Adaptation of DeLC system for e-Learning in Secondary School

S.Stojanov, T. Glushkova, M. Trendafilova, G. Cholakov

Abstract: The paper presents a possible application of the DeLC infrastructure for development of an intelligent e-learning portal in the secondary school. Furthermore a development environment for creating of e-content is described. We intend to provide the needed interoperability of the portal by using of SCORM standard.

*.**Key words:** e-learning, SCORM, portals, DeLC, semantic Web, ontology*

INTRODUCTION

The Distributed e-Learning Center (DeLC) [1,2,3,4] aims to provide a distance e-Learning and e-Teaching facility available at any place and at any time to individuals and groups of students/lecturers both in synchronous mode (on-line) and asynchronous mode (off-line). The DeLC project focuses at the development of a common concept for the creation of e-Learning information systems and a theoretical and conceptual base of service-oriented e-Learning infrastructure for the integration of electronic services (e-Services).

Development of eLearning is connected with using of determinate standards, which allow exchanging of eLearning resources between Nodes of the system. We intend to provide the needed interoperability of the portal by using of SCORM standard. It could use successfully for create and exchange of training resources between different Learning Management Systems.

E-LEARNING PORTAL

We created the first version of Educational portal by using the architecture framework of the system DeLC and included LMS Run-time Environment of SCORM 2004 in the portal (Fig.1.).
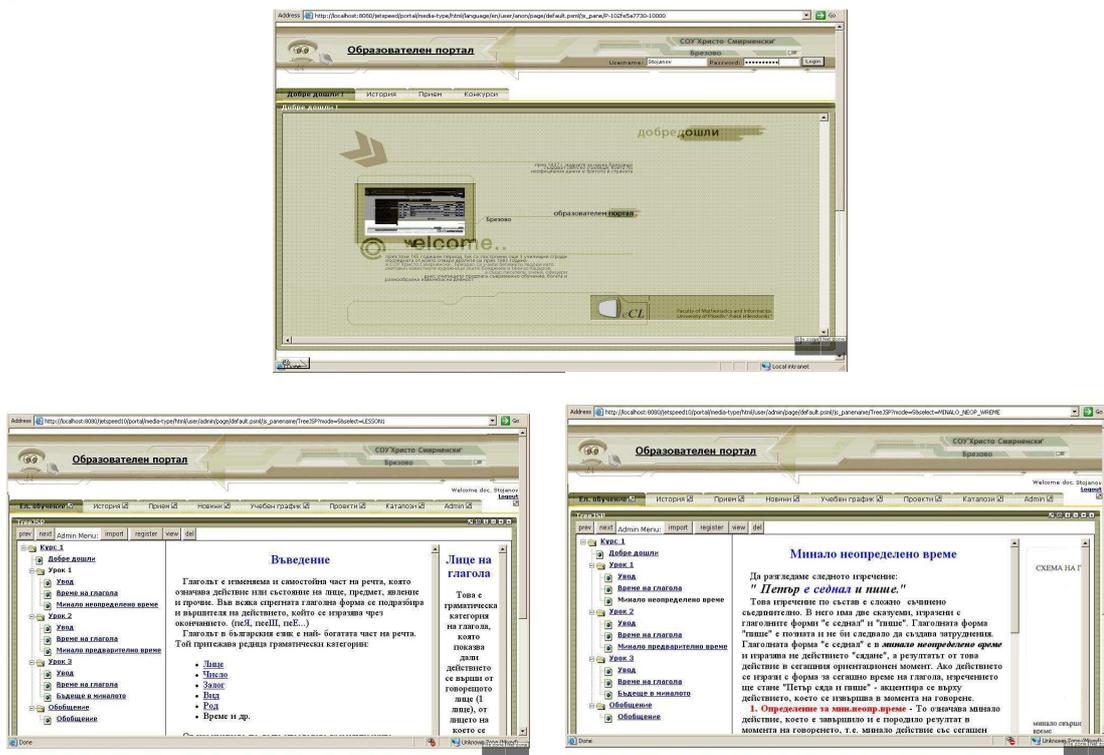
Fig.1. The e-learning educational portal "School Brezovo"

