Preface

In many companies, technical work environments integrate information systems aimed at supporting their long term organizational strategy and at providing efficient support to their core business processes. To support the knowledge worker by integrating these information systems is a complex task which requires the participation of various groups of people and technical systems. With the rise of semantic technologies, more and more information gets enriched with semantic metadata, which makes the information ready for harvesting. In the Web 2.0 (Murugesan, 2007) and Web 3.0 (Lassila & Hendler, 2007) movement, we experience this phenomenon through so-called "mashups" (Ankolekar, Krötzsch, Tran, & Vrandecic, 2007) of existing information sources such as search engines (e.g., Google Search), geographical map servers (e.g., Google Maps), collaborative encyclopedias (e.g., Wikipedia), or open picture repositories (e.g., Flickr).

In order to map this phenomenon to the work environments in companies, we have to integrate the different information sources available in and near organizations. Semantic Work Environments (SWE) such as Semantic Wikis (Semantic Wikis, 2005; Völkel, Schaffert, Pasaru-Bontas, & Auer, 2006) or Semantic Desktops (Decker, Park, Quan, & Sauermann, 2005) are aimed at exploiting this wealth of information in order to intelligently assist our daily work. Ideally, they are built to collect data for deriving our current information needs in a specific situation and to provide processed and improved information that can be integrated into the task at hand. Furthermore, as the usage of this information is tightly integrated into our daily work, we do not only take part in the (re)use but also in the creation and sharing of information. This continuous flow of information, experience, and knowledge helps to keep us up-to-date in our area of expertise and enables us to integrate the experience of our colleagues into our own work. Hence, semantic work environments will also address the challenge of life-long learning because they provide easy and fast access to information that fits our current working situation. This means, on the one hand, that such systems help us to solve short-term problems, and on the other hand, that they enhance long-term competence development.

Semantic Work Environments combine the strengths of Semantic Web technologies, workplace applications, and collaborative working—typically for a specific application domain such as research or journalism—and represent the "*Semantic Web in the small."* Instead of making all content in the Internet machine-readable (i.e., "*Semantic Web in the large*"), the SWE approach tackles the problem on a smaller, more focused scale. Take Semantic Wikis as an example: Wikis are enhanced by the simple annotation of Wiki content with additional machine-readable metadata and tools that support authors during the writing of new or the changing of existing content (e.g., via self-explaining templates). This approach of building up the Semantic Web in the small is in line with current developments in the area of the Semantic Web. One prominent example is the definition of so called "microformats" (Ayers, 2006; Khare, 2006): Based on standard Web technology, they allow embedding small information chunks like contact information into Web sites.

We believe that semantic work environments are the first step towards achieving the vision of the Semantic Web, for several reasons: they are lightweight, goal-oriented, and more likely to use synergies.

Semantic work environments are *lightweight,* since they support a specific problem and, therefore, require only relevant features for this task. They do not intend to solve a general, somewhat unfocused and fuzzy problem but have a certain application domain that imposes specific problem types to be solved.

Therefore, requirements elicitation and implementation of the semantic work environments can be performed in a *goal-oriented way* and can be related to a set of working situations with specific tasks, technical work applications, and networks of people. Since they operate within a defined organizational boundary or community, reaching a consensus about the needed concepts and their meaning (e.g., by creating a consensus through an ontology) can be performed more easily compared to general Semantic Web applications. In addition, due to this focus, a quick return on investment is more likely.

The focus of SWEs is also the basis for *synergies* that arise from embedding them tightly into the business processes and workflows within an organization. These business processes provide relevant information for classifying and organizing the information created and reused. This information can later be exploited by inference techniques to improve reuse by people operating in similar contexts. A second aspect of synergies is to overcome the dichotomy between the need for information and the often insufficient willingness to make information available for others.

SWEs will play an important role for information storage, acquisition, and processing in specific application domains during knowledge work. In the future, they will enable the widespread use of automated inference mechanisms or software agents on top of the semantic information. Semantic enrichment of work environments will help participants in their daily work to avoid risks and project failures that are frequently encountered in traditional projects.

CHALLENGES

A commonly accepted fact is the ever-increasing amount of information we have to cope with during our daily work. While a century ago, most countries were based on manual-labor cultures, we are currently living in a world of knowledge workers. And the rise of computers and their integration into our daily work environments increases this flood of information even more. Or, to quote John Naisbitt: “We are drowning in information but starved for knowledge” (Naisbitt, 1984).

Therefore, we need approaches to reduce the amount of information and to optimize access to important information and the way it is presented to the user—anywhere and anytime. Approaches such as Wikis are important; however, there is still much work to be done to integrate them into our daily working environments.

Attempts to construct semantic work environments have to adequately deal with the challenges that exist in the new millennium. Such challenges can be classified into several categories:

- **Challenge 1:** Enabling the collaboration of work communities for exchanging information and using semantic work environments.
- **Challenge 2:** Building semantic work environments to support social collaboration, information integration, and automated inference.
- **Challenge 3:** Starting semantic work environments and keeping them alive.
- **Challenge 4:** Adequately presenting information to a user so that it supports the two extremes of short-term problem solving and long-term competence development.

