Collaborative Wiki Tagging

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Abstract. Wikis as well as collaborative tagging have been subject of very intense research and an active discussion topic in the so-called blogsphere. In this paper, we propose Collaborative Wiki Tagging based on the idea to exploit inherent semantics of the concept of link in a wiki. The low-level integration of wiki and collaborative tagging of web resources is expected to be effective in enterprise environments particularly in the personal and group knowledge management application area. We first introduce a conceptualization of Collaborative Wiki Tagging. Then, we propose a simple scheme for using one of the existing native wiki syntax to represent tagging data. Collaborative Wiki Tagging Portal Prototype, developed as a proof of concept, is used to give illustrative practical examples of the proposed approach and illustration of the user interface.

1 Introduction

The past few years have witnessed a growing interest in the enterprise world for generating, managing and sharing knowledge. This knowledge management processes are recognized as being of crucial importance for enterprises to effectively manage innovation. The growing need for continuous innovation results fosters strategies to generate new knowledge through collaborative means at the individual, group, as well as community level. Also, traditional knowledge management technologies have not delivered as promised. In the

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same time, new developments are becoming more attractive, such as Semantic Web, social computing, open systems, emergent semantics, etc. As a result, collaborative systems that provide technological capabilities for collaborative interaction among multiple participants with shared goals and interests across time and place, have recently gained considerable attention [1].

Collaborative tagging systems appear as a new trend in collaboration, gaining growing popularity on the Web. The purpose of those systems is to organize web pages, objects, social relations, images, people locations, etc., as a set of Web resources, representing a new paradigm of organizing information and knowledge. They are very often interchangeably referred to as Social Tagging systems due to their social nature. It was shown recently that tagging distributions tend to stabilize into power law distributions. The stable distribution is considered as an essential aspect of what might be a user consensus around the categorization of information driven by tagging behaviors [7]. Also, recent research results indicate the social aspect as one of the most influential driving motivational factors for user participation and wide acceptance of the overall concept [3]. Collaborative tagging is expected to take a leading role in knowledge work related fields such as information storage, organization and retrieval [11]. Discussions within the blogsphere on the concept of tagging, tagging applications, problems that tagging processes retrieve, social and cognitive analysis of tagging [17], tagging formats, tag-clouds, hierarchy versus tagging for information classification etc., is very active. Results of the more thorough scientific research have also been published.

In this paper, we propose low-level integration of collaborative tagging in a wiki, where tagging data is stored using the native wiki syntax. This way we are able to apply all functionalities available in the wiki on the embedded tagging data. This includes collaborative editing and full-text search of tagging data, versioning, Ajax-like interface components, etc. Resources to be tagged are not limited on the internal wiki pages only, but can be any Web resource. The idea of the deep-integration approach to collaborative wiki tagging, particularly the relation between the concepts of a link in a wiki and the semantics of a tagging act in tagging systems, is in accordance with the latest research results about the integration of semantics, wikis, and the social web. We believe that the concept of collaborative wiki tagging removes some of the inherent bottlenecks related to group and personal knowledge management.

The rest of the paper is organized in the following way. In Section 2, we introduce the concept of collaborative wiki tagging. Syntax and wiki text formatting rules for tagging data are discussed in Section 3. Section 4 gives an overview of the Collaborative Tagging Wiki Portal Prototype. Section 5 discusses some of the recent research results that relate to our work, while Section 6 concludes the paper and gives some pointers for future work.

2 Concept of Collaborative Wiki Tagging

In this paper, we introduce the concept of collaborative tagging as an interaction procedure between two (or more) resources. As is assumed by the interaction, the link of a tagged resource is memorized together with some concomitant information about the resource. The link is memorized by the tagging resource (the tagging resource is also interchangeably called agent). The link is a reification of the identity of the tagged resource in the sense of information that is sufficient to initiate and conduct an interaction protocol between participating resources[1]. The agent with memorizing capability is implemented by means of a wiki page. Note that the agent's memorizing capability does not necessarily mean an intrinsic ability of the agent to activate the memorizing process. Instead, the process may be initiated by some other agent (for example, a human agent in the case of a wiki page). A formal definition of agents, resources, interaction protocol, an agent's knowledge, and addressing has been previously given in more detail in [19].

