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Project-Team ACACIA

*Acquisition des Connaissances pour
l'Assistance à la Conception par
Interaction entre Agents*

Sophia Antipolis

THEME SYM

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2. Overall Objectives

2.1. Overall Objectives

2.1.1. Context and Objectives

Our multidisciplinary project aims at offering methodological and software support (i.e. models, methods and tools) for knowledge management (KM), i.e., for building, managing and distributing a corporate memory. This research can be extended to any organization or community.

2.1.2. Research Topics

We study the case where the building of a corporate memory relies on use of knowledge underlying documents, on the management of links between documents and knowledge bases or on the modeling of multiple viewpoints. We study knowledge acquisition, modeling and management from multiple expertise sources (experts and documents). We are especially interested in several scenarios of corporate memory: technical memory, profession memory and project memory, in particular in concurrent design, skills management and scientific and technological watch.

We study the problems raised by the dissemination of knowledge through a knowledge server via the corporate Intranet or via the Web: we consider the semantic Web as a privileged way for supporting management of knowledge distributed either inside a company or between several companies. We aim at building knowledge servers enabling search for information in a heterogeneous corporate memory, this search being “intelligently” guided by ontologies and ontological annotations.

We pioneered the notion of “corporate semantic Web” for a company or a community. We focus on the case of a corporate memory materialized in the form of a XML-based corporate semantic Web.

For representing ontologies or knowledge models, we use Sowa’s conceptual graphs formalism and the languages of the XML galaxy (especially RDF - Resource Description Framework).

Our research topics can be decomposed as follows:

- Support to Corporate Memory Construction:
 - Methodology for building a corporate memory.
 - Multi-agents or distributed architecture for corporate memory.
 - Project memory and technical memory for concurrent design.
 - Management of multi-expertise:
 - * Acquisition, modeling and capitalizing knowledge from several experts.
 - * Managing multiple expert models, multiple ontologies, multiple points of view.
 - Acquisition, modeling and capitalizing knowledge from texts.
- Support for Corporate Memory Broadcast and Use:
 - Knowledge Servers on a Semantic Web.
 - Tools for Querying and Browsing Ontologies and Documents.
 - Support to “Intelligent” Information-Retrieval, guided by ontologies.
 - Multi-agents System for Information Retrieval in a Distributed Corporate memory and for Proactive Dissemination.

2.1.3. International and industrial relations

Our work was applied in the context of the IST project CoMMA. We collaborate or collaborated with industrialists in the following fields: aeronautics (Aerospace, Dassault-Aviation, EADS), car industry (Renault), telecommunications (CSELT, T-NOVA, Telecom Valley), service integration (Atos Origin), semi-conductors (Philips Semi-Conductors). We also had collaborations with researchers in accidentology (INRETS) and in the field of health (Nautilus). Currently we have collaborations in civil engineering sector (CSTB) and in biology (IPMC). We had international relations with Griffith University and CSIRO (Australia), Parma University (Italia) and T-Systems Nova (Germany). We took part in the OntoWeb thematic network and we take part in the Knowledge Web Network of Excellence.

3. Scientific Foundations

3.1. Foundations

Keywords: *Artificial Intelligence, Assistance to the User, Co-operation, Cognitive Sciences, Conceptual Graph, Corporate Memory, Corporate Web, Information Retrieval, Intranet, Knowledge Acquisition, Knowledge Engineering, Knowledge Management, Knowledge Server, Knowledge representation, Knowledge-Based System, Multiagent System, Multiexpertise, OWL, Ontology, RDF, Semantic Web, Structured Document, Web architectures, XML.*

Knowledge Management (KM) is one of the key progress factors in organizations. It aims at capturing explicit and tacit knowledge of an organization, in order to facilitate its access, sharing out and reuse [17]. The considered organization can be an actual enterprise or a public organization, but it may also just consist of a given department or service; it can also be a group, or a community, or a virtual enterprise (made of members possibly stemming from different companies, but sharing a common interest). An organization is made up of people interacting for common objectives, in an internal environment and with an external environment. These persons may have different functions and tasks in the organization, different competencies, knowledge, opinions, and work methods and they may produce explicit traces of their activities. In the course of their individual or collective tasks, they may need to find people able to give them useful information or to find such helpful information in an information source (a document, a database, a CDROM, a film, etc.).

The members of the organization have individual knowledge (that may be explicit, implicit or tacit), as well as individual and collective objectives in the framework of their group or of the whole organization. The organization has global objectives and KM must be guided by a strategic vision. This vision enables the organization to determine the main organizational objectives for KM:

- Improve knowledge sharing and cooperative work between people inside the organization.
- Disseminate the best practices in the company.
- Preserve past knowledge of the company so as to reuse it.
- Improve quality of projects and innovation.
- Improve relationships with external world (such as customers, or privileged partners).
- Anticipate evolution of the external environment (clients, competitors, etc.).
- Be ready to react to unexpected events and to manage emergency and crisis situations.

So a KM policy must rely on a deep understanding of what is the organization, what is its corporate culture, what kind of knowledge exists (either individual, or collective in an internal group or collective in the whole organization), how can the organization intellectual capital be assessed, how can the past explain the present and help to prepare the future, what can be the strategic objectives of KM and how they can be achieved according to the corporate culture and the environment of the end-users.

In an organization, knowledge can be individual or collective, it can be explicit, implicit, or tacit. In Nonaka's model [77], organizational learning relies on transformation between these different types of knowledge. Collective knowledge can also emerge in a community of practice. Tacit knowledge can be transmitted without any language (e.g. through observations), but in order to be transmitted to other persons, explicit knowledge generally needs a medium (i.e. document, database, etc.) so that people can create their own knowledge either by interacting with each other or by retrieving information from explicit traces and productions of other colleagues' knowledge. Knowledge can also be distributed among several knowledge sources in the organization, with possibly heterogeneous viewpoints.

There are three significant aspects to be tackled:

- **People:** their knowledge, the way they acquire and communicate this knowledge, their organizational functions, their interest centers, their knowledge networks, their work environment, etc. Any KM solution must be compatible with the end-users' cognitive models, roles, tasks, skills and work environment.
- **Organization:** its objectives, its business processes, the corporate culture, its corporate strategy, etc. Any KM solution must be compatible with the organizational strategy and culture, its objectives, its practices, its rules, its structure, its size, etc.
- **Information technologies for supporting the intended knowledge management:** the chosen technologies will depend on the KM objectives and on the intended end-users' environment.

The strategic vision for KM must enable the organization to select the KM priority needs and to orientate the choice of relevant techniques. One possible approach for KM is the building of a corporate memory or organizational memory (OM). A corporate memory can be defined as an "explicit, disembodied, persistent representation of crucial knowledge and information in an organization, in order to facilitate their access, sharing and reuse by members of the organization, for their individual or collective tasks". So different scopes and grains are possible for an organizational memory. Its building can rely on the following steps (cf. figure 1) [17], with Management throughout all such steps: (1) Detection of needs, (2) Construction, (3) Diffusion, (4) Use, (5) Evaluation, (6) Maintenance and evolution, all these steps being supervised by management.

An organizational memory can be modeled from several perspectives: for whom, why, what, how, when, who and where. It aims at delivering the right knowledge to the right person at the right time in the right format, in order to enable the right action / decision. Although KM is an issue in human resource management and enterprise organization beyond any specific technological issues, there are important aspects that can be supported or even enabled by intelligent information systems. Especially artificial intelligence (AI) and related fields provide solutions for parts of the overall KM problem. Several techniques can be adopted for the building of an OM. The choice of a solution depends on the type of organization, its needs, its culture and must take into account people, organization and technology.

Several research topics can be useful for OM design:

- Knowledge engineering and enterprise modeling techniques [61], [81], [68], [67] can contribute to identification and analysis of a company's knowledge-intensive work processes (e.g. product design or strategic planning): the analysis of information flow and involved knowledge sources allows to identify shortcomings of business processes, and to specify requirements on potential IT support.

