputaram as últimas 3 edições do *Challenge.* As aplicações concorrentes serão analisadas sob diversos aspectos. Neste primeiro artigo, apresentamos os metadados e a arquitetura das aplicações, assim como a classificação hipotética das mesmas. Nosso objetivo é desenvolver um(alguns) *framework*(*s*) que possibilite(m) o desenvolvimento de aplicações que atendam aos requisitos do *Challenge.* Mostrando, assim, quais os benefícios da utilização das técnicas da Web Semântica para os usuários finais.

Palavras-chave: Web Semântica, Aplicações para a Web Semântica, *Semantic Web Challenge,* Engenharia de Software, *Frameworks*

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1 Introduction

The dreams of software that could "understand" data (on the Web) has been being tackled by several approaches by researchers of different areas or fields, such as databases, semi-structured data, knowledge management, logics, formal representation and Web systems. Those dreams are not new. But, in the last years, more and more data is available on the Web (W3C, 2005a) and "clearly" related through the linking capacity (Rossi, Schwabe *et al.*, 1999). Also, the Web is distributed, dynamic, massive and an open world (Heflin, Hendler *et al.*, 2003). All these facts and characteristics bring new requirements. Some of them were already addressed by an organization (World Wide Web Consortium - W3C) in the effort to lead the Web to its full potential, through the development of protocols and guidelines including the development of the Semantic Web.

The Semantic Web tries to solve problems like interoperability, improvement of searching techniques, reliability in data, among others, by making formally explicit the semantics of the data. Adding semantics to the data available will permit applications to reason about the data and provide more personalized services to users (Berners-Lee, 1998) (Berners-Lee, Hendler *et al.*, 2001). According to the W3C Semantic Web Activity Statement: "The goal of the Semantic Web initiative is as broad as that of the Web: to create a universal medium for the exchange of data. It is envisaged to smoothly interconnect personal information management, enterprise application integration, and the global sharing of commercial, scientific and cultural data" (W3C, 2005b). However, if it is possible, how is it done?

In particular, in the case of the Semantic Web, Fensel *et alli* (Fensel, Hendler *et al.*, 2002) identifies that the following elements are required (Figure 1):

- formal languages to express and represent ontologies, which are, roughly, the artifacts that formally explicit the semantics of the data;
- editors to build, merge and reuse ontologies;
- reasoning services to enable advanced querying and help map between different terminologies;
- annotation tools to link unstructured and semi-structured information sources with metadata;
- tools for information access and navigation that enable intelligent information access for human users; and
- translation and integration services between different ontologies that enable multistandard data interchange.

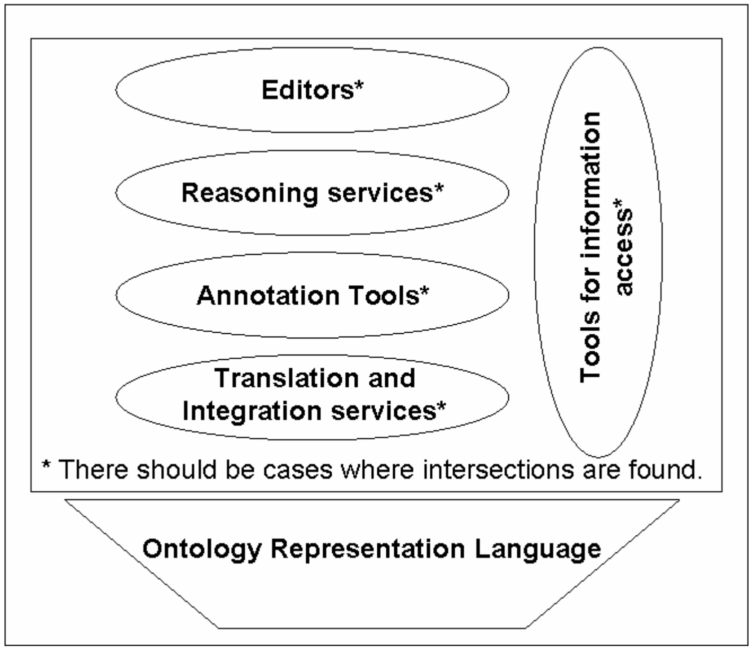

Figure 1 - An “interpretation” of Fensel *et alli* (Fensel, Hendler *et al.*, 2002) elicitation of tools and/or technologies for the Semantic Web

Many of those elements (tools and/or technologies), in Figure 1, have been tackled by several researchers. However a question stills calls the attention, that is, how the “tools for information access and navigation that enable intelligent information access for human users” look like, and more, how to develop them? As pointed by Alavi and Leider (Alavi and Leider, 1999), knowledge management systems (KMS), as the tools in the question, have to deal with different capabilities such as information-based, technology-based and culture-based ones. It is also clear that no dominant technology or tool (such as browsers, videoconferencing tools etc.) or product for KMS emerged in their survey that supplied all those capabilities.

This work deals with the question of how the applications “look like”. We then are interested in understanding and restraining the significance of which aspects are behind or supporting those applications. To do that, this work will review the applications submitted to the Semantic Web Challenge[1] (SWC) and that are named Semantic Web applications (SWAPps). This challenge shares some of the same objectives as this work, as section 3 will show.

1.1 Objectives

According to Conallen (Conallen, 1999), the differences between a Web site and a Web application involve its usage. In the Web applications, the developers should focus the modeling effort on the business logic and business state without paying less attention to presentation details. However, something to be strived for is the separation of business and presentation concerns. If the presentation concern is important or complex, of course it should also be modeled but not as part of the business concern.

1 The Semantic Web Challenge - http://challenge.semanticweb.org - accessed: 16/06/2006.

If we consider characteristics of the Web applications, the characteristics of the Web raised in (Heflin, Hendler *et al.*, 2003) seems even more pertinent. For them the Web is:

- distributed: no centralized authority;
- dynamic: data can be, and often is, out of date;
- massive: an issue of scalability. We have to restrict expressivity or use incomplete reasoning algorithms;
- open world: information can be, and often is, incomplete.

Designing and implementing a Semantic Web application (SWAPp) requires lots of pragmatic decisions (Tummarello and Morbidoni). Figure 2 depicts an example of that based on Berners-Lee's (controversial (Ayers, 2004) (Horrocks, Parsia *et al.*, 2005)) Semantic Web Layer Cake (Berners-Lee, 2000). In this work, we will present some possible realistic alternatives to those decisions. We do that through the analysis and the proposition of a categorization of the applications submitted to the SWC.

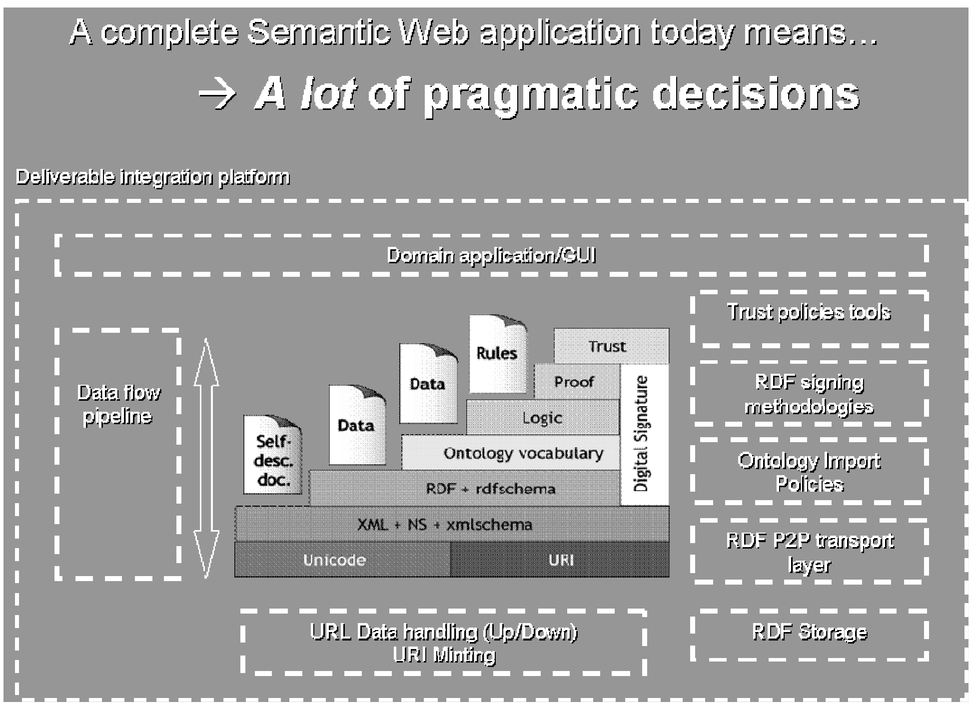

Figure 2 – A meaning of a complete Semantic Web application (Tummarello and Morbidoni)

The objective of the analysis of the applications and their categorization is to come up with a (some) framework(s) with hot spots that represent the customizing aspects of each category. Therefore, we intend to provide assistance (or guidance) for the developers of SWAPps in each correspondent category. For example, possibly as a reflect of the requirements of the challenge, a category that emerged was the "Mediation Infrastructure", which are the group of applications that mediate between different data sources, semantically-enabled or not, to provide users with a transparent view of the integration of those data sources. Describing and scrutinizing this group of applications should give us what the essential (fixed) and customizable components of this kind of applications are.

Up until the time of writing, 35 applications were submitted during the three editions of the SWC. They do not represent all possible applications on the Semantic Web. On the other hand, they do represent a segment of applications that attends specific requirements proposed by the challenge's organizers. The use of these applications may also work as a benchmark for the proposed framework(s).

Inspired by the requirements defined by the SWC for a SWAPp, we are going to consider four aspects in the analysis of the applications:

- metadata and architecture;
- data meaning;
- information sources; and
- applications.

Nevertheless, this work deals only with the first aspect (metadata and architecture) and is structured as follows: in the next section, some concepts of Logics are reviewed and the area of Semantic Web is introduced. In section 3 , we present the Semantic Web Challenge, through the reviewing of its requirements and results. Also in section1 3 , we present the reasons of the chosen vocabulary to describe the SWAPps submitted to the SWC. The vocabulary "per se" will be published when all the aspects of the applications were already analyzed. The major part of the "metadata and architecture" aspect of those SWAPps are presented in sections 4 ,5 and 6 that describe the applications for each edition of the challenge as well as the proposition of some categories for each SWAPp. Appendix A presents the metadata for each SWAPp. Section 7 presents the categories found in the applications presented in the previous sections. Section 8 presents a summary of this work and an outlook of future works; for example, we have to analyze the SWAPps considering the other aspects (data meaning, information sources and applications) to validate the hypothetical categories and to implement a framework or component for each of those categories. Section 9 shows the acronyms and some vocabulary used in this work. Finally, we present the bibliographical references.

2 Semantic Web

Formal representation of information can take a variety of forms. One of the oldest formalisms is semantic networks. A semantic network represents knowledge as a set of nodes connected by labeled links. The meaning is implied by the way a concept is connected to other concepts. Another approach are frames systems that are isomorphic to semantic networks (Heflin, Hendler *et al.*, 2003). Another way to facilitate the expression and justification of arguments would be through formal logics. In the many branches of logic, systems consist of:

- a well defined language for the representation of knowledge; and
- well defined methods for reasoning.

Those systems are limited in the type of knowledge that they can represent and in the type of reasoning that can be performed (Frost, 1986). Hence, logicians developed other kinds of logics to avoid those restrictions. Examples of such branches of logic are predicate logic, first order predicate logic, non-monotonic logic and description logic among others. In the case of the Web, computational restrictions are one of the most important restrictions. According to Berners-Lee (Berners-Lee, 1998) (Berners-Lee, Hendler *et al.*, 2001), a definition to the Semantic Web is: "an extension of the Web obtained via the semantic addition to the present data format representation". For that reason, next, some general concepts about logic are reviewed in order to better understand the branch of logic chosen to implement the Semantic Web: Description Logics.

2.1 Formal Representation, Logics and Formal Theories

A formal language makes possible to formulate assertions about parts of the universe in a precise and unambiguous way. A language has its syntax and semantics. The syntax of a language determines how legal statements, called well formed formulas (wffs), may be constructed combining simple components called atomic formulas and logical connectives. The semantics of a formal language determine how meaning may be ascribed to atomic formulas, and how this meaning can be extended to give meaning to wffs in which atomic formulas occur (Frost, 1986).

There are two types of reasoning: semantic reasoning and through formal deduction systems. Semantic reasoning is the use of truth tables (or equivalent methods) to determine properties of formulas such as satisfiability, universal validity, equivalence and logical consequence. In formal deduction systems, a set of wffs, *S*, is manipulated structurally, through syntactic operations, without references to truth tables, to derive or deduce new formulas which are guaranteed to be logical consequences of *S*. Still according to Frost (Frost, 1986), there are several types of formal deduction systems, the type described here is called axiom systems.

An axiom system consists of:

- a formal language;
- a set of inference rules; and
- a set of logical axiom schemas (or logical axioms for short).

Inference rules define the syntactic operations by which new formulas can be generated from given formulas. That is, they allow deductions to be made. Logical axioms encompass a set of templates for some of the universal valid wffs of the formal language.

The derivation of a formula *F* from a set of formulas *S* using an axiom system *A*, is called formal proof or formal deduction of *F* from *S* in *A*. A formal proof of *F* from *S* in *A* is a finite sequence *F1, F2, …, Fn*, of formulas such *F* = *Fn* and for each *i*, $(1 \leq i \leq n)$:

either - (i) *Fi* is a logical axiom of *A*;

or - (ii) $Fi \in S$;

or - (iii) *Fi* is generated from previous formulas of the sequence according to one or more of the inference rules of *A*.

A theory encompasses:

- a formal system; and
- a set of wffs that are known to be true in some set of intended interpretations. These wffs are called the proper axioms of the theory. The intended interpretations of a theory are those truth assignments that satisfy all proper axioms of the theory according to the rules of the formal system. Finally, a theorem of a theory is a formula that has a formal proof in that theory.

A theory is comparable to an ontology (schema accompanied by semantic annotations) about resources on the Web. The schema, the semantics and the abstract syntax of the language used to describe the ontology are similar to the formal system. The semantic annotations would be like the proper axioms. As we can see, the language used in the formal system plays a fundamental role on the definition of a theory. So, if we are considering semantic annotations and ontologies comparable to theories, one important concern are the languages to represent ontologies on the Web.

According to the W3C (W3C, 2004g), some of the prior languages used to represent ontologies, elicited later in the next section, and to develop tools for particular user communities were not compatible with the architecture of the Web in general, and, in specific, the Semantic Web. The consortium then proposed the Resource Description Framework (RDF) (W3C, 2004e) which is a language for representing information about resources in the Web. Subsequently they proposed the Web Ontology Language (OWL) (W3C, 2004b) that "extends" RDF providing some capabilities to ontologies such as scalability; distribution; compatibility with Web standards for accessibility and internationalization; openness and extensibility.

As stated before, only special branches of logic are computable. So, in the ontology representation language (OWL) recommended by the W3C (W3C, 2004b), three increasingly expressive sublanguages were designed for use by specific communities of implementers and users. They are OWL Lite, OWL DL and OWL Full. In the next section, we go into the description of the Semantic Web considering the W3C´s view and its choice to define OWL as a recommendation.

2.2 W3C and the Semantic Web

Before going into the discussion about the sublanguages of OWL, let us understand better what the originating ideas of the Semantic Web are. According to Berners-Lee (Berners-Lee, 1998) (Berners-Lee, Hendler *et al.*, 2001), a definition to the Semantic Web is: "an extension of the Web obtained via the semantic addition to the present data format representation".

The main purpose of having a Semantic Web is making the Web information understandable for humans and for software entities such as agents (Silva, Garcia *et al.*, 2003) or components (Szyperski, 1998). In this sense, if the Web content would be machine processable, applications could have access to a huge variety of resources, which could be processed and/or integrated to produce a result with more value to the user.

The "basis" of the present Web is the HyperText Markup Language (HTML), which allows human-to-human communication, because humans can understand its pages content. Benjamins *et alli* (Benjamins, Contreras *et al.*, 2002), presents the Semantic Web as a mean of treating the problem of information overload caused by the continuous Web growth, in size, languages, and formats. In the Semantic Web, pages present not even a set of words, figures, tables and other elements, but the code and the structure of their meanings, allowing the electronic processing of it.

To make the Semantic Web possible, Web ontology description languages were developed, such as: Simple HTML Ontology Extensions (SHOE) (Heflin and Hendler, 2000), Resource Description Framework (RDF) (W3C, 2004e), RDF Vocabulary Description Language 1.0 (RDF Schema) (W3C, 2004f), DAML+OIL Language (DAML+OIL) (W3C, 2001), OWL (W3C, 2004b) among others. As they are based on the eXtensible Markup Language (XML), these languages are richer than HTML. The languages allow the representation of the structure of contents through their syntax and the representation of the semantics through ontologies mechanisms to describe properties of or relationships between concepts. Some of the ontology description languages allow for inferences to be made about the concepts and relations between these concepts expressed on the ontologies. Those inferences would then generate new proper axioms in a theory.

As pointed at the end of the section 2.1 , the W3C has chosen to recommend the Web Ontology Language (OWL) (W3C, 2004b). And OWL was designed to offer three increasingly expressive sublanguages (W3C, 2004a):

- OWL Lite: supports, primarily, classification hierarchies and simple constraint features;
- OWL DL: provides the maximum expressiveness without losing computational completeness[2] and decidability[3] of reasoning systems. OWL DL is named like that due to its correspondence with description logics (Baader, Calvanese *et al.*, 2003). Description logics is a field of research that studies a particular decidable fragment of first order logic;
- OWL Full: offers maximum expressiveness and the syntactic freedom of RDF with no computational guarantees.

2 All entailments are guaranteed to be computed.

3 All computations will finish in finite time.

According to (W3C, 2004a): "Ontology developers adopting OWL should consider which species best suits their needs. The choice between OWL Lite and OWL DL depends on the extent to which users require the more expressive restriction constructs provided by OWL DL. Reasoners for OWL Lite will have desirable computational properties. Reasoners for OWL DL, while dealing with a decidable sublanguage, will be subject to higher worst-case complexity. The choice between OWL DL and OWL Full mainly depends on the extent to which users require the meta-modeling facilities of RDF Schema (i.e. defining classes of classes). When using OWL Full as compared to OWL DL, reasoning support is less predictable. For more information about this issue see the OWL semantics document (W3C, 2004c)."

Once the choice on which sub-language will be used in a solution is made, the question is what the advantages of such a choice are. In fact, the "use of ontologies by Web applications" or the "ontology understanding and processing by software agents" can be seen as a "way of building more intelligent applications in a near future while executing tasks in the closest conceptual level to the human level" (W3C, 2004d).

Besides that, it is desired that applications become more secure and confident based on trusted ontologies and inferred information. The Semantic Web will enable even more interesting functionality through complex logics and the exchange of proofs to establish trust relationships (Hendler, 2001). Those relationships, probably, will be based on theorems (formulas) generated from the theory through formal proofs. These assertions are illustrated in one of the architectural basis of the Semantic Web, which is the (controversial (Ayers, 2004) (Horrocks, Parsia *et al.*, 2005)) "Layer Cake" (see it in the context of Figure 2), first presented in a Berners-Lee's talk in XML 2000 Event (Berners-Lee, 2000).

For a definition of the layers, please refer to (Fensel, Hendler *et al.*, 2002). In reviewing the SWC applications, the architecture of each application will be visited. Corresponding layers such as logic and ontology vocabulary may have significant differences between the applications. Therefore, those differences may influence in a redefinition of some layers. In addition, we might have to remove from or to add some other important characteristics to the Semantic Web Layer Cake. A prospective future work would be to accommodate or to project the hypothetical categories into the Layer Cake providing a reconciling view of W3C layers and our categorization.

Now that we have a better understanding of the Semantic Web, in the next section, we present the Semantic Web Challenge through its requirements and we delineate a vocabulary to describe the applications submitted to the challenge.

3 The Semantic Web Challenge (SWC)

The Semantic Web Challenge[4] (SWC) had 3(three) editions (2003(Klein and Visser, 2004), 2004(Klein and Visser, 2005) and 2005 (Visser and Klein, 2005)) until the time of writing this work. In the 2005 edition, the flyer of the challenge says that the general objective of the challenge is to apply "Semantic Web techniques" in order to build an "online application that integrates, combines, and deduces information needed to assist users in performing tasks". SWC was started at the International Semantic Web Conference[5] (ISWC) for answering questions like "What kinds of things can be realized with today's techniques? … Are any Semantic Web Applications out yet?"

The challenge does not purposely define specific data sets because the prospective applicability of the Semantic Web is very wide-ranging. However, concerns about distribution, portability and other characteristics of the Web are important here. In the SWC, there was not a previous definition of what an ontology should be, nor of the language that should be used to represent it. We could assume that this decision takes into account the same reason that no data sets are defined, that is, the applicability of the Semantic Web is very broad.

Each application submitted to the SWC, named by the organizers as a Semantic Web Application (SWAPp), is revised by at least three (3) members of the advisory board. The submitted applications have to attend the application definition presented in section 3.1 and an additional goal that is defined by the advisory board each year for the challenge. We will present each year's additional goal in the sections that summarizes each year's applications. In the rest of the section, we present the ranking of the applications and the discussion about how to describe the applications in this work.

3.1 Application Requirements and Desirable Qualities

To define a SWAPp, a set of minimal requirements based on the discussion with several experts were elicited (Klein and Visser, 2004):

- Considering the information sources of the applications, they must:
    - ♦ be geographically distributed;
    - ♦ have diverse ownerships - that is, there is no control of evolution;
    - ♦ be heterogeneous (syntactically, structurally, and semantically);
    - ♦ contain real-world data - that is, the sources must be more than toy examples.
    - ♦ Considering the open/close world option: the application must assume an open world; that is, it assumes that the information is never complete;
    - ♦ Considering the description of the data's meaning: the application must use some formal description.

4 SWC - http://challenge.semanticweb.org - accessed: 16/06/2006.

5 ISWC - http://iswc.semanticweb.org - accessed: 19/06/2006.

Also, additional desirable qualities were defined:

- Considering the data sources, they should:
    - ♦ be used for other purposes or in another way than originally intended;
    - ♦ exploit both static and dynamic knowledge—for example, a combination of static ontologies and dynamic workflows;
    - ♦ use the contents of multimedia documents.
- Considering users' access: multiple languages and access through devices other than a Personal Computer (PC) should be offered;
- Considering scalability: should be scalable (in terms of the amount of data used and of distributed components working together).

3.2 Application Classification

There are several approaches, not considered in the challenge, for (somehow) classifying Ontology-Based Applications (OBAs), which are not necessarily designed for the Web, and SWAPps, for example:

- A Framework for Understanding and Classifying Ontology Applications (Jasper and Uschold, 1999) (Zyl and Corbett, 2000a) (Zyl and Corbett, 2000b);
- OWL Web Ontology Language Use Cases and Requirements (W3C, 2004d);
- Object Management Group[6] (OMG) Ontology Definition Metamodel (2nd revised submission) (DSTC, IBM *et al.*, 2005);
- OntoWeb´s Successful Scenarios for Ontology-based Applications (Léger, Bouillon *et al.*, 2002).

On the other hand, the advisory board does not classify the SWC applications according to any categories, specifically, due to the broad-ranging objective of the challenge. However, the applications are ranked.

Table 1 – Semantic Web Challenge Summary

	2003	**2004**	**2005**
Number of Submitters	10	18	7
1st Prize	CS AKTive Space	Flink	CONFOTO
2nd Prize	SEmantic COllaboration (SECO)	MuseumFinland	FungalWeb
3rd Prize	Annotated Terrestrial Information (AnnoTerra)	SemanticOrganizer	Personal Publication Reader

6 OMG Homepage - http://www.omg.org - accessed: 21/08/2005

Table 1 presents the number of submitters for each year and the name of the applications that won the challenge. Each application description can be found next in the respective sections of each year's challenge. In the next sections, we explain the foundations of our choice of how to describe the applications.

3.3 Describing the Applications

For now, the 35 applications submitted to the previous versions of the Semantic Web Challenge will be analyzed and categorized in order to obtain elements to create a (some) framework(s) of SWAPps. Therefore, to do that it will be necessary to describe such submissions. In the next section, there is a short description of our main influence on the choice of vocabulary to describe the submissions. Many of the applications submitters were invited to write an extended version of their abstracts submitted to the SWC. We are trying to keep this work based on those papers, but sometimes it is necessary to consider other sources and papers as well.

3.3.1 The W3C's Applications and Demos Task Force at the Semantic Web Best Practices and Deployment Working Group

The Semantic Web Best Practices and Deployment[7] (SWBPD) is a working group within the Semantic Web Activity[8] in W3C. The aim of SWBPD is to provide developers of Semantic Web applications with practical support, ranging from engineering guidelines to educational materials. One of the working group's task forces is the Applications and Demos Task Force[9] (ADTF). It provides a documented list of SWAPps and demos to promote the Semantic Web and for use by developers.

On March 2005, ADTF members agreed upon (W3C, 2005c) a specific proposed criteria for applications and demos to be included in their list. The criteria for inclusion is:

- Only applications and demos with their own Description Of A Project (DOAP) metadata (see section 3.3.2) will be included;
- Only freely downloadable applications and demos will be included unless they are products of a W3C member;
- For the time being only RDF, RDF Schema and OWL applications will be included.

In the face to face meeting minutes (W3C, 2005c) the explanations for the selection of such criteria are presented. We are going to adopt an adapted version of these criteria in this work. As we are going to use the DOAP descriptions, we are going to present the DOAP project[10] in the next section. We present our adapted DOAP vocabulary in section 3.3.3 .

7 SWBPD - http://www.w3.org/2001/sw/BestPractices - accessed: 29/11/2005.

8 W3C Semantic Web Activity - http://www.w3.org/2001/sw - accessed: 29/11/2005.

9 ADTF - http://esw.w3.org/topic/SemanticWebBestPracticesTaskForceOnApplicationsAndDemos - accessed: 29/11/2005.

10 The DOAP Project - http://usefulinc.com/doap - accessed: 16/06/2006.

3.3.2 DOAP: Description Of A Project

DOAP is a project to create a XML/RDF vocabulary to describe open source projects. The DOAP vocabulary is an RDF Schema similar to the Friend Of A Friend (FOAF) vocabulary (Brickley and Miller, 2005). According to Dumbill (Dumbill, 2004a) (Dumbill, 2004b) (Dumbill, 2004c), the DOAP vocabulary is meant to be extensible and in his vision some semantics can be left behind in order to have a more "human-readable" schema. However, many "design decisions" expressed in (Dumbill, 2004a) would become formally defined using an ontology instead of a RDF Schema vocabulary. Moreover, that ontology would still have not a significant level of complexity or expressiveness.

At the time of writing, there were two Web applications (DOAP A Matic[11] and DOAP-a-matic[12]) for the construction of DOAP files. The applications were not up-to-date with the recent schema. Even though, the obligatory items were covered. Two other applications (DOAP embedded in .NET assemblies[13] and DOAPamine[14]) offered the possibility to describe projects while developing them. The DOAPamine application was up-to-date with the recent vocabulary, however the update process seemed to be manual. That is, once the vocabulary changed, the developer changed the application. However, the DOAP vocabulary, and consequently the applications, did not cover all the requirements proposed by the SWC. Therefore, we are going to create an adapted DOAP vocabulary introduced in the next section.

