Creating Web Presentation for Observatory and Planetarium with Topic Maps

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Abstract. The aim of the Topic Maps application for astronomers and visitors of Observatory and Planetarium in Hradec Králové is to help them to search resources related to astronomy. The Topic Maps document can be immediately consulted during presentations and courses for public and can be reused for creation of web presentation of the Observatory. In the paper the process of the application development is summarized.

Keywords: Topic Maps, TM4L, Ontopia Navigator Framework, astronomy

1 Introduction

Semantic web is understood as the environment where software agents browse web page from one to another and perform sophisticated tasks on behalf of human users. To enable this, it is necessary to develop new technologies for encoding the meaning and context of each piece of information presented on web sites. An international standard ISO/IEC 13250 Topic Maps [6] is intended on realizing ideas of the semantic web.

The Topic Maps standard uses knowledge representation schema – Topic Map. We perceive this structure as some Topic Maps document written in certain syntax (XTM [4], LTM [2], etc.). It is composed of three basic elements – topic, association and occurrence. Having these elements, it is possible to create metadata layer describing digital sources of different types to facilitate access to them.

In this paper we introduce an application of Topic Maps approach that is related to e-learning, searching services and information delivery. We focus on creating

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web presentation for needs of the Observatory and Planetarium in Hradec Králové.

An unsuitable solution for organizing and convenient searching relevant terms connected with astronomy domain is used at the Observatory. Our Topic Maps document will help to access web pages related to astronomy and to ensure better navigation.

2 Original application used at the Observatory

At the Observatory and Planetarium in Hradec Králové, presentations and courses about astronomy are organized. For this purpose – and also for their own research – astronomers need to manage huge amount of digital information and knowledge resources. Astronomers were used to work with file-manager-like application written in Tcl/Tk. It enables browsing local digital repository during the lectures for public through the system of menus (in Czech), with main categories such as *Presentations, Animations, Pictures – physics* etc. E.g. the list of *Pictures - physics* includes the titles such as *Meteorological radar, Meteors - Perseids, Milky Way - structure, Molecular clouds* etc., see Fig. 1 [5].

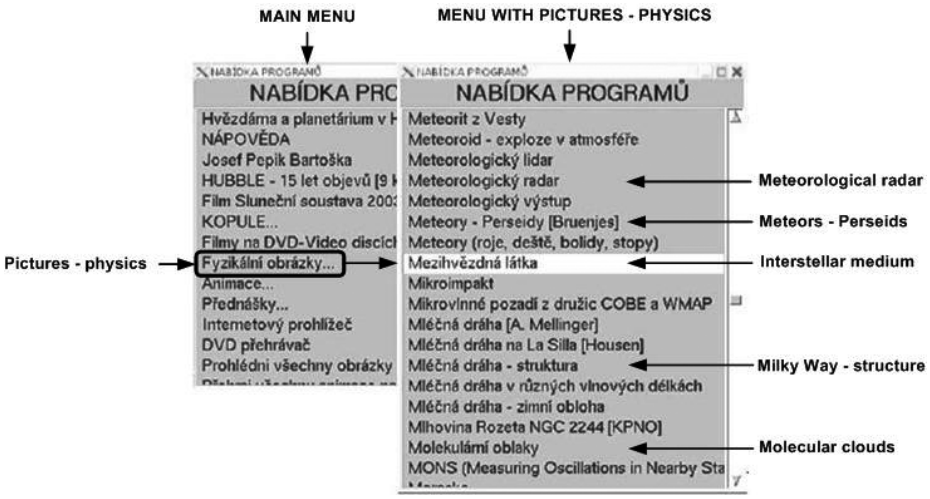

Fig. 1. Original solution in Tcl/Tk

The items inside main categories are ordered randomly. No hierarchies and no relations between concepts are defined, therefore it is not possible to differentiate

between general and special terms. The system is not user friendly, items are ordered alphabetically and in certain cases the lecturer has to remember the content of menus to be able to search it quickly.