The portal architecture ensures possibilities for using of SCORM-based e-content. It includes the following layers:

- Client layer – the client layer is responsible for the users' interaction. Three models (domain, user and the pedagogical models), which support the processing of the users' requests, are implementing in this layer. As shown in figure 2, the learner interacts with the learning management system (LMS) by passing the user profiler, which can provide relevant indicators to the system in order to undertake personalization adaptation tasks. Because of the focus on the learner and due to the utilization of an enhanced user profiler, these indicators can be derived from the characteristics of the learner. [10]
- Request analyzer – a sub layer to the client part, which has to analyze the incoming users' requests and in relation to the current domain, user and pedagogical instances (profiles) can select the suitable e-service(s).
- Navigation layer – responsible for the selected e-service(s) run-time management and control.
- Gateways management – in relation to DeLC three kinds of e-services can be called – local, remote and back-end services. This layer supports the call organization of the different services.
- Ontology – the presentation of the different models and their relationships achieves by help of ontology.
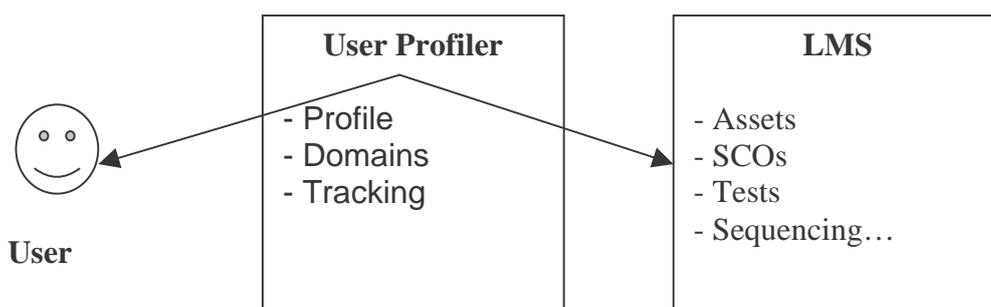

Fig.2. User model of the portal

The basic structures supported in the portal are e-lesson and e-package. E-lessons are independent units of teaching. According to aims of teaching, there are different kinds of lessons:

- According to the type of teaching - for regular, independent, distance, informal form of teaching;
- According to the purpose - for regular students, students with specific educational necessities and disabled students and for continuous teaching;
- According to the level of including to the educational contents - e-learning lessons, which include the completely educational content and e-learning lessons, which include a part of educational content;
- According to the type of lesson - for new knowledge, for exercise and assimilate of knowledge, for generalization of knowledge, for check-up, control and correction knowledge of students and so on.

From a design point of view the e-lessons join the e-content with e-services according to theirs profiles and the SCORM standard.

E-packages are sets of items, which supply the necessary educational contents and services for determinate educational subject and group of students. They can include e-lessons and e-tests, as well as e-consults, additional content, virtual excursions (generated by a special e-service) etc.[11]

DeLC ENVIRONMENT FOR E-CONTENT

There are different guides for creation SCORM-compliant electronic content. The development environment of DeLC will support an approach proposed by Carnegie Mellon University [8,9]. This is best practices guide created specifically for content developers and instructional designers tasked with creating new instructional materials that comply with the Sharable Content Object Reference Model (SCORM) or converting existing instructional materials into SCORM – compliant materials. While SCORM is pedagogically neutral, this guide focuses specifically on a single-user, self-paced e-Learning pedagogy. The guide's primary focus is for the training community. The SCORM definitions and strategies presented in this guide can be easily transferred to the educational community for a wide range of students. The guide can also be applied to developing materials for distance, independent and regular education.

Main steps of creation of the electronic content could be the following:
- The specification of the Sharable Content Objects (SCOs) corresponds with the separated educational objectives. The system must supply the maintenance of ready multiuse SCOs. The teachers could use these SCOs for creating of new educational materials. (Lessons, tests, packs)
- Creation of meta-data that includes information for profiles, purposes and performances of e-Learning contents.
- Definition of rules for sequencing behaviors of separate SCOs as inter-SCO sequencing and intra-SCO branching.
- Preparing of e-Learning package (manifest file) for implementation from run-time of LMS

We intend to develop tools supporting the next two basic scenarios (use cases):
- Direct generation of SCORM-compliant e-content;
- Domain-oriented generation of e-content.

