OntoWiki

A Tool for Social, Semantic Collaboration

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ABSTRACT

We present OntoWiki, a tool providing support for agile, distributed knowledge engineering scenarios. OntoWiki facilitates the visual presentation of a knowledge base as an information map, with different views on instance data. It enables intuitive authoring of semantic content, with an inline editing mode for editing RDF content, similar to WYSIWYG for text documents. It fosters social collaboration aspects by keeping track of changes, allowing comments and discussion on every single part of a knowledge base, enabling to rate and measure the popularity of content and honoring the activity of users. OntoWiki enhances the browsing and retrieval by offering semantic enhanced search strategies. All these techniques are applied with the ultimate goal of decreasing the entrance barrier for projects and domain experts to collaborate using semantic technologies. In the spirit of the Web 2.0 OntoWiki implements an "architecture of participation" that allows users to add value to the application as they use it. It is available as open-source software and a demonstration platform can be accessed at `http://3ba.se`.

Categories and Subject Descriptors

H.4.m [**Information Systems Applications**]: Miscellaneous;
K.4.3 [**Computers and Society**]: Organizational Impacts—*Computer-supported collaborative work*;
H.2.8.f [**Database Management**]: Database Applications—*Knowledge management applications*

Keywords

Semantic Wiki, Social Software, Semantic Collaboration

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1. INTRODUCTIONS

We present a tool supporting agile Knowledge Engineering in a pure Web environment. It is called OntoWiki since it is close in the spirit to existing Wiki systems. Technologically however, the OntoWiki design is independent and complementary to conventional Wiki technologies. As such, the OntoWiki approach differs from recently emerged strategies to integrate Wiki systems and the Semantic Web (cf. [5, 7]). In these works it is proposed to integrate RDF triples into Wiki texts in a special syntax. It is a straightforward combination of existing Wiki systems and the Semantic Web knowledge representation paradigms. The OntoWiki strategy presented in this paper, on the contrary, does not try to mix text editing with knowledge engineering, instead it applies the Wiki paradigm of "making it easy to correct mistakes, rather than making it hard to make them"[6] to collaborative knowledge engineering. The main goal of the OntoWiki approach thus is to rapidly simplify the presentation and acquisition of instance data from and for end users. This is achieved by regarding knowledge bases as "information maps". Each node at the information map is represented visually and intuitively for end users in a generic but configurable way and interlinked to related digital resources.

To stress the generic character of OntoWiki, the figures in this paper show screenshots of the OntoWiki prototype with a knowledge base collaboratively developed[1] and containing information about scientific conferences, as well as another publicly available knowledge base[2] containing information about research projects, people and publications at a research institute.

