

Semantifying Requirements Engineering – The SoftWiki Approach

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Abstract: This paper presents an integrated approach of basing requirements engineering on semantic technologies. First, the general approach of semantifying requirements and the underlying ontology are introduced. Second, tools that support requirements elicitation, development, analysis, and exchange on the basis of the semantic foundation are described.

Keywords: Semantic Web, Requirements Engineering, Distributed Software Development, Ontology-Driven, User-Oriented, Wiki, Semantic Interoperability, Linked Data

Categories: D.2.1, D.2.12, H.3.2, I.2.4

1 Motivation

Semantic interoperability, linked data, and a shared conceptual foundation become increasingly important prerequisites in software development projects that are characterized by spatial dispersion, large numbers of stakeholders, and heterogeneous development tools. Founding distributed software development on semantic web technologies seems promising in order to serve these demands.

The *SoftWiki*¹ project focuses specifically on semantic collaboration with respect to requirements engineering. Potentially very large and spatially distributed groups of stakeholders, including developers, experts, managers, and average users, shall be enabled to collect, semantically enrich, classify, and aggregate software requirements. Semantic web technologies are used to support collaboration as well as interlinking and exchange of requirements data. In the following, we will present the general approach and the tools we are currently developing in this context.

2 Semantification of Requirements

Within the SoftWiki approach, each requirement gets its own URI making it a unique instance on the semantic web. Then, it is linked to other resources using semantic web standards such as RDF and OWL. To ensure a shared conceptual foundation and semantic interoperability, we developed the *SoftWiki Ontology for Requirements*

¹ Research project, funded by the German Federal Ministry of Education and Research – <http://softwiki.de/>

Engineering (SWORE) [Riechert et al. 2007] that defines core concepts of requirement engineering and the way they are interrelated. For instance, the ontology defines frequent relation types to describe requirements interdependencies such as *details*, *conflicts*, *related to*, *depends on*, etc. The flexible SWORE design allows for easy extension. Moreover, the requirements can be linked to external resources, such as publicly available domain knowledge or company-specific policies.

We call the whole process *semantification* of requirements. It is envisioned as an evolutionary process: The requirements are successively linked to each other and to further concepts in a collaborative way, jointly by all stakeholders. Whenever a requirement is formulated, reformulated, analyzed, or exchanged, it might be semantically enriched by the respective participant. However, in order to reduce the user effort and to ease participation, stakeholders are not forced to semantify requirements.

3 Tool Support

We are currently developing several applications within the project that enable the elicitation, development, analysis, and exchange of semantified requirements (see Figure 1).

The central platform for semantic collaboration is based on the *OntoWiki* tool [Auer et al. 2006] that is extended to support requirements engineering according to the SWORE ontology. The effort and formal overhead for expressing or modifying requirements and relations is minimized due to the adoption of the *Wiki* paradigm [LC01]. The collaboration is supported by common wiki features such as revision control mechanisms allowing to track, review, and selectively rollback changes or a facility to discuss requirements.

The central platform is extended by decentralized participation channels. The bottom left screen in Figure 1 shows a tool that can be easily integrated into the web browsers of users. It enables the users to express requirements on basis of an already existing web application. In addition, it links the user input to application parts and the usage context. These relations can be semantified if the application or usage context is represented in an ontology and linked to the SWORE. Such context relations can be valuable for later analysis, reconstruction, and understanding of requirements.

A pre-defined topic structure supports the classification of requirements. Depending on the respective domain of the software project, the topic structure can be easily adapted or extended in the administration mode. The platform implements the *SKOS Core Vocabulary*² as representation form for the topic structure to enable semantic interoperability with other applications. In addition, stakeholders can tag requirements with freely chosen key words, resulting in an emerging tag space that represents the stakeholders' vocabulary. The tagging process is also ontologically grounded³.

