CONVERGENCE OF CONCEPT MAPS AND TOPIC MAPS: PROTOTYPE BASIS

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ABSTRACT

Our paper tries to open a discussion about a new research topic: Topic Maps, which we think it can be interesting to incorporate into software engineering projects as a technical terminology. Not only it is a new profound paradigms shift but also an unknown vision of how to represent knowledge in a smart way. We can approach to the paradigm thanks to the Project EA-2003-52, supported by the Spanish Ministry of Education, about subject gateways. We explain the software used to develop the first version, and while we were developing it, the reflection that make we think: Can concept maps be topic maps, when they begin to display lots of information in a relational way?

KEYWORDS

Topic Maps, Concept maps, Freeware, Potnia

1. INTRODUCTION

A Knowledge representation, semantics, ontologies, knowledge organization, metadata, XML, XTM, RDF, etc. Who have not heard to talk about these concepts once? How many times we have stopped thinking about them? What is really their meaning? How they are interrelated among them?, and what is more important: Are they really take place to any sort of innovation, or are we thinking about the same all the time?. Firstly, we can start talking about Concept Maps. Concept Maps are nowadays used for education and educational research, task planning, organising, presentation applications and lots more. But it wasn’t until 1984 when scientific disciplines adopt them as a didactical tool by the hand of Novak (Novak and Gowin, 1984: Novak, 1988). Since then, it’s possible to find a lot of publications and research about different contexts for the concept maps uses and users.

If we have to try to define what a Concept Map is, we can assert that basically a concept map is an advanced tool for representing visually the information and the knowledge, according to the concepts and their relations, in a specific knowledge domain (Cañas et al., 2000). The user simply starts with his topic of interest and that recurses down into the different aspects regarding this matter. A concept map is an expression of radial thinking and therefore a natural function of the human brain. The difference to traditional techniques is not found in the content, it is solely in the representation because it is a graphical method.

Secondly, we have to describe what a topic map is. Topic Maps (http://www.topicmaps.org), identified as XTM, are now ISO standard (currently ISO/IEC 13250). As Fisher, Wandersee and Moody (2000) describe, “Topic Maps are included in a class of objects we refer to as knowledge webs. A knowledge web is an interconnected web of ideas that conveys in skeletal form not only a set of ideas but also how those ideas are organized and interrelated”.

But topic maps are not just about navigating territories. As we can see, we can easily repurpose them for use in the display or discovery of knowledge. Carnot, Dunn and Cañas (2001) have proposed a web interface...
that, using concept maps, provides an integrated access for a knowledge domain. Finally, classrooms all over the world are using concept maps for this purpose. When concept maps begin to display lots of information in a relational way, they imply a new question: “Can concept maps be topic maps?” If we happen to implement a concept map engine on top of the XTM specification, those concept maps would be converted to topic maps, which will gain the ability to be shared, merged, and archived in a standard format for future use.

2. AN APPROACH PROJECT: THE DESCRIPTION

Arriving at this point, our objective was to take up again a project we made for the Spanish Ministry of Education (Tramullas, 2003), last year. The project studied the Spanish subject gateways, and their potential use in e-learning environments. One of the aims was to design and implement a software package, called Potnia, for creating and maintaining this kind of information resource. It was developed making use of non-declarative programming languages, a Relational Database Management System (RDBMS), and no special technique of information or knowledge visualization.

The project is around scientific subject gateways. A sort of concrete Internet information resources, well defined by a particular set of features showed in specialized bibliography (Bawden and Robinson, 2002). It is also an information-control service with value-added, and more up-to-date results than those compiled in a traditional scientific publication, thanks to the immediacy of the digital medium. A good example could be: Resource Discovery Network Program (http://www.rdn.ac.uk/).

The first project was developed with the following technology:

1. Macromedia Dreamweaver MX and The GIMP for the GUI (User Guide Interface),
2. PHP 4 with embedded SQL sentences and,
3. MySQL as an information repository. The data was selected and stored by following the standard placed by the Dublin Core Metadata Initiative (http://www.dublincore.org).

Finally, the project was uploaded at two well-known open source project hosts: Sourceforge (http://potnia.sourceforge.net) and Freshmeat (http://freshmeat.net/projects/potnia). In this first release, Potnia is based in traditional text based interface, working towards the metaphor of text searching and browsing, detail and external link. Brusilovsky and Rizzo has been studied this navigational combination between close and open information spaces (2003).