3.3.3 Our Adapted DOAP Descriptions

We are going to describe the SWAPps submitted to the SWC in terms of an adapted DOAP vocabulary. We will adapt the DOAP vocabulary in order to provide some other characteristics related to the challenge and to our objective of having at the end of this work a (some) framework(s) for SWAPps. The new characteristics are:

- The minimal and desirable requirements as presented by SWC's definition of a SWAPp (Visser and Klein, 2005). This will also be done because, as cited in the minutes (W3C, 2005c), the challenge's definition is presented as a potential subset of the ADTF criteria;
- Some other characteristics, especially technological ones, will be included because they are of our interest.

The final adapted DOAP vocabulary will be published when all the aspects of the applications were already analyzed. In this work, this section, is intended to be shallow since we are dealing with the Metadata and Architecture aspect of the applications and we believe that the adaptations are of easy understanding by the reader. As we move on the other aspects, they will do have to be better defined in order not to cause misunderstandings.

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11 DOAP A Matic - http://crschmidt.net/semweb/doapamatic - accessed: 16/06/2006

12 DOAP-a-matic - http://www.bonjourlesmouettes.org/doapy/doap-a-matic.php.en - accessed: 16/11/2005 on Google's cache.

13 DOAP embedded in .NET assemblies - http://usefulinc.com/doap/news/contents/2004/08-10-dotnet/read - accessed: 16/06/2006.

14 DOAPamine - http://www.ontogon.com/doapamine - accessed: 16/06/2006

4 Semantic Web Challenge 2003 Applications

The additional goal defined to SWC 2003 was that the applications should integrate at least two heterogeneous XML data or information sources that the application's author did not manage and that allow different viewpoints. SWC 2003 had 10 submissions presented in the next sections and summarized in section 4.11 (Table 2).

The chairs of the challenge got some interesting conclusions (Klein and Visser, 2004): the ontologies were quite straightforward; RDF Schema would provide the necessary support by itself, OWL's additional expressivity would not be necessary; a few ontologies had more than 100 concepts; most of the ontologies functioned as a schema for the data, and other as guides for the users in finding information.

4.1 SEmantic portAL (SEAL)

The core SEmantic portAL (SEAL) (Maedche, Staab *et al.*, 2002) approach aims to use ontologies to manage community Web sites and Web portals. The ontology permits queries to multiple sources. In addition, the use of schema information by SEAL allows automatic generation of navigational views. The submission to SWC 2003 was not the conceptual framework SEAL itself, it was an implementation and extension of SEAL. SEAL was improved with a framework for integrating knowledge which includes five conceptual layers as it can be seen in Figure 3 (Hartmann and Sure, 2004).

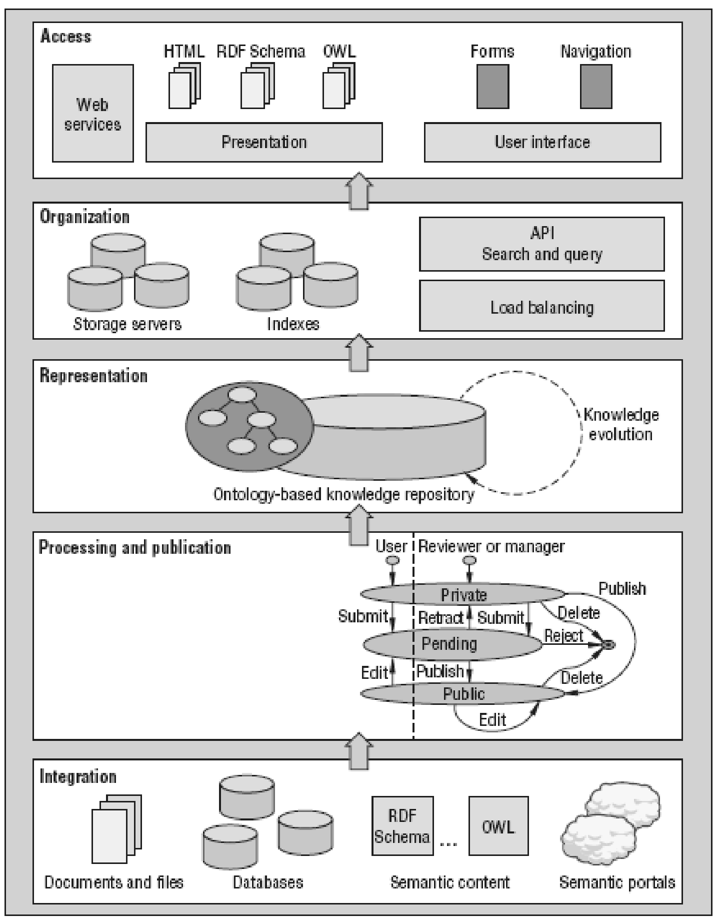

Figure 3 - The extended SEAL framework's five conceptual layers. (Hartmann and Sure, 2004)

The layers in Figure 3 can be seen as knowledge workflows, from the bottom layer (integration) to the top layer (access, for example, in a Web service).

The *integration layer* contains a set of modules, each able to handle a particular information source. The *processing and publication layer* creates content instances and provides a set of knowledge, processing methods, for example, publishing workflows. The *representation layer* uses ontologies and associated knowledge representation languages, such as RDF Schema and OWL to represent knowledge. The *organization layer* offers methods for indexing and search functionalities. At last, the *access layer* offers methods for showing content in several output formats and defines interaction interfaces (Hartmann and Sure, 2004).

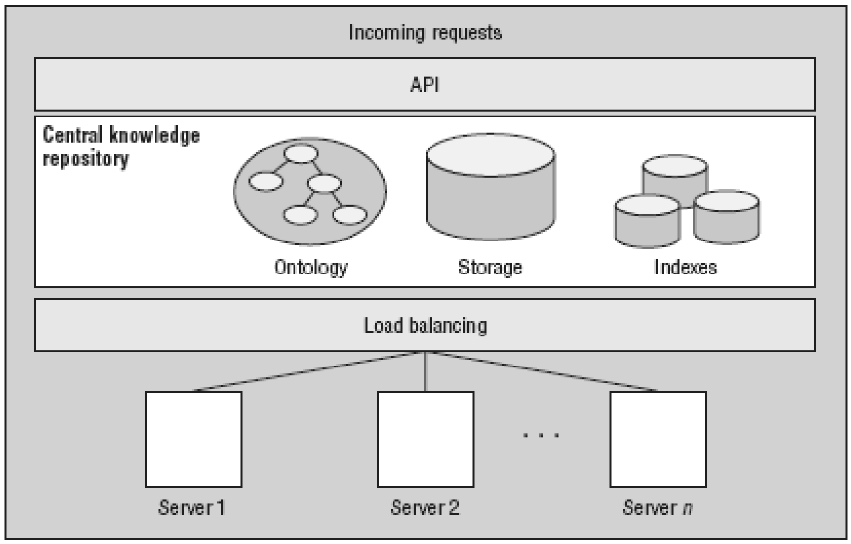

Figure 4 – SEAL Knowledge organization. (Hartmann and Sure, 2004)

As an example of the improvements in the core SEAL, in Figure 4, the architecture of a scalable storage mechanism to set up distributed servers in a cluster for handling several requests is presented.

4.1.1 Hypothetical Categories

From the user point of view, the extended SEAL is a ***Portal*** since it offers the browsing and search facilities. Considering a developer’s point of view, it could also be a ***Framework*** since a developer could implement some points as hot and frozen spots. For example, the output and input format in the *access layer* and in the *integration layer* could generate or accept other kind of files such as graphics or maps.

4.2 Drug Ontology Project for Elsevier (DOPE)

The Drug Ontology Project for Elsevier (DOPE) provides access to multiple lifescience information sources through a single and innovative user interface. The interface relies on a thesaurus-based search system that was developed. The system uses automatic indexing, RDF-based querying, and concept-based visualization. (Stuckenschmidt, van Harmelen *et al.*, 2004)

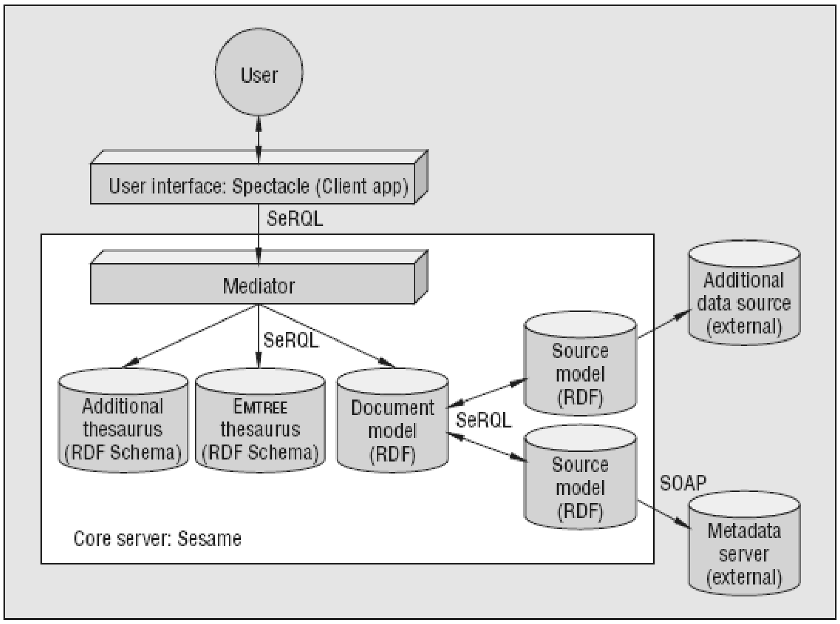

Figure 5 - Basic schematic of the DOPE architecture (protocols and data formats are in parentheses) (Stuckenschmidt, van Harmelen *et al.*, 2004)

Figure 5 depicts DOPE's architecture. The *DOPE Browser* provides the user interface, which is an interface that guides users in exploring the information space and presents the query results in a structured way. The browser makes querying and navigation "transparent" to user, while abstracting the several data sources involved or the mappings used to integrate them.

The *DOPE Browser* uses Aduna's thesaurus-driven, interactive visualization technology, the Spectacle Cluster Map (Fluit, Sabou *et al.*, 2005) for creating overviews and navigating the information. The user interface communicates, through the Sesame Query and Transformation Language (SeRQL) (Broekstra, Kampman *et al.*, 2002), with an *infrastructure* to mediate between the information sources, thesaurus representation and external document metadata that was implemented using the RDF repository Sesame (Broekstra, Kampman *et al.*, 2002).

4.2.1 Hypothetical Categories

From the user point of view, the browser seems to communicate only with the *DOPE Mediator*. Moreover, because of the functionalities offered (navigation and search) it seems to be a ***Portal***. Considering a developer's point of view, the DOPE architecture is a Sesame application or repository. Better, it is an ***Instance of a Framework***. What differentiates this work from other portals is the treatment given to data, that undergone a certain pre-processing, before getting into the repository.

4.3 SEmantic COllaboration (SECO)

SEmantic COllaboration (SECO) is an infrastructure of mediators that allows agents to access data that is potentially spread across the Web (Harth, 2004).

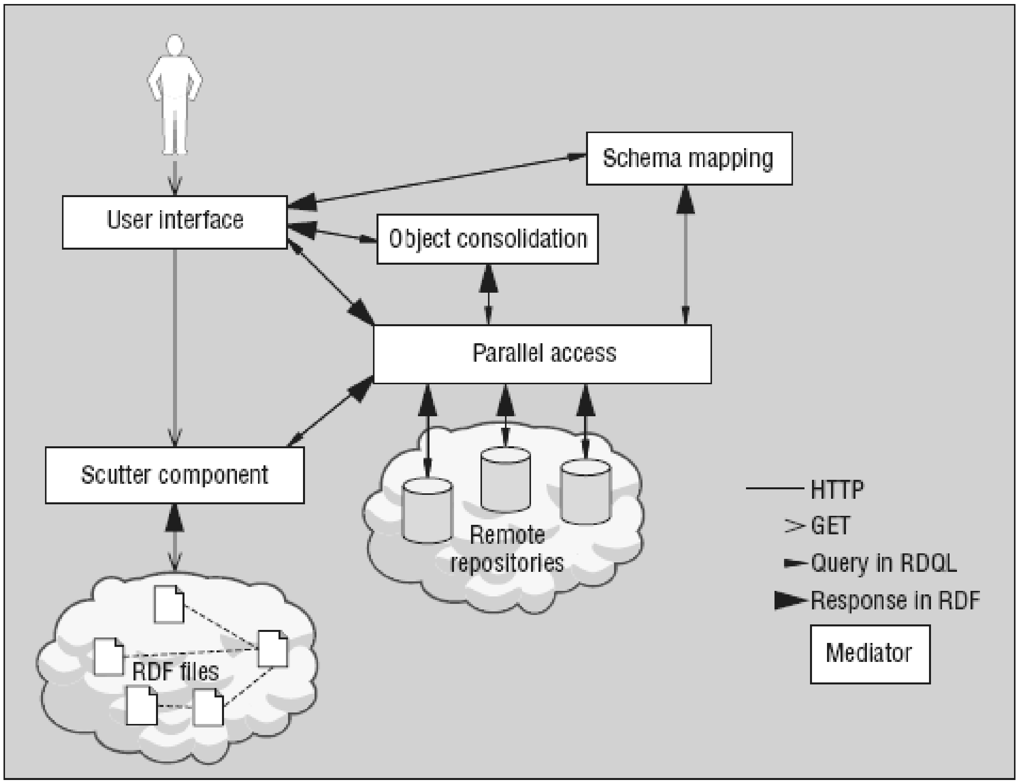

Figure 6 – SECO's Architecture (Harth, 2004).

In Figure 6 we present the architecture of SECO. SECO's components, or mediators, are interposed between databases and other information sources. Once all data sources are queryable, SECO obtains the needed data from repositories and integrates them on demand. The *scutter component* acts as an aggregation mediator that gathers RDF files from the Web, aggregates them, and enables software agents to query the RDF data set using a remote query interface. A mediator provides *parallel access* to all available data repositories. Other mediator services consolidate instances (*object consolidation*) and perform *schema mapping* based on an inference engine. The *interface* lets users browse the integrated data.

4.3.1 Hypothetical Categories

From the user point of view, the SECO user interface offers browsing (listing) and keyword search functionalities, and the output is an HTML. Therefore, SECO is a ***Portal***. Considering a developer's point of view, it could also be a ***Mediation Infrastructure*** between users' queries and scattered information sources consolidated combining warehouse functions and virtual integration (schema mapping).

4.4 Annotated Terrestrial Information (AnnoTerra)

Annotated Terrestrial Information[15] (AnnoTerra) is a prototype knowledge-based system that uses Semantic Web technologies to offer enhanced earth science news feeds by doing focused semantic searches on NASA resource catalogs using earth science concepts and relationships. AnnoTerra users receive, as result, an improved news feed with a list of system-determined data sets related to each news item. (Ramagem, Margerin *et al.*, 2004).

Figure 7 illustrates AnnoTerra's components. They are:

- The Earth Observatory which provides news feeds;
- The Global Change Master Directory[16] (GMCD);
- Earth Observing System ClearingHouse (ECHO);
- An ontology for each of the previous components, respectively:
  - ♦ Earth science ontology;
  - ♦ GCMD DIF ontology; and
  - ♦ ECHO DIF ontology.

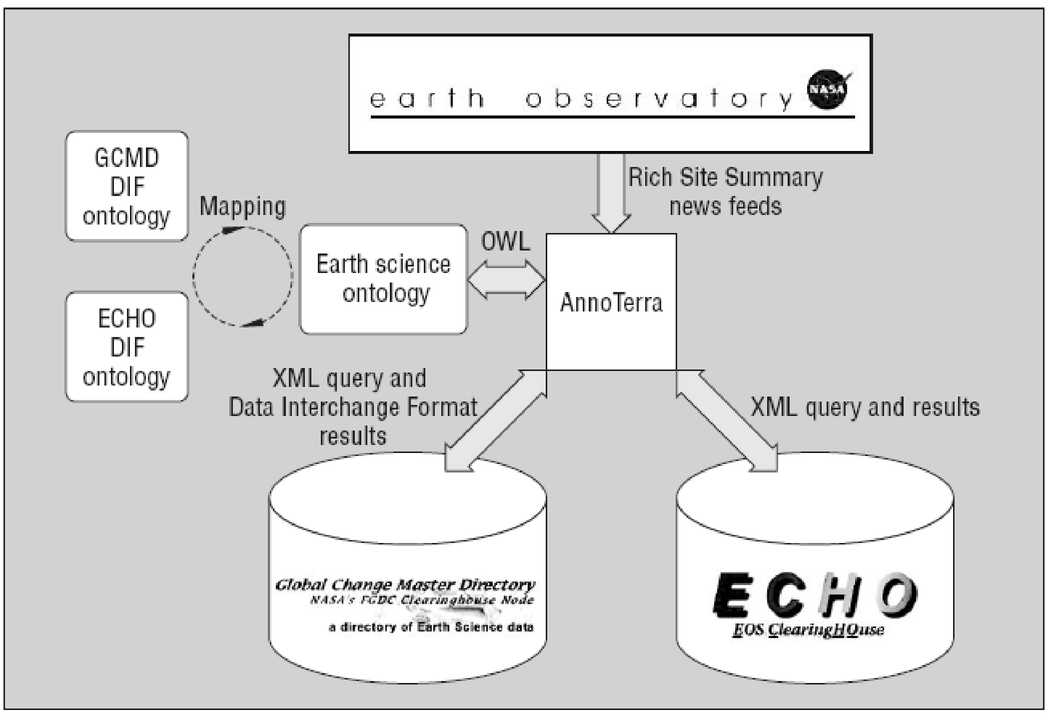

Figure 7 - AnnoTerra's components (Ramagem, Margerin *et al.*, 2004).

- The AnnoTerra component itself, which processes the news feeds to extract meaningful keywords from textual information. It then performs semantic searches using those keywords, which are mapped to concepts in an ontology, in the GCMD for potentially relevant resources (for example, data set descriptions, images, documents etc.). The retrieved items are mapped from GCMD to ECHO

15 AnnoTerra - http://annoterra.ssaihq.com/about.html – accessed: 18/07/2005 on Google's cache.

16 GMCD - http://gcmd.nasa.gov - accessed: 16/0/2005

using an ontology. The mapped items are then used to search ECHO's catalog for data sets. Consequently, the developers reached the integration of GCMD and ECHO through ontologies by asserting direct and indirect equivalencies between the concepts and data structures and between the data elements themselves.

4.4.1 Hypothetical Categories

From the user point of view, AnnoTerra offers a "value aggregation" to news feeds. It does not seem to be a Portal, since it does not offer browsing or search features. However, it aggregates information to data that the user is browsing. Therefore, AnnoTerra can be a ***Feature of a Portal***, specifically on its case, the feature is focused on news feeds enhancement with "geo-data". Considering a developer's point of view, we could classify it as a ***Mediation Infrastructure*** between news feeds accessed by users and ***"geo-data" sources*** integrated through mappings.

4.5 Building Finder

Building Finder combines satellite imagery, geospatial data, and structured and semi-structured data from diverse online data sources using Semantic Web technologies. Users can query an integrated view of these sources and request Building Finder to superimpose buildings and streets obtained from various sources on satellite imagery (Michalowski, Ambite *et al.*, 2004). Users can navigate through the Building Finder interface manually or have agents to query the application using RDF Data Query Language (RDQL).

To integrate semantically heterogeneous information from various data sources, Building Finder uses a number of technologies (Michalowski, Ambite *et al.*, 2004):

- Machine-learning techniques for converting traditional legacy Web sources and databases into Web services;
- A record linkage system for integrating data from various sources referring to a single entity;
- A mediator system providing uniform access to data from various Web services;
- An efficient execution system for information-gathering agents;
- RDQL and RDF formalisms for representing queries and query results respectively.

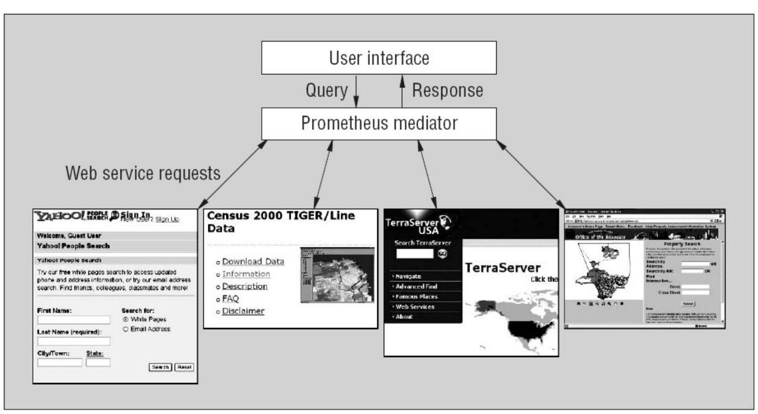

Figure 8 - Mediator execution (Michalowski, Ambite *et al.*, 2004).

In Figure 8, it is possible to see a general representation of the Building Finder application. It is, in a simple way, composed by:

- A mediator: its goal is to provide unified access to diverse data sources;
- Data sources that are adapted into Web Services, using machine-learning techniques, by wrappers;
- A user interface.

Building Finder uses the Prometheus (Thakkar, Ambite *et al.*, 2003) mediator. Prometheus runs over Theseus (Barish and Knoblock, 2002) to be able to consolidate the data sources. Theseus is an execution platform for information agents, which was augmented with underlying technologies initially developed for Active Atlas (Tejada, Knoblock *et al.*, 2002), a record-linkage system. Active Atlas compares objects' shared attributes to identify matching objects.

Prometheus mediator is composed by three parts (Figure 9):

- A data model;
- A query reformulation component;
- A query execution component using the Datalog to Theseus converter.

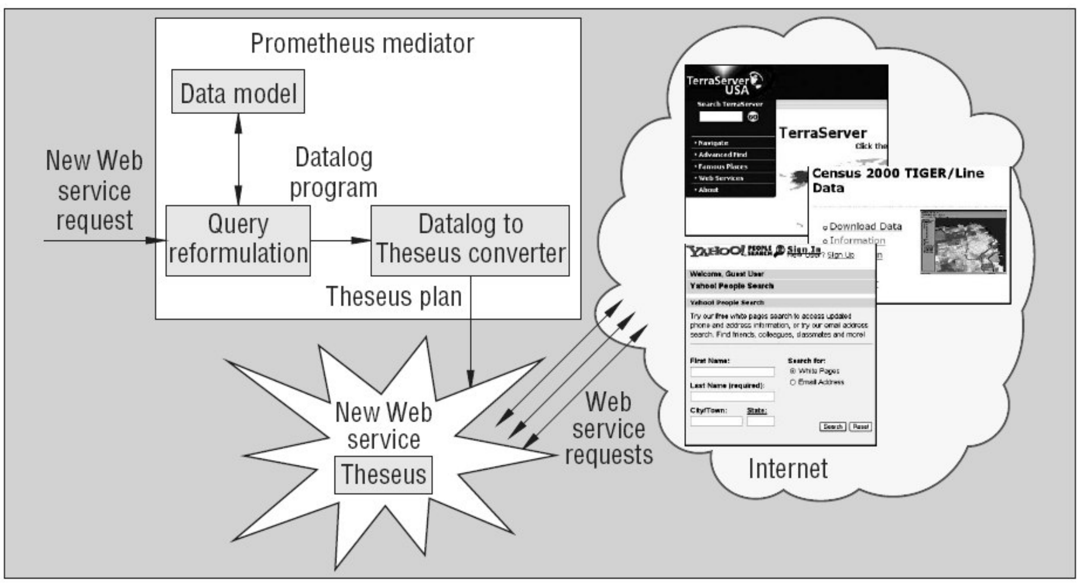

Figure 9 - Mediator architecture (Michalowski, Ambite *et al.*, 2004).

The mediator recognizes queries on any arrangement of domain predicates. On receiving a query, the mediator combines it with the domain model to produce a Datalog program that can respond to the user query. The mediator then executes the produced program to find the results of the user query using the Theseus execution engine. For example, the Datalog converter receives a request in RDQL format from the user interface and converts it to a correspondent Datalog query. When it receives this query from the Datalog converter, the mediator uses its domain model to generate a Theseus plan to obtain data from Web sites. It then passes the generated plan to the Theseus execution engine. In Building Finder, Theseus provides efficient execution of mediator-created information-gathering plans (Michalowski, Ambite *et al.*, 2004).

Resuming, Building Finder queries the mediator using RDQL queries, which are subsequently processed and executed. The mediator uses an internal RDQL to Datalog converter to interpret and process the query. On completing the query, the XML results produced by the mediator are converted to RDF and returned to the user. It was not clear to us which component is responsible for the conversion of the XML results: the mediator or the user interface. Therefore, we will contact the authors to clarify that question.

4.5.1 Hypothetical Categories

From the user point of view, Building Finder offers data in two levels of abstractions: through search and navigation of geospatial data interface (***"geo-data" feature***) and through RDQL queries posed by user agents. We could then consider Building Finder a ***Portal***. Considering a developer's point of view, Building Finder is providing access to spread data and geodata. We could also classify Building Finder as a ***Mediation Infrastructure*** between users' (agents or humans) queries and the scattered information sources. According to the developers, the adaptive nature of the technologies used for the consolidation and the use of machine-learning techniques by Building Finder makes it more flexible and easy to extend. Provided that, Building Finder can be considered a ***Framework*** where new data sources can be incorporated.

4.6 Semblog

Semblog developers are concerned not only about information handling on the Web (collect, create and donate information). They are also interested in communication handling (relate, collaborate and present people). For that purpose, they go into the "Weblog field" trying to provide a smooth path using classic Web and Semantic Web technologies. For more information about Weblogs please refer to (Blood, 2002). We detail some of the Weblog-specific terms used in this section in section 9 (

Acronyms and Vocabulary).

Takeda and Ohmukai divided the architecture of Web systems in four layers (Figure 10 and Figure 11) from the metadata point of view:

- Format;
- Management;
- Aggregation; and
- Application (Takeda and Ohmukai, 2005).

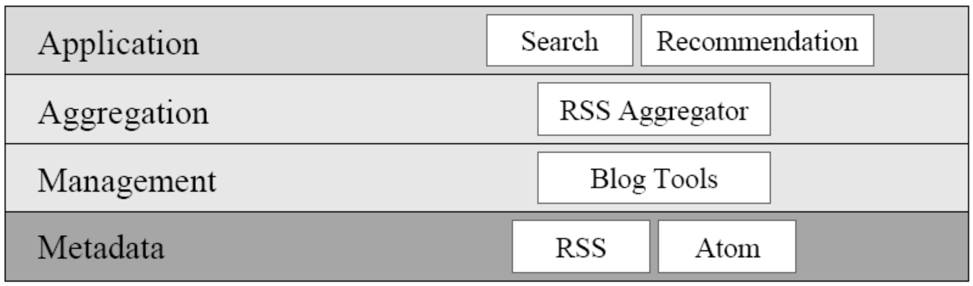

Figure 10 – Weblog Architecture (Takeda and Ohmukai, 2005).

