Ontology-based e-learning

Nassim Khozooyi,
Department of Computer Engineering,
yasujbranch,Islamic Azad University.
yasuj, Iran
n_khozooyi2003@yahoo.com

Nafise seyedi
Department of Economy
,tehran central branch,Islamic Azad University.
Tehran, Iran
nafiseseyedi@yahoo.com

Razie Malekhoseini
Department of Computer Engineering
yasuj branch,Islamic Azad University.
yasuj, Iran
malekhoseini.r@gmail.com

Abstract -An important issue in reusing learning objects on the Semantic Web is the development of appropriate technology to facilitate the discovery and reuse of learning objects stored in global and local repositories. Another issue is the development of ontologies for marking up the structure of learning objects and ascribing pedagogical meaning to them so that they can be understandable by machines. A third issue is making learning objects smarter so that they can perform a more meaningful role on the Semantic Web. In this paper discusses meta data models to formally describe shared meaning of the used vocabulary.

Key word; e-learning; meta data ;context;content;structure;ontology –based.

I. INTRODUCTION

The goal of the Semantic Web is to provide the capacity for computers to understand Web content that exists on systems and servers across the Internet, ultimately adding value to the content and opening rich new data, information, and knowledge frontiers. Billions of Web pages are downloaded daily and are easily understood by humans. The knowledge gap exists for computers as these pages are only structured in the hypertext markup language (HTML) formatting language. When applied to the realm of e-learning, be it content interactions or learner management, the potential to add value is almost limitless.

In essence, the Semantic Web is a collection of standards, data structures, and software that make the online experience more detailed, intelligent, and in some cases, more intense. The components that form the building blocks need a firm foundation to ensure data translated across systems can be recognized. This bedrock comes in the shape of Unicode, which defines one standard for representing all characters through the globe. It also has equivalent codes for future character sets. Once common characters can be identified, resources can be described, conceptualized, and categorized. This is where the Resource Description Language (RDF) and the Web Ontology Language (OWL) come in, providing a language and structure for describing all ideas and concepts in the universe and then relating these to each particular subject area.[21]

II. E-LEARNING POTENTIAL

E-learning is facilitated and supported through the use of information and communications technology, including technology used exclusively in a classroom environment as well as blended learning where technology may be employed in the classroom and then supplemented by external electronic coursework. The third aspect of e-learning-distance learning-

allows learners to interact directly online with the digital resource without any face-to-face communication. In distance learning there is often no tutor role and the learner simply works sequentially through content. In all three of these scenarios the learning can be synchronous, where the online interaction between student and tutor takes place in real time, or asynchronous, where the student learning experience is not dependent on real time communication.[21]

The Semantic Web offers learners the possibility of having a wealth of related content delivered to their desktop without explicitly identifying or requesting it. Meaning and associated relationships between content in disparate systems will be continuously evolving. Conceptually related content from learning objects to content stored within Virtual Worlds such as Second Life, would provide a web of complex learning interactions both relevant and interesting to the learner. E-learning facilitators, be they teachers or advisors, can utilize this rich content to enhance the learning experience, allowing them to deliver engaging and relevant courses.[21]

III. E-Learning Model Based On Semantic Web

In the following subsections, based on the Semantic Web technology and e-learning standards we describe proposed e-learning model, illustrated in Figure 2.[19]

The Web-based Services

Our model in Figure 2 provides the student with two kinds of contents, Learning content and Assessment content. Each content has different types of services such as:

- Learning services: provide registration, online course, interactive tutorial, course documents (is a repository for files that the instructor have made available to the student as a part of your course), announcements (displays information to the students that the instructors of the course want him to know), links (displays a list of useful URL links that have been identified by the course instructors), student papers (students can post/upload requests files to the instructor), and Semantic search (helps the student to search for resources).[19]
- Assessment services: provide exercises and quizzes for evaluation of the student knowledge. During the learning process, a dynamic selection presentation of both contents will be accomplished.[4]On other hand, our e-learning system allows instructors to create his course websites through a browser, and monitoring the students performance. they have many services and tools such as: publish documents in any format (Word, PDF, Video, ...) to the students, manage a list of useful links, compose exercises/quizzes, make announcements, and have students submit papers. To illustrate the services architecture, we will go through an e-learning scenario. Student first searches for an online course: the broker handles the request and returns a set of choices satisfying the query. If no course is found, the user can register with a notification service. Otherwise, the user may find a suitable course among the offerings and then makes a final decision about registering for the course.[19]

