

# Dynamic Synchronization of Learning Contents among distributed Moodle systems

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**Abstract** Sharing learning contents over distributed LMSs is an important issue in order to reduce the burden for building well-designed contents. As a lecture, regular updates of contents for on-going course are really important because contents should be reflects the learners' attributes as well as the correction and addition of contents. Although this kind of dynamics of contents is required for actual situation, differential updates of contents provided on distributed LMSs are not simple tasks. This paper introduces the dynamic synchronization between distributed Moodle systems connected over network. Concerning on the synchronization of contents, there are two types, uni-directional and bi-directional ones, however the method of uni-directional synchronization is discussed in this paper.

**Keyword** Synchronization of learning contents, distributed LMS, Moodle, uni-directional

## 1. Introduction

In order to reduce the burden of building and managing learning contents, a share of contents is important issue. One of the typical solutions is dump-copy-upload, that is whole contents are dumped, copied, then uploaded to other LMS via standard or original data format. This solution can be used only if the contents are already fixed. However lectures who utilize contents for their own courses always wish to update the contents according to the demand or acquisition of students as well as correction of errata. In order to meet this demand, the dynamic synchronization method between distributed LMSs is required. In this paper, the dynamic synchronization method of learning contents between distributed Moodle systems is discussed with communication failure treatment.

## 2. Concept and implementation

In order to share the same learning contents between many institutes, a technically simplest solution is to use a single LMS for supporting multiple classes by different schools or institutes if sufficiently wide bandwidth can be assumed. If multiple courses are linked

together, all of contents can update immediately so that dynamic synchronization of contents can be made easily. However, single LMS configuration has several issues to be considered well;

- Protection of personal, especially learners' information
- Robustness against failure of network communication channel for distant institute
- Cost efficiency of network bandwidth (For example, major Indonesian national universities are connected by INHERENT network now, but some of connection is only 1Mbps or so.)

In order to solve those issues, the authors have proposed the synchronization method of contents between multiple Moodle systems[1].

Figure 1 shows an image of distributed LMSs for dynamically synchronizing learning contents from a server LMS to multiple client LMSs. Synchronization process can be run regularly, i.e., once a day during least busy duration of communication channel. Because of direction of synchronization is "server to clients" only, it is named as uni-directional synchronization.

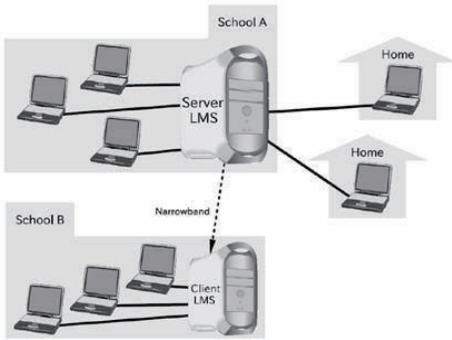


Fig. 1: Concept of synchronization of Multiple LMSs.

In order to implement the synchronization method, Moodle system is chosen by various reasons; i.e. software license, rich experiences of Moodle usage at authors' university and institute, and reliability. One server LMS carries the master contents, and client LMS carries the copy of server LMS's contents course by course unit as shown in Fig.2.

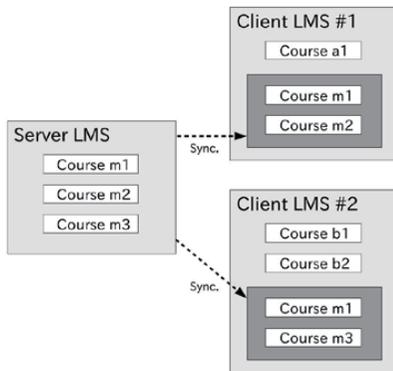


Fig.2 Courses allocation of server and client LMSs.

When one synchronizes the specified courses, only related database contents, such as updated html, quiz are checked while user specific data are omitted to avoid the sharing personal information between LMSs.

Figure 3 shows the basic procedure for synchronization.

STEP 1: Specified database tables are compared between master data (*Database M*, in Fig.3) with copy of client's data (*Database sub1*).

STEP 2: SQL commands to update / remove / add

records to make *M* and *sub1* identical are directly generated.

STEP 3: SQL commands are copied from server LMS side to the specified client LMS side.

STEP 4: Copied SQL commands are applied to client LMS's *Database S1*.

STEP 5: Based on the acknowledgement from client LMS, *Database sub1* is updated.

Against the failure of communication channel, handshaking protocol is utilized between server LMS and client ones even if SSH connection is utilized.

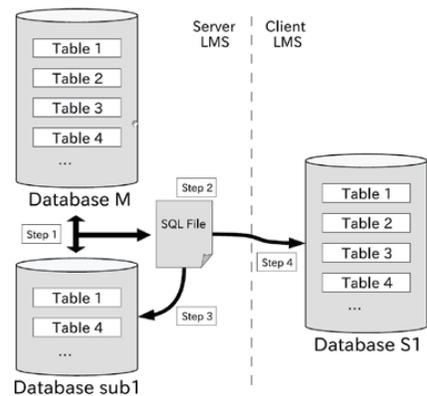


Fig.3 Synchronization method of contents by SQL operation.

### 3. Concluding Remarks

The dynamic synchronization method of contents between distributed LMSs is discussed. This method is testing as the test bed for e-learning activities at a local elementary school and some test are performing between Indonesia universities.

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Reference:

[1] J. Watanaba, T. Ishimuro, Y. Chisaki, T. Usagawa, Technical Report of IEICE, ET2008-70, pp.77-80 (2008.12.13) (in Japanese)