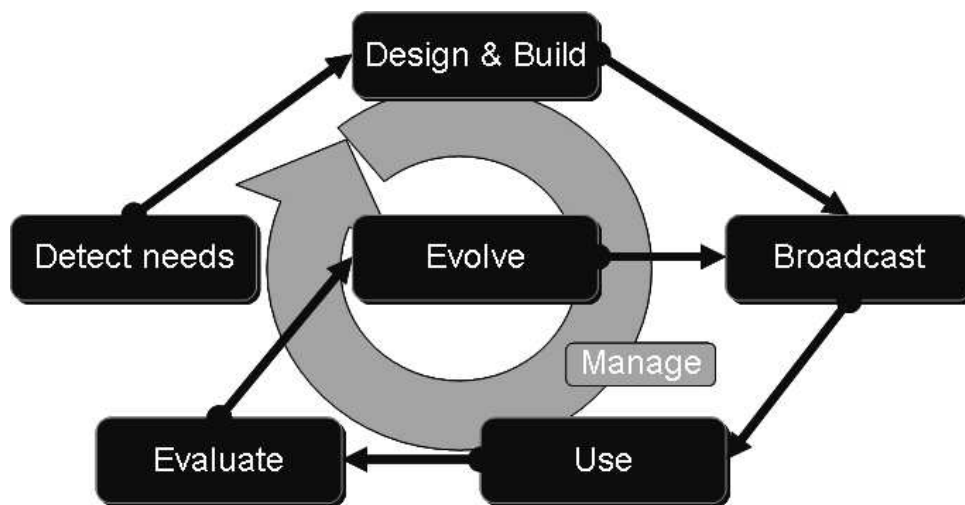


Figure 1. Life cycle of corporate memory

- In order to acquire implicit knowledge, knowledge engineering methods and techniques are useful, in particular concepts handled in knowledge engineering such as ontologies, tasks and problem-solving methods. Knowledge modeling can be needed. The degree of depth of required knowledge modeling can vary: a significant depth can be required if the organizational memory is materialized in a knowledge base, a shallow modeling is sufficient for building a competence map or a resource map of the organization.
- Past experiments (e.g. lessons of past projects, past incidents, past successes or failures, etc.) can be represented in a case-based system [59]; case-based reasoning techniques can then be useful for retrieving them and reusing them for a new situation.
- Ontologies can be a component of a corporate memory so as to be explored by the end-users; they can also be used for improving information retrieval about resources (such as documents or persons) constituting the memory if these resources are annotated w.r.t. the ontology. Such a use of ontology is close to the Semantic Web approach relying on metadata describing the semantic content of the Web resources, using ontologies [69], [78]. This approach for a corporate memory is inspired of the Semantic Web and is called “corporate semantic web” by the Acacia team [19].
- Natural language processing (NLP) tools can be exploited for the construction or enrichment of such ontologies [60] or for building annotations on the resources constituting the corporate memory.
- KM in an organization requires abilities to manage disparate know-how and heterogeneous viewpoints, to make them accessible and suitable for the organization members that need them. When the organizational knowledge is distributed on several experts and documents in different locations, an Intranet and Web technologies can be a privileged means for acquiring, modeling, managing this distributed knowledge. Agent technologies and Semantic Web technologies can be combined to handle such a distributed memory. Moreover, CSCW [62] offers an interesting way to enhance collaborative work between persons through distributed memories.
- A specific kind of corporate memory is a project memory for preserving knowledge acquired during a project, for improving project management, for reusing past project experiences, design technical issues and lessons learned [17]. KM can rely on the business processes. This process-oriented vision of KM can lead to OM integrating workflow systems.

- A corporate memory can rely on a competence map, and techniques enabling expertise location are very useful for knowing who knows what in the company.

The Acacia approach relies on the analogy between the resources of a corporate memory and the resources of the Web. We consider that a corporate memory can be materialized in a corporate semantic web, that consists of [17], [19]:

- resources (i.e. documents in XML, HTML or non Web-oriented formats, people, services, software, materials),
- ontologies (describing the conceptual vocabulary shared by the different communities of the organization),
- semantic annotations on these resources (i.e. on the document contents, on persons' skills, on the characteristics of the services/software/materials), these annotations using the conceptual vocabulary defined in ontologies.

The underlying research topics are:

- How can we build and make evolve each component (resource, ontology, annotation)?
- How can we build them semi-automatically through knowledge acquisition from textual sources or from structured database?
- How can we take into account multiple viewpoints?
- How can agent technology enable us to build, manage and use a distributed memory?
- How can we offer "intelligent", ontology-guided information retrieval or pro-active dissemination?
- How can we rely on scenarios of use for stakeholder-centered needs detection and for stakeholder-centered evaluation?

From knowledge representation viewpoint, we rely on the Sowa's conceptual graphs formalism, more precisely simple conceptual graphs extended by graph rules (SG-family proposed by LIRMM). The CG model enables to represent knowledge through bipartite labelled graphs using the vocabulary offered by a domain ontology. Reasoning on CG can be performed through graph operators such as projection. Reasoning on CG is logically founded since projection is sound and complete w.r.t. deduction in first-order logics, for simple graphs, for nested graphs and for more general graphs equivalent to first-order logics.

4. Application Domains

4.1. Panorama

Keywords: *Accidentology, Aeronautics, Automobile, Biology, Engineering, Health, Micro-electronics, Oncology, Telecommunications, Transportation.*

There are various application domains of the project: our work on technical memory or project memory has applications in engineering (aircraft industry and car industry). Our work on the knowledge servers also has applications in engineering, in the sector of telecommunications (for corporate memory, skills management and technological watch) and in the biomedical field. Accidentology for road safety was a privileged application domain of all our work. But many other fields are possible.

4.2. Transportation: Accidentology

We collaborated with INRETS for the modeling of knowledge of several experts in road accident analysis (psychological specialists in the driver's behavior, vehicle engineers, infrastructure engineers). This application of accidentology illustrates an example of (partial) corporate memory and moreover, served as concrete

example for numerous works of the team: analysis of co-operation between experts during a collective problem resolution, analysis of explanatory dialogues, comparison between multiple expertise models via our MULTIKAT software, exploitation of CommonKADS method generic models, association of conceptual graphs to expertise documents via our CGKAT software, representation of the artificial agents associated to the experts and their COMMONKADS expertise models, exploitation of the C-VISTA model for the representation of multiple points of view of different experts. We developed the RESEDA system (Intranet Network for Detailed Study of Accidents) in XML and JAVA, in order to support INRETS for road accident analysis.

4.3. Transportation and Engineering: Automobile

In the context of the improvement of the vehicle design process control, we collaborated with Renault to develop a memory of problems encountered during vehicle projects, whose traces were stored in the corporate information system. The construction of this project memory relied on techniques of knowledge engineering and of linguistic analysis. SAMOVAR (Système d'Analyse et de Modélisation des validations Renault) system can be considered as a concrete example of corporate semantic Web.

4.4. Transportation and Engineering: Aeronautics

In the past, we had collaborated with Aérospatiale and Dassault Aviation on project memory. Recently, we collaborated with EADS Corporate Research Laboratory for building a Corporate Memory for an Industrial Research Laboratory.

4.5. Telecommunications

Our work on corporate memory, in particular the use of intelligent agents, ontologies and XML technology, is of particular interest for companies of the telecommunications sector. We thus collaborated with T-NOVA (Deutsche Telekom) and CSELT (Italian Telecom) in the framework of the CoMMA IST project. T-NOVA applied this work for the assistance to insertion of new employees and CSELT for the assistance to technological monitoring. We also collaborated with Telecom Valley and the GET (ENST and ENST-Bretagne) for our work on skills management in the RNRT KmP project. We finally collaborated with ENST-Bretagne for the CNRS Specific Action on "Semantic Web and E-learning".

4.6. Civil Engineering Sector

Our work on corporate memory, in particular the use of intelligent agents, ontologies and XML technology, is also interesting for the construction industry: we thus collaborated with the CSTB (French Scientific and Technical Center for Building) within the framework of the CoMMA project for a scenario of technological watch. We continue a collaboration on the topics of technological watch.

4.7. Micro-electronics

Since September 2005, we started a new collaboration with Philips Semi-Conductors for an intra-firm skills management application.

4.8. Biomedical Domain

Our work on corporate memory, in particular our corporate semantic Web approach (ontologies and XML technology), is applied to several biomedical applications: use of linguistic techniques for building an experiment memory for transcriptome analysis (in the framework of the MEAT project in collaboration with IPMC), use of a medical ontology, viewpoints and CSCW for supporting collaborative work in a healthcare network (in the context of the ACI *Ligne de Vie* project in collaboration with the SARL Nautilus and SPIM (Service de Santé Publique et d'Informatique médicale de la Faculté de Médecine Broussais-Hôtel Dieu).

5. Software

5.1. CORESE

Keywords: *Conceptual Graph, Information Retrieval, OWL, RDF, RDFS, Semantic Web, XML, ontology.*

Participants: Olivier Corby [correspondant], Olivier Savoie.

5.1.1. Description.

CORESE (COnceptual REsource Search Engine) is an RDF(S)-dedicated engine based on Conceptual Graphs (CG) (<http://www.inria.fr/acacia/soft/corese>). It enables to load RDFS schemas and RDF annotations and to transform them into conceptual graph formalism. It then enables to query the base of annotations thus created, by using the projection operator offered by the conceptual graph formalism.

Corese implements RDF, RDFS, some statement types from OWL Lite and the query pattern part of SPARQL (Simple Protocol and RDF Query Language). Furthermore, Corese query language integrates original features such as approximate search, group, count, graph path. Approximate search consists of searching the best approximate answers to a query according to the ontology, graph path enables to search the graph structure of RDF. Corese also integrates an RDF Rule Language based on the CG Rule model. The inference rule engine works in forward chaining.

It has been applied in more than 10 applications at the INRIA and is available for download. It is a semantic web platform that enables us to design and develop semantic web applications. Corese is embedded in a Semantic Web Server (based on Tomcat) and called SEWESE

Corese was one of the first RDF engine as the development started in 1999 and a paper was published at ICCS'2000 [65]. The Acacia team has been a pioneer in applying conceptual graphs to RDF and semantic web [39]. The CG helped us for understanding and using RDF. Building a software prototype helped us for mastering the semantic web languages.

CORESE benefited from an INRIA operation of software development (ODL) intended to improve quality of the implementation in order to support its diffusion.

5.1.2. Applications.

CORESE is used as search engine:

- for the RNRT KmP project on skills management,
- for the KmP-Dirre project following this RNRT project with Telecom Valley,
- for the KmP-Philips project on intra-firm skills management with Philips,
- in the *Ligne de Vie* project on healthcare network,
- in the MEAT project on experiment memory on transcriptome analysis,
- in our co-operation with EADS,
- in QBLS system for e-Learning.

