Agent Based Learning Objects on the Semantic Web

Phaedra Mohammed and Permanand Mohan
Department of Mathematics and Computer Science
The University of the West Indies
St. Augustine, Trinidad and Tobago
fedre@lycos.com
pmohan@tstt.net.tt

Abstract. This paper presents ABLO, a first-attempt at engineering a more active learning object based on agent technologies that allows more sophisticated kinds of learning object reuse than what is currently available.

Introduction

Over the past six years, there has been tremendous interest around the world in the concept of a reusable digital learning resource, usually referred to as a *learning object* [3]. Although there are many advantages of the learning objects' approach, reuse and re-purposing of learning objects is a difficult task that is manually undertaken by content specialists. In [3], an implementation overview of a smart or active learning object is provided, and a range of features are suggested which could allow a learning object to function intelligently on the Semantic Web. Based on these features, we are developing Agent Based Learning Objects (ABLOs), a first-attempt at engineering a more active learning object based on agent technologies that allows more sophisticated kinds of learning object reuse than what is currently available.

Design and Implementation

Some of our design criteria for an active learning object are as follows:

a) It should be aware of itself and its environment and should be able to respond to changes in its environment
b) It should be capable of accepting input and exhibiting goal-oriented behaviour
c) It should be able to recommend itself and act without the direct intervention of humans or other learning objects
d) It should have control over its state and actions.

These characteristics can be met by treating a learning object as a software agent [2], hence the ABLO. In our design, the ABLO encapsulates the learning object and acts on its behalf, imparting agent characteristics such as self-awareness, portability and social interactivity. The ABLO contains a link to an ontology that describes the content of the learning object and provides semantic mark-up for the agent's own understanding of the

learning object. The learning material itself needs to be marked up with terminology consistent with the ontology in order for the ABLO to properly identify and understand what parts of the material mean in terms of the context in which they are used.

Within the ABLO, inference rules and an inference engine are used to harness the semantic power of the ABLO and siphon out the relevant pieces of information within the ontology that pertain to a search or query. An ontology editor or a parser is another major component that the ABLO uses for traversal of the ontology and for building a knowledge base. Various agent behaviours are personified by the ABLO. One such behaviour is determining the suitability of a learning object when a request for learning material is made. Another behaviour extracts the specific parts of the learning material in an ABLO that are relevant to a request. A third behaviour allows the ABLO to behave socially whereby other ABLOs that it has been associated with in the past (based on learning material collaboration) are queried for partial contributions to a learner's request. These are assembled with part of its own content to form a new learning object.

Discussion

Our ABLOs can differentiate between learning objects that have material identified by the same syntactic terms but actually refer to entirely different concepts. Consider two learning objects on *Trees* where one deals with living trees and the other with the computer science data structures called Trees. A request with the keywords *Tree, Data Structure* would cause the ABLO that had information on living *Trees* to produce a negative reply to the request since although it matches the 'Tree' search string, the context was different so it gave a negative conclusion. If the request had the keywords 'Tree, Water' then this ABLO would certainly have given a different reply to the request. Our ABLOs are also capable of concluding that concepts are related through chains made up of other concepts and different types of relationships such as subclass, superclass, object-property, datatype-property etc.

Conclusion

Suggestions have been made that including 'application code' within a learning object could enhance its reusability. By using an *Agent Based Learning Object* we are attempting to realize this potential. The coupling of learning content with agent technology is not a new idea and as such the scenario described by Hendler [1] may be achieved in the field of e-Learning by means of ABLOs. The repurposing, fragmentation, and reassembly of learning content can be intelligently undertaken by ABLOs because of the semantic markup associated with the learning content. In the future, we intend to add more behaviours to the ABLO and define new ontologies for communication between ABLOs.

References

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