Migration from Sakai to Canvas

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***Abstract*— The paper presents a software tool for migration of e-courses from Sakai to Canvas LMS. Both of the LMSs are described as well as their import/export course formats. The tool facilitates the migration between these two LMSs by supporting automatic conversion of a Sakai course into the Canvas-compliant course format. The verification is conducted on the courses held at the Faculty of Technical Sciences (FTN) at the University of Novi Sad, Serbia.**

I. INTRODUCTION

The advancement of ICT has inflicted the educational settings as well as other aspects of social life. Traditional education environment has been superimposed with flexible and adaptable teaching approaches fostered by Learning Management Systems (LMS). LMSs facilitate various aspects of learning process such as: delivering and management of instructional content, identifying and assessing individual and organizational learning or training goals, tracking the progress towards meeting those goals, and collecting and presenting data for supervising the learning process of organization [1].

Nowadays, more and more educational institutions, especially in developing countries, choose free and open source LMSs. In addition to the cost minimization, which is the main benefit of using such solutions, free and open source LMSs can be customized to fit the needs of particular educational institution. Therefore, the focus of our research is put on free and open source LMSs, namely Sakai and Canvas.

Regardless of chosen e-learning solution, each day institutions are being faced with new demands caused by ongoing changes in the learning environment and technologies [2, 3]. This results with the migrations to other LMSs that better fit to new circumstances. Moving from one LMS to another is not an easy task, since LMSs differ in data formats and features. Each LMS has its own data model, so migration from one LMS to another typically implies appropriate data alignment. This alignment can be performed either manually or automatically. Since manual alignment may be time consuming and prone to human errors, in this paper we propose a migration tool that utilizes the automatic approach when migrating from Sakai to Canvas LMS. The migration includes transferring course content from one LMS to another and it is verified on a case study of the courses held at the Faculty of Technical Sciences (hereinafter FTN) at the University of Novi Sad, Serbia. equal. Use automatic hyphenation and check spelling. Digitize or paste down figures.

II. SAKAI

Sakai LMS [4] is a free and open source system developed within the Sakai foundation. The foundation consists of numerous institutions gathered around a common goal to integrate and synchronize their local educational software into a single LMS. The development of the system follows a community-source model that relies on the cooperation among various stakeholders such as academic institutions, commercial companies and individuals with the goal to ensure sustainability and improve software development and distribution.

Sakai LMS has been distributed in two versions: Collaboration and Learning Environment (Sakai CLE) and Open Academic Environment (Sakai OAE). Sakai OAE is a new system within Sakai Foundation promoting constructivist learning model. It provides collaboration within users communities organized on the social networking principles.

Since this paper deals with Sakai CLE, the detailed description follows.

Sakai CLE is an e-learning framework, which, in addition to standard e-learning features, provides tools for general computer-supported collaborative work. Sakai enables users to create web pages that contain a specific set of tools. Tools are independent components that interact with users providing a specific set of functionalities. Sakai tools may be classified into four groups: learning, collaboration, presentation and administration tools.

Sakai learning tools support the administration of educational resources and participants. These tools relate to:

- *curriculum* – educational programs and learning objectives
- *learning material* – educational resources and their organization
- *assessment* – knowledge assessment through online tests with grade statistics

In Sakai, a special attention is put on collaborative work. Therefore, various collaboration tools are provided:

- *file sharing* – DropBox
- *creating content collaboratively* – wiki pages and dictionaries
- *communication* – e-mail, chat, forum information sharing – notifications, news, blogs
- *scheduling* – calendar of important events, activities and deadlines

Presentation tools enable user to create a set of personal presentation pages. The presentations may be used to publish the information on users such as their work, prior experience and skills. Available tools are:

- *wizards and matrices* – customized collections of arbitrary content following sequential, hierarchical or matrix visual organization

- *reports* – create, view and export reports containing presentation data
- *templates* – a predefined visual organization of data.

System configuration is managed by using administration tools aimed at managing following elements:

- *accounts* – managing basic information about user accounts
- *membership* – defining user permissions to access particular content
- *course organization* – managing courses and arbitrary sets of web pages
- *system monitoring* – observing technical system parameters

III. CANVAS

Canvas LMS [5] is a cloud-native learning management system developed by Instructure. It provides wide range of e-learning functionalities relying on web 2.0 technologies.

Standard Canvas distribution supports following learning tools:

- *curriculum* – defining learning outcomes and syllabi
- *learning material* – learning resources files organized into modules
- assessment – assignments, quizzes and polls supported by specialized grading tool

Regarding functionalities related to collaborative work, Canvas offers:

- *file sharing* – users have their own file repositories
- *creating content collaboratively* – wiki pages
- *communication* – discussions and messaging system including video messages
- *information sharing* – announcements (text or video messages with support of RSS feed)
- *scheduling* – calendar tool integrated with other tools such as syllabus, assignments etc.

Presentation tools are also supported by Canvas. There is a specialized tool for creating user's portfolios and custom web pages.