In the past, CORESE was the cornerstone of four co-operations of the Acacia team:

- the IST project, CoMMA (Corporate Memory Management through Agents) [70], [71],
- the SAMOVAR project with Renault [12], [75], [74],
- the co-operative research action ESCRIRE [76],
- the Color action Aprobation with CSTB.

5.1.3. Diffusion.

- CORESE was registered at APP.
- CORESE was made available to:
 - Renault,
 - ATOS Origin,
 - T-Systems NOVA (Deutsche Telekom),
 - CSTB,
 - CSELT (Telecom Italia),
 - LIRMM,
 - Mainline team at ESSI,
 - CETU (Centre d'étude des tunnels du Ministère de l'Équipement).
 - University of Santiago Chili,
 - ENST Bretagne,
 - Tech-CICO team at Université Technologique de Troyes (UTT),
 - Facultad de Informatica, LSIS
 - Zuhlke Engineering AG, CH
 - W3C Group on the Social Meaning of RDF Graphs, Deltek Systems, Inc. USA
 - Galaad team at INRIA Sophia Antipolis.
- In 2005, CORESE was presented in demonstration to members of:
 - Semantic Systems (a Spanish SME),
 - SAP Labs,
 - New South Wales University.
- The work on CORESE was published in [18], [51], [34], [65], [66], [64].
- There is a project of creation of a start-up, eCore, in order to market a solution for skills management based on Corese.

5.2. Sewese

Keywords: *RDF, RDFS, Semantic Web Server, ontology.*

Participants: Fabien Gandon [correspondant], Priscille Durville, Marek Ruzicka, Cécile Guigard.

Sewese is a generic factory to design and develop semantic web servers and portals. It is designed to embed Corese as semantic search engine and is based on Tomcat.

Sewese enables to design semantic forms in order to edit predefined queries. An XSLT (the Extensible Stylesheet Language Transformations) based compiler generates a JSP form and a JSP for processing the form. Sewese enables to process query results by means of XSLT stylesheets. It manages a set of compiled stylesheets to improve performance.

Sewese is based on Tomcat filters to build a semantic web site including session, menu and content management. Sewese also includes a JSP Tag library for predefined processing such as graphic tags for RDFS ontology browsing and editing and for RDF annotation editing.

5.3. KmP

Keywords: *RDF, RDFS, Semantic Web Server, ontology, skills management.*

Participants: Nicolas Gronnier, Cécile Guigard, Fabien Gandon, Olivier Corby, Alain Giboin.

5.3.1. Description.

The KmP System is a semantic web server based on CORESE, and a real-scale application illustrating an "inter-corporate semantic web", with 20 pilot companies. It comprises:

- KmP inter-firms ontologies,
- KmP ontology-based interfaces, developed by following the scenario method adapted to the design of usable ontology-based interfaces,
- a semantic clustering algorithm adapted to user representation of concept similarity.

The KmP system was evaluated by the pilot companies, through scenario-based approach. A pre-industrialization of KmP is planned.

5.3.2. Applications.

KMP will be adapted:

- for the KmP-Drire project following this RNRT project with Telecom Valley,
- for the KmP-Philips project on intra-firm skills management with Philips.

5.3.3. Demonstrations.

- In 2005, KMP was presented in demonstration to members of:
 - Semantic Systems,
 - SAP,
 - New South Wales University.
- The work on KMP was published in [44], [41]

6. New Results

6.1. Support to Modeling and Building of a Corporate Semantic Web

Keywords: *Assistance to the User, Co-operation, Cognitive Psychology, Cognitive Sciences, Communication, Corporate Memory, Corporate Semantic Web, Human-machine interaction, Knowledge Acquisition, Knowledge Engineering, Knowledge Management, Ontology.*

The objective of this action is to propose methodological and software support for the construction of a corporate memory, thanks to a user-centered approach. We study in particular the construction of a corporate semantic Web and the construction of ontologies and annotations from human and textual sources of expertise or from databases. Moreover, we study how to handle multiple viewpoints or multiple ontologies and how to take into account the life cycle and the evolution of a corporate semantic web. We also study e-Learning as a specific scenario of knowledge management. Recently, we started to study how to tackle the context and privacy of the (possibly mobile) user and how to develop and use “Corporate Semantic Web Services”.

6.1.1. Designing User-Adapted Semantic Web Applications

Participants: Sophie de Bonis, Olivier Corby, Karine Delêtre, Alain Giboin (resp.), Fabien Gandon, Thierry Grandsart.

Initially concerned by formal and technical aspects, the Semantic Web community recently acknowledged the necessity to take Semantic Web applications’ uses and users into account for the applications to be accepted by users and their organizations (cf. International Workshop on Interaction Design and the Semantic Web (2004), and the Workshop on End-user Semantic Web Interaction (2005)). The goal of our actions is clearly to propose methods and models to help the user-oriented design of semantic web applications; in particular, importing and adapting methods from the Human-Computer Interaction (or software ergonomics) and CSCW communities to the Semantic Web community and to the ontology engineering community. This goal was evident in various projects such as KmP, Knowledge Web, QBLS, and UsableIntranet. Below are some of the actions we undertook this year:

6.1.2. Introduction of user-oriented evaluation methods in a toolkit of Semantic Web application designers

We took part in The Knowledge Web deliverable D1.2.3 to do so [56]. This deliverable analyzes and evaluates existing methods for ontology content evaluation according to requirements from an industrial point of view. A classification of methods and tools for the evaluation of ontologies for industrial practice is provided. It concerns methods and tools to: (1) select existing ontologies (possibly from libraries); (2) measure the correspondence between textual sources and the corresponding ontology; (3) evaluate the impact of an ontology on an information retrieval application; (4) check and improve the quality and consistency of ontologies; (5) monitor an ontology in use. The methods and tools intervene at different stages in the industrial life cycle of a software product. For each method and tool, its scientific basis and design purposes as well as its relevance and usefulness for industry are presented.

6.1.3. Adaptation and extension of the ergonomic principles proposed for designing Web applications

The objective is to rely on ergonomic principles (e.g. Nielsen’s heuristics, Bastien and Scapin’s ergonomic principles) to help design usable Semantic Web applications. We focus in particular on the principles dealing with “semantics” [53], [58], [57]. We are currently discussing with Chrisian Bastien (Université Paris V) to analyze the possibility to collaborate on Semantic Web ergonomic principles.

6.1.4. Adaptation of scenario-based methods to the design of Semantic Web applications

We were particularly concerned this year with the story-boarding and mock-up techniques, in order to cope with the question of translating semantics in a Semantic Web interface [44], [55], [54], [57].

6.1.5. *A method allowing to keep in touch with users during a Semantic Web application development project*

A major problem met during the design of Semantic Web applications, even by defenders of a user-oriented approach, is to constantly keep in touch with users. Relying on our experience of KmP, we analyzed cases where the contact with users was taken, lost, and taken again, and identified some techniques to constantly keep in touch with users [44]. Our analysis and identification is based on the notion of "use(r) representations", which is related to the notion of "corresponding representations" we previously introduced (see Acacia 2004 activity report).

6.1.6. *The "Correspondences" framework*

We have published our work on the use of the Correspondences Framework [72], [73] to analyze and support the coordination between producing and understanding or using electronic documents constituting a part of the memory of some organization [21].

6.1.7. *Corporate memory and semantic web for the Transcriptome Analysis*

Keywords: *Biochip experiments, Corporate memory, Natural Language Processing, Ontologies, Semantic Web, Semantic annotations.*

Participants: Khaled Khelif, Rose Dieng-Kuntz.

This work is carried out in the context of Khaled Khelif's thesis [45], [46] that illustrates the scenario of experiment memory for a scientific community.

The study of gene expression has been greatly facilitated by biochip technology. Biochips can assess tens of thousands of genes simultaneously and lead to a huge amount of information: for example, information about the roles played by particular genes in drug sensitivity and the effects of drugs on gene expression. In the framework of a collaborative project with biologists working on biochip experiments at IPMC (Institut de Pharmacologie Moléculaire et Cellulaire), we aim at assisting them in their experiments and facilitating their validation and interpretation of obtained results. Our objective is to propose methodological and software support for capitalization and valorisation of knowledge resulting from experiments and techniques to preserve and reuse data (structured documents, semantic information retrieval). We rely on the techniques of semantic web (semantic annotations, ontology...) and knowledge engineering. After studying biologists' needs, we proposed to build an experiment memory and to materialize it through a corporate semantic web. The main modules of this memory are:

- MeatOnto, a modular ontology composed of 3 subontologies: (1) UMLS (Unified Medical Language System) to describe the biomedical domain; (2) MGED (Microarray Gene Expression Data) covering the technical aspects of the biochip experiments and (3) DocOnto which describes (a) metadata about scientific articles and about annotations, (b) the structure of articles and links documents to UMLS concepts.
- MeatAnnot, a system for the automatic generation of ontology-based semantic annotations: starting from a scientific article in biology, it allows to generate a structured semantic annotation, based on a domain ontology, and describing the semantic contents of this text. MeatAnnot relies on several NLP techniques (using in particular modules of GATE (General Architecture for Text Engineering), RASP (Robust Accurate Statistical Parsing) parser and a relation extraction grammar we wrote in JAPE); it extracts information from text, instantiates concepts and relationships of UMLS ontology and generates RDF annotation for the document.
- MeatSearch, the search module based on Corese: it enables biologists to use annotations. By using the query and rule languages of Corese, this system allows to perform reasoning on the annotation base for retrieving relevant information.