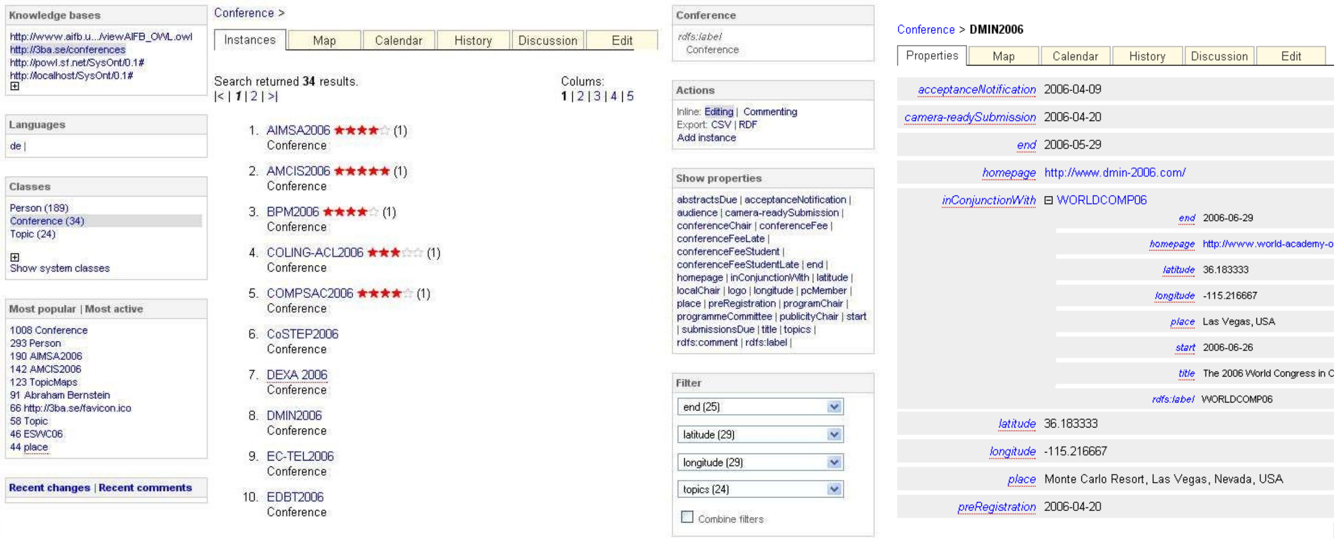
2. SYSTEM AND FEATURE DESCRIPTION

2.1 Visual Representation

Web pages in OntoWiki, representing nodes in the information map, are divided into three parts: a left sidebar, a main content section and a right sidebar. The left sidebar

[1] at `http://3ba.se`

[2] `http://www.aifb.uni-karlsruhe.de/viewAIFB_OWL.owl`


Knowledge bases
http://www.aifb.u.../viewAIFB_OWL.owl
http://3ba.se/conferences
http://powl.sf.net/SysOnt/0.1#
http://localhost/SysOnt/0.1#
⊞
Languages
de |
Classes
Person (189)
Conference (34)
Topic (24)
⊞
Show system classes
Most popular | Most active
1008 Conference
293 Person
190 AIMSA2006
142 AMCIS2006
123 TopicMaps
91 Abraham Bernstein
66 http://3ba.se/favicon.ico
58 Topic
46 ESWC06
44 place
Recent changes | Recent comments
Conference >
Instances
Map
Calendar
History
Discussion
Edit
Colums:
1 | 2 | 3 | 4 | 5
|< | 1 | 2 | >|

Search returned **34** results.

1. AIMSA2006 ★★★★☆ (1)
   Conference
2. AMCIS2006 ★★★★★ (1)
   Conference
3. BPM2006 ★★★★☆ (1)
   Conference
4. COLING-ACL2006 ★★★☆☆ (1)
   Conference
5. COMPSAC2006 ★★★★☆ (1)
   Conference
6. CoSTEP2006
   Conference
7. DEXA 2006
   Conference
8. DMIN2006
   Conference
9. EC-TEL2006
   Conference
10. EDBT2006
    Conference

Conference
rdfs:label
Conference
Actions
Inline: Editing | Commenting
Export: CSV | RDF
Add instance
Show properties
abstractsDue | acceptanceNotification | audience | camera-readySubmission | conferenceChair | conferenceFee | conferenceFeeLate | conferenceFeeStudent | conferenceFeeStudentLate | end | homepage | inConjunctionWith | latitude | localChair | logo | longitude | pcMember | place | preRegistration | programChair | programmeCommittee | publicityChair | start | submissionsDue | title | topics | rdfs:comment | rdfs:label |
Filter
end (25)
latitude (29)
longitude (29)
topics (24)
□ Combine filters
Conference > DMIN2006
Properties
Map
Calendar
History
Discussion
Edit

acceptanceNotification	2006-04-09		
camera-readySubmission	2006-04-20		
end	2006-05-29		
homepage	http://www.dmin-2006.com/		
inConjunctionWith	⊟ WORLDCOMP06		
		end	2006-06-29
		homepage	http://www.world-academy-o
		latitude	36.183333
		longitude	-115.216667
		place	Las Vegas, USA
		start	2006-06-26
		title	The 2006 World Congress in C
		rdfs:label	WORLDCOMP06
latitude	36.183333		
longitude	-115.216667		
place	Monte Carlo Resort, Las Vegas, Nevada, USA		
preRegistration	2006-04-20		

Figure 1: List view (left) and view of an individual instance with expanded inline reference view (right).

offers the selection of content to display in the main content section. Selection opportunities include the set of available knowledge bases, a class hierarchy browser and a full-text search. Once a selection is made, the main content section will arrange matching content in a *list view* linking to *individual views* for individual instances (cf. Figure 1). The right sidebar offers tools and complementary information specific to the selected content.