In Figure 10, the developers of Semblog present the Weblog technologies and tools for each layer. In Figure 11, the developers show the semantically enhanced tools and technologies proposed by Semblog, as well a distinction between the content and social relationship aspects.

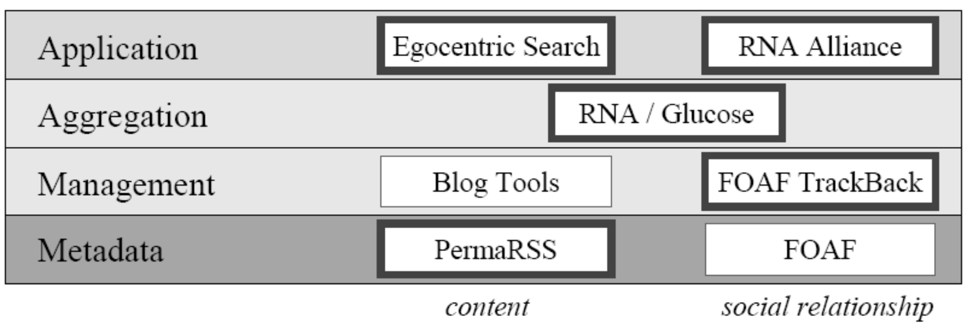

Figure 11 – Semblog Architecture (Takeda and Ohmukai, 2005).

In Semblog, the metadata on person and interpersonal relations plays a role on including activities on the communication level. The boxes with thicker borders are the ones proposed by the developers of the project. Those proposals are summarized bellow (Takeda and Ohmukai, 2005):

- PermaRSS is not defined on the works read;
- RNA is a Web-based RSS aggregator written with Perl;
- Glucose is developed to support information distribution process coordinating with RNA;
- RNA also has an interface for FOAF management to extend social network easily. This method is called "FOAF Track-Back";
- RNA Alliance is a content recommendation system based on cooperation of multiple RNAs;

- Egocentric Search is not defined on the works read.

More information about this application is necessary, but we could not find more publications about it yet. Therefore, we will contact the authors in order to try to get that information. We will do that in the future because, while we analyze the other aspects (data meaning, information sources and applications), doubts that are more concrete should emerge as well as a better understanding of the aspect(s) under analysis.

4.6.1 Hypothetical Categories

From the user point of view, Semblog offers a "value aggregation" to the Weblog field. It is not a "traditional" weblog, since, besides other improvements, it is concerned about the social relationships using FOAF. We can then consider Semblog as a set of ***Semantic Features of a Weblog***. Considering a developer's point of view, a deeper study is necessary to find out if this architecture of four layers could be applied to other Semantic Web applications in general (***Framework***), and, specifically, to collaborative applications (***Groupware***).

4.7 CS AKTive Space

CS AKTive Space (CAS) is a Semantic Web application that provides an integrated information overview of university-based Computer Science researchers, their works and their localization in the United Kingdom (UK). When developing the application, the authors had to face up quite a few pragmatic challenges and decisions related to the Semantic Web: acquiring content, developing ontologies to mediate heterogeneous data sources, developing scalable RDF storage and query facilities, semantically directing interaction design, and facilitating knowledge-processing services over the harvested content (Shadbolt, Gibbins *et al.*, 2004).

Figure 12 presents the CAS system's core as a collection of Web services that communicate via HyperText Transfer Protocol (HTTP) and collaborate to provide the knowledge capabilities that the user interface requires.

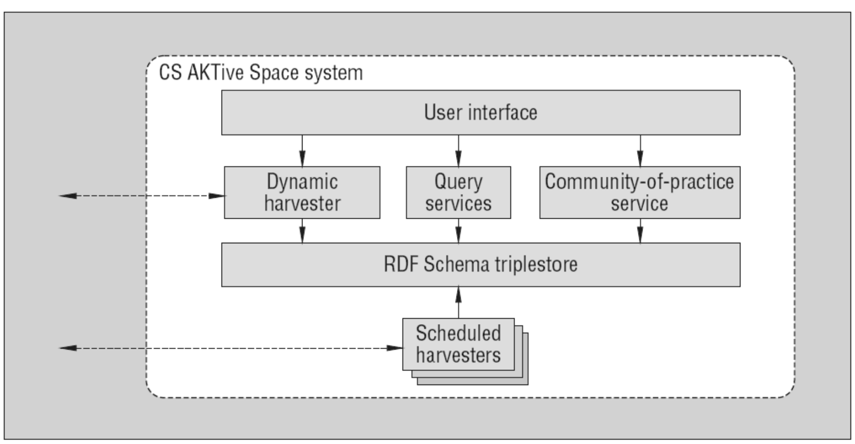

Figure 12 - Component interactions in the CAS system (Shadbolt, Gibbins *et al.*, 2004).

CAS has five main service types (Shadbolt, Gibbins *et al.*, 2004):

- 3store: is the RDF Schema triplestore (knowledge base), which evaluates queries and performs simple inferences on the information the system uses;

- Scheduled harvesters: the harvesters extract information from Web sites, databases, spreadsheets, and other information sources, convert it into RDF using an appropriate ontology, and assert it into the triplestore;
- Dynamic harvester: this service takes instances that are underpopulated in the knowledge base (3store) and produces more knowledge about them;
- Community-of-practice service: is "Ontocopi". It uses ontological network analysis to discover connections between the objects that the ontology only implicitly represents;
- Geographic visualizer: this service provides a graphical representation of the geospatial information in the ontology (the locations of institutions of interest) and lets the user directly specify geographical constraints.

The query services type is not described as one of the five main service types, however it provides a kind of query preview (Plaisant, Shneiderman *et al.*, 1999). CAS supports the exploration of the domain space through complex underlying queries represented by the simple relations expressed in columns. This facilitates users' contextual exploration of the domain via rapid selections of instances within columns.

4.7.1 Hypothetical Categories

From the user point of view, the CAS user interface offers browsing and query functionalities, and the output is an HTML. Therefore, we can consider CAS a ***Portal***. Furthermore, the Geographic Visualizer service adds a ***"geo-data" feature*** to the application. Considering a developer's point of view, the Web services that compose CAS are harvesting the UK research sites to integrate the data about the researchers, their projects etc. We could also classify CAS as a ***Mediation Infrastructure*** between users' (researchers, or funding councils etc.) queries and scattered information sources.

4.8 Semantic Web for Earth and Environmental Terminology (SWEET)

To support potential Semantic Web activities, a collection of ontologies for the Earth and environmental sciences and supporting areas were written by Semantic Web for Earth and Environmental Terminology (SWEET) developers. SWEET is one of them.

The developers used those ontologies in a prototype search tool that improves performance by creating additional relevant search terms based on the underlying semantics. They demonstrate how such a knowledge base can be "virtual" by adding a wrapper around remote, dynamic data repositories. The search tool consults the SWEET ontology to find related terms. These terms may be synonymous (same as), more specific (child of), or less specific (parent of) than those requested. The tool then submits the union of these terms to the Global Change Master Directory (GCMD) search tool and presents the results (Raskin).

More information about this application is necessary, but we could not find more publications about it yet. Therefore, we will contact the authors in order to try to get that information. We will do that in the future because, while we analyze the other aspects (data meaning, information sources and applications), doubts that are more concrete should emerge as well as a better understanding of the aspect(s) under analysis.

4.8.1 Hypothetical Categories

From the user point of view, SWEET offers a "value aggregation" to queries "restricting or broading" them with geo-terminology from GCMD (**"geo-data" feature**). Since SWEET does not offer a browsing feature, it does not seem to be a Portal in a "traditional sense", which offers browsing and searching features. However, it aggregates information to data that the user is searching. We could then consider SWEET approach as a ***Feature of a Portal***, specifically on its case, the feature focuses on queries enhancement with "geo-terminology". Considering a developer's point of view, we could also classify SWEET as a ***Mediation Infrastructure*** between queries requested by users and "geo-terminology" (**"geo-data" sources**).

4.9 BioInformatics

We could not find a publication about the application. However, there is the description of the BioInformatics submission to the SWC. In this description, the developers claim that the project applies Semantic Web technologies to integrate eight Web-based biological information sources for a sequence analisys service and search. A Web wrapper agent wraps the information sources as Web services. An ontology of agents is built so that it can represent the query answering power of each agent by specifying their input and output in RDF.

More information about this application is necessary, but we could not find more publications about it yet. Therefore, we will contact the authors in order to try to get that information. We will do that in the future because, while we analyze the other aspects (data meaning, information sources and applications), doubts that are more concrete should emerge as well as a better understanding of the aspect(s) under analysis.

4.9.1 Hypothetical Categories

As we do not have a formal publication, we are not trying to categorize this submission.

4.10 GeoShare

GeoShare is a cooperative project that intends to help the user: being she a professional of spatially referenced data, who needs to know which server contains the data and in which format; or a nonprofessional, such as a tourist, who would prefer digital maps presenting the requested information.

The GeoShare Network (Figure 13) employs a set of distributed, Web-based geoservices (Hübner, Spittel *et al.*, 2004).

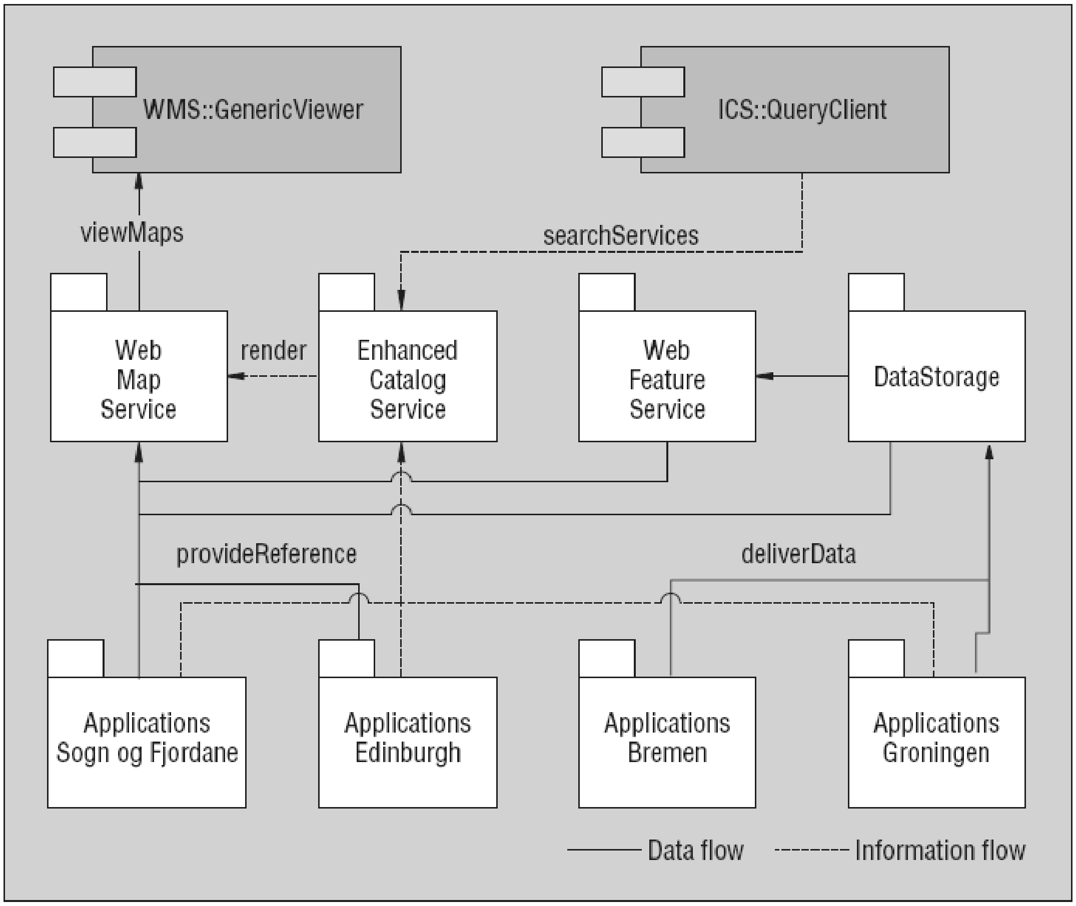

Figure 13 - The GeoShare Network (Hübner, Spittel *et al.*, 2004).

Figure 13 presents a group of basic services that forms the backbone of the GeoShare Network. This service group consists of (Hübner, Spittel *et al.*, 2004):

- GeoShare DataStorage: A storage service that lets the project partners store geodata in several databases and data formats;
- GeoShare Web Feature Service: A service to provide full access to geodata stored in the GeoShare DataStorage or other data stores;
- GeoShare Enhanced Catalog Service: An online data catalog that provides search functionality and facilitates access to the Network's applications, services, and data; and
- GeoShare Generic Viewer (in combination with cascading Web Map Service): A tool to visualize digital maps individually or in an integrated, layered view.

Figure 14 depicts the Geoshare Enhanced Catalog Service. The search module supports the specification of queries of the type *concept @ location* ***in*** *time.* That would explain the reasoners presented in Figure 14.

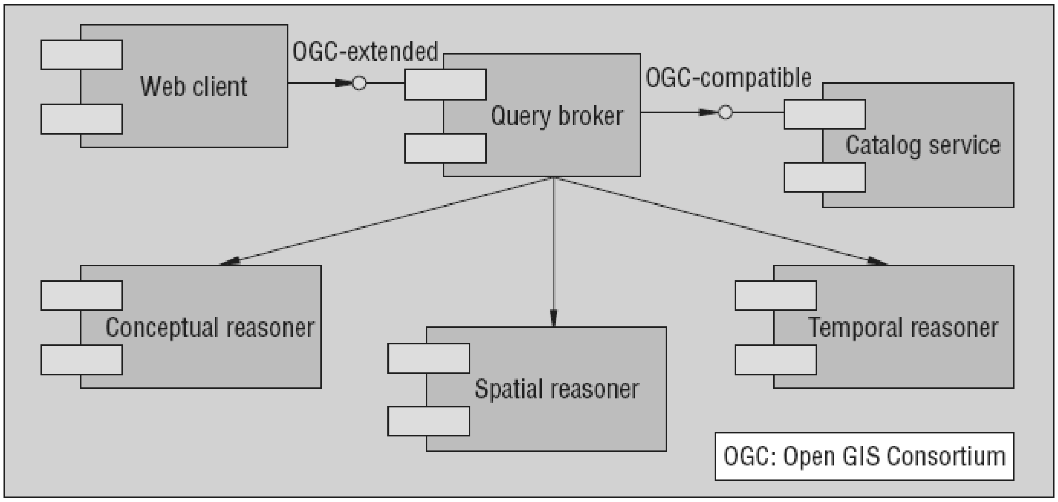

Figure 14 - The GeoShare Enhanced Catalog Service (Hübner, Spittel *et al.*, 2004).

The GeoShare Enhanced Catalog Service goal is to be able to resolve complex information requests. Therefore, the service integrates two components: a standard Open Geospatial Consortium (OGC)-compliant catalog service and the Bremen University Semantic Translator for Enhanced Retrieval (BUSTER) as a tool to specify complex, knowledge-based queries (Hübner, Spittel *et al.*, 2004).

4.10.1 Hypothetical Categories

From the user point of view, GeoShare offers data in two levels of abstractions: for professional users of spatially referenced data and for nonprofessional users in the form of digital maps (***"geo-data" feature***). We then could consider GeoShare a ***Portal***. Considering a "professional user" and a developer's point of view, the Web services that compose GeoShare are providing access to spread geodata about the North Sea region. So, we could also classify GeoShare as a ***Mediation Infrastructure*** between users' (professionals or nonprofessionals) queries and the scattered information sources. A deeper study of the architecture and the implementation is necessary to check if the exchange, or customization, of GeoShare services or the standard used (OGC) is possible, resulting in a ***Framework*** for ontology-based search for interactive digital maps.

4.11 SWC 2003 Summary

In Table 2, we present the applications submitted to 2003's challenge and our proposal of hypothetical categories for each of them. In the previous sections, we presented a brief explanation about each SWAPp and a first speculation about the categories it belongs.

Table 2 – SWC 2003 Summary

Applications		Hypothetical Category
1	SEmantic portAL (SEAL)	Portal, Framework
2	Drug Ontology Project for Elsevier (DOPE)	Portal, Instance of a Framework
3	SEmantic COllaboration (SECO)	Portal, Mediation Infrastructure
4	Annotated Terrestrial Information (AnnoTerra)	Feature of a Portal, Mediation Infrastructure, "Geo-data" Sources
5	Building Finder	Portal, "Geo-data" feature, Framework, Mediation Infrastructure
6	Semblog	Semantic Features of a Weblog, Framework, Groupware
7	CS AKTive Space	Portal, "Geo-data" Feature, Mediation Infrastructure
8	Semantic Web for Earth and Environmental Terminology (SWEET)	Feature of a Portal, "Geo-data" Feature, Mediation Infrastructure, '"Geo-data" Sources
9	BioInformatics	Unknown
10	GeoShare	Portal, "Geo-data" feature, Framework, Mediation Infrastructure

The categories represented in 2003 were:

- "Geo-data" Feature;
- "Geo-data" Sources;
- Feature of a Portal;
- Framework;
- Groupware;

- Instance of a Framework;
- Mediation Infrastructure;
- Portal;
- Semantic Features of a Weblog;
- Unknown.

5 Semantic Web Challenge 2004 Applications

SWC 2003 applications used simple and shallow ontologies, and then the organizers set up the additional goal to SWC 2004 based on that observation. The additional goal was to show the benefits of the inference capabilities of the Semantic Web languages used by the applications. SWC 2004 had 18 submissions presented in the next sections and summarized in section 5.19 (Table 3).

The organizers of the challenge saw an increase in the use of reasoning in applications. However, most of the applications did not take benefit from inference capabilities, such as automatic classification or satisfiability checking (Klein and Visser, 2005).

5.1 DBin

DBin is a platform to build "Semantic Web Peer-to-Peer (P2P) communities". DBin establishes a use case where users can benefit from an assortment of semantic based activities such as browsing or intelligent interaction with the local media and files. DBin is composed of a number of experimental units to deal with specific kind of metadata (audio metadata extraction, textual analysis, desktop integration) as well as a domain oriented user interface. DBin also enables personalized trust policies to provide disregarding unwanted information (Tummarello, Morbidoni *et al.*, 2005).

Figure 15 depicts the DBin architecture (Tummarello, Morbidoni *et al.*, 2005):

- At the database level, all the information is stored as RDF;
- Also contributing to the local database (DB) is a set of modules interacting with local and remote resources;
- The RDFGrowth algorithm (Growth Agent) is able to collect RDF metadata from other peers with common interests;
- DBin domain specific applications, are called "Brainlets": Brainlets can be thought of "configuration packages" preparing DBin to operate on a specific domain (wine lovers, Italian opera fans etc.). Given that brainlets include customized user interface, the user might perceive brainlets as full "domain applications" which are run by DBin;
- The RDF DB undergoes a local trust based filtering and the resulting content, along with the data retrieved by the URI Bridge, explained later, is displayed by brainlets.

Also, as part of a "P2P community of DBin clients", there are some other units (Tummarello, Morbidoni *et al.*, 2005):

- The RDFGrowth P2P Group algorithm only exchanges pieces of RDF graphs. Therefore, some facility is needed to provide the user with actual content (images, text etc);
- Once a Uniform Resource Locator (URL) is available for a specific annotation, it is retrieved over standard HTML by the URIBridge upload/download facility;

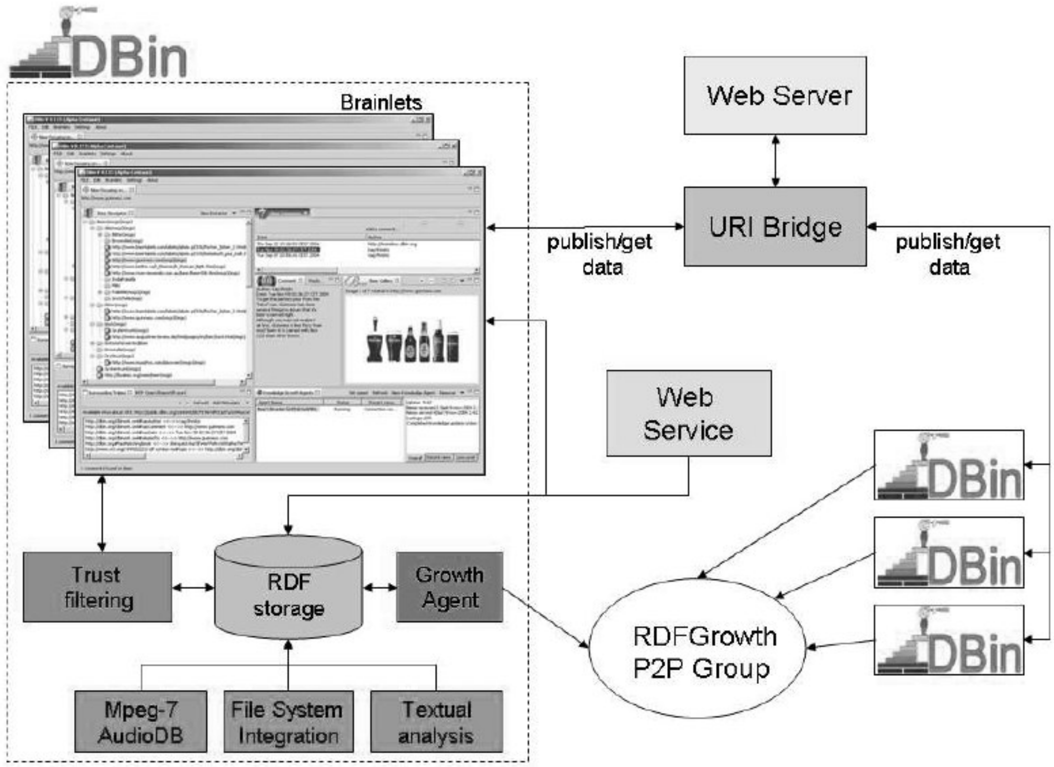

Figure 15 - A schema illustrating the overall DBin architecture and the use scenario (Tummarello, Morbidoni *et al.*, 2005).

- DBin clients exchange metadata through Growth Agents. Each DBin client, when publishing metadata referring to actual data, also makes sure this data is accessibly by publishing, if needed, in a Web space (Web Server).

5.1.1 Hypothetical Categories

From the user point of view, DBin offers a ***semantic P2P application,*** where peers exchange pieces of RDF graphs, customized for specific domains. However, we must also highlight the availability of a ***trust policy feature*** and the ***semantic growth feature***. Considering a developer's point of view, an Application Programming Interface (API) to implement the brainlets turns DBin into a kind of ***Framework*** for different semantic P2P domain-specific applications. Additionally, DBin proposes an ***architecture for semantic P2P*** applications through its semantic growth algorithms. Does the P2P feature imply that we could consider DBin a ***Groupware***?

5.2 MusiDB

MusiDB is a partial implementation of a semantic portal that combines access to multiple sources with the use of recommendation techniques. The developers focus on the use of unique representations of data objects in public repositories (in this case MusicBrainz (Swartz, 2002)) and the use of recommendation mechanisms as a basis for supporting information access (Stegers, Fekkes *et al.*).

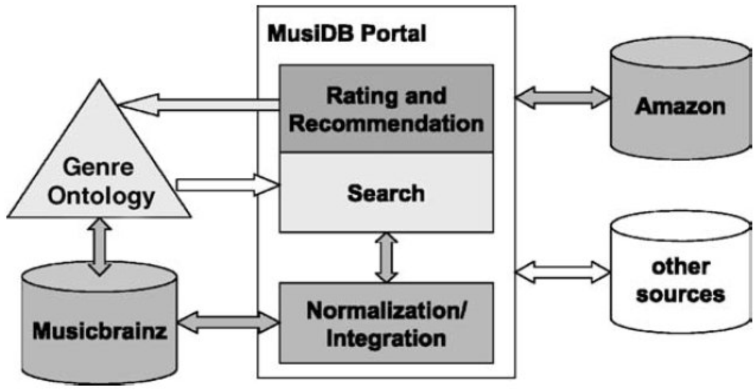

Figure 16 - Architecture of the MusiDB System (Stegers, Fekkes *et al.*).

Figure 16 depicts the architecture of MusiDB. MusiDB uses the MusicBrainz RDF database (Swartz, 2002). Therefore, the search and recommendation functionality of the system uses the information from MusicBrainz as the primary representation to find relations between artists, albums and songs to expand incomplete user queries.

The system then links content from different sources to the instances returned by MusicBrainz. In the current implementation, the system links the Amazon Web services[17] with MusicBrainz to provide a list of available albums, their content and price.

In an experimental addition to the recommender system, the developers implemented a functionality that automatically assigns artists and albums from MusicBrainz to an ontology of musical genres based on user ratings. This functionality has the potential to be used for topic based search and recommendation (Stegers, Fekkes *et al.*).

5.2.1 Hypothetical Categories

From the user point of view, MusiDB offers "value aggregation" to the users' queries. MusiDB is a ***Portal*** that also can find and add incomplete data to a user query, what we are calling, in this work, a ***Feature of a Portal.*** Specifically on the case of MusiDB, the feature is queries' enhancement with data from MusicBrainz RDF database. Moreover, the use of a ***semantic recommender feature***, based on an ontology, may help in searches and recommendations. Can we consider the semantic recommender feature a "loose" ***trust policy feature?*** A deeper study on trust policies and recommendation would answer that question, but this is not the focus of this work. Another question that arises is: with the presence of the semantic recommender feature, could we classify MusiDB as a **Groupware**? Taking into account the works analyzed so far about MusiDB, we could not classify it as a Groupware, maybe on the future when we have more information about the semantic recommender feature, we could say that. Considering a developer's point of view, MusiDB could also be classified as a ***Mediation Infrastructure*** between different that sources considering some recommendation system. A deeper study of the architecture and the implementation is necessary to check if one can customize MusiDB for different domains than digital music resulting in a ***Framework*** for ontology-based recommender systems.

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17 Amazon Web Services - http://aws.amazon.com - accessed: 16/06/2006.

5.3 The Multilingual Access to Data Infrastructures of the European Research Area (MADIERA) Portal

The intention of the Multilingual Access to Data Infrastructures of the European Research Area (MADIERA) project[18] is to develop an infrastructure for the European social science community by integrating data with other tools, resources and products of the research process. The MADIERA portal is based on three main components (Alvheim and Ryssevik, 2005):

- A common standard for data documentation developed by an international committee: Data Documentation Initiative[19] (DDI);
- The Multilingual European Language Social Science Thesaurus[20] (ELSST) that was used in the implementation of the DDI covering core concepts in social science research and methodology for nine European languages: English, French, Spanish, German, Greek, Norwegian, Danish, Finnish and Swedish;
- The Networked Social Science Tools And Resources[21] (NESSTAR) technology for making data resources available on the Web: NESSTAR is a state-of-the-art set of software tools developed to run data services at data archives.

The MADIERA Portal developed operates as a Web search engine by browsing and querying the NESSTAR Data Servers to harvest the RDF descriptions of the available statistical objects. The functionality of NESSTAR at the project initiation faced four basic aspects of the research process: resource location, metadata browsing, on-line analysis and data download.