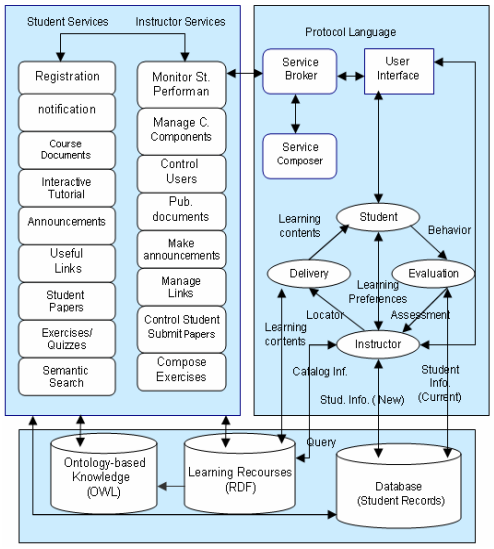


Figure 1.Proposed model for web-based e-learning system

Processing the registration can be seen as a complex service involvingregistering with the system, creating a confirmation notification, creating a student account (authentication/ authorization), and providing learning materials. Once all these in place, the student can start the course. As part of the course, a student

will be logging on and checking his learning agenda (e.g. next assignment due). This request is answered by combining several sources of information, such as course schedule, current date and student progress to date (e.g. completed units).[4][19]

IV. THE ONTOLOGY-BASED MODEL:

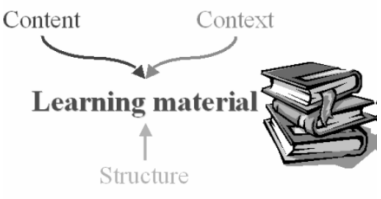
Before describing ontology-based model, we will discuss learning environments illustrated in Figure 1. Course sequencing generally starts with the student entity component that receives the learning contents, while the student's behavior is being observed. The instructor sends queries to the learning resources to search for learning content that is appropriate for the student entity component. The ontological knowledge is added to the learning resources as a resource for contextual learning, and it may be searched by means of queries. The student's performance is measured by the evaluation component, and the result is stored in the student records database. The data in the database can be used by the instructor component to locate a new content.[20][19]

Searching learning resources and sequencing a course can be done using a knowledge base of learning resources and a delivery component. To implement the knowledge base, first of all, the leaning resources have to be described by means of metadata. The metadata consists of the contextual knowledge of the learning resources, i.e., ontology in our model. It contains the general representation of the structural knowledge on specific domains, such as computer science, mathematics, biology, and so on.[14].

A. *Ontology-based metadata*

The role of an ontology is to formally describe shared meaning of the used vocabulary (set of symbols). In fact, an ontology constrains the set of possible mapping between symbols and their meanings.

But the shared understanding problem in eLearning occurs on several orthogonal levels, which describe several aspects of document usage, as sketched in Fig. 2.



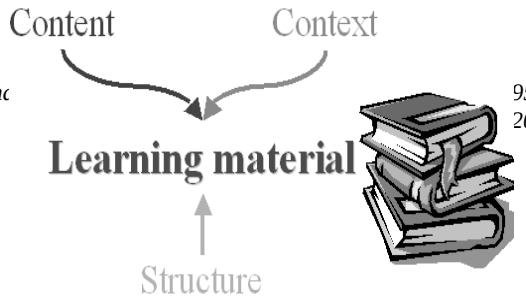


Figure 2.From the student point of view the most importantcriterions for searching learning materials are: what the learningmaterial is about (content) and in which form this topic is presented(context). However, while learning material does not appear inisolation, another dimension (structure) is needed to encompass a set of learning materials in a learning course. [20]

B. *Metadata for describing the content of learning materials*

The shared-understanding problem in eLearning occurs when one tries to define the content of a learning document in the process of providing learning materials as well as in the process of accessing to (searching for) particular learning material.