The annotations generated by MeatAnnot were validated by biologists and obtained good scores (82% of precision, 62% of recall and 96% of usefulness).

Our method can be generalized to any life science domain (e.g. chemistry, physics) having similar needs of support to validation and interpretation of experiments results.

The originality of this work consists of (a) the integration of metadata on annotations which gives new ways of reasoning and more information on the annotation base, (b) the use of several technologies (such as NLP, Ontologies, Semantic annotations, Corese) to build a real-world Corporate Semantic Web Application.

6.1.8. *Semantic Relation Acquisition from Biomedical Corpora for Ontology Discovery*

Keywords: *NLP, Semantic Web, Syntax-semantics interface, Unification-grammars, causation, lexico-syntactic information extraction, ontology and annotation learning, semantic schema acquisition.*

Participants: Laurent Alamarguy, Rose Dieng-Kuntz, Catherine Faron-Zucker.

This work is performed in the framework of Laurent Alamarguy's PhD thesis [25], [26]. This work deals with the acquisition of semantic relations from biomedical corpora for the construction of ontology and annotations. This aims at elaborating a methodological support and a tool to enhance the automation of ontology construction and enrichment from linguistic comprehension of texts in order to develop a community memory in biomedical area.

We synthesized a conceptual acquisition method, INSYSE, aimed at proposing some salient semantic relation schemas to domain experts who supervise the ontology and annotation construction.

This method follows the linguistics processing philosophy and is based on several main stages dedicated to the syntax-semantics interface. This interface is elaborated through the formalism of the grammatical parser, PATR-II, based on unification grammars that are performed through lexicons constituted by the results of term extraction and shallow processing that reveals different kinds of abstract lexico-syntactic information, and using grammars that we manually determine upon causative construction of salient semantic markers. This interface generates some candidate conceptual schemas that are transcribed in RDF(S) in order to be used with Corese semantic search engine.

This year, we focused on developing a prototype of INSYSE system, a knowledge extraction tool based on our causal semantic relation acquisition method. Concerning the Natural Language Processing aspect, we worked on enhancing and developing our grammatical rules governing the syntax-semantics interface. Particularly, we aimed at analyzing and modeling linguistic phenomena such as valence alternations designing the transition from active form to passive form, or from nominal form to support-verb form. To do so, we explored again our training corpus more accurately, so as to propose a more relevant and conspicuous linguistic analysis favoring a better modeling. Concerning the realization of our prototype, a workbench homogenizing the different modules of the system has been elaborated, and we particularly paid attention to problems related to the merging between term extraction and shallow syntactic parsing.

Moreover, the realization of the workbench gave us the opportunity to submit a training subject to second year engineering ESSI students. In the framework of this training project, we co-supervised a four-students team which proposed coding solutions mainly based on Java.

A paper detailing the elaboration of the system, submitted to the community of Natural Language Processing in Biomedical area, was published in [26].

6.1.9. *Construction of a multi-point of view Semantic Web*

Keywords: *Multiple Viewpoints, Ontology, Ontology Matching, Semantic Web.*

Participants: Thanh-Le Bach, Rose Dieng-Kuntz.

This work is carried out within the context of Thanh-Le Bach's PhD.

The objective of this thesis is to build and use a multi-viewpoints semantic web in a heterogeneous organization, based on multi-viewpoints ontologies. These ontologies can be created from existing ontologies by integrating them or merging them. That raises the problem of ontology alignment or matching: finding entities which are conceptually similar in the ontologies to be compared.

During this year, we continued our work on ontology alignment algorithms. We proposed and implemented two new algorithms based on the ontology structural information as well as linguistic information that we can extract from ontologies. The algorithms focus on the matching/alignment of two ontologies represented in OWL, so that they can take advantage of the well-defined underlying meanings of OWL constructs, such as `owl:equivalentClass`, `owl:cardinality`... The first algorithm uses local structure information, which can be extracted from an entity description to deduce the similarity between two entities. The second one uses the structure information extracted from the whole ontology structure: it represents OWL ontologies as graphs then finds their largest common subgraph. The similar entities can be deduced from that largest common subgraph [28]. The algorithms are implemented in Java and experimented with testing ontology pairs at I3CON (the Information Interpretation and Integration Conference) <http://www.atl.external.lmco.com/projects/ontology/i3con.html>. The first results are interesting, but the algorithm still needs to be optimized for better performance when running with larger ontologies. For representing multi-viewpoints ontologies, we also proposed an extension of OWL ontology language, so as to represent multi-viewpoints ontologies based on the C-Vista model proposed by Myriam Ribière [79].

6.1.10. Management of Corporate Semantic Web Evolution

Keywords: *corporate memory, corporate semantic web, evolution, ontology evolution, semantic annotation.*

Participants: Phuc-Hiep Luong, Rose Dieng-Kuntz.

This work is being carried out within the framework of Luong Phuc Hiep's PhD, that, based on the analysis of the life cycle of a corporate semantic web (CSW), aims at solving some problems related to its evolution: evolution of each component (resources, ontologies and semantic annotations) as well as evolution of relations among these components.

During this year, we studied the problems of change management and evolution. Organisations evolve in dynamic and changing environments because of the changes in their business, technologies and processes. These changes in the real world often result in needs of modifications of the CSW. Moreover, when one of three main components of a CSW is changed, it might impact the consistency of other components or of the overall system. In this case, other related parts may need to evolve after such changes in order to re-establish the consistency of the CSW. We mainly focus on the influence that ontology modifications can have on semantic annotations based on these ontologies and, in particular, on the evolution of these semantic annotations.

We studied related research on schema evolution in databases and in knowledge-based systems, and on main techniques dedicated for both levels of schema and instance evolution, we studied the change management for distributed ontologies and some existing methods and tools for ontology evolution and ontology versioning. After reviewing this related work, we have tried to give some propositions with the purpose of resolution of inconsistency on the relation between a semantic annotation and the ontology in case of ontology modification. We have proposed the architecture of a system enabling to manage the evolution of such a CSW when its ontologies or the semantic annotations of its resources change. This proposed evolution management system will focus on the evolution of each component, on the relations among these components and on the propagation of the ontology changes towards the semantic annotations depending on this ontology. In [47], we describe such an evolution management system for a CSW by giving its architecture system working cooperatively with a CSW. We also proposed a model of consistency including some defined invariants and a mechanism of verification allowing to check whether a semantic annotation is still consistent with respect to its ontology. In order to solve inconsistencies of annotations when the ontology changes, we have constructed all the possible solutions for each ontology change operation that might impact the consistency of annotation. Finally, we introduced a process of propagation for ontology changes towards their related semantic annotations. This process supports both versioning and evolution problems for the update of semantic annotations.

We will focus on a real scenario with evolving ontology (e.g. UMLS) and based on RDF(S) language. We will try to formulate invariants of consistency and propagation rules through Corese rules and Corese query language.

6.1.11. Support to Cooperative Work: Application to a Healthcare Network

Participants: Karima Aissiou, Rose Dieng-Kuntz.

Our previous work performed in the framework of the ACI *Ligne de Vie* project aimed at developing a knowledge management system for a healthcare network, in order to ensure care continuity and support to collaborative work of the actors of the network, was published in [20], [50]. We extended the virtual staff for enabling to store the results of a session in RDF(S) and to use Corese query language for asking queries about past sessions of virtual staff.

6.1.12. Semantic Web for E-Learning

Keywords: *Annotations, E-learning, Ontologies, Pedagogical Resource Composition, Pedagogical Resource Retrieval.*

Participants: Sylvain Dehors, Catherine Faron-Zucker, Alain Giboin, Stéphanie Mevel.

This work takes place in the framework of Sylvain Dehors's PhD.

During this year the following aspects have been explored through both bibliographic and experimental activities. The main experiment conducted this year is called QBLS, an acronym for "Question Based Learning System". It results from a fruitful collaboration with a teacher at ESSI school, Jean Paul Stromboni. During this work, we studied both methodological and technical aspects of putting and accessing "online" semantically enriched course material. This experiment fits in a broader reflection on the application of the semantic web, dealing with the following issues: "What kind of information does a teacher really need? How do I get them? What to do with them?" To answer those key questions the following points were investigated and concrete solutions proposed.

6.1.13. Ontologies for e-learning

The Semantic Web proposes to represent and share knowledge by means of ontologies. Even if the use of ontologies for learning is described quite extensively in the literature, we found that it is still very unclear how ontologies can be integrated in learning systems and effectively used otherwise than in very basic mechanisms. In the QBLS experiment we focused on that issue and showed the establishment and real usage of a "pedagogical ontology" used to describe learning resources.

6.1.14. Semantic annotations for E-learning

Here we have let aside all the technical and legal information which has been already extensively studied by standardization bodies like IEEE and IMS to focus on annotations with a high pedagogical value. Through the QBLS experiment which started in November 2004 we have proposed a method based on the analysis of the layout of existing documents to extract and generate semantic information about those documents. The rationale behind this method is to automate as much as possible the annotation task. This also turns the usual textual editor (Word or OpenOffice) into a semantic annotation editor.