For the direct generation (Fig.3.) we intend to use an adapted version of the SCORM-oriented editor Reload [12]. The authors of educational content design the structure of lessons. They create new or edit available SCOs. The teachers make e-learning resources by using Reload editor. The structure and organization of the lesson depends from kinds of lesson and educational objectives. The authors include meta-data information for the lessons and the separate parts of them. They define the rules for sequencing behaviors of the SCOs. Finally the authors make the pack as manifest file and transmit it to the LMS. The Run-time Environment unpack the e-learning resource and to place it at learner's disposal.

The authors of educational e-Learning resources must to have knowledge for basic components and requirements of SCORM-standard to create e-content by the first use case. This is the main disadvantage for them and the reason to found the conceptual model of the second use case.
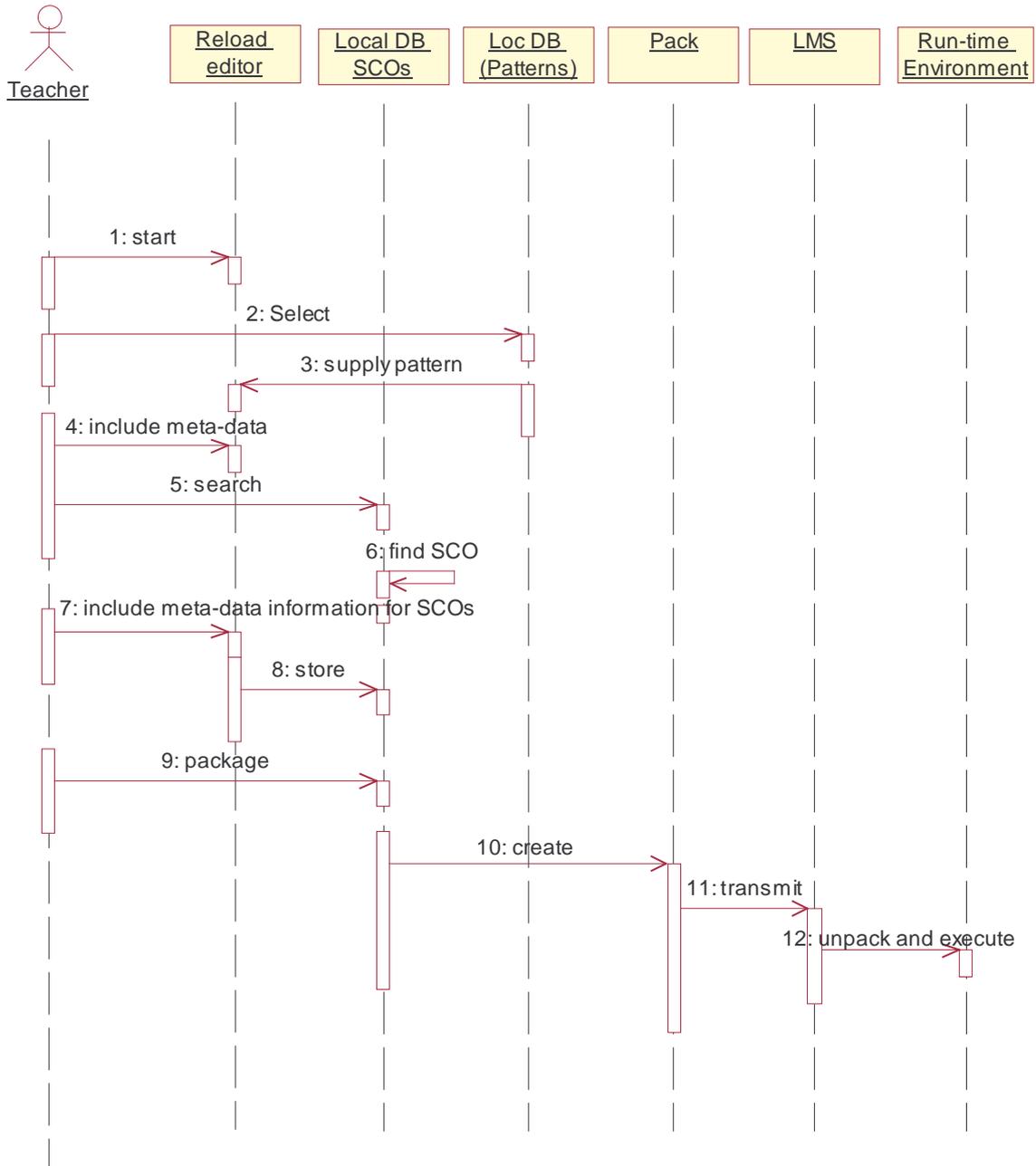
Fig.3. Sequence Diagram of direct generation of SCORM-compliant e-content