To find and access appropriate resources, MADIERA's use of DDI and ELSST offers four different perspectives (Alvheim and Ryssevik, 2005):

- Standard keyword and free-text searching (Google™ style);
- Browsing of structured subject-oriented catalogues (Yahoo® style);
- Geographical/map-based resource location;
- Specialized search for comparative data: this feature will establish "comparability" by analyzing a range of metadata descriptors.

5.3.1 Hypothetical Categories

From the user point of view, MADIERA is a ***Portal*** offering also a ***"geo-data" feature*** if the geographical/map-based resource location is considered. It also proposes a specialized search for comparative data, and then MADIERA offers also a ***Feature of a Portal*** since the user will be offered a degree of flexibility on its queries. Considering a developer's point of view, the use of a thesaurus (ELSST) and distributed data described according to a standard (DDI) suggests that MADIERA is also at the same time a ***Framework*** and a ***Mediation Infrastructure*** depending on how coupled it is to the thesaurus and to the standard.

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18 MADIERA - http://www.madiera.net - accessed: 16/06/2006

19 DDI - http://www.icpsr.umich.edu/DDI/index.html - accessed: 16/06/2006

20 ELSST - http://www.limber.rl.ac.uk/Internal/Deliverables/D4_2_final_V2.doc - accessed: 16/06/2006

21 NESSTAR - http://www.nesstar.com - accessed: 16/06/2006

5.4 SWAP

The Semantic Web Accessibility Platform (SWAP) is a knowledge-based approach to Web content accessibility. SWAP creates alternative representations (renderings) of sites, or SWAPviews, that enable people with varied special needs to access the content.

SWAP uses annotations, which reflect extra accessibility-related information about each page. A proxy server interprets these annotations to create an enhanced user experience including basic accessibility features required by users across platforms, and by international guidelines (Web Content Accessibility Guidelines[22] - WCAG) (Seeman, 2004).

More information about this application is necessary, but we could not find more publications about it yet. Therefore, we will contact the author in order to try to get that information. We will do that in the future because, while we analyze the other aspects (data meaning, information sources and applications), doubts that are more concrete should emerge as well as a better understanding of the aspect(s) under analysis.

5.4.1 Hypothetical Categories

From the user point of view, SWAP offers extra views based on Semantic Web technologies. It seems that the user can really improve its navigation (accessibility) experience. However, the data or the perception of the data is not (semantically) affected. Considering a developer's point of view, SWAP adds ***a layer to improve users' accessibility through a "semantic" proxy***.

5.5 SemanticOrganizer

SemanticOrganizer is a collaborative knowledge management application designed to support distributed project teams of NASA scientists and engineers. Although there are several document management tools available on the market, NASA science and engineering teams have some specialized requirements that justify more specialized solutions. For a list of them, please refer to the work of Keller, Berrios *et alli* (Keller, Berrios *et al.*, 2004).

Some challenges were imposed by those requirements (Keller, Berrios *et al.*, 2004):

- To make the information easily and intuitively accessible to members of different collaborating teams;
- To develop a single application that could be rapidly customized to meet the needs of several different types of teams;
- To acquire knowledge and to do automatic ingestion of information;
- To provide rapid and precise access to repository information despite the large volume of data.

22 WCAG - http://www.w3.org/WAI/intro/wcag.php - accessed: 16/06/2006

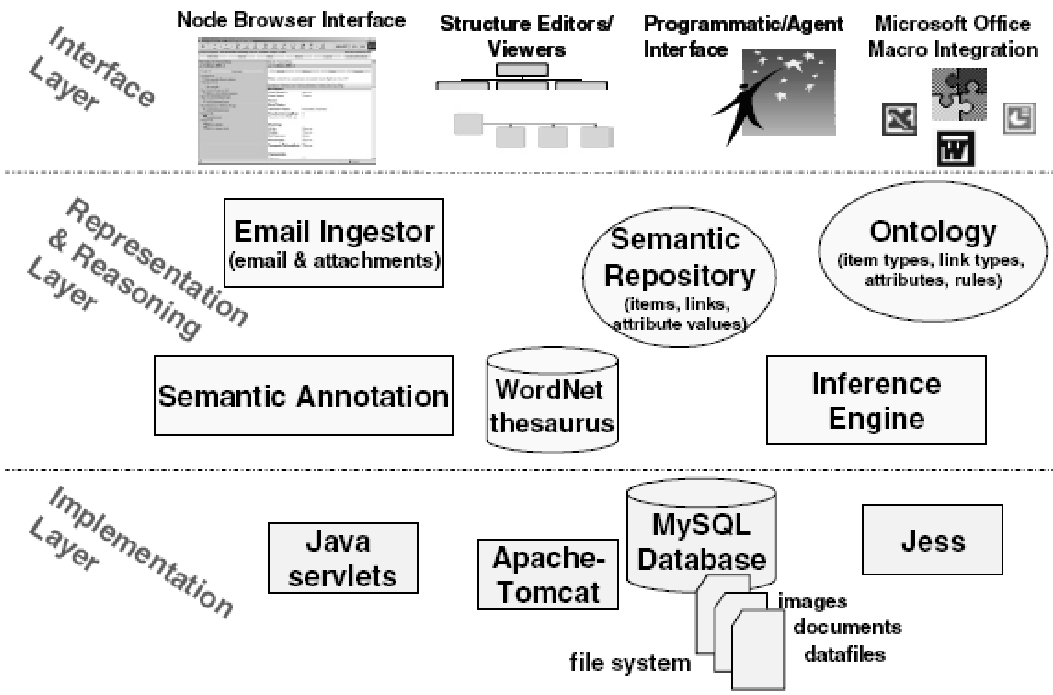

Figure 17 - SemanticOrganizer's architectural components (Keller, Berrios *et al.*, 2004).

Figure 17 depicts SemanticOrganizer's components. For conceptual clarity, in the diagram the authors differentiate between the ontology and the semantic repository. However, they implement these components using a single representational mechanism that stores both classes and instances. Even though the repository is stored on a single server, access control and ontology customization mechanisms make the repository format and content appear different for each group of users. In essence, SemanticOrganizer is a set of virtual repositories, each built upon the same representational framework and storage mechanisms, but still customized to suit the needs of its specific users (Keller, Berrios *et al.*, 2004).

5.5.1 Hypothetical Categories

From the user point of view, SemanticOrganizer is a ***Portal***. Considering a developer's point of view, we could classify SemanticOrganizer as a ***Framework*** since it offers the option of customization for each specific team requirements based on a single ontology. Semantic Organizer also presents some attractive approaches (access control and ontology customization mechanisms) that can represent some sort of ***Groupware*** approach for the design and development of customized portals for the management of projects. However, if the collaboration between users occurs, it is not clear to us yet at which level it happens. Another attractive approach is the e-mail ingestor but a deeper study of it is necessary to say if we can classify it as a ***semantic growth feature***.

5.6 Platypus Wiki

Platypus Wiki is a Personal Knowledge Management system, as well as a tool to manage Communities of Practice. Platypus Wiki represent metadata and relations between Wiki (Leuf and Cunningham, 2001) pages. It is a project enabling the collaborative editing of vocabularies and ontologies according to RDF Schema and OWL. The developers of Platypus Wiki decided to represent every RDF resource in the same way as a Wiki page. While standard Wikis use HTML links, Platypus Wiki uses RDF properties between resources to construct "labeled HTML links".

The convention chosen to represent a link to a page is namespace:pagename which can be reached with URL http://hostname/namespace/pagename/. If the user requests a URL http://hostname/namespace/pagename/index.rdf, the system returns only RDF metadata about the resources. Similarly if the user asks for http://hostname/namespace/pagename/index.html, the choice was to return only the plain HTML content without any navigation bar, page header or footer. (Tazzoli, Castagna *et al.*, 2004).

5.6.1 Hypothetical Categories

From the user point of view, Platypus Wiki is some kind of a ***Portal***. It offers data both in RDF or in HTML. Nevertheless, the most important thing may be that this portal manages knowledge being it individualized (personal) or in groups (communities of practice). Considering a developer's point of view, we could also classify Platypus Wiki as a ***Framework*** for editing knowledge information of any domain in specific representations. More specifically, Platypus Wiki deals with RDF, RDF Schema and OWL representations and their correspondents HTML "versions". For this reason, Platypus Wiki resembles a kind of "***ontology editor/tool/repository***" like Protegé, except that it is Web-based. However, Platypus Wiki inherits the collaborative feature from Wikis and so we could consider it a ***Groupware***. A question that emerges: is Platypus Wiki a ***Semantic Wiki?*** There is the need to discuss and study more such a concept.

5.7 MuseumFinland

MuseumFinland - Finnish Museums on the Semantic Web[23] is a system that presents an inter-museum exhibition of over 4000 cultural artifacts. MuseumFinland system also incorporates metadata concerning some 260 historical sites in Finland. The goals for developing the system were (Hyvönen, Mäkelä *et al.*, 2005):

- Global view to distributed collections;
- Content-based information retrieval;
- Semantically linked contents;
- Easy local content publication.

23 MuseumFinland - http://museosuomi.fi - accessed: 12/06/2006 on Google's cache.

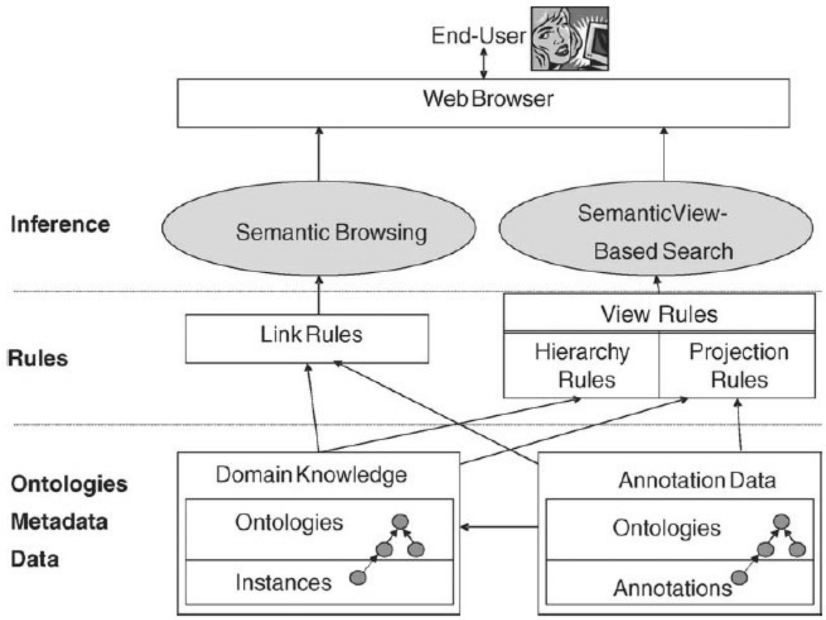

Figure 18 - Architecture of MuseumFinland on the server side (Hyvönen, Mäkelä *et al.*, 2005).

Figure 18 illustrates the architecture of MuseumFinland. The architecture separates generic search and browsing services from the underlying application dependent schemas and metadata by a layer of logical rules. According to this separation, the portal creation framework and software developed could be of use in other domains too.

MuseumFinland has been implemented by using a tool called OntoViews (Mäkelä , Hyvönen *et al.*, 2004) (The software is available at http://www.cs.helsinki.fi/group/seco/museums/dist/ in open source). OntoViews consists of the three major components presented in Figure 19.

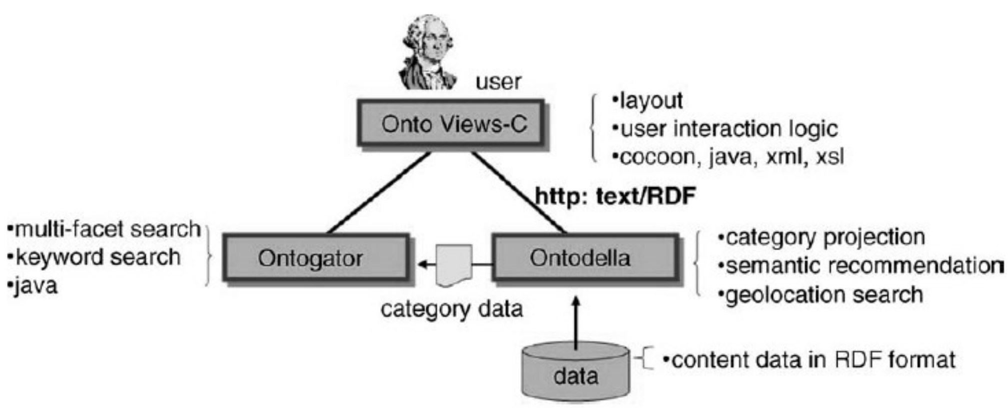

Figure 19 - The components of OntoViews (Hyvönen, Mäkelä *et al.*, 2005).

OntoViews-C component merges the services of Ontogator and Ontodella together, and provides the user interfaces. The logic server Ontodella provides the system with reasoning services, such as category view projection and dynamic semantic link recommendations; The search engine Ontogator is a generic view-based RDF search engine, responsible for the multi-facet search functionality of the system (Hyvönen, Mäkelä *et al.*, 2005).

5.7.1 Hypothetical Categories

From the user point of view, MuseumFinland is a ***Portal***, it offers browsing and search features. Considering a developer's point of view, we could consider the architecture used to implement MuseumFinland a framework since it separates search and browsing services from the underlying application dependent schemas and metadata by a layer of logical rules. Moreover, the architecture was applied to other domains as well (Laukkanen, Viljanen *et al.*, 2004) (Mäkelä , Hyvönen *et al.*, 2004). The framework would so be the OntoViews tool and not MuseumFinland. Consequently, MuseumFinland is an ***Instance of a Framework***.

5.8 Knowledge Management Platform (KmP)

The objective of the Knowledge Management Platform (KmP) project is to increase the collection of competences of the Telecom Valley of Sophia Antipolis - France by supporting actors in stating their interests and needs in a shared space. The solution relies on the specification, design, building and evaluation of an online customizable Semantic Web application (INRIA).

This Web application relies on ontology-based models and inferences; and merges the frameworks of the Semantic Web (RDF, RDF Schema), the classic Web (HTML, Cascading Style Sheets - CSS, Scalable Vector Graphics - SVG) and the structured Web (XML, eXtensible Stylesheet Language Transformation -XSLT) to integrate data coming from very different sources. The application allows queries from different viewpoints, adapt content to users, analyze, group, infer and render indicators of the Telecom Valley situation (INRIA).

KmP relies on the integration of multiple components: databases for back-end persistence, Web servers with Java Server Pages (JSP) and servlets to provide front ends, and the CORESE Semantic Web server[24] to provide Semantic Web processing capabilities (INRIA).

More information about this application is necessary, but we could not find more publications about it yet. Therefore, we will contact the authors in order to try to get that information. We will do that in the future because, while we analyze the other aspects (data meaning, information sources and applications), doubts that are more concrete should emerge as well as a better understanding of the aspect(s) under analysis.

5.8.1 Hypothetical Categories

From the user point of view, KmP is a ***Portal***, it offers semantic browsing and search features for actors competencies. Considering a developer's point of view, we could not still evaluate the architecture due to lack of specific information (publications in English) about it. However, it is clear that the CORESE Semantic Web server plays an important role on the architecture and, consequently, a deeper study of CORESE architecture is required to better understand KmP.

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24 CORESE - http://www-sop.inria.fr/acacia/soft/corese - accessed: 16/06/2006

5.9 pOWL

pOWL is intended to be a comprehensive ontology management tool. It integrates diverse aspects of ontology management such as storage and querying, supplying an API and a collaborative Web user interface.

pOWL's architecture consists of 4 stacked tiers. The architecture tries to minimize dependencies and to supply clean interfaces between tiers. The 4 tiers are (Auer, 2005):

- pOWL store – Structured Query Language (SQL) compatible relational database back-end;
- RDFAPI, RDFSAPI, OWLAPI – layered APIs for handling RDF, RDF Schema and OWL;
- pOWL API – containing classes and functions to build Web applications on top of the previous APIs;
- User interface – a set of Hypertext Preprocessor (PHP) pages combining widgets provided by pOWL API for accessing (browsing, viewing, editing) model data in a pOWL store.

5.9.1 Hypothetical Categories

pOWL could be classified as a Web-based "***ontology editor/tool/repository***". However, pOWL is strongly "integrated" with PHP what can be at the same time an advantage, for those who already know PHP, and a drawback, for those who do not. An adaptation on this aspect could throw pOWL into the ***Framework*** category too. The authors claim that pOWL can be used in a collaborative manner to deal with ontologies, would it be appropriate to classify pOWL as a ***Groupware*** as well? A deeper study of pOWL's functionalities is necessary to confirm that.

5.10 Semantic Portal of International Affairs (SPIA)

The Semantic Portal of International Affairs (SPIA) provides semantic access (contrasting to "pure" keyword-based access) to content. In SPIA's case, a semantic access approach is provided through tools and techniques that are being developed in the context of several European and National (Spanish) research and development projects (Contreras, Benjamins *et al.*, 2004):

- Semantic search engine;
- Semantic publishing and navigation;
- Three dimensional (3D) Visualization.

To implement these features of semantic access, the components of SPIA include:

- An ontology in the domain of International Affairs;
- An automatic annotator (metadata generator), named Knowledge Parser® (Figure 20);
- A semantic search engine with a natural language interface, as well as a forms based interface;
- A publication tool for publishing semantic content on the Web, called Duontology®, enabling semantic navigation including a 3D visualization tool.

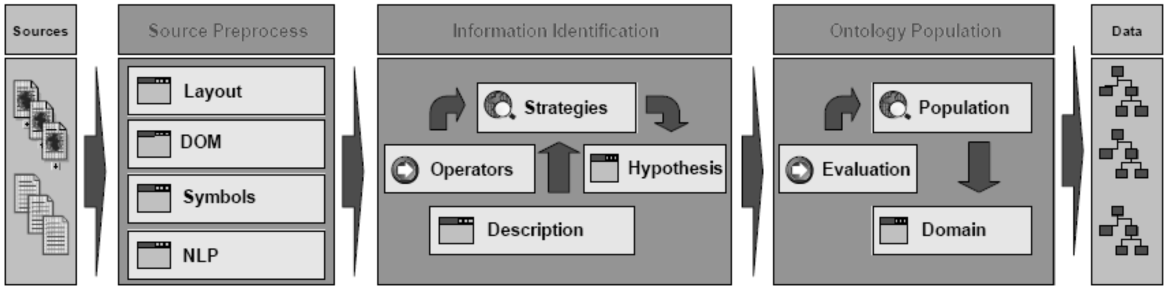

Figure 20 - Overview of the extraction and population process (Contreras, Benjamins *et al.*, 2004).

Knowledge Parser® is able to parse content and extract knowledge from it. Figure 20 presents the process executed in three main steps: Source Preprocessing, Information Identification and Ontology Population. For an extensive explanation about those steps, please refer to work of Contreras, Benjamins *et alli* (Contreras, Benjamins *et al.*, 2004).

In SPIA, the Knowledge Parser® executes two roles. The first is the wrapping of the USA's Central Intelligence Agency (CIA) World Factbook Web in order to populate the ontology with instances with information regarding countries such as their government composition, geographical data, political and commercial agreements etc. Once the process populates the ontology with instances, the Knowledge Parser® is applied to the documents provided by the Spain's Real Instituto Elcano de Estudios Internacionales y Estratégicos (Elcano Institute).

The Semantic Search Engine developed, with a natural language interface as well as a forms based interface, returns instances that constitute answers to queries instead of documents containing searched strings as traditional keyword based engines would do.

The developers of SPIA emphasize that the knowledge base as modeled by domain experts and knowledge engineers is not always a good candidate to visualize as is. Therefore, they introduce the idea of a "visualization ontology", which makes explicit all visualization rules and allows an uncomplicated interface management. This ontology will contain concepts and instances (publication entities) as perceived on the interface by the end user, and the visualization ontology will returns the attribute values from the International Relations ontology using a query. Consequently, not duplicating content (Contreras, Benjamins *et al.*, 2004).

5.10.1 Hypothetical Categories

From the user point of view, SPIA is a ***Portal*** that offers extra views based on a visualization ontology. The 3D visualization feature seems to be one of those extra views. Considering a developer's point of view, we could also classify SPIA as a ***Framework*** since it presents some points that could be adapted to be hot and frozen spots. For example, we could consider hot spots the domain and visualization ontologies if they are not strongly coupled to the other components. SPIA also presents an attractive ***metadata generation component*** that we should highlight due to the variety of techniques used by the Knowledge Parser®. The ***Semantic Search Engine*** is also of interest, but a deeper study is necessary to better understand SPIA.

5.11 Unspecified Ontology (UNSO)

Unspecified Ontology (UNSO) approach supposes that the domain ontology is not fully defined and peers can dynamically specify parts of the ontology. UNSO approach recommends a more flexible manner to describe an object. It allows constructing a multi-layered hypercube (MLH) graph topology, supporting efficient semantic routing (Ben-Asher and Berkovsky, 2004).

To reach the semantic routing, HyperCup's (Schlosser, Sintek *et al.*, 2002) hypercube graph topology was extended to a multi-layered hypercube (MLH). HyperCup proposes a scalable and efficient ontology-based graph topology to cluster peers in a P2P network. In HyperCup, a set of known ontologies is used to categorize peers as providers of particular services to efficiently route and broadcast queries (Schlosser, Sintek *et al.*, 2002). Using UNSO does not force peers to share or to use any explicit ontology (Ben-Asher and Berkovsky, 2004).

The work submitted to the challenge scrutinized the issue of implementing an infrastructure, dedicated for e-Commerce transactions over P2P networks. The service, provided by the system is insertion, searching and a matching of appropriate demand and supply ads (e-Commerce advertisements). Briefly, the main contribution of UNSO is in the notion of ontologies (as a technique for managing a dynamic set of forms) and its accompanied semantic routing (Ben-Asher and Berkovsky, 2004).

5.11.1 Hypothetical Categories

From the user point of view, UNSO seems to be a kind of P2P, or decentralized, ***Portal***: it is possible to edit metadata, as well as to navigate and to search for metadata that are stored on other peers. What differentiates this work from other portals is the distribution of data, UNSO then can be considered a ***Semantic P2P Application***. The differential feature offered by UNSO is that it not necessary to have an "integrated" or common ontology. Considering a developer's point of view, UNSO could be classified as a ***Mediation Infrastructure*** between dispersed data sources (and/or peers) and users' queries. Does this P2P feature imply that we can consider UNSO a ***Groupware***?

5.12 Semantic Web Assistant

We could not find a publication about the application. However, there is the description of the Semantic Web Assistant submission to the SWC. In this description, the developer asserts that the Semantic Web Assistant is part of a thesis submitted to the department of computer science at the University of Applied Sciences Bonn-Rhein-Sieg, Germany. The thesis explores the possibilities of a combination of Semantic Web technologies with production rule systems for letting end-users discover some of the applications of the Semantic Web.

More information about this application is necessary, but we could not find more publications about it yet. Therefore, we will contact the authors in order to try to get that information. We will do that in the future because, while we analyze the other aspects (data meaning, information sources and applications), doubts that are more concrete should emerge as well as a better understanding of the aspect(s) under analysis.

5.12.1 Hypothetical Categories

As we do not have a formal publication or the thesis, we are not trying to categorize this submission.

5.13 Swoogle

Swoogle (Ding, Finin *et al.*, 2004) intends to help human users and software agents find pertinent knowledge on the Semantic Web. The Swoogle search engine discovers, indexes, and analyzes the ontologies and facts that are encoded in Semantic Web documents (SWD) (Li, Finin *et al.*, 2005).

Rather than using one regular crawling technique to discover SWDs, Swoogle employs a fourfold strategy (Li, Finin *et al.*, 2005):

- running metasearches on conventional Web search engines, such as Google™, to find candidates;
- using a focused Web crawler to traverse directories in which SWDs have been found;
- harvesting URLs when processing discovered SWDs; and
- collecting URLs of SWDs and directories containing SWDs that users have submitted.

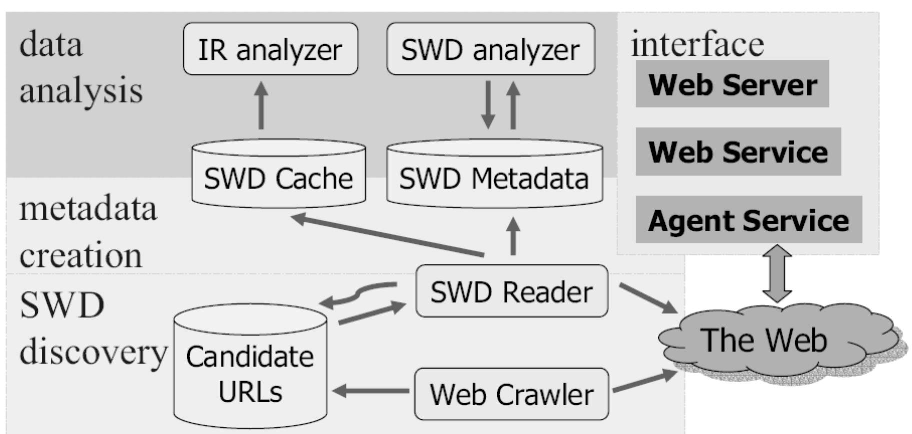

Figure 21 - The architecture of Swoogle (Ding, Finin *et al.*, 2004)

Figure 21 presents that Swoogle's architecture can be broken into four major components:

- SWD discovery;
- Metadata creation;
- Data analysis; and
- Interface.

This architecture is data centric and extensible, components work independently and interact with one another through a database (Ding, Finin *et al.*, 2004).

5.13.1 Hypothetical Categories

Swoogle has a kind of "extensible" interface. The intended audience of Swoogle are developers or Semantic Web experts, but in (Ding, Finin *et al.*, 2004), it is described the implementation of a Web interface[25], in which a "common user" can query with keywords, and the SWDs corresponding to those keywords will be returned in a ranked order. There is also the description of searches for more advanced users using Semantic Web technologies. Therefore, considering the user point of view, we can consider Swoogle a ***search engine for Semantic Web documents***. Considering a developer's point of view, Swoogle is on top of SWDs and helps finding them. We could then view Swoogle as a ***Mediation Infrastructure*** between users' queries and scattered SWDs consolidated and presented using innovative information retrieval techniques. Swoogle also would be a **Framework**, once Swoogle's authors claim its architecture to be extensible. Swoogle is on top of SWDs, however only the implementations of its extensible interface are available to users. Therefore, several customizations can take place on these implementations. For example, a customization of Swoogle for the Intranet of a company in a specific domain would be appropriate if the customized Swoogle uses specific information retrieval algorithms for that domain.

5.14 Flink

Flink has three objectives (Mika, 2005):

- To be a demonstration of the use of Semantic Web technology;
- To be a portal for any person who is interested to learn about the (work of the) Semantic Web community; and
- To have its collected data used for the purposes of social network analysis, in particular learning about the nature of power and innovativeness in scientific communities.

