An Open and Adaptive Learning Approach to Corporate Training by Leveraging Web 2.0 Concepts

by Herbert Lee, Eric Tsui, and Brian J. Garner

Abstract

Corporate e-Learning has been widely adopted in business and Government. In today's world, the delivery of education through LMS is mostly a "*top down approach*" where corporate management designs the courses according to their view of what is best for their staff – the learners. However, the competitive environment is intensifying and new technologies are emerging rapidly; business cycles are getting much shorter. Corporate training thus needs to be adaptive, productive and scalable. Merely specifying a course to fit all approach will not meet today's demand anymore. This article explores different ways to achieve an open and adaptive corporate LMS, in which instructional content can be composed on-the-fly and customized for a particular learner. Learning contents are broken down into fine-grained learning objects (LOs). These LOs may be classified and stored in a learning object repository (LOR). In the LOR LOs can be composed by corporate training headquarters or from the learning community in the organization, such that corporate knowledge can be retained and passed on to other staff in a more efficient way. A collective ranking mechanism is provided to differentiate the quality of the instructional contents. Learners' profiles are updated through continuous monitoring of the learners' behavior and progress. Instructional material is composed on-the-fly from the LOR through a personalized search engine, such that these courses correspond exactly to the learners' requirements. The article also explains different approaches to classifying Learning Objects, such as the use of a formal corporate taxonomy, informal folksonomy, and ontology. The comparative benefits of these approaches are discussed.

The Design of Learning Management Systems

The immediacy of Internet technology has made a lot of changes to the way we conduct business. The cost of getting information is drastically lowered, business cycles have been getting shorter, people are required less frequently to meet face to face, and the knowledge economy is getting increased attention. Members of the workforce need to be more diversified, knowledge oriented and adaptable. Corporate training can address the need to equip a modern workforce to meet these changes. We believe that the proposed ***open and adaptive corporate learning concept*** will meet today's changing demands.

The delivery of education through a learning management system (LMS) is mostly a "top down" approach, where corporate management specifies and designs courses that they think are best for their staff – the learners. This top down design attempts to provide regular instruction processes that can satisfy all learners of a particular group. However, design for a course to fit all approach will not meet today's demand anymore. Besides, such course offerings provide little motivation for learners, since each learner has different cognitive skills and personal learning attributes. Corporate e-learning needs to be ***adaptive, productive and scalable***. To elaborate further, adaptability requires not only delivering education at a personalized level it also implies the capability of adapting the learning content to different instructional contexts and organizations – the facilitation of reusable, or sharable instructional object model (ADL. 2001, p. 1-12). In terms of productivity, the LMS can support the production of instructional material (courses) very efficiently, and, in an ideal case, on-the-fly. A scalable LMS involves machine intelligence with little human intervention. This design goal to be adaptive, productive and scalable can be achieved by following the strategy laid out in the object-oriented instructional design (OOID) paradigm (Parrish 2004). OOID strategy is to break down the learning content into fine-grained adaptable learning objects to improve reusability. The OOID processes include:

- Breaking down instructional content into discrete, coherent learning objects (LOs), then
- Embedding metadata into LOs that describe accurately their unique attributes in order to facilitate storage and retrieval.
- Try to avoid contextual elements to facilitate adaptability, i.e. the LOs should be adaptable to multiple contexts - visually, conceptually, and functionally.

We believe that an alternate approach is emerging in regard to the traditional "top down" design of instructional content; namely, a "bottom up" approach by empowering the whole community (as in this case - the organization) to participate in the design of instructional content. There are many benefits in this approach. Firstly, a learner who may also be a content contributor inherits a sense of belonging to the community. In an organization, staff members who have registered for e-learning courses may be the subject experts of other courses, i.e. a learner can also be a content contributor. In another case, a staff who has gained some experience which may be invaluable for the organization. It is a loss to the organization if this piece of knowledge hasn't been captured and shared with his colleagues. So long as the system can efficiently capture and store these pieces of knowledge and make it searchable anytime when needed, the whole system becomes a learning machine such that it will grow organically. What has to be considered is to build a mechanism to ensure the knowledge objects (LOs) contributed are of quality, i.e. accurate, current, and useful. Secondly, the participation from the community provides feedback to management, so that future instructional content can be designed exactly to meet the needs of the learners. Thirdly, this "bottom up" approach is highly scalable, so long as the mechanism of quality control is well enforced. The following section discusses how to facilitate the searching of a large number of LOs and how quality can be maintained.