6.1.15. Semantic Web Tools and architecture

The semantic Web benefits from the effort of numerous research teams around the world as well as the standardization effort supported by W3C. By reviewing the TRIAL Solution project we showed that tools like Corese and standards for web services would greatly enhance performance and readability at the architecture level in not-so-new learning applications. The QBLS experiment also demonstrated the power of the emerging "semantic web server" (Sewese) developed by Acacia allowing a fast and efficient deployment of this application.

6.1.16. Interface for Semantic Web E-learning application

The last but not least of the aspects dealt with during this year is the requirements for user interfaces dedicated to "semantic enhanced learning". By collaborating with a student in ergonomics, we designed a specific interface for QBLS, putting in practice the need for the interface to : (1) closely support the usage scenario of the system and (2) hide the complexity of the semantic mechanisms used by semantic web tools.

By staying in close touch with the reality of pedagogical practice we were able to propose a simple yet coherent and efficient system that is described in several publications accepted this year [36], [37], [38], [35].

6.1.17. Corporate Semantic Web Services

Keywords: *Semantic Web, Web Services.*

Participants: Moussa Lo, Fabien Gandon.

We were granted an AUF funding for a post-doctorate exchange with University Gaston Berger of St Louis (Senegal). As a result the researcher Moussa Lo visited our team for six months and collaborated with us to start a new research topic: Corporate Semantic Services i.e. web services in corporate semantic web to integrate and unify the access to corporate knowledge, applications and services [43]. This work was an experiment in integrating semantic web services in the existing semantic web server architecture of Corese to provide web applications based on the semantic web services it can identify. Thus, Corese is used as a semantic UDDI (Universal Description, Discovery and Integration) registry and allows us to automatically discover and invoke corporate applications wrapped into semantically annotated web services. Using rules and an extension to the existing semantic web service frameworks, we also demonstrate how (i) to compose the web services with queries on the knowledge stored in the corporate memory to automatically populate the service inputs and (ii) to turn Corese into a composable service of the memory [52].

6.1.18. Mobility, Context-Awareness and Privacy

Keywords: *Awareness, Context, Mobility, Privacy.*

Participant: Fabien Gandon.

We continued our cooperation with the Mobile Commerce Laboratory of the University of Carnegie Mellon. Fabien Gandon spent a week in CMU (March 2005) to help finalize and release the e-Wallet engine implementing a secure and unified interface to access knowledge and services published by a person. This work was also integrated in a project with the III institute of Taiwan and the Computing Media and Communication Laboratory of Carnegie Mellon in an application to mobile tour guide in museums. This work was presented at a GTMob meeting (<http://iihm.imag.fr/nigay/GTMOB/Janvier2005/>) and at a symposium organized by the CNRT Telius (15/06/2005) and will be published in a book chapter to appear.

6.2. Information Retrieval in a Corporate Semantic Web

Keywords: *Conceptual Graph, Corporate Memory, Information Retrieval, Knowledge Acquisition, Knowledge Engineering, Knowledge Management, Knowledge Server, OWL, Ontology, RDF, Semantic Web, Semantic Web Server, XML.*

We study the problems involved in the dissemination of knowledge through a knowledge server via Intranet or Internet: we consider the Web, and in particular the semantic Web, as a privileged means for the assistance to management of knowledge distributed within a firm or between firms. A knowledge server allows the search for information in a heterogeneous corporate memory, this research being intelligently guided by knowledge models or ontologies. It also allows the proactive dissemination of information by intelligent agents. We look further into the case of a memory materialized in the form of a corporate semantic Web, i.e. in the form of resources (such as documents) semantically annotated by RDF statements relating to an ontology.

6.2.1. Corese Semantic Search Engine and its Semantic Web Server

Keywords: *Conceptual Graph, Corporate Memory, Information Retrieval, Knowledge Acquisition, Knowledge Engineering, Knowledge Management, Knowledge Server, Ontology, RDF, Semantic Web, XML.*

6.2.2. OWL Lite

6.2.3. Corese Query Language & SPARQL

Participant: Olivier Corby.

This year has been dedicated to upgrade Corese Query Language interpreter and to integrate SPARQL W3C Query Language.

We redesigned Corese interpreter in order to simplify it, to make it more uniform and more general. We extended Corese projection algorithm to n-ary relations in order to process *source* statement and property variable. The *source* statement enables to query the source (the document) where RDF triples come from. The source is denoted by a variable that can be part of the query such as variable `?src` in :

```
?person c:hasCreated ?src
source ?src (?document c:date ?date)
filter (?date <= "2005-01-01"^^xsd:date)
```

Corese now processes all SPARQL ¹ filter expressions such as Boolean expressions, function call, negation as failure, etc. We upgraded the graph projection algorithm with optional graph patterns. An optional graph pattern enables to return a result if it is found and does not fail if no target pattern is found. We designed an extension of the Conceptual Graph projection algorithm that authorizes optional query relations in a query graph.

We also implemented SPARQL Query Results XML Format ² that enables to deliver the variable bindings in an XML format.

6.2.3.1. GUI

Participant: Olivier Corby.

We leveraged Corese GUI Factory in order to be compatible with SPARQL. We can now build HTML forms that enable us to customize predefined SPARQL queries. The values selected in the form are used to customize variable parts of the query. We have designed a syntactic convention that is compatible with SPARQL syntax by using a specific namespace to declare variable parts that must be retrieved from the GUI. The target query can now be saved and reloaded. The GUI factory has been validated in several applications and projects (EADS, KmP, QBLS).

6.2.3.2. Distribution

Participants: Olivier Corby, Fabien Gandon, Khaled Khelif.

The Acacia team received a grant from Inria to hire an engineer to participate in the development of Corese (starting in October 2005). The engineer will start by completing the implementation of the SPARQL query language in Corese.

A new release of Corese and a new download site have been designed ³.

6.2.4. Sewese

Participants: Marek Ruzicka, Cécile Guigard, Fabien Gandon, Priscille Durville.

Pursuing the industrialization of our research results on Semantic Web Server, we developed Sewese, the second version of Corese Semantic Web Server (optimized and modularized architecture) and we are testing it in the context of a contract with Philips aimed at building a pilot product for the future start-up eCore.

6.2.4.1. Semantic Distances and Clustering

Keywords: *approximate search, ontologies, semantic distance.*

Participant: Fabien Gandon.

This work concerns conceptual distances, semantic similarities, defining metrics over ontological spaces. In literature, the work on the formal side of the semantic web is largely influenced by the fact that logic-based languages are the most frequently used implementation formalisms. However, entailment is not the only product one should expect from a knowledge-based system, and the conceptual structures of the semantic Web can support a broad variety of inferences that goes far beyond logical deduction even in its simplest forms (RDF/S). In particular, the graph structure of the semantic web formalisms provide a space where one

¹<http://www.w3.org/TR/rdfl-sparql-query>

²<http://www.w3.org/TR/rdfl-sparql-XMLres>

³<http://www.inria.fr/acacia/soft/corese>

can define metrics, distances, similarities for instance to extend classic logical entailment in the context of information retrieval. In the domain of Conceptual Graphs, a use for such a distance is to propose a non binary projection, i.e. a similarity $S : C^2 \rightarrow [0, 1]$ where 1 is the perfect match and 0 the absolute mismatch. In [51], we prove the characteristics of the algorithm used in CORESE and in particular, we prove that in the general case, it corresponds to a semi-distance i.e. the triangle inequality does not hold for any random third type t . However, by construction, it does hold for any third type t chosen among the supertypes. This weak notion of the principle of parsimony is enough in our case as we are only interested in paths going through the supertypes.

A second experience with semantic distances was conducted in building the KmP public semantic web server. One inference implemented in this server provides a cartography of competences. To do so it exploits the graph model of the semantic web using ontology-based metrics to provide an ultra-metric used to implement the clustering algorithm grouping the competences. These results were published in ISWC [41]. In parallel we are conducting an early experiment to evaluate and compare these simulated metrics with the ones humans naturally use in handling information. The preliminary results were presented in [40] and suggest that current algorithms relying solely on the hierarchy of types to calculate and combine the similarities might require a more complex conceptual structure to become closer to human similarities.

6.2.4.2. Visualization Surrogates for Conceptual Structures

Participant: Fabien Gandon.

There is a huge gap between the conceptual structures underlying the semantic Web and the final rendering of a user-interface enabling an end-user to peruse or act on part of it. We experimented with the automation of the generation of representations for such conceptual structures. We reuse the notion of surrogate from information retrieval and we suggested a relation between these surrogates and the notion of identity conditions used in ontology engineering. From this observation we suggested and discussed a mechanism to derive maximal surrogate candidates from structures found in ontologies and rules [42].

6.2.4.3. Web Mining for Technological and Scientific Watch

Keywords: *Corporate memory, Multi agent system, ontology, semantic annotations, semantic web, technological monitoring, technological watch, web mining.*

Participants: Tuan-Dung Cao, Rose Dieng-Kuntz.

This work was performed in the context of the PhD of Tuan-Dung Cao.