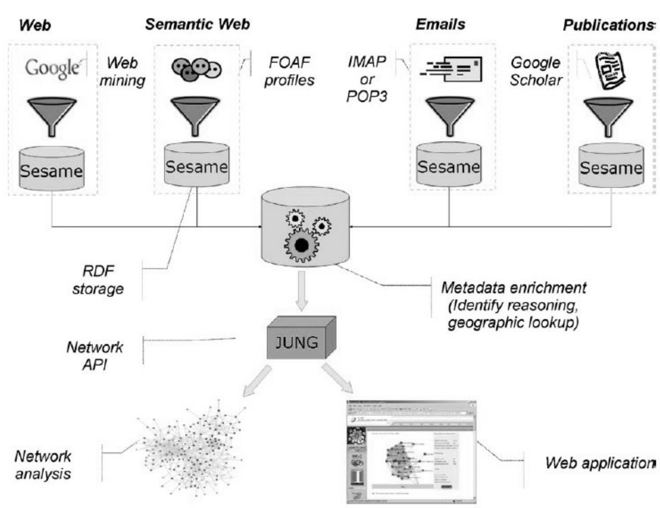

Figure 22 - The architecture of Flink from metadata acquisition (top) to the user interface (bottom) (Mika, 2005).

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25 Swoogle - http://www.swoogle.org - accessed: 16/06/2006 (it seems that this domain has been incorporated or bought by a company). We believe that the up-to-date URL is http://swoogle.umbc.edu - accessed: 16/06/2006.

The Flink's author suggests the segregation of the architecture of Flink in three layers related to metadata acquisition, storage (representation, inference and storage) and visualization as seen in Figure 22.

5.14.1 Hypothetical Categories

From the user point of view, Flink is a ***Portal,*** which does not seem to offer a search feature. It presents a social network (list) of Semantic Web researchers. At the time of writing, the list for the website was limited, due to practical implications, to those who have been Chairs, Programme Committee members and/or authors of full papers at any of the past international Semantic Web events (SWWS'01, ISWC2002, ISWC2003, ISWC2004 and ISWC2005). Considering a developer's point of view, we could consider Flink a ***Mediation Infrastructure*** between dispersed data sources and data about a person and its relationships with other people, given Flink's focus on social connectivity. A deeper study is necessary to find out how customizable the storage layer is; and more, how malleable the network API provided (JUNG) can be. Would that study be sufficient to demonstrate that Flink's architecture is a ***Framework***? A speculative idea is to carry out a deeper study of the Network Analysis area and its relationship (or similarity) with collaborative applications (***Groupware***).

5.15 Bibster

Bibster is a P2P system for exchanging bibliographic data among researchers (Haase, Broekstra *et al.*, 2004). Bibster is an instance of the Semantic Web and Peer-to-Peer Project - System Architecture (SWAPSA). For more information about SWAPSA, please refer to (Broekstra, Ehrig *et al.*, 2003) and (SWAP EU IST-2001-34103 Final Report, 2004).

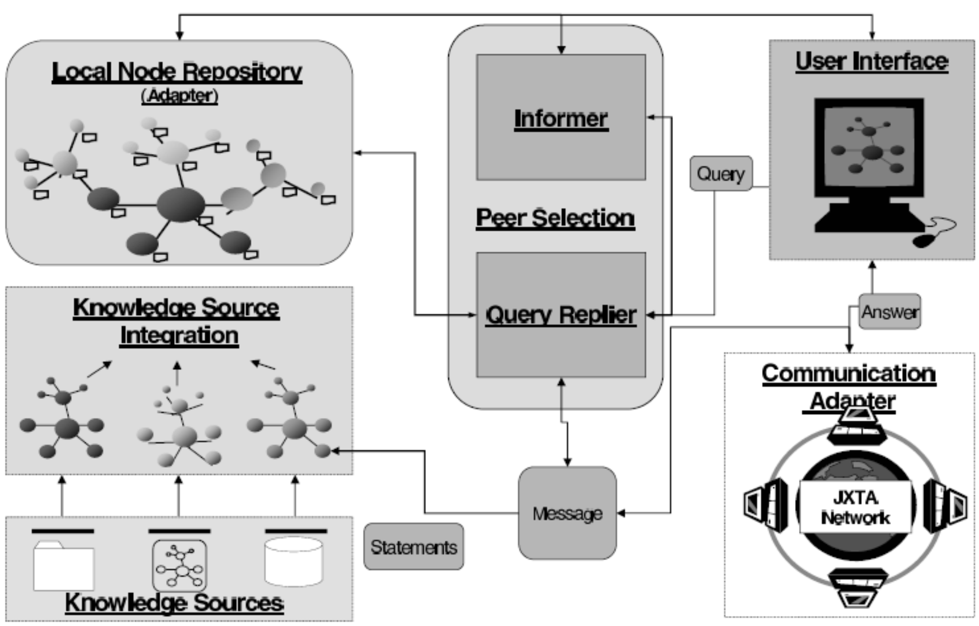

Figure 23 - SWAP System Architecture (Haase, Broekstra *et al.*, 2004).

Figure 23 shows an abstract design of the components of the architecture of a node in the P2P system. Next, the components are briefly described as instantiated for the Bibster system (Haase, Broekstra *et al.*, 2004):

- Communication Adapter: It serves for sending and forwarding queries for the rest of the system. It encapsulates all low-level communication details from other parts of the system;
- Knowledge Sources;
- Knowledge Source Integrator: The Knowledge Source Integrator extracts and integrates internal and external knowledge sources into the Local Node Repository;
- Local Node Repository:
  - ♦ Mediates between views and stored information;
  - ♦ Supports query formulation and processing;
  - ♦ Specifies the peer's interface to the network;
  - ♦ Provides the basis for peer ranking and selection.
- Informer: It proactively advertises the available knowledge of a peer in the P2P network and it discovers peers with knowledge that may be relevant for answering the user's queries;
- Query Replier: It is the coordinating component controlling the process of distributing queries. It receives queries from the user interface or from other peers;
- User Interface: The user interface allows the user to import, create and edit bibliographic metadata as well as to easily formulate queries.

5.15.1 Hypothetical Categories

From the user point of view, Bibster seems to be a kind of P2P, or decentralized, ***Portal***: it is possible to edit metadata, as well as to navigate and to search for new metadata that are stored on other peers. What differentiates this work from other portals is the distribution of data, through a P2P feature offered by SWAPSA. We can then consider Bibster a ***Semantic P2P application***. Considering a developer's point of view, we could also classify Bibster as a SWAPSA implementation. That is, an ***Instance of a Framework***. Does the P2P feature imply that Bibster, and consequently SWAPSA can be considered a ***Groupware***? Bibster could also be classified as a ***Mediation Infrastructure*** between dispersed data sources (and/or peers) and users' queries.

5.16 Mediator EnvirOnment for Multiple Information Sources (MOMIS)

Mediator EnvirOnment for Multiple Information Sources (MOMIS) is a framework that extracts and integrates information of heterogeneous sources (Beneventano and Bergamaschi, 2004). Figure 24 presents the MOMIS architecture. The MOMIS framework is based on a language and two main components (Bergamaschi, Beneventano *et al.*, 2005) :

- The ODL-I3 language that extends an object-oriented language (Object Definition Language - ODL), with an underlying Description Logic. The language is derived from the standard ODL-ODMG (Cattell and Barry, 2000);

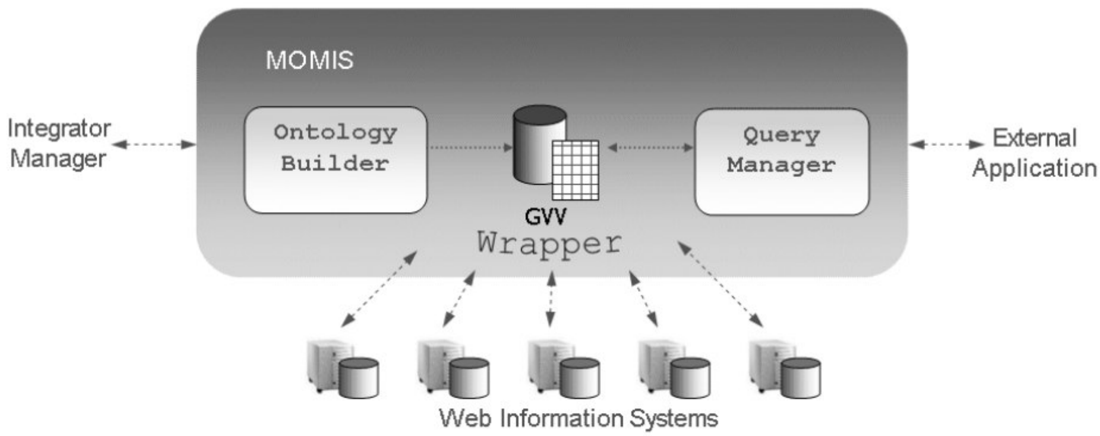

Figure 24 – The MOMIS Architecture (Bergamaschi, Beneventano *et al.*, 2005).

- The Ontology Builder; MOMIS system implements a semi-automatically data integration, developed in accordance with the Global as View (GAV) approach. The result of the integration process is a global schema, which provides a reconciled, integrated and virtual view of the underlying sources, Global Virtual View (GVV). The GVV is a collection of (global) classes that represent the information contained in the sources, and it is the result of the integration process. The GVV is then semi-automatically annotated according to a lexical ontology. The implementers of MOMIS firstly markup the local metadata descriptions and then the MOMIS system generates an annotated conceptualization of the sources. Their approach "constructs" the domain ontology as the synthesis of the integration process, despite the fact that the common approach in the Semantic Web is supported by "a priori" developed ontology (Beneventano and Bergamaschi, 2004). The information integration process for building the GVV is shown in Figure 25;

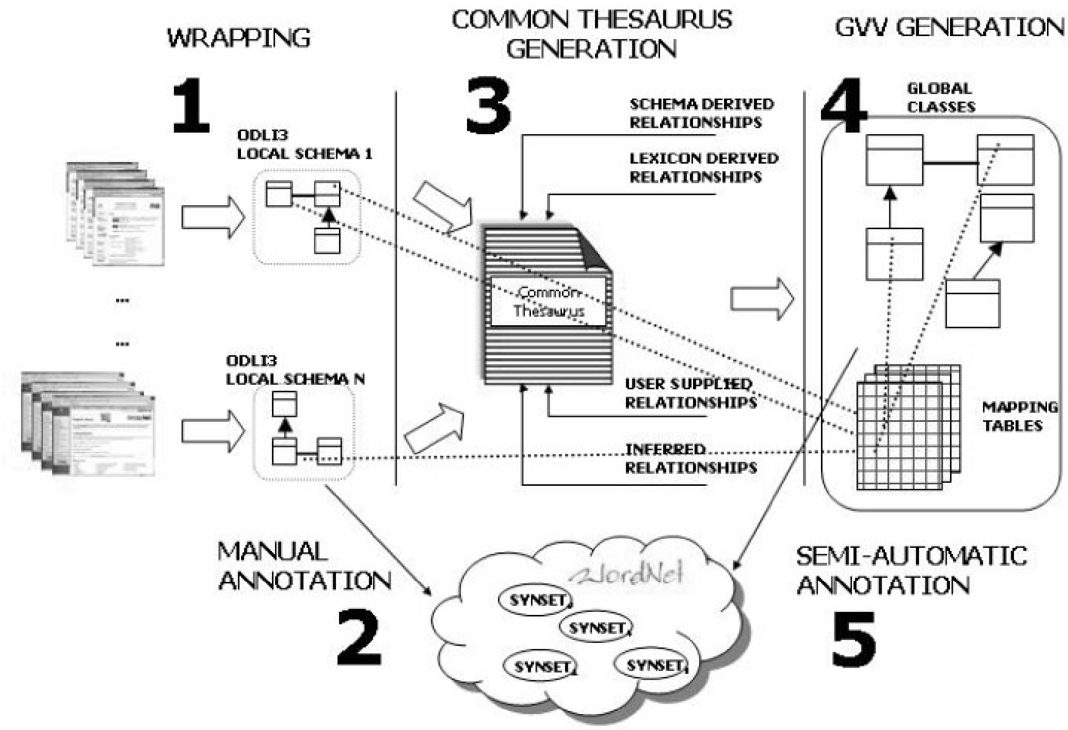

Figure 25 - Overview of the ontology-generation process. The figure shows the local schemas' generation, where local schemas are annotated according to the lexical ontology WordNet, the Common Thesaurus generation, and finally the GVV global classes. In particular, these ones are connected by means of mapping tables to the local schemas and are (semi-automatically) annotated according to WordNet.(Beneventano and Bergamaschi, 2004)

- The MOMIS Query Manager (Figure 24) is a coordinated set of functions that takes a query, decomposes the query according to the mapping of the GVV on the local data sources relevant to the query. Query Manager sends the subqueries to those data sources, collects their answers, performs any residual filtering necessary, and finally delivers the answer to the user (Bergamaschi, Beneventano *et al.*, 2005).

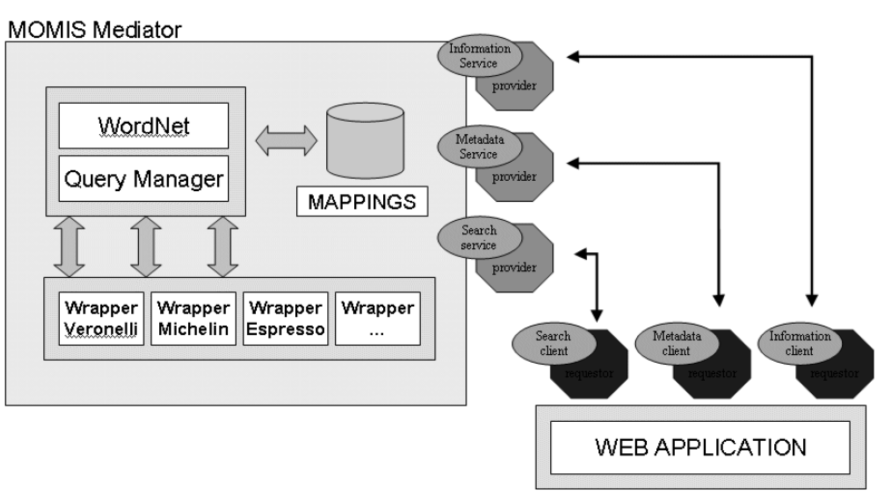

Figure 26 - The MOMIS Web services architecture (Bergamaschi, Beneventano *et al.*, 2005).

An instantiation of the MOMIS framework is a system (Figure 26) that is based on a conventional wrapper/mediator architecture, and provides methods and open tools for data management in Internet-based information systems (Bergamaschi, Beneventano *et al.*, 2005)

5.16.1 Hypothetical Categories

Considering a developer's point of view, we could classify MOMIS framework as a ***Mediation Infrastructure*** between users' queries and scattered information sources integrated using a semi-automatic methodology that follows the GAV approach, resulting in a global schema (GVV). In (Bergamaschi, Beneventano *et al.*, 2005) it is presented the new Web Services architecture for MOMIS instead of the CORBA-2 architecture used in (Beneventano and Bergamaschi, 2004). However, a deeper study is necessary to know how flexible the development of new wrappers, for different data sources, is. Moreover, how that development would influence in the Ontology Builder methodology to determine if we can really consider MOMIS a ***Framework***.

5.17 Annotea Shared Bookmarks

Annotea (Kahan, Koivunen *et al.*, 2001) is a Semantic Web based project which observed what users did naturally and opted for common metaphors for supporting better collaboration (Koivunen, 2005).

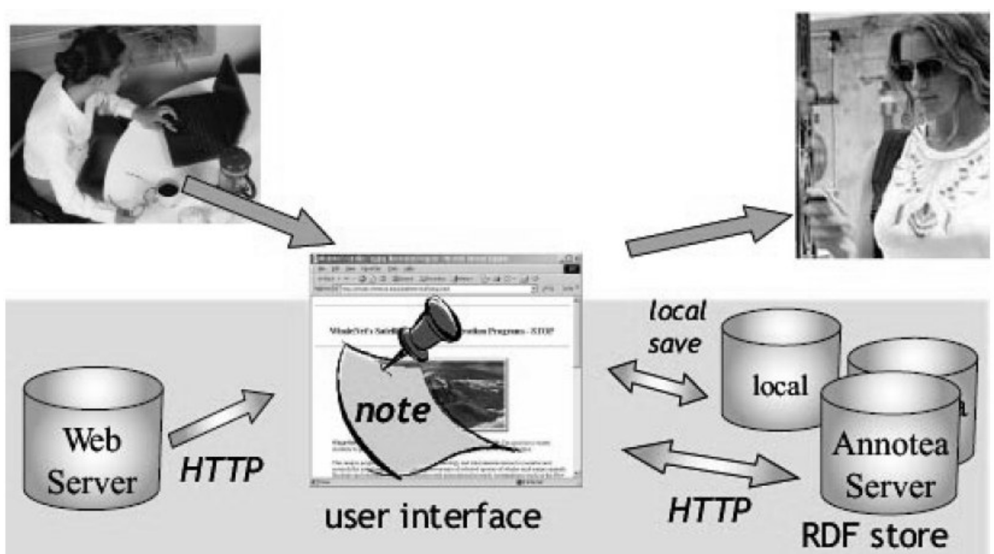

Figure 27 - The basic Annotea architecture (Koivunen, 2005).

Figure 27 presents the basic Annotea architecture. In the architecture, there are various RDF metadata repositories storing Annotea objects, a user interface providing different views to the objects in the context of the Web documents or other Web resources, and users collaborating via these objects (Koivunen, 2005).
The content of the Annotea objects can be viewed in any Web browser user interface as XML text. However, to be usable for any user the normal Web browser needs to support Annotea metaphors. For example, in Mozilla/Firefox®, the tool Annotea Ubimarks[26] provides that functionality.

26 Annotea Ubimarks - http://www.annotea.org/mozilla/ubi.html - accessed: 16/06/2006.

Annotea objects metadata can be stored locally, in Annotea servers or as published collections of Annotea objects in Web documents. The biggest direct benefit from the use of Semantic Web technologies and metadata in Annotea objects is that the user generated metadata can be easily combined and reused in several other applications, such as user profiles for services, data mining and search engine applications (Koivunen, 2005).

5.17.1 Hypothetical Categories

The user point of view will depend on the task being addressed. There are some interesting scenarios for different applications of Annotea infrastructure in (Koivunen, 2005). The schema that represents the Annotea metaphors (objects) can be customized to users' domain as well the output of the Annotea objects. We can then consider Annotea infrastructure as a somewhat specialized "***ontology editor/tool/repository***". It is important to highlight that the Annotea Servers may be distributed over the net. Given Annotea's possibilities of extendibility, we could also classify it as a ***Framework***. A deeper study of the (an) implementation of the infrastructure is necessary to say if we can consider Annotea a ***Groupware*** since one of Annotea's objectives is to enable better collaboration between users. This same motivation instigates the research about stating that Annotea is a potential ***Semantic P2P application***.

5.18 GOHSE

GOHSE is an application of the Conceptual Open Hypermedia Service (COHSE) (Carr, Bechhofer *et al.*, 2001) architecture to Bioinformatics, using the Gene Ontology (GO) (Ashburner, Ball *et al.*, 2000) as an ontology and GO associations as link targets. GOHSE provides both glossary functionality and the possibility of building dynamic hypertext structures linking bioinformatics documents (Bechhofer, Stevens *et al.*, 2005).

The COHSE system enhances document resources through the dynamic addition of hypertext links. These links are derived using an ontology and associated lexicon along with a mapping from concepts to possible link targets.

The implementation of the system (GOHSE) is in the form of a COHSE agent (Figure 28), in conjunction with two services: the Ontology Service and the Annotation Service. The agent adds, to documents, links based on the semantic content of those documents. The Ontology Service sends ontological information in a dynamic fashion to the agent. The Annotation Service correlates concepts with resources and provides mechanisms for querying those associations. In the implementation, the agent is attached to a proxy through which all HTTP requests are routed (Bechhofer, Stevens *et al.*, 2005).

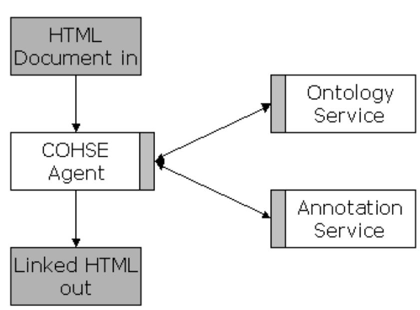

Figure 28 - COHSE Architecture (Bechhofer, Stevens *et al.*, 2005).

COHSE extends the Distributed Link Service (DLS) (Carr, De Roure *et al.*, 1995) with ontological services, providing information relating to an ontology. These services include mappings between concepts and lexical labels (synonyms). The services also provide information about relationships, such as sub- and super-classes.

DLS is an Open Hypermedia System (Grønbæk, Sloth *et al.*, 1999) (Østerbye and Wiil, 1996) which rather than embedding links in the documents, consider them first class citizens. They are stored and managed separately from the documents and can thus be stored, transported, shared and searched separately from the document itself. Documents and linkbases are dynamically combined by the DLS, which then adds proper links to documents (Bechhofer, Stevens *et al.*, 2005).

5.18.1 Hypothetical Categories

GOHSE is an Open Hypermedia System. Consequently, from the user point of view, we can consider GOHSE a ***Portal*** enhanced with a ***feature for dynamic and semantic linking hypertext structures***. From the developers' point of view, it is interesting to see the application of COHSE to a specific domain. We can then classify GOHSE as an ***Instance of a Framework***. We could also consider GOHSE a ***Mediation Infrastructure*** between dispersed Bioinformatics data sources and data through dynamic linking.

5.19 SWC 2004 Summary

In Table 3, we present the applications submitted to 2004's challenge and our proposal of hypothetical categories for each of them. In the previous sections, we presented a brief explanation about each SWAPp and a first speculation about the categories it belongs.

Table 3 – SWC 2004 Summary

Applications		Hypothetical Category
1	DBin	Semantic Growth Feature, Groupware, Framework, Trust Policy Feature, Semantic P2P Application, Architecture for Semantic P2P
2	MusiDB	Groupware, Semantic Recommender Feature, Mediation Infrastructure, Framework, Trust Policy Feature, Feature of a Portal, Portal
3	The Multilingual Access to Data Infrastructures of the European Research Area (MADIERA) Portal	Feature of a Portal, "Geo-data" Feature, Framework, Mediation Infrastructure, Portal
4	SWAP	A Layer to Improve Users' Accessibility through a Semantic Proxy
5	SemanticOrganizer	Semantic Growth Feature, Groupware, Portal, Framework
6	Platypus Wiki	Portal, Framework, Groupware, Ontology Editor/Tool/Repository, Semantic Wiki
7	MuseumFinland	Portal, Instance of a Framework
8	Knowledge Management Platform (KmP)	Portal
9	pOWL	Framework, Groupware, Ontology Editor/Tool/Repository

Applications		Hypothetical Category
10	Semantic Portal of International Affairs (SPIA)	Semantic Search Engine, Framework, Metadata Generation Component, Portal
11	Unspecified Ontology (UNSO)	Portal, Semantic P2P Application, Mediation Infrastructure, Groupware
12	Semantic Web Assistant	Unknown
13	Swoogle	Search Engine for Semantic Web Documents, Framework, Mediation Infrastructure
14	Flink	Portal, Framework, Mediation Infrastructure, Groupware
15	Bibster	Portal, Mediation Infrastructure, Groupware, Semantic P2P Application, Instance of a Framework
16	Mediator EnvirOnment for Multiple Information Sources (MOMIS)	Framework, Mediation Infrastructure
17	Annotea Shared Bookmarks	Semantic P2P Application, Framework, Groupware, Ontology Editor/Tool/Repository
18	GOHSE	Portal, Feature for Dynamic and Semantic Linking Hypertext documents, Mediation Infrastructure, Instance of a Framework

The categories represented in 2004 were:

- "Geo-data" Feature;
- A Layer to Improve Users' Accessibility through a Semantic Proxy;
- Architecture for Semantic P2P;
- Feature for Dynamic and Semantic Linking Hypertext documents;
- Feature of a Portal;

- Framework;
- Groupware;
- Instance of a Framework;
- Mediation Infrastructure;
- Metadata Generation Component;
- Ontology Editor/Tool/Repository;
- Portal;
- Search Engine for Semantic Web Documents;
- Semantic Growth Feature;
- Semantic P2P Application;
- Semantic Recommender Feature;
- Semantic Search Engine;
- Semantic Wiki;
- Trust Policy Feature;
- Unknown.

6 Semantic Web Challenge 2005 Applications

Up until the time of this writing, SWC 2005 does not have a "final" report published yet. The additional goal was to show the benefit of re-using ontologies, schemas, or models (Visser and Klein, 2005). In the 2005 challenge there was also an informal objective that was how you (the submitter) would explain the Semantic Web to your grandparents. SWC 2005 had 7 submissions presented in the next sections and summarized in section 6.8 (Table 4).

6.1 Pytypus

We could not find a publication about the application. However, there is the description of the Pytypus submission to the SWC. In this description, the developers assert that Pytypus is a collaborative semantic engine that uses RDF as a base technology as most of the functionalities are described through the meaning of RDF annotations.

More information about this application is necessary, but we could not find more publications about it yet. Therefore, we will contact the authors in order to try to get that information. We will do that in the future because, while we analyze the other aspects (data meaning, information sources and applications), doubts that are more concrete should emerge as well as a better understanding of the aspect(s) under analysis.

6.1.1 Hypothetical Categories

As we do not have a formal publication, we are not trying to categorize this submission.

6.2 Web Services Execution Environment (WSMX)

The Web Service Execution Environment (WSMX) (Moran, Zaremba *et al.*, 2005) makes available a framework for the discovery, selection, mediation and invocation of Semantic Web services. That is, WSMX provides the middleware that permits requesters and providers of Web services to find and communicate between them supported by the semantic descriptions of their functional (offerings) and non-functional (requirements and constraints on their offerings) properties. WSMX has its foundation on the conceptual model provided by the Web Services Modeling Ontology (WSMO) (Roman, Lausen *et al.*, 2004) which describes various aspects related to Semantic Web services. WSMO descriptions are represented using the Web Services Modeling Language (WSML) (Bruijn, 2005).