DESIGN OF LEARNING OBJECTS

For the design of instructional content to meet the above criteria, we need LOs to be fine-grained. These fine-grained LOs need to be searchable and are best assembled ***on-the-fly*** into instructional content. Attaching metadata to LOs facilitates their search capabilities. Control standards are required for such metadata to follow, so that the LOs can be implemented across different LMSs. An example of such standards is the Sharable Content Object Reference Model (SCORM), which is a specification deliverable of the Advanced Distributed Learning (ADL) Initiative. The ADL initiative emerged from the Office of the US Secretary of Defense. Other examples of metadata standards are provided by the IEEE Standards Committee; specifically, the Learning Technologies Standards Committee (LTSC). LTSC has developed a draft standard for ***Learning Object Metadata*** that is designed to provide a means of enhancing the findability of learning objects in a learning networked environment. Metadata that follow these standards are described as "authoritative" data elements; since they are particularly focused on solving the technical aspects of object description and cataloging the LOs within a networked environment or Learning Grid. They do not facilitate the capture of aspects of instructional context. In fact, there are two broad trends of approach in e-learning. One trend is directed at automation, standards, and control; the other towards open systems and learner-centric designs. Our framework embodies the benefits of both trends through the introduction of "non-authoritative" metadata (Recker & Walker 2000) in addition to the "authoritative" form. This category of "non-authoritative" metadata attempts to capture the context of use and surrounding activities of the LOs. Users contribute the metadata at the time of use. They can be in the form of tag labels or user rankings. The most relevant one is the collection of keyword tags (known as a tag cloud or tag space) generated by the community of users. This kind of community generated tag space is called Folksonomy (folks of taxonomy). Prominent examples that embrace folksonomy are Del.icio.us and Flickr. An example of the metadata elements contributed by the users is shown in Table (1).

Name	**Description**	**Format**
Keywords	Keywords to categorize the object	Text
Authoritativeness	Authority base of document author	5-point Likert scale
Educational relevance	Educational relevance of the object	5-point Likert scale
Description	Short comment on the object	Text
Quality	The subjective quality of the object	5-point Likert scale
Overall rating	Overall opinion from the users	5-point Likert scale

Table (1) – Example of Data elements contributed by Users

In the table above, these data elements can convey more meaningful attributes for use in a LMS. In addition to the hit rate (usage count) of each LO, these data elements can provide a means of "quality control" for the LOs. This is important if the LOs are contributed openly by the community which can be every member of the organization. In the context of corporate e-learning, we further suggested that the rejection of anonymous content contributors can enhance the overall quality of inputs. Although this may affect the quantity of contributions, nevertheless, quality is more important when it comes to learning. There is also a side benefit in revealing the identity of contributors. If data elements relating to the author, such as author name, contact URI, credential, etc., are aggregated and graphed, it can promote a learning community such that users can locate like-minded colleagues and domain experts. It provides great benefits in corporate social networking.

CORPORATE TAXONOMY, INFORMAL FOLKSONOMY, AND LIGHTWEIGHT ONTOLOGY

One of the most important aspects of handling LOs is classifying them according to their semantic content. There are different approaches, and current development on classifying LOs according to their semantic content is still an ongoing research. Our recommended solution for corporate e-learning follows from our review of current options.

Corporate Taxonomy

Most multinational corporations have formalized a corporate taxonomy; for example, a chart of accounts. Instructional designers or content contributors can classify the LOs according to the corporate taxonomy. However, this may lead to undesirable effects, as many LOs have to create a new place within an existing taxonomy (i.e., insertion within a given hierarchy). Taxonomy is only good at classifying well-structured terms; more specifically, terms with a well defined parent-child relationship structure. A good example is classifying plant and animal species. When classifying LOs in domains such as technology and technical skills, as in IT organizations, taxonomy doesn't work well as a framework. Sometimes, taxonomy terms are not familiar to the users, as these terms are composed by a small expert team who are often distant from the users and their practical requirements. The consequence will be that a lot of LOs are deeply embedded within inappropriate structures and may seldom be available for reuse.

