eleed
e-learning
& education

Issue 1
2005

Towards an Open Source Framework for Collaborative Problem-Based Learning Environments

Nodenot Thierry, Gaio Mauro, Sallaberry Christian, Lopistéguy Philippe

UPPA Computer Science Laboratory (LIUPPA) - http://liuppa.univ-pau.fr

Contact
Nodenot Thierry - Equipe IDEE Thierry.Nodenot@iutbayonne.univ-pau.fr
IUT de Bayonne - 3, avenue Jean Darrigrand - 64100 Bayonne (France)

urn:nbn:de:0009-5-901

Abstract

This paper presents our research works in the domain of Collaborative Environments centred on Problem Based Learning (PBL) and taking advantage of existing Electronic Documents. We first present the modelling and engineering problems that we want to address; then we discuss technological issues of such a research particularly the use of OpenUSS and of the Enterprise Java Open Source Architecture (EJOSA) to implement such collaborative PBL environments.

Keywords
Problem-Based Learning, Electronic Documents, UML, Java, XML, OpenUSS, Enterprise Java Open Source Architecture (EJOSA)

1 Introduction

Our works focus on Collaborative Problem-based Learning (PBL) environments that provide students with resources, guidance and instruction. Our research team emphasizes the role of the designer producing socio-constructivist scenarios which are sequences of phases, tasks and activities including resource discovery, discussion, resource production and feedback. The research work consists in both proposing models and engineering such collaborative PBL environments.

Most collaborative PBL environments are implemented on either monolithic commercial Learning Management Systems providing Collaborative Support Capabilities (whiteboards, chats, …) or some specific applications of available collaborative technologies (java RMI, P2P, …). As a consequence, reuse of any available powerful educational functionality and reproducibility of published experimentations are quite restricted: this puts a brake on advances on collaborative PBL environments.

2 Our proposal

To address these problems, we promote an application of Component Based Development that consists in engineering educational resources and gluing them to produce a learning environment fitted to a particular learning scenario. We propose a model driven approach

for developing cooperative PBL environments; this approach consists in making explicit, in connecting and documenting both the specifications of a learning scenario and the « resources » that it requires. Two types of resources are to be finely tuned with a socio-constructivist learning scenario: we try to contextualize and specialise both the software components and the electronic documents that the actors (learners, tutors) will exploit while interacting according to a given scenario. To contextualize such resources, we jointly investigated some design and implementation issues:

1. P. Laforcade's thesis showed that we can specialise the UML language to enable designers together describing structural, cognitive and social aspects of a collaborative PBL Situation or PBLS (Laforcade et al., 2003), (Nodenot et al., 2004). This specialisation of the UML language, called the CPM metamodel, is available as a UML profile for the Objecteering UML Case tool. The works of P. Laforcade also showed that such UML descriptions of a PBLS can then be transformed into software components embedded in a given Learning Management System (Laforcade et al., 2004).

2. To efficiently mark the content of documents with semantic tags, in-depth syntaxic and semantic analysis is mandatory. We rely here on a semantic analysis model of textual or graphical expressions that has been developed for several years and led us through significant results (Malandain et al., 2001). This analysis is based on spatial and temporal expressions found in the documents ; for textual expressions, the semantic analysis model have been implemented using the LinguaStream platform (Bilhaut et al., 2003) which offers an integrated NLP workbench especially targeted to semantics-oriented concerns. This java based platform relies extensively on XML; it is based on the paradigm of iterative enrichment of electronic documents where each step may produce new information to be integrated in the document that may in turn be used by further steps of the processing stream.

The approach consists in providing pedagogues with an interface enabling them to put and use such tag-layers:

1. on the documents from spatial, temporal and narrative points of view,

2. on generic learning scenarios described with the the CPM profile (structural, cognitive and social tags).

We are applying this approach to design and implement a cooperative PBL situation called Smash which is dedicated to the apprenticeship of good driving behaviours: The Smash PBLS is a learning situation in which groups of learners investigate and interact about an accident from a set of scenarised documents such as witnesses, a map of the streets, etc. We first specified the Smash PBLS from the CPM Metamodel. Then we mark documents with spatial, temporal and narrative semantic tags. From this specification, we are developing various prototypes of a component called "the Conflict_Manager" that provides functionality for initiating and regulating synchronous interactions between learners when they have contradictory interpretations of the documents put at their disposal. This tool embeds a set of components that can exploit the content of the provided witnesses: a Whiteboard, a Chat, a component for the analysis of the interactions about given witnesses, a component for the generation of just-in-time solicitations of the learners. The glue between these components is constrained by the Smash scenario

Our aim is to embed components such as the Conflict Manager in a Learning Management System (LMS) in order to put these components at the learners disposal. This approach impacts the technology to be used, as described in the next paragraph.