The realization of the second use case follows next lifecycle for creating of e-learning content (Fig.4.):

- ▪ Domain editoring - the teacher defines the eLearning unit - lesson, test, module, course in terms of the current education domain using a specialized subject editor. We use Protégé to construct domain ontologues. Protégé is a tool, which allows users also to customize data entry forms, and enter data. It is also a platform which can easily be extended to include graphical components such as graphs and tables, media such as sound, images, and video, and various storage formats such as OWL, RDF, XML, and HTML;

▪ Transformations – the created e-learning unit is transformed into an internal structure supported by suitable system patterns. The patterns are virtual structures (meta-data) saved and maintained in an appropriated ontology;

▪ E-content generating – the internal structures are transformed into SCORM–compliant e-packages.

The lifecycle of this use case will include following:

▪ Auto identification of the author into the Development Environment;

▪ Load of the special domain-oriented editor, according by profile of the author;

▪ Create of organization of the e-Learning content – course, module and lesson. They could use the patterns, that are accessible into the system;

▪ Supply of the needed resources-SCOs from Local DB or from the common Content Repository. If it is needed they could create new SCOs.

▪ The author chooses suitable pattern from Local Pattern DB, according to kind and aims of the lesson and arranges educational content;

▪ The system make the package of the eLearning content (make manifest file);

▪ The Run-time Environment unpacks the e-learning resource and places it at learner's disposal
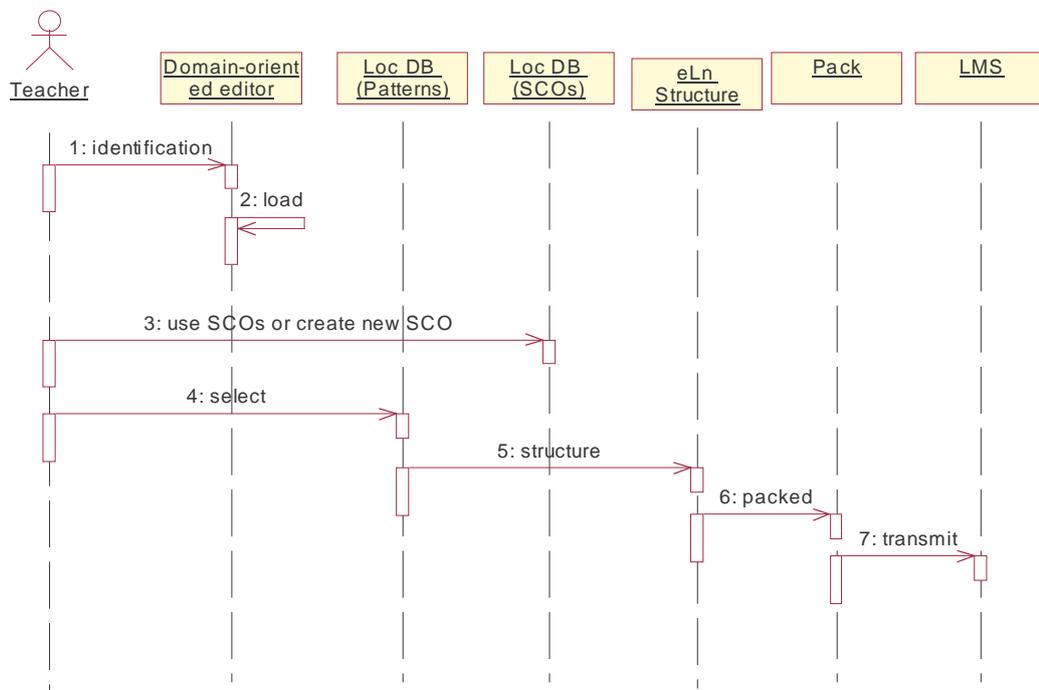
Fig.4. Sequence Diagram of Domain-oriented generation of e-content.

