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A Designing of a Storage Sharing System for LMS using Cloud Storage:

A Case Study of eDLTV

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Abstract: The use of e-learning has always been encouraged in Thailand; however, in medium and small schools, the effort has not yet been achieved due to the inability to produce quality content, which resulted in a knowledge gap between larger schools and the medium and small sized schools. This paper proposed the design of an e-learning system that can easily be distributed to schools throughout the country. The system is a combination of an existing LMS system called eDLTV and a cloud storage technology; thus creating an e-learning system that is available to all instructors and students through the use of the Internet, with the flexibility to choose whether to use an existing learning material or to create their own custom content.

Keywords: Learning Management System, LMS, Cloud Storage, Content Sharing, Distributed Data storage, Gluster File System

Introduction

The effort to encourage the use of e-learning in Thai educational system is increasing over the years, especially in secondary schools. Many of these schools accompany regular teaching with an e-learning system to improve the student performance. The teachers are trained to be able to manage a simple e-learning system, as well as to create the content. From this perspective, the growth of e-learning in Thailand is to be expected; however, the result is not so. Two major problems faced by most schools are in the creation of digital content and the readiness of the infrastructure. These problems are even more severe in rural schools because of the limited number of teachers and other financial resource; to have an e-learning system of their own is almost impossible to accomplished. With this in mind, we proposed a new model of an e-learning system so that schools will not have to create the content or own their own server. The content is created by experts in each subject and stored on cloud storage, ready for school access. The servers will be supported by organizations with available infrastructure such as government agencies or universities. In this paper, the design of digital content sharing based on cloud storage technology for eDLTV, a further development of LearnSquare e-learning system, is presented.

1. Background

The proposed system consists of two components: eDLTV system and Cloud Storage technology.

1.1 eDLTV: an e-learning system based on LearnSquare - an open source e-learning system developed by NECTEC, Thailand [1]. The eDLTV was established under the collaboration of Her Royal Highness Princess Maha Chakri Sirindhorn: Royal IT project and the Distance Learning Foundation for the celebrations on the auspicious occasion of his majesty the King's 80th birthday anniversary [2]. Initially, in May 2007, the project provided only the content of the secondary school; now the eDLTV has expanded its operations through a network of 35 Rajabhat universities, with more than 30,000 instruction content including videos, slides, sheets and tests [3].

1.2 Cloud Storage technology: an efficient way for data sharing over the Internet. People are able to access the storage anytime and anywhere [4]. Many large companies have begun to deploy their own cloud computing platform, such as IBM, YAHOO, Amazon, Google and Facebook [5]. Two popular methods used to create Cloud Storage are Hadoop Distributed File System and Gluster File System.

1.2.1 Hadoop Distributed File System (HDFS) is a distributed file system, which is one of the two component of Apache Hadoop [6]. The HDFS is composed of two modules called Namenode and Datanode [7]. The Namenode stores three major types of metadata of the entire file system, i.e. file and block namespaces, the mapping of files and blocks, and the locations of each block's replicas, whereas the Datanode stores the actual data [5].

1.2.2 Gluster File System (GlusterFS) is a network-attached storage file system developed by Gluster. The idea is to aggregate various storage servers over the Internet and interconnect them into one large parallel network file system [8]. Two component of GlusterFs are GlusterFS client and GlusterFS server. The GlusterFS servers are typically deployed as storage bricks, with each server running a glusterfsd daemon to export a local file system as a volume; the GlusterFS client composes these composite virtual storage volumes from multiple remote servers [9].

The paper will focus on GlusterFS because it is easier to be implemented with the eDLTV, since it doesn't affect the original data [9].

2. System Process

In this section, the overall structure and the fuctionality of the eDLTV Cloud Storage System is explained.

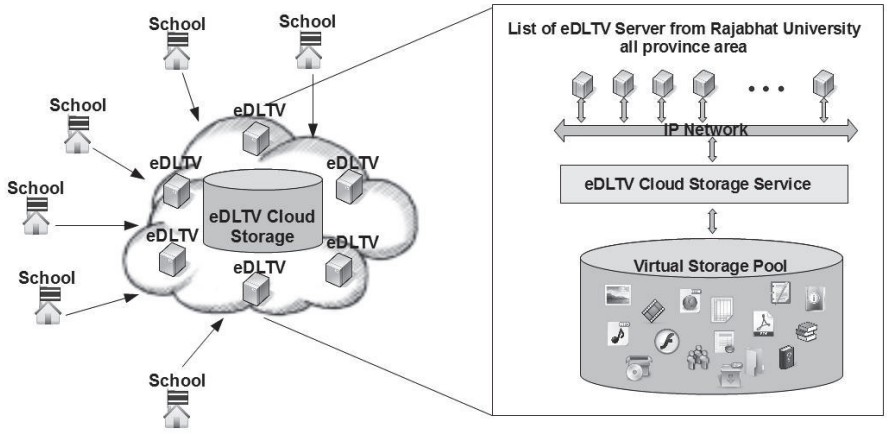

Figure 1. eDLTV Cloud Storage System Overview

2.1 eDLTV Cloud Storage System Overview

In Fig. 1, the eDLTV Cloud Storage System is the central storage for the eDLTV System. All eDLTV servers are connected to the eDLTV Cloud Storage Service which is then connected to the central Virtual Storage Pool that is responsible for storing data such as courses, texts, quizzes, SCORM, log files and so on. Every school has the same access to the same resource on the eDLTV server through the same URL, and will be able to use authoring tools, e-learning software and utilities from the eDLTV Cloud Storage Service without having to install them on their machines.