Our objective is to help astronomers by designing and implementing the Topic Maps application. It should simplify accessing relevant resources during lectures and help to better organize the content of the Observatory website.

3 Topic Maps document creation

Development of the Topic Maps document was realized in diploma thesis [5]. The key parts of this thesis were: analysis of the original current application and design development of the pilot project based on the Topic Maps standard.

The Topic Maps document was realized in cooperation with the domain expert, who is its future user (being lecturer at the Observatory). The participation of the expert was necessary to ensure the correctness of the final structure of the Topic Maps document. Following requirements for the Topic Maps document were defined, see Tab. 1.

Table 1. Requirements for the Topic Maps document

User´s requirements	Priority	Comment
Capturing the ontology of astronomical terms	high	
Topics implementation	high	
Implementation of associations among topics to enable navigation	high	This was expected to be the main benefit for users.
External occurrences implementation	medium	Lecturers often work with hyperlinks from Wikipedia.
Defining internal occurrences	medium	Internal definitions are not necessary.
Defining topic names in different languages	high	At least in English and Czech

Following requirements related to the Topic Maps editor were defined, because the updating and the maintenance of the Topic Maps document will be performed by users (lecturers and astronomers):

- The management of the Topic Maps document has to be intuitive, because astronomers are not IT specialists and do not want to study programming languages.

- Visualization and searching tools for the Topic Maps document content are required.
- Periodical automated testing of functioning of web links, stored as external occurrences in Topic Maps document, is important.
- Simple installation and maintenance, Windows version is preferred, low costs on future enhancing the application.

The first version of the Topic Maps document was created in editor Ontopoly, part of Ontopia Knowledge Suite (OKS) package [7], that fulfills most of requirements. The Topic Maps document was realized in iterative way. Requirements specification, design, implementation, integration, testing and debugging, were repeated several times to reflect comments and recommendations given by expert. During the design phase, elements for the Topic Maps document (topics, associations, etc.) were collected and organized into hierarchies. We could find out if any inconsistencies exist in the Topic Maps document with the aid of validation function that is offered by editor Ontopoly.

After consultations with expert was found out that the Topic Maps technology is suitable. The Topic Maps document could be used with OKS Samplers [8] for the pilot version. Experiences and results ensured us about practical usage of the Topic Maps document. Further requirements for the web application were specified, see Tab. 2.

Table 2. Requirements for the web application

User´s requirements	Priority	Comment
Intuitive navigation	high	
Clear organization of web pages	high	
Possibility to search Topic Maps elements	high	
Possibility to visualize Topic Maps document in expandable graph structure	high	Mainly for educational purposes
Possibility to edit elements of the Topic Maps document from web-based forms	medium	
Online presentation of the Topic Maps document	high	In the initial phase of the development, application is tested offline.

The Topic Maps document was created using Ontopoly editor and it was clear that the web-based application will be developed with next component of OKS

environment – scripting language based on XML - Ontopia Navigator Framework (ONF) [9].

Firstly experiments with ONF and the Topic Maps document were performed. It was seen that ONF is quite easy to use, but one problem occurred. If we had created web pages with ONF, we used various special tags. These tags can contain identifiers of the Topic Maps elements. If we had modified the Topic Maps document in Ontopoly, identification values changed. This was very unpleasant observation after long effort. Our next steps were focused on searching more suitable tool, without problems with identifiers and also eligible for users.

4 Comparison of Topic Maps tools

Following three editors of Topic Maps documents creation were investigated with respect to the given web application developers´ and users´ requirements:

- Wandora [12], knowledge management solution based on Topic Maps principles, which supports export into HTML and therefore can be used for web presentation creation,
- TMTab plug-in [11] for Protégé ontology editor that allows exporting the ontology into XTM syntax,
- TM4L editor (Topic Maps 4 E-learning) [1], an editor of Topic Maps documents, developed for educational purposes.

Experiments were made with LTM syntax [2] written in NotePad too, but this manual approach would be uncomfortable for the customer. Tab. 3 summarizes properties of tools. Editor Ontopoly is also mentioned for comparison with others tools.