In the case of wiki pages, information and knowledge are reified by means of wiki text stored within wiki pages. Traditionally, the content of the wiki page is interpreted as informational content primarily used by humans as a document or a Web page. We adopt an approach to reason about the system of wiki pages similar to the two-level interpretation of the Semantic Web [5]: There is a space of directed untyped links between documents, and there is a space of directed, typed relationships between the things described by the documents. In our approach, there is a space of directed untyped links between resources where each resource has an identity. The identity plays a crucial role for interaction between resources (as described above). A typed relationship between resources is considered as a composite structure consisting of an untyped directed link and an associated resource describing the link. Whether a resource represents a document, a type information about a link, or a thing described by a document is specified by associated semantics. We may distinguish two types of the associated semantics: implicit and explicit semantics. *Implicit semantics* assumes common knowledge that has a cultural nature, accumulated by a social protocol, and very loosely defined. Implicit semantics is a kind of information object called "document" since documents are assumed to be "understandable" to humans. Most of the pages on today's Web are documents, i.e. have implicit semantics and are aimed to be comprehended by humans. From the other side, *explicit semantics* does not assume any common knowledge: Explicit semantics is somehow reified and assigned to the resource representing an object (where object means a document as well as a thing described by

[1] Identity management of resources on the Web, as well as Semantic Web, is very important while still an open problem. Here, we adopt a definition of identity relative to the interaction protocol which is intended to be used. Informally, for an agent that has the intention to interact with some other resource using a given interaction protocol, reification of identity of the peer resource is interpreted as information sufficient for establishing this interaction protocol.

the document) with a purpose to be used in an automatic process of making conclusions by (artificial, software) agents.

Our approach to collaborative wiki tagging is based on the assignment of explicit semantics to the content of wiki pages. The design of a complete architecture of possible explicit semantics (ontology) is domain dependent and a very challenging task. Hence, we start with a minimal set of concepts that has the highest application potential, but keep the system open for future extensions with new concepts.

We identify 1) *presentation*, 2) *tag* and 3) *statement* semantic concepts that are assigned to wiki pages for the purpose of our target application. 1) *A presentation page* (a wiki page with assigned presentational semantics) is a traditional wiki page, a Web document understandable to a human, which can be created and collaboratively edited by several users. The page stores plain text using wiki syntax and text formatting rules. The presentation semantics should be considered as a placeholder for implicit semantics associated with a general Web document. 2) *A tag* is also a wiki page but with assigned tag semantics. The tag semantics is codified within the wiki page as a link to a unique meta-semantics page titled *"Tag"*. In other words, every wiki page that contains a link to a specific, predefined page *"Tag"*[2] is treated as a tag. 3) *A statement* is a wiki page that reifies semantic relations between any two wiki pages (including tag, presentation as well as content pages). The subset of wiki pages with assigned tag semantics is called *TagCloud System Repository*, or simply *TagCloud*, as shown in Fig. 1. Note that the classification, introduced in the set of all wiki pages by assignment of one of the defined explicit semantics, is not exclusive. Namely, a single wiki page may be assigned more then one explicit semantics. Which semantics is actually used for interaction with the wiki page is application dependent.

A wiki page with assigned tag semantics contains stored information about one or more links to resources that are tagged with the corresponding tag. With respect to the *TagCloud* we may identify *internal resources* (any wiki page from the set of all wiki pages containing the *TagCloud*) and *external resources* (any Web resource). The internal resources are under the same administrative control as resources representing tags. The internal resources are wiki pages too, so the system knows that it is possible to edit them, while this is not the case with the external resources. *A known resource* is a Web resource whose link is stored on a wiki page of the system. The wiki page may or may not have assigned tag semantics: If it has assigned tag semantics then we say the resource is tagged with the corresponding tag and consequently the resource belongs to the tag. A single resource may belong to zero, one or several tags. Accordingly, we may model *TagCloud* as a subset of power set of

[2] Note that we say nothing about the content of the *"Tag"* page, so it may be empty or may contain some additional informational content. In other words, the meta-semantics page *"Tag"* may have assigned presentational semantics itself, such that a human user may get additional explanation about the concept.

