Using a Semantic Wiki in Communities of Practice

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Abstract. In this paper, we present a new wiki engine: SweetWiki, offering the capabilities of a wiki together with some knowledge management features. And we give preliminary results of its use by some Palette CoPs.

Key words: Semantic Web, Wiki, Social Tagging, Knowledge Management

1 Introduction

The Communities of Practice, in particular during their emergence, need workplaces that enable the creation of knowledge, and facilitate the exchange. Wikis appear to be a suitable tool for these tasks, they allow CoP members to create pages, to share resources and to work collaboratively. However, many observers [1, 2] argue that it is complicated to convince users to use new tools, particularly those they are not used to, and the development of wikis is quite recent. It is then necessary to have an easy-to-use wiki, and to offer a visible added-value. On the other hand, the management of the produced knowledge *i.e.* structuring, searching, ... is a key issue for the CoPs since the amount of information and knowledge produced grows rapidly. The importance of the semantic dimension for learning using wikis is discussed in [3–5].

These observations allow to consider an easy-to-use semantic wiki, *i.e.* a wiki that offers the flexibility of wikis, an intuitive interface, together with knowledge management features, as a suitable tool for CoPs.

In this paper, we present a new wiki engine: SweetWiki [6], that combines an intuitive interface, the flexibility of wikis, enhanced with semantic web technologies, in order to facilitate collaborative work and to allow incremental construction of structured knowledge, thanks to social tagging. An experiment was initiated, in the context of the Palette project[1], with some CoPs using the wiki, we give some preliminary results of this experiment and present the further developments of SweetWiki, to make it more usable by CoPs.

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[1] http://palette.ercim.org

2   What is Sweetwiki?

SweetWiki is a wiki engine developed at INRIA and used in the context of Palette. It implements some common features of the wikis, such as the mechanisms of "WikiPages" that are materialized into a hyperlink structure. In addition, SweetWiki relies on semantic web technologies, thus providing additional and powerful structuring mechanisms. Indeed, SweetWiki makes use of:

– An *ontology* of the wiki structure formalized in OWL Lite. This ontology describes SweetWiki concepts, properties and relationships, such as "Page", "Web"[2], "Keyword", "Link", "Author", "Version", "Attached file", "Attached picture", etc. The corresponding meta-data are embedded in the wiki pages themselves. Making this structure and its ontology explicit allows to reason on it to generate widgets for helping the navigation (e.g. list of the related pages). This ontology can be modified and maintained by the wiki developers, letting us re-engineer the wiki structure or enrich it.
– A *folksonomy* of the topics (the Domain ontology) which enables the realization of the "social tagging" principle provided by SweetWiki. The pages and their attached documents (pictures, videos and attached files) can be tagged [7] from within the editor, using the folksonomy formalized using RDF/S. Thus, in the context of Palette, a CoP member can indicate that a page covers a particular field of knowledge of the CoP and that it is related to a particular activity handled in the CoP, for example. This mechanism is very simple to use and, at the same time, eases the navigation by reasoning on it (e.g. for finding the pages that are tagged with a concept, finding the semantically close concepts, formulating complex queries). This ontology can be modified by the wiki users (enriched directly by them and may be restructured by members having a particular role – since in general, CoP members may not have the skills, or not be interested in managing the folksonomy – in the CoP, so as to improve the navigation and querying capabilities) through the ontology editor that comes with SweetWiki. Moreover, if a CoP needs a specific additional ontology that is already available in RDF/S or OWL Lite [8, 9], this ontology can be loaded into the underlying semantic web server of SweetWiki and then, becomes directly accessible to the users.

2.1   Architecture

From the users' point of view, SweetWiki is a web application that can be accessed in two modes: the first one is navigation, following different types of links[3]. The second is an edition mode based on Kupu[4], an open source WYSIWYG XHTML editor. Since editing directly produces XHTML, we decided to use

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[2] A "Web" is a sub-space of the wiki.

[3] In each SweetWiki page we have static links, links associated to WikiWords, and dynamic links generated on the fly, according to the page tags.

[4] http://kupu.oscom.org

it as a persistence format. Thus, once saved, a page stands ready to be served by the Web server.

To address structuring and navigation problems in wikis, we wanted to include tagging at the core of the wiki concept, thus we integrated four new web technologies:

- RDF/S and OWL are W3C recommendations to model metadata on the web;
- SPARQL is a recommendation for a query language for RDF;
- RDFa is a draft syntax for embedding RDF in XHTML;
- GRRDL is a mechanism for getting RDF data out of XML and XHTML documents using explicitly associated transformation algorithms, typically represented in XSLT.