After studying about Topic Maps, XTM and design XML databases with their semantic retrieval instead of the relational one, we decided to redesign the project. We start our new task by following METRICA Versión 3 (http://www.csi.map.es/csi/metrica3/), a useful methodology and tool to give support to the software lifecycle, with the copyright of the Spanish Ministry of Public Administrations.

3. NEW PROJECT FOUNDATIONS

On the one hand, the theoretical conclusions: Knowledge Organization, Topic Maps, and Knowledge Representation have a crucial issue: "to arrange for semantic interoperability"; concept mapping doesn’t apply anything vocabulary control, and there is no rule for his building and visualization is a promising technique for both enhancing users’ perceptions of structure in large information spaces and providing navigation facilities.

Several applications exist specifically designed to bring the approach of concept mapping (sometimes only mind mapping) to a computer’s desktop. Some of them allow the user to export to HTML or/and XML format. But we have tried to find some visualization technique in XTM format. Karvonen, Rautama, Tarhio and Turkia (2001) suggested a specific markup language, named CML (Concept Markup Language), for creating concept maps, in order to represent it graphically. Finally, we can find one initiative at http://www.mapasconceptuales.com. A tool developed in JavaScript, by Cristófol Rovira, lecturer at Universitat Pompeu Fabra (Barcelona).
On the other hand, we have to analyze examples of fruitful projects with the aim of extracting the fields that can make use of this paradigm nowadays. Moreiro et al (2002), from an information science approach, compared features of thesaurus, concept maps and topic maps, but didn’t propose integration levels, logical or technical. In despite of that, we can select a lot of approaches: back-of-the-book indexing, indexing repositories for modules in programming languages, indexing of threads in academic discussion, multiview indexing of knowledge repositories, indexing for town magazines and innovative e-journals, coordinated text word indexing, and dictionaries, glossaries, and terminology work in general, etc.

In digital hyperlinked information resources, it’s clear that indexing, representation and navigation are sides of the same coin. Ross, (2000) has argued that it is necessary to develop a model that combines indexing and concept mapping, in order to get sophisticated information retrieval tools. In a referenced paper, Shipman and Marshall (1999) stated that spatial hypertext had characteristics which users can take advantage of visual recognition, reasoning and communication, and graphical interactions.

Secondly, to scan the commercial and the Open Source software available to develop an XTM application, in order to maintain the next releases of Potnia software in the public domain (Park, 2002: 199-265).

Finally, we can reckon, checking some evaluation versions of different vendors, that the majority of the developed software till now are focused on graphical representation. In other words, it doesn’t carry out with database relational systems such as MySQL or PostgreSQL, due to their lack of indexing systems and basic querying capabilities, always from a semantic perspective. All of the toolkits have been created in Java but for example, the TM4J package supports storage of processed topic map information in an Ozone object-oriented database system, which is very complex to learn for a user without familiarity with the principles of object-oriented programming languages. Or take of Nexist’s case with a persistent storage which is relatively lightweight but whose SQL (Structured Query Language) needs being easily modified.

4. ON REFLECTION

Our premises, now, were very clear but we have attempted to test to be true. Finally, we decided to use XTM to represent knowledge. According to the database design, we hold our statement designing a XML Database, without making use of the object-oriented database model or the relational one. And taking again the visualization aspect, the discussion is still open because at the beginning, there was the concept map. Later, there was the topic map. Now, there is XTM, an XML language for expression and serialization of topics, associations, and scopes. Concept maps have their roots in pedagogy, while topic maps have their roots in HyTime and the information management communities. Then, what is the best solution?

It became clear that there is a lack of use of XTM. It could be cause it is not very well-known or it is immature, or it could be cause, by hundrum, we think in other technologies less complicated or more trendy to develop our projects. So, it is time to take into account XTM as a suitable technology, as we are making in the ongoing development of the following version of our aforementioned project of subject gateways.

When we read between lines Topic Maps specification, we can notice that the underlying conceptual model is not clearly explicit. But if the power of concept mapping and semantic networking tools derives from the external support they provide for this internal process of knowledge building, that is, concepts maps and semantic networks facilitate knowledge capture, knowledge construction, reflection on knowledge, knowledge refinement, knowledge communication, knowledge collaboration, and knowledge transfer, where is the difference? If both are included into the concept of knowledge web, explained in the introduction. And considering Gorodetsky and Fisher definition for this concept (Gorodestky and Fisher, 1996): “Knowledge webs can also promote metacognition or thinking about thinking”, Why do not use topic maps as an alternative representation? Or being less radical, why do not use topic maps in combination with other techniques? There is no escaping the fact that the major forms of knowledge representation, including visuals, semantic networks, and text, will be much more powerful than any single form alone.
REFERENCES


