On Supporting HCOME-3O Ontology Argumentation Using Semantic Wiki Technology
(Position Paper)

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Abstract. To support the sharing of consistently evolved and living ontologies within and across different communities, HCOME-3O framework has been recently proposed. The framework introduces a set of three (meta-) ontologies for capturing the meta-information that is necessary for interlinking, sharing, and combining knowledge among the parties involved in a collaborative (domain) ontology engineering process. Although a prototype software (namely HCONE) based on this framework has being developed, collaborative tasks embedded in the HCOME methodology such as the *ontology argumentation* could be alternatively designed using *open* and *Web community-driven* (collective intelligence-based) technologies. In this short paper we state our position that the existing technology used to develop a Semantic Wiki (and its extensions) can be re-used in HCOME-3O-based tools in order to support Web community-driven collaborative ontology engineering tasks.

Keywords: ontology argumentation, collaborative ontology engineering, Semantic Wiki, HCOME methodology, collective intelligence.

1 Introduction

Ontologies are *evolving* and *shared* artefacts that are collaboratively and iteratively developed, evolved, evaluated and discussed within communities of knowledge workers. To enhance the potential of ontologies to be collaboratively engineered within and between different communities, these artefacts must be escorted with *all* the necessary information (namely meta-information) concerning the conceptualization they realize, implementation decisions and their evolution.

In HCOME-3O framework [1], authors proposed the integration of three (meta-) ontologies that provide information concerning the conceptualization and the development of domain ontologies, the atomic changes made by knowledge workers, the long-term evolutions and argumentations behind decisions taken during the lifecycle of an ontology. Figure 1 depicts ontology engineering tasks for a *domain* ontology and its versions, i.e. editing, argumentation, exploiting and inspecting, during which meta-information is captured and recorded (in *development* ontologies) either as information concerning a simple task or as information concerning the interlinking of

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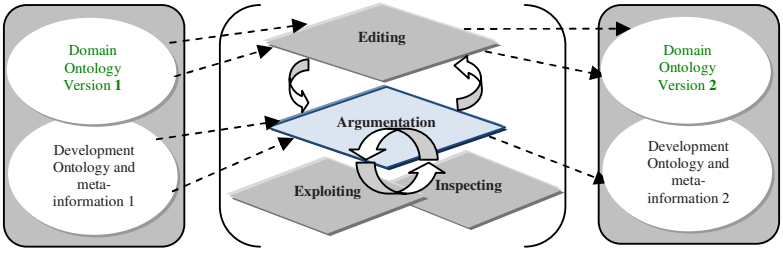

Fig. 1. The HCOME-3O framework for recording interlinked meta-information concerning ontology engineering tasks

tasks. This framework has been proposed in the context of HCOME collaborative engineering methodology [2]. HCOME places major emphasis on the conversational development, evaluation and evolution of ontologies, which implies the extended sharing of the constructed domain ontologies together with the meta-information that would support the interlinking, combination, and communication of knowledge shaped through practice and interaction among community members.

More specifically, in the context of HCOME-3O framework, ontology argumentation task is supported by the "Argumentation ontology"[1]. Such ontology provides a schema for representing meta-information about *issues*, *positions*, and *arguments* that contributing parties make during an argumentation dialogue upon the collaborative evolution of shared ontologies. Specifically, an argument may raise an issue that either suggests changes in the domain conceptualization, or questions the implementation of the conceptualized entities/properties. Based on this issue, a collaborative party may respond by publicizing a position, i.e. a new version of the ontology, or by suggesting the change of a specific ontology element. A new argument may be placed for or against a position, and so on. Issues may be generalized or specialized by other issues. The connection of the recorded arguments with the ontology elements discussed by specific contributing parties and with the changes made during a period is performed through the argumentation item and position classes' properties (formal item, contributing party, period and evolving ontology). The argumentation ontology supports the capturing of the structure of the entire argumentation dialogue as it evolves among collaborating parties within a period. It allows the tracking and the rational behind atomic changes and/or ontology versions. It is generic and simple enough so as to support argumentation on the conceptual and on the formal aspects of an ontology.

Current implementation of the ontology argumentation functionality of HCOME-3O framework is captured in HCONE prototype tool [1], based on a stand-alone JAVA implementation (front-end) and JENA support for ontology management (persistent storage). Although it is a platform in-depended implementation, the functionality is not open to the Web community. The use of open, Web community-driven technology, such as Wiki technology, in order to enable collaborative and

[1] An OWL implementation of the argumentation ontology can be accessed from http://www.icsd.aegean.gr/ai-ab/projects/HCONEv2/ontologies/HCONEarguOnto.owl

community-driven ontology engineering (by giving users with no or little expertise in ontology engineering the opportunity to contribute) is not new. In order to support open and Web community-driven ontology argumentation, existing Wiki technology can be integrated.

