Inconsistencies in Semantic Social Web Applications

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Abstract. *The semantic social web or web 3.0 is the movement of integrating popular social web (web 2.0) applications with ideas from the semantic web. Techniques like semantic wiki systems, social tagging of weblogs and other web 2.0 applications as well as FOAF (Friend of a Friend) specifications are some of the results of this movement. Since metainformation acquired by such systems depends mostly on the social system interacting with them it is almost certain that inconsistencies will emerge. We analyze the case of a semantic wiki system (TaOPis) dealing mostly with knowledge management and show how this inconsistencies can yield problems for eventual agents searching the dynamic knowledge base. In the end we give some guidelines and possible solutions for avoiding such unwanted behavior.*

Keywords. social web, semantic web, web 2.0, web 3.0, inconsistencies, knowledge management

1 Introduction

Through the development of the World Wide Web as well as the OpenSource paradigm a lot of new information technologies were introduced that are of great interest to knowledge management [7]. Such technologies are often hidden under the term Web 2.0 as well as the social web, even if there is no clear agreement of what technologies build up Web 2.0. Figure 1 gives a short resume of these technologies.

On the other hand there is the semantic web movement which main aims include the creation of machine readable data that will allow for automated search and reasoning through the use of intelligent agents. The main idea is to provide

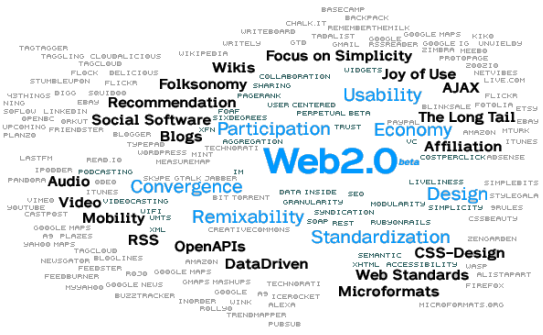

Figure 1: A Mindmap of the Web 2.0 Concept (by Markus Angermeier)

structured semantic web ontologies written in some formalized language like OWL (the Web Ontology Language) based on description logic or $\mathcal{F}$LORA-2 based on frame logic.

By merging these two perspectives one obtains social semantic web applications, often denoted with Web 3.0. Such application shall make it possible to take advantage of a "collective intelligence" of the social system surrounding web applications in terms of autopoietically generated metadata.

Due to the fact that social systems are complex, non-linear, dynamic systems it seems clear that Web 3.0 applications will face the issue of inconsistencies due to inconsistencies in the very social system. Such inconsistencies can yield problems for intelligent agents trying to obtain some proper information. When following Berners-Lee a very important layer in the semantic web stack is trust as shown on figure 2.

Herein we analyze the case of ŤAOPĪS a social semantic web application for self-organizing com-

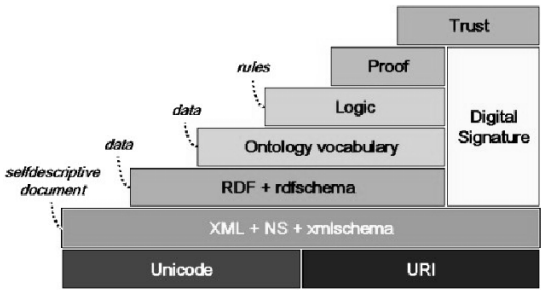

Figure 2: The semantic web stack [1]

munities providing suitable tools like semantic wiki systems, forums, blogs, ranking mechanisms, content filtering, tagging etc [3, 5, 6]. The system has been used for allmost two years for various purposes, but most projects deal with knowledge management due to the fact that the system is used in a knowledge management course at the Faculty of organization and informatics. Especially its semantic wiki subsystem is of special interest since it accumulates metainformation. In the end we propose a probabilistic annotation of metainformation based on a social network analysis algorithm.

2 Towards Web 3.0

In the last few years social web technologies became extremely popular. Applications like forums, chat rooms, bulletin boards, social networking software, various open source project management systems, weblogs or just blogs, podcasting, social tagging as well as wiki systems are most often in wide use. Such applications allow a group of people to communicate for sake of collaboration, problem solving, project management or just leisure.

Most important for the Web 3.0 perspective are semantic wiki systems, social tagging systems as well as social networking systems.

Semantic wiki systems try to integrate fast and lightweight content management systems with formal semantic metainformation. This is mostly achieved through adding semantic relationships between wiki pages and tags that are given by users. Such metainformation can later be used to issue dynamic queries against such a knowledge base or to be processed by intelligent agents.

Social tagging systems allow their users to tag diffrent content they encounter in order to organize it for them selves. It is amazing how such accumulated metainformation often obtains more relevant information then search engines using complex web mining algorithms. These systems most obviously take advantage of the previously mentioned "collective intelligence" of the social system surrounding them.

Social networking applications allow people to connect through various relationships, create contacts and communicate. The FOAF (friend of a friend) initiative is trying to create a "*Web of machine-readable pages describing people, the links between them and the things they create and do*". Lots of contemporary social networking applications already support this standard. As in the previous cases such metainformation can be used to ease search and reasoning.

3 The Case of ŧaOPīs

As mentioned previously ŧaOPīs has a semantic wiki subsystem[1] that allows users to create semantic linkages between pages as well as to tag these pages using attribute-value tags. Special attributes are used to enhance possible semantics (like class, subclass, rule etc.). Such additional tags allow the creation of metainformation in an object-oriented manner.