With RDFa, we have both page data and metadata in the same standalone XHTML file. Therefore, the pages can be crawled by external applications or saved by users using their browser without any loss of information. Besides the topic tags, metadata include contextual information (e.g. page author, last modification on the page, etc.).

The implementation relies on the *Corese* semantic search engine [10] for querying and reasoning and on *SeWeSe* [11], its associated web server extension that provides API and JSP tags to implement all the web-based interfaces that use ontologies, as well as a set of generic functionalities (security management, ontology editors, web application life cycle, etc.).

2.2   Offered functionalities

SweetWiki offers many traditional wikis functionalities, in addition of a performent WYSIWYG editor, the easy-to-use editor is important for CoPs, since many users are not used to WikiML.

In this section, we focus the semantic functionalities of SweetWiki:
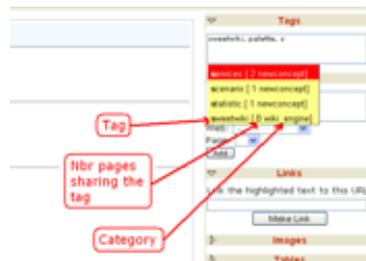
Fig. 1. Tagging a page

Tagging To tag a page or parts of it *e.g.* included pictures or attached files, the user is provided with a form to add tags. The form has an auto-completion

mechanism (Fig. 1) that suggests existing keywords by issuing SPARQL queries to the semantic web server in order to identify existing tags with compatible labels in the folksonomy. It also shows the number of other pages sharing these tags as an incentive to use them. Furthermore, related categories are also displayed in order to address the ambiguity of homonymy. With this approach, tagging remains easy (keyword-like) and becomes both motivating and unambiguous. Unknown keywords are collected and associated to the category "new concept" to enrich the folksonomy.
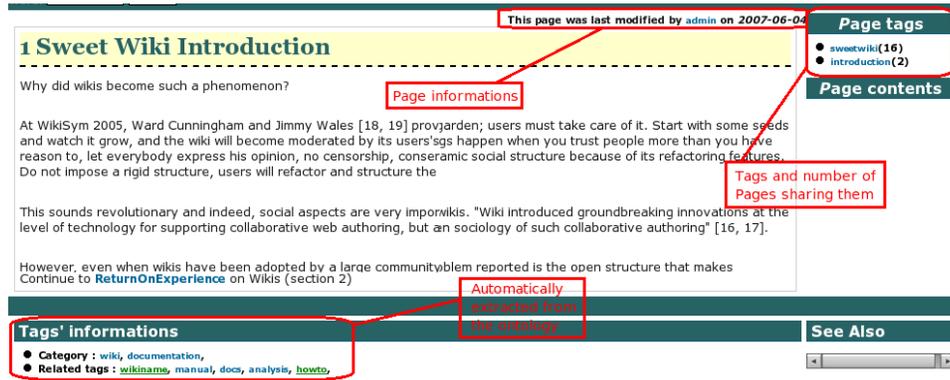
Fig. 2. Generated links from Page tags'

Tags supported navigation Tagging enables to find easily the tagged resource when searching for it, but it also enables to have access to other resources tagged with concepts related to the one(s) used to tag the resource. Indeed, when a page is saved, an RDF version of its metadata is extracted using GRRDL and feeds the Corese engine, which generates faceted navigation widgets (Fig. 2). In these widgets, the semantics of the tags is used to derive related topics.
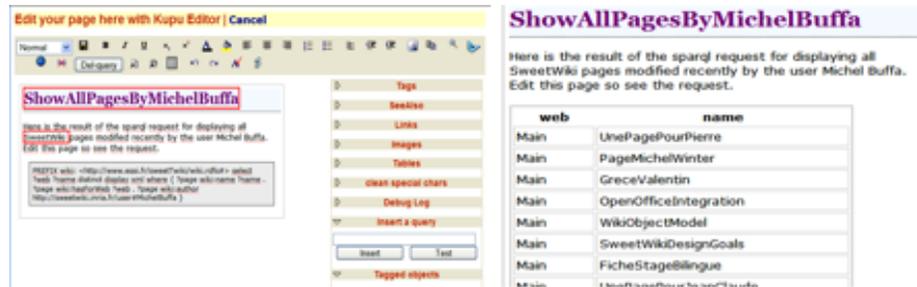

Fig. 3. Dynamic content in pages using queries

Querying SweetWiki offers a set of predefined queries to help users searching the wiki.Moreover, users can embed SPARQL queries into a page. SPARQL queries can be tested and validated in the editor before being inserted in the page, as illustrated in Fig. 3. Embedded queries allow users to incorporate dynamic content in the pages. In addition, those queries can be directed to other SPARQL servers than the one of SweetWiki , thus allowing users to include results from external sites.