List views allow to view a selection of several instances in a combined view. The selection of instances to display can be either based on class membership or on the result of a selection by facet or full-text search. OntoWiki identifies those properties used in conjunction with the instances of the selection. The display of the corresponding property values for each instance can be switched on, thus resulting in a tabular view. Furthermore, each individual instance displayed is linked to an individual view of that instance.

Individual views combine all the properties attached to a particular instance. Property values pointing to other individuals are rendered as HTML links in the corresponding individual view. Alternatively, to get information about the referenced individual without having to load the complete individual view, it is possible to expand a short summary (loaded per AJAX) right where the reference is shown. The right sidebar provides additionally information about similar instances (of the same type) and incoming links (i.e. references from other instances).

The OntoWiki prototype facilitates different views on instance data. The following views are currently implemented:

Map View: If the selected data (either a single instance or a list of instances) contains property values representing geographical information (i.e. longitude and latitude coordinates or a relation to a resource with coordinates), a map view provides information about the geographical location of the selected data (cf. Figure 2).

Calendar View: Instances having property values with the associated datatype `xsd:date` can be displayed in a calendar view (cf. Figure 2). The sidebar offers a link to export calendar items in iCal format, which enables to import the selected calendar items into a desktop calender application.

2.2 Collaborative Authoring

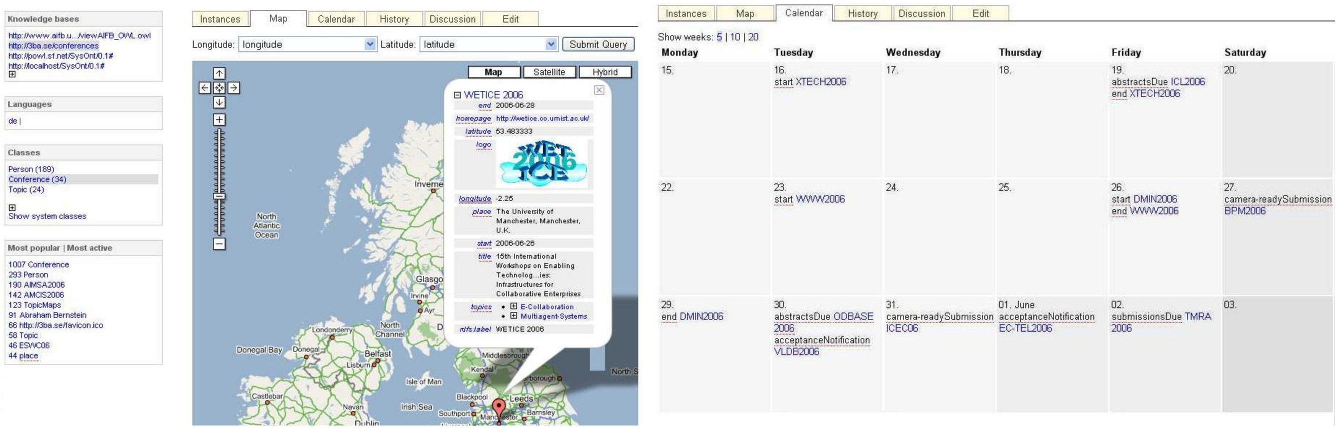
For human users it is important that the statements of a knowledge base are presented on the user interface in a way which facilitates the efficient reception of this information. For instance, if it is clear that a single object is described, it will be displayed only once on the OntoWiki user interface, even though all the statements describing the concept contain the concept URI as subject. Furthermore, if a property (e.g. referencing publications) occurs multiple times those statements are grouped together and the label of the property is displayed only once.

To enable users to rapidly edit or add statements as soon as they notice mistakes or missing information, OntoWiki features an inline editing mode. This means that all information originating from statements presented on the OntoWiki user interface is equipped with a small edit button as well as an add button. After clicking one of those buttons a resource editor is loaded and the corresponding statement can be easily edited – or similar content (i.e. a statement with the same subject and predicate) can be added. This strategy can be seen as an analogy to the WYSIWYG (What You See Is What You Get) editing strategy for text editing, since information can be edited in the same environment as it is presented to users.

