Semantic based Project Management

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ABSTRACT

In the past and still today, projects miss their goals or are cancelled because of overruns in time and budget. Reasons for their failure are that information often gets lost or that it is hard to remember how and where to find the needed information.

To improve this situation it is intended to enhance a project management system with semantic technologies, such as ontologies and semantic search. For access via client this project management system will enhance a fat-client on the Semantic Desktop system. The usage of this semantically enhanced project management system will be demonstrated by a prototype.

Categories and Subject Descriptors

H.3.2 [**Information Storage and Retrieval**]: Information Storage

General Terms

Management

Keywords

Project Management, Semantic technologies, ontologies, Semantic Desktop

1. INTRODUCTION

In the past and still today, projects miss their goals or are cancelled because of overruns in time and budget. Reasons for their failure are that information often gets lost or that it is hard to remember how and where to find the needed information.

The idea to enhance project management systems with semantic technologies enables for example a better search and reuse of already existing data. Thus it reduces time and costs and in addition, it reduces the effort of project management and increases the probability of project success.

To enable a better comprehension of this topic chapter two specifies the research problem and the benefit and chapter three the economic relevance. Chapter four describes the state-of-the-art of current Project Management and Semantic Desktop systems and the innovation of this topic. The proposed technical solution will be explained in chapter five, while chapter six gives an overview of the future work. Last but not least chapter seven gives an overview of the scientific contributions and chapter eight gives a short conclusion of this PhD thesis.

2. Research problems

The main goal of this PhD work is to enhance Project Management (PM) with semantic technologies and further, to enable an interchange of information between a Semantic Desktop and a Project Management System.

By combining semantic technologies and PM systems, a reduction of the administration effort and an improved control of the progress of a project seem possible. Introducing semantic technologies, such as ontologies, semantic annotation of content and semantic search open up new ways of delivering the needed insight and experience of past projects. Relevant information of former projects is consolidated in a knowledge base. With the use of ontologies project members can search for concepts and do not have to search for exact keywords. Furthermore, different information items are set in relationship which simplifies and optimises the search process. All information items for a project are on one platform or at least a relationship exists between the project data on a desktop and on the platform related to a project. With the availability of the knowledge of already finished, running and planned projects the probability to deliver a project in time, in budget and with the specified capabilities is improved.

For a better understanding what the expected added value of this PhD topic is, a small Use Case is given in the following:

There is a large company, which has lots of different (past, current and future) projects. Very often, new projects are similar to already finished ones or problems might appear in current projects, which were already solved in similar projects in the past. In those cases, it is necessary to look up again the information, such as documents, contact information or statements of costs of those finished projects.

A project member of a big company is involved in a project where some problems have appeared. This person remembers that similar problems arose in another project a few years ago. To save money and time he wants to get the information of this project and therefore searches for information about it. But he doesn't know the exact terms to get the description of how the problem was solved in the last project, the name of the person who solved it or wrote the documentation. Current project management tools only allow to search for keywords, different information items, and full text search or maybe in time categories. Hence, the search will be quiet difficult and of course will need time.

The goal of this PhD is to tackle this problem. The user can search for the name of the producer of the document, the creation date, the milestone in which the document is part of, an email where the document is attached or for a name of a project member. The result of this search is presented as an ontology tree that makes it possible to navigate through the possible results until the needed information is found. A normal listing of documents or information items is included in addition, but the main issue is to navigate through different information items based on the semantically annotated data until the user can find the needed information. In this way, the PhD work contributes to research in project management systems. Currently, the user has to know what he/she is looking for. Semantic annotations allow

connections between items and the establishment of an ontology so that users can navigate easily through all information items.

In addition, an interface between a Semantic Desktop system and the PM system shall be built, thus enabling an up-to-date access to the relevant information of a project. With this interface, relationships between data and information items of projects on multiple systems and information items on a desktop are established. Hence, also the desktop can be searched for project relevant information.

Another benefit of this thesis is its domain independencies. Project Management is part of every project, independent if it is part of a health care or of an e-commerce project.

To enhance an existing PM system with semantic technologies the following sub-goals are relevant:

- **Definition of a Project Management Domain Ontology and PM related Ontologies**

For the PhD topic a project management domain ontology as well as other related ontologies have to be developed. These ontologies concern project related issues (e.g., milestones, tasks), project documents, temporal issues, or project members and their capabilities. All these ontologies are not on the same level, but they support and complement each other.

- **Interface Semantic Desktop – Semantic PM**

An interface between the client, a Semantic Desktop system and the semantic PM system must be implemented. The Semantic Desktop system must be extended with a fat-client with the functionalities to search and to set links to PM information as well as to edit them. The ontology of the Semantic Desktop must be adapted with parts of the project management ontologies.

- **Flexible Architecture of the System**

To guarantee a positive result of this PhD a detailed architecture of the system has to be designed. This architecture has to be built in a modular and flexible way to allow future extensions. Also all interfaces of this system must adhere to open standards.