Ontology

A more vigorous approach is to develop ontologies to classify LOs. Ontologies are powerful tools, especially when it is used to classify concepts. Complex relationships between LOs can be modeled using ontology. However, ontology building is a difficult issue for some enterprises, both in terms of technical competency and the cost of development. Some examples of ontology building frameworks for LOs such as ALOCoM, COCO and COCO-Cite are listed in the References section (Verbert et. al. 2004 & 2005, Knight et. al. 2006). Another drawback is ontologies need a controlled vocabulary, and the design of the vocabulary may not blend in with the community of users. There are vocabulary databases that can be acquired. An Open Source vocabulary such as ***WordNet*** is free. WordNet is a large lexical database of English which was created and is being maintained at the Cognitive Science Laboratory of Princeton University. Nouns, verbs, adjectives, and adverbs are grouped into sets of cognitive synonyms (synsets), each expressing a distinct concept. Synsets are interlinked by means of conceptual, semantic, and lexical relations. In other words, ***WordNet*** is a lexical ontology in itself. Although vocabularies for building ontology can be acquired, the vocabulary database will seldom fulfill all aspects of classifying every LO in the enterprise, especially when these LOs need specialized terms in order to describe them meaningfully.

One of the authors of this article, Herbert Lee, is the chief architect of an R&D project on an open and adaptive learning platform. An important part of the research is an attempt to automatically generate ontologies for a vast number of domains of knowledge. There are a number of technical difficulties that have to be overcome. Prof. Keith Chan, head of department of computing science of the Hong Kong Polytechnic University, is the chief technical consultant for the research work. A proof of concept for this ontology generation has been completed. The different components of this proprietary ***Ontology Management System*** (OMS) are shown in Figure (1). OMS is a complex system that can perform many ontologically-related functions as indicated in the various system components. One of the most interesting parts of OMS is that it can auto-generate ontology data and

integrate the data into the Ontology Data Repository, which forms the heart of OMS. A topic-focused crawler is used to build the ontology by extracting the semantic content from public websites. When the user selects a new topic in Ontology Manager (a control interface between OMS and the outside), the crawler will be invoked to crawl public websites in search of the topic specified by the user. The user needs to specify a topic keyword and the starting page URL for the crawler to retrieve pages. The crawler will only retrieve pages that contain the topic keyword and ignore the irrelevant pages through a filtering program built inside the OMS. Concepts that are related to the user-selected topic will be extracted, filtered, transformed into the ontological data format, and mapped into the Ontology Data Repository. The main advantage of this approach is to overcome the aching manual process of building and maintaining ontologies.

