Chapter XXIX
For the Ultimate Accessibility and Reusability

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ABSTRACT

This chapter first argues that current approaches for sharing and retrieving learning objects or any other kinds of information are not efficient or scalable, essentially because almost all of these approaches are based on the manual or automatic indexation or merge of independently created formal or informal resources. It then shows that tightly interconnected collaboratively updated formal or semiformal large knowledge bases (semantic networks) can, should, and probably will, be used as a shared medium for the tasks of researching, publishing, teaching, learning, evaluating, or collaborating, and thus ease or complement traditional methods such as face-to-face teaching and document publishing. To test and support these claims, the authors have implemented their ideas into a knowledge server named WebKB-2 and begun representing their research domain and several courses at their universities. The same underlying techniques could be applied to a semantic/learning grid or peer-to-peer network.

INTRODUCTION

The smaller and less contextual the "learning objects (LOs) available for re-use" are, and the more precisely indexed or interconnected via metadata they are, the more easily they can be semi-automatically retrieved and combined to create "LOs to teach with" that are adapted to particular course objectives or kinds of users, and thus create contextual LOs (Downes, 2001; Hodgins, 2006). Although this general idea is well advocated in the LO community, its ultimate

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conclusion—the idea that we advocate—is hardly attempted or even written about: each "re-usable LO," which from now on is simply referred to as an "object," should either be one formal term (a category identifier) or an "undecomposable statement" (typically, one semantic relation between two other objects, with some information about the context of this relation, such as its creator and temporal, spatial or modal constraints on its validity, all of which preferably being expressed in a formal way, that is, with a knowledge representation language). Furthermore, each object should be connected to all other semantically related objects by semantic relations. In other words, there should be no difference between data and metadata, and there should be only one virtual well-organized knowledge base (KB) that all object providers can complement by inserting their objects "at the right place," or more generally, in a "normalized way" that permits the KB to stay well organized and hence to be searched and updated in an efficient or scalable way. A virtual KB does not imply only one actual KB; it simply means that all potential redundancies and inconsistencies detected by people or inference engines should be removed. As explained later, this also does not imply that knowledge providers have to agree with each other.

Nowadays, there is no such virtual KB, and LOs repositories are not even KBs; they are databases for informal documents containing many more than one undecomposable statement. Furthermore, current LO related standards (e.g., AICC, SCORM, ISM, IEEE WG12) and projects (e.g., CANDLE, GEODE, MERLOT, VLORN) essentially focus on associating *simple metadata* to whole documents or big parts of them (e.g., author, owner, terms of distribution, presentation format, and pedagogical attributes such as teaching or interaction style, grade level, mastery level, and prerequisites). Such superficial indices do not support the answering of queries such as "What are the arguments and objections for the use of an XML-based format for the exchange of knowledge representations?" "What are all the tasks that should be done in software engineering according to the various existing 'traditional system development life cycle models?" and "What are the characteristics of the various theories and implemented parsers related to Functional Dependency Grammar and how do these theories and parsers respectively compare to each other?" Answering such queries requires presenting and allowing the browsing of the KB as a semantic network: (i) for the first question, a network with argumentation, objection, and specialization relations, (ii) for the second question, a subtask hierarchy of all the advised tasks, and (iii) for the third question, a network with specialization relations between the various objects or attributes related to the theories and parsers.

LOs have special purposes but no special content: all advanced information sharing or retrieval techniques can be directed applied to LOs. On the Web, this means using *Semantic Web* related techniques (Shadbolt, Berners-Lee, & Hall, 2006). However, almost all them are about supporting the manual/automatic indexation of whole formal/informal documents or merging the content of independently created formal documents. Document-based techniques permit to exploit legacy data but their efficiency or scalability for organizing, sharing, and searching increasingly large amounts of information is limited. Hence, these techniques should ideally be used only as a complement to the building of a global virtual KB, not as sole techniques for exploiting information. This is the theme of the next section. Then, we show how such a virtual KB—on the Web or within the semantic/learning grid of a community—can and ultimately will be collaboratively built and hence used as a shared medium for researching, publishing, teaching, learning or collaborating since these tasks are based on information retrieval/comparison/sharing subtasks.

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