Nowadays, relevant and updated information about technology becomes a realistic need for every corporation in a rapidly evolving business environment. Technological Watch or Technology Monitoring (TM) are activities serving the purpose of identification and assessment of technological advances critical to the company's competitive position, and of detecting changes and discontinuities in existing technologies. The information explosion on the World Wide Web makes the Web itself a mine of gold for technology monitoring. Within the framework of the knowledge management of an organization or a community, Web information extraction can be particularly useful when it is applied by a multi agent system to discover in the Web of relevant information, at ends of the technological or strategic watch.

The objective of the thesis is to use technology agents to develop a multi agent system, these agents being guided by ontologies, to collect, capture, filter, classify and structure the contents of the Web coming from several sources of information, in a scenario of assistance to the technology watch at the CSTB (Center of science and technology for Building).

Last year, our analysis of the monitoring task for the considered field (construction and building) enabled us to choose a relevant scenario of monitoring and to build an ontology which will guide the search and the extraction of information. Besides reusing the O'CoMMA ontology previously built in the CoMMA project since a part of this ontology relates to the field of building and construction, we had also to perform knowledge modeling in order to transform the vocabulary from thesaurus currently used by CSTB into an ontology. Moreover, we integrated in the ontology concepts and relations dedicated for TM task concerning TM actors, monitoring phases and the information sources and some document types.

Then we proposed an ontology-based approach for building an information system supporting technology monitoring implemented by agents. This system facilitates the document searching and annotating task of the watcher. Its agents use the ontology to enrich any watcher's query, then formulate a system query and send it to Google to search the Web and finally generate annotations from search result. Thus the watcher can easily access to information annotated by exploiting the Corese semantic search engine.

To do so, we developed and implemented three algorithms using the ontology to search the Web with Google and then generate the RDF annotations from these results of Google automatically. The two first algorithms use branches of concepts in ontology to search the Web while the third one relies on the balanced selection of descendant concepts of user's concepts in the original query [32], [31]. This work will be published at RFIA'2006 [63].

We are now designing and implementing a subsociety of "annotator" Agents encapsulating this algorithm, working in cooperation with other agents dedicated to other tasks in the TM system.

7. Contracts and Grants with Industry

7.1. Knowledge Management Platform

Participants: Alain Giboin (resp.), Olivier Corby, Karine Delêtre, Fabien Gandon, Thierry Grandsart, Nicolas Gronnier, Cécile Guigard.

This two-years project ended in April 2005. A final prototype was delivered, with the final report of the project [57]. KmP involved teams specialized in computer science, economic sciences, management sciences, ergonomics and psychology, namely: Rodige Laboratory (UNSA-CNRS), Latapses Laboratory (UNSA-CNRS), Acacia Team (INRIA Sophia Antipolis), GET (Telecom Paris and ENST Bretagne), Telecom Valley Association (Sophia Antipolis). The project also involved a set of pilot users, who actively participate to the design of the prototype. The KmP project lead to the construction of a web server facilitating the sharing of competences within a community - the Telecom Valley (Sophia Antipolis) which gathers firms, local institutions, and research organizations working in the telecommunications domain. The aim of KmP is to promote partnership seeking and setting within the community (cf. [80]). The Acacia team coordinated the design and development of the prototype and of its underlying ontologies. The prototype is based on Corese, hence its name: KmP-Corese. The RNRT KmP project was so successful that it will continue through follow-up projects.

7.2. KmP-DRIRE

Participants: Olivier Corby (resp.), Semi Gaieb, Fabien Gandon, Alain Giboin.

Since July 2005, the Acacia team was awarded a one year grant by DRIRE PACA in order to leverage the research prototype developed during the RNRT KmP project. This new project is performed in collaboration with Rodige/Gredeg from UNSA CNRS and Telecom Valley. The purpose of the project is to improve the architecture and the usability of the platform and to design ergonomic user interfaces.

7.3. KmP-Philips

Participants: Olivier Corby (co-resp.), Priscille Durville, Fabien Gandon, Alain Giboin (co-resp.), Hervé Karp.

This two-year project is a second follow-up to the RNRT KmP project that started in September 2005. Its goal is to design and validate a prototype supporting the strategic management of individual and collective competencies within Philips Semiconductors France. The prototype will be adapted to Philips Semiconductors Sophia Antipolis and is a pilot for the future eCoRe start-up. The KmP-Philips project involves Acacia, Rodige, Philips and eCoRe.

7.4. EADS

Keywords: *Aerospace domain, Knowledge Management, Ontology, RDF, Semantic Web, XML.*

Participants: Sylvain Dehors, Fabien Gandon, Olivier Corby (resp.).

We had a second contract with EADS CCR to integrate new Corese functions into the earlier EADS Corese prototype for Corporate Research Memory Management. We enhanced XSLT style sheets for customized result presentation. We designed a prototype of an RDF editor to edit annotations. The editor is based on XSLT style sheets that perform edit actions. We integrated the editor into EADS Corese server.

8. Other Grants and Activities

8.1. Regional Actions

8.1.1. eCore

Participants: Olivier Corby, Rose Dieng-Kuntz, Fabien Gandon, Alain Giboin, Hervé Karp (resp.).

Acacia is engaged with Hervé Karp in a process of creation of a start-up, eCore, in order to market a solution for skills management based on Corese. The contract with Philips will enable to develop a pilot for eCore.

8.1.2. MEAT Project

Participants: Khaled Khelif, Rose Dieng-Kuntz (resp.), Olivier Corby.

We collaborate with Pascal Barbry (IPMC), Rémi Bars (Bayer Crop Science) and Martine Collard (I3S) to build a memory of experiments on DNA chips (see section 6.1.4).

8.1.3. Laboratoire des usages de Sophia Antipolis

Participants: Alain Giboin, Sophie De Bonis, Thierry Grandsart.

We take part in the “Use laboratory” that aims at observing the current collective usages of technologies, and to anticipate future usages « by a pluridisciplinary research gathering technologists, economists, sociologists, ergonomists, marketing specialists with rigorous methodologies around effective technological platforms and relevant and various users. »

8.1.4. CSTB (French Scientific and Technical Center for Building)

Participants: Tuan-Dung Cao, Rose Dieng-Kuntz (resp.).

We collaborate with Bruno Fiès and Marc Bourdeau (CSTB) for Tuan-Dung Cao’s PhD on *Software Agents for the Web Mining, Application to Technological and Scientific Watch*.

8.1.5. CINDY, Pôle Cindynique of ENSMP

Participants: Thanh-Le Bach, Rose Dieng-Kuntz (resp.).

We collaborate with Franck Guarnieri (CINDY - Pole of Research and Formation on Danger and Risk Management of the École Nationale Supérieure des Mines de Paris, in Sophia Antipolis) for Thanh-Le Bach’s PhD on *Construction of a multi-viewpoint Semantic Web*. We also have contacts for follow-up of the PhD of Denis Overall, PhD student at CINDY/ENSMP.

8.1.6. WebLearn Colors

Participants: Olivier Corby, Sylvain Dehors, Rose Dieng-Kuntz (resp.), Catherine Faron-Zucker, Fabien Gandon, Alain Giboin.

We collaborate with the Mainline Team at ESSI, the LIRMM, and the CREGO for the WebLearn Colors on *Semantic Web for E-Learning*. Our objective is to explore the techniques of the Semantic Web for e-learning applications and to measure the impact of e-learning specificities for the design of dedicated semantic portals.

8.1.7. "UsableIntranet" Colors

Participants: Michel Buffa, Olivier Corby, Sylvain Dehors, Sophie De Bonis, Rose Dieng-Kuntz, Catherine Faron-Zucker, Fabien Gandon, Alain Giboin (resp).

UsableIntranet is an INRIA Colors action dealing with the usage-oriented evaluation and redesign of corporate intranets. The originality of this research action is to make informatics specialists and usability specialists collaborate to identify ways to help informatics specialists effectively integrate the usage aspects in the intranet design process to make the intranet more usable. Five teams are involved in UsableIntranet, four academic teams, with pluridisciplinary and complementary competencies, and an industrial team: Acacia, M@inline (I3S Laboratory, UNSA, CNRS), Rainbow (I3S, UNSA, CNRS), PCE and LPEQ (UNSA), Webcore (ILOG, Sophia Antipolis). The first period of the action was devoted to states-of-the-art about intranets and intranet usability, and to a usage study of the ILOG intranet [58]. The UsableIntranet group has been solicited by the French association ClubNet to present its work during one of the thematic workshops organized by the association. ClubNet gathers intranet managers (<http://www.clubnet.asso.fr>). We were solicited by Jean-François Nogier, a ClubNet member who is also the author of "Ergonomie du logiciel et design web : le manuel des interfaces utilisateur", and who introduced a novel section on the usability of intranets in the new edition of his book (2005).

8.2. National Actions

8.2.1. WebLearn CNRS Specific Action

Participants: Olivier Corby, Sylvain Dehors, Rose Dieng-Kuntz (resp.), Catherine Faron-Zucker, Fabien Gandon, Alain Giboin.

Rose Dieng-Kuntz, Monique GrandBastien (LORIA - Université Nancy I) and Danièle Hérim (LIRMM) co-ordinate the national CNRS Specific Action (SA) on *Semantic Web for E-Learning* (to which the local WebLearn Colors (see above) belongs). In addition to the local teams involved in the WebLearn Colors, the WebLearn Specific Action involves HEUDIASYC (Université Technologique de Compiègne), IMAG-CLIPS (Université Joseph Fourier & CNRS & INPG), LORIA, LIUPPA (Université de Pau et des Pays de l'Adour) Pau University, the LIASC (ENST Bretagne), and LPS - Université Pierre Mendès France (see <http://www.lirmm.fr/~toutilou/as-weblearn/>).