For the system administration, Canvas offers following sets of tools:

- *accounts* – Canvas resources are available only to registered users organized into groups with different permissions
- *membership* – only enrolled students can access a course
- *course organization* – course organization and navigation can be customized
- *system monitoring* – automatized tasks such as message exchange can be monitored from Canvas

The tools are implemented using Web 2.0 technology and Ruby on Rails development platform. In addition to predefined set of tools, Canvas may be extended by adding third-party tools. So far, there are numerous external applications and plug-ins for Canvas. For example, in [6] 132 Canvas applications are listed with new applications added every day. The only precondition that has to be met when developing a new Canvas application is to be compliant with IMS LTI specification [7].

By comparing two described LMSs, we can see that both of them provide standard e-learning features. Still, we believe that Canvas LMS is better solution than Sakai at this moment, since it is newer system, more oriented on modern web technologies and easier for the extension using third-party tools.

IV. MIGRATION TOOL

Each LMS has its own format for representing course data. LMSs typically support *export* functionality which stores the course data in a specific format. The stored data can later be *imported* back to the system.

Software tool proposed in this paper relies on import/export functionalities. It takes a course exported from the Sakai CLE and converts it into such a format which can be imported into Canvas LMS.

Before any migration can be performed, it is necessary to analyze export/import data format of the above mentioned LMSs. Among all course data, the software tool in this paper deals only with migration of learning resources in a course. We refer to "learning resources" as any digital content (file) uploaded into the system.

A. Sakai course format

Sakai course format is illustrated with Figure 1. As shown in Figure 1, Sakai course content is exported in a separate folder containing different files. XML files contain data or metadata about exported course content. Each tool in a Sakai course is exported in a separate XML file.

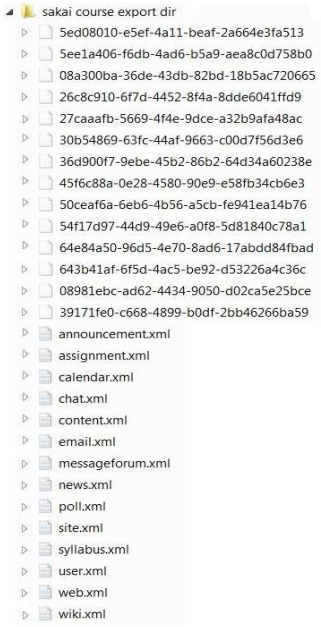

Figure 1. Sakai course format

The files meaning is as follows:

- `announcement.xml` – holds the data about all announcements created or generated in the exported course

- `assignment.xml` – the data about all readings, quizzes, tests and projects in the course
- `calendar.xml` – export file for the *Calendar* Sakai tool that contains schedule of the learning activities
- `chat.xml` – the history of all chat messages are exported in this file
- `content.xml` - metadata about course learning resources
- `email.xml` – an archive of all e-mail messages sent by course participants
- `messageforum.xml` – messages posted in the course forum are stored in this file
- `news.xml` - news received in the course from external resources through the RSS feed
- `poll.xml` – the file contains the data about polls organized within the course implementation
- `site.xml` – course sections are stored within this XML file
- `syllabus.xml` – stores a description of a course syllabi
- `user.xml` – the file contains a list of course participants
- `web.xml` – stores custom web content defined within the course
- `wiki.xml` – the file is a backup of wiki pages administered by course participants

Since the migration tool transfers learning resources from a Sakai course to Canvas LMS, we are going to analyze `content.xml` file that stores learning resources metadata. The file enumerates all the resources in the course and its structure is shown in Figure 2.

Figure 2. File containing metadata about learning resources exported from the Sakai course

Tag `archive` is a root element in the resources description. Its children tags `date`, `server`, `source` and `system` describe some global information about exported course and Sakai system where the course has been stored. `ContentHostingService` tag contains all learning resources in the course. Since resources may be organized into folders, for each folder there is a `collection` tag that represents its content. Within this tag, an identifier and name of the folder are defined. Some additional info, such as the visibility of the folder, is given too. Learning resources in the course are described by using the `resource` tag. As mentioned, the `content.xml` file stores only metadata about resources. The resource content is stored in a separate file within the exported course folder. Such files have no extension and they are shown at the top of Figure 1. Tag `body-location` in the `content.xml` file references the name of the file that contains resource content. Besides, `resource` tag holds data about length and type of the resource file, resource name and resource type. All metadata specified for a resource in the Sakai system are listed in the `properties` tag shown at the bottom of Figure 2.

B. Canvas course format

Exported Canvas courses are stored as zip archives with the `.imscc` extension. The structure of this archive is illustrated with Figure 3.

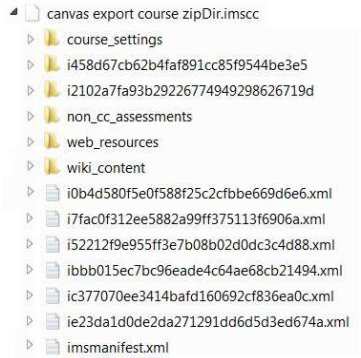

Figure 3. Canvas course format

The archive contains XML files whereby `imsmanifest.xml` is the main file. The file describes course settings and organization. Figure 4 shows the structure of the Canvas `imsmanifest.xml` file.

