

MYSQL DATABASE SYNCHRONIZATION SOFTWARE FOR THE NEEDS OF DISTRIBUTED INTERNET PERFORMANCE SUPPORT ENVIRONMENT FOR INDIVIDUALIZED LEARNING (DIPSEIL)

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DIPSEIL is a project for distributed e-learning environment aiming to define, develop and test a distributed system for individualized learning and the underlying pedagogical procedures to implement, facilitate and promote performance-centered learning experiences in the context of international university education. DIPSEIL is a continuing work, based on an existing model, developed working prototype, conducted empirical research and analysis of experimental data that have been done in a previous project – Internet-based performance support system with educational elements IPSS_EE (www.ipss-ee.net Minerva, 2001). MySQL Database Synchronization software (MySQLDbSync) is a new way for database synchronization between one main database server and two or more remote database servers, which are key components of DIPSEIL architecture.

Keywords: distributed e-learning environment, mysql database synchronization

1. DIPSEIL PROJECT

Distributed Internet-based Performance Support Environment for Individualized Learning is defined as an integrated and Internet accessible collection of performance support systems for educational purposes, that can be used when required, at a particular point of need, by an individual user, or a workgroup.[2]

In DIPSEIL multiple users can interact with distributed educational content in real time, running on several servers, connected by a computer network using client server applications.

The educational content is spread over several IPSS_EE servers across Europe and is structured mainly in the field of Electronics and Information technologies education.

The architecture of DIPSEIL is shown on fig.1

These are the main characterizations of the DIPSEIL architecture [1]:

- The local IPSS_EE servers are independent of one another. They contain educational courses created from learning objects according to various scientific subjects;
- The local IPSS_EE servers are geographically allocated and language specified;
- A learning objects repository and database of all educational courses is maintained in the communication server by replication of the databases of local servers, as well as the contents of the courses by replication of content files.

- The distributing environment for the databases replication and content files is Internet.
- The operational systems of the separate local IPSS_EE servers can be heterorganic (Linux, Solaris, Windows and others).
- In the communication server is running special designed replication and communication system, for content retrieval, login service, student records exchange service, IPSS_EE skill assessment portal, test manager, authoring service, IPSS_EE Learning objects repository and build in adaptive system model.
- The communication protocol between the web services is TCP/IP, as well special designed protocol for data and file replication between databases of the local IPSS_EE servers and communication server.
- The replication system, synchronization and transfer of files and learning objects are completely automatic.
- The software of the system for the distributed databases management is independent, regarding its platform.