Table 1. Chapters and approached challenges

Chapter	Challenge 1	Challenge 2	Challenge 3	Challenge 4	Challenge 5	Challenge 6	Challenge 7	Challenge 8
Chapter I		×			×			
Chapter II	×							
Chapter III		×			×			
Chapter IV					×			
Chapter V				×		×	×	×
Chapter VI		×		×		×		
Chapter VII		×		×				
Chapter VIII		×			×	×		×
Chapter IX					×			
Chapter X	×	×						×
Chapter XI			×					
Chapter XII				×		×		
Chapter XIII					×			
Chapter XIV								×
Chapter XV		×						
Chapter XVI		×						

- **Challenge 5:** Coping with the plethora of overlapping and similar Semantic Web-technologies, that is, how to select the right building blocks for the development of semantic work environments.
- **Challenge 6:** Coping with quick innovation cycles and the resulting time pressure that drives us away from classical search to context-sensitive and pro-active information offerings.
- **Challenge 7:** Obtaining the needed information in a timely manner.
- **Challenge 8:** Building architectures of such environments with different APIs, data structures, and business processes. In order to deal with the complexity of developing such tools, adequate methodologies, technologies, and ontologies are mandatory.

As in the case of Chapter X, most chapters in this book do not only approach one challenge, but tackle several of them.

SOLUTIONS/BACKGROUND

Today, members from multiple disciplines work on SWEs and collaborate to provide highly integrated services by integrating the ever increasing amount of information. Based on collaborative technologies such as Wikis and using semantic technologies such as OWL, collaborative semantic work environments

can be created that are more efficient and effective than the sum of their parts and support the work of their users. However, this requires coping with different APIs, data structures, business and learning processes, as well as with the complexity of developing such tools, methodologies, technologies, and ontologies.

Fortunately, SWEs do not need to be built from scratch. Modern information technologies as well as developments in knowledge management provide a substantial basis for developing SWEs. In particular, the vision of the Semantic Web (Berners-Lee, 1998) provides the basis for SWEs: Documents understandable by humans are augmented with machine-processable metadata. The Semantic Web provides standards such as the resource description framework (RDF) (Decker, Melnik et al., 2000; Decker, Mitra, & Melnik, 2000) or the Web ontology language (OWL) (Dean et al., 2002). Based on these standard languages, ontologies—that is, formal descriptions of concepts and their relations—allow inferring further facts and hypotheses. Examples of such ontologies are the document description ontology Dublin Core (McClelland, 2003) or upper-level ontologies like SUMO (Bouras, Gouvas, & Mentzas, 2007; Pease, 2003) or DOLCE (Oberle et al., 2007). These standards as well as the tools using these standards are the technical building blocks for semantic work environments.

Besides the usage of such technologies, we have to think about how such systems provide information to the user. How should the information be structured? How should it be presented? What kind of navigation support should be offered? Information might be gathered from very different sources, different domains, and communities. The semantic annotation of information will help us to select relevant information and to put these information chunks in relation, thus giving a meaning to the information set. Solutions for making information more understandable, transferable to a new situation, and more learnable can be found in the domain of e-learning and knowledge management systems, (educational) adaptive hypermedia systems, instructional design literature, and so forth.

BOOK CONTENT

The objective of this book is to provide an overview of the field of semantic work environments by bringing together various research studies from different subfields and underlining the similarities between the different processes, issues, and approaches. The idea is also to show that many different application areas can benefit from the exploitation of already existing information sources. In order to present the solutions that address the challenge of creating semantic work environments by developing adequate methodologies, technologies, and ontologies, we structured the book into the four sections Introduction, Tools, Methods, and Techniques.

The *introduction* section provides approaches that enable collaborative semantic work environments while the tools section gives an overview of currently implemented technologies with concrete results from field applications. The methods section provides insights into how to set up and run semantic work environments, and the techniques section describes base technologies to be used within semantic work environments.

The introduction section starts with Chapter I, "Enabling Social Semantic Collaboration: Bridging the Gap between Web 2.0 and the Semantic Web" by Sören Auer and Zachary Ives. This chapter describes the interrelation between two trends that semantic work environments rely on in order to process existing and develop new knowledge: Web 2.0 as the base technology for human collaboration and the Semantic Web as the approach to add machine-processable descriptions to this knowledge. The technical realization is performed using the example of the tool OntoWiki. Chapter II, "Communication Systems for Semantic Work Environments," by Thomas Franz and Sergej Sizov, points out how different means

of communication are used within knowledge work. Common means of communications like e-mail or groupware are analyzed for "semantic gaps," which are then refined into requirements for semantically enabled communication. Chapter III, "Semantic Social Software: Semantically Enabled Social Software or Socially Enabled Semantic Web?" by Sebastian Schaffert continues the discussion of the synergies between Web 2.0/social web and the Semantic Web. The author describes two ways of how semantic social software can be implemented: One possibility is semantically enabled social software, that is, Web 2.0 applications that are enriched with semantics. The other possibility is a Socially Enabled Semantic Web, which means involving communities in the build-up of ontologies. Three applications provide examples of semantic social software.