According to the different ways of semantification, the system provides various access points and ways to navigate the requirements. For instance, the user can

² Simple Knowledge Organization System – <http://www.w3.org/2004/02/skos/>

³ An ontology for tags – <http://www.holygoat.co.uk/owl/redwood/0.1/tags/>

explore the requirements by using the tree navigation and additionally narrow down the shown requirements set by choosing tags from the tag cloud. Requirements that are linked to geographical locations according to the *Basic Geo Vocabulary*⁴ can additionally be explored on a map. Furthermore, the system provides graph visualizations that specifically support the discovery of relationships and interdependencies between requirements by highlighting instances that are semantified in a similar way.

In order to enable semantic interoperability with further tools, the requirements collection can be exported in RDF-format according to the SWORE schema or other underlying ontologies. Alternatively, the requirements can be accessed via a SPARQL endpoint. Moreover, we are currently working on an extension that enables export in RIF⁵-format to integrate the SoftWiki approach with established requirements and project management tools – even though this goes along with a loss of semantics.

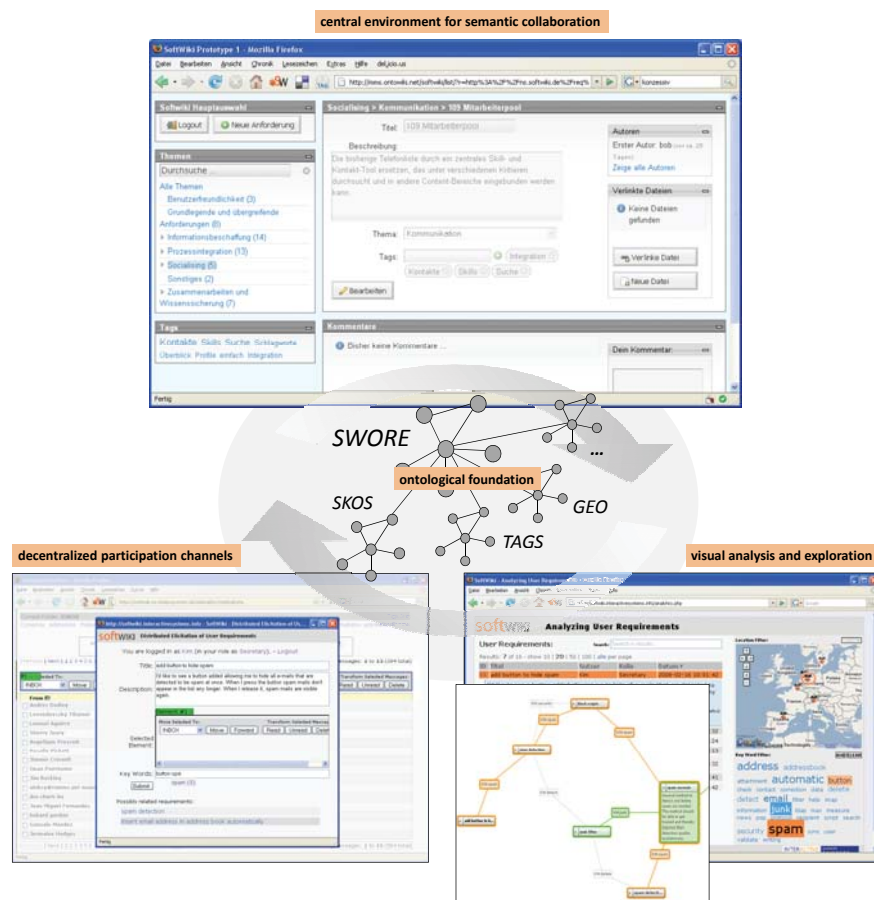


Figure 1: Semantic based tool support for requirements engineering

⁴ Basic Geo Vocabulary – <http://www.w3.org/2003/01/geo/>

⁵ Requirements Interchange Format – <http://www.automotive-his.de/rif/doku.php>

4 Conclusion and Future Work

The SoftWiki approach of semantifying requirements engineering aims to support distributed software development with a large number of participants. First experiences with use cases of the project indicate several benefits compared to non-semantified requirements engineering, including easier detection of conflicts and dependencies or better means to exchange requirements. Our current activities include further development of the tools and the semantic foundation as well as a comprehensive testing of the approach in use cases of different application domains.

References

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