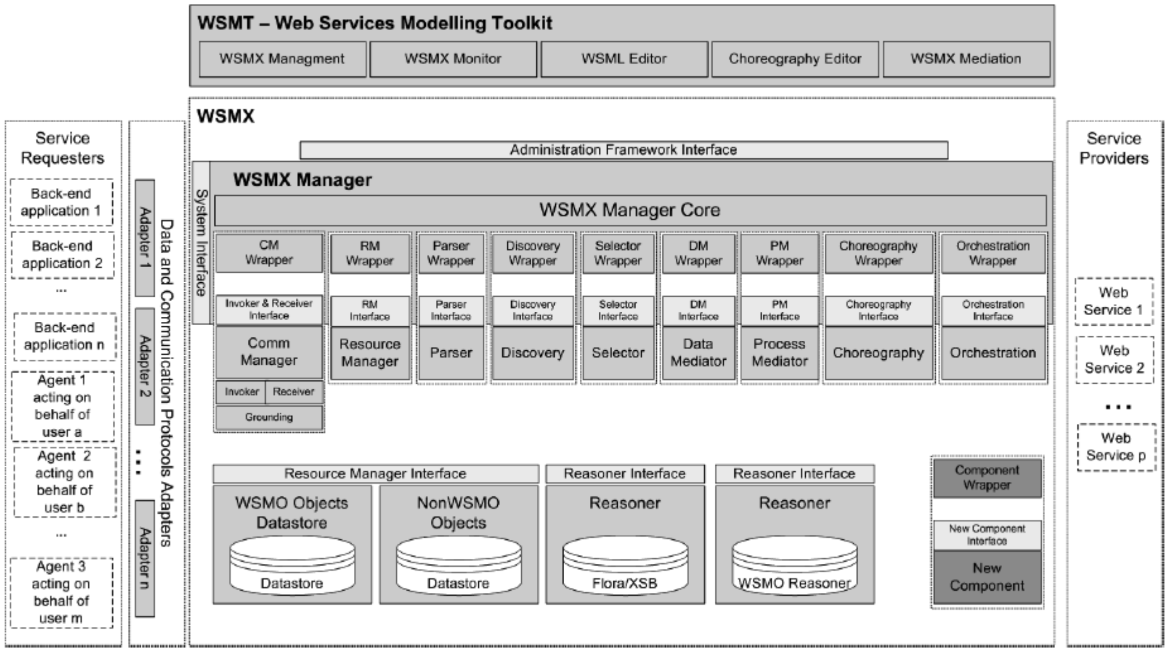

Figure 29 - WSMX Architecture (Moran, Zaremba *et al.*, 2005)

For a comprehensive description of the functionality of WSMX components (Figure 29), please refer to (Zaremba and Moran, 2005). Below, a short description of the key components borrowed from (Moran, Zaremba *et al.*, 2005) is presented:

- The WSMX Manager Core manages the events engine, internal workflow engine and the loading of registered components at start-time;
- The Resource Manager manages the persistent storage of both WSMO and non-WSMO entities;
- The Parser component parses WSML documents into equivalent WSMO4J[27] objects;
- The Discovery component is responsible for finding Web services whose capability matches the goal provided by the service requester;
- Where multiple candidate Web services are identified, the Selector component selects the Web service that provides the best match for the goal based on service requester preferences;
- During discovery or service execution, the Data Mediator and/or Process Mediator may be required to mediate between data and behavior from heterogeneous sources;
- The Communication Manager is responsible for dealing with all aspects of sending and receiving messages to and from WSMX;
- The Choreography component manages the conversation between WSMX and Web services while the Orchestration component deals with the creation of new services based on the composition of existing ones;
- Reasoning support is provided using Flora-23;

27 WSMO4J - http://wsmo4j.sourceforge.net - accessed:16/06/2006.

- The Web Service Modeling Toolkit (WSMT) (Kerrigan, 2005) is a framework for the deployment of graphical administrative tools, which can be used with WSMO, WSML and WSMX.

6.2.1 Hypothetical Categories

Considering a developer's point of view, WSMX could be classified as a Web-based "***ontology editor/tool/repository***" for Semantic Web Services since it uses WSMO model and WSML language. Given its several functionalities, we could also consider WSMX a ***Mediation Infrastructure*** between service providers and requesters. Since its conception, WSMX was already thought as an extensible platform through the definition of interfaces (Component wrappers) to incorporate new functionalities. Could we consider WSMX a ***Framework***? Or is it necessary a deeper study to prove that some of its components can be exchanged by others offering equivalent features? In addition, only a deeper study of the Orchestration component could allow us to say if it is a somewhat ***Semantic Growth Feature***. We also should highlight the fact that WSMX follows a conceptual model provided by the WSMO Ontology, and both are then specialized in "***Semantic Web Services features***" and domain.

6.3 DynamicView

DynamicView is a Semantic Web application for researchers to query, browse and visualize the distribution and the evolution of research areas in computer science. Present and past Web pages of top 20 universities in USA and China are analyzed, and research areas of faculties in computer science are extracted automatically by a segmentation based algorithm (Gao, Qu *et al.*, 2005).

Different ontologies of Association for Computing Machinery (ACM) (ACM Computing Classification System[28]) and China's Ministry of Science and Technology (MST) classification systems (classification and code of disciplines GB/T 13745/92) are combined by Simple Knowledge Organisation System (SKOS) vocabularies. Query results including numbers of researchers and their locations are visualized in SVG maps and animations (Gao, Qu *et al.*, 2005).

The major components of DynamicView are (Gao, Qu *et al.*, 2005):

- Crawler: Faculty lists are found by humans and the Crawler searches and stores the homepage of each faculty by link analysis;
- Extraction Engine: English pages are processed automatically. Chinese pages are processed by hand due to its complexity. Extraction results in research areas, names of researchers and universities are stored in relational databases;
- Ontology Learner: The developers use the ACM digital library[29] to learn classification of research areas. Each research area is input as a keyword, and top sixty (60) papers returned with primary and additional classifications are used as training samples;
- Query Processor: Users can query by country (USA or China), ontology (ACM or MST), hot topics and history.

28 ACM Computing Classification System - http://www.acm.org/class/1998/ccs98.html - accessed: 16/06/2006.

29 ACM digital library - http://portal.acm.org/dl.cfm - accessed: 16/06/2006

More information about this application is necessary, but we could not find more publications about it yet. Therefore, we will contact the authors in order to try to get that information. We will do that in the future because, while we analyze the other aspects (data meaning, information sources and applications), doubts that are more concrete should emerge as well as a better understanding of the aspect(s) under analysis.

6.3.1 Hypothetical Categories

From the user point of view, DynamicView offers digital maps as one of its queries results (***"geo-data" feature***). The other functionalities are typical from a ***Portal***. Considering a developer's point of view, the components of DynamicView, although through human interference, are providing access to spread data about the computer science topics in the USA and China. We could then also classify DynamicView as a ***Mediation Infrastructure*** between users' queries and the scattered information sources. More resources (publications) about the application are necessary in order to check how DynamicView components are coupled to the Computer Science domain or not. In the last case, we could also consider DynamicView a ***Framework*** from different viewpoints such as ontology learning techniques or as for the creation of portals about distribution and evolution of other research areas or domains. A deeper study would also show if we could consider that the Ontology Learner component is offering a ***Semantic Growth Feature***.

6.4 Personal Publication Reader (PPR)

Personal Publication Reader (PPR) is an instance of the Personal Reader Framework (Henze and Herrlich, 2004) (Henze and Kriesell, 2004). The Personal Reader Framework is an environment for designing, implementing and maintaining personal Web content Readers (Henze and Herrlich, 2004) (Henze and Kriesell, 2004). These personal Web content Readers allow a user to browse information (the Reader part), and to access personal recommendations and contextual information on the currently regarded Web resource (the Personal part) (Baumgartner, Henze *et al.*, 2005).

PPR makes use of Web data extraction techniques, reasoning about ontological knowledge and metadata description of information, and provides a personal semantic view on publication data (Baumgartner, Henze *et al.*, 2005). PPR is composed by a framework (Figure 30) of Web services (Baumgartner, Henze *et al.*, 2005) for:

- constructing the user interface;
- mediating between user requests and currently available personalization services;
- user modeling; and
- offering personalization functionality.

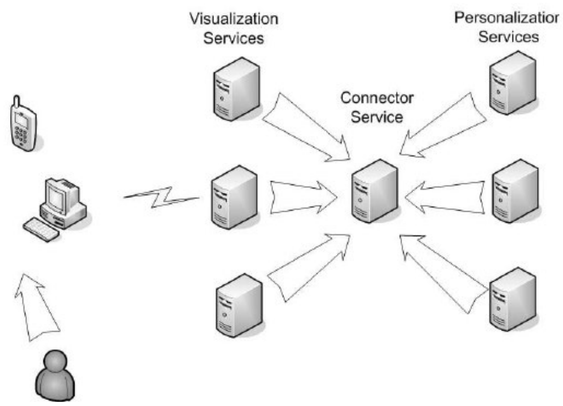

Figure 30 - Architecture of the Personal Reader framework, showing the different components of the Personal Reader: visualization, personalization, and the Personal Reader backbone (consisting of the connector service which organizes the communication and matching between the various visualization and personalization services)(Baumgartner, Henze *et al.*, 2005).

PPR application demonstrates how to provide personalized, syndicated views on distributed Web data using Semantic Web technologies. The application comprises four steps (Abel, Baumgartner *et al.*, 2005):

- The information gathering step, in which information from distributed, heterogeneous sources is extracted and enriched with machine-readable semantics;
- The operation step for timely and up-to-date extractions;
- The reasoning step in which rules reason about the created semantic descriptions and additional knowledge bases like ontologies and user profile information; and
- The user interface creation step in which the RDF descriptions resulting from the reasoning step are interpreted and translated into an appropriate, personalized user interface.

6.4.1 Hypothetical Categories

From the user point of view, PPR seems to be a ***Portal***. The personal Web content Readers offers personal recommendations and contextual information that we could see as a ***Feature of Portal*** for aggregating information to users' data. A deeper study is necessary to say if we can consider the personal recommendations as a ***Semantic Recommender Feature***. Moreover, if the use of the personal recommendations by the users implies that we can classify PPR as a ***Semantic P2P Application*** and/or a ***Groupware***.

Considering a developer's point of view, PPR is a Personal Reader application. Therefore, we could classify PPR an ***Instance of a Framework***. A facet that we should highlight in PPR is the division of the process in four steps: information gathering, operation, reasoning and interface creation. As the gathering step is performed in distributed heterogeneous sources, PPR can also be considered a ***Mediation Infrastructure***. A hint given by the descriptions of the three (3) first steps is that we could classify PPR as presenting a ***Semantic Growth Feature*** and/or a ***Metadata Generation Component***.

6.5 Oyster

Oyster[30] is a P2P application that makes use of Semantic Web techniques with the purpose of providing an infrastructure for exchanging and re-using ontologies. To accomplish this, Oyster implements a proposal for a metadata standard, so called Ontology Metadata Vocabulary[31] (OMV) (Palma and Haase, 2005).

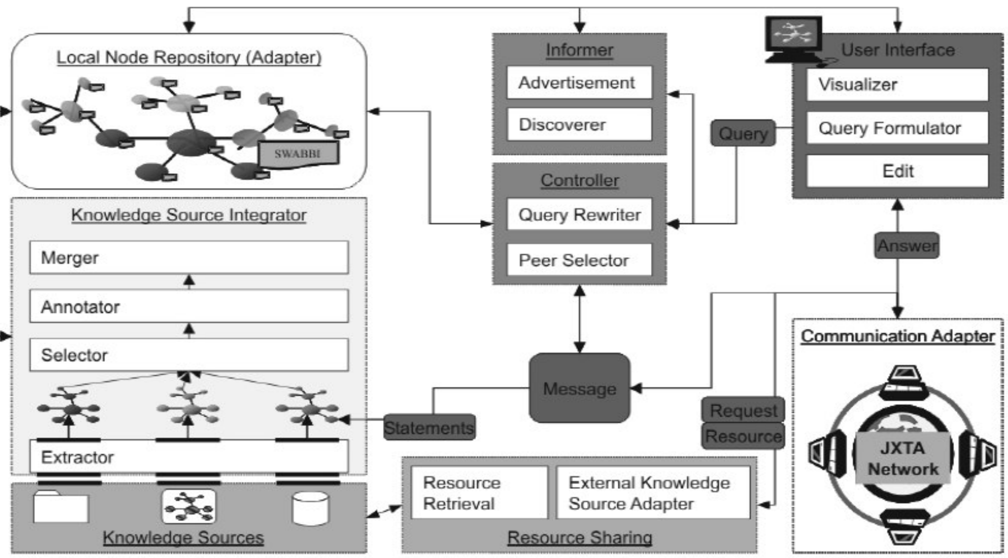

Figure 31 - Abstract Architecture of a SWAP Node (Ehrig, Haase *et al.*, 2003)

The Oyster system has been implemented as an instance of the Swapster (SWAP EU IST-2001-34103 Final Report, 2004) system architecture (Figure 31). In Oyster, ontologies are used in order to provide its main functions: importing data, formulating queries, routing queries and processing answers.

6.5.1 Hypothetical Categories

From the user point of view, Oyster seems to be a kind of P2P, or decentralized, ***Portal***: it is possible to edit metadata, as well as to navigate and to search for new metadata that are stored on other peers. The metadata that Oyster deals with is about ontologies. We can consider Oyster a ***Semantic P2P Application*** through a P2P infrastructure offered by Swapster. Considering a developer's point of view, we could classify Oyster as a Swapster implementation. Then, it is an ***Instance of a Framework***. We could also consider Oyster as P2P "***ontology editor/tool/repository***". Does the P2P feature imply that Oyster, and consequently Swapster can be considered a ***Groupware***? Oyster could also be classified as a ***Mediation Infrastructure*** between dispersed data sources (and/or peers) and users' queries.

30 Oyster - http://oyster.ontoware.org - accessed: 16/06/2006

31 OMV - http://ontoware.org/projects/omv - accessed: 16/06/2006

6.6 FungalWeb

FungalWeb is a formal ontology design and implementation case study which provides the core for a Semantic Web application in the area of fungal genomics (Shaban-Nejad, Baker *et al.*, 2004). The Semantic Web system can be used by human, bioinformatics applications or intelligent systems for ontology-based information retrieval to provide extended interpretations and annotations (Shaban-Nejad, Baker *et al.*, 2005).

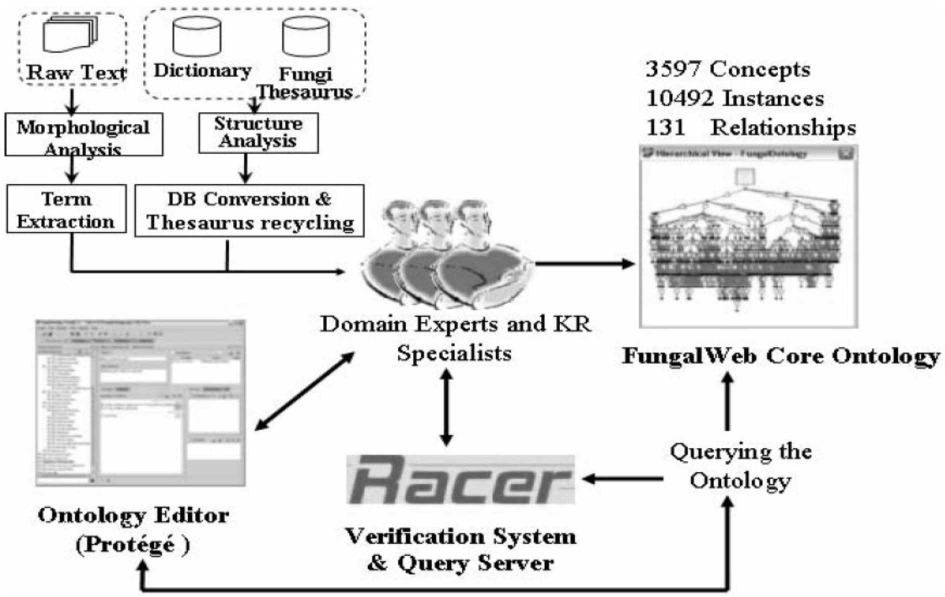

Figure 32 - Ontology Development. FungalWeb: "Ontology, the Semantic Web an Intelligent Systems for Genomics" aims to represent and map fungal genomics information using ontologies (Shaban-Nejad, Baker *et al.*, 2004).

In Figure 32 the design and development of the FungalWeb Ontology is shown and it can be divided into the following macro-steps (Shaban-Nejad, Baker *et al.*, 2004):

- Specification;
- Knowledge acquisition;
- Implementation; and
- Semantic query.

Figure 32 have some obsolete numbers of FungalWeb Core ontology which are updated in (Shaban-Nejad, Baker *et al.*, 2005). According to (Shaban-Nejad, Baker *et al.*, 2005), the ontology contains 3667 concepts, 12686 instances and 157 properties; and the efforts to expand the conceptualization were continuing.

Also according to Figure 32, FungalWeb final user interface seems to be Protégé and Racer, however Ontologent Interactive Query Tool (OntoIQ) can also be downloaded[32] from the project's homepage. OntoIQ provides non-specialists with mechanisms to build DL-based query syntax and query ontologies written in the OWL. OntoIQ requires an OWL file and connection to Racer.

32 OntoIQ Download form - http://www.cs.concordia.ca/FungalWeb/OntoIQ.html - accessed: 16/06/2006

More information about this application is necessary, but we could not find more publications about it yet. Therefore, we will contact the authors in order to try to get that information. We will do that in the future because, while we analyze the other aspects (data meaning, information sources and applications), doubts that are more concrete should emerge as well as a better understanding of the aspect(s) under analysis.

6.6.1 Hypothetical Categories

If the used features of Protégé, Racer and OntoIQ were grouped together into a single Web interface, it would be possible to classify the Semantic Web application based on FungalWeb ontology as a ***Portal***. However, by the publications analyzed that was not the case. Considering a developer's point of view, the FungalWeb project makes use of several interesting Semantic Web technologies and approaches. Nevertheless, by the same reason given for not classifying FungalWeb as a Portal, we could not classify the application.

6.7 CONFOTO

CONFOTO[33] is a browsing and annotation service for conference photos. CONFOTO offers both an end-user-oriented browsing and editing front-end for rich annotations; and also a W3C-compliant interface to an RDF-based data store. It supports the Semantic Web idea by allowing resource descriptions to be imported, created, annotated, combined, exported, and re-purposed (Nowack, 2005).

CONFOTO implements a set of wrappers to make possible to import photo and conference data from diverse input formats, for example (Nowack, 2005):

- RSS 2.0 feeds from w3photo - A Semantic Photo History of the IW3C2 Conferences[34];
- Atom feeds from Flickr™ [35]; or
- Proprietary XML documents from events such ESWC 2005 and XTech 2005.

The system can generate and enhance RDF data for:

- Uploaded pictures;
- Image files linked via Web-accessible URLs; and
- Photos described in external RDF/XML documents.

CONFOTO was suited for information about conferences and photos. Nevertheless, the RDF model tolerates any resource description to be combined with related objects (a FOAF file or a list of publications could be associated with a person depicted in a photo).

33 CONFOTO - http://www.confoto.org/ - accessed: 16/06/2006.

34 w3photo - http://w3photo.org/ - accessed: 16/06/2006.

35 Flickr™ - http://flickr.com/ - accessed: 16/06/2006.

The tools and features, at the time of writing, offered at confoto.org (Nowack, 2005):

- Image Upload or Linking;
- Photo Browser;
- Annotators;
- Data Export for Re-Use.

More information about this application is necessary, but we could not find more publications about it yet. Therefore, we will contact the author in order to try to get that information. We will do that in the future because while the other aspects (data meaning, information sources and applications) are being analyzed doubts that are more concrete should emerge as well as a better understanding of the aspect(s) under analysis.

6.7.1 Hypothetical Categories

From the user point of view, we can consider CONFOTO a ***Portal***. Furthermore, the use of photos or images adds a ***"photo-image" feature*** to the application contrasting with "regular" resources like texts. However it is necessary a deeper study of the application in order to assure that last category. For example, it is necessary to know if part of an image can be annotated. Considering a developer's point of view, the CONFOTO wrappers and exportation features offers a variety of possibilities for customization what brings the system to the status of a ***Framework.*** We could also classify CONFOTO as a ***Mediation Infrastructure*** between users' queries and scattered wrapped information sources through RDF generation and enhancement. Other points that need more study are the features for generation an enhancement of RDF of diverse sources. Are these features a ***Semantic Growth Feature*** and/or a ***Metadata Generation Component***?

6.8 SWC 2005 Summary

In Table 4, we present the applications submitted to 2005's challenge and our proposal of hypothetical categories for each of them. In the previous sections, we presented a brief explanation about each SWAPp and a first speculation about the categories it belongs.

Table 4 – SWC 2005 Summary

Applications		Hypothetical Category
1	Pytypus	Unknown
2	Web Services Execution Environment (WSMX)	Semantic Growth Feature, Semantic Web Services Features, Framework, Mediation Infrastructure, Ontology Editor/Tool/Repository
3	DynamicView	Portal, "Geo-data" Feature, Framework, Mediation Infrastructure, Semantic Growth Feature
4	Personal Publication Reader (PPR)	Semantic P2P Application, Semantic Recommender Feature, Metadata Generation Component, Semantic Growth Feature, Instance of a Framework, Feature of a Portal, Portal, Groupware, Mediation Infrastructure
5	Oyster	Mediation Infrastructure, Groupware, Instance of a Framework, Semantic P2P Application, Portal, Ontology Editor/Tool/Repository
6	FungalWeb	Unknown
7	CONFOTO	Metadata Generation Component, Portal, "Photo-Image" Feature, Framework, Mediation Infrastructure, Semantic Growth Feature

The categories represented in 2005 were:

- "Geo-data" Feature;
- "Photo-Image" Feature;
- Feature of a Portal;
- Framework;
- Groupware;
- Instance of a Framework;
- Mediation Infrastructure;

- Metadata Generation Component;
- Ontology Editor/Tool/Repository;
- Portal;
- Semantic Growth Feature;
- Semantic P2P Application;
- Semantic Recommender Feature;
- Semantic Web Services Features;
- Unknown.

7 Applications Categories

Table 5 presents the categories that emerged from the analisys of the applications and how often they occurred along the years. For now, the next subsections presents which are the applications for each category. As this work progress, in the analysis of the rest of the aspects, we intend to better specify (maybe in the form of a list of requirements or use cases) and refine each of the categories instead of showing simply the applications that can represent the categories. Another important task is a deeper reflection on the names of the categories. We believe that that task will be reached more naturally as we better understand the other aspects of the applications in the categories.

Table 5 – Hypothetical Categories Summary

Hypothetical Categories		Number of applications			
		2003	2004	2005	Total
1	Portal	6	11	4	21
2	Feature of a Portal	2	2	1	5
3	"Geo-data" Feature	4	1	1	6
4	Semantic Features of a Weblog	1	0	0	1
5	Semantic P2P Application	0	4	2	6
6	Trust Policy Feature	0	2	0	2
7	Semantic Growth Feature	0	2	4	6
8	Semantic Recommender Feature	0	1	1	2
9	Search Engine for Semantic Web Documents	0	1	0	1
10	Feature for Dynamic and Semantic Linking Hypertext Structures	0	1	0	1
11	"Photo-image" Feature	0	0	1	1
12	Framework	4	11	3	18
13	Instance of a Framework	1	3	2	6
14	Mediation Infrastructure	6	8	5	19
15	"Geo-data" Sources	2	0	0	2
16	Groupware	1	9	2	12
17	Architecture for Semantic P2P	0	1	0	1
18	A Layer to Improve Users' Accessibility through a "Semantic" Proxy	0	1	0	1
19	Ontology Editor/Tool/Repository	0	3	2	5
20	Semantic Wiki	0	1	0	1
21	Metadata Generation Component	0	1	2	3
22	Semantic Search Engine	0	1	0	1
23	Tool	0	0	0	0
24	Semantic Web Services Features	0	0	1	1
25	Unknown	1	1	2	4

After scrutinizing the applications, we ran into the categories presented in the next subsections. At first, we thought that we could divide the categories considering a user (categories 1 to 11) and a developer (categories 12 to 24) point of view, however, that division is not so clear to us anymore. For example, to say that an application is a Portal is not necessary to know much about its architecture, a user point of view can confirm that. On the other hand, to say if an application is a Framework, often a deeper study of the architecture is necessary. However, there are categories that do not lie exclusively on one side, for example to say an application is a Groupware is necessary to take into account both a developer and a user point of view.

Now it is also clear that some categories are similar or could be classified in a regular taxonomy. Next, we present some questions that already emerged, but that still need some more thinking:

- Is Mediation Infrastructure a kind of Tool ?
- Is Semantic Search Engine a kind of Tool ?
- Is Tool a kind (sub or super) of Ontology Editor/Tool/Repository ?
    - ♦ It seems that Tool is a super class for:
        - Mediation Infrastructure;
        - Semantic Search Engine;
        - Ontology Editor/Tool/Repository.
- Are the Semantic P2P Applications always a Mediation Infrastructure?
- Is the Semantic Recommender Feature a kind (sub class) of Trust Policy Feature ?
- Is Feature for Dynamic and Semantic Linking Hypertext Structures a kind (sub class) of Feature of a Portal?
- Is "Photo-image" Feature a kind (sub or super class) of "Geo-data" Feature?
- Is Architecture for Semantic P2P a kind (sub or super class) of "Geo-data" Feature and/or "Geo-data" Sources ?
- Is Semantic Growth Feature a kind of Metadata Generation Component ?
    - ♦ The Semantic Growth Feature is a kind of "reasoning" step where the theory (or knowledge base) is augmented with new proper axioms that can be theorems or not, that is, it can generate contradictions.
    - ♦ The Metadata Generation Component also inserts new facts into the knowledge base, but the facts are more likely not to be in the base yet. That is, the new facts are likely not to be theorems, just new data.
- Is Semantic Search Engine a kind of Feature of a Portal ? Or is Semantic Search Engine decomposable in other categories or features?
- What is the main difference or similarity between Search Engine for Semantic Web Documents and Semantic Search Engine?
- Is the Semantic Features of a Weblog a sub class of Feature of a Portal?
- What is the relation between Semantic P2P Application and Groupware?

7.1 Portal

SEAL, DOPE, SECO, Building Finder , CS AKTive Space, GeoShare, MusiDB, MADIERA Portal, SemanticOrganizer, Platypus Wiki, MuseumFinland, KmP, Semantic Portal of International Affairs, UNSO, Flink, Bibster, GOHSE, DynamicView, Personal Publication Reader, Oyster, CONFOTO.

7.2 Feature of a Portal

AnnoTerra, SWEET, MusiDB, MADIERA Portal, Personal Publication Reader.

7.3 "Geo-data" Feature

Building Finder, CS AKTive Space, SWEET, GeoShare, MADIERA Portal, DynamicView.

7.4 Semantic Features of a Weblog

Semblog.

7.5 Semantic P2P Application

DBin, UNSO, Bibster, Annotea Shared Bookmarks, Personal Publication Reader, Oyster.

7.6 Trust Policy Feature

DBin, MusiDB.

7.7 Semantic Growth Feature

DBin, SemanticOrganizer, Web Services Execution Environment, DynamicView, Personal Publication Reader, CONFOTO.

7.8 Semantic Recommender Feature

MusiDB, Personal Publication Reader.

7.9 Search Engine for Semantic Web Documents

Swoogle.

7.10 Feature for Dynamic and Semantic Linking Hypertext Structures

GOHSE.

7.11 "Photo-image" Feature

CONFOTO.

7.12 Framework

SEAL, Building Finder , Semblog, GeoShare, DBin, MusiDB, MADIERA Portal, SemanticOrganizer, Platypus Wiki, Powl, Semantic Portal of International Affairs, Swoogle, Flink, MOMIS, Annotea Shared Bookmarks, Web Services Execution Environment, DynamicView, CONFOTO.

7.13 Instance of a Framework

DOPE, MuseumFinland, Bibster, GOHSE, Personal Publication Reader, Oyster.

7.14 Mediation Infrastructure

SECO, AnnoTerra, Building Finder , CS AKTive Space, SWEET, GeoShare, MusiDB, MADIERA Portal, UNSO, Swoogle, Flink, Bibster, MOMIS, GOHSE, Web Services Execution Environment, DynamicView, Personal Publication Reader, Oyster, CONFOTO.

7.15 "Geo-data" Sources

AnnoTerra, SWEET.

7.16 Groupware

Semblog, DBin, MusiDB, SemanticOrganizer, Platypus Wiki, Powl, UNSO, Flink, Bibster, Annotea Shared Bookmarks, Personal Publication Reader, Oyster.

