

Design and Implementation of Synchronized data with e-Learning systems

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Abstract: There have been a lot of web systems in Higher Education (e.g. LMS, library system, registration system and so on). When several LMSs (e.g. Moodle) exist in each faculty (or each department), the student should access to any LMSs. Furthermore the web usage between universities extends. It is assumed that the students use LMSs of any universities. When credit transfer system at other institutions is signed, student can take a course at other university's LMS. The student acquires the credits from other universities. It is necessary to check the recording history log. However, the log is distributed. The demands of interconnection of data of between systems arise when several Web systems exist. To solve the problem, we develop the synchronized environment that uses the web interface between web systems.

Keywords: LMS, e-Learning, data synchronize, script agent, web scraping

Introduction

In the 2000's, Japanese higher education introduced the web based information systems rapidly. Especially most universities built an e-Learning system. A student can download digital learning materials from LMS (Learning Management System). The number of contents increases and there is diversity. LMS is not an isolated system any more. There are a lot of web systems in the University. Some systems work alone. The user requests the cooperation between systems. One is implementation of single sign-on and other is data linkage. As for single sign-on, many methods are proposed and single sign-on is used at a lot of universities. Also, the federation that ties the organization based on SAML is operated. In our university, we can use SSO service by the Shibboleth that is the famous framework of federation. On the other hand, the frame of the data exchange is not maintained still enough.

The use of LMS in the class becomes common. The information of the student who takes a class is in both the registration system and LMS. The class name (information of teacher in charge and so on) is in both the electronic syllabus and LMS. In addition, when the user is using some LMSs, the teacher and the registrar staff will check the recording history log in each LMS. Under federation, it is natural for the student to use LMS of other universities. The learning history of one learner is distributed. It is necessary to construct a mechanism of data exchange between systems. The purpose of this research is to propose the frame of the data exchange.

There are various methods in the data exchange. We pay attention to the indirection approach. There is a data base in one of the components of the WEB system. There is a method of converting data directly between data bases. The realization of this method is easy. However, the database format changes in the meaning of an author of the web system. It is always exposed to the danger of the change. In many Web systems, import and the export function of data is implemented. This import and export function is useful for realization of the data exchange. Flexibility is high though this method is an indirection.

1. Web base information system

The concept named e-Learning covers wide areas. For example a video based distance education is a kind of e-Learning. We handle the LMS of the Web based information system like a Moodle as the typical e-Learning. A lot of universities have introduced a variety of WEB systems other than LMS, like an e-Registration, an e-Portfolio, a Portal, a Library, a grade management system, a student information database and so on. LMS has the functions, management of learning material (like PDF file), transfer of the homework, announcement, electric forum, minutes test and so, at each class. We use the open-source LMS "Moodle". The Moodle is unsuitable to large-scale use. So, we set up Moodles at each faculty (or department). Various information is necessary to operate LMS. The LMS has some databases previously. The LMS needs the information, like a student's attribute, a class name, a charge teacher, a list of registered students and so on. The LMS receives these data from other systems in some way or other. It is not a good method that a human staff enters registration information on the LMS's console while watching the sheet that is printed out from the e-Registration. The users and operation staffs want to exchange the data automatically between systems. It is necessary to design work to achieve this desire, taking out necessary information from the database, converting the data format, and putting in other database.

2. Agent based data exchange

We think over the solution that synchronizes the data between web based systems. We classify the method of the data synchronization in the following three kinds.

1. Direct synchronization from database to database

The LMS database of X University connects to the database of Y University. The information transfers from database to database directly. A smart copy program enables the copy of data. the copy program is necessary to know the database design. The programmer should analyze the database.

2. Database sharing between applications

Some applications share the database. It is not a big problem that the database is shared or not for the behavior of the Web system. The web system keeps usually processing only. The programmers of the application should agree the database sharing previously.

3. Agent script method

Data is converted by using both import and export functions of the Web system. The Web system has the function to output data outside as the file and to read the file. Data is saved once as a file. Because the XML format has high flexibility, we use the XML format. The script operates the interface of the Web system on behalf of human. It is necessary to prepare the agent script.

The second method seemingly looks efficient. However, this hides a big problem of how to design the sharing database. The programmer of the web system does not consider the

sharing database. According to circumstances, it is necessary to rewrite the system thoroughly. Furthermore it is difficult to share the database when you assume the web system beyond the organizations. Officials cannot decide where to put the database physically. The realization of second method is very difficult though it is a rational idea. The efficiency of the first method is high on the process of web system. We should analyze details of the database. There is a possibility that the design of the database changes when an author upgrades the web system. We should make the copy program every time the database format changes. The cost of system development is also high.

In this research, we adopt the third method. We should make the program for this method. This program is an agent script that operates the Web interface. This method is an indirect data exchange through the XML file. Because it is an indirection, flexibility to the change of the system is high. Moreover this method can correspond even if the number of relating systems increases. We think that flexibility is more important though the cost of the system development is large.

Conclusion

In this paper, we propose necessity and implementation federation between the web information systems. Many Web systems flood in the e-Learning environment of the present university and the teacher and the student are forced very complicated processing. There are many examples about SSO between systems. However, the problem of the synchronization of data is not solved yet. We propose about the indirect data synchronous method. The flexibility of the agent script method is high.

We are building the test environment for verification. We evaluate behavior of the agent and performance in the test environment.

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