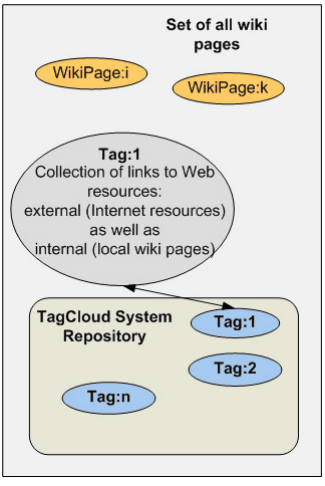

Fig. 1 TagCloud System Repository

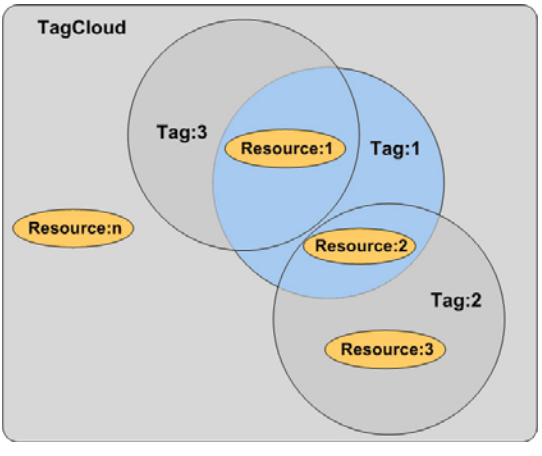

Fig. 2 *TagCloud* as a subset of power set of the set of all known resources

the set of all known resources (Fig. 2.), where each element of the *TagCloud* is a set of resources tagged with the corresponding tag.

3 Collaborative Tagging Wiki Syntax

In this paper, our aim is to store tagging data in a wiki using the native text formatting syntax of the used wiki. Consequently, we have to address two issues: 1) an ontology for tagging, and 2) a syntax for tagging data representation. We use a simple ontology for tagging based on the conceptualization

developed by [19] and described in the previous paragraph. The adopted ontology is in compliance with existing ontologies for tagging [18], [14], [13], [10]. Nested bulleted lists are used as a basic element of the wiki syntax for tagging data representation. Table 1 shows some of the JspWiki text formatting rules[3] that we use as tagging format. Note that even the syntax is wiki engine dependent, the concept of nested lists is not[4]. Therefore, the proposed tagging format can be generally applied in any wiki engine.

Table 1 Some of the JspWiki text formatting rules

Rule	Description
`[link]`	Create hyperlink to "`link`", where "`link`" can be either an internal WikiPage or an external link (http://).
[`text` | `link`]	Create a hyperlink where the link text is different from the actual hyperlink link.
*	Make a bulleted list. For deeper indentations more (**,***) is used.

Using the JspWiki text formatting rules, a tagging data format is:

```
 * [ResTitle | ResourceURL][| Tagging]/ / Tags:[tag1][tag2][tag3]
** Clipping: content_of_clipping_if_exist
** Comment: link_to_comment_if_exist
** Posted on date&time, by [username | username_userprofile]
```

HTML preview of the tagging data is as follows:

```
<ul>
    <li>
       <a class="wikipage" href="Wiki.jsp?page= ResourceURL "> ResTitle </a>
       <a class="wikipage" href="Wiki.jsp?page= Tagging "> </a>
       <br />
       Tags:
       <a class="wikipage" href="Wiki.jsp?page=tag1">tag1</a>
       <a class="wikipage" href="Wiki.jsp?page=tag2">tag2</a>
       <a class="wikipage" href="Wiki.jsp?page=tag3">tag3</a>
       <ul>
          <li>Clipping: content_of_clipping_if_exist</li>
          <li>Comment: link_to_comment_if_exist</li>
          <li>Posted on date&time, by <a class="wikipage" href="Wiki.jsp?page=
username_userprofile"> Username </a></li>
       </ul>
    </li>
 </ul>
```

Link may be a wiki-internal page link (page name reference) or an external resource link (URL address is written explicitly in the text, including the protocol prefix). In third line of the HTML code snippet, a link to an internal

[3] http://www.jspwiki.org
[4] WikiCreole.org is developing an universal Wiki syntax for interwiki compatibility.

wiki page is assigned the `wikipage` CSS class. In case of tagging an external resource, the link is assigned the external CSS class.

