Chapter IX
Supporting Evolution of Knowledge Artifacts in Web Based Learning Environments

Dimitris Kotzinos
Institute of Computer Science, FORTH-ICS and Department of Geomatics and Surveying, TEI of Serres, Greece

Giorgos Flouris
Institute of Computer Science, FORTH-ICS, Greece

Yannis Tzitzikas
University of Crete and Institute of Computer Science, FORTH-ICS, Greece

Dimitris Andreou
Institute of Computer Science, FORTH-ICS, Greece

Vassilis Christophides
University of Crete and Institute of Computer Science, FORTH-ICS, Greece

ABSTRACT

The development of collaborative e-learning environments that support the evolution of semantically described knowledge artifacts is a challenging task. In this chapter we elaborate on usage scenarios and requirements for environments grounded on learning theories that stress on collaborative knowledge creation activities. Subsequently, we present a comprehensive suite of services, comprising an emerging framework, called Semantic Web Knowledge Middleware (SWKM), that enables the collaborative evolution of both domain abstractions and conceptualizations, and data classified using them. The suite includes advanced services for ontology change, comparison and versioning over a common knowledge repository offering persistent storage and validation.
INTRODUCTION

Classical learning theories are based either on the knowledge acquisition metaphor (where a learner individually internalizes a body of knowledge) or on the social participation metaphor (where a group of learners collaboratively appropriate a body of knowledge). Although widely accepted, these theories do not sufficiently capture innovative practices of both learning and working with knowledge (i.e., knowledge practices). Only sharing of knowledge in action, i.e., sharing the process of learning itself, is a reliable base for developing a shared cognition (seen both as a group and an individual characteristic).

Knowledge creation activities rely heavily on the use, manipulation and evolution of shared knowledge artifacts externalizing a body of (tacit or explicit) knowledge (Paavola, Lipponen & Hakkarainen, 2004). In order to capture the changing dynamics of community knowledge, team members should be able to update and keep versions of knowledge artifacts, to compare different artifacts or different versions of the same artifact, and to assess the consequences of such an evolution on other community artifacts. Evolution might require to negotiate the meaning of the artifacts at hand and to change the encoded knowledge (i.e., the conceptualization) accordingly, or might require encoding new knowledge regarding a real world object, process or phenomenon at hand.

Shared knowledge artifacts emerge in many collaborative learning and working settings. For instance, a video that records how group members carry out their tasks could be considered as a shared knowledge artifact which the group could annotate (with free text or with respect to an ontology), analyze and further discuss (e.g., for capturing tacit group knowledge). Moreover, and more interestingly, a knowledge artifact could take a more formal substance (e.g., for capturing explicit group knowledge) as in the case of conceptualizations (e.g., a data/knowledge base), or even software code developed within a group.

Hereafter, we shall use the term knowledge artifact to refer to various forms of conceptual models created and/or shared by a group of learners or knowledge workers (which could be concept maps, annotations, ontologies, etc). Collaborative conceptual modeling, even though not always acknowledged as such, plays an essential role in the knowledge practices of quite many professional communities (e.g., in Communities of Practice: Domingue, Motta, Shum, Vargas-Vera, Kalfoglou & Farnes, 2001) as well as scientific communities, because the respective models provide means to explicate, discuss and scrutinize the stakeholders’ understanding of a domain of discourse. Thereby, conceptual models are more than mere descriptions of a particular object of interest or phenomenon under investigation. As a matter of fact, they interpret and reconstruct a domain of discourse allowing both individual understanding and knowledge sharing among group members to improve.

Recent advances in semantic web technology (Berners-Lee, Hendler, Lassila, 2001) provide new and more powerful means to support communities in collaborative modeling activities by creating and reusing shared conceptualizations that guide, direct and shape their learning or working processes. However, most of these tools are still at their infancy. In this paper, we present a comprehensive collection of services, comprising an emerging framework, called Semantic Web Knowledge Middleware (SWKM), that allow support for collaborative knowledge evolution both of domain abstractions (i.e., models) and domain conceptualizations (i.e., modeling languages or ontologies) (Guizzardi, Pires and van Sinderen, 2005). In particular, we offer services for ontology change and comparison, version creation and persistent storage in a knowledge repository in a coherent way that will account for multi-user dynamic environments.

In this work, we assume that the community ontologies and their instances are represented using the RDF language, under the semantics of
Related Content

The Role of Interface Elements in Web-Mediated Interaction and Group Learning: Theoretical and Empirical Analysis
[www.igi-global.com/article/role-interface-elements-web-mediated/2959?camid=4v1a](www.igi-global.com/article/role-interface-elements-web-mediated/2959?camid=4v1a)

Framework for Developing and Assessing Business Education Wikis
[www.igi-global.com/chapter/framework-developing-assessing-business-education/62894?camid=4v1a](www.igi-global.com/chapter/framework-developing-assessing-business-education/62894?camid=4v1a)

Instructor Presence in Online Distance Classes
[www.igi-global.com/chapter/instructor-presence-online-distance-classes/41422?camid=4v1a](www.igi-global.com/chapter/instructor-presence-online-distance-classes/41422?camid=4v1a)

Learner Self-Regulation and Web 2.0 Tools Management in Personal Learning Environment