7.17 Architecture for Semantic P2P

DBin.

7.18 A Layer to Improve Users' Accessibility through a "Semantic" Proxy

SWAP.

7.19 Ontology Editor/Tool/Repository

Platypus Wiki, Powl, Annotea Shared Bookmarks, Web Services Execution Environment, Oyster.

7.20 Semantic Wiki

Platypus Wiki.

7.21 Metadata Generation Component

Semantic Portal of International Affairs, Personal Publication Reader, CONFOTO.

7.22 Semantic Search Engine

Semantic Portal of International Affairs.

7.23 Tool

No applications were found in this category.

7.24 Semantic Web Services Features

Web Services Execution Environment

7.25 Unknown

BioInformatics, Semantic Web Assistant, Pytypus, FungalWeb.

8 Summary and Outlook

The "metadata and architecture" aspect of the SWAPps submitted to the SWC were presented in this work, as well as hypothetical categories to their clustering. In addition, some questions about the relations between the categories emerged and we intend to answer them as the categories are refined.

The analysis of remaining aspects introduced in section 1 will refine and may confirm or refute the hypothetical categories presented. The remaining aspects to be analyzed about the applications are:

- data meaning;
- information sources; and
- applications.

After that, another future work is to elicit the requirements for each category and implement a framework or component for each of them. As well, it will be necessary to integrate the framework(s) or component(s).

9 Acronyms and Vocabulary

Table 6 –Vocabulary

Term	Description
3store	RDF Schema Triplestore
Aggregator	An aggregator or news aggregator is a type of software that retrieves syndicated Web content that is supplied in the form of a Web feed (RSS, Atom etc.)
Annotea	A Generic Annotation Environment Using RDF/XML
Annotea Ubimarks	An application of Annotea shared bookmarks in Mozilla
AnnoTerra	Annotated Terrestrial Information
Atom	Atom is an XML-based document format that describes lists of related information known as "feeds"
Bibster	A Peer-to-Peer system for exchanging bibliographic data among researchers
Brainlet	A DBin application
CONFOTO	A semantic browsing and annotation service for conference photos
Crawler	Also known as a Web crawler, Web spider or Web robot is a program which browses the World Wide Web in a methodical, automated manner.
Datalog	A subset of PROLOG. Datalog is a language of facts and rules
DOAPamine	DOAP Annotations for Java 5
E-Commerce	Electronic Commerce
eDonkey	File sharing application
Elcano Institute	Spain's Real Instituto Elcano de Estudios Internacionales y Estratégicos
eMule	File sharing application
Flickr™	An online photo management and sharing application
Google	The Google™ search engine. "Googol" is the mathematical term for a 1 followed by 100 zeros. Google's play on the term reflects the company's mission to organize the immense amount of information available on the Web.
Kazaa	File sharing application
MuseumFinland	Finnish Museum on the Semantic Web
MusicBrainz	A user-maintained community music metadatabase
OntoWeb	Ontology-based information exchange for knowledge management and e-commerce
Oyster	Peer-to-Peer application that exploits Semantic Web techniques in order to provide a solution for exchanging and re-using ontologies.
Servlet	Server + applet, a server-side application
Sesame	A Generic Architecture for Storing and Querying RDF and RDF Schema
Swoogle	According to the authors (Ding, Finin *et al.*, 2004): "Semantic Web Ontology ..." Well, the developers are still trying to figure out the rest.
W3photo	A Semantic Photo History of the IW3C2 Conferences

Term	Description
WIKI	What I Know Is (a content management system, or "quick" in Hawaiian)
WSMO4J	An API and a reference implementation for building Semantic Web Services applications compliant with WSMO.
XTech 2005	Formerly known as the XML Europe conference. XTech has widened its scope to incorporate neighboring technologies from the Web and business

Table 7 – Acronyms

Acronym	Description
3D	Three dimensional
ACM	Association for Computing Machinery
ADTF	Applications and Demos Task Force
API	Application Programming Interface
BUSTER	Bremen University Semantic Translator for Enhanced Retrieval
CAS	CS AKTive Space
CIA	USA's Central Intelligence Agency
COHSE	Conceptual Open Hypermedia Service
CORESE	Conceptual Resource Search Engine
CS	Computer Science
CSS	Cascading Style Sheets
DAML+OIL	DARPA Agent Markup Language + Ontology Inference Layer
DARPA	USA's Defense Advanced Research Projects Agency
DDI	Data Documentation Initiative
DLS	Distributed Link Service
DOAP	Description Of A Project
DOPE	Drug Ontology Project for Elsevier
ECHO	Earth Observing System ClearingHouse
ELSST	European Language Social Science Thesaurus
ESWC 2005	The Second European Semantic Web Conference - 2005
FOAF	Friend Of A Friend RDF/XML vocabulary.
GAV	Global As View
GCMD	Global Change Master Directory
GO	Gene Ontology
GOHSE	GO + COHSE
GVV	Global Virtual View
HTML	Hypertext Markup Language
HTTP	HyperText Transfer Protocol
INRIA	Institut National de Recherche en Informatique et en Automatique
IR	Information Retrieval
ISWC2002	International Semantic Web Conference (ISWC) 2002
ISWC2003	The Second International Semantic Web Conference
ISWC2004	The Third International Semantic Web Conference
ISWC2005	The Fourth International Semantic Web Conference
IW3C2	International World Wide Web Conference Committee

Acronym	Description
JSP	Java Server Pages
KmP	Knowledge Management Platform
KMS	Knowledge Management System
MADIERA	Multilingual Access to Data Infrastructures of the European Research Area
MDA	Model Driven Architecture
MLH	Multi-Layered Hypercube
MOMIS	Mediator EnvirOnment for Multiple Information Sources
MST	A classification and code of disciplines GB/T 13745/92 by Ministry of Science and Technology, China
NASA	USA's National Aeronautics and Space Administration
NESSTAR	Networked Social Science Tools and Resources
OBA	Ontology-Based Application
ODL	Object Definition Language
ODL-I3	A language that extends ODL with an underlying Description Logic
ODMG	Object Database Management Group
OGC	Open Geospatial Consortium
OHS	Open Hypermedia System
OMG	Object Group Management
OMV	Ontology Metadata Vocabulary
OntoIQ	Ontologent Interactive Query Tool
OWL	Web Ontology Language
OWL DL	A specie (DL) of Web Ontology Language (OWL)
OWL Full	A specie (Full) of Web Ontology Language (OWL)
OWL Lite	A specie (Lite) of Web Ontology Language (OWL)
P2P	Peer-to-peer
Perl	Practical Extraction and Report Language
PHP	Hypertext Preprocessor
PPR	Personal Publication Reader
PRF	Personal Reader Framework
PROLOG	PROgramming in LOGic
RDF	Resource Description Framework
RDF Schema	RDF Vocabulary Description Language 1.0
RDQL	RDF Data Query Language
RSS	RDF Site Summary (RSS 0.9 and 1.0)
RSS	Rich Site Summary (RSS 0.91, RSS 1.0)
RSS	Really Simple Syndication (RSS 2.0)
RSS	Real-time Simple Syndication (RSS 2.0)
SEAL	SEmantic portAL
SECO	SEmantic COllaboration
SHOE	Simple HTML Ontology Extensions
SKOS	Simple Knowledge Organisation System
SPIA	Semantic Portal of International Affairs
SVG	Scalable Vector Graphics
SW	Semantic Web
SWAP	Semantic Web Accessibility Platform
SWAPp	Semantic Web Application

Acronym	**Description**
SWAPSA	Semantic Web and Peer-to-Peer Project – System Architecture. See Swapster.
Swapster	A generic platform to account for the general need of sharing semantic-based information in P2P fashion. See SWAPSA.
SWBPD	Semantic Web Best Practices and Deployment Working Group
SWC	Semantic Web Challenge
SWC 2003	Semantic Web Challenge 2003
SWC 2004	Semantic Web Challenge 2004
SWC 2005	Semantic Web Challenge 2005
SWD	Semantic Web Documents
SWEET	Semantic Web for Earth and Environmental Terminology
SWWS'01	Semantic Web Working Symposium (SWWS) 2001
UK	United Kingdom
UML	Unified Modeling Language
UNSO	UNSpecified Ontology
URL	Uniform Resource Locator
USA	United States of America
W3C	World Wide Web Consortium
WCAG	Web Content Accessibility Guidelines
wff	Well formed formula
WSML	Web Service Markup Language
WSMO	Web Service Modeling Ontology
WSMT	Web Service Modeling Toolkit
WSMX	Web Service Execution Environment
WWW	World Wide Web
XML	eXtensible Markup Language
XSLT	eXtensible Stylesheet Language Transformation

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Appendix A - Metadata

project id	0	***project name***	Example
homepage	http://example-pointer.br	***project created on***	
old homepage	http://example_older.br		

description

This is an example project

contact name	Unknown
e-mail	Unknown
see also	

metadata created on	2005-12-13	***status***	Online
first pointer	http://example-pointer.br	***last visited on***	
DOAP URL	no		2005-12-13
affiliation	example university		
challenge year	2000	***challenge ranking***	
Is it downloadable?	☑		

observation

Fields:
- created: The date of the creation of this metadata about this project
- first-pointer: First URL that pointed to this project, we would also call it source
- DOAP-URL: The DOAP URL of the project, if it has one
- affiliation: Affiliation of the project
- status: Status of the homepage of the project, it answers a concern if the project is a 404 or not, if it is maintained etc.
- last-visited: Date of the last visit to the homepage of the project
- challenge-year: Year of the submission of this project to the Semantic Web Challenge
- challenge-ranking: Ranking reached by the project in the Semantic Web Challenge
- downloadable: Is the submission/application downloadable? Leave empty if you are not sure.
- observation: Observation about the project

project id	1	***project name***	SEAL
homepage	http://www.aifb.uni-karlsruhe.de/about.html	***project created on***	
old homepage	http://www.aifb.uni-karlsruhe.de/WBS/		

description

We present a scalable and reliable framework for Semantic Portals which is an extension of our existing SEAL approach. We illustrate the instantiation of our framework by the real-world example of a heterogeneous and distributed infrastructure of Semantic Portals viz. the portal of our institute AIFB, the OntoWeb.org portals and the KM-Vision.org portal. The approach relies on the application of current semantic technologies whereby we still keep practical usability. Generally, we show that our approach can be used to build up Semantic Portals from scratch or to build up on existing portal infrastructures as a layered Semantic Portal on top. We present several modi for integration of multiple portals and show how we address practical issues like scalability and robustness of Semantic Portals.

contact name	Denny Vrandecic
e-mail	dennyvrandecic@aifb.uni-karlsruhe.de
see also	

metadata created on	2005-12-07	***status***	Online
first pointer	http://www.informatik.uni-bremen.de/swc/seal.html	***last visited on***	
DOAP URL	no		2005-12-07
affiliation	University of Karlsruhe, Germany		
challenge year	2003	***challenge ranking***	
Is it downloadable?	☐		

observation

The ontology is downloadable. The annotated data is downloadable

project id	2	***project name***	DOPE
homepage	http://www.aduna.biz/dope/index.html	***project created on***	
old homepage	http://www.aduna.biz/dope/index.html		

description

The aim of the DOPE project (Drug Ontology Project for Elsevier) is to investigate the possibility of providing access to multiple information sources in the area of life sciences, through a single interface. In this paper, we describe how DOPE allows thesaurus-driven access to heterogeneous and distributed data, based on the RDF data model. This architecture allows for the easy addition of ontologies and data sources, to facilitate the investigation of ontology mapping and data integration issues. We also describe some user studies evaluating the effectiveness of this system. Next steps for expanding on this work are proposed.

contact name	Heiner Stuckenschmidt
e-mail	heiner@cs.vu.nl
see also	

metadata created on	2005-12-07	***status***	Offline
first pointer	http://www.informatik.uni-bremen.de/swc/dope.html	***last visited on***	
DOAP URL	no		2005-12-07
affiliation	Vrije Universiteit Amsterdam, The Netherlands		
challenge year	2003	***challenge ranking***	
Is it downloadable?	☐		

observation

The homepage is online. Browser(application) download is offline. It is necessary to contact dope@aduna.biz to know about the status of the project in general.

project id	3	***project name***	SECO
homepage	http://seco.semanticweb.org/2003/seco/	***project created on***	
old homepage	http://seco.semanticweb.org/		

description

SECO is a system to enable collaboration in online communities. It collects RDF data from the web, stores it in an index, and makes it accessible via a web interface. At the moment the system contains information about more than 7000 people and 2000 news items. This represents most of the information on the emerging semantic web in FOAF and RSS 1.0 vocabularies. This data has been created by a large number of people. The challenge is to tidy up this data and integrate it in a way that facilitates easy access and re-use.

contact name	Andreas Harth
e-mail	andreas@harth.org
see also	

metadata created on	2005-12-07	***status***	Online
first pointer	http://www.informatik.uni-bremen.de/swc/seco.html	***last visited on***	
DOAP URL	no		2005-12-07
affiliation	USC Information Science Institute, USA		
challenge year	2003	***challenge ranking***	2
Is it downloadable?	✔		

observation

A middleware?
BSD License

project id	4	***project name***	AnnoTerra
homepage	offline	***project created on***	
old homepage	http://annoterra.ssaihq.com/		

description

AnnoTerra is a Semantic Web Application that presents enhanced Earth science newsfeeds by making focused semantic searches on NASA knowledge catalogs using concepts and relationships of the Earth science realm. At present, AnnoTerra processes newsfeeds from the NASA Earth Observatory by extracting meaningful keywords. These keywords are then used to perform ontology based semantic searches in the Global Change Master Directory (GCMD) for relevant resources. The results retrieved are subsequently mapped to an ontology of the Earth Observing System (EOS) ClearingHOuse (ECHO) and a new search is performed for corresponding datasets in the ECHO catalog. By creating an ontology for the GCMD and ECHO, and a equivalence between the two, we've created a semantic unification of Earth science resources registered in GCMD and data collections registered in ECHO. Our project name, AnnoTerra, is derived from Annotated Terrestrial Information, with the idea of enhancing existing data sources with extra information.

contact name	Daniel Ramagem
e-mail	daniel_ramagem@ssaihq.com
see also	

metadata created on	2005-12-07	***status***	Offline
first pointer	http://www.informatik.uni-bremen.de/swc/annoterra.html	***last visited on***	
DOAP URL	no		2005-12-07
affiliation	Science Systems & Applications, Inc.		
challenge year	2003	***challenge ranking***	3
Is it downloadable?	☐		

observation

We checked the cache from google. The homepage is offline.

project id	5
project name	Building Finder
homepage	offline
project created on	
old homepage	http://atlas.isi.edu/semantic/servlet/SemanticServ

description

A key promise of the semantic web is seamless integration of heterogeneous data from various data sources. The Building Finder is a web application that demonstrates this promise. The Building Finder integrates satellite images in order to locate buildings.

contact name	Craig Knoblock
e-mail	knoblock@isi.edu
see also	

metadata created on	2005-12-07
status	Offline
first pointer	http://www.informatik.uni-bremen.de/swc/buildingfinder.html
last visited on	2005-12-07
DOAP URL	no
affiliation	University of Southern California, USA
challenge year	2003
challenge ranking	
Is it downloadable?	☐

observation

project id	6	***project name***	Semblog
homepage	http://www.semblog.org/	***project created on***	
old homepage	http://www.semblog.org/wiki/?en		

description

We propose a personal publishing system with semantic web techniques. Publishing activity consists of not only content producing but also information gathering. In the current web environment, we perform these activities respectively for lack of glue. We adopt content aggregation and syndication methods with RSS: RDF Site Summary, which is a basic element of semantic web, to this problem. One of the key issues of semantic web is how metadata can be generated. We useWeblog tools for personal RSS generator. The user only describes her/his content in a fixed form so that the tool will create RSS-based metadata automatically.

contact name	Ikki Ohmukai
e-mail	i2k@grad.nii.ac.jp
see also	

metadata created on	2005-12-07	***status***	
first pointer	http://www.informatik.uni-bremen.de/swc/semblog.html	***last visited on***	
DOAP URL	no		2005-12-07
affiliation	National Institute of Informatics, Tokyo, Japan		
challenge year	2003	***challenge ranking***	
Is it downloadable?	☐		

observation

Does it structure the entry of the blog in order to generate na RSS feed which will be distributed as an RDF file?
It is online, but it is in Japanese (We believe so)

project id	7	***project name***	CS AKTive Space		
homepage	http://www.aktors.org/technologies/csaktivespace/			***project created on***	
old homepage	http://triplestore.aktors.org/SemanticWebChallenge				

description

CS AKTive Space (CAS) is an integrated Semantic Web application which provides a way to explore the UK Computer Science Research domain across multiple dimensions for multiple stakeholders, from funding agencies to individual researchers.

contact name	Nick Gibbins
e-mail	nmg@ecs.soton.ac.uk
see also	

metadata created on	2005-12-07	***status***	Online		
first pointer	http://www.informatik.uni-bremen.de/swc/csaktivespace.html			***last visited on***	
DOAP URL	yes			2005-12-07	
affiliation	University of Southampton, UK				
challenge year	2003	***challenge ranking***	1	***Is it downloadable?***	☐

observation

It is a big project. Even if the scenario looks like a toy example, the project is biased by several publications. The ontologies are available for download in 4 different languages.

project id	8	***project name***	SWEET
homepage	http://sweet.jpl.nasa.gov/	***project created on***	
old homepage	http://sweet.jpl.nasa.gov/perl/challenge/html.pl		

description

SWEET integrates knowledge regarding earth science from various sources, including WWW available gazetteers, earthquake data from the USGS, CIA databases on countries and geographic polygons, and others. SWEET will automatically query the information sources, if the information is dynamic and SWEET does not know the requestion information. SWEET queries the gazetteers and the world factbook for specific facts related to countries and cities in textual form. It queries USGS for near real-time information on earthquakes and displays them on a zoomable world map. The same goes for the CIA World Databank polygons. SWEET also allows for human users to browse the local knowledge base and accept user input for modifications to the kb. It is also capable of outputting its knowledge various formats, including HTML, XML, RDF, OIL+DAML, and OWL.

---

contact name	Michael Pan
e-mail	michael.j.pan@jpl.nasa.gov
see also	

---

metadata created on	2005-12-07	***status***	Online
first pointer	http://www.informatik.uni-bremen.de/swc/sweet.html	***last visited on***	
DOAP URL	no		2005-12-07
affiliation	NASA Jet Propulsion Laboratory, USA		
challenge year	2003	***challenge ranking***	
Is it downloadable?	☐		

observation

The have an "application" online: http://sweet.jpl.nasa.gov/perl/challenge/html.pl .
Is there any publication in a conference or workshop? We could only find a poster in a ISWC 2003 Workshop and some final reports of the project.
The project has several ontologies. It is also used by several projects.

project id	9	***project name***	BioInformatics
homepage	offline	***project created on***	
old homepage	http://snp.csie.ntu.edu.tw:8080		

description

Exploiting Bioinformatics Web Resources for Single Nucleotide Polymorphism (SNP) Analysis Single nucleotide polymorphism (SNP) markers are single base pair positions in genomic DNA at which different sequence alternatives (alleles) exist in normal individuals in some population(s), wherein the least frequent allele has an abundance of one percent or greater. SNP alleles can be used as genetic markers. Because the SNP itself is the variant that causes or contributes to the risk of developing a particular genetic disorder, SNPs are expected to facilitate large-scale association genetics studies, which usually aim at identifying novel disease-causing genes and possible treatments of many genetic disorders. To perform association study requires integrating a variety of information sources. However, the number of biological on-line databases and tools is growing at breakneck speed. To integrate these databases and tools to provide a convenient search tool is a challenging task in bioinformatics. Thus, solutions for database integration and interoperability of bioinformatics tools are in urgent need. In this project, we apply the Semantic Web technologies to integrate eight Web-based biological information sources for a sequence analysis service. With this service, users can ask a variety of queries about a given SNP (represented by a RS id, e.g., rs1799967). For example, 1. Show me the sequence next to this SNP? 2. How does this SNP probably affect protein structure? 3. How many kind of transcription does the SNP lie in? Answering these queries and the likes requires to access multiple Web-based bioinformatics resources. For example, we need to retrieve the sequence of the given SNP (i.e., a string of AGTC) from one database, and then submit this string to a set of Web sites that provide SNP function prediction services, and then compute the answer according to the results from different services. In this service, each information source is wrapped as a Web Service by a Web wrapper agent. Then we build an ontology of agents that represent the query answering power of each agent by specifying their input and output in RDF. With this ontology, we can compute a query answering workflow by a simple planning algorithm.

contact name	Koung-Lung Lin
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see also	

metadata created on	2005-12-07	***status***	Offline
first pointer	http://www.informatik.uni-bremen.de/swc/bioinformatics.html	***last visited on***	
DOAP URL	no		2005-12-07
affiliation	National Taiwan University, Taiwan		
challenge year	2003	***challenge ranking***	
Is it downloadable?	☐		

observation

"Bio" application.
Is it focused on integration? They use wrapper agents (what can be a good idea)
We could not find a publication.
Was the "generic" project transformed/evolved into specific projects? We could not find any information about that in english.

project id	10	***project name***	GeoShare
homepage	http://www.tzi.de/index.php?id=150&L=1&tx_projectdisplay_pi1[sh	***project created on***	
old homepage	http://geoshare.tzi.de/swc2003/		

description

One of the main goals of the GeoShare project is to support users with geographically distributed environmental data. The data provided by the partners and their subcontractors cover three distinct thematic topics, namely urban and environmental planning, tourism, an well as labor and education. The data are geographically distributed among the GeoShare partners, and they are syntactically, structurally, and semantically heterogeneous. The key idea behind our SemanticWeb Challenge submission is to use the Bremen University Semantic Translator for Enhanced Retrieval (BUSTER) to provide an intelligent access to GeoShare data sources and information services.

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contact name	Thomas Vögele
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see also	

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metadata created on	2005-12-07	***status***	Online
first pointer	http://www.informatik.uni-bremen.de/swc/geoshare.html	***last visited on***	
DOAP URL	no		2005-12-07
affiliation	TZI, Universität Bremen, Germany		
challenge year	2003	***challenge ranking***	
Is it downloadable?	☐		

observation

project id	11	***project name***	DBin
homepage	http://dbin.org	***project created on***	
old homepage	http://dbin.org		

description

DBin is a the first Semantic Web P2P platform aimed at the general internet users. The model is as follows: power users create "brainlets", which are domain specific applications (e.g. the Italian Opera Fan club) using the available high level API and these can be used to richly and cohoperatively annotate "things" that are commonly considered to be of interest in the domain (e.g. singers, operas, arias, theatres etc..). Given its all RDF, brainlets can interact and benefit from each other. DBin is currently based on the novel RDFGrowth P2P algorithm and sports a rich user interface and plugin system based n Eclipse RCP. Scheduled next (release 0.2x) : MPEG7 audio metadata integration for music brainlets, security trough digital signatures and certificates on RDF subgraphs, brainlets creation by a simple XML file and support for NON distributed models in a "semantic newsgroup" fashion.

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contact name	Giovanni Tummarello
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see also	

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metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/dbin.html	***last visited on***	
DOAP URL	no		2006-03-07
affiliation	Universita' Politecnica delle Marche, Italy		
challenge year	2004	***challenge ranking***	
Is it downloadable?	✔		

observation

GPL license

project id	12	***project name***	MusiDB
homepage	http://www.cs.vu.nl/~rstegers/iwa/	***project created on***	
old homepage	http://www.cs.vu.nl/~rstegers/iwa/		

description

The World Wide is becoming the mainsource for music, both in terms of digital music directly accessible over the web and portals like Amazon that sell music in more traditional formats. The World Wide Web is becoming the main source for music, both in terms of digital music directly accessible over the web and portals like Amazon that sell music in more traditional formats. As in other areas the size of the Web and the amount of available information is becoming a problem, because browsing through all available files is not an option. The aim of this application is to help people to find albums and to actively recommend albums that the user is likely to enjoy. In MusiDB the functionality of finding a piece of music based on its name and the name of the artists is achieved by matching the user input with Musicbrainz, one of largest RDF data bases, that contains information about artists, albums and songs. Based on the information about the albums of that particular artist, the Amazon Web service is queried to provide additional information about albums containing the song (this can be more than one due to compilations and best-of albums) like the cover, sound samples, the retails price etc.