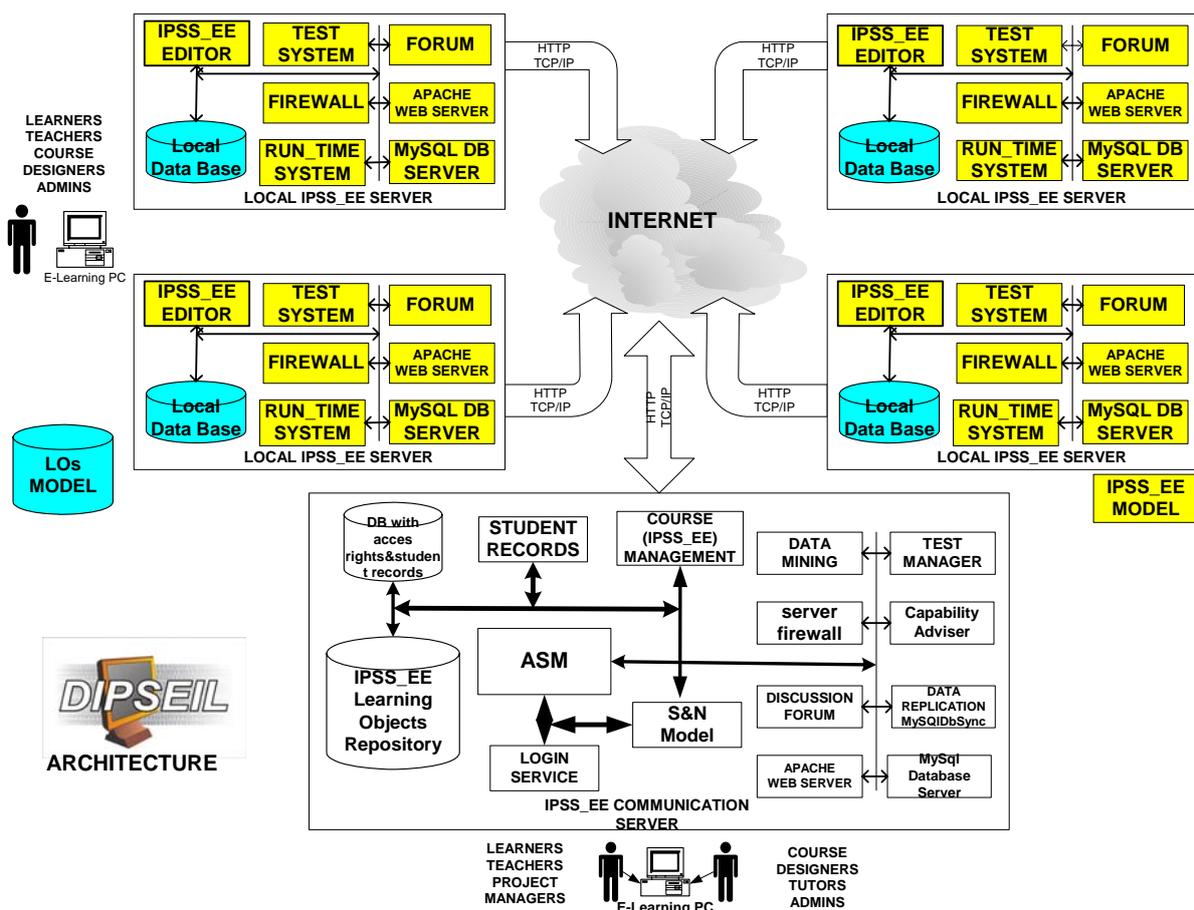


Fig.1 DIPSEIL architecture

2. MYSQL DATABASE SYNCHRONIZATION SOFTWARE FOR THE NEEDS OF DIPSEIL

MySQL Database Synchronization software (MySQLDbSync) is a new way for database synchronization between one main database server and two or more remote database servers – fig.2. The synchronization is established over the Internet. Because of this the servers (the remote and the main one) have to be connected directly (with real IP-addresses) to the global network. This software is used to synchronize the DIPSEIL servers, by examining four important tables from all the remote servers and sending the new/changed information from them to the database on the main server. One of the main features of MySQLDbSync is that it is developed in Java Development Language, which ensures that this software could run on many operating systems: Windows, *nix, Mac OS, as long as they have the Java module and a MySQL server installed.

When MySQLDbSync is started – fig3. , It logs with a pre-given username and password, to the local MySQL database, where it checks its system database. There is a "Configure" table, in which are stored basic settings – 1) interval time for the timer (described later); 2) address of the forum, in which the points and submitted task performance for/of the students will be displayed (module 4 and 5); 3) Path to the error log file. Next the software reads another table from the database, in which the IP addresses of the remote servers are stored. This table consists of two very simple columns – name and IP-address. The name is here not important, but the DIPSEIL php software later to identify and display the servers uses it. The names are more for convenience than for work. After the IP-addresses are cached, the software goes in the so called "working" state - a timer is created using the settings, which were taken from the "Settings" table at the beginning. At the given interval a thread is started by the timer for every server – if we have 10 servers we will have 10 threads. The number of the servers is not limited, but it must be synchronized with the available upload and download traffic – these values of the traffic depend on the Internet service provider. Every thread needs two database connections – one to the local database, where the transferred data will be stored, and one to the remote server, for which the given thread is started. That is why the remote servers need their 3306 (mysql) ports opened, and also a direct connection to the Internet. If the remote server doesn't have a direct connection, it can be configured as a DMZ (demilitarized zone) for the 3306 port on the gateway, behind which it is.

Now every thread executes consecutive five modules, every one of which uses the opened connections. Modules number 1,2 and 3 check three tables on the remote database – "systems", "modules", "tasks" - these build the main DIPSEIL structure. If there are any changes in these databases, they are transferred to the local database. The idea of this transfer is that the Communication Server (where the local database is) must always have actual information for the data on the remote servers, because every user first connects to it, in order later to be transferred to the remote server. If data was deleted from the remote server, it is also deleted on the Communication Server. Modules number 4 and 5, are currently not used in the DIPSEIL system, but

their main task is to check the information of the students – points they have received from the teacher, and submitted task performances, and this information to be imported in the database of the local forum (phpBB, MyBB or such others). These modules are currently not used, because we have developed our notification system. After all changes are done, or if there are no changes, the connections to the remote and local databases are closed – this is important, in order not to overload the remote servers with many connections. After this is done, the threads are destroyed – this way some memory is freed for the software. While the threads are running the timer continues to measure time.