Fig. 4. Semantic awareness

Awareness Users are provided with a semantic awareness capability. They can be noticed on recent modifications on pages corresponding to a set of tags they have already chosen. The results are displayed at the bottom of their home page as shown in Fig. 4.

Fig. 5. Folksonomy Editor

Folksonomy edition In order to maintain and re-engineer the folksonomy, SweetWiki reuses web-based editors available in SeWeSe. Using these editors, the folksonomy and the annotations may be updated. For instance, one can add/remove/edit concepts, community experts can pick a couple of tags and declare semantic relations between them such as subClassOf. They may also merge concepts when two tags are synonymous, etc. Enhancements

of the ontology seamlessly improve content sharing: search and faceted navigation benefit directly from the updates. If a concept is suddenly missing from the folksonomy, it still remains as a tag for the pages it has been used to tag before being deleted, and it re-appears in the folksonomy, where it is just treated as a new tag. Fig. 5 shows the hierarchy editor and the form allowing the edition of a concept.

3   Use of SweetWiki by CoPs

Independently of the use that the CoPs can make of SweetWiki, this tool enables them to formalize simply and easily the knowledge they create. Indeed, SweetWiki relies on the "social tagging" approach which consists of allowing any CoP member to tag its content. Thus, everybody can participate to tag the wiki pages and create knowledge. Besides, the organisation of the tags in the folksonomy can also be performed by any CoP member and anytime; it can be performed progressively when adding a new tag to the folksonomy, or *a posteriori.*

In the context of the Palette project, in addition to the participatory design approach, we observe the use of SweetWiki by the CoPs by relying on some statistical data. These data on the activity on SweetWiki give clues on how to enhance some of its functionalities, such as the awareness functionalities, by providing the users with more suitable awareness queries to subscribe to, for instance. Moreover, these observations can be available to some members who might want to have access to a statistical report describing the "life" of the CoP on SweetWiki.

3.1   Preliminary observations about Palette CoPs

Many Palette CoPs use SweetWiki (e.g. ePrep, @apretic, ADIRA, Learn-Nett, ...). We have the opportunity to observe these CoPs. Unfortunately, at the moment, many of them are emergent CoPs with a limited activity. Fig. 6 shows the visited pages in the wikis of some of the pre-cited CoPs compared with those of the test instance of SweetWiki (Wiki in the figure).

As mentioned above, the activity of the CoPs is not yet huge, and the gathered statistics are not enough to make observations on these CoPs, but we expect the activity of the CoPs on the wiki to become more and more important, we can then use this information both for studying these CoPs and for providing their members with useful awareness information.

3.2   Observing CoP activity: The case of STE-CRIFA

SweetWiki is also used by some researchers of STE-CRIFA[5] to manage the different projects on which they work. As they cannot often exchange and discuss

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[5] STE-CRIFA (`http://www.stecrifa.ulg.ac.be`) is a research team at Liège University that acts as a CoP, and tries to use the wiki to collaboratively produce new knowledge and to share information within the team.
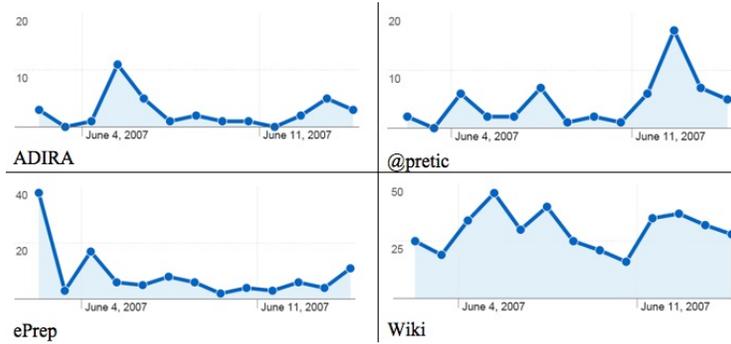
Fig. 6. Visited pages of the wikis of ADIRA, @pretic, ePrep and the public test instance

altogether synchronously, they use SweetWiki to work[6] collaboratively, each one providing knowledge and correcting the others. The community is composed of 13 members using SweetWiki. The observations of the activity on the wiki for STE-CRIFA extend from June 2nd till June 14th. The information gathered can be used as a tool to study the community, by analysing its activity on the wiki, and are also useful to learn how its members use the wiki, in order to improve it and to identify issues to study with CoPs during future training sessions.