We took part in the workpackages "Ontologies for e-Learning", "Composition", "Languages", "Tools for Semantic Web and for e-Learning".

The final workshop of the WebLearn AS & Colors was held on May 31, 2005, in the framework of the AFIA Platform.

Several members of the Acacia team contributed to this final Weblearn workshop [23], [24], [27], [30], [38].

8.2.2. Working Groups

Members of the Acacia team take part in several working groups:

- Rose Dieng-Kuntz is member of:
 - the board of the GRACQ (*Groupe de Recherche en Acquisition des Connaissances*) (<http://www.irit.fr/GRACQ>).
 - the TIA Group (*Terminology and AI*) <http://tia.loria.fr/>.
- Alain Giboin is member of:
 - the Group « Psychologie ergonomique » of the Département Recherche de la Société française de Psychologie. Founder member and secretary of this group, he is also the Webmaster of the group website: <http://www-sop.inria.fr/acacia/gtpe/>
- Fabien Gandon, Olivier Corby and Catherine Faron-Zucker are creating an informal Group RWCG (Reasoning Semantic Web with Conceptual Graphs).

8.3. European Actions

8.3.1. Knowledge Web

Participants: Thanh-Le Bach, Olivier Corby, Sylvain Dehors, Rose Dieng-Kuntz (resp.), Fabien Gandon, Alain Giboin, Phuc-Hiep Luong.

We take part in the Knowledge Web Network of Excellence. This year, we took part in the workpackages WP2.2 Heterogeneity where we worked on ontology alignment, WP2.3 Dynamics where we studied thoroughly ontology evolution, and WP1.2 Evaluation. Rose Dieng-Kuntz took part in the research meetings in Hannover. In the WP3 Education, Sylvain Dehors contributed to the WP3.1 and WP3.3 of the Knowledge Web NoE. He attended the general meeting in Hannover in January, and contributed to the different deliverables and evaluation of the work packages he was involved in. Especially he contributed to the definition of the requirements for the future e-learning platform for semantic web studies, and he is still active in the definition of the domain ontology for semantic web.

This year, Alain Giboin took part in the Workpackage 1.2. Evaluation," and contributed to the Deliverable "D1.2.3. Methods for ontology evaluation." [56].

Fabien Gandon took part in the Deliverable on best practices of WP1.4.

Olivier Corby took part in the Workpackage 2.1 on the benchmark on RDF tools. The results for Corese were very good: Corese was even the best tool among the competing tools) (cf. see http://knowledgeweb.semanticweb.org/benchmarking_interoperability/working_days/).

8.3.2. Future European projects

For the IST-4 Call, the Acacia team took part in three successful proposals, positively evaluated, and under negotiation for being funded:

- PALETTE (Pedagogically sustained Adaptive LEarning Through the exploitation of Tacit and Explicit knowledge), an Integrated Project coordinated by Ercim and EPFL,
- SeaLife (A Semantic Grid Browser for the Life Sciences Applied to the Study of Infectious Diseases), a STREPS, coordinated by Dresden University and that was ranked first among 150 submissions,
- SEVENPRO (Semantic Virtual Engineering Environment for Product Design), a STREPS coordinated by Semantic Systems.

8.4. International Actions

8.4.1. W3C

Fabien Gandon is a member of the Semantic Web Best Practices and Deployment Working group and reports on the activities of this group to the INRIA DirDRI. This working group discusses issues and reviews notes on best practices for different aspects of the semantic web: schema engineering design patterns, vocabulary management, tutorials, directory of applications and demos, etc. Fabien Gandon participated in the technical plenary session of W3C (March 2005) and regularly participates to bi-weekly teleconferences. We also presented a contribution to the W3C Workshop on Semantic Web Services (June 2005); it showed our experience in applying Corese to corporate semantic web services and stated our position w.r.t. what in our opinion should be the first step in issuing standards for semantic web services.

8.4.2. Carnegie Mellon University

Fabien Gandon continued his collaboration with CMU.

8.4.3. University Gaston Berger

The Acacia team welcomed Moussa Lo (University of Gaston Berger of St-Louis, Senegal), In addition this visit initiated an exchange between ACACIA and the Computer Science Department of the University of

Gaston Berger of St Louis (Senegal): Fabien Gandon will go there for two weeks of lectures at beginning of December 2005.

9. Dissemination

9.1. Animation of the Scientific Community

9.1.1. Programme committees

Olivier Corby was member of the following programme committees:

- *16èmes Journées Francophones d'Ingénierie des Connaissances (IC'2005)*, Nice, AFIA platform, June 1-3, 2005.
- *13th Int. Conference on Conceptual Structures (ICCS'2005)*, Kassel, Germany, July 18-22, 2005.
- *ISWC'2005 Workshop on Knowledge Markup and Semantic Annotation (SemAnnot'2005)*.

Rose Dieng-Kuntz was member of the following programme committees:

- *The IASTED International Conference on Artificial Intelligence and Applications (AIA 2005)* as part of the Twenty-Third IASTED International Multi-Conference on Applied Informatics, February 14-16, 2005, Innsbruck, Austria <http://www.iasted.org/conferences/2005/innsbruck/aia.htm>.
- *Third International Conference on Knowledge Capture (K-CAP'2005)*, October 2-5, 2005, Banff, Canada, <http://www.kcap05.org/>.
- *16èmes Journées Francophones d'Ingénierie des Connaissances (IC'2005)*, Nice, AFIA Platform, June 1-3, 2005.
- *2nd International Workshop on Semantic Web for Web-based Learning. Implications in the area of Information Systems in Education*, Porto, in conjunction with CAiSE'05, the 17th International Conference on Advanced Information Systems Engineering (June 13-17, 2005).
- *AAMAS 2005 Agent-Mediated Knowledge Management (AMKM'2005)*,
- *12th ISPE International Conference on Concurrent Engineering: Research and Applications (CE'2005)*, Dallas, USA, 25 - 29 July, 2005
- *11th Conference of the Spanish Association for Artificial Intelligence (CAEPIA'05)*, Santiago de Compostela (Spain), in November 23-25.

Fabien Gandon was member of the program committees or reviewer for:

- Conferences: *International Joint Conference on Artificial Intelligence (IJCAI)*; *IEEE/WIC/ACM Web Intelligence (WI)*;
- Symposium: *AAAI Fall Symposium on Agents and the Semantic Web (ASW)*; *Symposium Mobilité CNRT Télius*;
- Workshops: *International Workshop on Web Semantics (WebS)*; *Organizations to Organization Oriented Programming (OOP)*; *Agent-Mediated Knowledge Management (AMKM)*; *Knowledge Management and Organizational Memories (KMOM)*; *Knowledge Markup and Semantic Annotation (SemAnnot)*.

Alain Giboin was member of the following programme committees:

- CONTEXT'05, the *Fifth International and Interdisciplinary Conference on Modeling and Using Context*, July 5-8, 2005, Paris, France: <http://www.context-05.org>
- UbiMob'05, *Deuxièmes Journées Francophones: Mobilité et Ubiquité 2005*, 1-3 June 2005, Grenoble, France: <http://ubimob05.imag.fr/>
- ÉPIQUE'2005, *Troisièmes journées d'étude en Psychologie ergonomique*, 26-28 September 2005, Toulouse, France: <http://www-sop.inria.fr/acacia/gtpe/epique-2005/welcome.html>
- *Workshop "Web sémantique pour le E-learning"*, Nice, 31 May 2005, Plate-forme AFIA, <http://www-sop.inria.fr/acacia/WORKSHOPS/WebLearn2005/call.html>

9.1.2. Journals and Publishers

Rose Dieng-Kuntz:

- is co-editor of the series "*Frontiers in Artificial Intelligence Applications*" at IOS Press,
- is member of the editorial board of the journal *ETAI (Electronic Transactions on Artificial Intelligence)* on the topics *Semantic Web*.
- did a review for *ACM Transactions on Internet Technologies (TOIT)* and a review for *ARIMA (Revue africaine de la recherche en informatique et mathématiques appliqués)*.

Fabien Gandon did several reviews for the international journals *IEEE/TKDE*.

Alain Giboin was reviewer for the journal *Le Travail Humain*

9.2. Organization of conferences and courses

- Rose Dieng-Kuntz was:
 - Co-chair of the *IJCAI'2005 Workshop on Knowledge Management and Organizational Memories* [16] <http://www.inria.fr/acacia/WORKSHOPS/IJCAI2005-OM/call.html>, Edinburgh, uk, August 2005.
 - Co-chair of the *Weblearn Thematic Day on Semantic Web and E-Learning* [15], in the framework of the AFIA'2005 platform.
- Fabien Gandon organized the AFIA platform grouping three conferences and 7 workshops and one tutorial: CAP (Conférence d'Apprentissage), IC (Ingénierie des Connaissances), RJCIA (Rencontres Jeunes Chercheurs en Intelligence Artificielle), WSeL (Web sémantique pour le e-Learning), Tutorial "Apprentissage Pro-Actif", RTE (Représentation et raisonnement sur le temps et l'espace), AABio Apprentissage automatique et bioinformatique, RàPC (Raisonnement à Partir de Cas), CDT (Connaissances et Documents Temporels), RWSG (Raisonner le web sémantique avec des graphes). This platform lasted a week; it allowed the publication of 142 articles and gathered some 250 participants. <http://www-sop.inria.fr/acacia/afia2005/>
- Alain Giboin was co-chair (with Jean-Yves Tigli, I3S, and Philippe Dubois, FNDV) of *DeViNT'2005*, Troisième journée "Déficients visuels et NTIC", Sophia Antipolis, France, 2-3 June 2005.