The *tools* section provides an overview of current applications that can be a part of semantic work environments. This section comprises chapters four to ten. Chapter IV, "SWIM – A Semantic Wiki for Mathematical Knowledge Management," by Christoph Lange and Michael Kohlhase, presents a semantic Wiki to share mathematical knowledge. In this Wiki, the regular Wiki markup is enhanced with additional mathematical markup, which integrates a mathematical ontology. Chapter V, "CoolWikNews: More than Meet the Eye in the XXI Century Journalism," by Damaris Fuentes Lorenzo, Juan Miguel Gómez, and Ángel García Crespo, is about a semantic work environment for the collaborative creation of news articles, thus building a basis for citizen journalism. Articles in this Wiki can be annotated using ontological metadata. This metadata is then used to support navigation within articles, in particular for finding further relevant articles. Chapter VI, "Improved Experience Transfer by Semantic Work Support," by Roar Fjellheim and David Norheim describes, the Active Knowledge Support for Integrated Operations (AKSIO) system. This system supports the experience management of oil drilling activities. This system supports collaborative knowledge creation and annotation by linking practitioners and experts. Chapter VII, "A Semi-Automatic Semantic Annotation and Authoring Tool for a Library Help Desk Service," by Antti Vehviläinen, Eero Hyvönen, and Olli Alm, provides a help desk system that allows annotating natural language question-answer pairs with additional semantic information. To support this annotation, the system suggests potential annotations. Case-based reasoning is then used on this semantic information to retrieve the best fitting answers to a certain problem. The system itself is used in a help-desk application run by Finnish libraries to answer questions asked by library users. Chapter VIII, "A Wiki on the Semantic Web," by Michel Buffa, Guillaume Erétéo, and Fabian Gandon, is about the SweetWiki system. This system combines a WYSIWYG editor and semantic annotations, creating a Wiki system with improved usability. The semantic annotation feature can use previously uploaded ontologies. In their article, they also provide an overview of several other semantic Wikis. Chapter IX, "Personal Knowledge Management with Semantic Technologies," by Max Völkel, Sebastian Schaffert, and Eyal Oren, presents how to use semantic technologies to improve one's personal knowledge management. Requirements on personal knowledge management based on a study are described. Current personal knowledge management tools are investigated concerning their drawbacks. To overcome these drawbacks, the usage of semantic Wikis for personal knowledge management is suggested. Chapter X, "DeepaMehta – Another Computer is Possible," by Jörg Richter and Jurij Poelchau, presents the DeepaMehta platform, which can be used to build up semantic work environments. This platform provides native support for topics maps to visualize the underlying semantics of knowledge. Two examples of the application of the DeepaMehta platform show implementations of semantic work environments.

Methods for Semantic Work Environments as the third section of this book presents approaches on how to build up and run semantic work environments. Chapter XI, "Added Value: Getting People into Semantic Work Environments," by Andrea Kohlhase and Normen Müller, analyze the motivational aspect of why people are using semantic work environments based on the "prisoner's dilemma." Based on these considerations, they describe their approach of added-value analysis. Two application examples

of this analysis approach are presented. Chapter XII, "Enabling Learning on Demand in Semantic Work Environments: The Learning in Process Approach," by Andreas Schmidt, presents a method for building individual learning material. The cornerstone of this approach is the Context-Steered Learning method, which uses the context of the user and ontologically enriched learning material to build tailored e-learning material.

Base techniques for building Semantic Work Environments are presented in the final section. Chapter XIII, "Added Automatic Acquisition of Semantics from Text for Semantic Work Environments," by Maria Ruiz-Casado, Enrique Alfonseca, and Pablo Castells, provides an overview of techniques for extracting semantics from text. These techniques can be used to support the semantic enrichment of previously non-annotated documents. Chapter XIV, "Technologies for Semantic Project-Driven Work Environments," by Bernhard Schandl, Ross King, Niko Popitsch, Brigitte Rauter, and Martin Povazay, is about the METIS media data—an approach to support project management and execution by semantic work environments. Particular focus is placed on semantically enriched multimedia content. Based on METIS, the semantic Wiki Ylvi is used to build up organizational memories. Furthermore, the SemDAV Protocol is used for semantic data exchange. Chapter XV, "An Integrated Formal Approach to Semantic Work Environments Design," by Hai H. Wang, Jin Song Dong, and Jing Sun, provides an ontology for defining Semantic Web services to build up flexible semantic work environments. An online talk discovery system is used as an example of their approach. Finally, Chapter XVI, "Lightweight Data Modeling in RDF," by Axel Rauschmayer, and Malte Kiesel, presents the Editing Meta-Model (EMM), which supports editing within semantic work environments. Particular focus is given to a formal description of the Editing Meta-Model and to the potential implementation of this model in the GUI of a semantic work environment.

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