We reify the act of tagging as a segment of the wiki text. When a resource is tagged, the corresponding wiki text segment is appended to the wiki page of every used tag. For example, let us tag a presentation wiki page (or any other resource on the web) called `A` with a tag called `B`. As a result, a link to the "`Tag`" meta-data wiki page and a link to the resource `A` are appended to the content body of the tag page `B`. Note that there is no difference in format of the stored tagging data when we tag an internal wiki page or any other (external) web resource. The same resource can be tagged with several tags.

Following the proposed syntax of the concept of semantics reification in the wiki that we used to implement tagging, we extend the set of basic concepts in order to be able to make statements about wiki pages. For that purpose, we introduce `Statement`, `Relation`, and `Category` meta-pages. The format of the `Statement` is as follows:

```
* [WikiPage_Title | WikiPage][| Statement]
**[Relation] [Category] [Tag]
```

where, `WikiPage` is the identifier (wiki page name) of the resource that we make the statement about. The statement data is written in the wiki page called `WikiPageStatement`. The link `[| Statement]` means that the `WikiPageStatement` page is a statement saying that the `WikiPage` resource is in the `Relation` relation with the resource `Tag` from the category `Category`.

For example, when we make a statement about the wiki page `wikipageX`, a statement page `wikipageXStatement` is created (if it does not exist). Let the relation be `is_same_as`, category be `tagPage`, and tag be `tagX`. Then the format of the statement is:

```
 * [WikiPage_Title | wikipageX][| Statement]
**[is_same_as] [tagPage] [tagX]
```

An unlimited number of statements can be made for a single wiki page. All statements will be written within the same statement page for that wiki page. For example, the statement says that `WikiPage` resource is also in relation `belong _ to` with the category `project`, while tag `projectName` assigns a name to the project:

```
 * [WikiPage_Title | WikiPage][| Statement]
**[belong_to] [project] [projectName]
**[is_same_as] [tagPage] [tagX]
```

Making statements about resources and storing them in the wiki system is a general approach, but quite useful for folksonomy engineering. For example, let us consider a simple illustration of the more complex problem of "organizing the tags" [4]: Let us consider a collaborative wiki tagging system used in the food retail industry where each uploaded picture is tagged by users. In such a system we may expect tags such as `Fruit`, `Apples`, and `Apple`. We may want to

"organize"[5] the tags so that `Apples` and `Apple` tags are considered synonyms, and `Apple` is a subclass of `Fruit`. The following text segment will be stored in the wiki page named `AppleStatement`:

```
 * [Apple | Apple] [| Statement]
**[is_synonyme_with] [Tag] [Apples]
**[is_subcategory_of] [Tag] [Fruit]
```

4 Collaborative Wiki Tagging Portal Prototype

We have developed a testing prototype of the described collaborative wiki tagging system, *Collaborative Wiki Tagging Portal Prototype (CWTP)*[6]. The CWTP is aiming to support personal knowledge management, inter- and intra-community collaboration, workflow and process management, interaction, knowledge sharing and dissemination, and heterogeneous information integration (Fig. 3.). The prototype supports collaborative tagging, but it is a wiki site at the same time. This means that every page can be edited, including pages that contain tagging data as well as meta-pages. Edit rights are not publicly available but are instead regulated by an authentication and authorization mechanism at the page level.

Interaction over structure is represented by means of an automatic set of page neighborhood links (links pointing to the page and links pointing from the page) and useful drop-down menus, as well as page-specific menus. Page neighborhood links are useful for content but even more for semantic navigation. Interaction over structure is augmented with a primitive version of a *TagCloud* that is useful for navigation over presentation content. Tagging presentation wiki pages and other internal resources allows systematic (re)arrangement of the internal structure. Fig. 4. shows a tagging window for internal resource tagging, while Fig. 5. shows external resource tagging.