Conventional Web technologies do not support large data sets to be handled at the client (browser) side, but this is usually needed when working with large knowledge bases. To overcome this limitation, reloading of web pages becomes necessary. This approach is time consuming and requires multiple user interactions. Recently, with the deployment of more sophisticated Web browsers, supporting modern JavaScript and XML technologies, mixed server and client side web applications became possible. These were recently named AJAX (Asynchronous JavaScript and XML) and early adopters such as Google-Maps[3] or Flickr[4] make

[3] `http://maps.google.com`

[4] `http://www.flickr.com`



Knowledge bases

http://www.aifb.u.../viewAIFB_OWL.owl
http://3ba.se/conferences
http://powl.sf.net/SysOnt/0.1#
http://localhost/SysOnt/0.1#
⊞

Languages

de |

Classes

Person (189)
Conference (34)
Topic (24)

⊞
Show system classes

Most popular | Most active

1007 Conference
293 Person
190 AIMSA2006
142 AMCIS2006
123 TopicMaps
91 Abraham Bernstein
66 http://3ba.se/favicon.ico
58 Topic
46 ESWC06
44 place

⊟ WETICE 2006

end	2006-06-28
homepage	http://wetice.co.umist.ac.uk/
latitude	53.483333
logo	
longitude	-2.25
place	The University of Manchester, Manchester, U.K.
start	2006-06-26
title	15th International Workshops on Enabling Technolog...ies: Infrastructures for Collaborative Enterprises
topics	⊞ E-Collaboration ⊞ Multiagent-Systems
rdfs:label	WETICE 2006

Show weeks: 5 | 10 | 20

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
15.	16. start XTECH2006	17.	18.	19. abstractsDue ICL2006 end XTECH2006	20.
22.	23. start WWW2006	24.	25.	26. start DMIN2006 end WWW2006	27. camera-readySubmission BPM2006
29. end DMIN2006	30. abstractsDue ODBASE 2006 acceptanceNotification VLDB2006	31. camera-readySubmission ICEC06	01. June acceptanceNotification EC-TEL2006	02. submissionsDue TMRA 2006	03.

Figure 2: Map view (left) and calendar view (right) of instance data.

extensive use of them. OntoWiki uses the AJAX technology to interactively propose already defined concepts while the user types in new information, which he wants to add to the knowledge base. To realize this interactive search, all URI references and literals are indexed for full-text searches in the statement repository.

For convenient editing of differently typed literal data, the OntoWiki system provides a library of reusable user interface components for data editing, called widgets. The following widgets are currently provided by the prototypical OntoWiki implementation: *Statements* allowing to edit subjects, predicates, and objects, *Nodes* to edit literals or resources, *Resources* to select and search from/for existing resources, *Literals* to display literal data in conjunction with data type or language identifier, *File* to upload files to OntoWiki, and specific widgets for literal data types, e.g. a calendar for dates.

All widgets can be configured. The OntoWiki system allows to define and attach certain sets of configurations to a specific widget.

Editable views are combinations of widgets to edit a specific view on the knowledge base in one single step. The OntoWiki system provides the following types of editable views:

- *Metadata*: Comments, labels, and annotations (such as versioning and compatibility information) which can be attached to arbitrary resources are combined in a metadata view.
- *Instances*: An instance view combines all properties attached to the instance's class or one of the superclasses. For large knowledge bases, this might include a large amount of properties. The OntoWiki system thus allows to restrict the view to such properties which are really used in conjunction with other instances of the same class. On the basis of range definitions for the property, OntoWiki selects appropriate editing widgets. Additional properties can be added on-the-fly.
- *Views*: The earlier described inline-editing technique allows to edit arbitrary views. The columns of list views arranging many instances in a tabular way, for example, can be easily edited at once, thus allowing to rapidly add "horizontal" knowledge (across several instances) to the knowledge base.

2.3 Enabling Social Collaboration

A major aim of OntoWiki is to foster and employ social interactions for the development of knowledge bases.