- **Proof of Concept of the PM System**

The proof of concept of the PM system includes a prototype of the system with the following parts: ontologies, databases, semantic technologies (metadata, tagging …), interface to the Semantic Desktop, adaptation of the Semantic Desktop and the functionalities of PM. It also includes the evaluation of the prototype. The PhD deals with project management in general. But to receive useful test results, the prototype directs its attention to project management for IT projects and in greater depth to the tourism (industry) domain.

The main problems of the PhD will be

- **The evaluation of existing Project Management Systems**

One issue of the PhD work is to find an OpenSource Project Management System, based on a client-server application. Further consideration regards the types of documents that are to be integrated in the system as well as their storage. Another question is if the system will support automatic annotation of metadata or if the users have to annotate their inputs by themselves. To address these risks, an in-depth evaluation of existing OpenSource PM Systems as well as of possible semantic systems, such as document management or knowledge management systems, will be done.

- **To develop ontologies and combining them**

A major problem is to develop the different types of ontologies, such as a domain ontology for project management and a time and date ontology for time data, and then to link them. The risk here is that the matching does not fit. To avoid these problems an evaluation of possible existing ontologies will be done. Based on these experiences, possible problems should be avoided. A further preliminary consideration regards whether the ontologies should be merged. The PhD work will start with the assumption that they will not be merged, but properly interlinked.

- **To ensure valid test results**

A problem at the end of the work could be poor test results in case of poor test scenarios and questionnaires. To avoid this problem, requirements and use cases will be done at the beginning of the project. In addition, useful test scenarios are needed. Therefore the main tests will be at the Electronic Commerce Group of the Institute of Software Technology and Interactive Systems at the Vienna University of Technology. During and after using the prototype (for a few weeks) questionnaires and test scenarios concerning the usage will be carried through and analyzed.

3. Economic relevance

Today many projects miss their goals or are cancelled because of overruns in time and budget. The Chaos Report [10] identifies that 31% of IT projects were cancelled or never completed and nearly 53% of the projects cost almost twice the initial estimate. Reasons for their failure are that information often gets lost. It is hard to remember how and where to find the needed information.

The working prototype enables a better search and reuse of already existing data by using semantic technologies, reducing thus time and costs. In addition, it reduces the effort of project management and increases the probability of project success.

Information of already finished projects can be used as input for planning of new projects and to monitor progress and risks of projects underway. That is because of better storage of project relevant information. Due to explicitly describing the relationships between various project documents in machine accessible form, better administration of projects and easier identification of relevant information is possible. Based on improved relationships between different information tasks, connections between previous and current projects are possible and a better administration of projects is feasible as well. Another advantage is a faster reaction to project changes because experiences and problems of previous projects and their management are traceable and visible.

Since project management software is a high volume market, and since the solution envisaged tackles the major problems in project management, the economic potential is very high.

4. State-of-the-art

This chapter is divided into three parts, the state-of-the-art of Project Management, of ontologies and of Semantic Desktop systems. All of them include the innovation aspects of this PhD thesis.

4.1 Project Management

There are several Project Management software tools, which help companies to manage IT projects. Currently, there are no solutions in the field of project management which contain semantic technologies. The available systems differ considerably with regard to their functionality. The spectrum ranges from just time planning (milestones) or resource planning to tools that assist the entire project management process, as for example project-open[1] or dotproject[2].

Problems with projects and their management are often a mix of information storage (PM platforms, personal computer …), neglecting of milestones, costs, etc. and inconsistence of stored information (versioning of documents). These are only some reasons why projects might suffer overruns in time or budget or miss their goals or are cancelled. The Chaos Report of the Standish Group [10] identifies that in 1994 US companies invested approx. $250 billion in IT development. 31% of the projects were cancelled or never completed and nearly 53% of the projects cost almost twice the initial estimate.

The PhD work explicitly defines and employs the relationships between different data items and their semantic descriptions. It allows a better search and reuse of already existing data and reduces the effort of project management and thus increases the probability of project success. Information of already finished projects can be consulted and be used as input to plan new projects, as well as to monitor progress and risks of projects underway.

4.2 Ontologies

Ontologies are the backbone of Semantic Web technologies. They establish a common understanding of a domain by making the shared conceptualization explicit in a machine-accessible manner. An ontology represents the domain knowledge by describing its concepts or entities, and the relationships between these concepts in a precise, detailed way, so that all relevant knowledge of the domain is actually made explicitly. PROMONT [9], for example, is a basic project management ontology which formalizes the typical elements for project structuring. Another already existing ontology is Harmonise [6], which is a tourism domain specific ontology. Harmonise could be consulted for adapting the project management ontology (with an industry specific domain) to enhance test results. An example of a time ontology is a part in ONTO-SD [7], which will be part of the evaluation of existing time ontologies.

In this PhD the innovation is to develop a project management domain ontology, as well as the development of related ontologies, like date, time or events and the matching of the ontologies. However, the primary focus will be on IT projects.