First two children of the `manifest` tag specify global course information – its identifier and name. Metadata describing course and imscc file global information are given within the `metadata` tag. The tag `resources` `stores` metadata about all learning resources in the course. It can be noticed that each resource is represented by using the `resource` tag. Within this tag, an identifier and type of the resource are specified. Tag `file` and its child tag `href` reference a physical file on a disk where the resource has been stored.

Other XML files and folders in the Canvas imscc file contain the metadata on the dynamic aspects of the course, such as announcements. The general course settings are defined within the `course_settings` folder.

Files and folders with names that start with the letter "i" are related to announcements created within the course. In addition to the announcements, the files contain notifications sent or received during the course.

All the course resources (files) are placed within the `web_resources` folder. In contrast to Sakai course format, the files in this folder have names that correspond to the original file names.

Folder `wiki_content` contains wiki pages in the course.

C. Implementation

The tool is implemented in Java programming language. Tool components are shown in the UML component diagram in Figure 5.

The tool is an intermedior between Sakai and Canvas LMSs. An input of the tool is an archived Sakai course. Starting on this input, the tool produces a new Canvas course.

Migration process, represented in a form of an UML activity diagram, is shown in Figure 6.

The process starts with exporting Sakai course to the file system. After that, a user enters the file path of the course and the destination path where a Canvas course is going to be stored. Then, the tool parses `content.xml` file in the archived Sakai course. Next step is to create a folder for storing the Canvas course. Using the data loaded from the Sakai course, the `imsmanifest.xml` file of the Canvas course is programmatically generated. Then, all resource files from the Sakai course are copied to the Canvas course folder where they are renamed according to the Canvas course format. After that, all content in the destination folder is zipped to an archive with the .imscc extension. Finally, the user can import the generated Canvas course.

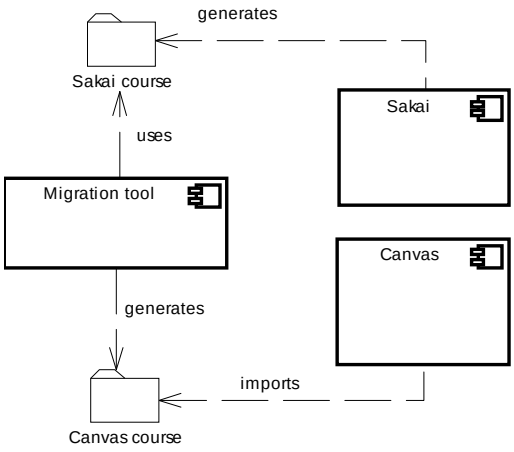

Figure 5. Component diagram of migration tool

D. *Verification*

The tool has been verified by migrating several courses held at FTN from Sakai to Canvas LMS. Figure 7 shows the "Object-oriented programming platforms" course generated by using the migration tool proposed in this paper. The course content is in Serbian as well as resource names.

V. CONCLUSION

The paper presents a software tool that facilitates migration from Sakai to Canvas LMS by providing an automatic conversion of Sakai exported courses into the Canvas-compliant course format. The tool relies on internal export/import formats of the mentioned LMSs and it has been implemented as a stand-alone Java application.

The main limitation of the proposed solution is that the tool only provides the migration of learning resources in the course. Announcements, messages, wiki pages and export of other course content is not currently supported.

Future work will be aimed at overcoming this limitation by extending the tool. Another direction of the following research will be to support the bidirectional migration among multiple LMSs, such as Moodle, Desire2Learn, Blackboard etc.

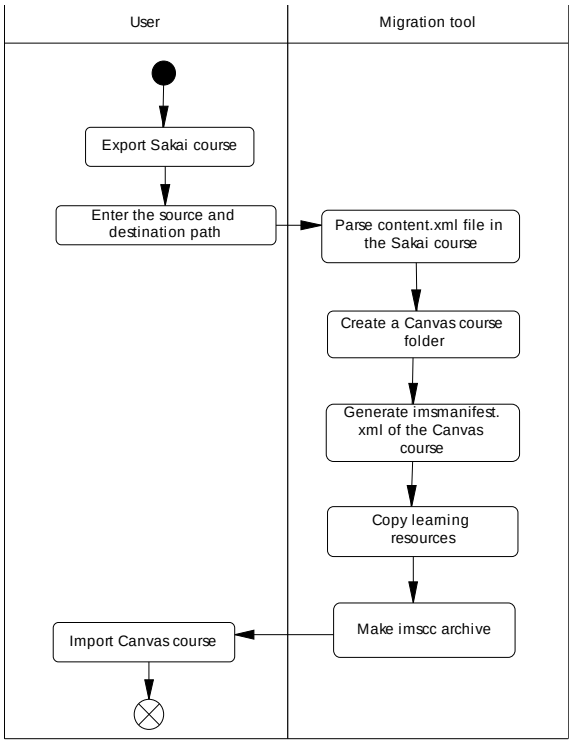

Figure 6. UML activity diagram of the migration process

Figure 7. Result of tested Sakai course migrated for Canvas

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