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contact name	Heiner Stuckenschmidt
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see also	

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metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/musidb.html	***last visited on***	
DOAP URL	no		2006-03-07
affiliation	Vrije Universiteit Amsterdam, The Netherlands		
challenge year	2004	***challenge ranking***	
Is it downloadable?	☐		

observation

Is it focused on Information Retrieval?

project id	13	***project name***	MADIERA Portal		
homepage	http://damad.essex.ac.uk/portal/			***project created on***	
old homepage	http://www.nesstar.org/portal/				

description

The MADIERA Portal provides access to an unprecedented quantity of social sciences quantitative datasets using an easy to use Yahoo-style interface. It works by harvesting statistical datasets published on the Semantic Web.

contact name	Pasqualino Assini
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see also	

metadata created on	2005-12-07	***status***	online		
first pointer	http://www.informatik.uni-bremen.de/swc/madiera.html			***last visited on***	
DOAP URL	no				2006-03-07
affiliation	Nesstar Ltd. & University of Essex, UK				
challenge year	2004	***challenge ranking***		***Is it downloadable?***	☐

observation

Project Homepage: www.madiera.net (which is different from the application homepage).

project id	14	***project name***	SWAP		
homepage	http://ubaccess.com/swap.html			***project created on***	
old homepage	http://ubaccess.com/swap.html				

description

SWAP – the Semantic Web Accessibility Platform is a semantic web knowledge based approach to accessibility. SWAP adds a layer of knowledge to a site from which it creates alternative renderings of sites.

contact name	Lisa Seeman
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see also	

metadata created on	2005-12-07	***status***	online		
first pointer	http://www.informatik.uni-bremen.de/swc/swap.html			***last visited on***	
DOAP URL	no				2005-12-15
affiliation	UB Access, Jerusalem, Israel				
challenge year	2004	***challenge ranking***		***Is it downloadable?***	☐

observation

The product is on sale. It is possible to test some features. It is also possible to ask for a demo by e-mail.

project id 15 ***project name*** SemanticOrganizer

homepage http://sciencedesk.arc.nasa.gov/ ***project created on***

old homepage http://sciencedesk.arc.nasa.gov/

description

SemanticOrganizer is a collaborative knowledge management system designed to support the information storage and access needs of diverse NASA project teams, including distributed teams of scientists, engineers, and accident investigators. The system provides a customizable, semantically structured information repository that stores work products relevant to multiple projects of differing types. SemanticOrganizer contains a local repository for data, metadata, and links, but is also able to reference information available on arbitrary web servers. Semantic Organizer has been used to support a large number of teams in real world applications from astrobiology to robotics to engineering accident investigation. SemanticOrganizer was used to support the evidence organizing needs of the Space Shuttle Columbia Accident Investigation Board, and received numerous NASA honors for its contributions. SemanticOrganizer was a finalist in NASA's 2003 Software of the Year award competition.

contact name Richard Keller

e-mail keller@email.arc.nasa.gov

see also

metadata created on 2005-12-07 ***status*** online

first pointer http://www.informatik.uni-bremen.de/swc/semanticorganizer.html ***last visited on***

DOAP URL no 2005-12-15

affiliation NASA/Ames Research Center, USA

challenge year 2004 ***challenge ranking*** 3 ***Is it downloadable?*** ☐

observation

project id	16	***project name***	Platypus Wiki
homepage	http://platypuswiki.sourceforge.net/	***project created on***	
old homepage	http://platypuswiki.sourceforge.net/		

description

This article describes PlatypusWiki, an enhanced Wiki Wiki Web using technologies from the Semantic Web. Platypus Wiki offers a simple user interface to create Wiki pages including metadata according to W3C standards. It uses RDF, RDF Schema and OWL to manage the metadata and create ontologies. We present the essential features of what we have called a Semantic Wiki Wiki Web, showing how the existing Wiki WikiWeb can be improved and how we have implemented these features in Platypus Wiki. Platypus Wiki is a rapid and useful Personal Knowledge Management system, as well as a valuable tool to manage Communities of Practice.

contact name	Paolo Castagna
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see also	

metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/platypus.html	***last visited on***	
DOAP URL	no		2005-12-15
affiliation	Stefano Campanini, Paolo Castagna, Roberto Tazzoli		
challenge year	2004	***challenge ranking***	
Is it downloadable?	☑		

observation

project id 17 ***project name*** MuseumFinland

homepage http://www.seco.tkk.fi/applications/museumfinland/ ***project created on***

old homepage http://www.cs.helsinki.fi/group/seco/museums/

description

"MuseumFinland -- Finnish Museums on the Semantic Web" is a semantic portal that contains metadata from the collection databases of the National Museum, Espoo City Museum, and Lahti City Museum, and more content from other museums is being ported into the system. The application is intended for the public in the large to use (in addition to museum personnel).□MuseumFinland provides the end-user with a semantic seamless view to distributed heterogeneous cultural collections. A view-based semantic search engine based on seven cultural ontologies can be used for getting overviews of the contents along nine different dimensions (such as artifact type, material, place of usage, time of creation, situation of usage etc.), and for concept-based information retrieval. Semantic browsing is supported by a logic-based link generator that associates collection pages with each other in a meaning way and with explanatory link labels. For the museums, MuseumFinland provides a shared national publication channel for the Semantic Web. □□

contact name Eero Hyvönen

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see also

metadata created on 2005-12-07 ***status*** online

first pointer http://www.informatik.uni-bremen.de/swc/museumfinland.html ***last visited on***

DOAP URL no 2005-12-15

affiliation University of Helsinki & HIIT, Finland

challenge year 2004 ***challenge ranking*** 2 ***Is it downloadable?*** ☐

observation

There are several publications.

project id	18	***project name***	KmP
homepage	http://kmp.inria.fr	***project created on***	
old homepage	http://beghin.inria.fr/		

description

The aim of the KmP project is to increase the portfolio of competences of the Telecom Valley of Sophia Antipolis by helping actors in expressing their interests and needs in a common space. The solution relies on the specification, design, building and evaluation of an online customizable semantic web application.

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see also	

metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/kmp.html	***last visited on***	
DOAP URL	no		2005-12-15
affiliation	INRIA Sophia Antipolis, France		
challenge year	2004	***challenge ranking***	
Is it downloadable?	☐		

observation

Are there any publications in english? We could only find them in french. It was developed in association with industry.

project id	19	***project name***	pOWL
homepage	http://powl.sourceforge.net/swc/	***project created on***	
old homepage	http://powl.sourceforge.net/swc/		

description

The broad application of ontologies as shared terminological knowledge representations is one of the main strategies of the semantic web paradigm. With OWL (Web Ontology Language) there exists now a W3C standard for defining web enabled ontologies which fits in the semantic layering of web languages. Although there are some OWL ontology management solutions available, most of them are complicated to deploy or handle, do not support strategies for collaborative, distributed development of ontologies, are not Open Source or are not available for the most distributed web technologies. Since PHP (http://www.php.net) is at a distance the most distributed web development technology (as regularly confirmed by Netcraft), the semantic web paradigm will probably only be successful in a broad perspective if there are applications and tools available tightly interacting with this language. The goal of this document is to give an overview on the usage of pOWL which meets this requirement. The aim of pOWL is to deliver an easy-to-deploy and easy-to-use, scalable, PHP and web-based ontology management solution to the Open Source community, which covers the whole ontology lifecycle. Despite the fact that pOWL is still in beta quality stage it is already productively used in several projects. A final production grade version 1.0 will be published October 15th. As a use case, we present the application of pOWL to semantic web content management and how it may be used as a foundation framework for semantic web applications.

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see also	

metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/powl.html	***last visited on***	
DOAP URL	no		2005-12-15
affiliation	University of Leipzig, Germany		
challenge year	2004	***challenge ranking***	
Is it downloadable?	✔		

observation

There are some use cases which are portals.

project id	20	***project name***	Semantic Portal of International Affairs
homepage	http://elcano.isoco.net	***project created on***	
old homepage	http://elcano.isoco.net		

description

The Royal Institute Elcano (Real Instituto Elcano) in Spain is a prestigious independent political institute whose mission is to comment on the political situation in the world focusing on its relation to Spain. As part of its dissemination strategy it operates a public website. The online content can be accessed by navigating through categories or by a keyword-based, full text search engine. The work described in this paper aims at improving access to the content. We describe an approach, tools and techniques that allow building a semantic portal, where access is based on the meaning of concepts and relations of the International Affairs domain. The approach comprises an automatic ontology-based annotator, a semantic search engine with a natural language interface, a web publication tool allowing semantic navigation, and a 3D visualization component. The semantic portal is currently being tested by the Institute.

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contact name	Jesus Contreras
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see also	

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metadata created on	2005-12-07	***status***	authorization required
first pointer	http://www.informatik.uni-bremen.de/swc/spia.html	***last visited on***	
DOAP URL	no		2005-12-16
affiliation	Intelligent Software Components S.A., Spain		
challenge year	2004	***challenge ranking***	
Is it downloadable?	☐		

observation

We were not able to use(enter) the portal. It is developed by a laboratory called ISOCO.
More information about the Knowledge Parser is available at http://www.isoco.com/en/innovation/applications/kp.html

project id	21	***project name***	UNSO
homepage	http://cslx.haifa.ac.il/~slavax/UNSO.html	***project created on***	
old homepage	http://cslx.haifa.ac.il/~slavax/UNSO.html		

description

In this work we developed a novel approach of an Unspecified Ontology (UNSO). UNSO approach premises that the domain ontology is not fully defined and parts of it can be dynamically specified by the peers. To implement semantic routing we extend a hypercube graph structure to a multi-layered hypercube (MLH) that can be schematically depicted as a hypercube, where each vertex recursively consists of another hypercube. We use hashing to deal with the unspecified nature of the ontology and with the variety of terms that can be used. This allows the peers to distributively manage a dynamically growing ontology and uniformly distributes the ads among the MLH. To eliminate ambiguity and enhance system precision, the terms used by the peers in the ontological description of an object, undergo simple semantic standardization using WordNet. In summary, the main contribution of UNSO is in the novel notion of ontologies (as a technique for managing a dynamic set of forms) and its accompanied semantic routing.

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see also	

metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/unso.html	***last visited on***	
DOAP URL	no		2005-12-16
affiliation	University of Haifa, Israel		
challenge year	2004	***challenge ranking***	
Is it downloadable?	☐		

observation

There is an extensive list of publications. But where were they published?

project id	22	***project name***	Semantic Web Assistant
homepage	http://www.roetzel.de/swa/	***project created on***	
old homepage	http://www.roetzel.de/swa/		

description

The Semantic Web Assistant was created as part of a thesis submitted to the department of computer science at the University of Applied Sciences Bonn-Rhein-Sieg in partial fulfillment of the requirements for the german degree of Diplom-Informatiker (FH). The thesis explores the possibilities of a combination of Semantic Web technologies with production rule systems for letting end-users discover some of the powerful applications of the SemanticWeb on their desktop.□The thesis describes some sample applications of such a system and defines requirements and a basic architecture. The Semantic Web Assistant was developed during the 3-month editing time of the thesis as a first prototype implementing these specifications. It was built on top of the Jena Semantic Web Framework.□□The idea behind the system was developed because of the lack of real world applications for the Semantic Web, that do not focus on one very specific domain. This lack is at least partly responsible for the slow adoption of the new Semantic Web technologies on the World Wide Web.

contact name	David Roetzel
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see also	

metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/swa.html	***last visited on***	
DOAP URL	no		2005-12-16
affiliation	University of Applied Sciences Bonn-Rhein-Sieg, Germany		
challenge year	2004	***challenge ranking***	
Is it downloadable?	✔		

observation

A framework?
It is the result of a thesis. Is there any publication besides the thesis?

project id	23	***project name***	Swoogle
homepage	http://swoogle.umbc.edu	***project created on***	
old homepage	http://swoogle.umbc.edu		

description

Swoogle is a crawler-based indexing and retrieval system for the Semantic Web documents - i.e., RDF or OWL documents. It analyzes the documents it discovered to compute useful metadata properties and relationships between them. The documents are also indexed by using an information retrieval system which can use either character N-Gram or URIs as terms to find documents matching a user's query or to compute the similarity among a set of documents. One of the interesting properties computed for each Semantic Web document is its rank - a measure of the document's importance on the Semantic Web.

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contact name	Li Ding
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see also	

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metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/swoogle.html	***last visited on***	
DOAP URL	no		2005-12-16
affiliation	University of Maryland, Baltimore, USA		
challenge year	2004	***challenge ranking***	
Is it downloadable?	☐		

observation

It stores URLs but not the triples yet.
It is not downloadable yet because the code is stil imcomplete and/or stable. Is it possible to get a version anyway?

project id 24 *project name* Flink

homepage http://prauw.cs.vu.nl:8080/flink/ *project created on*

old homepage http://prauw.cs.vu.nl:8080/flink/

description

Flink is a unique entrant to this year's Challenge. As opposed to products of large EU projects or DARPA funds, it is the result of the effort of a single Ph.D. student driven by the desire to see for himself the state-of-the-art in Semantic Web application development. In particular, the simple question this application intends to answer is whether it is possible today to develop with the minimal effort possible an engaging, cutting-edge SW application from the LEGO blocks available as open source. In this sense, Flink serves as a showcase of the achievements of SW development and highlights the challenges lying ahead. Compared to the entrants to last year's challenge, advances have been made in the use of OWL, custom inferencing, Web Services integration, the latest features in query languages (SeRQL), contextualization and support for handheld devices. Flink itself is also likely to be unique as a crossover between a social experiment and a semantic application. Flink brings together a number of different knowledge sources and use them to learn about the social structures of the community that created them -- in this case, the community of Semantic Web researchers. The resulting application is a Who is Who of the Semantic Web, which can be of interest to this community as a reflection of their social organization, but is also valuable as an input for Social Network Analysis, a branch of sociology concerned with relational data. (Export to popular network analysis packages is directly supported by the application.) Lastly, Flink is a true a Web citizen, integrating the information sources of the traditional web (HTML pages) with those of the Semantic Web (FOAF profiles). Although scalability is not an issue addressed by the application, extensibility is: due to its modular design, Flink is easily extended with additional features and information sources while preserving a minimal, lightweight and dynamic profile.

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see also

metadata created on 2005-12-07 *status* online

first pointer http://www.informatik.uni-bremen.de/swc/flink.html *last visited on*

DOAP URL no 2005-12-16

affiliation Vrije Universiteit Amsterdam, The Netherlands

challenge year 2004 *challenge ranking* 1 *Is it downloadable?* ☐

observation

On the "surface" it is a portal, however under the cloak it has several things like: integration, extensibility (?) and "web citizenship". However it is a kind of application for those who "understand" what the semantic web is. Maybe showing the relation between the "social use" (groupware?) and the semantic web would help clarifying the last statement or the goal of the application in general. It is a good place to find references and even content of e-mails from public e-mail lists.

project id	25	***project name***	Bibster
homepage	http://bibster.semanticweb.org/	***project created on***	
old homepage	http://bibster.semanticweb.org/		

description

We present Bibster, a Peer-to-Peer system for exchanging bibliographic data among researchers, obtained e.g. from Bibtex files. Bibster exploits ontologies in data representation, query formulation, query-routing and answer presentation. Bibster is a fully implemented open source solution built on top of the JXTA platform. The system is currently being used by several hundreds of users from multiple organizations across the world.

contact name	Peter Haase
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see also	

metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/bibster.html	***last visited on***	
DOAP URL	no		2005-12-16
affiliation	AIFB, University of Karlsruhe, Germany		
challenge year	2004	***challenge ranking***	
Is it downloadable?	✔		

observation

Even being a bit "researchers specific", the use of semantics is not very clear to us. How does the semantics is used?

project id	26	***project name***	MOMIS
homepage	http://dbgroup.unimo.it/Momis/	***project created on***	
old homepage	http://dbgroup.unimo.it/Momis/momis-iswc/		

description

The MOMIS (Mediator envirOnment for Multiple Information Sources) is a framework to perform information extraction and integration from both structured and semi-structured data sources, plus query management facilities to take incoming queries and process them through the exploitation of the annotated GVV. The framework consists of a language and several semi-automatic tools. - The ODL-I3 language is an object-oriented language, with an underlying Description Logic; it is derived from the standard ODMG. Information integration is performed in a semi-automatic way, by exploiting the knowledge in a Common Thesaurus (defined by the framework) and - ODL-I3 descriptions of source schemas with a combination of clustering techniques and Description Logics. This integration process gives rise to a virtual integrated view of the underlying sources (the Global Schema, GVV) for which mapping rules and integrity constraints are specified to handle heterogeneity. - The MOMIS Query Manager is the coordinated set of functions which take an incoming query, decompose the query according to the mapping of the GVV onto the local data sources relevant for the query, send the subqueries to these data sources, collect their answers, perform any residual filtering as necessary, and finally deliver the answer to the requesting user. The MOMIS system is based on a conventional wrapper/mediator architecture, and provides methods and open tools for data management in Internet-based information systems by using a CORBA-2 interface.

contact name	Francesco Guerra
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see also	

metadata created on	2005-12-07	***status***	online		
first pointer	http://www.informatik.uni-bremen.de/swc/momis.html	***last visited on***			
DOAP URL	no	2005-12-16			
affiliation	DII- Universita' di Modena e Reggio Emilia, Italy				
challenge year	2004	***challenge ranking***		***Is it downloadable?***	☐

observation

There is an example of application in the area of tourism.
The application submited to SWC2004 requires authorization. But the homepage of the project is online.

project id 27 ***project name*** Annotea shared bookmarks

homepage http://www.annotea.org/ ***project created on***

old homepage http://www.annotea.org/ISWC2004/annoteademo.html

description

In the real, physical world, we often label things to know what they contain or mark pages in the documents with different types of bookmarks or flags to find them easily later. We may even add yellow post-it notes as annotations to pages to write longer comments. When we use these annotations and bookmarks we create information about objects. The type and color of the label also often tells us what kind of information we create. In computers, the objects and the information are expressed with data, so when we use the annotations and bookmarks in computers, we create data about data or as we call it: metadata. In Semantic Web users attach information to objects with meaningful labels, so the types of the used labels are as important as the objects and the attached information. Furthermore, objects and labels are identified with an unambiguous Web addresses called URIs, so we always know if we talk about the same label or the same object. With Annotea shared bookmark it is possible to easily create Semantic Web bookmarks and categories that organize information on the Web, and integrate them from different sources and share them with others. It is also possible to use a familiar concept and with help from the teenage granddaughter make a connection from that concept to a corresponding teenage concept so that it becomes easier to talk with teenagers. Concepts from all grandparents can be collected to create a dictionary. It is also possible to collect the bookmarks from the woodworking hobby group and follow them to find more interesting information. It is also possible to use google with all the woodworking group bookmarks when searching that information and get the first the results bookmarked with others, or use collection of woodworking bookmarks as a profile and go to the Amazon.com and look for similar information. In research, common use of shared bookmarks can create a network effect leading to new discoveries. Semantic Web adds exactness to information so than it can be used not only for the purpose it was first created but for other purposes as well and easily merge it with other information. Annotea shared bookmarks brings Semantic Web close to users so that in spite of the exactness users can still function in ways that are familiar to them and learn new concepts in their own pace.

contact name Marja-Riitta Koivunen

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see also

metadata created on 2005-12-07 ***status*** online

first pointer http://www.informatik.uni-bremen.de/swc/annotea.html ***last visited on*** 2005-12-16

DOAP URL no

affiliation Annotea, USA

challenge year 2004 ***challenge ranking*** ***Is it downloadable?*** ☑

observation

It is a kind of http://del.icio.us/
At a first glance, it seems to convice about the relation between semantics and the web through examples like the one of the use of bookmarks within Amazon, for instance.
Another website: www.w3.org/2001/Annotea.
Open source.

project id 28 ***project name*** GOHSE

homepage http://cohse.man.ac.uk/gohse/ ***project created on***

old homepage http://cohse.man.ac.uk/gohse/

description

GOHSE is a demonstration of the COHSE infrastructure to bioinformatics. COHSE brings together an ontology and an open hypermedia service to dynamically add links to web resources. In this example, we use the Gene Ontology as the ontology, with resources from the GO annotation database as link targets.

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see also

metadata created on 2005-12-07 ***status*** online

first pointer http://www.informatik.uni-bremen.de/swc/gohse.html ***last visited on***

DOAP URL no 2005-12-16

affiliation University of Manchester, UK

challenge year 2004 ***challenge ranking*** ***Is it downloadable?*** ☐

observation

The project homepage is online, although the application is offline.
GHOSE is an application that uses COHSE. COHSE is downloadable.
The portal also "provides" semantics and inference capabilities. How should we express that in the categories of the application?

project id	29	***project name***	Pytypus
homepage	http://sourceforge.net/projects/pytypus	***project created on***	
old homepage	http://www.pytypus.org		

description

Pytypus is an open source project. It is a collaborative semantic engine that uses RDF as a base technology as most of the functionalities are described through the meaning of RDF annotations. Pytypus ontologies are studied to be useful for services (robots, or bots). The base service of this project is Tralco: a semantic database that manages contents, metadata and security. Tralco communicates with the world through XML-RPC and Perspective Broker, two open protocols for remote procedure calling. Tralco allows one content for each URI. It uses a simple ontology to describe owners upon URI namespaces, but a complex politics based on that ontology to perform access control. Tralco security is based on a public key algorithm. Another semantic bot, called Renderer, has been developed to interact with a Tralco via browsers. It offers some useful services for people, such as 'user/password' access login, and a semantic template engine. Pytypus bots are built to be configured and extended through the semantic database. Tralco can be extended runtime with specialized queries, writing the code for them in an URI content. Similarly Renderer can be extended with new rendering codes, writing them in contents of URIs on its corresponding Tralco.

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metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/pytypus.html	***last visited on***	
DOAP URL	no		2005-12-16
affiliation	Roberto Tazzoli, Italy		
challenge year	2005	***challenge ranking***	
Is it downloadable?	✔		

observation

Is it based on Platypus (SWC 2004)?
Is there a publication?
What is, clearly, the objective of the project?
It is downloadable via CVS, although there is not a "pack ready to go". Are there instructions to download?

project id	30	***project name***	Web Services Execution Environment
homepage	http://www.wsmx.org/	***project created on***	
old homepage	http://www.wsmx.org/		

description

The technology of Semantic Web services (SWSs) envisions easy access to resources and facilitates the consumption of the functionality exposed by those resources on the Web. Seamless integration, ad-hoc cooperation between various business parties or dynamic collaborations on the Web, can be achieved only if tools for handling semantically enhanced services are provided. In this context, we propose the Web Service Execution Environment (WSMX), a framework for the discovery, selection, mediation and invocation of SWSs. WSMX is based on the conceptual model provided by the Web Services Modeling Ontology (WSMO) which describes various aspects related to Semantic Web services. In addition, WSMX provides a reference implementation for WSMO in the form of a Service Oriented Architecture (SOA), a set of collaborative software components with well defined interfaces.

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metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/wsee.html	***last visited on***	
DOAP URL	no		2005-12-16
affiliation	DERI, Ireland/Austria		
challenge year	2005	***challenge ranking***	
Is it downloadable?	✔		

observation

It is on version 0.2.
Open source.

project id	31	***project name***	DynamicView		
homepage	http://xobjects.seu.edu.cn/DynamicView/index.html			***project created on***	
old homepage	http://xobjects.seu.edu.cn/DynamicView/index.html				

description

A Semantic Web application, named DynamicView, is implemented for students, professors and researchers to query and visualize distribution of research areas in computer science in top 20 universities of USA and China. Research areas are extracted from web pages of these universities and stored into relational databases. Based on the ACM Computing Classification System (1998) and the classification and code of disciplines by MST China, we use SKOS-like vocabularies to express the combination of the two classification hierarchies. Query results of research areas and hot topics are visualized in SVG (Scalable Vector Graphics) graph. It is found that researcher numbers are different in different countries, or even in the same country but with different ontologies. Great differences of hot topics between two countries do exist.

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see also	

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metadata created on	2005-12-07	***status***	online		
first pointer	http://www.informatik.uni-bremen.de/swc/dynamic-view.html			***last visited on***	
DOAP URL	no				2005-12-16
affiliation	Southeast University, China				
challenge year	2005	***challenge ranking***		***Is it downloadable?***	☑

observation

Public code.

project id	32	***project name***	Personal Publication Reader
homepage	http://www.personal-reader.de/semwebchallenge/sw-challenge.ht	***project created on***	
old homepage	http://www.personal-reader.de/semwebchallenge/sw-challenge.ht		

description

This application demonstrates how to provide personalized, syndicated views on distributed Web data using Semantic Web technologies. The application comprises four steps: The information gathering step, in which information from distributed, heterogenous sources is extracted and enriched with machine-readable semantics, the operation step for timely and up-to-date extractions, the reasoning step in which rules reason about the created semantic descriptions and additional knowledge-bases like ontologies and user profile information, and the user interface creation step in which the RDF-descriptions resulting from the reasoning step are interpreted and translated into an appropriate, personalized user interface. We have developed this application for solving the following real-world problem: We provide personalized, syndicated views on the publications of a large European research project with more than twenty geographically distributed partners and embed this information with contextual information on the project, its working groups, information about the authors, related publications, etc.

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see also	

metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/ppp.html	***last visited on***	
DOAP URL	no		2005-12-16
affiliation	U Hannover, TU Vienna, Lixto Software GmbH		
challenge year	2005	***challenge ranking***	3
Is it downloadable?	☐		

observation

The infrastructure behind the portal is "cleverly" segmented: gathering; reasoning; interfacing.
The project is focused on customization and "views". The interfacing segment resembles SWAP (SWC 2004).

project id	33	***project name***	Oyster
homepage	http://oyster.ontoware.org/	***project created on***	
old homepage	http://oyster.ontoware.org		

description

Currently, ontology re-use is rather difficult, as it is hard to find and share ontologies available among the community. This leads to the problem of having many isolated ontologies created by many different parties. Besides the costs of the duplicate efforts this also hampers interoperability between ontology-based applications. Oyster1 is a Peerto- Peer application that exploits semantic web techniques in order to provide a solution for exchanging and re-using ontologies. To achieve this, Oyster implements a proposal for a standard set of ontology metadata (i.e. an ontology of ontologies) developed in the Knowledge Web project2 as the way to describe ontologies. Furthermore, exchanging ontology metadata is an interesting use case for the semantic web application for the following characteristics: The information sources (ontologies) are geographically distributed among the community and at the same time the developers are willing to share the information about the ontologies they created provided they do not have to invest much work in doing so and they are able to mantain the ownership of their ontologies. Finally, since ontologies can be represented in different languages (such as OWL, DAML+OIL, RDF-S), Oyster provides the possibility to exchange heterogeneous information through the use of the metadata standard.

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metadata created on	2005-12-07	***status***	online		
first pointer	http://www.informatik.uni-bremen.de/swc/oyster.html	***last visited on***			
DOAP URL	no		2005-12-16		
affiliation	Uni Politecnica de Madrid, Spain				
challenge year	2005	***challenge ranking***		***Is it downloadable?***	✔

observation

project id 34 ***project name*** FungalWeb

homepage http://www.cs.concordia.ca/FungalWeb/ ***project created on***

old homepage http://www.cs.concordia.ca/FungalWeb/

description

FungalWeb is the first project of its kind in Canada to focus on bringing semantic web technology to genomics. Ontology, multi-agent systems, machine learning and natural language processing are used to build tailored knowledge base and semantic systems of direct use to the scientific discovery process. Since its inception genomics has concerned itself with storage, management, and analysis of biologically relevant data derived from experimental and in-silico biological analysis which are distributed in different locations. Initially such information was predominantly sequence information along with hand curated annotation. FungalWeb Ontology is a large-scale integrated bio-ontology in the domain of fungal genomics using state-of-the-art semantic technologies. The Ontology provides querying and simplified access to units of intersecting information from different biological databases and existing bio-ontologies. It is imple-mented in OWL-DL language. In particular, the FungalWeb ontology as a core for the semantic web system can be used by human, bioinformatics applications or some intelligent systems for ontology-based information retrieval to provide extended interpretations and annotations that can better serve the purpose of communication over the Semantic Web.

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see also

metadata created on 2005-12-07 ***status*** online

first pointer http://www.informatik.uni-bremen.de/swc/fungalweb.html ***last visited on***

DOAP URL no 2005-12-16

affiliation Concordia University, Canada

challenge year 2005 ***challenge ranking*** 2 ***Is it downloadable?*** ☐

observation

Is it just the ontologies or is there something else? There is a paper where the authors describe some scenarios. It was published in a conference of intelligent systems for molecular biology. There is also a paper about the project in Semantic Web Interest Group in Canada 2004.
There are 2 ontologies to download and one "agent" that formulates queries in DL which works with Racer.

project id	35	***project name***	CONFOTO
homepage	http://www.confoto.org/	***project created on***	
old homepage	http://www.confoto.org/		

description

CONFOTO is a browsing and annotation service for conference photos. It combines recent Web trends (tag-based categorization, interactive user interfaces, syndication) with the advantages of Semantic Web platforms (machine-understandable information, an extensible data model, the possibility to mix arbitrary RDF vocabularies). CONFOTO offers a variety of tools to annotate and browse pictures. Simple forms can be used to create multilingual titles, tags, or descriptions, while more advanced forms allow the relation of pictures to events, people, ratings, or copyright information. CONFOTO provides a tailored photo browser and gallery generator for pictures, and a generic RDF browser for other resource types. Although a central repository is used to store resource descriptions, it is not neccessary to copy photo files to the server: The application supports uploaded pictures as well as pictures linked via a URL or described in external RDF/XML documents. RSS export functions facilitate photo sharing, and a SPARQL interface enables and encourages extended data re-use.

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see also	

metadata created on	2005-12-07	***status***	online
first pointer	http://www.informatik.uni-bremen.de/swc/confoto.html	***last visited on***	
DOAP URL	no		2005-12-16
affiliation	Appmosphere web applications, Germany		
challenge year	2005	***challenge ranking***	1
Is it downloadable?	☐		

observation

Is it a Flickr + RDF?
How clear is the use of semantics for the final user?
There are few publications yet, but some of information on the website and on the author's homepage.