The differences between the two tagging windows are in statement and link. Since statements can be made for internal resources only, we provide that functionality within the tagging frame when an internal resource is being tagged. For usability purposes, this option does not exist within the tagging frame when an external resource is being tagged. Also a wiki page name is captured as the internal resource identifier instead of it's full URL as is the case for external resources. In the Tag text edit field, a user enters a set of

[5] The word organize is quoted due to an open nature of the tags organization problem. Namely, it depends on answers to questions such as what is the information capacity of individual tags, the information capacity of whole TagClouds, what is the relationship between folksonomy and ontology, what are dynamics of the TagCloud, etc. We use this example as an illustration only, and do not suggest any solution to the tags organization problem.

[6] http://infosys-work.elfak.ni.ac.yu/InfosysWiki-v2-1/Wiki.jsp?page=TagClouds. A proof of the concept beta site may also be found at http://www.tagleen.com.

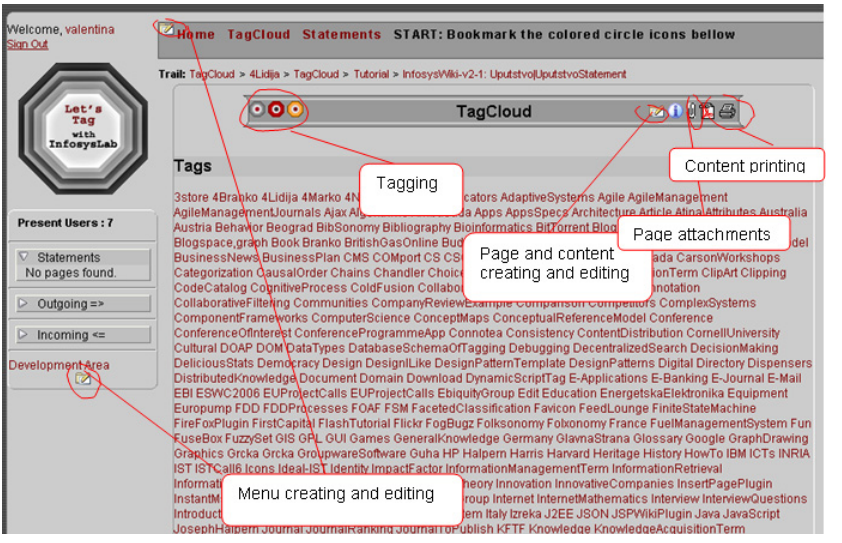

Fig. 3 Collaborative Tagging Wiki Portal Prototype (CTWP)

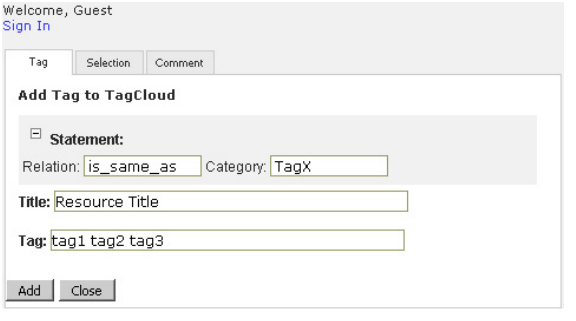

Fig. 4 Internal resource tagging

Fig. 5 External resource tagging

tags for the resource. Tags are separated by blank character, while multiple words expressions are possible by quoting them together.

Also a rudimentary tag suggestion mechanism is implemented that presents to the user a list of several existing tags based on the first letter(s) that the user has just typed in. Note that ranking and suggesting tags in collaborative tagging systems is an important research topic (see for example [20]). The suggestion algorithm guides the dynamics of the *TagCloud* towards the particular tag distribution representing a fixed point for the tagging process. Convergence of the tagging process is very important for the coherent categorization schemes that can emerge from unsupervised tagging by users [7], [6].