3 Technological issues

Tagged Documents generated by the Linguastream platform are XML files. Socio-constructivist learning scenarios produced from the CPM Profile are UML/XMI files that we implement as software components to be embedded in a Learning Management System (LMS). These software components must extend the functionality of such an LMS which then gives access not only to lectures, websites, quizzes, etc. but also to those socio-constructivist learning scenarios.

This is the reason why we studied the OpenUSS LMS (Grob et al., 2004) that relies on J2EE technology. We noticed that the OpenUSS development team frequently extends OpenUSS (cf http://www.campussource.de/org/software/OpenUSS/) with new components developed by Tiers (Babylon Chat, Skype, Scorm module, etc.) thus demonstrating the power of J2EE, particularly of the J2EE framework from which OpenUSS is built: the Enterprise Java Open Source Architecture (EJOSA cf http://ejosa.sourceforge.net/). EJOSA (Dewanto, 2004) provides a collection of up-to-date Open Source Components which are bundled together and pre-configured and this frees developers of educational components from this hard work. Two orientations of EJOSA make us feel that OpenUSS and EJOSA is the right choice for implementing our socio-constructivist learning scenarios:

1. EJOSA main component is JOnAS, the Open Source implementation by ObjectWeb of the J2EE specification (cf http://jonas.objectweb.org/) which implements, among others, a "Web Services" service providing support of Web Services on top of Axis. Precisely, web services will be particularly useful to extend the Linguastream platform in order to facilitate education enrichment of electronic documents.
2. Recently, EJOSA incorporated AndroMDA technology (cf http://www.andromda.org/) which is an open source code generation framework for generating J2EE components quickly and reliably from models drawn with the UML language. Precisely, our learning scenarios are specified using a UML profile.
3. Recently, OpenUSS community has promoted the Laszlo Technology (cf http://www.laszlosystems.com/) which is an open source XML-native platform for building rich client applications (Laszlo Server can be integrated in any J2EE Server environment, particularly in EJOSA). For our research activities, the Laszlo Presentation Server completes Java Based Presentation capabilities of the current version of EJOSA (and OpenUSS) because the collaborative PBL environments that we design often require real-time information updates and a significant interactivity.

4 Conclusions and Perspectives

In this paper, we have presented our current research projects that extensively rely on UML as a modelling language, on XML and open-source Java technology as an implementation framework. We consider that EJOSA and OpenUSS are key elements to carry these projects to a successful conclusion. However, although their capabilities (extensibility, scalability, etc), we do not ignore the complexity of such J2EE solutions and we still encounter difficulties for developing new components from the EJOSA framework. As leaders of PhD students, we need to convince our students that investigating this powerful but complex framework is worth the effort. The EJOSA and OpenUSS community could help us in this challenge if they could provide people interested in these technologies with more documentation and tutorials.

References

Bilhaut, F., Charnois, P., Enjalbert, P. and Mathet, Y., Passage Extraction in Geographical Documents, Proceedings of New Trends in Intelligent Information Processing and Web Mining (IIPWM), Zakopane (Poland), 2003.

Dewanto, B. L., Enterprise Java Open Source Architecture, http://prdownloads.sourceforge.net/ejosa/ejosa-revo-doc.pdf , 2004.

Grob, H. L., Bensberg, F. and Dewanto, B. L., Developing, Deploying, Using and Evaluating an Open Source Learning Management System, http://www.campussource.de/aktuelles/docs/Bensberg_Paper_ITI04_1.pdf , 2004.

Laforcade, P. and Barbier, F., UML Modeling for Cooperative Problem-Based Learning Situations:Towards Educational Components, Instructional Technologies: Cognitive Aspects of Online Programs, P. Darbyshire Editor, IDEA-Group Publishing, 2004.

Laforcade, P., Barbier, F., Sallaberry, C. and Nodenot, T., Profiling Co-operative Problem-Based Learning Situations, IEEE International Conference on Cognitive Informatics (ICCI 2003), London (UK), IEEE, 2003.

Malandain, N., Gaio, M. and Madelaine, J., Improving retrieval effectieveness by automatically creating some multiscaled links between text and pictures, Proceedings of SPIE, Document Recognition and Retrieval VIII, San Jose (USA), 2001.

Nodenot, T., Marquesuzaà, C., Laforcade, P. and Sallaberry, C., Model based Engineering of Learning Situations for Adaptive Web Based Educational Systems, ACM Thirteenth International World Wide Web Conference (IW3C2 Conference), ISBN : ACM 1-58113-912-8/04/0005, New-York (USA), ACM 1-58113-912-8/04/0005, http://www.www2004.org , 2004.