Ontology-Based Personal Annotation Management on Semantic Peer Network to Facilitating Collaborations in e-Learning

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ABSTRACT

The trend of services on the web is making use of resources on the web collaborative. Semantic Web technology is used to build an integrated infrastructure for the new services. This paper develops a distributed knowledge-based system using the RDF/OWL technology on peer-to-peer networks to provide the basis of building personal social collaboration services for e-Learning. This paper extends the current tools accompanied with lecture content to become annotation sharable using the distributed knowledge base.

Keywords: Annotation, e-Learning, Ontology, Peer-to-Peer Network, RDF, Semantic Web, Social Collaboration, Web 2.0

INTRODUCTION

Web sites provide effective intermediaries between instructors and learners to share lecture contents and exchange messages. From the course web site, learners choose to download lecture notes and slides used in class, lecture videos, etc., and study them offline either in printed form or on screen. During the course of reading, learner may want to take down notes, or annotations, about specific pieces of the contents as reminder that has been done. If learners have chance to share their annotations with each other, then it is possible to work out the collaborative intelligence according to the topics of the lecture content (O’Reily, 2005). Instructor, on the other hand, may know learners’ responses by collecting the annotations attached to lecture contents as an aid to future teaching. Yang, et al. summarize that this kind of personal annotation has the advantage in helping student

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in focusing and organizing learning content, and providing a place for discussion (Yang & Shao, 2004).

Web 2.0 services, for example, blogs, wikis, social web site, etc., provide collaborative environment by sharing content and response among authors and readers (O’Reily, 2005). It has been investigated in e-Learning domain that the new services are helpful to enhance the interactions among instructors and learners (Owen, Grant, Sayers, & Facer, 2006; Anderson, 2007; Franklin, & van Harmelen, 2007; Gillet, Ngoc, & Rekik, 2005; Gillet, Helou, Yu, & Salzmann, 2008). Since the advent of Semantic Web, annotation mechanisms, for example, Annotea (Kahan, Koivunen, Prud’Hommeaux, & Swick, 2001), CREAM (Hanschuh & Staab, 2003; Handschuh, Staab, & Ciravegna, 2002), have long been developed for as means of knowledge sharing among users. Through browser, user adds annotations to web pages and the resulting ontology-based metadata in RDF (Beckett, 2004) is either inserted in the web page document or stored in RDF server for others to use.

The Semantic Web technology has been employed to capture author-created wikitext in formal way, for example, Semantic Mediawiki (Krötzsch, Vrandecic, & Völkel, 2006), Semantic Wikipedia (Krötzsch & Vrandecic, 2009) and Rhizome (Souzis, 2005). The wikitext inserted with metadata in RDF makes the knowledge management of wiki content more efficient. Though the introduction of Semantic Web technology improves the collaboration and reuse of knowledge in Web 2.0 services, they however are isolated from each other and hence form disconnected communities and the valuable knowledge acquired from public effort, for example, Wikipedia, would be difficult to reuse (Bojars, Breslin, Peristeras, Tummarello, & Decker, 2008). For integrating the social web sites, the SIOC project develops an ontology describing entities found in Web 2.0 services as the infrastructure to build the integrated platform (Bojars, Breslin, Peristeras, Tummarello, & Decker, 2008; Bojars, Breslin, Finn, & Decker, 2008).

Yang, Chen, and Shao (2004) develop a personalized annotation management system as the basis to support collaborations in e-learning applications. Documents and the associated annotations are stored in two relational data models, respectively. Annotations on the objects of documents are clustered according to their semantic similarities. User’s query is first computed to determine the semantically related clusters and then further refine the search to obtain match result from the potential clusters. In their succeeding work (Yang, 2006), ontology technology is used to construct the context-aware environment for ubiquitous learning and peer-to-peer technology is employed to develop collaborative learning, including learning content access, personalized annotation management and discussion group.

In Web 2.0, the mechanism is naturally embedded in various kinds of services to support the multi-directional information flow among authors and readers. In Semantic Web context, the collaboration is further employed to create new knowledge to be reuse based on the exchange of knowledge on the distributed knowledge-based environment (d’Aquín, Motta, Dzbor, Gridinoc, Heath, & Sabou, 2008). As mentioned previously, annotation taking and sharing is essential to facilitate knowledge management and collaborative learning. In this paper, we attempt to take advantages of both technologies, i.e., collaborative services in Web 2.0 and semantic integrated infrastructure in Semantic Web, to develop a platform for managing personal annotations. On this platform, user can annotate lecture contents and share the annotated results using Web 2.0 services, like wiki, blog, instant messaging, etc., or reading tools, for example, MS PowerPoint, Adobe Acrobat.

The infrastructure of the platform is a distributed RDF management system built on peer-to-peer (P2P) network. The P2P network allows any device to join the network as a peer
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