Fig. 6 Screenshot of tagging data

5 Discussion and Related Work

Probably the best known approach to organizing information within a wiki is Wikipedia[7] categories. Collaborative wiki tagging presented in this paper associates tags to wiki pages in a similar way except that the cognitive investment made by the user and his/her level of attention is much higher in the case of categorization then in the case of free tagging. As a consequence categorization requires heavy involvement of domain experts with all drawbacks that this approach brings along, such as high costs, social protocols needed to identify and prove specific expertise, etc. Instead, the collaborative tagging is a self-organizing emergent process that converges into consensus around categorization of the tagged resources.

Wikipedia categories, as well as several popular blogging and image tagging platforms that offer similar functionalities, are restricted to the classification of internal resources (wiki pages or blog posts) into internally developed

[7] http://www.wikipedia.org

categories. General-purpose social tagging systems (such as del.icio.us[8]) allow tagging of any web resource including web resources identifying system's internal tags. However, it is unclear how such self-tagging possibilities are further exploited. With the proposed Collaborative Wiki Tagging we are able to tag any web resource and not just an internal wiki page. We are also able to use tagging to semantically enrich the organization of local resources in an emerging manner.

Underlying models that would enable the effective integration of the powerful RDF-based Semantic Web with massively adopted user-friendly Social Web is a hot research topic at the moment [8]. A particularly interesting aspect is the relation between static and dynamic characteristics of folksonomies and ontologies: How can an ontology be automatically derived from a folksonomy? How can an ontology help driving tagging dynamics? (see for example [9]).

With respect to low-level syntax relevant research includes microformats: a simple convention for embedding semantics in HTML to enable decentralized development[9] for web resources tagging called tag-rel[10]. Both the microformats and the proposed wiki tagging syntax are based on existing, simple, and widely used mechanisms: The microformats are based on the HTML syntax while the proposed approach is based on the wiki text formatting syntax. However, the wiki tagging page can be easily edited online by an end user using a simple text area of a web browser while this is not the case with HTML based microformats.

RDFa lets XHTML authors express structured data within a document using existing XHTML attributes and a handful of new ones [2]. RDFa gets its expressive power from RDF. Like microformats, RDFa is similar to our approach in the sense that it is based on the wide adopted XHTML syntax. However, RDFa is much more along our abstract model of explicit semantics. Adoption of the RDFa into Collaborative Wiki Tagging system is one of the goals of our future research, particularly for the integration of XHTML based WYSIWYG editors.

A second relevant stream of existing research includes Semantic Web related work, particularly Semantic Wikis [15], [4]. Among the whole family of different Semantic Wikis, IkeWiki may be the closest to our approach [16]. The proposed solution is low-level and in this way a complementary approach to Semantic Wikis. Also, semantic collaborative tagging system, as proposed in [12], is based on semantic assertions that are very close to our Statements.

6 Conclusions

In this paper, we propose a concept of collaborative tagging for the organization of knowledge stored within a wiki system. The knowledge is about any

[8] http://del.icio.us

[9] http://microformats.org/wiki/Main_Page

[10] http://microformats.org/wiki/reltag

Web resource as well as system internal wiki pages. We first introduced the semantics of collaborative tagging that is implemented in a wiki fashion. Then, we discussed syntax and wiki text formatting rules that we use to store tagging data in a wiki system. The proposed concepts and syntax is used for the implementation of our *Collaborative Wiki Tagging Portal Prototype*. We use the prototype extensively for personal knowledge management, group knowledge interaction and project management. We have recently started testing the prototype in our undergraduate teaching practice and we experienced very promising results: improved student-teacher communication, students being more actively involved into learning processes and the management of the course being more interactive.