4.3 Semantic Desktop

Semantic Desktop systems provide personal information management where a user can store personal information items (documents, emails …). These information items are interpreted as Semantic Web resources, identified by a Uniform Resource Identifier (URI) and all data tasks are accessible as RDF Graphs. Ontologies allow users to qualify their information with their own words and enable the relationships between different information tasks (documents, contact information, calendar …). There are already some Semantic Desktop systems available, like Gnowsis [2,4], which is part of the NEPOMUK project, or IRIS [1], which belongs to the CALO research project at SRI International. Current work in the field of Semantic Desktop is to enable collaboration between such systems [3] or [5].

In the PhD work one existing Semantic Desktop system, either IRIS[3] or Gnowsis[4], will be adapted for including project relevant information and therefore an interface between a Semantic Desktop and the PM system will be built. The idea is that project members can search on their personal desktop for project relevant information.

5. Technical solution

The PhD work is still at the beginning and thus, this technical solution is a first draft how it should look like.

The ontologies will be developed in OWL (Web Ontology Language) using Protegé. The programming language of the application depends on the selected project management system, which will be evaluated. It was decided that the PhD application will rely on an OpenSource solution. The database will be either PostgreSQL or MySQL and the application will run on a Linux server.

The implementation will follow a client-server architecture. The client uses Web Services, interacting with the Project Management application. The application includes the project relevant functionalities as well as the semantic ones. The application communicates with the database, ontologies and data storage via standard interfaces. The types of these interfaces depend on the finally selected PM system. Figure 1 gives an overview of a draft architecture of the PhD project (SemProM is short for Semantic based Project Management).

The fat-client offers functionalities, such as upload and download of documents, editing (e.g. tasks, milestones, calender), annotation of information, etc. With this client in the Semantic Desktop, relationships are enabled between project management information and information on the personal desktop.
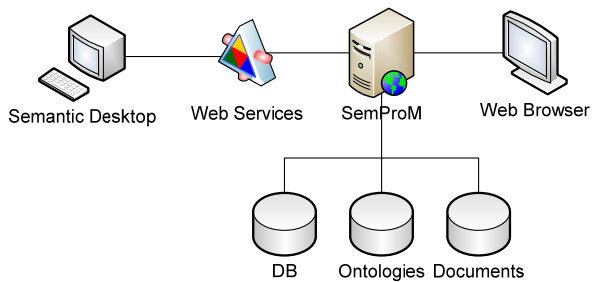
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[1] http://project-open.org

[2] http://www.dotproject.net

[3] http://www.openiris.org/

[4] http://www.gnowsis.org/

Figure 1: Draft architecture of the PhD project

Another possibility of implementing the client is a conventional Web Browser. Therefore an evaluation is needed for studying the feasibility of useful functionalities. However it is not guaranteed that all the functionalities of the fat-client are feasible for the Web Browser.

6. Future work

The work is at the very beginning and hence an in-depth study of the available literature is necessary to understand the general terms and methods which already exist. In addition, already existing ontologies as well as project management systems must be analyzed and proofed if they can be taken as basis for this PhD work.

During this study, a detailed architecture of the prototype should be designed to specify all relevant interfaces and potential difficulties as well as a time plan for the programming part, where the building of the ontologies and their combination, the extension of the project management system, the extension of the Semantic Desktop, the interfaces and the combination of all these tasks are part of it.

Furthermore use cases and requirements will be defined by means of evaluations.

Based on these results the domain ontology for project management and the other ontologies will be developed, implemented and combined.

After these steps the prototype as well as the interface between the Semantic Desktop and the PM system and the fat-client on the Semantic Desktop will be implemented and tested by the staff of the Institute of Software Technology and Interactive Systems.

7. Scientific Contribution

Current research in the area of semantic desktops focuses on integrating those systems in order to interchange information. The work in this thesis concentrates on integrating a Semantic Desktop and a project management system extended by semantic functionalities. Thus, this thesis is in line with current research in this area and an exchange of information between them and us is preferable.

The main goal of this thesis is to accomplish an integration of two systems having different business justifications – a project management tool and a semantic desktop. Best to our knowledge, this has not been done before. The integration challenge is twofold: firstly, both systems must be aligned on the semantic layer. Secondly, information items on the semantic desktop (client) must be linked on the technical layer with items on the

project management system (server). The user benefits from such an integrated environment by having project management items enriched with semantic descriptions readily available on the desktop.

8. Conclusion

The main advantage of this PhD thesis is the higher probability of successful delivery of projects based on better information retrieval. The use of semantic technologies may lead to less expenditure of time and therefore fewer costs. Also a better storage of project relevant information is given due to for example, metadata and relationships between information items. By the improved relationships between different information tasks connections between previous and current projects are possible and therefore a better administration of projects is feasible. Also a faster reaction to project changes is possible because experiences and problems of previous projects and their management are traceable and visible.

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