Finally TM4L environment was chosen because of properties that are compliant much more than editor Ontopoly. It bears on among other things steady identification values of Topic Maps elements if you modify Topic Maps document, see more details in Tab. 3.

Activities on developing the Topic Maps document did not finish. It was found out that original Topic Maps document could be opened in TM4L editor (ver. 1, 2), but taxonomy was not saved. For solving this problem we saw only one way – to develop the Topic Maps document once more in TM4L editor. We chose TM4L editor version 2, because is more sophisticated than version 1: it can visualize Topic Maps structure and supports tolog query language [3], see Tab. 3.

Table 3. Tools for Topic Maps document creation

Requirements	Ontopoly	TMTab	Wandora	TM4L editor
Intuitiveness	yes	no	no	yes
Visualization	yes (Vizigator)	no	yes	yes
Searching topics	yes	yes	yes	yes
Automated testing of web sources	no	no	no	yes
Installation with no sweat	no	yes	yes	yes
OS Windows	yes	yes	yes	yes
Low price	yes (OKS Samplers)	free	free	free

5 Web presentation creation

Experience with TM4L editor and ONF confirms that combination of these tools is good way for creation pilot version of web with Topic Maps approach – TM4L editor for defining Topic Maps document and ONF for designing web presentation based on the Topic Maps document.

Developing web pages with ONF lies in creating JSP documents containing special tags with queries in tolog language [3]. Their purpose is for example: extracting pieces of information and knowledge from the Topic Maps document, their view on the web pages, supply information from the Topic Maps document under some condition etc. It is not necessary to know details about JSP programming for creating simple web pages with ONF, but knowledge about tolog language is indispensable.

Firstly, scope of pilot web-based presentation had to be mentioned. The domain of astronomy – which is extremely complex, and includes knowledge of mathematics, physics, chemistry, history, philosophy etc. – was restricted after consultation with expert. Only concepts related to selected objects of the Solar System were taken into account, and the aim was to define corresponding ontology and to present relevant information and knowledge resources on these objects.

For web-based presentation based on the Topic Maps document, we chose predefined layout and adjusted it for our purposes. The layout of main pages (about particular objects in the Solar System) can be seen on Fig. 2. The topic name is presented in the heading. The left part of the page contains other names, description of the topic (internal occurrence) and links to web resources, i.e. pictures, animations, documents (external occurrences). Navigation menu and list of associations are published on the right side of the page. Hypertext link to the homepage, information about web and contact to the author is entirely up on the right side of the every web page. Sample page is presented on Fig. 3.

We were focused on quality not for quantity in the first stages of web development. It means that we only chose for example *Discoverers* of some astronomical object and we tried hard to ensure right view, encoding and layout particular information on the page. This strategy was realized with Apache Tomcat servlet/JSP Container, that was installed in our personal computer. We used following tags in web pages: *tolog:context*, *tolog:set*, *tolog:foreach*, *tolog:id*, *tolog:out* and *tolog:if* . Explanation of them can be found in [10].

6 Final state of the pilot application

The web presentation contains web pages dedicated to particular objects of the Solar system - *Planets* - with Czech and English names, description of the object, list of related topics, links to internally stored pictures and to external web resources. Czech-English astronomical dictionary, overview of involved Solar System objects, people (famous astronomers), external resources (animations, pictures, text documents) are presented on special pages. For statistics of the Topic Maps document, see Tab 4. All requirements (Tab. 1) were accomplished.

Table 4. Statistics of the Topic Maps document

Element of the Topic Maps document	Count
topic types	18
instances	69
associations	6
external occurrences	143
internal occurrences	67
themes	10
Total TAOs	313

The pilot web presentation was evaluated by the expert from the Observatory. Regarding requirements in Tab. 2, his conclusion was that both navigation scheme and organization of pages are clear and easy to use.