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References

1. Dynamic Collaboration: Enabling Virtual Teamwork in Real Time (2003), http://www.accenture.com/xdoc/en/services/technology/research/tech_collaboration.pdf
2. Abida, B., Birbeck, M.: RDFa Primer. W3C Working Draft (October 26, 2007), http://www.w3.org/TR/xhtml-rdfa-primer/
3. Ames, M., Naaman, M.: Why We Tag: Motivations for Annotation in Mobile and Online Media. In: Proceedings of the SIGCHI conference on Human Factors in computing systems (CHI 2007), San Jose, CA, USA (2007)
4. Buffa, M., Gandon, F., Sanders, P., Faron, C., Ereteo, G.: SweetWiki: a semantic wiki. Journal of Web Semantics, Manuscript Draft (2007), http://www.websemanticsjournal.org/papers/2007119/SweetWikiBuffaV6I1.pdf
5. Berners-Lee, T., Hollenbach, J., Lu, K., Presbrey, J., Pru d'ommeaux, E., Schraefel, m.c.: Tabulator Redux: Writing Into the Semantic Web (2007) (unpublished), http://eprints.ecs.soton.ac.uk/14773/
6. Golder, S., Huberman, B.A.: Usage Patterns of Collaborative Tagging Systems. Journal of Information Science 32(2), 198–208 (2006)
7. Halpin, H., Robu, V., Shepherd, H.: The Complex Dynamics of Collaborative Tagging. In: Proceedings of the 16th International World Wide Web Conference (WWW 2007), Banff, Canada (2007)
8. Immaneni, T., Thirunarayan, K.: A Unified Approach to Retrieving Web Documents and Semantic Web Data. In: Franconi, E., Kifer, M., May, W. (eds.) ESWC 2007. LNCS, vol. 4519, pp. 579–593. Springer, Heidelberg (2007), http://www.eswc2007.org/pdf/eswc07-immaneni.pdf
9. Kim, H.L., Yang, S.K., Song, S.J., Breslin, J.G., Kim, H.G.: Tag Mediated Society with SCOT Ontology. In: The 5th Semantic Web Challenge, The 6th International Semantic Web Conference (ISWC 2007), Busan, Korea (2007)

10. Knerr, T.: Tagging Ontology - Towards a Common Ontology for Folksonomies (2006), http://code.google.com/p/tagont/
11. Macgregor, G., McCulloch, E.: Collaborative Tagging as a Knowledge Organisation and Resource Discovery Tool. Library Review 55(5) (2006)
12. Marchetti, A., et al.: SemKey: A Semantic Collaborative Tagging System. In: Proc. WWW 2007 Workshop on Tagging and Metadata for Social Information Organization, Banff, Canada (2007)
13. Marlow, C., Naaman, M., Boyd, D., Davis, M.: HT 2006, tagging paper, taxonomy, Flickr, academic article, to read. In: Proceedings of the Seventeenth Conference on Hypertext and Hypermedia, HYPERTEXT 2006, Odense, Denmark, August 22-25, 2006, pp. 31–40. ACM, New York (2006), http://doi.acm.org/10.1145/1149941.1149949
14. Newman, R.: Tag Ontology design (2007), http://www.holygoat.co.uk/projects/tags/ (viewed December 2007)
15. Oren, E., Völkel, M., Breslin, J.G., Decker, S.: Semantic wikis for personal knowledge management. In: Bressan, S., Küng, J., Wagner, R. (eds.) DEXA 2006. LNCS, vol. 4080, pp. 509–518. Springer, Heidelberg (2006)
16. Schaffert, S.: IkeWiki: A Semantic Wiki for Collaborative Knowledge Management. In: 1st International Workshop on Semantic Technologies in Collaborative Applications STICA 2006, Manchester, UK (2006)
17. Sinha, R.: A cognitive analysis of tagging. Weblog entry, Rashmi Sinha's weblog (2005), http://www.rashmisinha.com/archives/05_09/tagging-cognitive.html
18. Story, H.: Search, Tagging and Wikis. Weblog entry, The Sun BabelFish Blog, (Feburary 6, 2007), http://blogs.sun.com/bblfish/entry/search_tagging_and_wikis
19. Tosic, M., Milicevic, V.: Semantics of The Collaborative Tagging Systems. In: 3rd European Semantic Web Conference, 2nd Workshop on Scripting for the Semantic Web, Budva, Serbia & Montenegro (2006)
20. Vojnovic, M., Cruise, J., Gunawardena, D., Merbach, P.: Ranking and Suggesting Tags in Collaborative Tagging Applications. Microsoft Research, Technical Report MSR-TR-2007-06 (2007)