Distribution of the number of visits Fig. 7 illustrates the number of sessions opened on SweetWiki during the observation period. We can see that the community is quite active with a total number of 197 sessions: from 4 to 29 visits per day on the wiki (from 3 to 15 distinct visitors, which means that there have sometimes been more visitors than the number of registered persons).

Fig. 7. Distribution of the number of visits

Time on Site The average time spent on the wiki is around 9 min. Furthermore, we notice (see Fig. 8) that the average time spent on SweetWiki by the STE-

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[6] Diverse topics are discussed through SweetWiki, such as the structure of STE-CRIFA Web site, brainstorming on the vocabulary used, the questions or problems met with Palette tools, etc.

CRIFA members is not due to a sudden and punctual activity on the wiki, but rather to a continuous and regular activity. As the target of using a wiki is to

Fig. 8. Average time spent on the wiki   **Fig. 9.** Average visited pages per session

enable and motivate people to work and learn collaboratively, we can consider that this target is on the right road to be attained. Regarding the curves that describe the activity of STE-CRIFA researchers on SweetWiki, we conclude that these users often connect to SweetWiki and, when they do so, they spend time navigating through its content (the sessions are not limited to one-page visits); indeed, as shown in Fig. 9, there is an average number of 6.19 pages visited per session. This means that the visitors are interested in the content they find in SweetWiki, which is the knowledge that is being built by their "colleagues" or that they collaborate to build.

Top content During the observation period, 159 URLs have been visited (at least once). Among these URLs, the "Recent changes" page of SweetWiki is the most frequently visited since it has been viewed 124 times. Then, several pages belonging to the WikiWeb "Private" are also often accessed. The navigation track shows that the more accessed WikiWeb is the "Private" Web. The explicit links put on some pages to refer to others are frequently used, whereas the faceted navigation using the tags is not used a lot; on the other hand, the pages are not always tagged. It seems that pages tagging is not systematic for all the users. The "Advanced search" functionality is not often used too. This is probably due to the fact that, at the moment these observations are made, the wiki is very active, the pages are constantly updated and thus, it is very easy to find a page by viewing the "Recent changes" page, and this is why this page is the most frequently visited.

Summary From the point of view of the "aliveness", there is no doubt on the involvement and participation of the STE-CRIFA researchers subscribed to use SweetWiki. However, there is not a general and full use of the functionalities provided by SweetWiki, maybe because the greatest part of the activity is handled within the "Private" workspace which is dedicated to a restricted group of researchers, and then it's easy for them to find the needed information. But, if this information is to be made accessible to a wider group, it would be worthy

to "teach" the users to provide more knowledge by tagging the pages they create/update by reflex. In fact, the number of participants is not the only reason why information should be made more explicit; the information itself, becoming huger and huger, it would be more and harder to access it even with a very restricted group of participants.

4   Further developments

The first analysis of the use of SweetWiki by CoPs shows the necessity to improve the following functionalities:

Tagging considering the importance of tags in SweetWiki, and the wishes of users we plan to:
- Improve tagging and tag-based search by enabling the users to tag the wiki pages without imposing them to activate the pages editor. As for the tag-based search, improve it by enabling the submission of complex tag-based queries ;
- Offer a Semi-Automatic mechanism of tags organization. The idea behind is to help the users in charge of maintaining the ontology by providing them with assistance for re-organizing it, based on the use of the tags in the wiki (webs and pages), their use amongst other tags, or by some users (relying on their profiles). The issue concerning these criteria has to be deepened so as to provide an efficient way to suggest an organization of the tags that will enhance the search and thus, the learning through the use of SweetWiki.
- Enhance tags management, by making the ontology edition more user-friendly (ergonomics, drag & drop mechanism for structuring the ontology, enabled multiple inheritance, etc.).

Awareness functionality Enabling the users to subscribe to the set of predefined queries that meet their respective needs, so as to receive notification mails with information about the changes on the wiki content and the statistics that they are interested in. The gathered information on the usage of the wiki could also be used.

5   Conclusion

SweetWiki gives the users the opportunity to create content and annotate it semantically (using tags) using semantic web technologies. Moreover, community members can access the model behind this semantic organization, and some of them ("Wiki volunteers") can re-organize it, in order to facilitate and improve the navigation and knowledge retrieval in the wiki. In that, SweetWiki can support the issue of incremental formalization of knowledge, addressed in [12].

The first experiments of the use of SweetWiki by CoPs, show many interesting possibilities for communities, mainly the possibility given to members to

share and collaboratively build annotated knowledge. A knowledge that can be re-organized at any time, to fit the needs of the CoP.

Another reason of satisfaction is the numerous feedbacks of the users about the usability of the wiki [13], which, as advocated in [14], is a key argument to facilitate the adoption of a the tool by CoPs.

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