One of the main benefit is possibility to quickly detect association(s) between topics, for example *Sun* and *Solar flare (has activity)*. This application has also some weaknesses. It has not been accessible through the Internet yet. In the first phase of this web project is tolerable because pilot version of this web is testing with OKS samplers. Searching, editing and visualization elements of the Topic Maps document has not been realized too. It means that only 2 from 6 requirements for web application were solved so far. It is clear what steps are going to follow.

7 Conclusion

This paper describes the process of Topic Maps application creation for the purpose of Observatory and Planetarium in Hradec Králové. Two tools were used, TM4L editor for the defining the Topic Maps document, and Ontopia Navigator Framework for creating the web presentation.

The pilot web presentation contains information and links to knowledge resources about selected objects of the Solar System. Next effort will be focused on extending the Topic Maps document in cooperation with domain experts and mainly on defining the procedures of further maintenance and utilization of the application.

The visualization of the Topic Maps structure should be presented on the website of the Observatory. This can be achieved using VizLet applet that is provided with professional version of OKS. Searching relevant information and their optional editing through web-based forms by authorized users is planned too.

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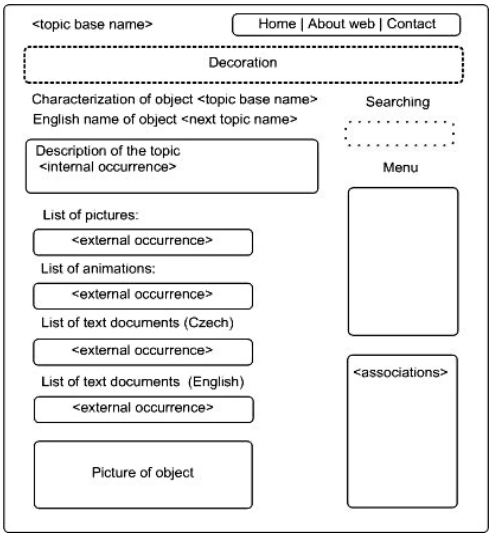

Fig. 2. Layout of web page

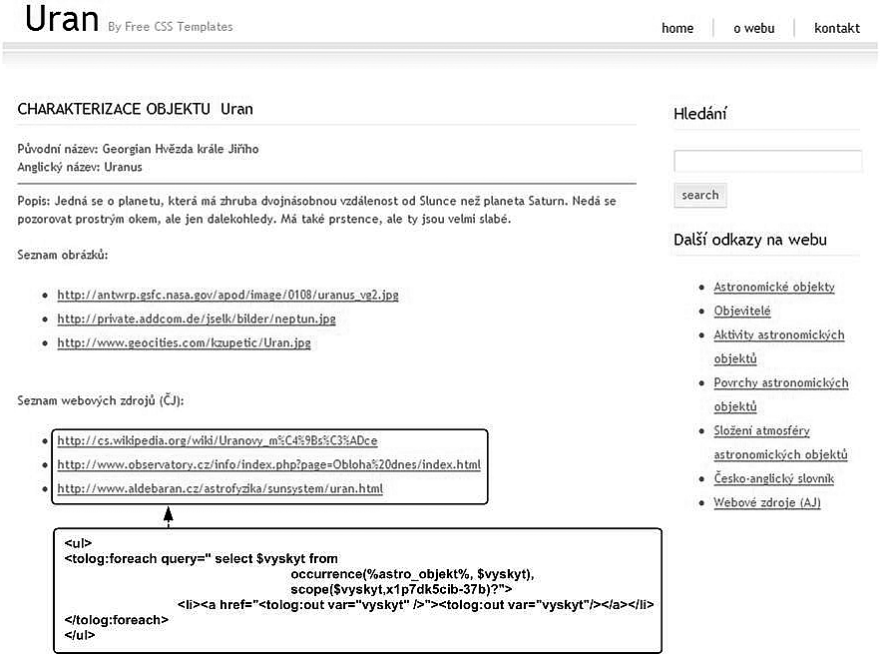

Fig. 3. Sample page of the topic “Uran” with relevant tolog code

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