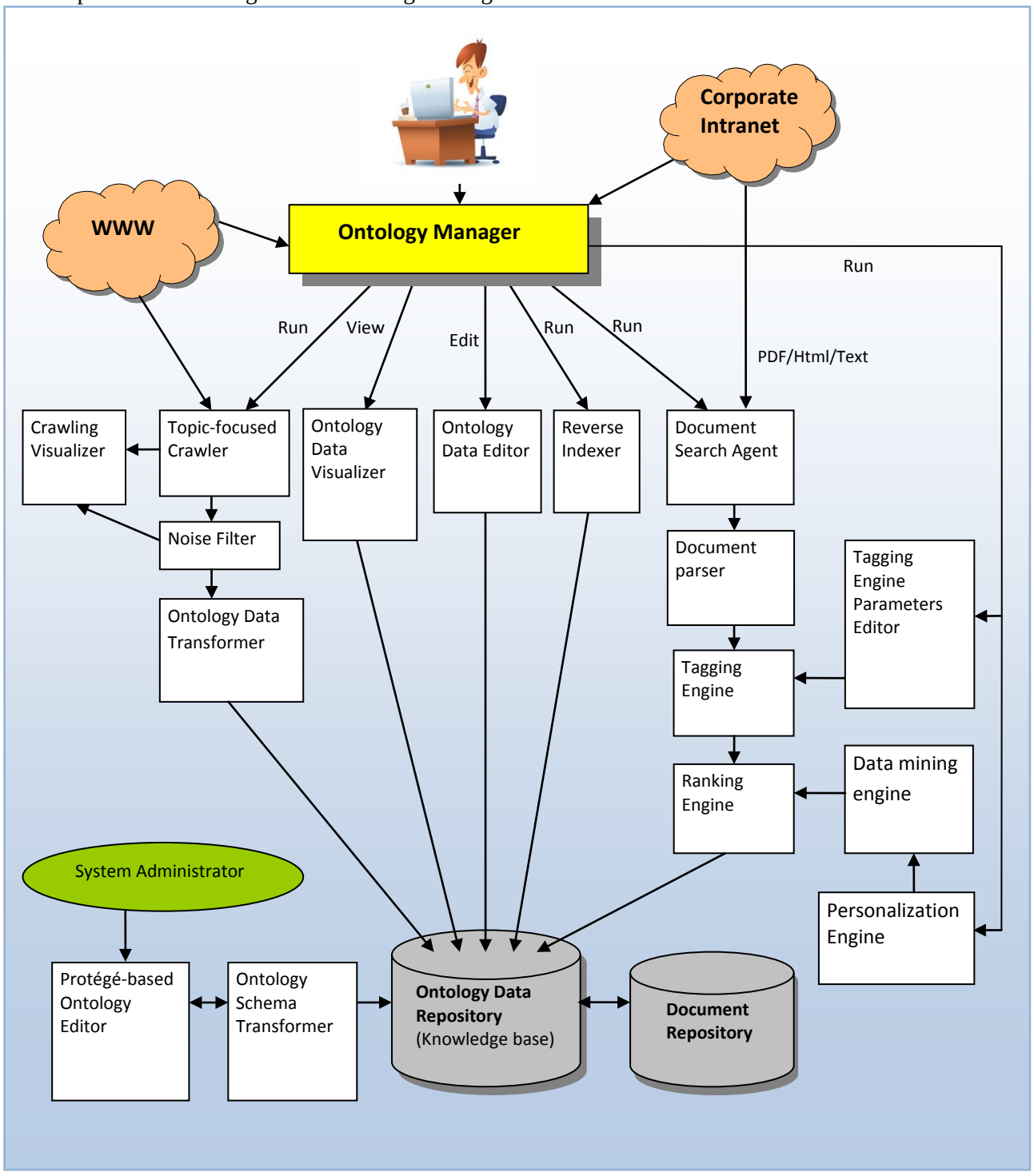

Figure (1) - Ontology Management System

Folksonomy

Collective tagging, also known as folksonomy, is a more organic approach to categorizing LOs. Examples of well-known Websites that use this technology are Del.icio.us and Flickr. When LOs are uploaded into the corporate LMS, the contributors assign tags to the LOs. These tags are essentially keywords or concept terms that describe the LOs. The contributors are free to use whatever terms they think best fit. This is a more natural way of categorizing entities. The categorizing process is scalable and the cost of maintaining such a system is much less than previous approaches. This method has its drawbacks, however. Firstly, the tags only have meaning to the taggers and to the users. They have no meaning to the computer, since the machine only associates a particular tag to the LO. Secondly, the meaning of the tags provided by the taggers may not have the same meaning when interpreted by other users, as there is no formal agreement on the representation of such tags. This may lead to a tag used by two taggers who tag on two LOs of different meanings, or tags of different meaning (to the users) pointing to the same LO. One way to overcome this is to suggest the most popular keywords in the rank-order list to the tagger. This will help final convergence into just a few tags for each specific resource.

RECOMMENDATION FOR DESIGNING CORPORATE LMS

We have already discussed the pros and cons of various ways of classifying LOs, which is the most important part of building an open and adaptive LMS. We recommend the collective tagging approach because it is much easier and more cost-effective for the enterprise to develop its own system. Collective tagging has great potential, in which user participation is the primary driver of value. It is a concept of Web 2.0 and it leverages the wisdom of the crowd to create value to the system. As proposed earlier, the entire learning community not only consumes knowledge; it also contributes knowledge into the system. When combined with user tagging, ratings and comments (blogs), the LMS turns into an open learning ecosystem that supports organic growth with very low running costs. We denote this open learning ecosystem as "***Social LMS***". In order to further this concept, we suggest implementing some kind of mechanism within this Social LMS to make it more robust and to create value.