For designing and developing an open and Web community-driven ontology argumentation functionality embedded in a collaborative ontology engineering environment that is based on HCOME-3O framework, the following requirements should be met:

1. Use an Argumentation Ontology to represent meta-information concerning the recording and tracking of the structured conversations. Record such meta-information as individual elements (instances) of the Argumentation Ontology classes. Any Argumentation Ontology can be used, given that it will be interlinked with the HCOME-3O (meta-) ontologies.
2. Use the HCOME-3O (meta-) ontology framework to record meta-information concerning the interlinking between conversations and ontology development and evolution (changes and versions of a domain ontology). The recording of interlinking between (meta-) ontologies is what really supports the sharing of consistently evolved and living ontologies within and across different communities [1].
3. Use of Semantic Wiki technology for openness and Web community-driven engineering. Developing collaborative functionalities of ontology engineering, such as ontology argumentation, is much more easy and efficient when we use technologies that were devised for such purposes.

The aim of this paper is to state author's position concerning the use of (semantic) Wiki technology for supporting ontology argumentation task in O.E tools that have been (or going to be) designed according to HCOME-3O framework.

2 Related Work and Motivation

In myOntology project [3] the challenges of collaborative, community-driven, and wiki-based ontology engineering are investigated. The simplicity of Wiki technology and consensus finding support by exploiting the collective intelligence of a community is being used to collaboratively develop lightweight ontologies. myOntology goal is not only to allow co-existence and interoperability of conflicting views but more importantly support the community in achieving consensus similar to Wikipedia, where one can observe that the process of consensus finding is supported by functionality allowing discussion (however, not structured dialogues).

In NeOn project, the Cicero web-based tool [4] supports asynchronous discussions between several participants. This social software application is based on the idea of Issue Based Information Systems (IBIS) and the DILIGENT argumentation framework [5]. The DILIGENT argumentation framework was adapted for Cicero in order to make it easier applicable on discussions and in order to reduce the learning effort by users. In Cicero, a discussion starts with defining the issue which should be discussed. Then possible solutions can be proposed. Subsequently, the solution proposals are discussed with the help of supporting or objecting arguments.

Both works provide strong evidences that collective intelligence in the form of (semantic) Wikis can be used to support collaborative ontology engineering, with the advantages of openness and scalability. As far as concerns reaching a consensus on a shared ontology during argumentation, both works, although they provide mechanisms to record the actual dialogues, meta-information concerning the recording of the interlinking between conversations and ontology evolution (versions of a domain ontology) is not recorded.

Our position statement in this paper has been motivated by these related technologies. We conjecture that the related technologies must aim to their integration with the HCOME-3O framework since the recording of interlinking between (meta-) ontologies is what really supports the sharing of consistently evolved and living ontologies within and across different communities [1]. By re-using such technologies and extending them to be compliant with HCOME-3O framework it is possible to achieve this goal.

3 Wiki-Based HCOME-3O Ontology Argumentation

Following the HCONE tool design requirements as these were implied by HCOME-3O framework [1], we introduce a personal and a shared space for performing ontology engineering tasks. In this paper an initial architecture for the design of a HCOME-3O-based ontology engineering tool that integrates Semantic Wiki technology (currently for the ontology argumentation task only) is proposed (Figure 2). The proposed architecture, following the "Exploitation" phase of HCOME methodology, supports the following tasks:

1. The inspecting of shared ontologies (reviewing, evaluating and criticizing specified conceptualizations),
2. The inspecting (comparison) of shared versions of an ontology, for identifying the differences (tracking changes) between them,
3. The posting of arguments upon versions of ontologies for supporting decisions for or against specifications.

Although tasks 1 and 2 can be performed in the personal space, it has been already shown in other lines of HCONE research [2] that they could also be performed collaboratively in the shard space. Given that existing technology can support it, the *Exploiting* and *Inspecting* tasks could be performed to the shared space using extensions of Semantic Wiki technology such as the Halo[2] extension. Allowing however the execution of these tasks in both spaces may be a "gold" design solution (must be evaluated with further work). The *Editing* task can also be moved to the shared space, since technologies have been already proposed that can support it [3]. However, only the editing of lightweight ontologies can be (with existing and proposed technologies) supported. Finally, the *Argumentation* task can be executed in the shared space since technology is mature enough to support it in an open and Web community-driven environment [4].

[2] http://semanticweb.org/wiki/Halo_Extension

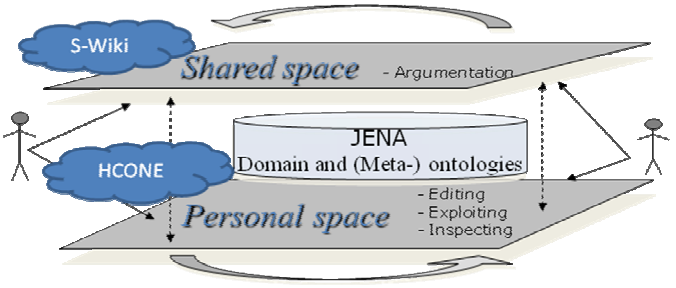

Fig. 2. An HCOME-3O-based ontology engineering architecture integrating Semantic Wiki technology

To meet the requirements outlined in the Introduction section, the above presented ontology engineering tasks should be integrated in environments that have been designed according to HCOME-3O framework for recording meta-information and their interlinking. Concerning the Ontology Argumentation task, integrating a Wiki-based tool such as CICERO with stand-alone Ontology Engineering tools (e.g. HCONE [1]) that store meta-information in JENA ontologies, is feasible. The integration of such tools requires their extension in order to communicate information concerning ontology argumentation (at the Ontology Argumentation Wiki side e.g. CICERO) and ontology evolution (at the Editing tool side e.g. HCONE) meta-information.