This eases the structured exchange of meta-information about the knowledge base drastically and promotes collaboration scenarios where face-to-face communication is hard. Furthermore, making means of social interactions as easy as possible contributes in creating an "architecture of participation" that allows users to add value to the system as they use it. Social collaboration within OntoWiki is in particular supported by:

Change tracking: All changes applied to a knowledge base are tracked. OntoWiki enables the review of changes on different levels of detail (see also [2]) and optionally restricted to a specific context, such as changes on a specific instance, changes on instances of a class, or changes made by a distinct user. In addition to present such change sets on the Web, users can subscribe to get information about the most recent changes on objects of their interest by email or RSS/Atom feeds.

Commenting: All statements presented to the user by the OntoWiki system may be annotated, commented, and their usefulness can be rated. This enables community driven discussions, for example about the validity of certain statements.

Rating: OntoWiki allows to rate instances. Users have to be registered and logged in to participate in order to avoid duplicate ratings by the same user. A user may change his rating for a certain instance. Special annotation properties allow the creation of rating categories with respect to a certain class. Instances of the class can then be rated according to these categories, thus allowing for example the rating of instances of a class publication according to categories originality, quality and presentation.

Popularity: All accesses to the knowledge base are logged thus allowing to arrange views on the content based on popularity. As with ratings or user activity, the popularity of content can be measured with respect to a certain knowledge base or fragment of it (e.g. popularity with respect to class membership). This enables users to add value to the system as they use it.

Activity/Provenance: The system keeps record of what was contributed by whom. This includes contributions to the ontology schema, additions of instance data or commenting. This information can be used to honor active users in the context of the overall system, a specific knowledge base or a fragment of it (e.g. instance additions to some class). This way it instantly gratifies users for their efforts and helps to build up a community related to the edited knowledge base.

2.4 Semantic Search

OntoWiki provides a full-text search for one or multiple keywords occurring in literal property values. Since there can be several property values of a single individual containing the search string, the results are grouped by instances. They are ordered by frequency of occurrence of the search string. Search results may be filtered to contain only individuals which are instances of a distinct class or which are described by the literal only in conjunction with a distinct property.

A semantic search has significant advantages compared to conventional full-text searches. By detecting classes and properties, which contain matching instances, the semantic search delivers important feedback to the user on how the search may be successfully refined.

3. STATUS AND FURTHER WORK

OntoWiki is implemented as an alternative user interface for the schema editor integrated in Powl. Powl is a platform for Semantic Web application development realized in a 3-tier architecture consisting of storage tier, object-oriented API and user interfaces. Many of the requirements for OntoWiki were gathered from use cases of Powl.

OntoWiki was implemented in the scripting language PHP, thus allowing to be easily deployed on most Web hosting environments. The application is available as open-source software from SourceForge[5]. A publicly available knowledge repository on the basis of OntoWiki is available at `http://3ba.se`.

The system is designed to work with knowledge bases of arbitrary size (only limited by disk space). This is achieved by loading only those parts of the knowledge base into main memory which are required to display the information requested by the user on the screen (i.e. to render a Web page containing this information).

Currently, OntoWiki is extended and adopted within a variety of R&D projects. The project SoftWiki[6] for example is developing a prototype based on OntoWiki, which aims to employ OntoWiki's social collaboration functionality for end-user driven Requirements Engineering of massively distributed software development projects. For the project Orchestra [4] OntoWiki's storage, browsing and retrieval functionality is envisioned to be used as a shared repository for ontologies and queries in the bio-informatics domain. In the project "Vernetzte Kirche" [3] Powl and parts of OntoWiki were applied to foster a meta-data initiative for social, cultural and religious content.

Future work will focus on the following aspects:

- Implement a privilege system and access control for and on the basis of the RDF data model with support for rights management on higher conceptual levels than that of statements.
- Obtain more case studies. In particular, independent comparisons are needed to provide further evidence to see whether OntoWiki lives up to its promises.
- Examine possibilities to tightly integrate reasoning services (based on Description Logics) into OntoWiki.
- Establish better methods of interaction with existing content and knowledge management systems.

This paper is a more compact, updated and summarized version of [1].

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