CONCLUSIONS AND FUTURE WORK

This conceptual model for application of architecture framework of DeLC –system for training in secondary school enables to create flexible, interaction, and standard-based systems for e- Learning. Every e-Learning Node is independent system for training, but the sharing of services and resources by the e-Learning clusters will give possibility for quality, interesting and effective teaching.

REFERENCES

[1] Stojanov S., I. Ganchev, I. Popchev, M. O'Droma, R. Venkov, "DeLC – distributed e-Learning center," Proc. of the 1st Balkan Conference on Informatics BCI'2003, Thessaloniki, Greece. 21-23 Nov. 2003, pp. 327-336.

[2] Stojanov S., M. O'Droma, I. Ganchev, "A model for integration of electronic services into a distributed e-Learning center," Proc. of 14th EAEEIE International Conference, Gdansk, Poland. June 2003. ISBN 83-918622-0-8. A17, 7 pp.

[3] Ganchev, S. Stojanov, M. O'Droma, I. Popchev. "Enhancement of DeLC for the Provision of Intelligent Mobile Services". Proc. of the 2nd International IEEE Conference on Intelligent Systems (IS'2004), vol. 1, Varna, Bulgaria, 22-24 June 2004. IEEE Cat. No. 04EX791. ISBN 0-7803-8278-1. Library of Congress 2003115853, pp. 359-364.

[4] Ganchev, M. O'Droma, S. Stojanov, I. Popchev, "Provision of mobile services in a distributed e-Learning center," Proc. of the International Conference on Automatics and Informatics, Sofia, Bulgaria, 6-7 Oct. 2003, pp. 79-82.

[5] Glushkova T., Framework for eLearning in Secondary School by application of DeLC system, 2nd International Workshop on eServices and eLearning, September 28-29, 2004, Smolian, Bulgaria

[6] Glushkova T., The eLearning cluster "ECL-SB", Scientific and practical conference "The new education technologies", May 16-17, 2003, Sofia.

[7] Glushkova T., S. Stoyanov, A model of application of architecture framework of system DeLC for training in secondary school, Scientific and practical conference "The new education technologies", 21-22 May, 2004, Plovdiv.

[8] Learning System Architecture Lab (LSAL) at Carnegie Mellon University, SCORM Best Practices Guide for Content Developers 1st edition, 2003, www.lsal.cmu.edu/lsal/expertise/projects/developersguide/index.html

[9] Andreev, R., Ivan Ganchev, Martin O'Droma, Innovative SCORM-Based Approach for the Creation of Reusable VUIS eLearning Content, 2004

[10] Brusilovsky, P.: Methods and techniques of adaptive hypermedia. In journal User Modelling and User-Adapted Interaction, vol. 6, pp. 87-129, 1996.

[11] Daniela Chaushkova, Malina Trendafilova, "Automatic Generation of electronic routes for students", Proceedings, 2nd International Workshop on services and eLearning – September 28-29, 2004, University of Plovdiv, Smoljan Bulgaria, 131 – 146

[12] www.reload.ac.uk

ABOUT THE AUTHORS

Assoc.Prof. Stanimir Stojanov, PhD, E-commerce Laboratory, University of Plovdiv, Phone: +359 888 318 164, E-mail: csstani@pu.acad.bg

Todorka Glushkova, E-commerce Laboratory, University of Plovdiv, Phone: +359 899 212 950, E-mail: Todorka.Glushkova@ecl.pu.acad.bg

Malina Trendafilova, E-commerce Laboratory, University of Plovdiv, Phone: +359 887 282 515, E-mail: malina.trendafilova@ecl.pu.acad.bg

Georgi Cholakov, E-commerce Laboratory, University of Plovdiv, Phone: +359 887 987 995, E-mail: georgi.cholakov@ecl.pu.acad.bg