- *Try to expose anonymous contributors.* This is not a difficult issue since everybody in the organization is supposed have the opportunity to know each other. There is no point in staying anonymous. Abolishing anonymity can ensure higher quality in the instructional content since the contributor's reputation is accountable for the quality of the content. In the context of education, quality is in a higher priority than quantity.
- *Combine folksonomy with ontology.* Here, the community generated folksonomy can be merged into the corporate formal ontology. This is not an easy task, however. Conflicts have to be resolved for the difference in the meaning of terms suggested by the tagger and the terms in the corporate ontology. Another approach is to build a completely new lightweight ontology from the community generated folksonomy. This approach needs a critical mass, i.e. a sizable tag cloud generated by the community of users. We have proposed in here our OMS (Fig (1)) where we have combined benefit of both – the ease and flexibility of folksonomy and the computation power of ontologies. In here, our OMS can auto-generate an ontology from the start and let users to add concept terms into the ontology simply through a similar tagging process. This ontology generated by the OMS can be edited and maintained by the community of users. For detail explanation of this OMS, the readers can contact the author, Herbert Lee, directly through his email.
- *Implement social networking as a side benefit.* The experts who contribute the LOs, the users who comment, the taggers who are interested, the raters who rank the contents, etc. can be grouped and graphed according to their profiles and demographics. This has great value to large corporations with thousands of employees scattered around the globe. Expert location is an example of value creation. Like minded colleagues can be located to form community of practice which will enhance corporate knowledge sharing and collaboration within corporate members.
- *Selectively open the LMS to channel partners and customers.* Open the part of the content that is not classified as confidential to the enterprise. Invite the channel partners, allied individuals, and customers to participate as well. This will eventually create a much bigger learning community with a higher value of

instructional content. In addition, a bigger social network external to the enterprise can be created, promoting greater trust and relationships in the extended network.

- *Extend the system into a personalized LMS.* A personal profile capturing program can be built into the system to track the learners' behavior. This will facilitate the design of an intelligent LMS such that personalized instructional content can be composed on-the-fly by the user. Alternatively, personalized recommendations for instructional content can be sent to the user periodically according to their updated profiles.
- *A critical mass is needed to take off.* Both the instructional content contributed by the community and the tag space need a critical mass to create the network effect that subsequently drives organic growth. In order to get a critical mass, our suggestion is to convert the current instructional contents into the new system and kick start the basic system. Human tutors can be employed in the initial stages until the LOs and tag space have grown substantially. Given that the tutors are expert users of the system, they can easily assemble personalized courses for the learners on-the-fly. In this case, a small number of tutors are needed to serve many users. Besides, once a personalized course is composed, it can be stored and later retrieved when another learner's profile can make a match.

CONCLUSION

We have mentioned about combining folksonomy and ontology. There are a few ways to achieve this end. While a thorough explanation of these methods is beyond the scope of this article, the reader should refer to the journal articles listed in the References section. The Social LMS concept outlined here — merging of folksonomy, ontology and open learning platform — is currently an active topic of ongoing research. Interoperability of LOs in the design of an LMS enables knowledge sharing not only inside the organization, but globally across channel partners and alliances. We anticipate that social LMS will become a mature technology, which can greatly enhance learning experience and promote the adaption of knowledge management in the enterprise.

In a broader sense, if folksonomy is the enabler of the Social Web, and ontology is the enabler of the Semantic Web, then the marriage of folksonomy and ontology will bring in the unification of both Web technologies towards a new era. Disseminating knowledge across the Web will be made ubiquitous. Learning becomes a daily routine for all of us. In fact this is already happening as you can find MITOpenCourseware portal offers 1800 courses free. Yale, Wikiversity and others have also follow the trend. Knowledge will soon be universal and become commoditized. However, even knowledge is ubiquitous; it doesn't mean your corporate staffs will become more knowledgeable. They have to be motivated to learn. Learning courses are everywhere doesn't mean you can find a course that matches your profile. In order to delivery education to your corporation more effectively, we suggest to develop an open and adaptive learning platform. Educational material can be contributed by the community and then customized to each learner according to his profile. Management need to re-think, and probably start to reconsider, their corporate e-learning strategy to adjust to the future trend.

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