9.3. Others

9.3.1. Prices

Rose Dieng-Kuntz won the Irène Joliot-Curie Price 2005 of Ministry of Research in the category Scientist of the Year (<http://www.recherche.gouv.fr/discours/2005/prixijc05.htm>).

9.3.2. Scientific Councils and Evaluation tasks

Rose Dieng-Kuntz was member of:

- Scientific Council of the Laboratoire Perception, Systèmes, Information of the University of Rouen and of INSA-Rouen,
- Specialist Commission CS27 of UNSA, till June 2005.

Rose Dieng-Kuntz was expert evaluator for:

- Fonds québécois de recherche sur la nature et les technologies,
- ANR Call for « Young Research Teams »,
- World Class Jury for France Telecom R & D.

Fabien Gandon was expert evaluator for ANR call for RNTL Network.

9.3.3. International Working Groups

Rose Dieng-Kuntz has been nominated chair of the IFIP Working Group on Knowledge Management.

9.3.4. Collective tasks

- Olivier Corby is member of:
 - CDL (Commission for software development).
at INRIA UR Sophia Antipolis.
- Rose Dieng-Kuntz was:
 - member of the board of the Project Committee, till June 2005,
 - chair of the Colors Commission, till October 2005.
at INRIA UR Sophia Antipolis.
- Fabien Gandon:
 - is a member of the CSD (Comité de Suivi Doctoral) of INRIA Sophia Antipolis,
 - is the secretary of the CP (Comité des Projets),
 - reports to the DIRDRI on his standardization activities in the W3C.
- Alain Giboin is member of the Cumir (Commission des Utilisateurs des Moyens Informatiques pour la Recherche).

9.3.5. Visits

The ACACIA team welcomed:

- Wayne Wobcke (New South Wales University), on September 16, 2005.
- Members of BritiSh Petroleum, Axa, Marriot, Johnson & Johnson, Nielsen, Intel, l'Oreal on June 23, 2005,
- J. Bear and M. Garbey, Houston University, (College of Natural-Sciences and Mathematics),
- Mathias Wagner, Massimo Paolucci and Marko Luther, Docomo Eurolabs, August 9, 2005.

Fabien Gandon visited CMU in the framework of his collaboration with Norman Sadeh.

9.4. Teaching

9.4.1. University

- The Acacia project is a welcoming team of the "École doctorale STIC of the Nice - Sophia Antipolis University (UNSA)".
- The members of the project gave the following courses:
 - Olivier Corby, Fabien Gandon and Alain Giboin are in charge of a course on knowledge engineering applied to semantic web. It's a one semester course during the last year of the curriculum at EPU (Ecole Polytechnique Universitaire de Nice Sophia Antipolis). They also supervised several student projects.
 - Olivier Corby gave the following courses:
 - * Knowledge Engineering for the Semantic Web at ESSI UNSA Engineering school in 3rd year (total of 45 Hours).
 - * ENTPE: Course on Knowledge engineering and XML: 12 hours
 - * UTT Troyes: Course on RDF and Corese semantic search engine: 5 hours
 - Sylvain Dehors did eight practical sessions at ESSI teaching XML and XSLT.
 - During this year, Sylvain Dehors supervised three internships: Leonid Syniukov who worked as a master student on the interaction design of QBLS during three months. He was a student of the ErgoN'tic Master in Nice. He supervised 4 second year students of Polytech'Nice during their mid-term three weeks project. They had to develop a Java Program to analyze log files generated by the activity of learners on an e-learning system. Stephanie Mevel made her summer two months internship after Polytech'Nice second year among the acacia team. She redeveloped a web-based tool to analyze the logs generated by the activity of the learners during the QBLS experiment.
 - Rose Dieng-Kuntz is responsible for the course on "*Knowledge Capitalization and Economic Intelligence* (20h) in the framework of the Masters "Audit Informatique et Stratégique" at the Institut d'Administration d'Entreprises, UNSA.
 - Fabien Gandon gives lectures as part of the course at ESSI on "Knowledge Engineering and Semantic Web" and supervises a number of students' projects.
 - Alain Giboin gave the following courses:

- * EPU, ESSI 3rd year, Module « Interfaces graphiques homme-machine » (GUI), Université de Nice Sophia Antipolis: contribution to the organization of the module, lectures, participation to tutorials, and assessment of students' GUI projects.
 - * EPU, ESSI 1st year, tutoring of students' programming projects (ergonomics).
 - * EPU (With Olivier Corby and Fabien Gandon) ESSI, Knowledge engineering applied to the Semantic Web course" : lectures and tutoring of students projects.
 - * Master « Ergonomie des Nouvelles Technologies de l'Information et de la Communication (ErgoNTIC) », Université de Nice Sophia Antipolis : in charge of the Module « Méthodes et Techniques de Conception et d'évaluation des IHM », lectures, tutoring and training supervision. Coordination between the ESSI GUI Module and the Master ErgoNTIC. This coordination aims at making work together software engineers and ergonomists as early as the learning phase, and to allow software engineering and ergonomics teachers to set up joint actions promoting cooperation between software engineers and ergonomists.
- Khaled Khelif gave:
- * Practical courses on Java Programming in UNSA (24 hours)

9.4.2. Theses

- Current theses:
 1. Laurent Alamarguy: *Ontologies and Semantic Relations Acquisition from Biomedical Corpora*, université de Nice - Sophia Antipolis.
 2. Thanh-Le Bach: *Construction of a Multi-Viewpoints Semantic Web*, Ecole Nationale Supérieure des Mines de Paris.
 3. Tuan-Dung Cao: *Software Agents for the Web Mining, Application to Technological and Scientific Watch*, Université de Nice - Sophia Antipolis, in collaboration with CSTB.
 4. Sylvain Dehors: *Semantic Web and Knowledge Management for E-learning*, université de Nice - Sophia Antipolis
 5. Khaled Khelif: *Semantic Web and Experiment Memory for the Transcriptome Analysis*, université de Nice - Sophia Antipolis (in collaboration with IPMC and Bayer Crop Science).
 6. Phuc-Hiep Luong: *Management of a Corporate Semantic Web*, Ecole Nationale Supérieure des Mines de Paris.
- Thesis juries:
 - Olivier Corby was member of Adorjan Kiss's thesis jury, Montpellier II University, December 13, 2005.
 - Rose Dieng-Kuntz was member of the following thesis juries:
 - * Chair of the jury of Stéphanie Werli, Paris-Sorbonne University, June 27, 2005,
 - * Reviewer of the thesis of Jean-Yves Fortier, Amiens, October 6, 2005,
 - * Reviewer of the thesis of Alicia Diaz, Nancy, October 21, 2005,
 - * Reviewer of the thesis of Mathieu d'Aquin, Nancy, December 12, 2005.

9.4.3. Training

We welcomed the following trainees:

- Karima Aissiou, ESSI 2ème année: *Exploitation d'une Ontologie médicale et du moteur de recherche sémantique Corese pour un staff virtuel dans le cadre d'un réseau de soin*
- Sophie De Bonis, Master ErgoNTIC, UNSA: « *Contribution à l'évaluation et à la reconception ergonomiques d'un intranet d'entreprise* » ,
- Muriel Boutet, Master ESSI: « *Conception d'une plateforme d'étude des distances conceptuelles telles qu'elles sont perçues par les humains* » ,
- Anthony Canto, Master ESSI: « *Conception d'une plateforme d'étude des distances conceptuelles telles qu'elles sont perçues par les humains* » ,
- Hassan El Mahrati, ESSI 3ème année: « *Serveur Web sémantique* » ,
- Thierry Grandsart, Master ErgoNTIC, UNSA: « *Contribution à l'évaluation ergonomique de la plate-forme KmP* » ,
- Stephanie Mevel, ESSI 2ème année: « *Réalisation d'un outil en ligne d'exploitation des enregistrements de l'activité des apprenants sur une plateforme de e-learning* » ,
- Michel Pepino, ESSI 3ème année: « *Serveur Web sémantique* » ,
- Emmanuel Roux, Master ESSI: « *Conception d'une plateforme d'étude des distances conceptuelles telles qu'elles sont perçues par les humains* » ,
- Leonid Syniukov, UFR Nice Sophia Antipolis: « *Interface de visualisation de cours pour des étudiants mobiles* » .

9.5. Participation to conferences, seminars, invitations

Members of the team took part in conferences and *workshops* (see the bibliography). In addition to these conferences,

Rose Dieng-Kuntz was keynote speaker at:

- EGC'2005 (*5èmes Journées d'Extraction et de Gestion des Connaissances*), Paris, January 2005,
- ICCS'2005 (*13th International Conference on Conceptual Structures*), Kassel, Germany, July 18-22, 2005.

She will also give an invited conference at the *15ème Journée de Rencontre de l'Observatoire Technologique : L'Internet de Connaissances*, Genève, November 11, 2005.

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