In order to test the proposed in this paper technology, we have developed an experimental Ontology Argumentation Wiki (namely, HCOMEasWiki) using the freely available PHP API's of MediaWiki[3], Semantic MediaWiki[4], and CICERO (see Figure 3). As depicted, a first "Issue" has been created for discussion under the title "My first issue", concerning the specification of an ontology class ("It concerns the ontology class…"). There are no "Reactions" (Arguments or Solution Proposals) for this "Issue", according to CICERO technology.

To integrate CICERO Ontology Argumentation functionality in HCOME-3O framework-based HCONE tool, some variables (corresponding to properties or classes of the ontologies from both tools) should be mapped and some others to be introduced, as shown in the Table 1. The table is not complete, but it gives an idea of what is needed to be done at the design level in order to easily extend HCONE tool's ontology argumentation functionality with the Semantic Wiki technology. Having said that, it must be also stated that CICERO is being used for evaluating the prototype version of the proposed approach. Several limitations of CICERO impose several new variables (property or category type of Wiki pages) that need to be introduced prior integrating it with HCONE tool. However, other similar implementations designed in accordance to the Ontology Argumentation framework proposed in HCOME [1, 2] could be more easily integrated in the proposed approach.

[3] www.mediawiki.org/
[4] http://semanticweb.org/wiki/Semantic_MediaWiki

Table 1. Example integration actions towards a Wiki-based HCOME-3O ontology argumentation

HCOMEasWiki wiki	Integration Action	HCONE tool
"Created by" property (e.g. "Kotis")	Map	"Name" and "Surname" variables corresponding to properties of Contributing_Party class of Administrative (meta-) Ontology
"Discussed_Element_Class" "Discussed_Element_Individual" "Discussed_Element_Property"	Introduce categories in Wiki and then Map	"Class", "Individual", "Property" variables corresponding to sub-classes of "Element" class of Administrative (meta-) Ontology
"Discussed_Ontology"	Introduce categories in Wiki and then Map	"Evolving Ontology" variable corresponding to sub-class of "Ontology" class of Administrative (meta-) Ontology
"Issue" Category (e.g. "My first issue")	Map	"Issue" variable corresponding to "Issue" class of Argumentation (meta-) Ontology

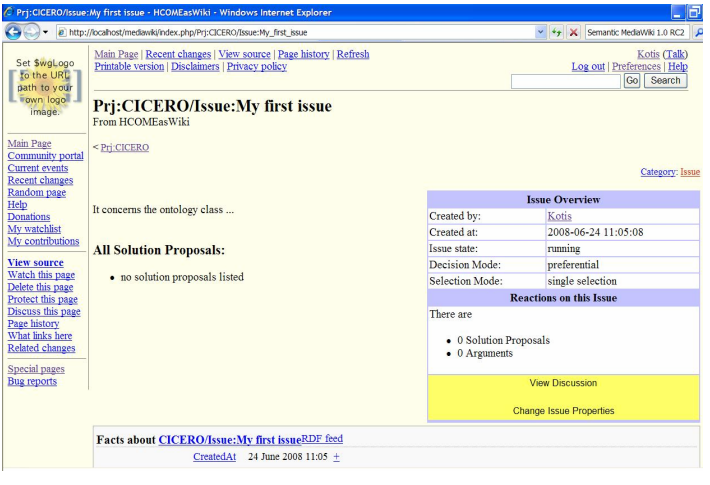

Fig. 3. Preliminary experimentations with Ontology Argumentation Wiki's (CICERO snapshot)

4 Conclusions

The aim of this paper is to state author's position concerning the use of (semantic) Wiki technology for supporting ontology argumentation task in O.E tools that have been (or going to be) designed according to HCOME-3O framework. An initial architecture for the design of a HCOME-3O-based ontology engineering tool that integrates Semantic Wiki technology (currently for the ontology argumentation task only) is proposed and preliminary experimentation with such technology is reported.

Apart from completing the proposed approach and experimentation towards reporting prons and cons from its full scale evaluation, future work includes further consideration of important methodological implications: Wiki-based ontology engineering approaches (and Wiki-based ontology argumentation consequently) are based on a self-organization principle, where concepts emerge uncontrolled following from the implicit community interests (bottom-up approach). On the other hand, middle-out approaches [2], [5] and [6] provide knowledge workers with a clear direction/focus to render their perspectives on an initial common ontology (which was grounded using a top-down approach). This focus is translated in concept-templates that are most urgent to be filled and are derived from the community discussion (socialization). Top-down (traditional approaches that are based on the knowledge engineer), bottom-up, and middle-out ontology engineering approaches should be seen as complementary. A key challenge is to find a balance between them, a point that will be accepted by knowledge workers during their ontology engineering practice [6].

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