In an eLearning environment there is a high risk that two authors express the same topic in different ways.

This means semantically identical concepts (i.e. topics of eLearning-content) may be expressed by different terms from the domain vocabulary. For example, one may use the following semantically equivalent terms for the concept "Agent": agent, actor, contributor, creator, player, doer, worker, performer. The problem can be solved byintegrating a domain lexicon in the ontology and thus defining mappings from terms of the domain vocabulary to their meaning as defined by the concepts of the ontology. E.g. in our example agent, actor, contributor, creator, player, doer, worker, performer are symbols used in the real world and they are all mapped to the same conceptAgentin the domain ontology. Also, in the process of providing information, ontological axioms play an importantrole. For example, an axiom that states that two relations are mutually inverse relations is used for checkingconsistency of provided information, as described in the next section.[20]

From the point of view of the user there is the problem of what terms or keywords to use when searchingfor learning materials. Simple keyword queries are valuable in situations where users have a clear idea of what theyare seeking and the information is well-defined. It doesn't hold for eLearning, where the viewpoints and theknowledge levels of the author and the users of learning materials may be completely

different. Therefore, somemechanism for establishing shared understanding is needed. Second, simple keyword searches cannot pick upsynonyms ("Agent" and "Actor"), abbreviations ("World Wide Web" and "WWW"), different languages („house"(English) and „Haus" (German)) and often not even morphological variations ("Point-to-Point Network" and "Pointto Point Network"), not to mention the context of the query. This problem can be resolved by definingcorresponding relations (e.g., synonym, abbreviation) in the domain ontology. Ontological relations are also used inthe process of navigating through learning materials (for example, it is reasonable to "jump" from the topic"Network" to the topic "Protocol") [20]

C. Metadata for describing the context of learning materials

Learning material can be presented in various learning or presentation contexts. We may e.g. distinguish learning contexts like an introduction, an analysis of a topic, or a discussion. An example or a figure are some usualpresentation contexts. The context description enables context-relevant searching for learning material according tothe preferences of the user. For example, if the user needs a more detailed explanation of the topic, it is reasonable tofind learning material which describes an example of the given topic. In order to achieve a shared-understandingabout the meaning of the context vocabulary (e.g. intro or introduction) a context-ontology is used. [20]

D. Metadata for describing the structure of learning materials

Because eLearning is often a self-paced environment, training needs to be broken down into small bits of information ("lego" learning) that can be tailored to meet individual skill gaps and delivered as needed. These chunks of knowledge should be connected to each other in order to be able to build up a complete course from these chunks. Learning material is usually more complex in its structure than continuous prose, so it requires greater care in its design and appearance. Much of it will not be read continuously. The structure isn't a static one, because acourse structure is configured depending on the user type, the user's knowledge level, his or her preferences and the semantic dependencies that exist between different learning chunks, e.g. an example might depend on first giving the corresponding definiton. But, again shared understanding about used terms is also needed for describing the structure of a learning course.[20].

Several kinds of structuring relations between chunks of learning material may be identified. Some of them are: Prev, Next, IsPartOf, HasPart, References, IsReferencedBy, IsBasedOn, IsBasisFor, Requires, IsRequiredBy.There exist semantic connections between some of these relations that may be defined by axioms: for example,IsPartOf and HasPart are mutually inverse relations. The corresponding axiom may be exploited when searching forinformation. Without the definition of the inverse relation, searching for information would depend on the way metadata were provided from the author of the learning material. If one defines that some learning material named"X" "IsBasedOn" some other learning material named "Y", there is no possibility (without programming or explicit specification) to find all learning materials the learning material "Y" "IsBasisFor".[20]

The reader may note that these three dimensions of metadata also appear in the conventional metadata model (content = classification metadata, context = educational/pedagogical metadata, structure = relational metadata). However, our metadata are ontology-based metadata and have therefore a precisely defined semantics ,The semantic basis results in a better semantic description of learning materials and better searching for usefulmaterials according to user preferences.[20]

REFERENCES

[1] Berners-Lee T. "What the semantic web canrepresent",http://www.w3.org/DesignIssues/RDF/not.html , 2000.