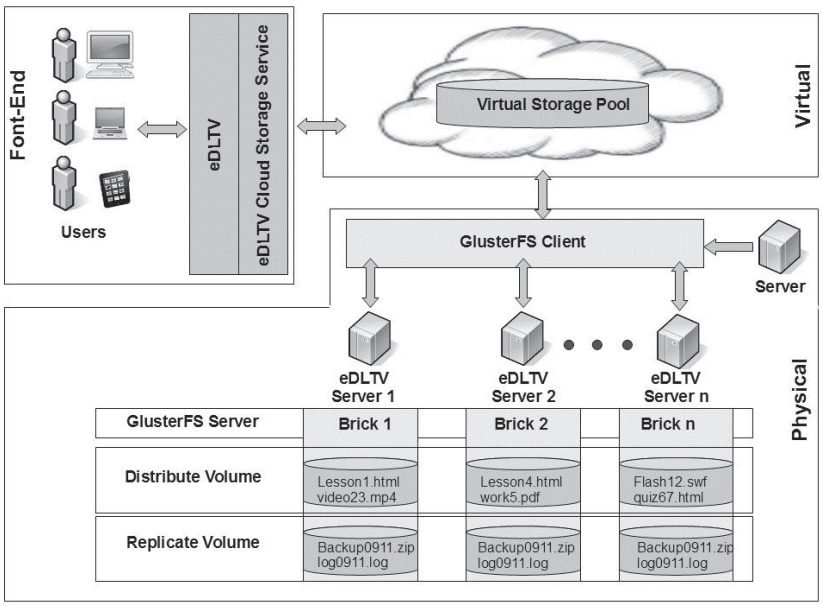

Figure 2. eDLTV Cloud Storage System Structure

2.2 eDLTV Cloud Storage System Structure

Fig. 2 is the process flow of the eDLTV Cloud Storage System: the flow starts when a user connects to the eDLTV server through various clients, such as computers or mobile devices

as shown in the Front-End block. Each eDLTV server then tries to retrieve the requested content via eDLTV Cloud Storage Service, which is connected the Virtual Storage Pool. Virtual block represents Virtual Storage Pool on the Internet. Virtual Storage Pool is created by GlusterFS which includes GlusterFS client and GlusterFS server.

In Physical block, the server that installs GlusterFS Client is responsible for managing GlusterFS Server from network, connect Brick from GlusterFS Server and defining data cluster type in Brick to create a virtual storage pool. Section of eDLTV server which installed GlusterFS Server will create Brick from free space in eDLTV server. Format of data cluster type of eDLTV cloud storage system includes two volume: Distribute and Replicate. Distribute Volume is distribute data storage of data cluster type which distribute files such as html, pdf, video, sound and flash store at each Brick. Example: Courses includes lesson1.html is stored in Brick 1, work5.pdf is stored in Brick 2 and flash12.swf is stored in Brick n. Replicate Volume is repicate data storage of data cluster type which repicated same files in all Brick. It backups file about content and log file.

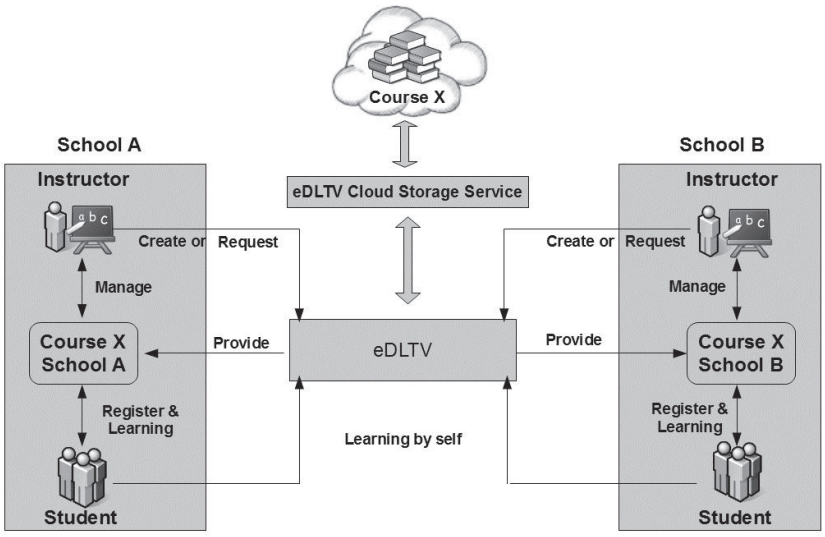

Figure 3. LMS via eDLTV Cloud Storage System process

2.3 LMS via eDLTV Cloud Storage System Process

Fig. 4 illustrates the work process flow of the LMS in eDLTV cloud storage system. As you can see, School A is connected to eDLTV servers. If the students want an access to Course X, they can do so using the eDLTV server through the Internet. The eDLTV server fulfills the request by connecting to the eDLTV cloud storage system, retrieving the Course X, and passing it to the students. The same process also applies if the instructors want to create their own course; they can upload their courses to the eDLTV cloud storage system using the eDLTV Cloud Storage Service as well. School B also has the same access to the eDLTV system; however, the instructor and the student of School B will not have the access to the custom course created by School A.

3. Conclusion and Future work

The purpose of this work is to solve two major problems in implementing e-learning in schools in Thailand, which are the creation of digital content and the readiness of the infrastructure. We proposed a model of an e-learning system that can be used in schools without the requirement to have their own server or to create the content themselves. By using cloud storage technology, we expect that the digital content will be thoroughly distributed to schools in every part of the country, the issues concerning human and financial resource will be reduced, and the quality of the education system will improve.

In the future, we plan to connect the eDLTV to the Repository system to provide a larger knowledge base.

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