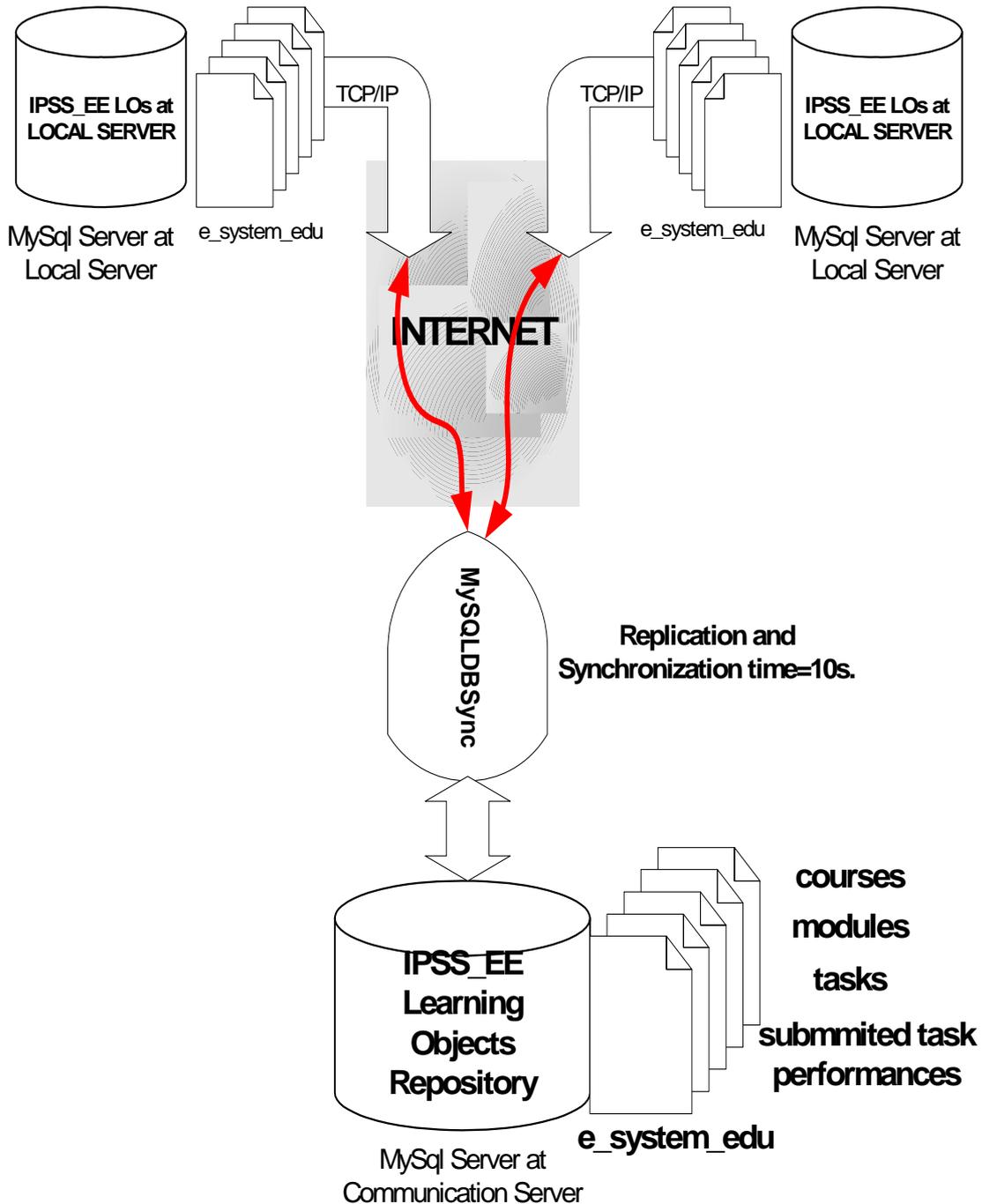


Fig.2 Synchronization of Databases of main and remote database servers

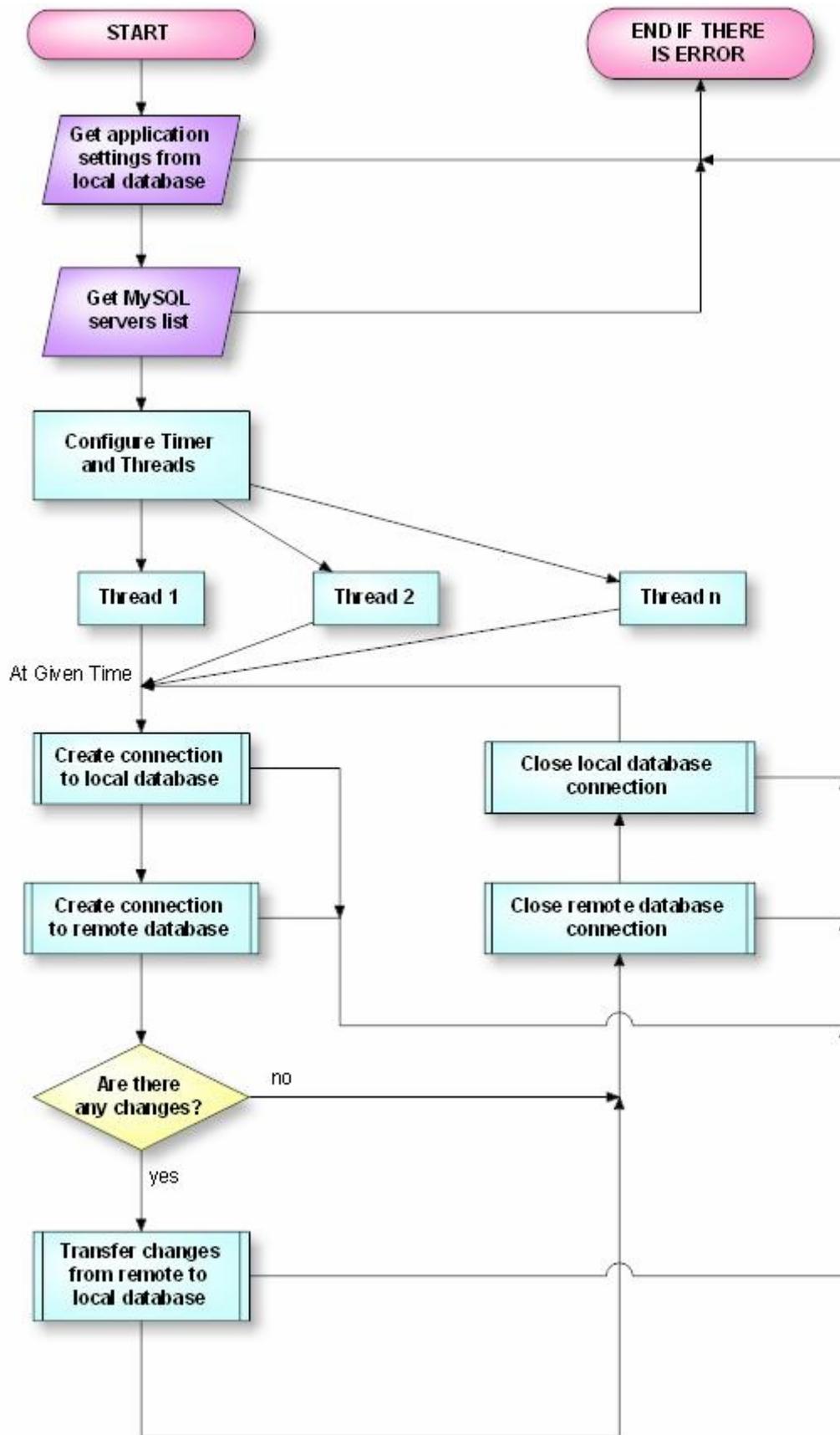


Fig.3 Operation of MySQLDbSync

And after the time interval comes another threads are started. The proper way for stopping MySQLDbSync is just to kill it. If at a given point a problem occurs – the thread is destroyed, and the application writes a full log of the error to the error log (usually in "/var/log"). If the error occurs before the timer is started (there are no threads) the whole application is killed, after the log is written.

3. CONCLUSION

This paper proposes MySQLDbSync software for database synchronization and replication of educational content from two or more geographically distributed servers. The communication and synchronization environment is Internet. The software is tested and is currently working on the Linux operating system. Further releases of MySQLDbSync will include modularized technology – this will allow the administrators to enable and disable some of the features. Another new feature will be the better configuration mechanism, which will allow the users of the software to set different times for the different modules for example.

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4. REFERENCES

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