[2] Downes, S. "Learning Objects: Resources for Distance Education Worldwide". International Review of Research in Open and Distance Learning. 2001.

[3] Maurer, H, M. Sapper. "E-Learning Has to be seen as Part of General Knowledge Management". ED-MEDIA Conference, 2001.

[4] J.Davies, D.Fensel, and F. Harmelen, "Towards the Semantic Web", Willy 2002.

[5] Hosam F. El-Sofany, Ahmad M. Hasnah, Jihad M. Jaam and Fayed F. M. Ghaleb., "A Web-Based E-Learning System Experiment". Proc. Of the Intel. Conf. on E-Business and E-learning, PSUT, Amman-Jordan, 112-119, 2005.

[6] W3C site: http://www.w3c.org. (See www.w3.org/XML,www.w3.org/RDF, www. w3.org/TR/2004/REC-owl-features-2004 0210/), and http://www.w3.org/2000/10/swap/ Primer.html.

[7] Berners-Lee, T., Hendler, J., & Lassila, O. TheSemantic Web. Scientific American 284, 34–43, May 2001.

[8] Berners-Lee, T., Fischetti, M., & Dertouzos, T.M. Weaving the Web: The Original Design andUltimate Destiny of the World Wide Web by itsInventor. San Francisco: Harper, 1999.

[9] Fensel, D., van Harmelen, F., Horrocks, I., McGuinness, D.L., & Patel-Schneider, P.F.E-Learning Model Based On Semantic Web Technology 71OIL: An Ontology Infrastructure for theSemantic Web. IEEE Intelligent Systems 16(2),38-45, 2001.

[10] Klein, M. Tutorial: The Semantic Web - XML, RDF, and Relatives. IEEE Intelligent Systems16(2), 26-28, 2001.

[11] Protégé-2000: http://protege. stanford.edu/,OILed:http://img.cs.man.ac.uk/oil, and OntoEdit:http://ontoserver.aifb.uni-karlsruhe.de/ontoedit.

[12] Fayed Ghaleb1, Sameh Daoud1, Ahmad Hasna2, Jihad M. ALJa'am2, Samir A. El-Seoud3, andHosam El-Sofany," E-Learning Model Based On Semantic Web Technology" ,Aug 2006.

[13] Protégé-2000:http://protegestanford.edu/,OILed:http://img.cs.man.ac.uk/oil, and OntoEdit: http://ontoserver.aifb.uni-karlsruhe.de/ontoedit.

[14] Dr Brian Matthews," semantic web Technologies", CCLRC Rutherford Appleton Laboratory

[15] Permanand Mohan, Christopher Brooks," Learning Objects on the Semantic Web",

[16] STEFAN DECKER AND SERGEY MELNIK,FRANK VAN HARMELEN, DIETER FENSEL, AND MICHEL KLEIN

[17] JEEN BROEKSTRA,MICHAEL ERDMANN,IAN HORROCKS ," THE SEMANTIC WEB"

[18] TIM BERNERS-LEE, JAMES HENDLER and ORA LASSILA, "The Semantic Web", 2002.

[19] Nassim Khozooyi , Maryam Tahajod , Peyman Khozooyi - elearning on semantic web,IC4E,India

[20] Ljiljana Stojanovic, Steffen Staab, Rudi Studer- eLearning based on the SemanticWeb-

[21] Chris Daly, The Semantic Web and e-Learning, . Elearn magazine,April2009

Authors : Nasim KHozoie

Biography:

I,m orginaly from Iran,I have been studing aboat semantic web since 2009. I havegraduated from shiraz state university in IT(Master degree) at 2009. I had written

several paper in semantic web topice , such as: Managment of semantic web- Dubai-Dec2009(ICCEE) print&presentation security in SCM -Amsterdam -September 2010print&presentation e learning on semantic web 7 -9, January 2011, Mumbai,India(ICEo4) print&presentation and in anther topic, like: Security in MobileGovernmental Transactions –Dubai-Dec2009(ICCEE Dec2009(ICCEE)print&presentation E-cash ,Iran, 1388(2009,semanic HIM(health Informatiom management,ijwest journal ,…

furthermore I do multi tasking smart card project (national project) and ,…