A semantic wiki system on ŧaOPīs consists basically of an extensible set of wiki pages describing some particular content. Pages are considered to be objects having their corresponding classes, attributes as well as relations to other objects. Relations to other object are implemented through hyperlinks.

As mentioned previously the system has now been used for allmost two years for various projects including open-source project management, university course documentation, political activism, alumni, job search etc. After analyzing the metadata provided by its users, we were able to observe basically two types of inconsistencies:

- Syntactical inconsistencies - arisen mostly due to different or inadequate spelling in attribute-value tags;

[1]Please reffer to [3, 5, 6] for an introduction to ŧaOPīs architecture

- Semantic inconsistencies - arisen mostly due different views of project members.

While syntactical inconsistencies can be easy detected, solved and prevented, semantic inconsistencies can yield problems in various situations. For example in a case there was a cyclic definition of subclass relations depicted on figure 3. Such a subclass definition can pose problems for intelligent agents reasoning about this particular domain.

Figure 3: Inconsistent definition of subclasses

Other examples include multiple class definitions for a given object (page), set relations to one and the same object due to multiple hyperlinks to the same page,

4 Guidelines and Solutions

To minimize and prevent syntactic errors a suggestion mechanism for attribute-value tags was implemented. The suggestion mechanism allows the user to see the possible classes in a specific domain, attributes for a given class as well as attribute values for a given attribute name. Such a suggestion mechanism allows for less syntactical inconsistencies. The new entry form is shown on figure 4.

As shown on the figure when adding a specific attribute or class the user gets a suggestion of the system for similar terms. On the image the user allready entered the attribute city (cro. *grad*) and the system automatically shows possible values for this attribute (e.g. Koprivnica and Zagreb).

Semantic inconsistencies are much harder to prevent, which is why we suggest to couple to the social system. Social network analysis allows to detect the most trustworthy members of a social network. In ꜧAOPīs a special case of eigenvector centrality [2] used in the PageRank algorithm [4]. Users can vote for each other on a given project to establish the trust network. In this way numerical values of trust can be obtained and used to annotate metainformation.

5 Conclusion

Social semantic web applications or web 3.0 technologies seem to be the next step in the evolution of the World Wide Web. Herein we analyzed such an application based on ideas from wiki systems, social tagging systems and social networking applications. Due to the fact that such systems' metainformation is the result of the social system surrounding them it is obvious that certain inconsistencies will emerge. We identified two types of possible inconsistencies in such applications: (1) syntactical and (2) semantic.

Syntactical inconsistencies can be partially solved through suggestion mechanisms. Other solutions would probably include techniques from the fields of pattern matching and data mining.

Semantic inconsistencies pose a much bigger problem, and due to the fact that the average user probably hasn't enough knowledge in semantic modelling, such problems will be a major issue in the future. An approach to solve such inconsistencies is to acknowledge that the social system is a probabilistic system, and allow for uncertain information. The probability of thrustworthiness can be determined through social network analysis as proposed in this paper.

Formal search and reasoning techniques for such uncertain information are subject to our future research.

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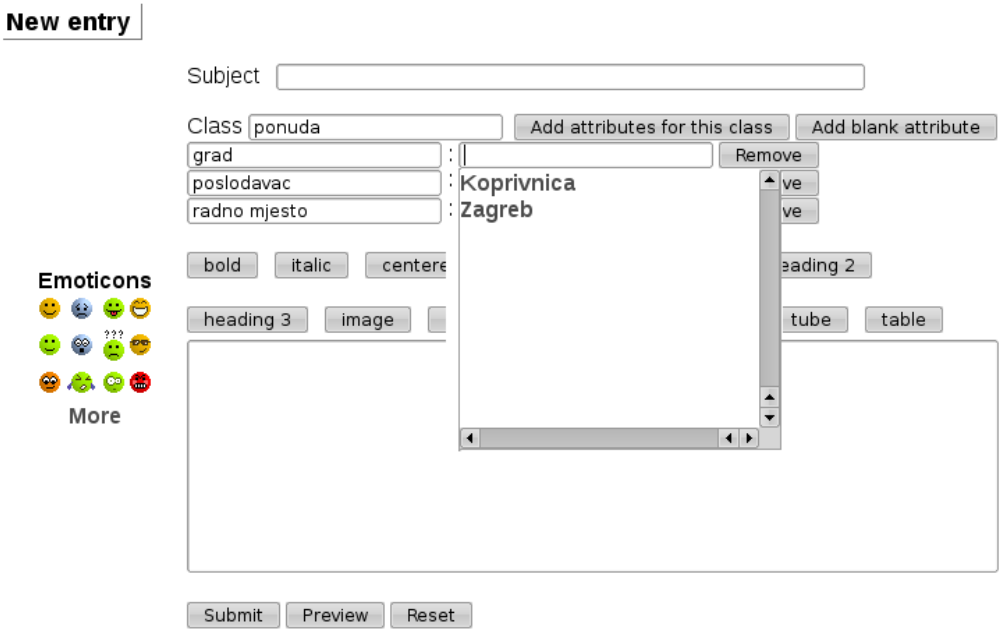

Figure 4: Suggestion mechanism entry form

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